Understanding Mathematics

Textbook for Class IV

ཤེས་རིག

Department of School Education
Ministry of Education and Skills Development
Royal Government of Bhutan

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Advisors

Dasho Pema Thinley, Vice Chancellor, Royal University of Bhutan

Tshewang Tandin, Director, Department of School Education, Ministry of Education

Yangka, Director for Academic Affairs, Royal University of Bhutan

Karma Yeshey, Director, Department of Adult and Higher Education, Ministry of Educaiton

Research, Writing, and Editing

One, Two, ..., Infinity Ltd., Canada

Authors

Marian Small

Wendi Morrison

Reviewers

Tara Small

Gladys Sterenberg

Editors

Jackie Williams

Carolyn Wagner

Coordination

Karma Yeshey,
Curriculum Officer, CAPSD

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Bhutanese Reviewers

Tashi Phuntsho	Shaba MSS, Paro
Kuenzang	Damphu LSS, Tsirang
Penjor	Tendu MSS, Samtse
Chencho	Meritsemo CPS, Chukha
Pelden Dorji	Moshi CPS, Trashi gang
Nim Dorji	Sisina CPS, Thimphu
Ugyen Choden	Katsho LSS, Haa
Dorji Wangmo	Shaba LSS, Paro
Jigme	Shaba LSS, Paro
Yeshey Lhamo	Pangna PS, Dagana
Sonam Choden	Khangkhu MSS, Paro
Sonam Choden	Phuntsholing LSS, Chukha
Bijoy Hangmo Subba	Zilukha LSS, Thimphu
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Kedhar Nath Sharma	Lobesa LSS, Thimphu
Ugyen	Laptsakha CPS, Punakha
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Thoner Zangmo	Changzamtog LSS, Thimphu
Tika Devi Adhikari	Zilnon Namgyaling PS,T/phu
Singye Namgay	Dawakha LSS, Paro
Tshewang Dorji	Ura MSS, Bumthang
Phuntsho Dolma	Paro College of Education
Lobzang Dorji	BBED
Ugyen Dorji	CAPSD
Karma Yeshey	CAPSD

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MINISTRY OF EDUCATION
THIMPHU :BHUTAN
Cultivating the Grace of Our Mind

MINISTER

December 15, 2008

Foreword

I am at once awed and fascinated by the magic and potency of numbers. I am amazed at the marvel of the human mind that conceived of fantastic ways of visualizing quantities and investing them with enormous powers of representation and symbolism. As my simple mind struggles to make sense of the complexities that the play of numbers and formulae presents, I begin to realize, albeit ever so slowly, that, after all, all mathematics, as indeed all music, is a function of forming and following patterns and processes. It is a supreme achievement of the human mind as it seeks to reduce apparent anomalies and to discover underlying unity and coherence.

Abstraction and generalization are, therefore, at the heart of meaning-making in Mathematics. We agreed, propped up as by convention, that a certain figure, a sign, or a symbol, would carry the same meaning and value for us in our attempt to make intelligible a certain mass or weight or measure. We decided that for all our calculations, we would allow the signifier and the signified to yield whatever value would result from the tension between the quantities brought together by the nature of their interaction.

One can often imagine a mathematical way of ordering our surrounding and our circumstance that is actually finding a pattern that replicates the pattern of the universe – of its solid and its liquid and its gas. The ability to engage in this pattern-discovering and pattern-making and the inventiveness of the human mind to anticipate the consequence of marshalling the power of numbers give individuals and systems tremendous privilege to the same degree which the lack of this facility deprives them of.

Small systems such as ours cannot afford to miss and squander the immense power and privilege the ability to exploit and engage the resources of Mathematics have to present. From the simplest act of adding two quantities to the most complex churning of data, the facility of calculation can equip our people with special advantage and power. How intelligent a use we make of the power of numbers and the precision of our calculations will determine, to a large extent, our standing as a nation.

I commend the good work done by our colleagues and consultants on our new Mathematics curriculum. It looks current in content and learner-friendly in presentation. It is my hope that this initiative will give the young men and women of our country the much-needed intellectual challenge and prepares them for life beyond school. The integrity of the curriculum, the power of its delivery, and the absorptive inclination of the learner are the eternal triangle of any curriculum. Welcome to Mathematics.

Imagine the world without numbers! Without the facility of calculation!

Tashi Delek.

Thakur S Powdyel.

Telephone : (00975) - 2 - 323825 / 325431 Fax : (00975) - 2 - 326424

INTRODUCTION

HOW MATHEMATICS HAS CHANGED

This year in Class IV you will learn some new mathematics that Class IV students before you did not learn. Some things are the same, but many things are different. For example, some of the topics you will learn about in geometry are new to all Class IV students.

You will learn mathematics differently this year. Instead of memorizing and following rules, you will do much more explaining and making sense of the mathematics. When you understand the mathematics, you will find it more interesting and easier to learn.

Your new textbook lets you work on problems about everyday life as well as on problems about Bhutan and the world around you. These problems will help you see the value of math.

For example:

• One problem will ask you to consider the number of plants, cards, and stamps that are arranged in a certain way.

3. How many items are there altogether in each array?

a) 5 rows with 28 carrots in each row

b) 6 rows with 18 cards in each row

c) 6 rows with 157 stamps in each row

d) 4 rows with 132 potato plants in each row

• In another lesson you will look at information about parts of Bhutan.

The 2005 census told how many people lived in each dzongkhag.

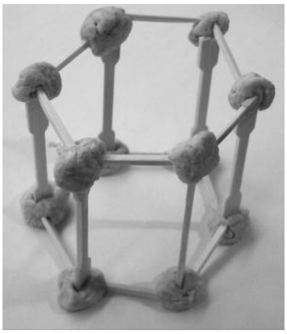
A. Which of the dzongkhags in the chart has the most people? How do you know?

Dzongkhag	Population (2005)
Ha	11,648
Samtse	60,100
Trongsa	13,419

Your textbook will often ask you to use objects to learn the math.
For example:

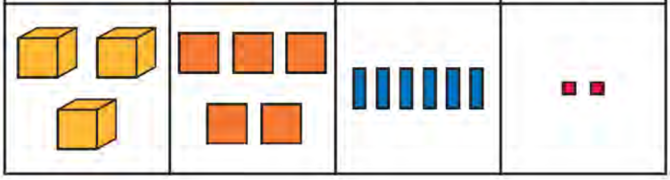
• You will use cubes to learn about volume.

• You will use modelling clay and sticks to build skeleton models of 3-D shapes.



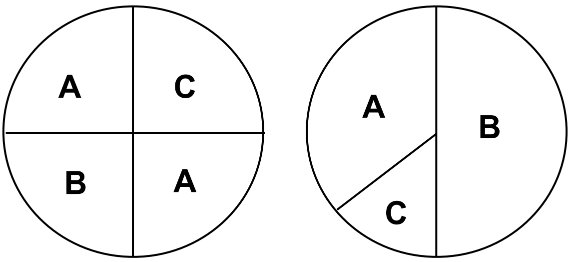
• You will use base ten models of thousands, hundreds, tens, and ones to model numbers and to compare numbers.

Thousands	Hundreds	Tens	Ones
3	5	6	2



Modelling the number 3562 with base ten blocks on a place value mat

• You will use spinners to predict how likely it is that something will happen.



On which spinner is it more likely to spin A?

This textbook will also ask you to explain *why* things are true. It will not be enough just to say something is true. For example, you will calculate 25 × 100 = 2500 and then you will explain how you found the answer.

You will solve many types of problems and you will be encouraged to use your own way of thinking to solve them.

USING YOUR TEXTBOOK

Each unit has
- a *Getting Started* section
- two or three chapters
- regular lessons and at least one *Explore* lesson
- a *Game* and a *Connections* activity
- a *Unit Revision*

Getting Started

There are two parts to the *Getting Started*. First, you will complete a *Use What You Know* activity. Then you will answer *Skills You Will Need* questions. Both remind you of things you already know that will help you in the unit.

• The *Use What You Know* activity is done with a partner or in a group.

• The *Skills You Will Need* questions help you review skills you will use in the unit. You will usually do these by yourself.

Regular Lessons

• Lessons are numbered #.#.# — the first number tells the unit, the second number is the chapter, and the third number is the lesson in the chapter.

For example, Lesson 4.2.1 is Unit 4, Chapter 2, Lesson 1.

• Each regular lesson is divided into five parts:

- A *Try This* problem or task

- A box that explains the main ideas of the lesson; it is called the exposition

- A question that asks you to think about the *Try This* problem again, using what you have learned in the exposition

- one or more *Examples*

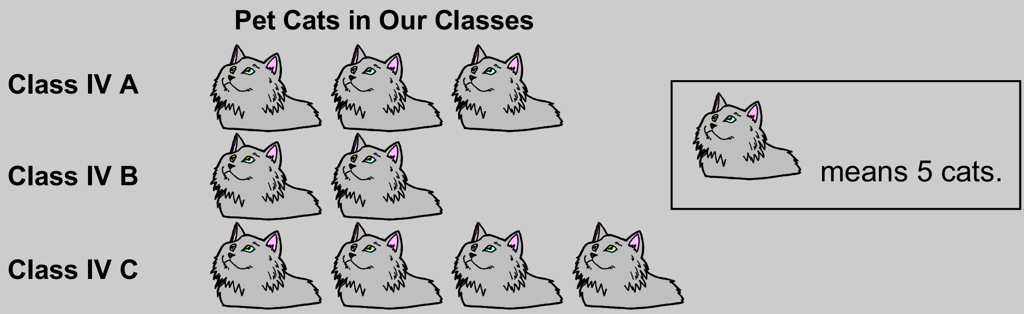
- *Practising and Applying* questions

Try This

• The *Try This* is in a grey box, like this one from lesson 2.1.1 on page 37.

Try This

This pictograph shows the number of pet cats in three different Class IVs.



A. How many pet cats are there altogether in the three classes?

You will solve the *Try This* problem with a partner or in a small group. The math you learn later in the lesson will relate back to this problem.

The Exposition

• The exposition comes after the *Try This*.

• It presents and explains the main ideas of the lesson.

• Important math words are in **bold** text. You will find the definitions of these words in the glossary at the back of the textbook.

• You are not expected to copy the exposition into your notebook.

Going Back to the Try This

• There is always a question after the exposition that asks you to think again about the *Try This* problem or task. You can use the new ideas presented in the exposition. The example below is from lesson 2.1.1 on page 38. The exposition that comes before this one shows how to skip count on a number line to multiply. You can use the strategies you learned to solve the *Try This* problem again but in a different way.

B. Use skip counting to solve each. Tell how you skip counted.

i) How many pet cats are there in each class?

ii) How many pet cats are there in all three classes?

C. Write a multiplication fact for each.

i) The number of pet cats in each class

ii) The number of pet cats in all three classes

Examples

• The *Examples* prepare you for the *Practising and Applying* questions. Each example is a bit different from the others so that you can refer to many models.

• You will work through the examples sometimes on your own, sometimes with another student, and sometimes with your teacher.

• The *Solutions* column shows you what you should write when you solve a problem. The *Thinking* column shows what you might be thinking as you solve the problem.

• Some examples show you two or three different solutions to the same problem. The example on the next page, from lesson 2.1.1 on page 39, shows three ways to solve the problem about how many wheels there are on five cars: *Solution 1*, *Solution 2,* and *Solution 3*.

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As you can see, there is more than one way to solve the problem below.

Examples

Example Solving a Multiplication Problem by Skip Counting

There are five cars in the parking lot.
How many wheels are there altogether?
Show your work.

Solution 1

5 × 4 = ?

1, 2, 3, 4,
5, 6, 7, 8,
9, 10, 11, 12,
13, 14, 15, 16,
17, 18, 19, 20

5 × 4 = 20

There are 20 wheels.

Thinking

• There are 5 cars. Each car has 4 wheels. That is 5 groups of 4 wheels, which is 5 × 4.

• I skip counted by 4s five times.

• To skip count, I counted some numbers silently and said every 4th number out loud.

Solution 2

5 × 4 = ?

5 × 4 = 4 × 5

5, 10, 15, 20

5 × 4 = 20

There are 20 wheels.

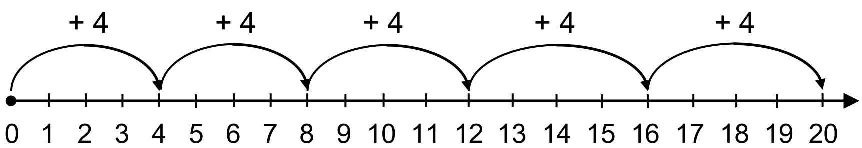
Thinking

• There are 5 cars. Each car has 4 wheels. That's 5 × 4.

• You can multiply in any order. I used 4 × 5 instead of 5 × 4 because skip counting by 5s is easy for me.

Solution 3

5 × 4 = 4 + 4 + 4 + 4 + 4 = ?



There are 20 wheels.

Thinking

• 5 cars with 4 wheels on each is 4 + 4 + 4 + 4 + 4 wheels.

• I added 4 + 4 + 4 + 4 + 4 by jumping by 4s five times on a number line.

Practising and Applying

• You might work on the *Practising and Applying* questions by yourself, with a partner, or in a group. You can use the exposition and examples to help you.

• The first few questions are similar to the questions in the *Examples* and the exposition.

• The last question helps you think about the most important ideas you have learned in the lesson.

Explore Lessons

• An *Explore* lesson lets you work with a partner or in a small group to investigate some math.

• Your teacher does not tell you about the math in an *Explore* lesson. Instead, you work through the questions and learn in your own way.

Connections Activity

• The *Connections* activity is usually something interesting that relates to the math you are learning. For example, in Unit 7, the *Connections* on page 226 is about predicting how many times in a row you might get a Khorlo when you flip a Nu 1 coin.

• Every unit has a *Connections* activity.

• You will usually work in a pair or a small group to complete the task or answer the question(s).

Game

• Each unit usually has at least one *Game*.

• The *Game* is a way to practise skills and concepts from the unit with a partner or in small group.

• The materials you need and the rules for the game are listed in the textbook. Usually the textbook shows a sample game to help you understand the rules.

Unit Revision

• The *Unit Revision* helps you review the lessons in the unit.

• The order of the questions in the *Unit Revision* is usually the same as the order of the lessons in the unit.

• You can work with a partner or by yourself, as your teacher suggests.

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Glossary

• At the end of the textbook you will find a glossary of new math words and their definitions. The glossary also contains other important math words from Class III that you need to remember.

• The glossary also has definitions of instructional words such as “explain”, “predict”, and “estimate”. These will help you understand what you are expected to do.

Answers

• You will find answers to most of the numbered questions at the back of the textbook. Answers to questions that ask for explanations (Explain your thinking or How do you know?) are not included in your textbook. Your teacher has those answers.

• Questions with capital letters, such as A or B, do not have answers in the back of the textbook. Your teacher has the answers to these questions.

• If there could be more than one correct answer to a question, the answer will start with *Sample response*. Even if your answer is different than the answer at the back of the textbook, it may still be correct.

ASSESSING YOUR MATHEMATICAL PERFORMANCE

Forms of Assessment

Your teacher will be checking to see how you are doing in your math learning. Sometimes your teacher will collect information about what you understand or do not understand in order to change the way you are taught. Other times your teacher will collect information in order to give you a mark.

Assessment Criteria

• Your teacher should tell you about what she or he will be checking and how it will be checked.

• The amount of the mark assigned for each unit should relate to the time the class spent on the unit and the importance of the unit.

• Your mark should show how you are doing on skills, applications, concepts, and problem solving.

• Your teacher should tell you whether the mark for a test will be a number such as a percent, a letter grade such as A, B, or C, or a level on a rubric (level 1, 2, 3, or 4). A rubric is a chart that describes criteria for your work, usually in four levels of performance. If a rubric is used, your teacher should let you see the rubric before you start to work on the task.

Determining a Mark or Grade

In determining your overall mark in mathematics, your teacher might use a combination of tests, assignments, projects, performance tasks, exams, interviews, observations, and homework.

THE CLASSROOM ENVIRONMENT

In almost every lesson you will have a chance to work with other students. You should always share your responses, even if they are different from the answers offered by other students. It is only in this way that you will really be engaged in the mathematical thinking.

Pair and Group Work

• There are many reasons why you should work in pairs or groups:

- to have more opportunities to communicate mathematically
- to make it easier for you to discuss an answer you are not sure of
- to see the different mathematical ideas of other students
- to share materials more easily

• Sometimes you might work with the person next to you, but at other times you might be asked to work with particular students.

• When you work in a group, it is important to contribute and to follow your teacher's rules for working in groups. Some sample rules are shown here.

Rules for Group Work

- Make sure you understand all of the work produced by the group.
- If you have a question, ask your group members first, before asking your teacher.
- Find a way to work out disagreements without arguing.
- Listen to and help others.
- Make sure everyone is included and encouraged.
- Speak just loudly enough to be heard.

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Communication

• Many of the questions in the textbook ask you to explain your thinking. Look for instructions like these:

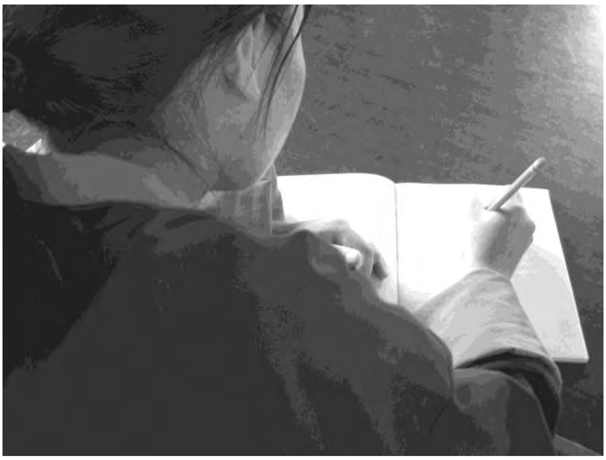
- Explain.
- Explain your thinking.
- Show how you know.
- How do you know?
- How do you know you are right?
- Explain your prediction.
- Explain your estimate.

• The sample *Thinking* in the *Examples* provides a model for mathematical communication.

• One of the ways you communicate mathematically to yourself is by checking your work. Even when a question does not ask you to check your work, you should think about whether your answer makes sense. When you check your work, you should check using a different way than the way you used to find your answer so that you do not make the same error twice.

YOUR NOTEBOOK

• It is valuable for you to have a well-organized, neat notebook to look back at to review the main ideas you have learned. You should do your rough work in this same notebook. Do not do your rough work elsewhere and then waste valuable time copying it neatly into your notebook.



• Your teacher will sometimes show you important points to write down in your notebook. You should also make your own decisions about which ideas to include in your notebook.

UNIT 1 NUMERATION, ADDITION, AND SUBTRACTION

Getting Started

Use What You Know

Play this game in a group of two or three.

- You need three sets of cards with these digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Mix up all the cards, turn them over so you cannot see them, and then spread them out.

Each player does the following:

- Takes three cards and uses them to create a 3-digit number less than 850.
- Adds the number to 148 to get a sum.
- Returns the cards and mixes them up.
- Takes another three cards and creates a 3-digit number less than the sum.
- Subtracts the new number from the sum to get a difference.

The player with the greatest difference gets 1 point.

Play seven more times. The player with the most points wins.

For example:

Karma took the digit cards 1, 3, and 8.
She made this number and got the sum 979:

8	3	1

831 + 148 = 979

She then took the cards 6, 7, and 9.
She made this number and got the difference 300:

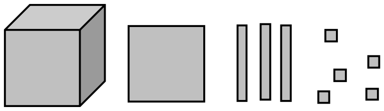
6	7	9

979 – 679 = 300

If Karma's difference of 300 is greater than the other player's difference, Karma will get 1 point.

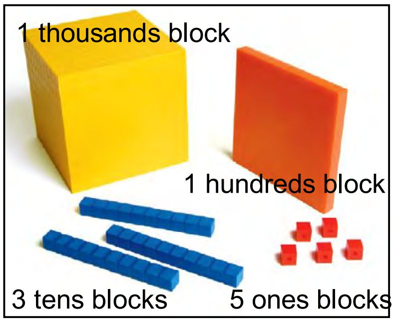
Skills You Will Need

1. This is a sketch of a base ten block model of the number 1135.



Sketch a base ten block model for each.

a) 3005 **b)** 1062



Base ten blocks showing 1135

2. What is the thousands digit in each number?

a) 4107 **b)** 3789

3. What is the place value of the 4 in each number?

a) 31$\underline{4}$2 **b)** $\underline{4}$007

c) 6$\underline{4}$28 **d)** 567$\underline{4}$

4. Write a number for each.

a) It has a 0 in the tens place and a 5 in the thousands place.

b) It is 300 more than 5478.

5. You can write 6712 as 6 thousands + 7 hundreds + 1 ten + 2 ones. Write each number in this way.

a) 5902 **b)** 6008

6. 3124 can be written as 3 thousands + 1 hundred + 2 tens + 4 ones.

3124 can also be written as 31 hundreds + 2 tens + 4 ones.

Complete each.

a) 4056 = ____ hundreds + ___ tens + ____ ones

b) 3108 = ____ thousands + ____ tens + ____ ones

7. Order each set of numbers from least to greatest.

a) 4217, 1245, 899 **b)** 5101, 4923, 9764, 1037

8. Add.

a) 512 + 387 **b)** 614 + 788

c) 498 + 378 **d)** 148 + 975

9. Subtract.

a) 598 – 387 **b)** 714 – 688

c) 412 – 378 **d)** 975 – 148

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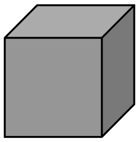
Chapter 1 Whole Number Place Value

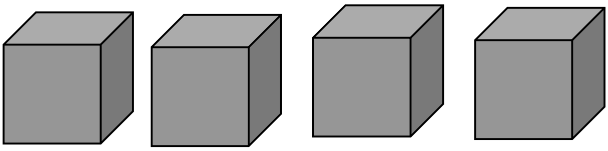
1.1.1 EXPLORE: Modelling 4-digit Numbers

• A 4-digit number is between 1000 and 9999. A **model** of a 4-digit number uses one or more thousands blocks.



A thousands block

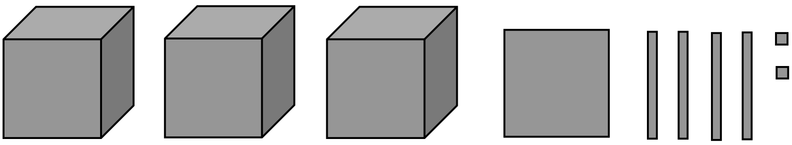
For example, 4000 looks like this:



4 thousands blocks = 4000

• To show most 4-digit numbers, you need to use other blocks too.

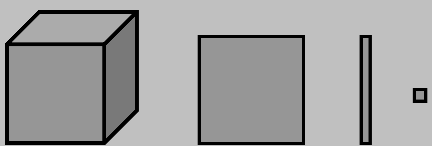
For example, 3142 looks like this:

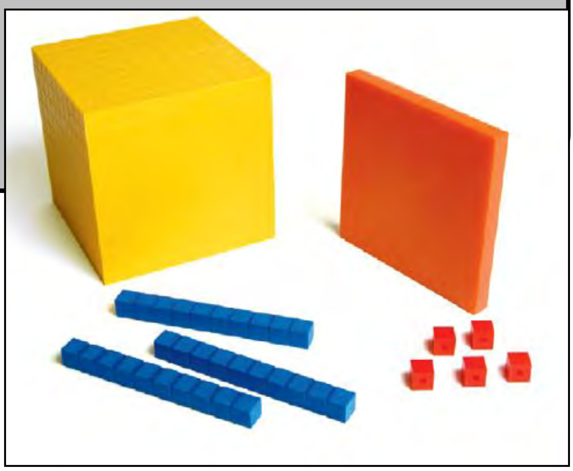


3 1 4 2

3 thousands blocks, 1 hundreds block, 4 tens blocks, and 2 ones blocks

A. How are thousands, hundreds, tens, and ones blocks alike?
How are they different?





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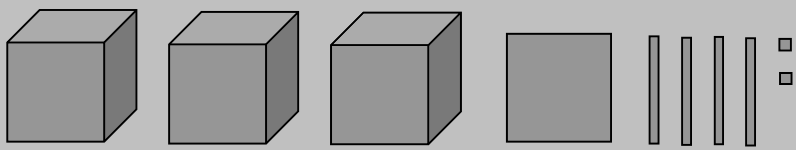
B. How can you build a thousands block with hundreds blocks?

C. How can you use blocks to show 2314? Sketch your model.

D. Show 2314 with blocks. Then show 3142 with blocks.
Why do you use the same number of blocks for both numbers?

E. Why do you use more thousands blocks for 3142 than for 2314?

F. You can show 3142 with 10 blocks:

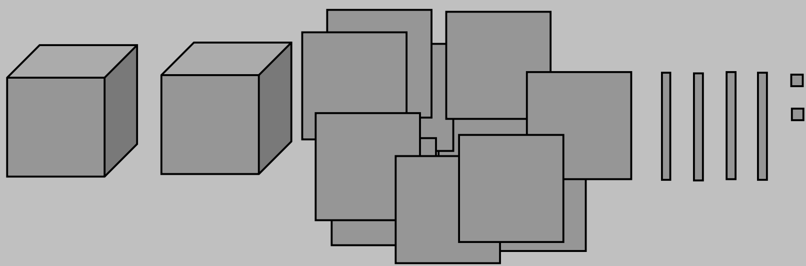


3 thousands blocks, 1 hundreds block, 4 tens blocks, 2 ones blocks

i) List five other 4-digit numbers you can show with 10 blocks.

ii) Which number in **part i)** is greatest? Which is least?

iii) Why can you also show 3142 with 19 blocks?



2 thousands blocks, 11 hundreds blocks, 4 tens blocks, and 2 ones blocks

iv) Describe or sketch four other ways to show 3142.

v) What is the greatest number of blocks you can use to show 3142?
Which blocks would you use?

vi) What is the least number of blocks you can use to show 3142?
Which blocks would you use?

G. Decide on a total number of blocks to use. You can use from five to nine blocks altogether. List four 4-digit numbers you can show with that number of blocks. You can use any kind of blocks.

H. Create your own 4-digit number. Describe or sketch three ways to show it with blocks.

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1.1.2 EXPLORE: Describing 10,000

Here are some things that are true about the number 10,000:

- 10,000 days is almost 30 years.
- If 100 young children lay down in a line, the line would be about 10,000 cm long.

- If you walk 10,000 steps, you might cross your classroom about 800 times.

- If you add 100 to itself 100 times, you get 10,000:

100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 +…+ 100 = 10,000

92 more times

- 10,000 is the tenth number in this pattern: 1000, 2000, 3000, 4000, …

A. Estimate to see if 10,000 days is almost 30 years.
Show your work.

B. i) Tell how you might find out how many times you can cross your classroom in 10,000 steps.

ii) Use the method you described in **part i)** to see if you can cross your classroom 800 times in 10,000 steps. Tell what you did.

C. Create a pattern that includes the number 10,000.
Tell how you know your pattern includes 10,000.

D. What else can you describe with the number 10,000?
Tell how 10,000 describes it.

1.1.3 Place Value: 5-digit Numbers

Try This

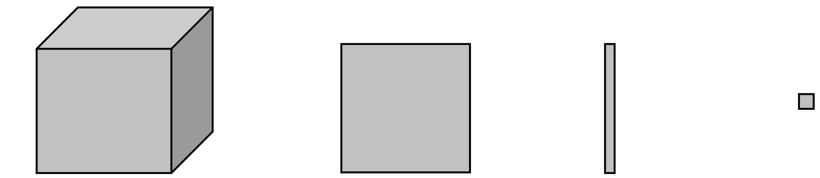
You have already learned about different ways to describe numbers like 9000 (9 thousand).

For example:

- 9000 is 1000 more than 8000.
- 9000 is 9 thousands.
- 9000 is 1 thousand less than 10,000.

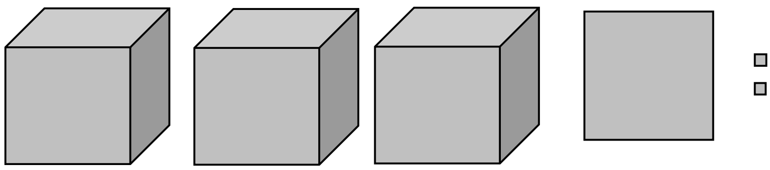
A. How you can describe 90 thousand in different ways?

- You can show any 4-digit number using these base ten blocks:



Thousands block Hundreds block Tens block Ones block

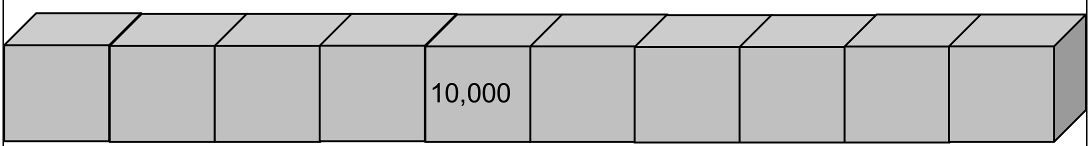
For example, 3102 looks like this:



3 thousands blocks, 1 hundreds block, and 2 ones blocks

- You can also use blocks to show any 5-digit number.

To show 10,000, you can make a stick using 10 thousands blocks.



10 thousands blocks = 1 ten thousands stick = 10,000

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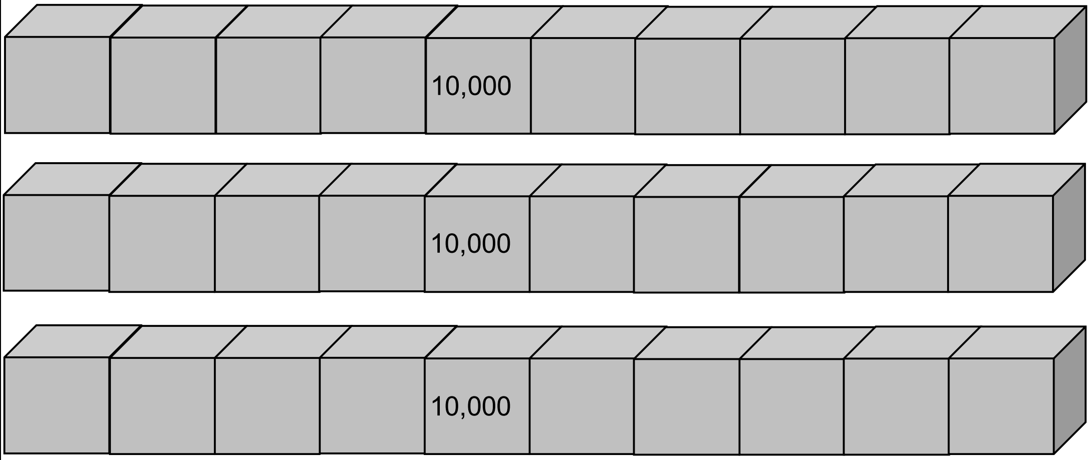
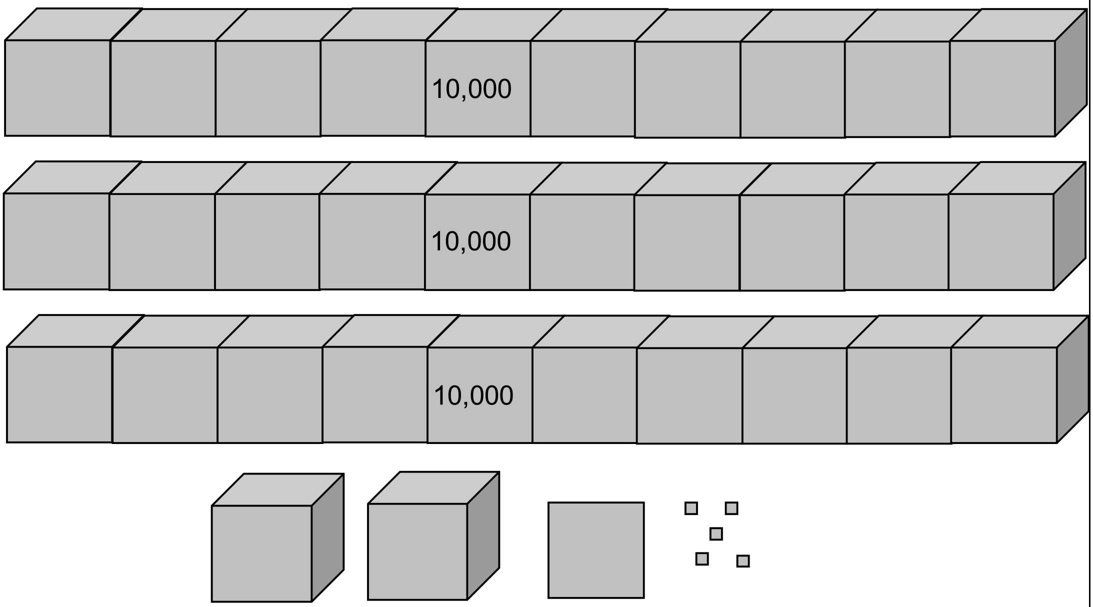
To show 30,000 you can use three 10,000 sticks.



To show 32,105 you can use three 10,000 sticks to show 30,000 and use other blocks to show 2 thousand, 1 hundred, and 5 ones.



• A comma is used to separate the thousands digit from the hundreds digit.

3<u>2</u>,<u>1</u>05

thousands digit
comma
hundreds digit

• The comma helps you read the number aloud in two parts.

For example: We read 32,105 as “thirty two thousand, one hundred five”.

Notice that we do not use the word “and” when we read a whole number. We only use “and” for reading decimals, such as 1.2, “one and two tenths”.

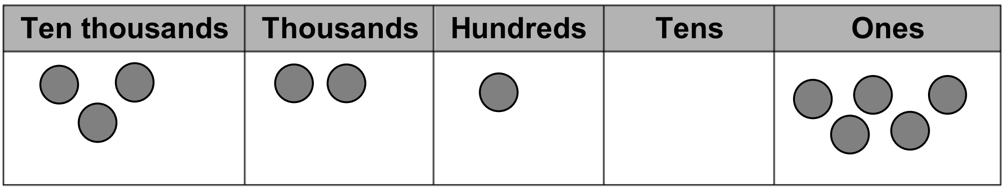
• To take a number in **standard form** and write it in **expanded form**, you write the value of each digit and then put the values together.

> 32,105 is in standard form.
>
> Here are two ways to write 32,105 in expanded form:
>
> *Using numbers* 30,000 + 2000 + 100 + 5
>
> *Using words* 3 ten thousands + 2 thousands + 1 hundred + 5 ones

• You can use a place value chart to model a number.
For example, you can show 32,105 in these ways:

Ten thousands	Thousands	Hundreds	Tens	Ones
3	2	1	0	5

OR



• When you read or write a number, think about what each digit means.
For example, in 40,014, each 5 digit means something different.

40,014

4 ten thousands 4 ones

B. How can you show 90,000 using each?

i) base ten blocks

ii) expanded form using words

iii) digits and a place value chart

Showing 90,000 using counters and a place value chart

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Examples

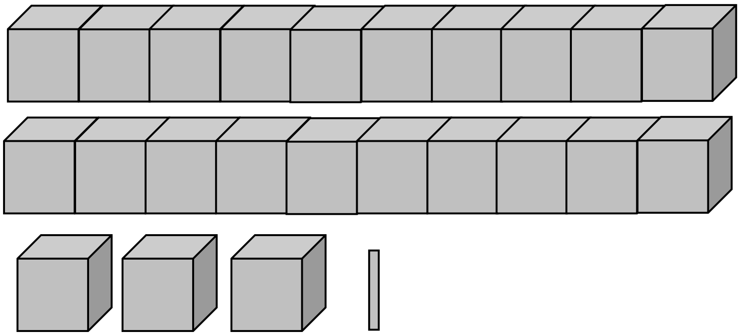
Example 1 Writing a Number from a Model

The blocks below show a number. Write the number in each way.

a) in expanded form two ways: using words and using numbers

b) in a place value chart

c) in standard form



Solution

a) *In expanded form two ways*

2 ten thousands + 3 thousands + 1 ten

20,000 + 3000 + 10

b) *In a place value chart*

Ten thousands	Thousands	Hundreds	Tens	Ones
2	3	0	1	0

c) *In standard form*

23,010

Thinking

a) I wrote how many there were of each kind of block. Then I added the parts together.

b) For each place in the chart, I thought, "How many are there of this kind of block?"

• I used 0 when there were no blocks.

c) For standard form, I copied the digits from the place value chart.

• I put a comma between the thousands digit and the hundreds digit.

Example 2 Showing a Number in Different Ways

10,032 is in standard form. Show 10,032 in two other ways.

Solution

10,032 = 1 ten thousand + 3 tens + 2 ones

10,032 =

Ten thousands	Thousands	Hundreds	Tens	Ones
●			● ● ●	● ●

Thinking

• I wrote the expanded form that uses words. I could have used only numbers instead.

• For the place value chart, I could have shown digits instead of drawing pictures of counters.

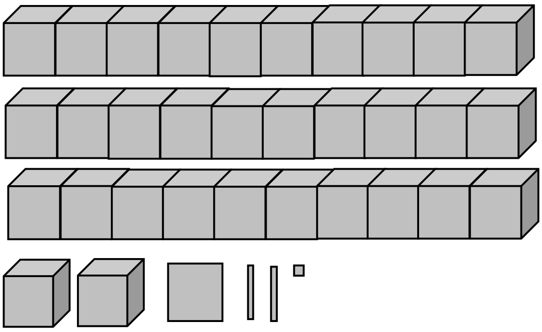
Practising and Applying

1. Write the number for the model shown below in each way.

a) in expanded form

b) in a place value chart

c) in standard form



2. Show 12,341 in each way.

a) using base ten blocks

b) in a place value chart

c) in expanded form two ways

3. Write a 5-digit number for each.

a) It has a 3 in the ten thousands place.

b) It has a 4 in the hundreds place and a 0 in the thousands place.

c) It has a 1 in the ten thousands place.

4. a) Create an odd number that fits all three clues:

• The ten thousands digit is twice the tens digit.

• The thousands digit is three times the ones digit.

• Each digit is used only once.

b) Create another odd number that fits the clues.

5. a) List three 5-digit numbers that you could show with eight blocks.

b) If you showed each number with counters on a place value chart, how many counters would there be?

c) If you wrote each number in expanded form using words, what would be the sum of the digits?

6. Use these digits to create two different 5-digit numbers that are about 20,000 apart.

6, 5, 1, 9, 2

7. Why are there more 5-digit numbers than 4-digit numbers?

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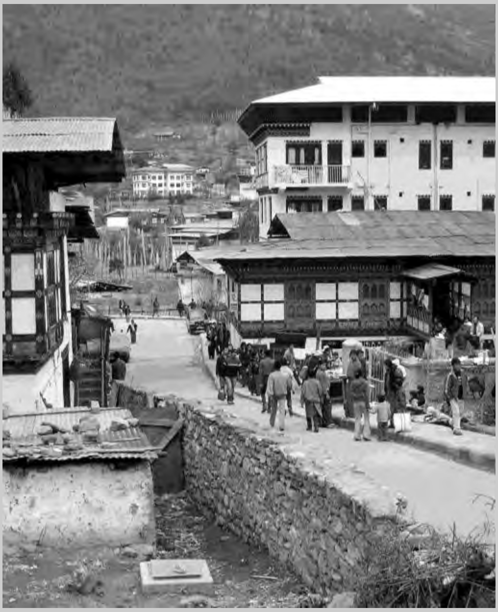
1.1.4 Renaming Numbers

Try This

In 2005, there were 98,676 people living in Thimphu.

A. i) If all the people were put into groups of 1000, about how many groups would there be?

ii) If all the people were put into groups of 100, about how many groups would there be?

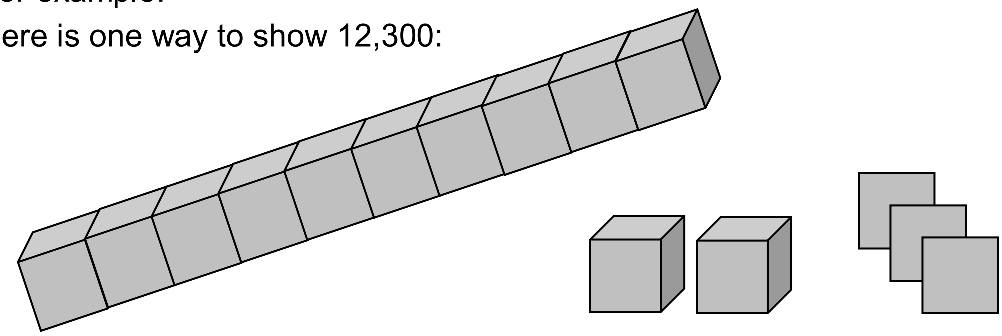


Downtown Thimphu

• You can show a number different ways.

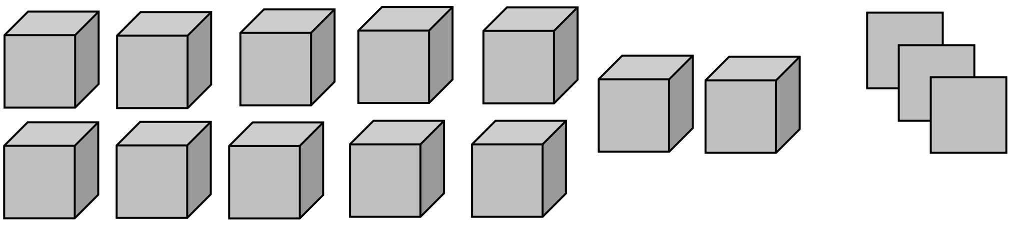
For example:

Here is one way to show 12,300:



12,300 = 1 ten thousand + 2 thousands + 3 hundreds

If you trade the 1 ten thousand stick for 10 thousands blocks, you can show 12,300 in another way:



12,300 = 12 thousands + 3 hundreds

You can also show 12,300 in different ways using a place value chart.

You can trade 1 ten thousand for 10 of the place value to its right, the thousands.

Ten thousands	Thousands	Hundreds	Tens	Ones
1	2	3	0	0

1 ten thousand + 2 thousands + 3 hundreds

Ten thousands	Thousands	Hundreds	Tens	Ones
	10 + 2	3	0	0
	12	3	0	0

12 thousands + 3 hundreds

• Trading 1 in a place value for 10 of the place value to the right is a way to **rename** a number.

Here are some ways to rename **41,200:**

Ten thousands	Thousands	Hundreds	Tens	Ones
4	1	2	0	0

4 ten thousands + 1 thousand + 2 hundreds

Ten thousands	Thousands	Hundreds	Tens	Ones
	41	2	0	0

41 thousands + 2 hundreds

Ten thousands	Thousands	Hundreds	Tens	Ones
		412	0	0

412 hundreds

41,200 = 4 ten thousands + 1 thousand + 2 hundreds
= 41 thousands + 2 hundreds
= 412 hundreds

• Renaming numbers can help you to think about different ways to group a number such as 41,200:

41,200 is about 4 groups of 10,000.
41,200 is about 41 groups of 1000.
41,200 is about 412 groups of 100.

B. How can renaming 98,676 in different ways help you answer **part A**?

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Examples

Example 1 Renaming from Standard Form

Rename 62,140 in three different ways. Show your work.

Solution

	Ten thousands	Thousands	Hundreds	Tens	Ones
First way	6	2	1	4	0
Second way	5	12	1	4	0
Third way		62	1	4	0

62,140 = 6 ten thousands + 2 thousands + 1 hundred + 4 tens
= 5 ten thousands + 12 thousands + 1 hundred + 4 tens
= 62 thousands + 1 hundred + 4 tens

Thinking

I used a place value chart to help me.

First way: I wrote each digit in a column in a place value chart.

Second way: I traded one of the ten thousands for a thousand.

Third way: I traded the rest of the ten thousands for thousands.

Example 2 Renaming to Standard Form

Write each number in standard form. Show your work.

a) 41 thousands + 3 hundreds + 4 tens + 3 ones

b) 512 hundreds + 3 ones

a) Solution

41 thousands + 3 hundreds + 4 tens + 3 ones
= 40 thousands + 1 thousand + 3 hundreds + 4 tens + 3 ones
= 4 ten thousands + 1 thousand + 3 hundreds + 4 tens + 3 ones

4 ten thousands + 1 thousand + 3 hundreds + 4 tens + 3 ones = 41,343

Thinking

• Since there were more than 10 thousands, I traded each group of 10 thousands for 1 ten thousand.

Example 2 Renaming to Standard Form [Continued]

b) Solution

512 hundreds + 3 ones

Ten thousands	Thousands	Hundreds	Tens	Ones
		512	0	3
	51	2	0	3
5	1	2	0	3

512 hundreds + 3 ones = 51,203

Thinking

- I wrote 512 hundreds and 3 ones in a place value chart.
- Then I traded to the left until I had a digit less than 10 in each place.

Practising and Applying

1. a) Sketch a block model for 10,100.

b) Trade the ten thousands block for thousands blocks. Sketch the new model.

c) Sketch a block model for 21,210.

d) Trade one of the ten thousands blocks for thousands blocks. Sketch the new model.

2. Complete.

a) 30,470 = ___ thousands + ___ hundreds + ___ tens

b) 12,480 = ___ hundreds + ___ tens

c) 40,281 = 3 ten thousands + ___ thousands + ___ hundreds + ___ ones

3. Write each in standard form.

a) 3 ten thousands + 12 thousands + 3 ones

b) 51 thousands + 7 tens

c) 17 thousands + 2 tens + 5 ones

d) 480 hundreds

e) 152 hundreds + 8 ones

4. You are putting 100 pencils in each box. How many boxes can you fill with each number of pencils?

a) 12,100 **b)** 15,000

c) 16,280 **d)** 8245

5. 1 m = 100 cm.

a) How many metres is 13,000 cm?

b) How is writing centimetres as metres like renaming a number?

6. 1 km = 1000 m

a) How many kilometres is 27,000 m?

b) How is writing metres as kilometres like renaming a number?

7. How would you teach a friend to rename a number like 32,100 in two ways?

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1.1.5 Comparing and Ordering Numbers

Try This

The 2005 census told how many people lived in each dzongkhag.

Dzongkhag	Population (2005)
Ha	11,648
Samtse	60,100
Trongsa	13,419

A. Which of the dzongkhags in the chart has the most people? How do you know?

• You can compare and order 5-digit numbers just like you compared and ordered numbers less than 10,000.

• Start by comparing the digits on the left. Then move to the right if necessary.

For example:

- If a number has more ten thousands, it is greater.

  42,111 > **2**1,892 since **4** ten thousands > **2** ten thousands

- If a number has the same number of ten thousands, compare the rest of the number to decide which is greater.

  4**2**,111 > 4**1**,279 since **2** thousands > **1** thousand

• A number is between two other numbers if it is greater than one of the numbers and less than the other number.

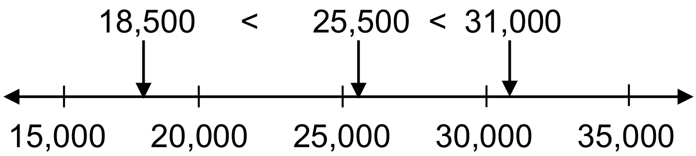
For example, to order 25,489, 15,130, and 29,411:

25,489 is between 15,130 and 29,411 because

25,489 > 15,130 and 25,489 < 29,411.

You can write 15,130 < 25,489 < 29, 411.

• You can put numbers on a number line to compare and order them.
If a number is to the right of another number, it is greater.



B. Which population in **part A** is between the other two populations?
How do you know?

Examples

Example 1 Ordering Numbers

a) Use the digits 4, 0, 0, 2, and 3 to create three different 5-digit numbers.

b) Order your numbers from least to greatest.

Solution

a) 40,203
30,402
20,043

b) In order:
Least: 20,043
Middle: 30,402
Greatest: 40,203

Thinking

a) I used the digit 4 first, then
I used the digit 3 first, and then
I used the digit 2 first.

b) The number with the most ten thousands is the greatest.

2 ten thousands < 3 ten thousands < 4 ten thousands

Example 2 Finding a Number in Between

Wangdue Dzongkhag has 31,135 people.
Pemagatshel Dzongkhag has 13,864 people.
Which dzongkhag below has a population between 31,135 and 13,864?

Paro Dzongkhag	36,433
Tsirang Dzongkhag	18,667
Mongar Dzongkhag	37,069

Solution

Tsirang Dzongkhag has a population in between.

13,864 < 18,667
18,667 < 31,135

13,864 < 18,667 < 37,069

Thinking

• 36,433 is too high, since
36 thousands > 31 thousands.

• 37,069 is also too high, since
37 thousands > 31 thousands.

• 18,667 works, since
18 thousands > 13 thousands and
18 thousands < 31 thousands.

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Example 3 Comparing Numbers with Different Numbers of Digits
Gasa Dzongkhag has 3116 people. Ha Dzongkhag has 11,648 people. Which dzongkhag has the greater population? How do you know?

Solution

	Ten thousands	Thousands	Hundreds	Tens	Ones
3116 →		3	1	1	6
11,648 →	1	1	6	4	8

Ha Dzongkhag has the greater population because 11,648 > 3116.

Thinking

- I first thought 3116 was greater than 11,648 because the first digit in 3116 is greater than the first digit in 11,648.
- I wrote the numbers in a place value chart and saw that the 1 in 11,648 was 1 ten thousand but the 3 in 3116 was only 3 thousands.

Practising and Applying

1. Which number is greater in each?

a) 42,978 or 31,999

b) 15,203 or 51,302

c) 82,135 or 8213

d) 53,147 or 53,299

2. Order from least to greatest.

a) 13,287; 15,149; 10,003

b) 28,147; 32,875; 7820

3. In 2005, the number of people in each home in Bhutan was counted.

Number of people in the home	Number of homes with that many people
1 or 2 people	26,139
3 or 4 people	39,381

Which is greater?

- the number of homes with 1 or 2 people

or

- the number of homes with 3 or 4 people

How do you know?

4. List three numbers that are between 15,239 and 16,100.

5. Arrange the digits below to make a number for each.

a) It is greater than 50,000.

b) It is less than 10,800.

c) It is between 20,000 and 50,000.

d) It is between 12,000 and 16,000.

2 1 7 0 4

6. A number is between 20,000 and 22,000.

20,000 < ■■,■■■ < 22,000

a) How many ten thousands does the number have?

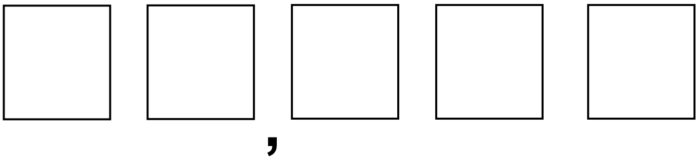
b) Use examples to explain why you cannot be sure how many thousands the number has.

7. How is comparing 5-digit numbers like comparing 4-digit numbers?

GAME: As High as You Can

Play in a group of two or three. Players can share one die.

Each player draws five boxes like these, with a comma.



Each player then does the following:

- Rolls a die and writes the digit in one of the boxes.

- Rolls four more times until all five boxes have a digit. You cannot move a digit after you have written it.

The player with the greatest value gets 1 point.

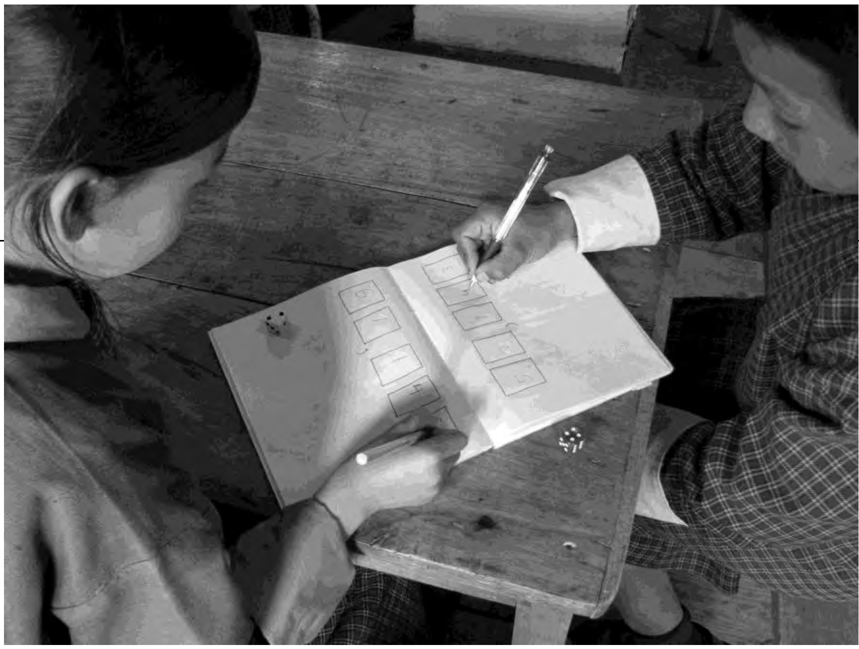
Play five more times. The player with the most points wins the game.

For example:

If Player A makes the number 61,142

and Player B makes the number 52,143

Player A gets 1 point because 61,142 > 52,143.



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Chapter 2 Addition and Subtraction

1.2.1 Adding and Subtracting Mentally

Try This

Tshering makes cloth to sell. She earned Nu 2850 last month and Nu 3600 this month.

A. How much did she earn in total?

There are different ways to add numbers using mental math.

For example: 3875 + 4225

• You can add in parts.

The parts of 4225 are 4000 + 200 + 25.

$$\begin{aligned} & 3875 + \underline{4225} \\ &= 3875 + \underline{4000 + 200 + 25} \\ &= 7875 + 200 + 25 \\ &= 8075 + 25 \\ &= \mathbf{8100} \end{aligned}$$

• You can add an easier number and then change the result.

4000 is 125 more than 3875 but it is easier to add.

Add 4000 instead of 3875: $\underline{3875} + 4225 \rightarrow \underline{4000} + 4225 = 8225$

Subtract 125 in parts: $8225 - 100 = 8125 \rightarrow 8125 - 25 = \mathbf{8100}$

• You can break up the numbers into parts that are easy to add.

$$\left.\begin{array}{l} 38\underline{75} + 42\underline{25} \rightarrow 75 + 25 = 100 \\ \underline{38}\cancel{75} + 4\underline{2}\cancel{25} \rightarrow 3800 + 200 = 4000 \\ \cancel{3875} + \underline{4}\cancel{225} \rightarrow 4000 \end{array}\right\} 100 + 4000 + 4000 = \mathbf{8100}$$

There are also different ways to subtract numbers using mental math.

For example: $9125 - 3994$

- You can count up from 3994 to 9125 in steps.

The number line below shows the steps you might follow:

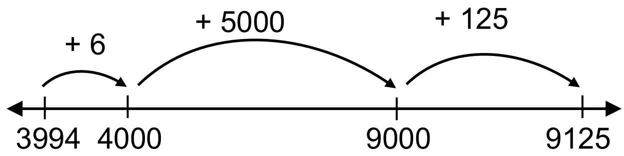
Start at 3994.

Count up **6** to get to 4000.

Count up **5000** to get to 9000.

Count up **125** to get to 9125.

Add 6 + 5000 + 125 = **5131**



Since 6 + 5000 + 125 = 5131,
then 9125 – 3994 = 5131.

- You can subtract an easier number than 3994 and then change the answer.

4000 is 6 more than 3994 but it is easier to subtract.

Subtract 4000 instead of 3994:	9125 – 4000 = 5125
Add 6 because you subtracted 6 more:	5125 + 6 = **5131**

- You can subtract 3994 in parts.

Think about 3994 in parts: $3994 = 3000 + 900 + 90 + 4$

Start at 9125 and subtract 3000: $9125 - \underline{3000} = 6125$

Then subtract 900 by subtracting 1000 and then adding 100 back:

$$\begin{aligned} 6125 - \underline{900} &= 6125 - 1000 + 100 \\ &= 5125 + 100 \\ &= 5225 \end{aligned}$$

Then subtract 90 by subtracting 100 and then adding 10 back:

$$\begin{aligned} 5225 - \underline{90} &= 5225 - 100 + 10 \\ &= 5125 + 10 \\ &= 5135 \end{aligned}$$

Finally, subtract 4: $5135 - \underline{4} = \mathbf{5131}$

B. Add Nu 2850 and Nu 3600 from **part A** using mental math.
Tell what you did.

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Examples

Example 1 Adding using Mental Math

Add each using mental math. Show your thinking.

a) 4278 + 9912 **b)** 2884 + 3616

Solution

a) 4278 + 9912 = ?

10,000 is close to 9912 and it is easy to add:

4278 + 9912 → 4278 + 10,000 = 14,278

I added 10,000, which is more than 9912, so I have to subtract to change the answer.

10,000 is 100 more than 9900, so I subtract the extra 100:

14,278 – 100 = 14,178

9900 is 12 less than 9912, so I add 12:

14,178 + 12 = 14,190

4278 + 9912 = 14,190

b) 2884 + 3616 = ?

2884 + 3616 → 84 + 16 = 100

28~~84~~ + 36~~16~~ → 2800 + 3600 = ?

4000 is 400 more than 3600 but it is easier to add:

2800 + 3600 → 2800 + 4000 = 6800

Subtract 400 because I added 400 extra:

6800 – 400 = 6400

2884 + 3616 = 100 + 6400 = 6500

Thinking

a) I used both of these strategies:

- adding an easier number and then changing the answer,

and

- subtracting an easier number and then changing the answer.

b) I used both of these strategies:

- breaking up the numbers into easy parts to add,

and

- adding an easier number and then changing the answer.

Example 2 Subtracting using Mental Math

Subtract each using mental math. Show your thinking.

a) 4625 – 1995 **b)** 6628 – 4608

Solution	**Thinking**
a) 2000 is 5 more than 1995, but it is easier to subtract: 4625 – 1995 → 4625 – 2000 = 2625 Add 5 because I subtracted 5 extra: 2625 + 5 = 2630 4625 – 1995 = 2630	 **a)** I decided to subtract an easier number that was too much and then add back the extra.
b) $66\underline{28} - 46\underline{08} \rightarrow 28 - 8 = 20$ $\underline{66}\cancel{28} - \underline{46}\cancel{08} \rightarrow 6600 - 4600 = 2000$ 2000 + 20 = 2020 6628 – 4608 = 2020	**b)** I subtracted the tens and ones parts and then the thousands and hundreds parts. Then I put the two parts together.

Practising and Applying

1. Add using mental math.
Show your thinking.

a) 5289 + 3711 **b)** 3846 + 2993

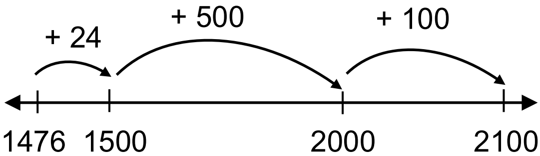
2. Subtract using mental math.
Show your thinking.

a) 7125 – 2999 **b)** 9004 – 3802

3. a) Kunzang says it is easy to subtract 7304 – 3999 using mental math. Why does she say this?

b) She also says it is easy to add 4615 + 3999 using mental math. Why does she say this?

4. a) What subtraction does this number line show?



b) What addition does it show?

5. What 4-digit number (with no zero digits) would you choose to add to 3812 using mental math? Why?

3812 + ■■■■

6. What 4-digit number (with no zero digits) would you choose to subtract from 7003 using mental math? Why?

7003 – ■■■■

7. Why might you use mental math to add 3075 + 2125 but not to add 3178 + 4767?

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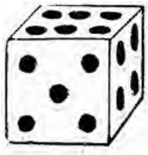
GAME: Add High and Subtract Low

Play in a group of two or three. You can share one die.



Each player does the following:

• Rolls the die four times to get four digits.

• Uses the four digits rolled and chooses four more digits to make two 4-digit numbers.

☐☐☐☐ ☐☐☐☐

• Adds the two numbers using mental math.

☐☐☐☐ + ☐☐☐☐

• Uses the same 8 digits to make two more 4-digit numbers. Subtracts them using mental math.

☐☐☐☐ – ☐☐☐☐

Players then compare their sums and differences:

The player with the greatest sum gets 1 point.

The player with the smallest difference gets 1 point.

The first player to get 8 points wins.

For example:

Peldon rolled 3, 1, 4, and 5 and then chose the digits 9, 9, 9, and 9.

3, 1, 4, 5

9, 9, 9, 9

She made the numbers 5431 and 9999 and added them: 5431 + 9999 = 15,430.

She made the numbers 5139 and 4999 and subtracted them: 5139 – 4999 = 140.

1.2.2 Estimating Sums and Differences

Try This

In 2005, there were 33,169 people in Paro Dzongkhag and 16,116 people in Bumthang Dzongkhag.

A. i) Estimate how many people altogether live in Paro and Bumthang.

ii) Estimate how many more people live in Paro than in Bumthang.

The Paro market

A temple in Bumthang

- When you do not need to know an exact amount, you can **estimate** a sum or a difference. To estimate means to find "about how many".
- When you estimate the sum or difference of 5-digit numbers, you can **round** each number to the thousands or the ten thousands.

For example:

22,179 + 35,812 rounds to about 22 thousands + 36 thousands.

22 thousands + 36 thousands = 58 thousands, which is 58,000.

So 22,179 + 35,812 is about 58,000.

35,812 – 22,179 rounds to about 36 thousands – 22 thousands.

36 thousands – 22 thousands = 14 thousands, which is 14,000.

So 35,812 – 22,179 is about 14,000.

- Sometimes you might estimate using only the ten thousands.

For example:

22,179 + 35,812 rounds to about 2 ten thousands + 4 ten thousands
= 6 ten thousands, or 60,000.

35,812 – 22,179 rounds to about 4 ten thousands – 2 ten thousands
= 2 ten thousands, or 20,000.

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B. i) Give two possible estimates for **part A i)**. Tell why both are good estimates.

ii) Give two possible estimates for **part A ii)**. Tell why both are good estimates.

Examples

Example 1 Estimating Sums and Differences

Estimate each. Show your work.

a) 52,783 + 43,296 **b)** 63,100 – 48,253

Solution	Thinking
a) 52,783 + 43,296 is about 50,000 + 40,000 = 90,000. So 52,783 + 43,296 is about 90,000.	 **a)** I rounded to the ten thousands to estimate.
b) 63,100 – 48,253 is about 63 thousands – 48 thousands. 63 thousands – 48 thousands= 15 thousands = 15,000 So 63,100 – 48,253 is about 15,000.	**b)** I rounded to the thousands to estimate the difference.

Example 2 Matching an Estimate With Pairs of Numbers

Manju estimated the sum of a pair of numbers to be 40,000.
She estimated the difference between the two numbers to be 20,000.
What are some pairs of numbers she could be using?

Solution	Thinking
30,000 + 10,000 = 40,000 30,000 – 10,000 = 20,000 30,000 could be an estimate for numbers such as 29,900, 31,204, and 30,008 10,000 could be an estimate for numbers such as 11,243, 9875, and 10,512 Some possible number pairs: 29,900 and 11,243 31,204 and 9875 30,008 and 10,512	 • I looked for two numbers that added to 40,000 but were 20,000 apart. • Then I made up numbers that could have been rounded to each number. For example: - 29,900 could be rounded up to 30,000. - 30,008 and 31,204 could be rounded down to 30,000. - 9875 could be rounded up to 10,000. - 11,243 and 10,512 could be rounded down to 10,000.

Practising and Applying

1. Estimate. Show your work.

a) 32,000 + 41,789

b) 53,702 + 15,789

c) 28,412 + 32,880

d) 17,789 + 39,205

2. Estimate.

a) 51,410 – 27,219

b) 39,005 – 33,297

c) 50,037 – 14,489

d) 91,106 – 34,822

3. The sum of two numbers is about 47,000. What could the numbers be, if neither number has a zero digit?

■■,■■■ + ■■,■■■ is about 47,000.

4. The difference between two numbers is about 12,000. What could the numbers be, if neither number has a zero digit?

■■,■■■ – ■■,■■■ is about 12,000.

5. The sum of two numbers is about 36,000. The difference is about 8000. What could the numbers be, if neither number has a zero digit?

■■,■■■ + ■■,■■■ is about 36,000.

■■,■■■ – ■■,■■■ is about 8000.

6. Why does it make sense to estimate the total population of Thimphu and Paro instead of finding an exact number?

7. Describe two ways to estimate:

33,295 + 18,492 is about ________.

GAME: Estimating the Range

Play in a group of two or three. Use a deck of cards without face cards.

Each card is a digit. An Ace is 1, a 10 is 0, and each other card is the digit shown on the card.

- Place the cards face down between you and spread them out.
- Each player takes 10 cards, arranges them into two 5-digit numbers, and then decides whether to add or subtract them.

☐☐,☐☐☐ + or – ☐☐,☐☐☐

- You win points according to this chart.
- Return the cards to the middle, mix them up, and start again.

The first player with 15 or more points wins.

How points are earned

Range of sum or difference	Points
0 to 10,000	3
10,000 to 49,999	1
50,000 to 89,999	2
90,000 to 100,000	3
More than 100,000	0

For example:

A player has the numbers 41,235 and 38,572:

41,235 + 38,572 is between 50,000 and 89,999 so adding would get 2 points.

41,235 – 38,572 is between 0 and 10,000 so subtracting would get 3 points.

If the player subtracts, he or she will earn more points for this turn.

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1.2.3 Adding 5-digit Numbers

Try This

When Pema's father bought his car, it had travelled 29,145 km. After he had owned it for a few years, it had travelled another 31,128 km.

A. About how far has the car travelled in total?

• You can add two 5-digit numbers by adding the ten thousands, thousands, hundreds, tens, and ones. A place value chart can help with this.

For example: 38,145 + 46,285

Line up the digits in each place (ten thousands, thousands, hundreds, tens, and ones), and add the values in each column. **Regroup** when there are 10 or more in a column.

- You can add the digits in each column, going from right to left:

Ten thousands	Thousands	Hundreds	Tens	Ones
1		1	1	
3	8	1	4	5
4	6	2	8	5
8	14	4	13	10
8	**4**	**4**	**3**	**0**

- Or, you can add the digits in each column, going from left to right.
If a column to the right has a sum that is 10 or greater, increase the value of the digit in the sum to its left by 1 and decrease the sum that is 10 or greater by 10.

Ten thousands	Thousands	Hundreds	Tens	Ones
3	8	1	4	5
4	6	2	8	5
7	14	3	12	10
7 + 1 = 8	4	3 + 1 = 4	2	0
8	4	4	2 + 1 = 3	0
8	**4**	**4**	**3**	**0**

• It is always a good idea to estimate to see whether a sum is reasonable.

For example: 38,145 + 46,285 = 84,430

38,145 + 46,285 is a bit less than 4 ten thousands + 5 ten thousands, so a sum of 84 thousands is reasonable.

B. Exactly how far has Pema's father's car travelled altogether? Add the kilometres in **part A** (29,145 km and 31,128 km) two different ways to find out. Show your work.

Examples

Example Adding 5-digit Numbers

One lady has counted 30,720 beads (mani chhem). Another lady has counted 19,456 beads. How many beads have they counted altogether?

Solution 1

30,720 + 19,456 = ?

Estimate first

30,720 + 19,456 is about
30 thousand + 20 thousand = 50,000.

Exact answer

$$\begin{array}{r} {\scriptstyle 1\,1} \\ 30{,}720 \\ +\ \underline{19{,}456} \\ 50{,}176 \end{array}$$

They have counted 50,176 beads altogether.

Thinking

• I estimated first so I could check my answer.

• I added, starting from the right.

• 50,176 is close to 50,000, so I figured my answer was probably right.

Solution 2

<u>30</u>,720 + <u>19</u>,456:

30 thousands + 19 thousands = 49 thousands

30,<u>720</u> + 19,<u>456:</u>

720 + 456 → 720 + 400 = 1120
1120 + 56 = 1176

49 thousands + 1176
= 49 thousands + 1000 + 176
= 50 thousands + 176
= 50,176

Estimate to check

30,720 + 19,456 is about
31,000 + 19,000 which is 50,000.

They have counted 50,176 beads altogether.

Thinking

• First I added the ten thousands and thousands parts. Then I added the rest.

• I added 720 + 456 by adding 400 and then 56.

• I added the two parts.

• I estimated to see if my answer was reasonable.

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Practising and Applying

1. Add.

a) 42,386 + 28,675

b) 18,299 + 46,168

c) 39,488 + 51,212

2. Which sum is closest to 43,000? Tell how you know.

A. 31,286 + 12,998

B. 18,112 + 24,875

C. 27,379 + 26,712

3. Add each in two different ways. Show your work.

a) 57,128 + 3999

b) 62,418 + 10,582

4. One swarm of insects has 19,456 insects. Another swarm has 78,112 insects. How many insects are there altogether?

5. The sum of a pair of 5-digit numbers is 47,396. There are no zero digits in either number.

■■,■■■ + ■■,■■■ = 47,396

List three possible pairs of numbers with this sum.

6. Use the digits 1, 2, 3, 4, and 5 in the blanks to make each true.

a)
```
  78,[]2[]
+ 1[],2[]1
  9[],374
```

b)
```
  17,3[]6
+ [][],[]91
  5[],917
```

7. You add three numbers that are 10 apart. The sum is 70,065. What are the three numbers?

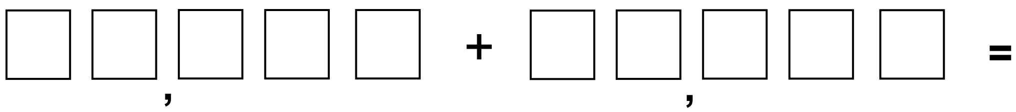
8. Jigme is adding 38,125 + 7829. He begins by adding the 3 and 7. What would you tell him, and why?

GAME: Give Me Thousands

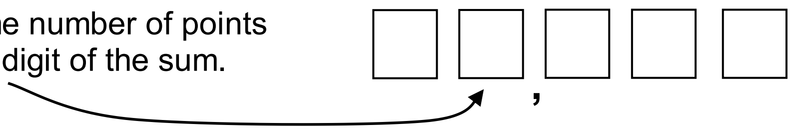
Play in a group of two or three. You need a deck of playing cards without face cards. Each card is a digit. An Ace is 1, a 10 is 0, and each other card is the digit on the card.

• Put the cards face down in the middle. Mix them up and spread them out.

• Each player takes 10 cards, arranges them to make two 5-digit numbers, and then adds the numbers.



• You get the same number of points as the thousands digit of the sum.



• Return the cards to the middle, mix them up, and start again.

The first player with 25 or more points wins.

For example:

39,120 + 56,643 = 9<u>5</u>,763, so the player gets 5 points.

1.2.4 Subtracting 5-digit Numbers

Try This

The longest road tunnel in China is 18,040 m long. The longest road tunnel in Norway is 24,510 m long.

A. About how much longer is the tunnel in Norway than the tunnel in China? How do you know?

A road tunnel through a mountain

You can subtract 5-digit numbers like you subtract smaller numbers.

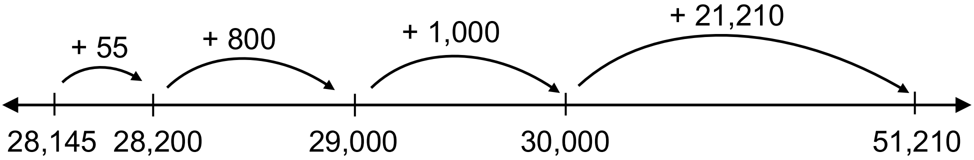
For example: 51,210 – 28,145

• You can take away. Regroup if necessary.

You can regroup like this: the 1 ten are 10 ones, the 2 hundreds are 1 hundred and 10 tens, and the 51 thousands are 4 ten thousands and 11 thousands.

0 10	1 10 10	4 11 10 10	4 11 10 10
51,2~~10~~	51,~~2~~~~10~~	~~51~~,~~210~~	~~51~~,~~210~~
– 28,145	– 28,145	– 28,145	– 28,145
5	065	3,065	23,065

• You can add up to find 28,145 + ___ = 51,210:
  From 28,145 to 28,200 is 55.
  From 28,200 to 29,000 is 800.
  From 29,000 to 30,000 is 1000.
  From 30,000 to 51,210 is 21,210.
  The total added is 55 + 800 + 1000 + 21,210 = 855 + 22,210 = 23,065.



28,145 + <u>55 + 800 + 1000 + 21,210</u> = 51,210
28,145 + <u>23,065</u> = 52,210
51,210 – 28,145 = <u>23,065</u>

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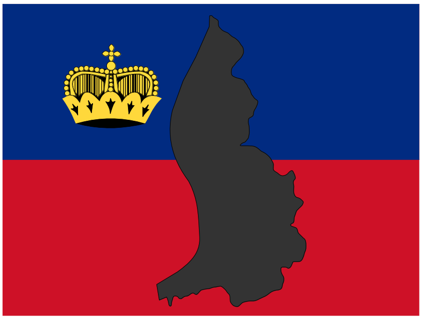
• You can also subtract in parts.
28,145 = 28,000 + 100 + 40 + 5, so
51,210 – 28,145 = 51,210 – 28,000 – 100 – 40 – 5
51,210 – 28,000 = 23,210
23,210 – 100 = 23,110
23,110 – 40 = 23,070
23,070 – 5 = 23,065

B. Use each method described above to solve the problem in **part A**.

Examples

Example Subtracting 5-digit Numbers

Two of the smallest countries in the world are Liechtenstein in Europe and Grenada in the Americas. Liechtenstein has 34,247 people and Grenada has 89,971. How many more people live in Grenada than in Liechtenstein?


Flag and map of Liechtenstein


Flag and map of Grenada

Solution 1

89,971 – 34,247 = ?
34,247 = 30,000 + 4000 + 200 + 40 + 7
89,971 – 30,000 = 59,971
59,971 – 4000 = 55, 971
55,971 – 200 = 55, 771
55,771 – 40 = 55,731
55,731 – 7 = 55,724

There are 55,724 more people in Grenada.

Thinking

• I subtracted in parts.

• To subtract 7, I used mental math. I subtracted 10 and then added back 3.

Solution 2

$$\begin{array}{r} 89{,}9\overset{6}{\cancel{7}}\overset{11}{\cancel{1}} \\ -\ 34{,}247 \\ \hline 55{,}724 \end{array}$$

There are 55,724 more people in Grenada.

Thinking

• To subtract the tens and ones, I regrouped 71, which is 7 tens + 1 one, as 6 tens + 11 ones.

Practising and Applying

1. Subtract two different ways.
Show your work.

a) 30,256 – 14,812

b) 62,112 – 48,934

c) 57,302 – 18,467

2. You subtract a 5-digit number from 32,789. The difference is about 12,000. List three possible numbers.

32,789 – ■■,■■■ is about 12,000.

3. One car has travelled 32,458 km. A second car has travelled 69,117 km. How much farther has the second car travelled?

4. Fill in the missing digits.

a)
$$\begin{array}{r} 42{,}8[]6 \\ -\ \underline{15{,}[]78} \\ []7{,}438 \end{array}$$

b)
$$\begin{array}{r} 30{,}[]41 \\ -\ \underline{1[]{,}3[]5} \\ []2{,}65[] \end{array}$$

5. Which has a difference of about 35,000?

A. 42,051 – 8,942

B. 66,091 – 48,500

C. 61,037 – 25,987

6. If you subtract a 5-digit number from a 5-digit number, are you more likely to get a 4-digit difference or a 5-digit difference? How do you know?

7. Which subtraction method would you use for 41,000 – 28,989? Why?

CONNECTIONS: A Different Way to Subtract

Here is an interesting way to subtract.

$$\begin{array}{r} 4275 \\ -\ \underline{1438} \\ 3\bar{2}4\bar{3} \end{array}$$

Subtract the digits in each column.
If you subtract the top digit from the bottom digit, put a bar over the answer.

$$\begin{aligned} 3\bar{2}4\bar{3} &= 3000 - 200 + 40 - 3 \\ &= 2800 + 40 - 3 \\ &= 2837 \end{aligned}$$

Combine the values of the digits:
If there is no bar over a digit, add its value.
If there is a bar over a digit, subtract its value.

Use this new way to subtract these numbers.

1. 5003 – 2897

2. 3121 – 2946

3. 8037 – 3674

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UNIT 1 Revision

1. a) Model 3812 using 14 base ten blocks. Sketch your model.

b) Model another number using 14 blocks. Sketch your model. Write the value of the number.

c) Model 3812 using more than 14 blocks. Sketch your model. How many blocks did you use?

2. Use the number 13,301.

a) Model it using base ten blocks. Sketch your model.

b) Write it in expanded form using numbers.

b) Write it in expanded form using words.

d) Write it in a place value chart.

3. Create a number to fit each clue.

a) It has 4 ten thousands, 5 hundreds, and 4 ones.

b) It has 3 hundreds and it has 2 more ten thousands than hundreds.

c) It has 5 fewer thousands than ten thousands.

4. Complete:

a) 53,417 = __ hundreds + __ ones

b) 16,007 = __ thousands + __ ones

c) 21,389 = __ ten thousands + __ hundreds + __ tens + __ ones

5. Rename 57,810 in two different ways.

6. About how many 100 km trips did you make if you traveled 41,245 km altogether? How do you know?

7. About how many kilometres are there in 34,216 m?

8. Use the digits 3 and 4 to make each true. If there is more than one way to do it, show all the ways.

a) _4,217 > _8,217

b) _1,384 > _0,562

9. Order from least to greatest.

a) 30,045; 23,179; 8945

b) 16,127; 99,434; 8976; 18,000

10. Tell how you know that 36,000 > 29,243.

11. List six numbers that are between 23,218 and 25,678.

12. Add or subtract using mental math. Show your thinking.

a) 4125 + 3897 **b)** 6225 + 4875

c) 8120 – 3798 **d)** 6245 – 3512

13. Which is closer to 30,000 than to 31,000?

A. 25,123 + 5423

B. 13,567 + 17,942

C. 47,213 – 16,295

D. 53,129 – 23,356

14. Add or subtract.

a) 63,128 + 17,459

b) 13,612 + 45,892

c) 37,110 – 15,617

d) 78,211 – 45,379

15. Wangdue Dzongkhag has a population of 31,135. Dagana Dzongkhag has a population of 18,222.

a) What is the total population?

b) How many more people live in Wangdue than in Dagana?

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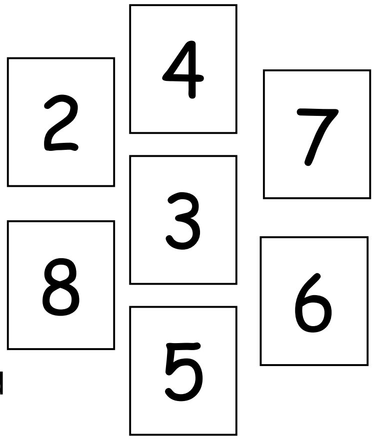
UNIT 2 MULTIPLICATION AND DIVISION FACTS

Getting Started

Use What You Know

A. You need a set of number cards like these and 60 counters.



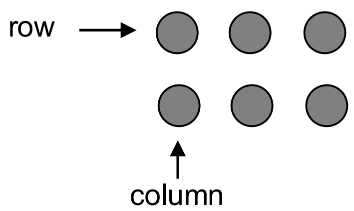
i) Turn the cards face down so you cannot see them. Spread them out and mix them up.

ii) Choose two cards. Use the two numbers to make an array with counters.

- One number is the number of rows.
- The other number is the number of columns.

For example, if you choose a 2 and a 3, you could make an array with 2 rows and 3 columns.

An array is a set of items arranged in a rectangle.



This array is 2 rows by 3 columns.

You can describe this array using the multiplication facts 2 × 3 = 6 and 3 × 2 = 6. You can also describe it using the division facts 6 ÷ 2 = 3 and 6 ÷ 3 = 2.

B. i) Write all the multiplication facts that describe your array.

ii) Write all the division facts that describe your array.

C. i) Choose two other numbers and make an array.

ii) Write all the multiplication and division facts for that array.

D. Write a word problem that someone could solve using one of your multiplication facts or one of your division facts.

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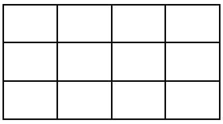
Skills You Will Need

1. You can write 5 × 3 as the repeated addition 3 + 3 + 3 + 3 + 3.
Write each multiplication as a repeated addition.

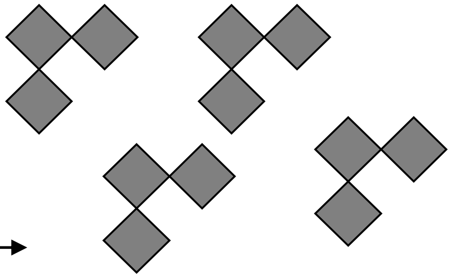
a) 6 × 4 **b)** 3 × 7 **c)** 2 × 9 **d)** 4 × 6

2. Tell how you know that each picture shows 4 × 3.

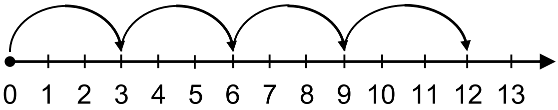
a)



b)



c)



3. All three pictures in **question 2** also show a division. What could the division be? Tell how the division matches each picture.

4. Which of these are true?

A. 5 × 4 = 4 × 5 **B.** 20 ÷ 4 = 4 ÷ 20
C. 4 × 3 = 2 × 6 **D.** 8 × 0 = 8
E. 5 × 1 = 5 **F.** 0 ÷ 7 = 0

5. Draw a picture to show each.

a) 3 × 5 **b)** 16 ÷ 8

6. Use the first fact to figure out the second fact.
Explain what you did for each.

a) If 5 × 4 = 20, then 6 × 4 = __.
b) If 4 × 7 = 28, then 28 ÷ 4 = __.
c) If 3 × 8 = 24, then 6 × 4 = __.

7. Write each product or quotient.

a) 7 × 6 = __ **b)** 5 × 9 = __ **c)** 24 ÷ 4 = __ **d)** 56 ÷ 7 = __

The answer to a multiplication is called the product.

3 x 4 = 12

Product

The answer to a division is called the quotient.

12 ÷ 4 = 3

Quotient

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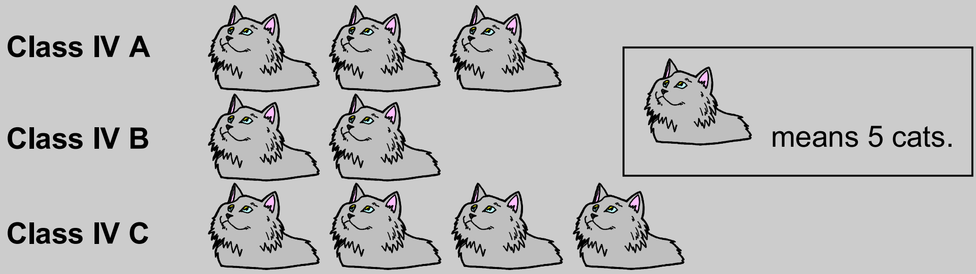
Chapter 1 Multiplication

2.1.1 Multiplying by Skip Counting

Try This

This pictograph shows the number of pet cats in three different Class IVs.

Pet Cats in Our Classes

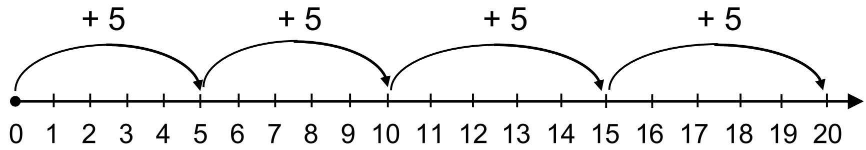


A. How many pet cats are there altogether in the three classes?

• You can multiply by adding the same number over and over. That is why one meaning of multiplication is **repeated addition**.

For example:

$4 \times 5 = 5 + 5 + 5 + 5$, since you add 5 four times.



$$4 \times 5 = 5 + 5 + 5 + 5 = 20$$

• You can **skip count** to show repeated addition. When you skip count, you count by saying some numbers in a pattern.

For example:

To solve 4×5, you can skip count by 5s four times. You say every 5th number and skip the numbers in between. You say, “five, ten, fifteen, twenty”.

1, 2, 3, 4, **5**, 6, 7, 8, 9, **10**, 11, 12, 13, 14, **15**, 16, 17, 18, 19, **20**

5, 10, 15, 20

$$4 \times 5 = 20$$

This is just like jumping by 5s on the number line above. At the end of each group of 5 numbers you say the number you are on.

• You can skip count to do multiplications because skip counting is the same as counting groups of numbers.

For example:

To multiply 6 × 5, you can skip count by 5s six times.

1, 2, 3, 4, **5**, 6, 7, 8, 9, **10**, 11, 12, 13, 14, **15**, 16, 17, 18, 19, **20**, 21, 22, 23, 24, **25**, 26, 27, 28, 29, **30**

When you skip count by 5s to 30, you count 6 groups of 5 numbers, or 6 × 5.

Here is another example:

To multiply 3 × 8, you can skip count by 8s three times.

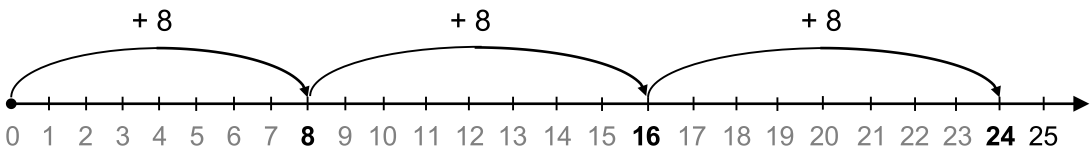
1, 2, 3, 4, 5, 6, 7, **8**, 9, 10, 11, 12, 13, 14, 15, **16**, 17, 18, 19, 20, 21, 22, 23, **24**

When you skip count by 8s to 24, you count 3 groups of 8 numbers, or 3 × 8.

• You can use a number line to help you multiply by skip counting.

For example:

3 × 8 is skip counting by 8s three times, or jumping by 8s on a number line.



B. Use skip counting to solve each. Tell how you skip counted.

i) How many pet cats are there in each class?

ii) How many pet cats are there in all three classes?

C. Write a multiplication fact for each.

i) The number of pet cats in each class

ii) The number of pet cats in all three classes

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Examples

Example Solving a Multiplication Problem by Skip Counting

There are five cars in the parking lot.
How many wheels are there altogether?
Show your work.

Solution 1

5 × 4 = ?

1, 2, 3, 4,
5, 6, 7, 8,
9, 10, 11, 12,
13, 14, 15, 16,
17, 18, 19, 20

5 × 4 = 20

There are 20 wheels.

Thinking

- There are 5 cars. Each car has 4 wheels. That is 5 groups of 4 wheels, which is 5 × 4.
- I skip counted by 4s five times.
- To skip count, I counted some numbers silently and said every 4th number out loud.

Solution 2

5 × 4 = ?

5 × 4 = 4 × 5

5, 10, 15, 20

5 × 4 = 20

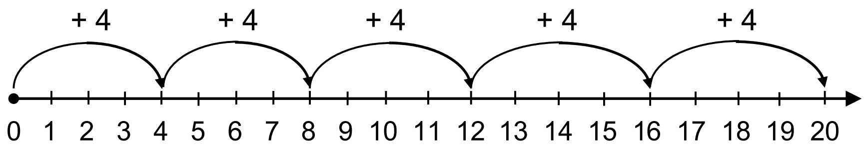
There are 20 wheels.

Thinking

- There are 5 cars. Each car has 4 wheels. That's 5 × 4.
- You can multiply in any order.
I used 4 × 5 instead of 5 × 4 because skip counting by 5s is easy for me.

Solution 3

5 × 4 = 4 + 4 + 4 + 4 + 4 = ?



There are 20 wheels.

Thinking

- 5 cars with 4 wheels on each is 4 + 4 + 4 + 4 + 4 wheels.
- I added 4 + 4 + 4 + 4 + 4 by jumping by 4s five times on a number line.

Practising and Applying

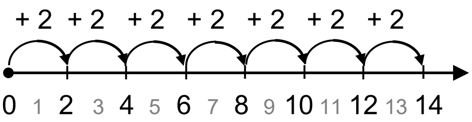
1. Skip count to solve each.
Show your work.

a) 4 × 6 **b)** 5 × 3

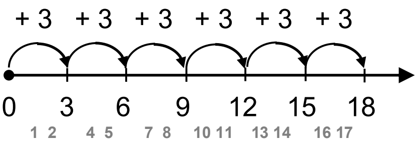
c) 2 × 9 **d)** 8 × 3

2. What multiplication does each number line model show?

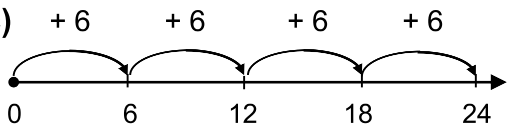
a)



b)



c)



3. Show how would you change the number line model in **question 2 c)** to show each fact. Use words or sketch a number line.

a) 6 × 6 **b)** 8 × 3 **c)** 9 × 3

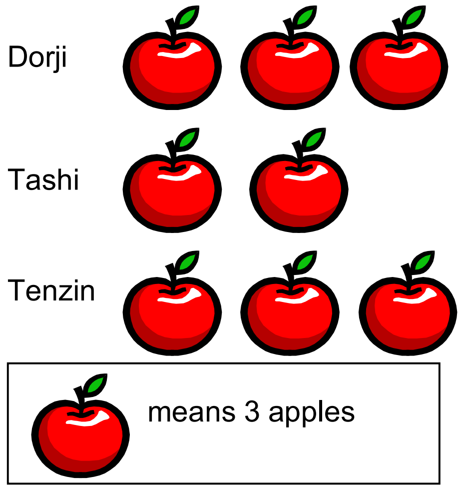
4. Ugyen and four friends each bring five books to school. How many books altogether do they bring to school?

5. A spider has eight legs.
How many legs do six spiders have?

6. The pictograph below shows how many apples three students picked.

a) How many apples did each student pick?

b) How many apples did they pick altogether?



7. Thinley skip counted to 12.
By what number might he have skip counted? Find more than one answer.

8. Yeshi says that you can use 4 × 8 = 32 and skip counting to solve 6 × 8. How would you do it?

9. When you skip count to multiply two numbers, how do you know each?

• which number to count by

• when to stop skip counting

Explain, using an example.

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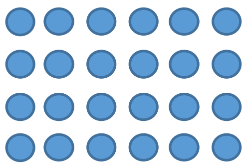
2.1.2 Multiplying Using Arrays

Try This

32 students stood in an array for
a morning assembly.

A. How many rows and columns might there be?
Find more than one answer.

• One way to show multiplication is to arrange the equal groups in an **array**.

Factors	Array	Product
4 × 6 you can show 4 × 6 as 4 rows of balls arranged in 6 columns.		24 The product is the total number of balls.
5 × 3 you can show 5 × 3 as 5 rows of stars arranged in 3 columns.		15 The product is the total number of stars.

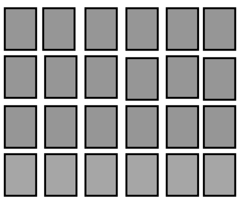
Here are some other ways to find it:

- You can use repeated addition: 6 + 6 + 6 + 6 = 24.
- Or, you can skip count by 6s four times: 6, 12, 18, 24.

• To show 5 × 3 as an array, you can use 5 rows and 3 columns.
Here are some ways to find the total number of items in the array:
- You can add 3 + 3 + 3 +3 + 3 = 15.
- Or, you could skip count by 3s five times: 3, 6, 9, 12,15.

- The array for 4 × 6 is the same as the array for 6 × 4.

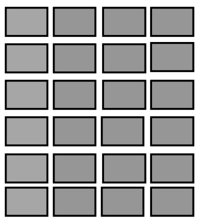
4 rows



6 columns

4 × 6 = 24

6 rows



4columns
6× 4= 24

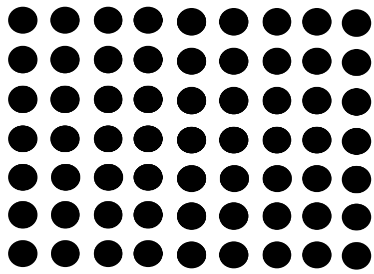
So, 4 × 6 = 6 × 4. This is the commutative property of multiplication.

- (2×3) × 4 = 2 × (3 × 4) or (2 × 4) × 3 = 4 × (3 × 2). This is Associative property of multiplication.

Examples

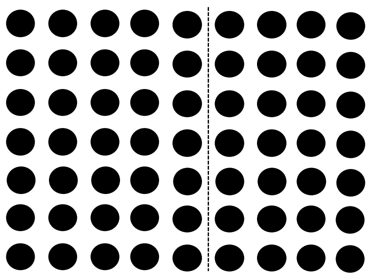
Example 1 Using Multiplication to Describe an Array

How many dots are there?
Show your work.



Solution 1

7 × 9 = ?



7 × 5 + 7 × 4

35 + 28

7 × 9 = 35 + 28 = 63

Thinking

- I cut the array into two smaller arrays because I knew the multiplication fact for each:

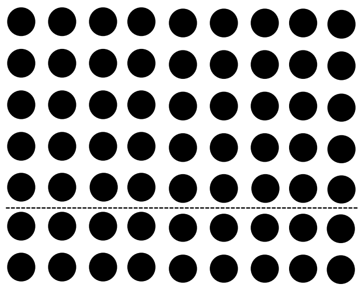
- a 7-by-5 array is 7 × 5 = 35

- a 7-by-4 array is 7 × 4 = 28

- I added the two products to find the product for the whole array.

Solution 2

7 × 9 = ?



5 × 9

+

2 × 9

5 × 9 = 9 × 5 = 45

2 × 9 = 18

45 + 18 = 63

Thinking

- I cut the array into two smaller arrays that I knew the facts for.

- The first was a 5-by-9 array.
Instead of using 5 × 9
I used 9 × 5 so I could skip count by 5s.

- The other array was 2-by-9 and
I knew 2 × 9 = 18.

- I added the two products to find the product for the whole array

Example 2 Using an Array and Multiplication to Solve a Problem

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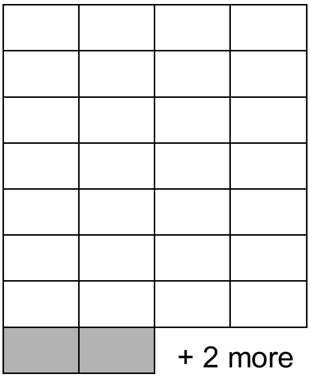
Students at the School for the Deaf in Drugyel learn sign language. Here are the signs for the alphabet. How many signs are there? Show your work.

Solution



7 × 4

+ 2 more

7 × 4 = 28   7, 14, 21, **28**

28 + 2 = 30

There are 30 signs.

Thinking

- I could see an array of 7 rows by 4 columns plus 2 more.
- I multiplied 7 × 4 by skip counting. Then I added on 2 more.

Practising and Applying

1. What multiplication fact does each array show?

a)
X X X X X X
X X X X X X
X X X X X X

b)
X X X
X X X
X X X
X X X

c)
X X X X X X X X
X X X X X X X X
X X X X X X X X

2. a) Imagine each array in **question 1** was turned sideways. Write a multiplication fact for each new array.

b) Each array in **question 1** has two possible multiplication facts. Which fact would you use to find the total number of Xs in each? Why?

3. Sketch an array to show each.

a) 4 × 8   **b)** 3 × 7

c) 2 × 6   **d)** 5 × 8

4. What multiplication fact does this array show?

5. Sketch an array for each multiplication fact below. Cut the array into two smaller arrays. Use the multiplication fact for each small array to find the number of items in the whole array.

a) 6×8 **b)** 4×9

6. Imagine you have 24 items.

a) Sketch two possible arrays.

b) Write a multiplication fact for each array.

7. a) How are arrays for 7×1, 8×1, and 9×1 alike?

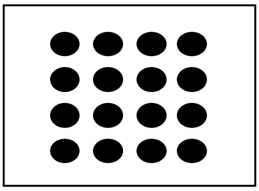
b) What do the arrays in **part a)** show about what happens when you multiply by 1?

8. Why is an array of 5 rows and 7 columns a way to show 5×7?

GAME: Array Fact Match

Play with a partner.

You need 15 array cards and 15 multiplication fact cards.



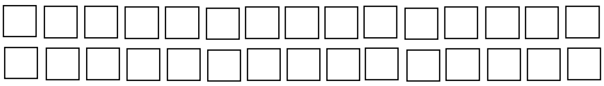
$4 \times 4 = 16$

Mix up the array cards and then place them face down in one row.

Mix up the fact cards and then place them face down in another row.

Array cards →

Fact cards →



Take turns flipping over any two cards at once, one from each row.

If the cards match, keep the cards and take another turn.

If the cards do not match, turn them face down. Your turn is over.

Play until all cards are matched.

The player who has kept more cards wins the game.

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2.1.3 EXPLORE: Meanings of Multiplication

These six different word problems can all be solved using 4 × 3.
Each problem shows a different meaning for 4 × 3.

I. Tshering earned Nu 3 each day for 4 days.

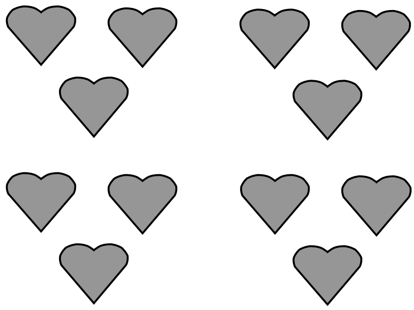
Monday	Nu 3
Tuesday	Nu 3
Wednesday	Nu 3
Thursday	Nu 3

How much did she earn altogether?

II. An array has 4 rows of 3 leaves.

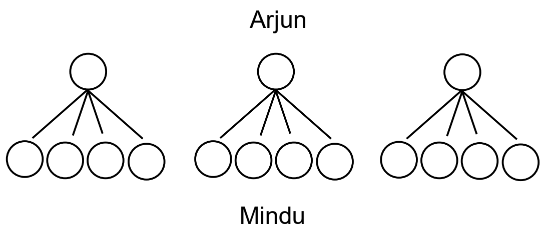
How many leaves are there?

III. There are 4 groups of 3 hearts.



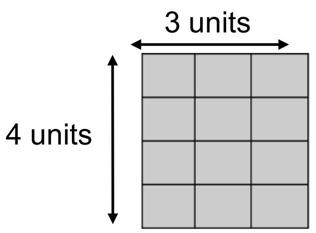
How many hearts are there?

IV. Arjun has 3 coins.
Mindu has 4 times as many coins.



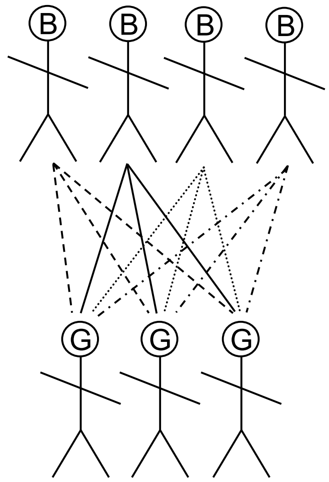
How many coins does Mindu have?

V. A rectangle is 4 units long and 3 units wide



How many square units will cover its area?

VI. There are 4 boys and 3 girls.



How many different boy-girl pairs are there?

A. Tell how each word problem on **page 45** shows 4 × 3.

B. i) Which word problem on **page 45** is like the problem below?

A man walks 2 km.
His friend walks 4 times as far.
How far does his friend walk?

ii) Sketch a picture to model the word problem in **part B i)**.
Write the multiplication fact.

C. i) Which word problem on **page 45** is like this problem?

Pelden is laying tiles on a floor.
There are 5 different colours of tiles.
There are 3 different patterns in each colour.
How many different tiles are there?

ii) Sketch a picture to model the word problem in **part C i)**.
Write the multiplication fact.

D. Choose three word problems below. Do this for each problem:

- Tell which word problem on **page 45** is like the word problem.
- Sketch a picture, if possible, and write the multiplication fact.

i) How many toes are there on 4 feet?	**ii)** How many square units will cover a rectangle that is 4 units wide and 5 units long?
iii) Kinley picked 4 apples. His sister Yangchen picked 5 times as many. How many apples did Yangchen pick?	**iv)** Gyatri skip counted by 5s four times. How far did she count?
v) Penjor's teacher is making pairs of Class IV and Class I students. There are 4 Class IV students and 5 Class I students. How many different pairs of students can be made?	**vi)** Desks are arranged in 4 rows with 5 desks in each row. How many desks are there?

E. Create and solve three different multiplication word problems.
Each problem should use a different meaning of multiplication.

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2.1.4 Relating Facts by Doubling and Halving

Try This

Class IV students are practising two dances.

- 3 groups of 4 girls are dancing one dance.
- 3 groups of 8 boys are dancing another dance.

A. i) Write a multiplication fact that tells the number of girls dancing.

ii) Write a multiplication fact that tells the number of boys dancing.

ii) What do you notice about the two products?

You can use multiplication facts you know, to figure out multiplication facts that you do not know.

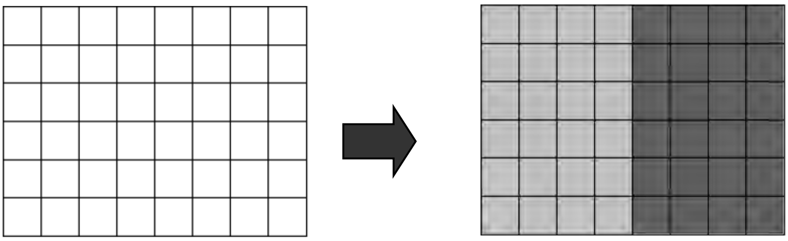
When you multiply two numbers, you can first multiply by half of it and then double the product

For example:

You can think of 6 × 8 as double 6 × 4, since 8 is double 4.

So, if 6 × 4 = 24, then 6 × 8 = 24 + 24 = 48.

This model shows how it works:

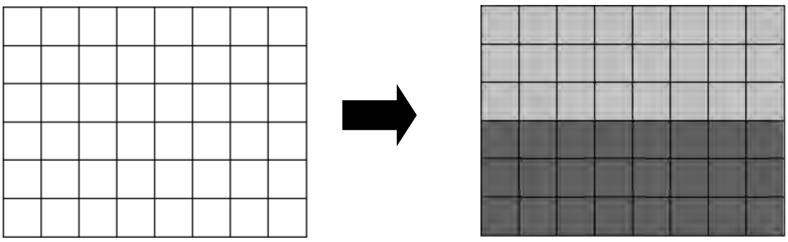


6 × 8   6 × 4 + 6 × 4 = 24 + 24 = 48

Or, you can think of 6 × 8 as double 3 × 8, since 6 is double 3.

So, if 3 × 8 = 24, then 6 × 8 = 24 + 24 = 48.

This model shows how it works:



3 × 8 = 24

3 × 8 = 24

6 × 8 = 24 + 24 = 48

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Here are more examples of halving, then doubling:

To figure out 7×8, you might double 7×4:

$7 \times 8 = ?$
$7 \times 4 = 28$
$7 \times 8 = 28 + 28 = 56$

To figure out 8×3, you might double 4×3:

$8 \times 3 = ?$
$4 \times 3 = 12$
$8 \times 3 = 12 + 12 = 24$

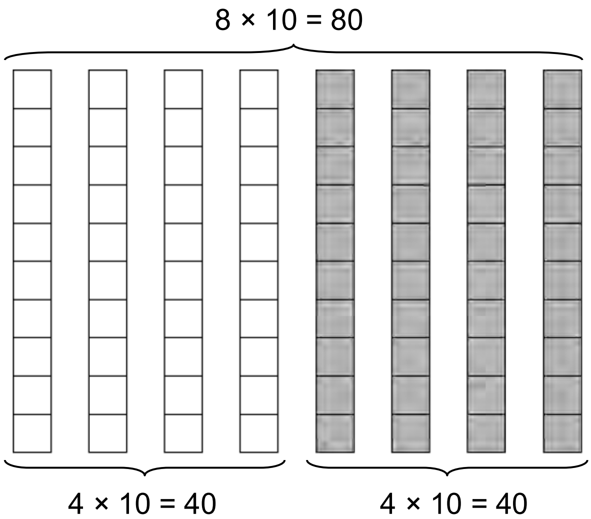
• Sometimes it is easier to multiply by the double of one of the numbers and then take half the product.

For example:

You can think of 4×10 as half of 8×10, since 4 is half of 8.

So, if $8 \times 10 = 80$, then 4×10 is half of 80, so $4 \times 10 = 40$.

This model shows how it works:



Here is another example of the strategy of doubling, then halving:

To figure out 6×5, you might take half of 6×10:

6×5 = half of 6×10

If $6 \times 10 = 60$, then $6 \times 5 = 60 \div 2 = 30$

$6 \times 5 = 30$

B. In **part A**, how could you find the number of boys dancing if you already knew the number of girls dancing? Explain your thinking.

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Examples

Example 1 Halving, then Doubling to Calculate a Product

Use halving, then doubling for each. Show your work.

a) 7×6 **b)** 4×8

Solution

a) $7 \times 6 = ?$

$7 \times 3 = 21$

$7 \times 6 = 21 + 21$

$7 \times 6 = 42$

b) $4 \times 8 = ?$

$4 \times 4 = 16$

$4 \times 8 = 16 + 16$

$4 \times 8 = 32$

Thinking

a) I knew I could multiply the even number by half and then double the answer.

• Since 6 is double 3, I knew 7 × 6 was double 7 × 3.

b) Since both numbers were even, I could have taken half of either number and then doubled the product. I decided to take half of 8.

Example 2 Doubling, then Halving to Calculate a Product

Use doubling, then halving to multiply. Show your work.

a) 7×5 **b)** 6×4

Solution

a) $7 \times 5 = ?$

$7 \times 10 = 70$

half of 70 =

$30 + 5 = 35$

$7 \times 5 = 35$

b) $6 \times 4 = ?$

half of 6 = 3

double 4 = 8

$6 \times 4 = 3 \times 8$

Since $3 \times 8 = 24$,

$6 \times 4 = 24$.

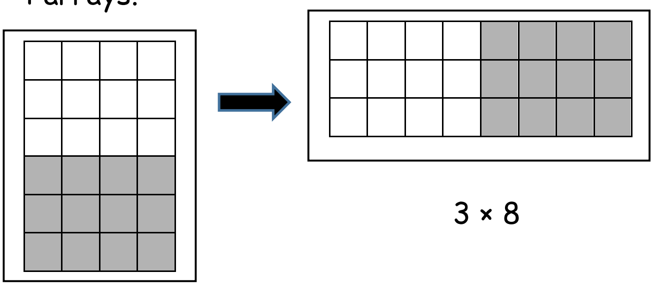
Thinking

a) I doubled 5 to get 10.

• I had to take half of 7 × 10 = 70.
I thought: 70 = 60 + 10 and then I took half of each part and added the halves.

• Half of 60 = 30 and Half of 10 = 5.

b) I knew 6 × 4 = 3 × 8 because both are made up of two 3 × 4 arrays.



6 × 4 3 × 8

• I took half of the 6 and doubled the 4.

• I did this because I knew that 3 × 8 = 24, but I had forgotten what 6 × 4 was.

Practising and Applying

1. Use halving, then doubling to solve each. Show your work.

a) 6 × 9 **b)** 4 × 7

c) 8 × 9 **d)** 7 × 8

2. Use doubling, then halving to solve each. Show your work.

a) 9 × 5 **b)** 5 × 5

3. a) Solve each.

i) 3 × 8 **ii)** 3 × 10

b) For each multiplication in **part a)**, double the first number, halve the second number, and then multiply. What do you notice?

4. Sketch a picture to model each.

a) 7 × 4 is double 7 × 2

b) 5 × 4 is half of 10 × 4

c) 6 × 2 is the same as 3 × 4

5. A set of triplets is 3 children born at the same time to the same mother.

a) How many children are in 2 sets of triplets?

b) Use your answer to **part a)** to find the number of children in 4 sets of triplets and 8 sets of triplets.

6. Tshering solved 8 × 6 by doubling 2 × 6 and then doubling again. Sketch a picture to show why her strategy works.

7. Choose a number from 2 to 9 and multiply it by 3. How can you use your answer to multiply the number you chose by 6?

$$? \times 3 \rightarrow ? \times 6$$

8. Look at the multiplication table below. Compare the numbers within each column. Which rows have the doubles of the numbers in which other rows? Why is that?

×	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

GAME: Matching Doubles

Play against another student.

You each need a set of 30 Matching Doubles Game Cards.

• Mix up your cards and place them face down in front of you.
Your partner does the same thing with his or her cards.

• Starting at the same time, you both turn over all your cards and match each multiplication with a multiplication that has a product that is double.

For example: $\boxed{3 \times 5}$ matches $\boxed{6 \times 5}$ or $\boxed{3 \times 10}$

The first person to finish matching all his or her cards wins the game.

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2.1.5 Multiplying by 7, 8, and 9

Try This

Karma will visit her grandmother 8 weeks from now.

A. i) How many days are there in a week?

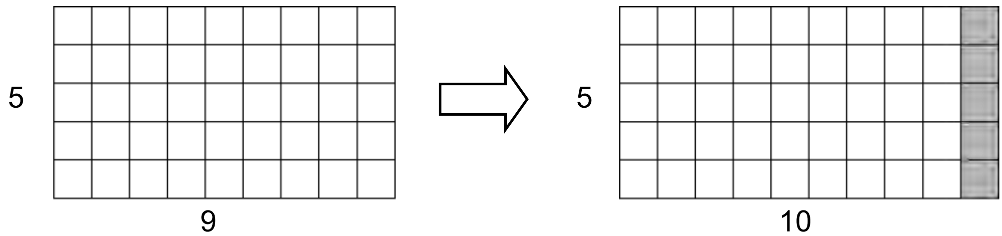
ii) How many days are there until her visit? How do you know?

If you cannot remember the multiplication facts for 7, 8, and 9, here are some strategies you can use.

• Knowing 9 = 10 – 1 can help you multiply by 9.

For example: $5 \times 9 = 5 \times (10 - 1) = 5 \times 10 - 5 \times 1$

This picture shows why $5 \times 9 = 5 \times 10 - 5 \times 1$.

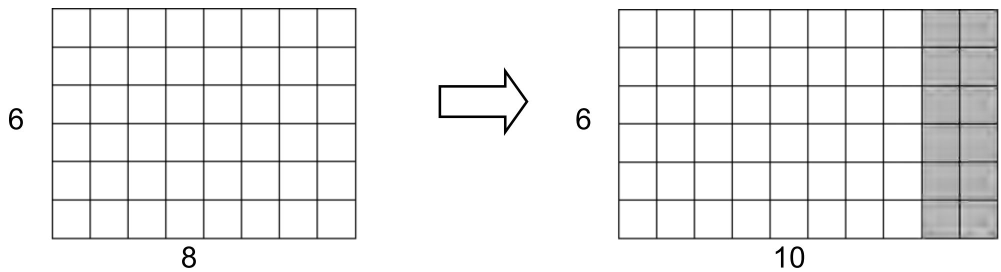


$5 \times 10 = 50$ and $5 \times 1 = 5$. So $5 \times 9 = 50 - 5 = 45$.

• Knowing 8 = 10 – 2 can help you multiply by 8.

For example: $6 \times 8 = 6 \times (10 - 2) = 6 \times 10 - 6 \times 2$

This picture shows why $6 \times 8 = 6 \times 10 - 6 \times 2$.



$6 \times 10 = 60$ and $6 \times 2 = 12$. So $6 \times 8 = 60 - 12 = 48$.

• Knowing 7 = 10 – 3 can help you multiply by 7.

For example:

$6 \times 7 = 6 \times (10 - 3) = 6 \times 10 - 6 \times 3$

$6 \times 10 = 60$ $\qquad$ $6 \times 3 = 18$

So $6 \times 7 = 60 - 18 = 42$.

B. Use the strategy you just learned to solve the problem in **part A**. Show your work. Sketch a picture to show what you did.

Examples

Example 1 Multiplying by 8 Using Strategies	
Sithar has not memorized all of his 7 or 8 times multiplication facts. How could he multiply 8 × 7?	
Solution 1 8 × 7 = ? Double 7 three times, since 8 = 2 × 2 × 2. 8 × 7 = 7 × 8 = 7 × 2 × 2 × 2 7 × 2 = 14 14 × 2 = 28 28 × 2 = 56 8 × 7 = 56	**Thinking**  • When I multiply a number by 8, it's like doubling the number 3 times.
Solution 2 8 × 7 = ? 8 = 9 – 1 9 = 10 – 1 10 × 7 = 70, so 9 × 7 = 70 – 7 = 63 8 × 7 = 63 – 7 = 56 8 × 7 = 56	**Thinking**  • 8 groups of 7 is 7 less than 9 groups of 7. • 9 groups of 7 is 7 less than 10 groups of 7.
Solution 3 8 × 7 = ? 7 × 7 is 7 groups of 7 = 49 8 × 7 is 8 groups of 7 = 49 + 1 group of 7 8 × 7 = 49 + 7 = 56 8 × 7 = 56	**Thinking**  • I know facts like 6 × 6 = 36, 7 × 7 = 49, and 8 × 8 = 64. I sometimes use them to calculate other facts.

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Example 2 Multiplying by 7 to Solve a Problem

How many days are in 4 weeks? Show your work.

Solution

There are 7 days in 1 week, so there are 4 × 7 days in 4 weeks.

4 × 7 = ?

7 = 5 + 2, so 4 × 7 = 4 × 5 + 4 × 2

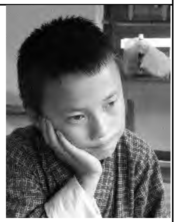
X X X X X | X X
X X X X X | X X
X X X X X | X X
X X X X X | X X

4 × 5 = 20 and 4 × 2 = 8

4 × 7 = 20 + 8 = 28

There are 28 days in 4 weeks.

Thinking



- 7 = 5 + 2, so
  4 groups of 7 =
  4 groups of 5 + 4 groups of 2.

Practising and Applying

1. Use one of the strategies in this lesson to multiply. Show your work.

a) 7 × 9 **b)** 6 × 9

c) 8 × 6 **d)** 8 × 8

2. Multiply.

a) 1 × 9 **b)** 2 × 9

c) 3 × 9 **d)** 4 × 9

e) 5 × 9 **f)** 6 × 9

3. a) What pattern do you notice in the products in **question 2**?

b) Use the pattern to predict 8 × 9. Explain your prediction.

4. Tenzin checked each answer for **question 2** by adding the digits of the product. Explain what he did.

5. a) Write the numbers you say when you skip count by 8s to 64.

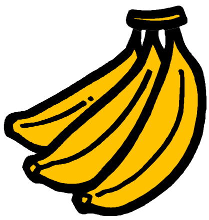
b) For each number in **part a)**, add the digits until you get a 1-digit number.

For example, for 64:

6 + 4 = 10 → 1 + 0 = 1

c) What pattern do you see in the numbers for **part b)**?

6. Kinzang is selling 8 bunches with 3 bananas in each bunch. How many bananas is he selling?



7. Write a word problem that you could solve using 8 × 5. Solve your problem.

8. Why is it useful to know that 6 × 10 = 60 to multiply each?

6 × 9 6 × 8 6 × 7

2.1.6 EXPLORE: Multiplication Table Patterns

There are many patterns in a multiplication table.

You can look for patterns in the rows and in the columns.

You can look for other types of patterns too.

	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

For example:

Each number in the 3 row is the sum of the numbers in the ×1 row and the ×2 row.

1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27

A. **i)** Compare these pairs of rows. What do you notice?

- Compare the ×1 row and the ×2 row
- Compare the ×2 row and the ×4 row
- Compare the ×3 row and the ×6 row

ii) Which other rows can be paired in this way?

B. Which columns can be paired in the same way as the rows in **part A**? Why?

C. i) How do the numbers in the ×6 row increase? Why?

ii) How do the numbers in the ×8 row increase? Why?

D. Look at the products for 1 × 1, 2 × 2, 3 × 3, 4 × 4, and 5 × 5.

i) Describe the pattern in how the numbers increase.

ii) Does the pattern continue for 6 × 6, 7 × 7, 8 × 8, and 9 × 9? How do you know?

E. Look for other patterns in the table. Try to find five or more patterns.

F. Tell how you can use three of the patterns you found to make multiplying easier for yourself.

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CONNECTIONS: Multiplication Fact Digit Circles

If you create a circle with the numbers 0 to 9 like the circle below, you can draw shape patterns for the multiplication facts.

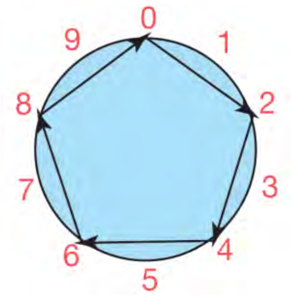
• Here are the multiplication facts for 2, in order:

0 × 2 = 0	1 × 2 = 2	2 × 2 = 4	3 × 2 = 6	4 × 2 = 8
5 × 2 = 10	6 × 2 = 12	7 × 2 = 14	8 × 2 = 16	9 × 2 = 18

Notice the pattern in the ones digits of the products:

0, **2**, **4**, **6**, **8**, 1**0**, 1**2**, 1**4**, 1**6**, 1**8**

If you join the ones digits on the circle, 0, 2, 4, 6, 8, 0, 2, 4, 6, 8, you get a pentagon:



• If you do the same thing for the multiplication facts for 3, you get a 10-sided shape.

What shapes do you get for the multiplication facts for 4, 5, 6, 7, 8, and 9?

CONNECTIONS: Finger Multiplication

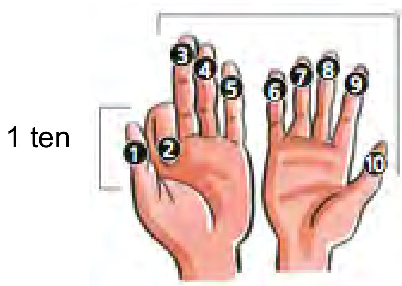
Did you know that you can use your fingers to multiply by 9?

Here is what you do:

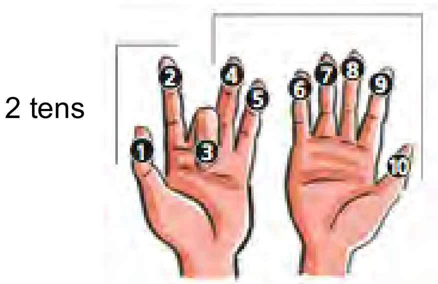
• Number your fingers from 1 to 10 as shown below.

• To multiply a number by 9, bend the finger with that number.

• The number of fingers to the left of the bent finger tells how many tens are in the product. The number of fingers to the right tells how many ones.



2 × 9 = 1 ten, 8 ones = 18



3 × 9 = 2 tens, 7 ones = 27

Use your fingers to multiply 9 by 4, 5, 6, 7, 8, and 9.

Chapter 2 Division

2.2.1 Division as Sharing

Try This

There are 18 biscuits to be shared equally among three students.

A. How many biscuits will each student get? How do you know?

• One meaning of division is sharing. In a sharing problem, you know the total number of items and the number of groups. You need to find the number of items each group gets.

For example:

20 ÷ 5 can mean 20 items shared equally in 5 groups.

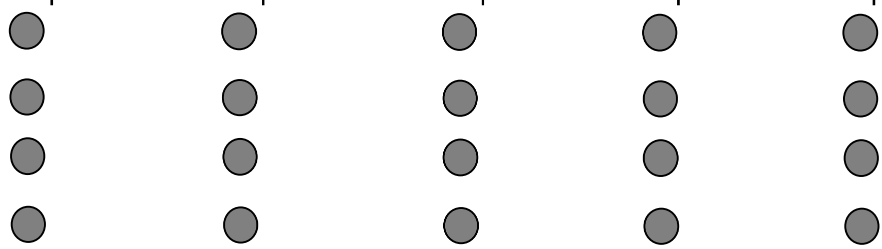
The number of items that each group gets is the **quotient**.

• To model the sharing meaning for 20 ÷ 5, you can arrange 20 counters in 5 groups by putting one counter in each group, then another counter in each group, and continue until all the counters have been shared.

20 ÷ 5 = ?

20 items shared among 5 groups

Group 1 Group 2 Group 3 Group 4 Group 5



Each group has 4 items, so 20 ÷ 5 = 4.

• Notice that the counters above form a 5 × 4 = 20 array. This shows how division is related to multiplication.

• You can check your quotient by multiplying to see if the product is the number you began with.

For example, if 20 ÷ 5 = 4, then 4 × 5 = 20.

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B. Write a multiplication fact and a division fact for the problem you solved in **part A**.

Examples

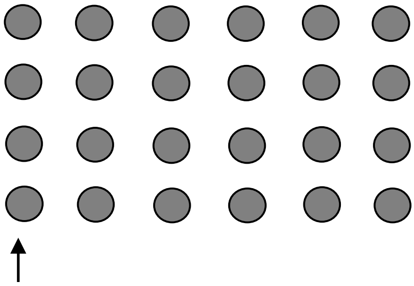
Example Solving a Sharing Problem

A job would take 24 hours for one student to complete. Six students are sharing the job equally. How many hours must each student work? Show your work.

Solution 1

24 hours shared among 6 students

1 2 3 4 5 6



one share is 4 counters

$24 \div 6 = 4$

Each student must work 4 hours.

Thinking

- I used 24 counters to model the 24 hours.
- I shared the 24 counters into 6 equal groups. Each group is what 1 student got, or 1 share.
- I counted the counters in each share.

Solution 2

$24 \div 6 = ? \rightarrow 6 \times ? = 24$

If $6 \times 4 = 24$, then $24 \div 6 = 4$.

Each student must work 4 hours.

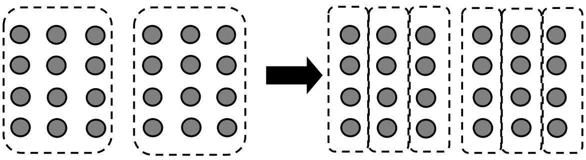
Thinking

- Even though it was a division problem, I knew I could multiply to solve it.

Solution 3

$24 \div 6 = 24 \div 2 \div 3$

$24 \div 2 = 12$ $12 \div 3 = 4$ $12 \div 3 = 4$



Each student must work 4 hours.

Thinking

- I forgot what $24 \div 6$ was, so I divided 24 by 2 and then by 3 instead.
- I knew that dividing 24 into 6 groups is the same as dividing 24 into 2 large groups and then dividing each large group into 3 small groups.

Practising and Applying

1. Sketch a picture and write a division fact to show the size of each share.

a) 8 biscuits shared by 4 people

b) 6 mangos shared by 6 people

c) 18 apples shared by 6 people

d) 30 counters shared by 5 students

2. A class of 35 students is divided into 7 teams. How many students are on each team?

3. There are 20 toys to be shared.

a) If four children share, how many toys does each child get?

b) If five children share, how many toys does each child get?

4. Bhagi said you can divide 49 ÷ 7 by subtracting 7s from 49, one at a time, until you get to 0. Then you count how many 7s you subtracted.

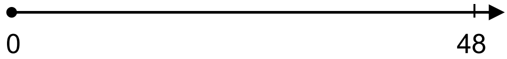
This is what he did:

$$\left.\begin{array}{r} 49 - 7 = 42 \\ 42 - 7 = 35 \\ 35 - 7 = 28 \\ 28 - 7 = 21 \\ 21 - 7 = 14 \\ 14 - 7 = 7 \\ 7 - 7 = 0 \end{array}\right\} \begin{array}{l} \text{There are} \\ \text{7 subtractions,} \\ \text{so } 49 \div 7 = 7. \end{array}$$

a) Why does his method make sense?

b) Use his method to solve 35 ÷ 5.

5. Duptho divided 48 ÷ 6 using a number line. He divided the part from 0 to 48 into 6 equal sections.



a) Try his method. Explain how you made the 6 equal sections.

b) What is 48 ÷ 6? How do you know?

6. Write a sharing problem that could be solved using 30 ÷ 5.

7. Some sweets are shared equally by six students. There are no sweets left over. How many sweets might there have been to start with? Find more than one answer.

8. Some tins of fish are shared equally by four people with none left over. The same number of tins can be shared equally by three people with none left over. How many tins might there be? Find more than one answer.

9. Describe two or more different ways to solve 36 ÷ 9.

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2.2.2 Division as Grouping

Try This

16 students are playing a game in pairs.

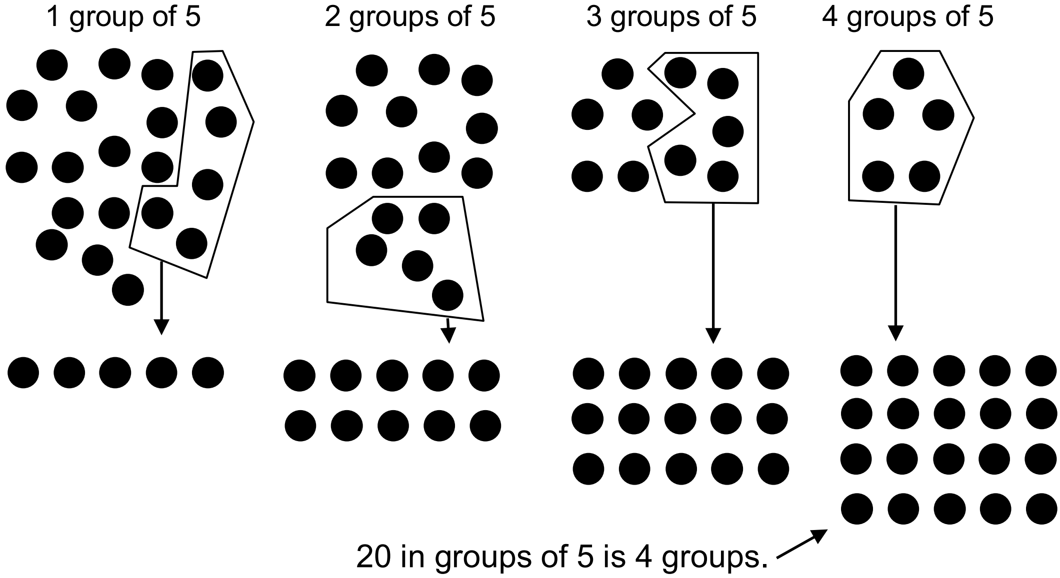
A. How many pairs of students are playing?

Another meaning for division is grouping. In a grouping problem, you know the total number of items and the number of items in each group. You need to find the number of groups.

For example:

If there are 20 students in groups of 5, how many groups are there?

You can model the 20 students with counters and then make groups of 5.



So 20 ÷ 5 = 4.

• The array above looks like the array on **page 56**. This is because when you share 20 among 4 groups, you actually create groups of 5:

20 ÷ 5 can mean 20 grouped into groups of 5, or

20 ÷ 5 can mean 20 shared among 5 groups.

B. i) Write a division fact for the problem in **part A**.

ii) What makes the problem a division grouping problem?

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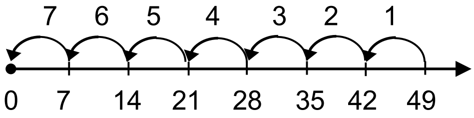
Example Solving a Grouping Problem

A game requires 7 players. In a class of 49 students, how many groups can play the game? Show your work.

Solution 1

49 ÷ 7 = ?



49 ÷ 7 = 7

Thinking

- I knew it was division because it's putting 49 into groups of 7.
- I counted backwards from 49 by 7s on a number line to find the number of 7s in 49.

Solution 2

49 ÷ 7 = ? → 7 × ? = 49

7 × 2 = 14 Too low

7 × 10 = 79 Too high

7 × 7 = 49 That works

If 7 × 7 = 49, then 49 ÷ 7 = 7.

Thinking

- I thought about how many 7s are in 49 by finding what to multiply 7 by to get 49.

Practising and Applying

1. Sketch a picture and write a division fact to show each.

a) How many lengths of 5 cm are in 25 cm?

b) How many plates of 3 biscuits can you make with 24 biscuits?

c) How many groups of 9 students can be made with 36 students?

2. 16 people are going on a car trip. Each car holds 4 people. How many cars are needed?

3. Kinley is reading a book that has 42 pages. He reads 6 pages each night. How many nights will he read to finish the book?

4. 30 students are in equal teams. How many teams could there be and how many could be in each team? Find more than one answer.

5. Make three division facts using each number once.

32	7	4	4	6
8	24	8	56	

6. To divide 42 ÷ 6, Ugyen skip counts by 6s to 42 and then counts how many numbers she has said.

42 ÷ 6 = ?

6, 12, 18, 24, 30, 36, 42

7 numbers, so 42 ÷ 6 = 7

a) How does her method work?

b) Use her method to solve 56 ÷ 7.

7. Write two word problems that could be solved using 72 ÷ 9. Write a sharing problem and a grouping problem.

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2.2.3 Multiplication and Division Fact Families

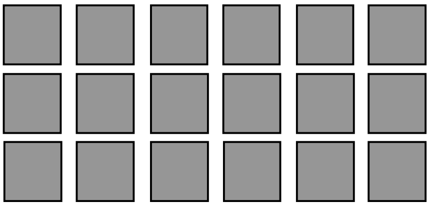
Try This

Pema creates a design that is an array made of 40 squares.
He arranges the squares in 5 rows.

A. How many squares are in each row? Show your work.

• You can use an array to show both multiplication and division.
For example:

3 rows



6 columns

In this array, you can see these facts:

$3 \times 6 = 18$ (3 rows of 6 squares)
$6 \times 3 = 18$ (6 columns of 3 squares)
$18 \div 3 = 6$ (18 squares in 3 rows)
$18 \div 6 = 3$ (18 squares in 6 columns)

A set of multiplication and division facts that describes the same array is called a **fact family**. Notice that the fact family above uses the numbers 3, 6, and 18.

• Knowing about fact families can be useful. You can use one fact to solve another fact in the same family.
For example:
To find out how many groups of 7 can be made with 42 students, you might write a division but solve it using multiplication.

$$42 \div 7 = ? \rightarrow ? \times 7 = 42$$

If you know $6 \times 7 = 42$, then you know $42 \div 7 = 6$.
Notice that this fact family uses the numbers 6, 7, and 42.

• Since each fact family uses three numbers, if you see two numbers in a division or multiplication problem, then you know what the third number is.

B. i) What is the fact family for the design in **part A**?
ii) How can you use the fact family to solve the problem in **part A**?

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Examples

Example Solving a Division Using Multiplication

Bijoy and three of her friends are sharing 24 momos.
How many momos does each person get?

Solution

$24 \div 4 = ? \rightarrow ? \times 4 = 24$

Since $6 \times 4 = 24$, then $24 \div 4 = 6$.

Each person gets 6 momos.

Thinking

- There were 24 momos to be shared among 4 people so I knew it was division.
- I noticed the numbers 24 and 4, so I used the fact family that has 4, 6, and 24.

Practising and Applying

1. Which fact family uses the numbers 9 and 63?
List all the facts in the family.

2. Which fact family does each show?

a)

X X X X X
X X X X X
X X X X X
X X X X X
X X X X X

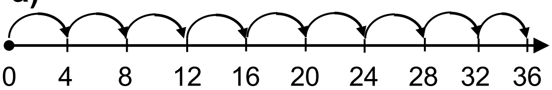
b)

X X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X X X X

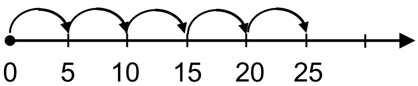
3. Why does the fact family for **question 2 a)** have only two facts instead of four facts?

4. Which multiplication and division facts does each show?

a)



b)



5. Which multiplication and division facts does each show?

a) $9 + 9 + 9 + 9 + 9 = 45$

b) $42 - 6 - 6 - 6 - 6 - 6 - 6 - 6 = 0$

6. 32 children are going for a walk. One adult must take care of each group of four children.

a) How can you use multiplication to decide how many adults are needed?

b) How can you use division to decide how many adults are needed?

7. How can you use $5 \times 6 = 30$ to solve both of these division facts?

$30 \div 6 =$ __

$30 \div 5 =$ __

8. Samten says that if you know all the multiplication facts, then you do not have to memorize the division facts. Do you agree? Why?

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2.2.4 EXPLORE: Multiplying and Dividing with 1 and 0

There are special patterns for multiplying or dividing by 1 and for dividing 0 by a number.

A. An array of **3** rows with **4** items in each has **12** items altogether.

X X X X
X X X X
X X X X

i) Sketch an array to model each.

1 × 6 and 6 × 1

1 × 8 and 8 × 1

1 × 4 and 4 × 1

ii) Tell the total number in each array.

iii) Write division facts for each array.

iv) How do your answers to **parts i)**, **ii), and iii)** help you predict the values for 1 × 9, 9 × 1, and 9 ÷ 1?

B. i) Multiply.

4 × 8 =
3 × 8 =
2 × 8 =
1 × 8 =

ii) Continue the pattern to solve 0 × 8.
How do you know you are right?

C. The multiplication 5 × 7 = 35 can mean this:

5 groups with **7** items in each group is **35** items altogether.

Use this idea to explain why each is true.

i) 0 × 6 = 0 **ii)** 6 × 0 = 0

D. The division 35 ÷ 7 = 5 can mean

35 items shared among **7** groups means each group gets **5** items.

Use this idea to explain what 0 ÷ 4 means. Then divide 0 ÷ 4.

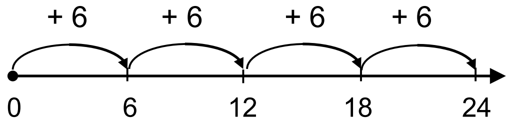
E. Describe a rule for each.

i) multiplying by 0 **ii)** dividing 0 by a number (but not 0)

iii) multiplying by 1 **iv)** dividing by 1

UNIT 2 Revision

1. a) What multiplication fact does this model show?



b) Sketch a number line model to show 5 × 6.

2. Each of the 8 students at Tashi's table has 5 books. How many books are there altogether?

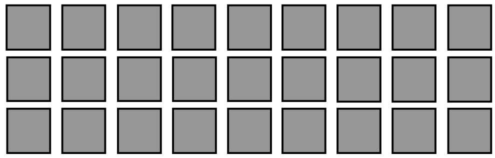
3. Jigme says that you can multiply 5 × 7 using 3 × 7 = 21 and skip counting.

a) Show what Jigme would do.

b) Solve 5 × 7.

4. There are 10 windows on the front of this building. What multiplication fact could you use to tell about the number of windows?

5. What multiplication fact does this array show?



6. Sketch an array to show each. Calculate each product.

a) 5 × 9 **b)** 6 × 6

7. a) Divide each array in **question 6** into two parts using a straight line. The line can go across or it can go up and down.

b) Write a multiplication fact for each part and a multiplication fact for the whole array.

8. Why can you use 3 × 7 to solve each problem?

a) How many days are in 3 weeks?

b) A rectangle is 3 cm wide and 7 cm long. What is its area?

c) Your friend has 7 coins. You have 3 times as many coins. How many coins do you have?

9. Sketch a picture to show why each is true.

a) 6 × 7 is double 3 × 7

b) 4 × 5 is half of 4 × 10

10. Use halving, then doubling to solve each. Show your work.

a) 6 × 8 **b)** 5 × 8

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11. How can you use 5 × 10 = 50 to multiply each?

a) 5 × 9 **b)** 5 × 8

12. a) What multiplication fact could you use to multiply 7 × 8? Tell how you would use it.

b) Multiply 7 × 8 using a different multiplication fact. Show your work.

13. Sketch a picture and write a division fact for each.

a) 20 biscuits shared by 5 people

b) 18 mangos shared by 9 people

14. 18 shoes are in pairs. How many pairs of shoes are there?

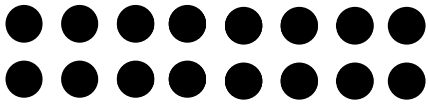
15. a) Write a sharing problem you could solve using 30 ÷ 6.

b) Write a grouping problem you could solve using 30 ÷ 6.

16. How many triangles can you make with 27 sticks, if the triangles do not share any sides?

17. Manju must bake 40 cakes to sell at the market. She can bake 8 cakes each day. For how many days must she bake?

18. Write the fact family for this array.



19. Why is it easy to do each?

a) multiply by 0

b) divide by 1

UNIT 3 MULTIPLICATION AND DIVISION WITH GREATER NUMBERS

Getting Started

Use What You Know

For homework Dorji has 3 nights to read a book with 48 pages. He plans to read the same number of pages each night.

A. i) How do you know he has to read more than 10 pages each night?

ii) How do you know he will read fewer than 20 pages each night?

iii) How many pages must he read each night?

A multiplication sentence gives the product of two numbers.

For example:

$3 \times 12 = 36$

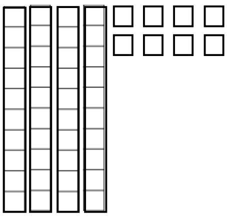
A division sentence gives the quotient of two numbers.

For example:

$24 \div 12 = 2$

B. i) Write a multiplication or division sentence that shows how you got your answer to **part A iii)**.

ii) The base ten block picture below represents 48 pages. Sketch a picture to show how you can use the blocks to answer **part A iii)**.



48 pages

C. How many pages does Dorji have to read each night for each?

i) if he must read the book in 4 nights

ii) if he must read the book in 5 nights

iii) if the book had 97 pages and he had to read it in 3 nights

iv) if the book had 97 pages and he had to read it in 5 nights

D. Write a word problem that you can solve using $42 \div 3$.
Solve your problem.

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Skills You Will Need

1. Find each product.

a) 5 × 0 **b)** 7 × 1 **c)** 9 × 4 **d)** 6 × 5

e) 4 × 8 **f)** 6 × 6 **g)** 0 × 8 **h)** 5 × 5

2. a) Find each product.

i) 6 × 13 **ii)** 7 × 39 **iii)** 5 × 42

b) Sketch base ten block pictures for two questions in **part a)**.

3. Which multiplication has a product of about 300?

A. 4 × 72 **B.** 6 × 28 **C.** 5 × 41

4. Write a multiplication sentence that you can use to solve each.

a) 50 ÷ 5 = [ ] **b)** 48 ÷ 4 = [ ] **c)** 99 ÷ 9 = [ ]

5. a) Sketch a picture to show why 42 ÷ 7 = 6.

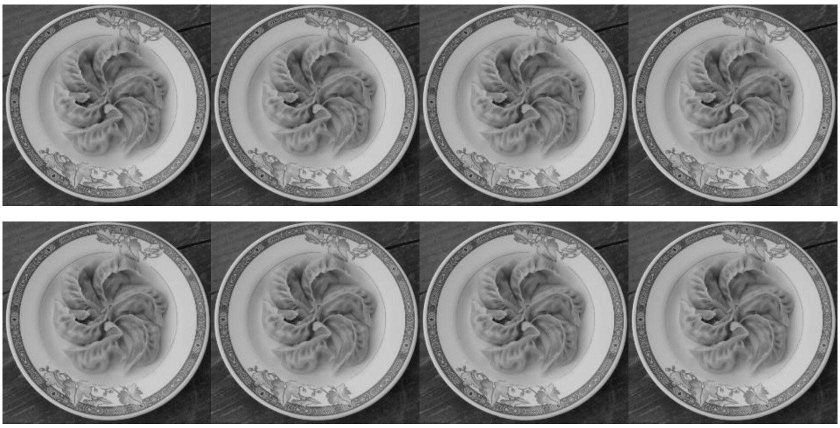
b) Explain how your picture shows 42 ÷ 7 = 6.

6. Find each quotient.

a) 16 ÷ 4 **b)** 32 ÷ 4 **c)** 0 ÷ 7 **d)** 8 ÷ 8

e) 9 ÷ 1 **f)** 56 ÷ 8 **g)** 45 ÷ 5 **h)** 64 ÷ 8

7. a) What multiplication sentence describes the number of momos in the picture below?



There are 6 momos on each plate.

b) What division sentence describes the number of momos on each plate?

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Chapter 1 Multiplication

3.1.1 Multiplying by Tens and Hundreds

Try This

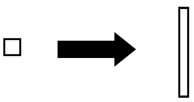
Dechen is making bangles. She uses 100 red beads and 50 blue beads for each.

A. i) How many red beads does she need for 5 bangles?

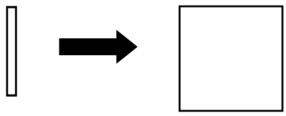
ii) How many blue beads does she need for 5 bangles?

• Multiplying any amount by 10 means that you have 10 of that amount. You can use **place value** and base ten blocks to show this:

1 × 10 = 1 ten = 10 10 ×



10 × 10 = 10 tens = 100 10 ×



Knowing this can help you multiply any number by 10.

For example:

If you multiply 3 × 10, each one becomes 1 ten, so 3 ones become 3 tens.

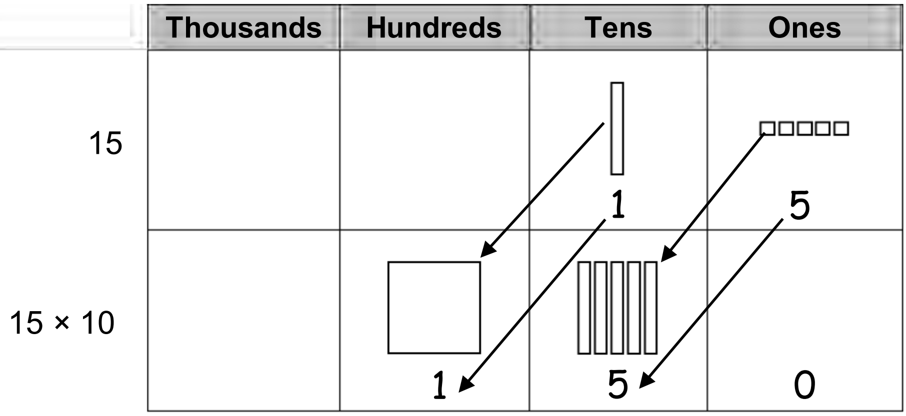
If you show it on a place value chart, you can see this:

- The 3 ones blocks change to 3 tens blocks and move one place to the left.
- The digit 3 moves one place to the left as its value changes from 3 ones to 3 tens. The digit 0 is used in the ones place.

	Thousands	Hundreds	Tens	Ones
3				3
3 × 10			3	0

3 × 10 = 30

• The same thing happens if you multiply a 2-digit number by 10.
To multiply 15 by 10, the 1 ten becomes 1 hundred and
the 5 ones become 5 tens.



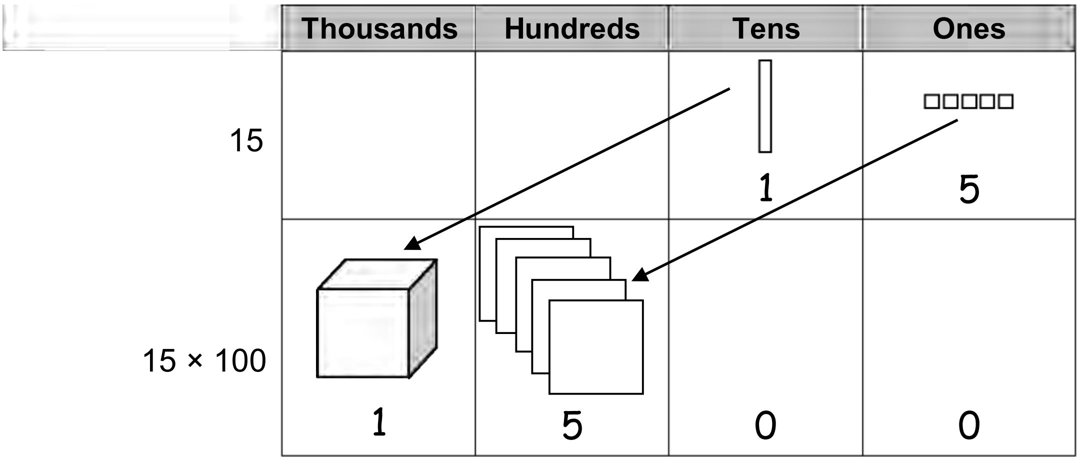
15 × 10 = 150

• When you multiply by 10, the product always ends in 0. This makes sense because there are only tens in the product, which means there are 0 ones.

$3 \times 10 = 3\underline{0}$

$15 \times 10 = 15\underline{0}$

• When you multiply by 100, the blocks and digits move 2 places to the left because the ones become hundreds and the tens become thousands.
For example, 15 × 100 = 1500:



15 × 100 = 1500

The digits in the ones and tens places are 0 because the product has only hundreds and thousands.

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• It is easy to multiply any number by 10 or by 100 using mental math.
All you do is move the digits one or two places to the left. Then you put 0s in the ones place or in the tens and ones places.

For example:

25 × 10 = 250 [25 = 2 tens + 5 ones:
2 tens × 10 = 2 hundreds, and 5 ones × 10 = 5 tens
2 hundreds + 5 tens = 250]

25 × 100 = 2500 [25 = 2 tens + 5 ones:
2 tens × 100 = 2 thousands, and 5 ones × 100 = 5 hundreds
2 thousands + 5 hundreds = 2500]

• You can use what you know about multiplying by 10 and by 100 to multiply by 20, 30, 40, … or by 200, 300, 400, ….

For example:

6 × 20 = 6 × 2 tens = 12 tens

12 tens = 12 × 10 = 120

You can use the same idea for these calculations:

4 × 120 = 4 × 12 tens
= 48 tens
= 48 × 10 [To multiply by 10, move the digits 1 place to the left.]
= 480

7 × 600 = 7 × 6 hundreds
= 42 hundreds
= 42 × 100 [To multiply by 100, move the digits 2 places to the left.]
= 4200

B. Now you know how to multiply by 10 and by 100. How does this help you use mental math to solve the bangle problem in **part A**?

Examples

Example 1 Multiplying a 2-digit Number by 50

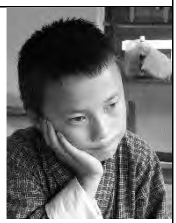
A school has 18 classes with 50 students in each class.
How many students are there altogether?

Solution 1	Thinking
$18 \times 50 = 18 \times 5$ tens $= 90$ tens 90 tens $= 90 \times 10 = 900$ There are 900 students.	• I thought about 50 as 5 tens. • To multiply by 50, I multiplied by 5 and remembered that these are tens. 
Solution 2	**Thinking**
$18 \times 50 = 18 \times 100 \div 2$ $18 \times 100 = 1800$ $1800 \div 2 = 900$ $18 \times 50 = 900$ There are 900 students.	• Since 50 is half of 100, I knew that to multiply by 50 I could multiply by 100 and then divide by 2. • To multiply 18 by 100, I moved the digits 1 and 8 two places to the left. • I knew 18 hundreds ÷ 2 = 9 hundreds. 

Example 2 Finding a Missing Multiplier

a) Find the missing number in 3600 = 60 × [ ].

b) What numbers could be missing from 480 = [ ] × [ ]? Find two answers.

Solution	Thinking
a) $3600 = 60 \times [\ ]$ $360 \times 10 = 60 \times [\ ]$ $60 \times 60 = 60 \times [\ ]$ $3600 = 60 \times \underline{60}$	**a)** I knew 3600 = 36 hundreds = 360 tens = 360 × 10. • I needed to multiply by 60 instead of by 10, so I changed the groups of 10 to groups of 60: Each 6 groups of 10 make 1 group of 60. $6 \times 10 = 1 \times 60$ 10 10 10 10 10 10 → 60 If 6 × 10 = 1 × 60, then 360 × 10 = 60 × 60. 
b) $480 = [\ ] \times [\ ]$ $480 = [\ ] \times \underline{10}$ $480 = \underline{48} \times \underline{10}$ $480 = 48 \times 10$ $48 \times 10 = 24 \times 20$ $480 = \underline{24} \times \underline{20}$	**b)** Since the ones digit of 480 is 0, I knew one number could be 10. • Since 480 is 48 tens, then 480 = 48 × 10. That's how I knew the other number was 48. • 48 × 10 means 48 groups of 10. If I group 480 into groups of 20 instead, I have groups that are twice as big so I need half as many groups.

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Practising and Applying

1. Multiply.

a) 7 × 10 **b)** 23 × 10

c) 8 × 100 **d)** 53 × 100

e) 5 × 40 **f)** 12 × 30

g) 7 × 400 **h)** 16 × 500

2. Rinchen's family went on 2 trips each year for 10 years. How many trips did his family take in 10 years?

3. What number is missing in each?

a) 1600 = [ ] × 100

b) 150 = [ ] × 10

c) 4800 = [ ] × 400

d) 360 = [ ] × 90

e) 750 = 3 × [ ] × 10

f) 1200 = 2 × 6 × [ ]

4. A bee beats its wings 200 times in 1 second. How many times does it beat its wings in 20 seconds?

5. List two possible pairs of numbers for each.

a) [ ] × [ ] = 800

b) [ ] × [ ] = 560

6. If an insect beats its wings 40 times in 1 second, how many times does it beat its wings in each amount of time?

a) 10 seconds

b) 20 seconds

c) 30 seconds

d) 80 seconds

7. Sketch a picture to show how you know each is true. Explain each picture.

a) 2 × 600 = 1200

b) 7 × 50 = 350

c) 12 × 20 = 240

d) 7 × 20 = 14 × 10

e) 5 × 300 = 10 × 150

8. Explain why the ones digit and the tens digits in the product of 17 × 300 must be 0.

9. Your friend has asked for your help to multiply 8 × 30 and 7 × 300. What do you say?

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3.1.2 Estimating Products

Try This

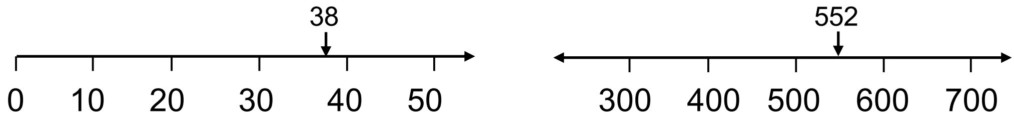
242 students in Tashi's school are playing a game with sticks.

They play in pairs. Each pair of students uses 9 sticks.

A. Estimate the number of sticks the whole group will need.

• You can use what you have learned about multiplying by tens and by hundreds to estimate products mentally. You can round to nearby tens and hundreds.

Nearby tens and hundreds are numbers like 10, 20, 30, ... and 100, 200, 300, ... that are close to the numbers you are multiplying.



38 is about 40.

552 is about 500 or 600.

For example:

- To estimate 9 × 38, you might multiply 10 × 40 = 400.

You know that 400 is a high estimate for 9 × 38, since 10 > 9 and 40 > 38.

- You can also estimate when you multiply by a 3-digit number.

To estimate 8 × 552, you might use 8 × 500 = 4000

or 8 × 600 = 4800

or 10 × 600 = 6000.

Each estimate is reasonable, but it is good to know whether it is high or low:

4000 is a low estimate for 8 × 552 because 500 < 552.

4800 is a high estimate because 600 > 552.

6000 is an even higher estimate because 10 > 8 and 600 > 552.

• If you round high for one number and low for the other number, you might not be sure whether your estimate is high or low.

For example, suppose you round 8 × 538 to 10 × 500 = 5000.
Since 10 > 8 but 500 < 538, it is difficult to know whether 5000 is low or high.

• Sometimes you might want a high estimate.

For example, you are buying 3 items at Nu 28 each and you want to be sure you have enough money. You might round 3 × Nu 28 to 3 × Nu 30 = Nu 90.

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B. Show two or more ways you could estimate to solve **part A**.

Examples

Example Estimating High and Low	
Devika's parents pay Nu 825 each week for food. **a)** About how much money do they pay in 6 weeks? **b)** Is your estimate high or low? How do you know?	
Solution 1 **a)** 6 × 825 is about 6 × 800 = 4800. **b)** 4800 is a low estimate because 6 stayed the same but 800 < 825.	**Thinking** • The closest hundred to 825 is 800. • I multiplied 6 × 800 mentally by thinking 6 × 8 hundreds. 
Solution 2 **a)** 6 × 825 is about 5 × 900 = 4500 **b)** I cannot be sure whether 4500 is low or high because 5 < 6 but 900 > 825. The estimate is probably low since 5 weeks' worth of food costs much less than 6 weeks' worth of food.	**Thinking** • I estimated 6 as 5 because I find it easy to multiply by 5. 

Practising and Applying

1. Estimate each so that your estimate is high but reasonable.
Show your work.

a) 4 × 392 **b)** 8 × 437

c) 9 × 247 **d)** 5 × 459

2. Estimate each so that your estimate is low but reasonable.
Show your work.

a) 8 × 517 **b)** 7 × 218

c) 6 × 882 **d)** 9 × 147

3. Describe two different ways to estimate each. Tell which estimate you think is better and why.

a) 6 × 542 **b)** 9 × 713

4. Use what you know about estimating to tell how you know each is true.

a) 7 × 421 is between 2800 and 3500.

b) 9 × 627 is less than 6270.

c) 8 × 352 is less than 3000.

5. The product of a pair of numbers is about 4200. List three possible pairs of numbers.

6. Write a problem where it would make sense to estimate a product to solve the problem.

7. Why is it useful to know how to estimate products?

3.1.3 Multiplying Using Rectangles

Try This

The floor of a room is covered with large tiles. There are 8 rows of 12 tiles.

A. How many tiles are on the floor?

• You can use a rectangle to model multiplication because the area of a rectangle is equal to the length of the rectangle times its width:

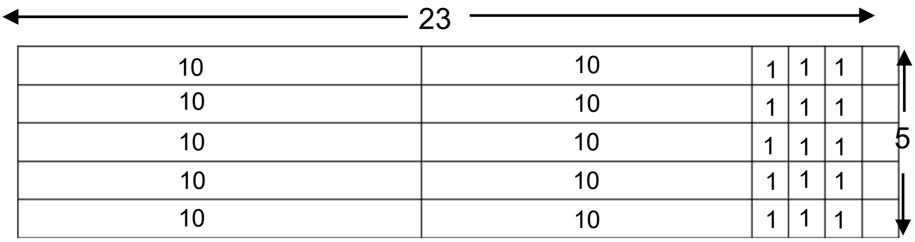
Area = length × width

For example, you can show 5 × 23 as a rectangle that is 5 units by 23 units. The product of 5 × 23 is the area of the rectangle.

• If you use base ten blocks to make the rectangle, you can see that the rectangle is made of two parts:

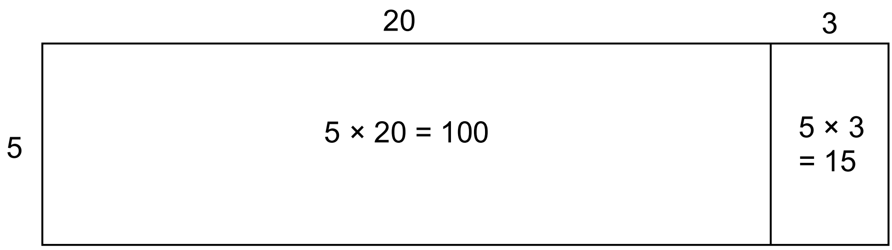
The part that is made of tens blocks.

The part that is made of ones blocks.



The sketch of the rectangle below shows the two parts.

To find the area or product, you find the value of each part and then add.



You can also write the multiplication like this:

$$\begin{array}{rl} 23 & \\ \underline{\times\ 5} & \\ 100 & [5 \times 20] \\ \underline{+15} & [5 \times 3] \\ 115 & \end{array}$$

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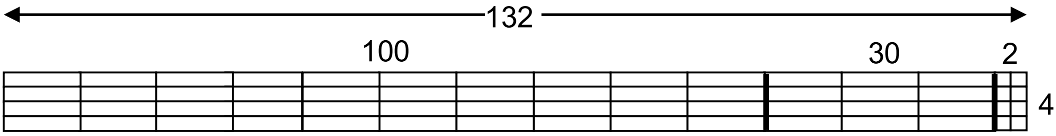
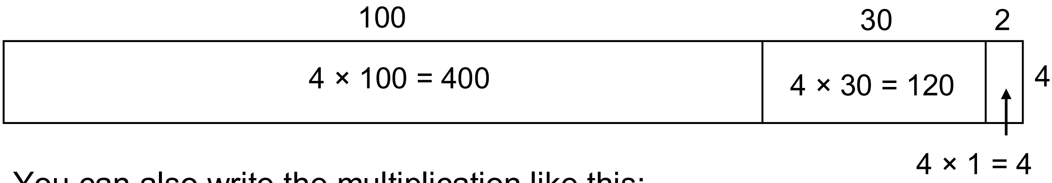
• You can use the same idea to multiply 3-digit numbers.

For example:

To multiply 4 × 132, you can create a base ten block rectangle that is 4 units by 132 units.



Since a block model like this uses so many blocks, you can sketch a rectangle to show the same thing.



You can also write the multiplication like this:

$$\begin{array}{rl} 132 & \\ \times\ \ 4 & \\ \hline 400 & [4 \times 100] \\ 120 & [4 \times 30] \\ +\ \ 8 & [4 \times 2] \\ \hline 528 & \end{array}$$

B. How can you use a rectangle model to solve **part A**?

Examples

Example 1 Representing a Multiplication in Different Ways

Write 7 × 512 as the sum of other products.

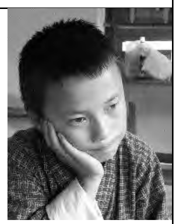
Solution

512 = 500 + 10 + 2

so

$$\begin{array}{rl} 512 & \\ \times\ \ 7 & \\ \hline 3500 & [7 \times 500] \\ 70 & [7 \times 10] \\ +\ \ 14 & [7 \times 2] \\ \hline 3584 & \end{array}$$

Thinking



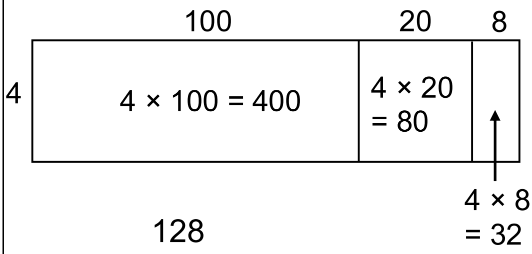
• I knew 7 groups of 512 was the same as combining
7 groups of 500,
7 groups of 10, and
7 groups of 2.

Example 2 Multiplying to Solve a Problem

The students in Tandin's school competed in groups of 4.
There were 128 groups. How many students were there?

Solution

4 × 128




```
   128
 ×   4
   400   [4 groups of 100]
    80   [4 groups of 20]
 +  32   [4 groups of 8]
   512
```

There were 512 students.

Thinking

- I sketched a rectangle that was 4 wide by 128 (100 + 20 + 8) long.
- I found the area of each part and then added the areas.

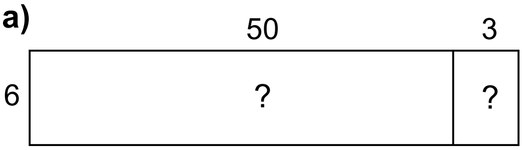
Practising and Applying

1. Sketch and label a rectangle model for each.

a) 5 × 39 **b)** 4 × 28
c) 3 × 62 **d)** 7 × 31
e) 6 ×134 **f)** 8 × 356

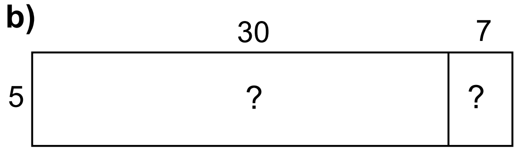
2. Solve each. Show the products you would add.

a)



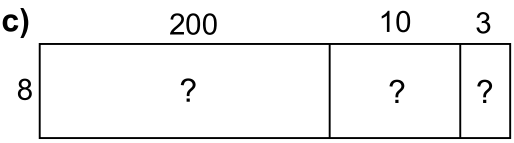

```
   53
 ×  6
  [   ]
+ [   ]
  [   ]
```

b)




```
   37
 ×  5
  [   ]
+ [   ]
  [   ]
```

c)




```
  213
 ×  8
  [   ]
  [   ]
+ [   ]
  [   ]
```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3. How many items are there altogether in each array?

a) 5 rows with 28 carrots in each row

b) 6 rows with 18 cards in each row

c) 6 rows with 157 stamps in each row

d) 4 rows with 132 potato plants in each row

4. Find the missing numbers.

a) 8 × 23

$$\begin{array}{rl} 23 & \\ \times\ \ 8 & \\ \hline [\ \ ] & \text{8 groups of [ ]} \\ +\ \ 24 & \text{8 groups of 3} \\ \hline [\ \ ] & \end{array}$$

b) 9 × 48

$$\begin{array}{rl} 48 & \\ \times\ \ 9 & \\ \hline [\ \ ] & \text{[ ] groups of 40} \\ +\ [\ \ ] & \text{[ ] groups of 8} \\ \hline [\ \ ] & \end{array}$$

c) 7 × 87

$$\begin{array}{rl} 87 & \\ \times\ \ 7 & \\ \hline [\ \ ] & \text{7 groups of 80} \\ +\ [\ \ ] & \text{[ ] groups of 7} \\ \hline [\ \ ] & \end{array}$$

d) 5 × 362

$$\begin{array}{rl} 362 & \\ \times\ \ 5 & \\ \hline [\ \ ] & \text{5 groups of [ ]} \\ [\ \ ] & \text{5 groups of 60} \\ +\ \ 10 & \text{5 groups of 2} \\ \hline [\ \ ] & \end{array}$$

5. Multiply.

a) 3 × 37 = [ ]

b) [ ] = 8 × 58

c) 5 × 93 = [ ]

d) [ ] = 3 × 112

e) 9 × 342 = [ ]

f) [ ] = 4 × 316

6. A garden is planted with:

- 8 rows of 38 vegetables
- 3 rows of 46 vegetables
- 4 rows of 26 flowers
- 7 rows of 57 flowers

Are there more vegetables or more flowers? Show your work.

7. Why is it useful to multiply 6 × 148 in these three parts?

6 × 100

6 × 40

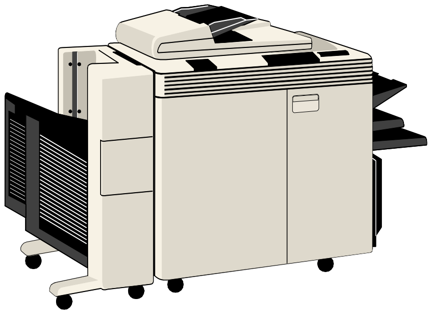
6 × 8

3.1.4 Multiplying a 3-digit Number by a 1-digit Number

Try This

The principal has to make copies of a letter for all 253 students in the school. The letter has three pages.

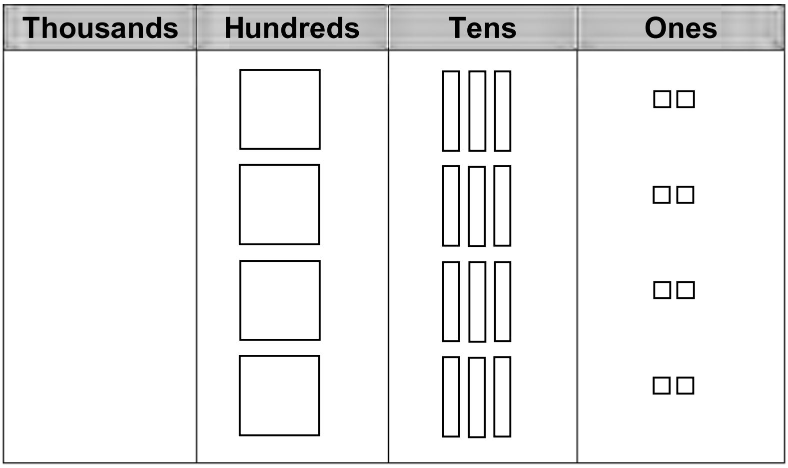
A. How many pieces of paper will the principal need?



• You can model multiplication with base ten blocks on a place value chart.

For example:

You can model 4 × 132 as 4 groups of [1 hundred + 3 tens + 2 ones].



This is what you do:

• Multiply in three parts:

multiply the ones

multiply the tens

multiply the hundreds

• Then add the three parts.

$$\begin{array}{rl} 100 + 30 + 2 & \\ \times\ \ 4 & \\ \hline 8 & [4 \times 2] \\ 120 & [4 \times 30] \\ \underline{+\ 400} & [4 \times 100] \\ 528 & [400 + 120 + 8] \end{array}$$

It looks like this when you write it:

$$\begin{array}{r} 132 \\ \times\quad 4 \\ \hline 8 \\ 120 \\ \underline{+\ 400} \\ 528 \end{array}$$

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Or, you can multiply by regrouping as you go, like this:

Model 4 × 132:

$$\begin{array}{r} 132 \\ \underline{\times\ \ 4} \end{array}$$

Multiply the ones:

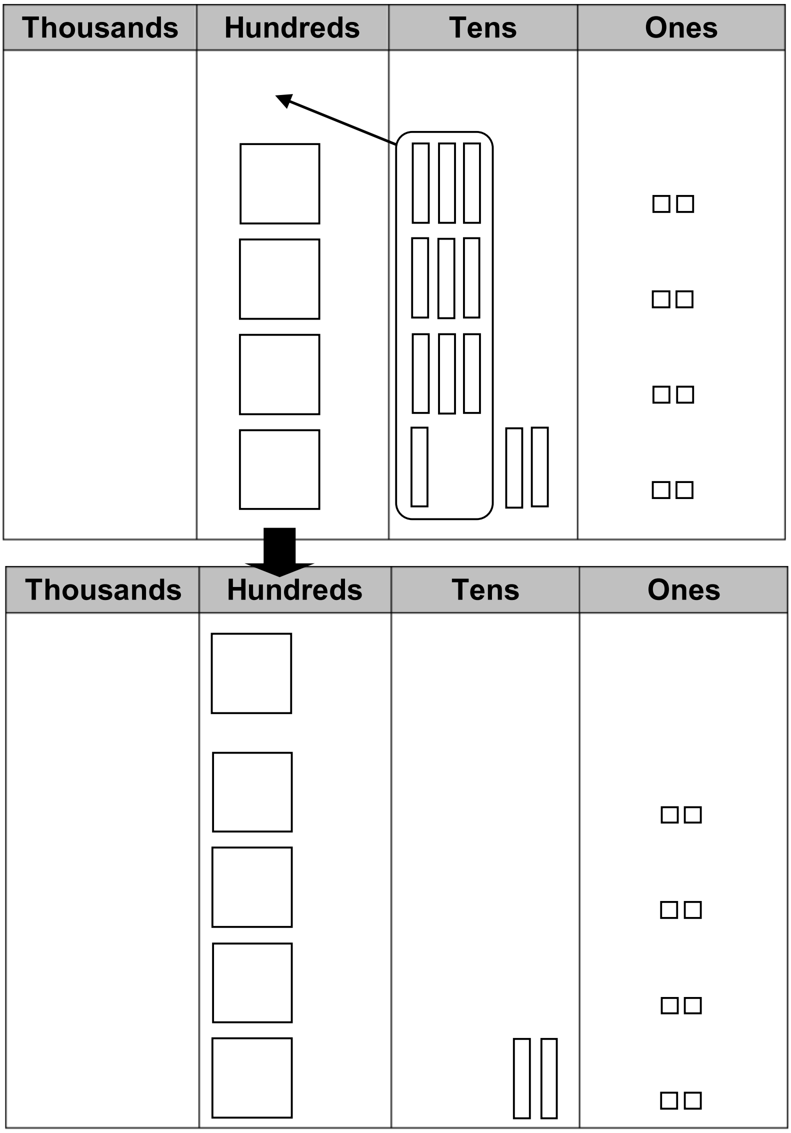
$$\begin{array}{r} 13\mathbf{2} \\ \underline{\times\ \ \mathbf{4}} \\ \mathbf{8} \end{array}$$

Multiply the tens. Regroup 10 tens for 1 hundred:

$$\begin{array}{r} \mathbf{1}\ \ \ \\ 1\mathbf{3}2 \\ \underline{\times\ \ \mathbf{4}} \\ \mathbf{2}8 \end{array}$$

Multiply the hundreds and then add on the regrouped 1 hundred block:

$$\begin{array}{r} \mathbf{1}\ \ \ \ \ \\ \mathbf{1}32 \\ \underline{\times\ \ \mathbf{4}} \\ \mathbf{5}28 \end{array}$$



$$\begin{array}{r} 1\ \ \ \ \ \\ 132 \\ \underline{\times\ \ 4} \\ 5\mathbf{2}8 \end{array}$$

This is the regrouped 1 hundred.

This is 2 tens, not 12 tens, since you regrouped the 12 tens as 1 hundred, 2 tens.

B. How could you write the calculation to solve the problem in **part A**?

Examples

Example 1 Solving a Multiplication Puzzle

The same digit is missing in two spots. What is the missing digit?

8 × 2[ ][ ] = 2304

Solution

The digit 4 in the product 2304 is from multiplying 8 × [ ] ones.

[ ] might be 3 or 8.

$$\begin{array}{r} 233 \\ \underline{\times\ 8} \\ 24 \\ 240 \\ \underline{+1600} \\ 1864 \end{array} \qquad \begin{array}{r} 288 \\ \underline{\times\ 8} \\ 64 \\ 640 \\ \underline{+1600} \\ 2304 \end{array}$$

The missing digit is 8.

Thinking

- I knew the digit was 3 or 8 since 8 × 3 = 24 and 8 × 8 = 64 are the only multiplication facts that have a product with 4 ones.
- That meant 8 × 2[][] was either 8 × 233 or 8 × 288, so I tried calculating both.

Example 2 Multiplying to Solve a Problem

Each of the 485 students in Kinzang's school is bringing three items of food for a school festival. How many items will there be altogether? Show your work.

Solution 1

$$\begin{array}{rl} 485 & \\ \underline{\times\ 3} & \\ 15 & [3 \times 5] \\ 240 & [3 \times 80] \\ \underline{+\ 1200} & [3 \times 400] \\ 1455 & \end{array}$$

There will be 1455 items.

Thinking

- I knew I had to multiply 3 × 485.
- I decided to multiply in parts and then add the parts at the end.

Solution 2

$$\begin{array}{r} {}^{1} \\ 485 \\ \underline{\times\ 3} \\ 5 \end{array} \qquad \begin{array}{r} {}^{2\ 1} \\ 485 \\ \underline{\times\ 3} \\ 55 \end{array} \qquad \begin{array}{r} {}^{2\ 1} \\ 485 \\ \underline{\times\ 3} \\ 1455 \end{array}$$

There will be 1455 items.

Thinking

- I multiplied 3 × 485 by starting on the right and regrouping as I multiplied.
- After multiplying 3 × 5 = 15 ones, I regrouped 10 of the 15 ones for 1 ten. I added it to 3 × 8 tens = 24 tens to get 25 tens.
- Then I regrouped 20 of the 25 tens for 2 hundreds. I added them to 3 × 4 = 12 hundreds to get 14 hundreds.

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Practising and Applying

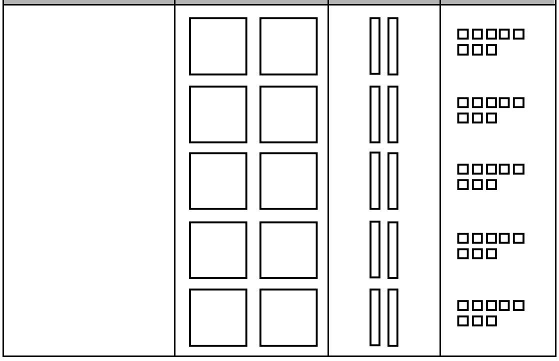
1. Calculate each.

a) 7 × 348 **b)** 5 × 364

2. Write the multiplication sentence for each model.

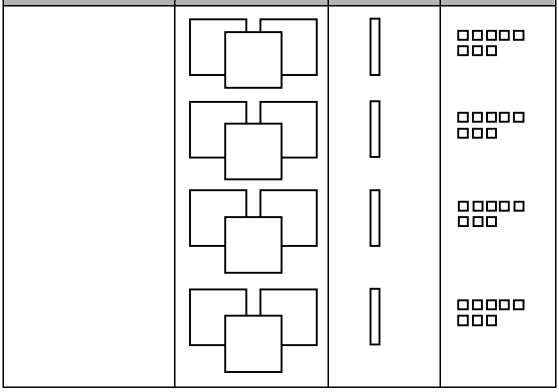
a)

Thousands	Hundreds	Tens	Ones



b)

Thousands	Hundreds	Tens	Ones



3. Fill in the missing digits.

a) 300 + 20 + 8
× 6
[][]
120
+ 1800
[][][][]

b) 400 + 30 + 9
× 9
[][]
270
+ [][]00
[][][][]

4. Calculate only the products less than 3000. Estimate to help you choose which to calculate.

A. 3 × 492 **B.** 6 × 941
C. 6 × 299 **D.** 5 × 544

5. Kuenga spent Nu 240 for a gift. Pema spent 3 times as much. How much did Pema spend?

6. a) Which two products below have a difference of 3152?

A. 6 × 617 **B.** 9 × 533
C. 7 × 783 **D.** 5 × 329

b) Which of the two products you chose in **part a)** is greater?

7. Write a problem that you can solve using 7 × 382. Solve your problem.

8. One kind of small jet plane carries 131 passengers. A larger plane can carry 4 times as many people. How many people can the larger plane carry?

9. Find the missing digits. In each question, the same digit is missing in both places.

a) 9 × 3[ ]5 = 29[ ]5
b) [ ] × [ ]78 = 1912
c) 6 × 5[ ]2 = [ ]192

10. What is the greatest product you can make if you use the digits 2, 4, 6 and 8 below?

[ ] × [ ] [ ] [ ]

11. How is multiplying a 3-digit number like multiplying using rectangles in the previous lesson?

GAME: Lots of Tens

Play in a group of 2 to 4 players.

Players can share one die.

Each player draws multiplication digit boxes like this:

$$\boxed{} \times \boxed{}\ \boxed{}\ \boxed{}$$

Take turns. Do this on your turn:

- Roll the die. Write the number rolled in one of the digit boxes.
- Keep rolling until all four boxes are filled. You cannot move a digit once you have written it.
- Calculate the product.
- The player with the greatest digit in the tens place of the product wins 1 point. If there is a tie (players have the same tens digit), the greatest product wins 1 point.

The winner is the player with the most points after 5 rounds.

For example:

Player A rolls 4, 3, 1, and 6

$$\boxed{6} \times \boxed{4}\ \boxed{3}\ \boxed{1}$$

$$= 2\ 5\ \underline{8}\ 6$$

Player B rolls 4, 5, 1, and 2

$$\boxed{4} \times \boxed{5}\ \boxed{2}\ \boxed{1}$$

$$= 2\ 0\ \underline{8}\ 4$$

Player A and B both have an 8 in the tens place.

Since 2586 > 2084, Player A wins 1 point.

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3.1.5 EXPLORE: Multiplication Patterns

Gayatri was multiplying numbers by 10. She noticed a pattern:

23 × 10 = 230
24 × 10 = 240
25 × 10 = 250
26 × 10 = 260

Each time, the tens digit in the product went up by 1. She knew the pattern happened because there was one more group of 10 each time.

She wondered if there would be patterns when she multiplied by numbers
that are close to 10, like 8 and 9.

A. Multiply. What pattern do you notice in each?
Why do you think the pattern happened?

i) 9 × 120 = 9 × 220 = 9 × 320 =	**ii)** 9 × 120 = 9 × 130 = 9 × 140 =	**iii)** 9 × 120 = 9 × 230 = 9 × 340 =

B. Multiply. What pattern do you notice in each?
Why do you think the pattern happened?

i) 8 × 120 = 8 × 220 = 8 × 320 =	**ii)** 8 × 120 = 8 × 130 = 8 × 140 =	**iii)** 8 × 120 = 8 × 230 = 8 × 340 =

C. How are the × 8 patterns and the × 9 patterns different?
Do those differences make sense? Explain your thinking.

D. Multiply. What pattern do you notice?
Do you think the pattern will continue? Why?

3 × 111 = 4 × 111 = 5 × 111 =

Chapter 2 Division

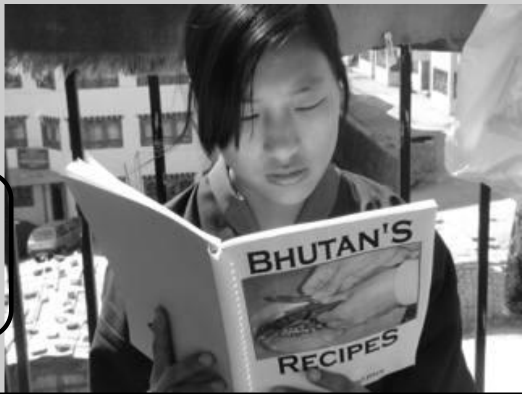
3.2.1 Dividing Tens and Hundreds

Try This

Ugyen has chosen a recipe to make for her family of six. It uses 240 g of meat and 60 g of onion.

A. How many grams of each will be in each serving?

i) meat **ii)** onion



Numbers like 10, 20, 30, ... or 100, 200, 300, ... are easier to divide than some other numbers because you can use place value.

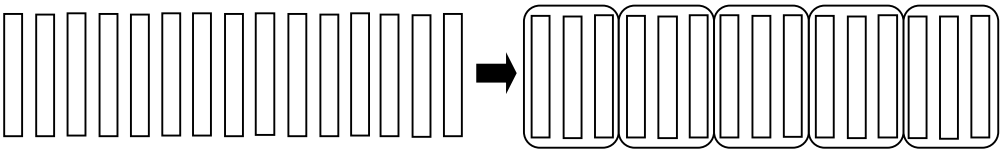
• For example:

To divide 150 ÷ 5, you can think "150 is 15 tens", so 150 ÷ 5 = 15 tens ÷ 5.

To solve 15 tens ÷ 5, you only need to know 15 ÷ 5 = 3.

15 tens ÷ 5 = 3 tens, which is 30.

You can model this with base ten blocks by dividing 15 tens into 5 groups of 3 tens.



150 ÷ 5 = 15 tens ÷ 5 = 3 tens = 30

This makes sense since 5 × 30 = 5 × 3 tens
= 15 tens
= 150

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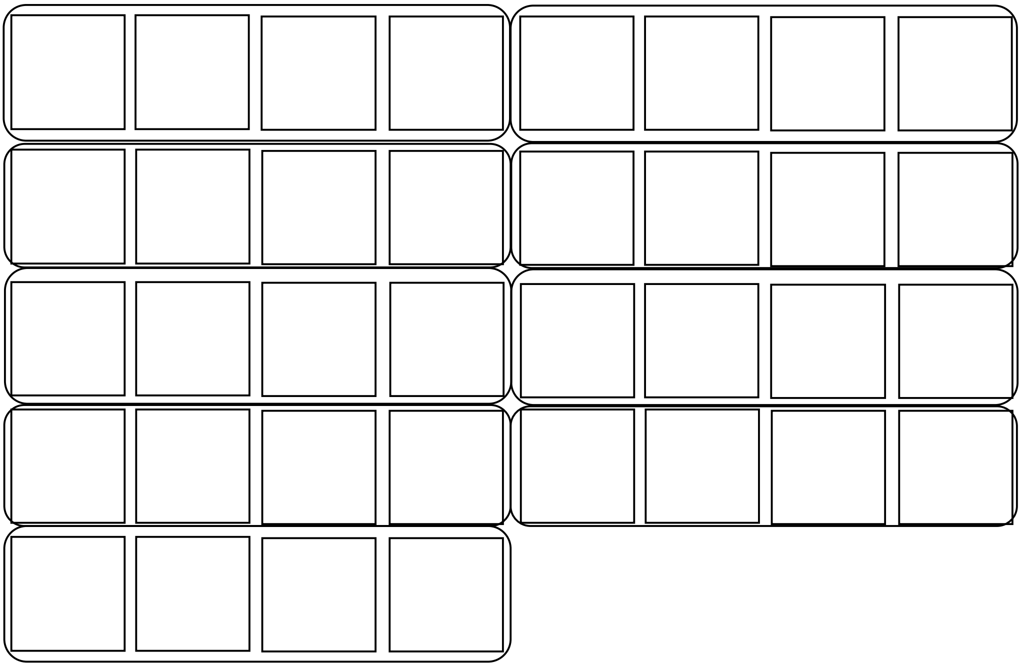
• For example:

To divide 3600 ÷ 9, you can think “3600 = 36 hundreds”,
so 3600 ÷ 9 = 36 hundreds ÷ 9.

To solve 36 hundreds ÷ 9, you only need to know 36 ÷ 9 = 4.

36 hundreds ÷ 9 = 4 hundreds, which is 400.

You can model this with base ten blocks by dividing 36 hundreds into 9 groups of 4 hundreds.



3600 ÷ 9 = 36 hundreds ÷ 9 = 4 hundreds = 400

This makes sense since 9 × 400 = 9 × 4 hundreds
= 36 hundreds
= 3600

B. Show how to use place value ideas to solve **part A**.

Examples

Example Comparing Quotients

Tshewang divided 180 by 3. Govinda divided 350 by 7.
Whose quotient is greater? Show your work.

Solution

180 ÷ 3 = 18 tens ÷ 3
= 6 tens
= 60

350 ÷ 7 = 35 tens ÷ 7
= 5 tens
= 50

60 > 50, so 180 ÷ 3 > 350 ÷ 7.
Tshewang's quotient is greater.

Thinking

- I used place value to write each 3-digit number as a number of tens.
- Then I used these division facts that I knew to calculate each quotient:

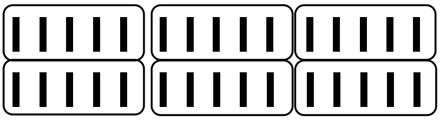
18 ÷ 3 = 6 and 35 ÷ 7 = 5.

Practising and Applying

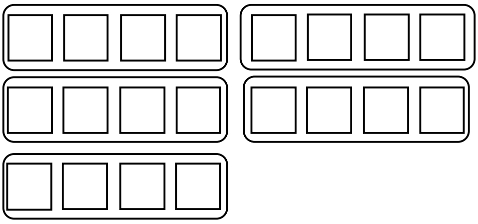
1. The 350 students in a school were put into groups of 5 for a special event. How many groups were there?

2. Write the division sentence for each base ten block model.

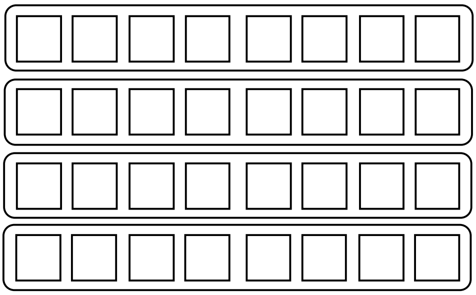
a)



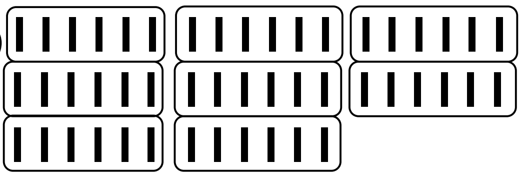
b)



c)



d)



3. Which quotient is greater in each pair?

a) 540 ÷ 9 or 420 ÷ 7

b) 280 ÷ 4 or 350 ÷ 7

4. Calculate.

a) 280 ÷ 7 = [ ]

b) 7200 ÷ 8 = [ ]

c) [ ] = 560 ÷ 7

d) 4900 ÷ 7 = [ ]

5. Sketch a picture to show why you can use 12 ÷ 3 to find 1200 ÷ 3. Explain how your picture shows it.

6. List three pairs of numbers that make this true.

[ ] ÷ [ ] = 40

7. Sketch a picture to show why 300 ÷ 6 is the same as 150 ÷ 3. Explain how your picture shows both divisions.

8. Explain why someone might think that dividing 450 ÷ 9 is easier than dividing 400 ÷ 9.

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3.2.2 Estimating Quotients

Try This

Kangaroos travel in groups called mobs.

A. A mob of 114 kangaroos split up into four equal groups and hopped off in different directions. Estimate the number of kangaroos in each smaller group.

• To estimate the quotient of a 3-digit number divided by a 1-digit number, you can use a number close to the 3-digit number that is easy to divide by the 1-digit number.

For example:

To estimate 582 ÷ 3, you might use 600 instead of 582 because 600 is close to 582 and because you are dividing by 3 (6 ÷ 3 = 2).	582 ÷ 3 is about 600 ÷ 3. 600 ÷ 3 = 6 hundreds ÷ 3 = 2 hundreds = 200 582 ÷ 3 is about 200.

To estimate 582 ÷ 7, you might use 560 instead of 582 because 560 is close to 582 and because you are dividing by 7 (56 ÷ 7 = 8).	582 ÷ 7 is about 560 ÷ 7. 560 ÷ 7 = 56 tens ÷ 7 = 8 tens = 80 582 ÷ 7 is about 80.

• If you know your estimate is high or low, you have a better idea of what the exact answer will be.

For example:

582 ÷ 3 is about 200: 200 is a high estimate because you rounded 582 up to 600 and you did not change the 3.

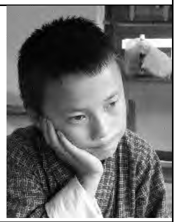
582 ÷ 7 is about 80: 80 is a low estimate because you rounded 582 down to 560 and you did not change the 7.

B. What would be a good number to use instead of 114 to estimate the answer for **part A**? Why?

Examples

Example Solving an Estimation Puzzle

[ ]72 ÷ 6 is about 90. What is the missing digit? Show your work.

Solution	Thinking
If [ ]72 ÷ 6 is about 90, then 6 × 90 is about [ ]72. 6 × 90 = 540 The missing digit is 5.	• I know division is the opposite of multiplication, so I changed the division to a multiplication. 

Practising and Applying

1. A flock of 278 birds was formed when 4 small flocks flew together. The small flocks were all about the same size.

a) What number close to 278 would you use to estimate 278 ÷ 4? Why?

b) About how many birds were in each small flock?

2. Estimate each. Show your work.

a) 415 ÷ 4 **b)** 436 ÷ 5

c) 517 ÷ 6 **d)** 136 ÷ 7

e) 366 ÷ 4 **f)** 513 ÷ 7

3. A chef served 216 momos onto plates of 6. About how many plates did she make? Show your work.

4. Each quotient is about 40. What is one possible value for each missing digit?

a) 347 ÷ [ ] **b)** 251 ÷ [ ]

c) [ ]72 ÷ 7 **d)** [ ]31 ÷ 8

e) 1[ ]2 ÷ 4 **f)** [ ]51 ÷ 6

5. Is it possible for [ ][ ][ ] ÷ 8 to be about 200? Explain your thinking.

6. A large school of 142 fish formed when 8 small schools joined. The small schools were all about the same size. About how many fish were in each small school of fish? Explain your thinking.

A group of fish is called a school of fish.

7. Use estimation to explain how you know 517 ÷ 9 is about 10 more than 430 ÷ 9.

8. Describe a situation where you might wish to estimate 257 ÷ 3.

9. Why might you estimate 422 ÷ 6 differently than 422 ÷ 5?

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3.2.3 Dividing by Multiplying and Subtracting

Try This

139 biscuits are to be arranged on plates with 3 biscuits per plate.

A. Estimate how many plates will be needed. Show how you estimated.

• One way to divide is to find how many groups can be formed.

For example, 216 ÷ 6 asks, "How many groups of 6 are in 216?"

You begin at 216 and create some groups of 6, subtract to see what is left, and then create more groups of 6 until you cannot form any more groups.

This is what it looks like when you write it:

$$\begin{array}{r|r}
6\,\overline{)216} & \\
-\underline{120} & 20 \text{ groups} \\
96 & \\
-\underline{60} & 10 \text{ groups} \\
36 & \\
-\underline{36} & \underline{6 \text{ groups}} \\
0 & 36 \text{ groups}
\end{array}$$

When you divide 216 into groups of 6, you get 20 + 10 + 6 = 36 groups.

• There is more than one way to divide like this because you can form groups of 6 in different ways.

For example:

You can create 10 groups of 6, then another 10 groups of 6, then another 10 groups of 6, then another 6 groups of 6.

$$\begin{array}{r|r}
6\,\overline{)216} & \\
\underline{-60} & 10 \text{ groups} \\
156 & \\
\underline{-60} & 10 \text{ groups} \\
96 & \\
\underline{-60} & 10 \text{ groups} \\
36 & \\
\underline{-36} & \underline{6 \text{ groups}} \\
0 & 36 \text{ groups}
\end{array}$$

This takes more steps than the first division but someone might find it easier to do because you mostly multiply 6 by 10 and subtract.

B. i) Use the method above to solve **part A**. Write the division to show what you did.

ii) What does the remainder mean?

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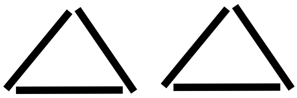
Examples

Example Counting Groups

How many separate triangles can be created with 410 sticks?

Show your work.



Solution

Each triangle uses 3 sticks, so
410 sticks will make 410 ÷ 3 triangles:

3) 410		
– $\underline{300}$	100 groups	
110		
– $\underline{90}$	30 groups	
20		
– $\underline{18}$	$\underline{6 \text{ groups}}$	
2	136 groups	

136 triangles can be created.
There are 2 sticks left over.

Thinking

- I had to find how many groups of 3 there were in 410.
- I first took out 100 groups of 3 sticks.
  I multiplied 3 × 100 = 300 and subtracted 410 – 300 = 110.
- Then I took out 30 more groups of 3 sticks. I multiplied 3 × 30 = 90 and subtracted 110 – 90 = 20.
- Finally, I took out 6 groups of 3 sticks. I multiplied 3 × 6 = 18 and subtracted 20 – 18 = 2.

Practising and Applying

1. How many teams of each size can be formed from 142 people?

a) teams of 5 **b)** teams of 6

2. Calculate each. Show your work.

a) 248 ÷ 8 **b)** 666 ÷ 6

c) 512 ÷ 4 **d)** 617 ÷ 8

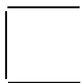
e) 912 ÷ 4 **f)** 372 ÷ 5

3. a) Each window has 4 panes of glass. How many windows can be made with 166 panes of glass?

b) What does the remainder tell you?

4. A pile of Nu 5 notes is worth Nu 605. How many Nu 5 notes are in the pile?

5. How many squares can be formed from 372 sticks?



6. 336 students are in groups of 4. How many groups are there?

7. Thoner divided 382 ÷ 5 and got a quotient of 81. How do you know she made an error?

8. Why is this lesson called “Dividing by Multiplying and Subtracting”?

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3.2.4 Dividing in Parts

Try This

Namgyel and Chencho both collect stamps. Namgyel has 5 times as many stamps as Chencho.

A. Namgyel has 345 stamps. How many stamps does Chencho have?

• Another way to divide is to break up the number being divided into smaller numbers that are easy to divide using mental math.

For example.

For 347 ÷ 6, you can rename 347 as 300 + 42 + 5. You divide each number by 6 and then add the parts.

$$\begin{array}{l} \phantom{6\overline{)347} \rightarrow 6\overline{)}}\text{57 R 5} \\ \phantom{6\overline{)347} \rightarrow 6\overline{)}}50 + 7 + 0 \\ 6\overline{)347} \rightarrow 6\overline{)300 + 42 + 5} \end{array}$$

Renaming 347 as 300 + 42 + 5 is a good choice because it is easy to divide 300 by 6 and 42 by 6.

• You can make your own choice about how to break up the number.

For example, for 347 ÷ 6, you could have done this instead.

$$\begin{array}{l} \phantom{6\overline{)347} \rightarrow 6\overline{)}}\text{57 R 5} \\ \phantom{6\overline{)347} \rightarrow 6\overline{)}}40 + 9 + 6 + 2 \\ 6\overline{)347} \rightarrow 6\overline{)240 + 54 + 36 + 17} \end{array}$$

Renaming 347 as 240 + 54 + 36 + 17 is also a good choice because it is easy to divide 240, 54, and 36 by 6.

• To rename the number, list the multiplication facts for the number you are dividing by.

For example:

If you are dividing by 7, list the × 7 facts and then choose from the list:

7, 14, 21, 28, 35, 42, $\underline{49}$, $\underline{56}$, and 63

$$7\overline{)613} \rightarrow 7\overline{)560 + 53} \rightarrow 7\overline{)560 + 49 + 4}$$

OR

7, 14, $\underline{21}$, 28, $\underline{35}$, 42, $\underline{49}$, 56, and 63

$$7\overline{)613} \rightarrow 7\overline{)350 + 263} \rightarrow 7\overline{)350 + 210 + 53} \rightarrow 7\overline{)350 + 210 + 49 + 4}$$

B. Solve **part A** by dividing in parts. Show your work.

Examples

Example Calculating a Perimeter

A shape has 6 equal sides. Its perimeter is 411 cm.
What is the length of each side?

Solution

411 ÷ 6 = ?

The × 6 facts:

6, 12, 18, 24, 30, <u>36</u>, 42, <u>48</u>, 54

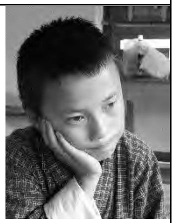
411 = <u>36</u>0 + 51

= <u>36</u>0 + <u>48</u> + 3

$$\begin{array}{r} 68 \text{ R } 3 \\ 60 + \ \ 8 + 0 \\ 6\overline{)360 + 48 + 3} \end{array}$$

Each side is 68.5 cm.

Thinking



- I knew I needed to divide 412 by 6.
- I wrote the × 6 facts to help me break up the number.
- I changed the remainder to 0.5 since it is 3 parts out of 6, or $\frac{3}{6}$.

Practising and Applying

1. Manju has 524 stamps. She has 4 times as many stamps as Ngedup. How many stamps does Ngedup have?

2. How would you rename the first number in each to divide in parts?

a) 378 ÷ 6 **b)** 178 ÷ 7

c) 648 ÷ 5 **d)** 812 ÷ 3

e) 715 ÷ 9 **f)** 566 ÷ 4

3. Calculate each quotient in **question 2**.

4. You are dividing 370 g of meat into 4 equal portions. How much meat is in each portion?

5. For 297 ÷ 3, Karma renamed 297 using subtraction instead of addition:

$$3\overline{)297} \rightarrow \begin{array}{r} 99 \\ 100 - 1 \\ 3\overline{)300 - 3} \end{array}$$

Do you agree with what she did? Explain your thinking.

6. Show two ways to rename 594 to divide it in parts by 3.

7. How is dividing in parts like dividing by subtracting?

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GAME: Two Hundred Plus

Play in a group of 2 to 4 players.

Players can share one die.

Each player draws division digit boxes like this:

$$\square \quad \square \quad \square \div \square$$

Take turns. Do this on your turn:

- Roll the die. Write the number rolled in one of the digit boxes.
- Keep rolling until all four boxes are filled. You cannot move a digit once you have written it.
- Divide to find the quotient and remainder.
  You get 1 point if the remainder is 0,
  2 points if the quotient is 200 or more, or
  3 points if the remainder is 0 and the quotient is 200 or more.

The winner is the first player with 10 or more points.

For example:

Player A rolls 3, 1, 5, and 2.

$$\boxed{5}\ \boxed{1}\ \boxed{2} \div \boxed{3}$$

= 170 R 2

The remainder is 2.

The quotient is less than 200.

Player A gets 0 points.

Player B rolls 2, 5, 6, and 4

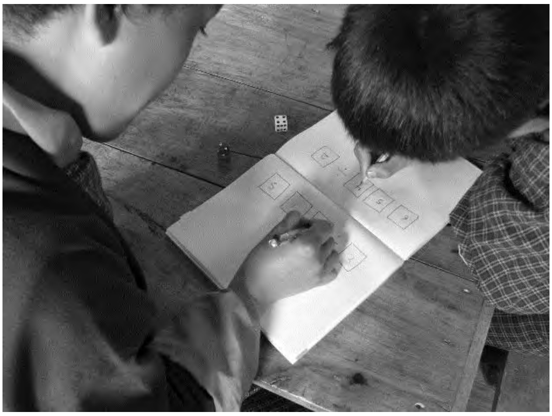
$$\boxed{6}\ \boxed{5}\ \boxed{4} \div \boxed{2}$$

= 327

The remainder is 0.

The quotient is greater than 200.

Player B gets 3 points.



3.2.5 Dividing by Sharing

Try This

Three brothers are sharing a gift of Nu 420 from their grandmother.

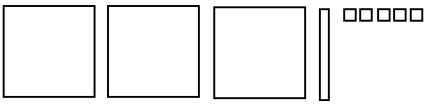
A. How much money does each brother get?

• You can share base ten blocks to model a division problem.

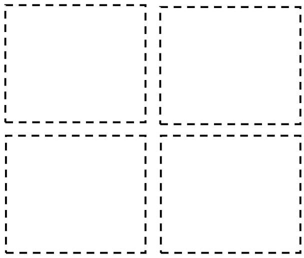
For example:

One meaning for 315 ÷ 4 could be 315 items shared equally by 4 people. The quotient is how many items are in each person's share.

Step 1: Model 315 with base ten blocks and draw a box to represent each person's share.

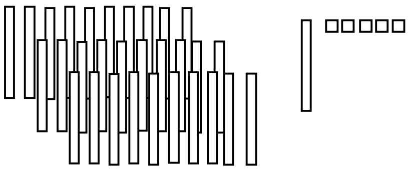


$$4\overline{)315}$$

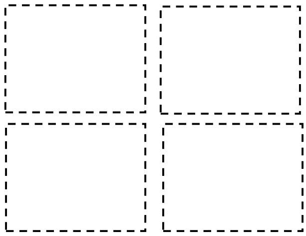


Step 2: Start sharing the blocks.

Since there are 4 people and only 3 hundreds blocks, trade each hundred for 10 tens.

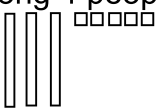


$$4\overline{)315}$$



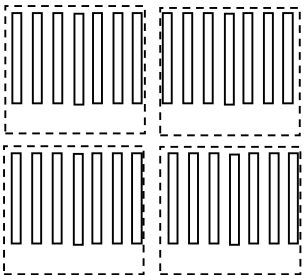
There are now 31 tens and 5 ones.

31 tens shared among 4 people is 7 tens each.



Notice the 7 in the tens place.
This shows that it means 7 tens.

$$\begin{array}{r} 7 \\ 4\overline{)315} \\ -\underline{280} \\ 35 \end{array}$$



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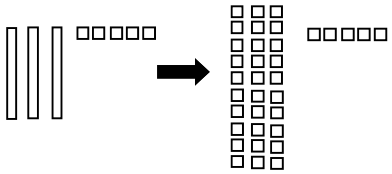
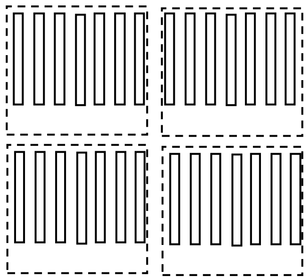
Step 3: Continue sharing the blocks.

Since there are 4 people and only 3 blocks, trade each ten for 10 ones.



$$\begin{array}{r} 7 \\ 4\overline{)315} \\ -\underline{280} \\ 35 \end{array}$$

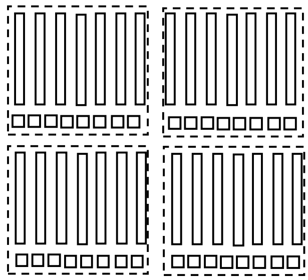
There are now 35 ones.



35 ones shared among 4 people is 8 ones each.

There are 3 ones remaining.

$$\begin{array}{r} 78 \text{ R } 3 \\ 4\overline{)315} \\ -\underline{280} \\ 35 \\ -\underline{32} \\ 3 \end{array}$$



Each share is 78.

• When there is a **remainder**, think about the situation to decide what to do.

For example:

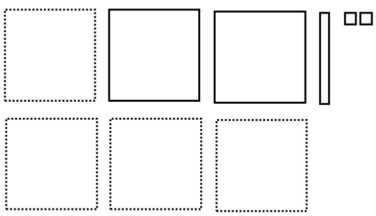
- If the remainder was Nu 3, it could be traded for 300 chhetrums and divided among the 4 people. Each person would get Nu 78 and 75 chhetrum.

- If the remainder was 3 m or 300 cm of cloth, it could be divided further so each person gets an extra $\frac{3}{4}$ m or 0.75 m, or $78\frac{3}{4}$ m or 78.75 m altogether.

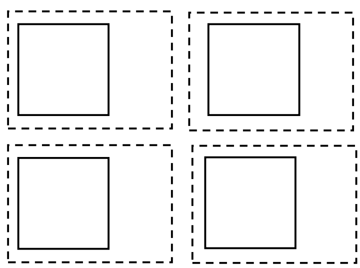
- If the remainder was 3 children, each of the 3 children could join one of the 4 groups, making three of the groups a bit larger.

• Sometimes there are enough hundreds blocks to share them in *Step 2*.

For example, for 612 ÷ 4, each share would get 1 hundreds block. Then you would trade the remaining 2 hundreds blocks for tens, so there would be 21 tens blocks to share in Step 3.



$$\begin{array}{r} 1 \\ 4\overline{)612} \\ \underline{-400} \\ 212 \end{array}$$



B. i) Model the sharing in **part A** using base ten blocks. Sketch your model.
ii) Show what you would write to represent your model.

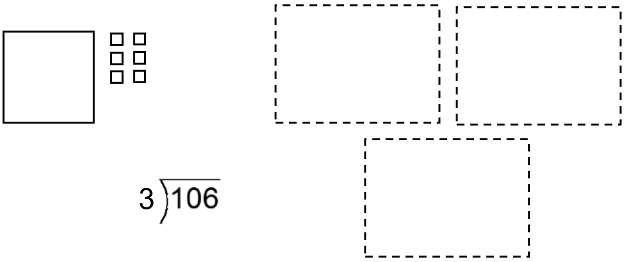
Examples

Example Sharing to Solve a Problem

A farmer is dividing 106 kg of apples equally onto three tables at the market. About how many kilograms of apples will be on each table?

Solution

Step 1: Model the problem.

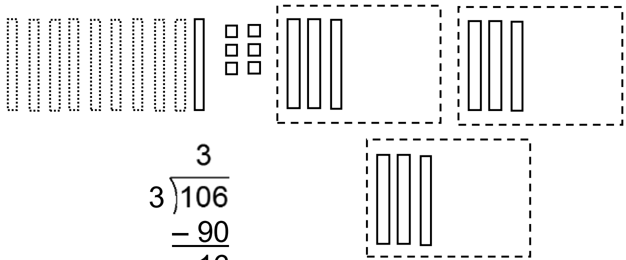


$3\overline{)106}$

Step 2: Start sharing the blocks.

Since there are not enough hundreds blocks to share, trade the 1 hundred for 10 tens.

Then share the tens blocks.



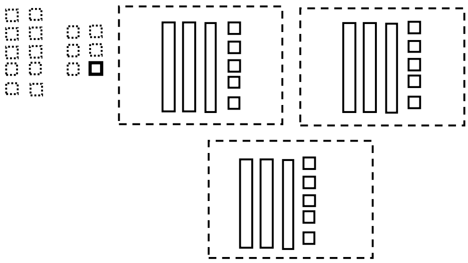
$$\begin{array}{r} 3 \\ 3\overline{)106} \\ -\underline{90} \\ 16 \end{array}$$

Step 3: Continue sharing the blocks.

Since there are not enough tens blocks to share, trade the 1 ten for 10 ones.

Then share the 15 ones blocks.

$$\begin{array}{r} 35 \\ 3\overline{)106} \\ -\underline{90} \\ 16 \\ -\underline{15} \\ 1 \end{array}$$



Each table will have 35 kg of apples, plus a few more apples.

Thinking

- I knew I had to divide 106 by 3.
- I modelled with base ten blocks.
- I recorded 3 above the 0 tens in 106 to show that it meant 3 tens.
- I recorded 5 above the 6 hundreds in 106 to show that it meant 5 ones.
- For the remaining 1 kg, I would count the number of apples in 1 kg and then share them among the 3 tables.

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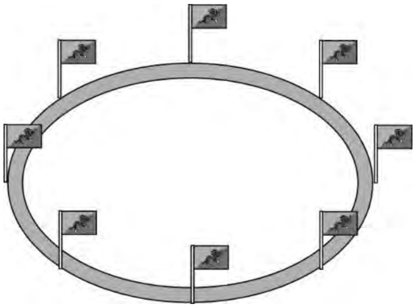
Practising and Applying

1. Flags are spaced evenly around a 200 m round racetrack. How far apart are the flags in each case?

a) if there are 5 flags

b) if there are 4 flags

c) if there are 8 flags



2. Divide using base ten blocks to find each quotient.

a) 403 ÷ 6 **b)** 285 ÷ 5

c) 515 ÷ 7 **d)** 617 ÷ 3

3. Tenzin made 208 sha balay for 7 families to share.

a) Estimate the number of sha balay each family gets.

b) Calculate the exact number.

c) What would you do with any leftover sha balay?

4. Show two different ways to calculate 617 ÷ 4.

5. Calculate.

a) 567 ÷ 8 **b)** 317 ÷ 4

c) 507 ÷ 9 **d)** 403 ÷ 6

6. Tshering made 175 momos for 5 friends. Her sister made 312 momos for 8 friends.

a) Estimate to decide whose friends will get more momos.

b) Calculate the number of momos the friends of each girl will get.

7. Every sixth person in a line of 500 people was given a card to hold. How many people got a card?

8. A group of students planted 206 trees. Another group planted 312 trees. If they combine and share equally, how many trees does each group get to take care of?

9. a) Write a word problem you can solve using 100 ÷ 3 and where you would change the remainder to a fraction.

b) Write a word problem that you can solve using 100 ÷ 3 but where you would NOT change the remainder to a fraction.

10. What could the number be?

[ ][ ][ ] ÷ 7 is between 30 and 40.

The remainder is 3.

11. You are dividing 215 ÷ 5.

a) Why might renaming 2 hundreds as 20 tens help you divide?

b) Explain how you could divide by sharing starting with the 20 tens.

CONNECTIONS: When Do Remainders Change?

If you move the digits in a number to different positions but divide by the same number, the quotient will change but the remainder might not.

For example:

If you divide a number by 2, the remainder changes.

But if you divide a number by 3, the remainder does not change.

436 ÷ 2 = 218 R 0 218 2)436 – 400 36 – 20 16 – 16 0	643 ÷ 2 = 321 R 1 321 R 1 300 + 21 + 0 2)600 + 42 + 1	435 ÷ 3 = 145 R 0 3)435 – 300 100 groups 135 – 120 40 groups 15 – 15 5 groups 0 145 groups	453 ÷ 3 = 151 R 0 345 ÷ 3 = 115 R 0 354 ÷ 3 = 118 R 0 534 ÷ 3 = 178 R 0 543 ÷ 3 = 181 R 0

Notice above that you only need two examples to show that the remainder changes but you need to try all possible combinations of digits to that show the remainder does not change.

1. Divide the numbers in each set by 2 and then by 3. What do you notice about the remainders?

a) 217, 271, 127, 172, 712, 721

b) 683, 638, 836, 863, 368, 386

c) 522, 252, 225

2. a) Divide any 3-digit number by 9.

b) Rearrange the digits and divide by 9 again. Does the remainder change?

c) Rearrange the digits another way and repeat **part b)**.

3. Repeat **question 2** but divide by each number below.

a) ÷ 4 **b)** ÷ 5 **c)** ÷ 6

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UNIT 3 Revision

1. Multiply.

a) 4 × 10 **b)** 36 × 10
c) 6 × 100 **d)** 36 × 100
e) 3 × 30 **f)** 24 × 20
g) 7 × 200 **h)** 23 × 200

2. What number is missing in each?

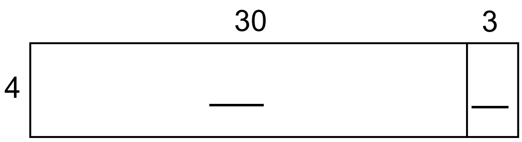
a) 3200 = [ ] × 100
b) 480 = [ ] × 10
c) 2400 = [ ] × 300
d) 300 = [ ] × 60

3. Estimate each. Show your work.

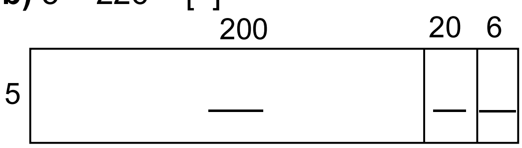
a) 7 × 255 **b)** 9 × 386
c) 5 × 663 **d)** 8 × 717

4. Complete each rectangle model and then solve the multiplication.

a) 4 × 33 = [ ]



b) 5 × 226 = [ ]



5. Sketch a rectangle model to find each product. Show your work.

a) 4 × 28
b) 6 × 59
c) 5 × 63
d) 9 × 71

6. Find the missing numbers.

a) 8 × 217 = 8 × 200 + [ ] × [ ] + [ ] × 7

b)

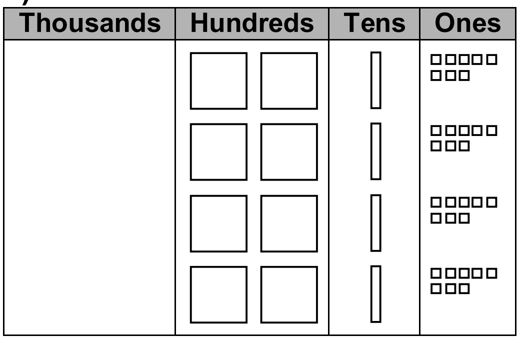
```
    217
  ×   8
  [    ]   8 groups of 200
  [    ]   [ ] groups of [ ]
 +[    ]   [ ] groups of 7
  [    ]
```

7. Multiply.

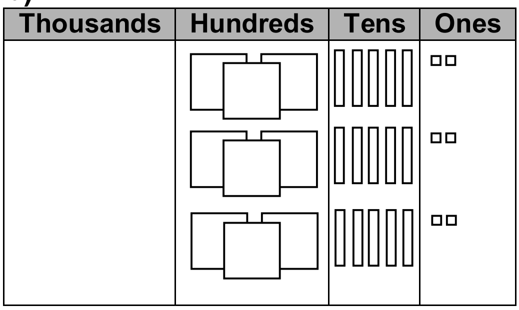
a) 2 × 84 = [ ] **b)** [ ] = 6 × 37
c) 3 × 67 = [ ] **d)** [ ] = 7 × 216
e) 4 × 258 = [ ] **f)** [ ] = 8 × 587

8. Write a multiplication sentence for each model.

a)



b)



9. a) Which two products below have a difference of 1018?

A. 4 × 317 **B.** 5 × 523
C. 6 × 373 **D.** 7 × 519

b) Which of the two products you chose in **part a)** is greater?

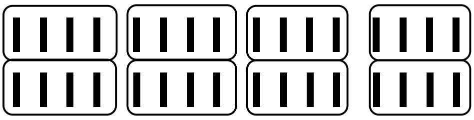
10. Find the missing digits. In each question, the same digit is missing in both places.

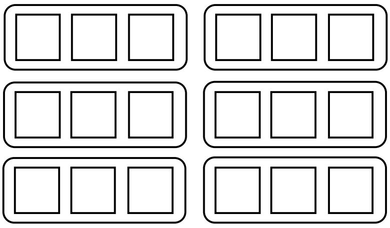
a) [ ] × 3[ ]5 = 1380

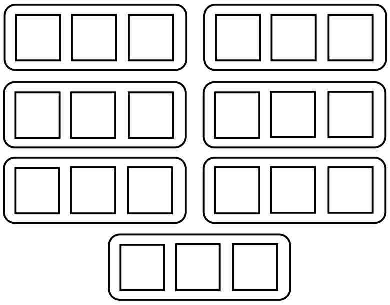
b) 6 × 21[ ] = 129[ ]

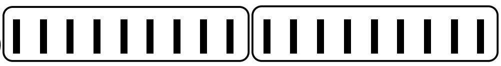
c) 9 × 148 = 1[ ][ ]2

11. Write the division sentence for each base ten block model.

a) 

b) 

c) 

d) 

12. Calculate.

a) 240 ÷ 6 = [ ] **b)** 5400 ÷ 9 = [ ]

c) [ ] = 160 ÷ 4 **d)** 2500 ÷ 5 = [ ]

13. Explain why you can use 15 ÷ 3 to find 1500 ÷ 3. If you use a picture to explain, tell how your picture shows it.

14. Estimate each quotient. Show your work.

a) 621 ÷ 2 **b)** 802 ÷ 9

c) 935 ÷ 7 **d)** 268 ÷ 6

e) 554 ÷ 3 **f)** 472 ÷ 9

15. A store clerk packaged 138 pencils in groups of 5. About how many packages did the clerk make?

16. Every quotient below is about 30. What is one possible value for each missing digit?

a) 147 ÷ [ ] **b)** 251 ÷ [ ]

c) [ ]27 ÷ 7 **d)** [ ]59÷ 8

e) 1[ ]2 ÷ 4 **f)** [ ]51÷ 6

17. A pile of Nu 5 notes is worth Nu 815. How many Nu 5 notes are in the pile?

18. How would you rename the first number in each to divide in parts?

a) 378 ÷ 4 **b)** 816 ÷ 7

c) 823 ÷ 5 **d)** 743 ÷ 3

e) 404 ÷ 6 **f)** 391 ÷ 9

19. Show two ways to rename 815 so you can divide it in parts by 5.

20. Use base ten blocks to find each quotient.

a) 802 ÷ 4 **b)** 612 ÷ 7

c) 278 ÷ 5 **d)** 306 ÷ 8

21. Every fifth person in a line of 320 people was given a card to hold. How many people got a card?

22. Calculate each.

a) 594 ÷ 6 **b)** 516 ÷ 4

c) 381 ÷ 5 **d)** 203 ÷ 7

23. What could the number be?

[ ][ ][ ] ÷ 4 is between 80 and 90

The remainder is 2.

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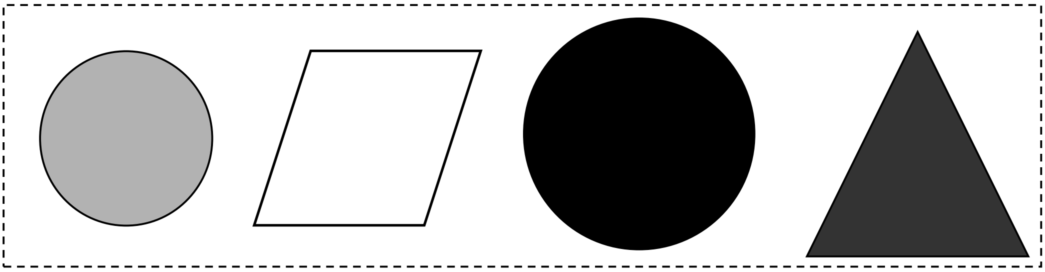
UNIT 4 FRACTIONS AND DECIMALS

Getting Started

Use What You Know



A. Look at the picture of the group of shapes above.

i) What fraction describes the shapes that are black?

ii) What other shapes in the group does that same fraction describe?

iii) What does $\frac{1}{4}$ describe about the group of shapes?

List three answers.

iv) What does $\frac{4}{4}$ describe about the group of shapes?

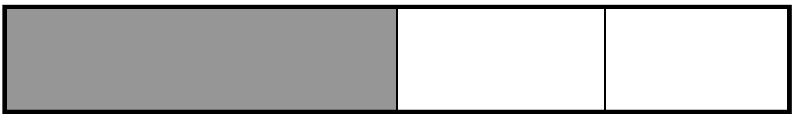
B. Look at the picture of the rectangle below.

i) What fraction describes the part of the rectangle that is white?

ii) What does $\frac{2}{3}$ describe about the rectangle?

iii) Does the picture of the rectangle below show $\frac{1}{3}$ grey?

How do you know?



C. Draw one picture that shows all of these fractions.
Explain how your picture shows each fraction.

$\frac{2}{5}$ $\frac{3}{5}$ $\frac{1}{5}$

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Skills You Will Need

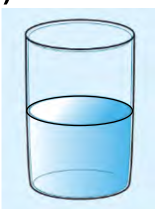
1. List two fractions that describe this group of children.

2. a) Write a fraction with a numerator of 2 and a denominator of 5.

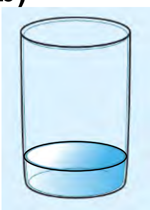
b) Draw a picture to show your fraction from **part a)**.

3. Write a fraction to tell about how full each glass is.

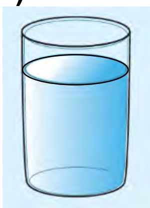
a)



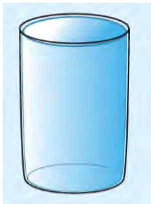
b)



c)

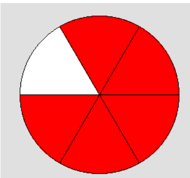


d)

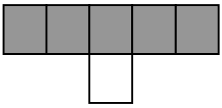


4. Which of these pictures show $\frac{5}{6}$?

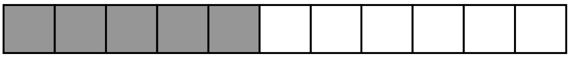
A.



B.



C.



5. What fraction of your fingers are thumbs? Write it as a decimal.

6. What decimal does this picture show?

7. Draw a picture to show each decimal.

a) 0.5 **b)** 0.4 **c)** 1.7

8. Order these decimals from least to greatest.

0.3 1.0 2.5 0.8 0.9

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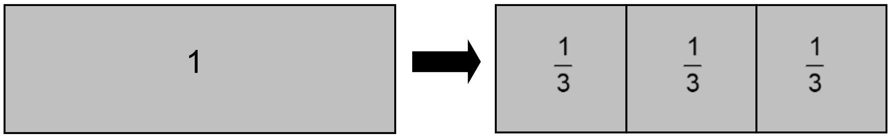
Chapter 1 Fractions

4.1.1 EXPLORE: Renaming Fractions

• You can use shapes of different sizes to show fractions.
For example:

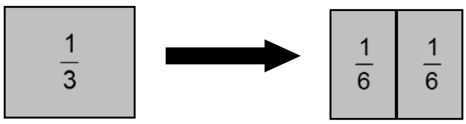
If you name the large rectangle 1, then the small rectangle is $\frac{1}{3}$.

This is because you can cover 1 large rectangle with 3 small rectangles.



• You can cover shapes with other shapes to find different fraction names.
For example:

You can cover the $\frac{1}{3}$ rectangle with two $\frac{1}{6}$ rectangles.



This shows why $\frac{2}{6}$ is another name for $\frac{1}{3}$.

$\frac{1}{3} = \frac{2}{6}$

You need fraction strip rectangles for this activity.

A. Cover the rectangle named $\frac{1}{2}$ with copies of the rectangle named $\frac{1}{4}$.

Write another fraction name for the rectangle $\frac{1}{2}$ like this: $\frac{1}{2} = \frac{[]}{4}$

B. Try to cover each rectangle with copies of smaller rectangles.
If you can cover the rectangle, write another fraction name
for the rectangle like this: $\frac{1}{[]} = \frac{[]}{[]}$

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4.1.2 Equivalent Fractions

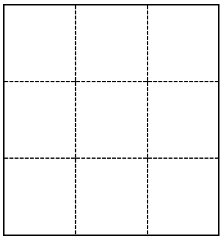
Try This

A. Make two copies of the square on the right.

i) Use one copy to draw a picture of each fraction:

$\frac{2}{3}$ $\frac{6}{9}$

ii) What do you notice about the two pictures?



• There is always more than one way to name any number.

For example: 5 can have the name 4 + 1.
5 can also have the name 10 ÷ 2.

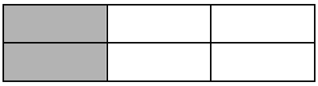
Since a fraction is a number, there is more than one way to name any fraction.

• Different names for the same fraction are called **equivalent fractions**.

For example:

$\frac{1}{3}$ and $\frac{2}{6}$ are equivalent since they show the same amount of the same whole.

$\frac{1}{3}$



$\frac{2}{6}$

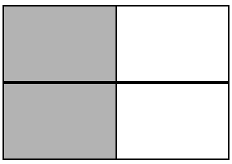
$\frac{1}{3} = \frac{2}{6}$

• You can make an equivalent fraction by dividing each part of a fraction into smaller equal parts.

$\frac{1}{2}$

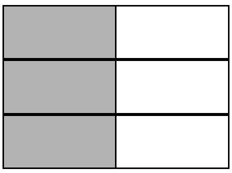
$\frac{1}{2}$

$\frac{2}{4}$



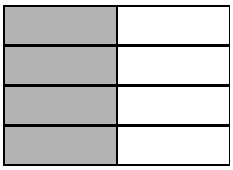
$\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$\frac{3}{6}$



$\frac{1 \times 3}{2 \times 3} = \frac{3}{6}$

$\frac{4}{8}$



$\frac{1 \times 4}{2 \times 4} = \frac{4}{8}$

This is the same as multiplying the **numerator** and **denominator** by the same number. You multiply by the number of smaller parts you divided each part into.

For example, for $\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$, each part was divided into 2 parts, so the numerator and denominator were multiplied by 2.

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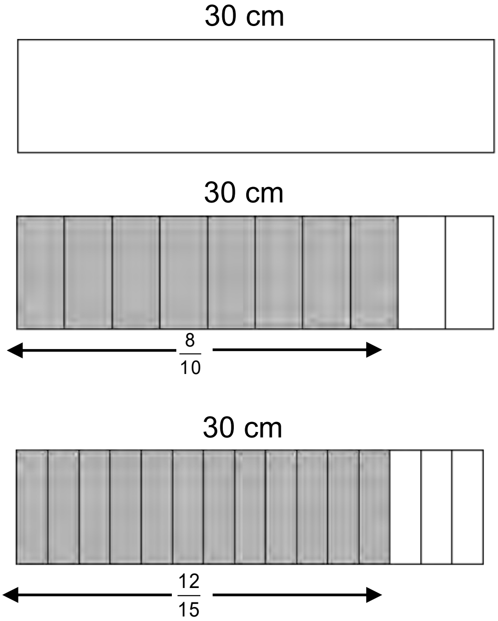
B. How do you know that the fractions in **part A** are equivalent fractions?

Examples

Example 1 Deciding Whether Two Fractions are Equivalent

Are $\frac{8}{10}$ and $\frac{12}{15}$ equivalent fractions? Show how you know.

Solution



Yes, $\frac{8}{10}$ and $\frac{12}{15}$ are equivalent, since the same amount is shaded in each.

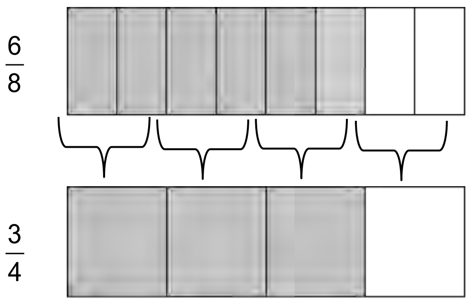
Thinking

- I needed to draw $\frac{8}{10}$ and $\frac{12}{15}$ of the same whole to see if they were the same.
- I drew a 30 cm wide rectangle because 30 is easy to divide into 10 parts and into 15 parts.
- I divided the rectangle into 10 parts to draw a picture of $\frac{8}{10}$.
- I divided the rectangle into 15 parts to draw a picture of $\frac{12}{15}$.

Example 2 Creating Equivalent Fractions

Create a fraction that is equivalent to $\frac{6}{8}$.

Solution 1



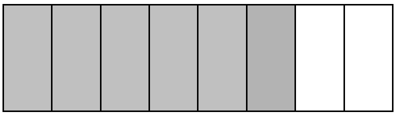
$\frac{6}{8} = \frac{3}{4}$

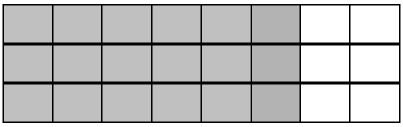
Thinking

- I started by drawing a picture of $\frac{6}{8}$.
- I combined pairs of parts.
- The new name for $\frac{6}{8}$ was $\frac{3}{4}$ because there were 4 equal parts altogether and 3 were shaded.

Example 2 Creating Equivalent Fractions [Continued]

Solution 2

$\frac{6}{8}$ 

$\frac{18}{24}$ 

$\frac{6}{8} = \frac{18}{24}$

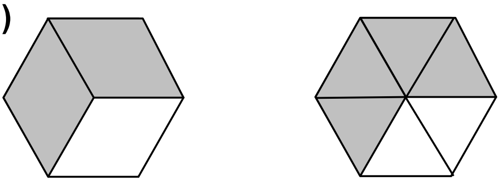
Thinking

- I drew a picture of $\frac{6}{8}$. Then I divided each part into 3 equal parts.
- The new name for $\frac{6}{8}$ was $\frac{18}{24}$ because 18 out of 24 parts were shaded.

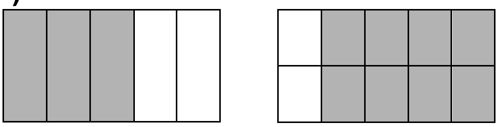
Practising and Applying

1. Name the fractions in each pair. Tell whether or not the fractions are equivalent.

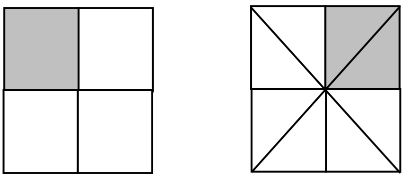
a)



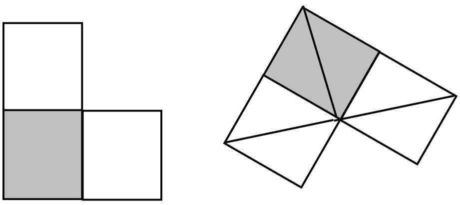
b)



c)



d)



2. Draw pictures of each pair of fractions. Tell whether or not the fractions are equivalent.

a) $\frac{3}{5}$ and $\frac{6}{10}$ **b)** $\frac{10}{12}$ and $\frac{15}{18}$

c) $\frac{4}{8}$ and $\frac{4}{10}$ **d)** $\frac{6}{8}$ and $\frac{15}{20}$

3. Create two fractions equivalent to each.

a) $\frac{4}{5}$ **b)** $\frac{3}{8}$ **c)** $\frac{2}{6}$ **d)** $\frac{4}{4}$

4. Sonam said that $\frac{2}{3}$ of the shoes were muddy. Dorji said that $\frac{4}{6}$ of the shoes were muddy. Explain why they are both right.

5. Tashi created a fraction equivalent to $\frac{1}{6}$ by multiplying both the numerator and the denominator by 2. Draw a picture to show what he did. Explain your picture.

6. How do you know that $\frac{1}{10}$ and $\frac{5}{6}$ cannot be equivalent fractions?

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4.1.3 Comparing and Ordering Fractions

Try This

Sangay's family ate $\frac{1}{2}$ of a loaf of bread.

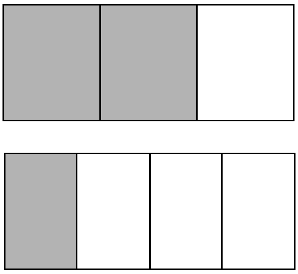
Bijoy's family ate $\frac{1}{3}$ of a loaf the same size.

A. Which family ate more bread? How do you know?

B. Why did you have to know that the loaves were the same size to answer **part A**?

• One fraction is greater than another fraction if it is more of the same whole.
For example:

In the pictures below, you can see that $\frac{2}{3}$ is greater than $\frac{1}{4}$, since more of the same whole is shaded.



$\frac{2}{3}$

$\frac{2}{3} > \frac{1}{4}$

$\frac{1}{4}$

• You can compare fractions without using pictures when the fractions have the same denominator.
For example:

$\frac{4}{5} > \frac{3}{5}$ because 4 fifths > 3 fifths. It makes sense that 4 of something is more than 3 of the same thing. The picture below shows why.

$\frac{4}{5} > \frac{3}{5}$

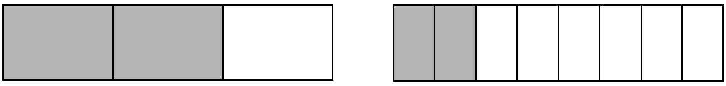
If two fractions have the same denominator,
the fraction with the greater numerator is greater.

• You can also compare fractions without using pictures when the fractions have the same numerator.

For example:

$\frac{2}{3} > \frac{2}{8}$ because 2 pieces out of a whole divided into 3 pieces is more than 2 pieces out of the same whole divided into 8 pieces.

The picture below shows why.



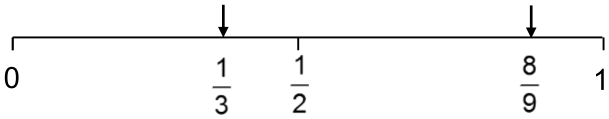
$\frac{2}{3} > \frac{2}{8}$

> If two fractions have the same numerator,
> the fraction with the smaller denominator is greater.

• Sometimes you can compare two fractions by thinking about how they compare to 0, $\frac{1}{2}$, or 1.

For example: $\frac{1}{3}$ is less than $\frac{8}{9}$ since $\frac{8}{9}$ is almost 1, but $\frac{1}{3}$ is not even $\frac{1}{2}$.

A number line picture shows what this looks like.



$\frac{1}{3} < \frac{8}{9}$

C. Which strategy would you use to help you answer **part A**?

Examples

Example 1 Fractions with the Same Numerator or Denominator

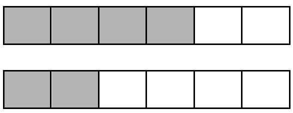
Which fraction in each pair is greater? Show how you know.

a) $\frac{2}{6}$ or $\frac{4}{6}$

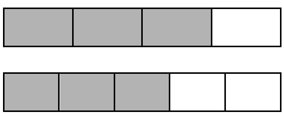
b) $\frac{3}{4}$ or $\frac{3}{5}$

Solution

a) $\frac{4}{6} > \frac{2}{6}$



b) $\frac{3}{4} > \frac{3}{5}$



Thinking

a) I knew that 4 sixths was more than 2 sixths.

b) I knew 1 fourth of a whole was bigger than 1 fifth of the same whole, because the whole is divided into 4 parts instead of into 5 parts.
That meant 3 fourths > 3 fifths.

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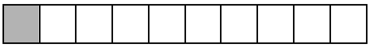
Example 2 Comparing Fractions by Relating them to 0, ½, or 1

Which fraction is greatest? $\frac{3}{4}$ $\frac{1}{10}$ $\frac{3}{8}$ How do you know?

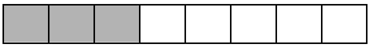
Solution

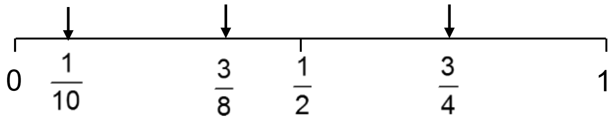
$\frac{1}{10}$ is close to 0. This picture shows that it is only 1 part out of 10 parts.



$\frac{3}{4}$ is close to 1. This picture shows that it is 3 parts out of 4 parts.

$\frac{3}{8}$ is close to $\frac{1}{2}$ since 3 out of 8 is almost 4 out of 8, which is $\frac{1}{2}$.





$\frac{3}{4}$ is greatest.

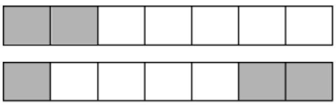
Thinking

- I thought about how close each fraction was to 0, $\frac{1}{2}$, or 1.
- I noticed these things:
  - If a fraction is close to 0, the numerator is a lot less than the denominator.
  - If a fraction is close to 1, the numerator is close to the denominator.
  - If a fraction is close to $\frac{1}{2}$, the denominator is about twice the numerator.

Practising and Applying

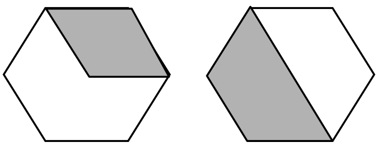
1. Name the two fractions that are shaded in each pair. Then tell which fraction is greater.

a)

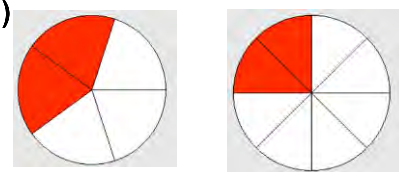


b)

c)



d)



2. Which fraction in each pair is greater?

a) $\frac{4}{10}$ or $\frac{7}{10}$ **b)** $\frac{6}{9}$ or $\frac{3}{9}$

c) $\frac{3}{8}$ or $\frac{3}{10}$ **d)** $\frac{7}{10}$ or $\frac{7}{12}$

e) $\frac{1}{4}$ or $\frac{3}{5}$ **f)** $\frac{2}{12}$ or $\frac{11}{15}$

3. Name a fraction for each.

a) greater than $\frac{3}{4}$ **b)** less than $\frac{1}{4}$

c) close to $\frac{1}{2}$ **d)** less than $\frac{4}{5}$

e) greater than $\frac{2}{9}$

4. What number is missing? Find as many answers as you can for each.

a) $\frac{[\ ]}{8} < \frac{4}{8}$ **b)** $\frac{3}{[\ ]} > \frac{3}{6}$

c) $\frac{[\ ]}{9} < \frac{1}{2}$ **d)** $\frac{[\ ]}{6}$ is close to 1

5. Tshering did $\frac{2}{3}$ of her homework.

Yanka did $\frac{4}{5}$ of his homework.

Karma did $\frac{8}{20}$ of her homework.

Who is closest to being finished? How do you know?

6. Name a pair of fractions for each. Explain your choices.

a) fractions that are easy to compare

b) fractions that are more difficult to compare

GAME: Closer to 1

Play in a group of two or three.

You need four sets of number cards from 1 to 10.

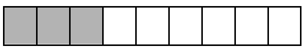
How to play:

- Mix up the cards. Spread them out face down.
- Each player takes two cards and creates a fraction
that is equivalent to 1 or less than 1.
- The player with the fraction closest to 1 keeps all the cards. If there is a tie, those players go again.
- The game is over when there are not enough cards left for every player to make a fraction.

The player with the most cards wins the game.

For example:

Nima took a 3 card and a 9 card

and made the fraction $\frac{3}{9}$. 

Pema took a 2 card and a 3 card

and made the fraction $\frac{2}{3}$. 

They used their fraction strips to help them decide which fraction was closer to 1.

Since $\frac{2}{3} > \frac{3}{9}$, Pema keeps all four cards.

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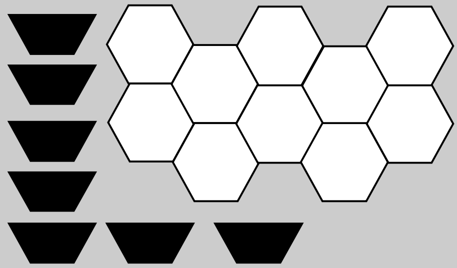
4.1.4 Modelling Mixed Numbers

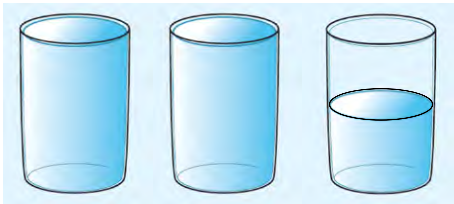
Try This

Yeshi is covering hexagon blocks with trapezoid blocks to make a design.
He has 7 trapezoid blocks.

A. How many hexagon blocks will he be able to cover?



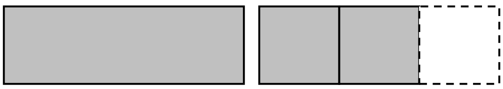
Sometimes you have more than one item as well as a fractional part.
For example:
You might have 2 glasses of water and another glass that is $\frac{1}{2}$ full.
You can use the **mixed number** $2\frac{1}{2}$ to describe that amount.



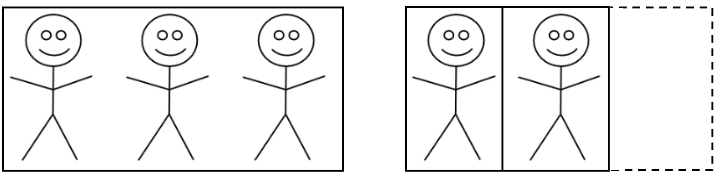
$2\frac{1}{2}$ glasses of water

- A mixed number is a whole number part and a fraction part less than 1.
You can think of the two parts added together, so $2\frac{1}{2} = 2 + \frac{1}{2}$.

- A mixed number can describe wholes and parts of wholes.
For example:
Each rectangle is 1, so this picture shows $1\frac{2}{3}$ rectangles.



- A mixed number can also describe whole groups and parts of groups.
For example:
3 people is 1 group, so this picture shows $1\frac{2}{3}$ groups of people.



B. If Tashi covered $4\frac{1}{2}$ hexagons, how many trapezoids did he have?

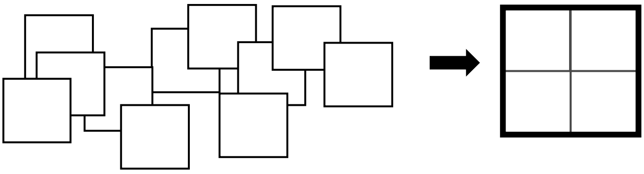
Examples

Example 1 Describing an Amount with a Mixed Number

Describe each amount using a mixed number.

a) How many pairs of shoes are there?

b) How many large squares can you make with 11 small squares?

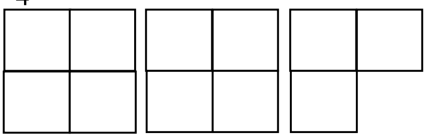


Solution

a) $3\frac{1}{2}$ pairs

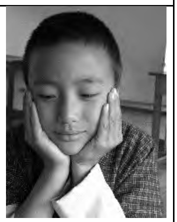
1 pair 1 pair 1 pair $\frac{1}{2}$ pair

b) $2\frac{3}{4}$ large squares



1 square 1 square $\frac{3}{4}$ of a square

Thinking



a) I counted 3 whole pairs and 1 half pair.

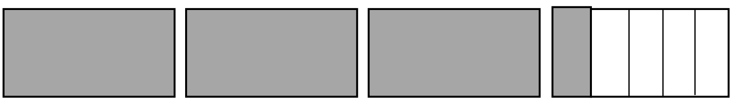
b) I knew I needed 4 small squares to make 1 large square. That meant I needed 4 small squares for 1 large square and another 4 for a second large square. I didn't have enough to make a full third large square.

Example 2 Building a Model of a Mixed number

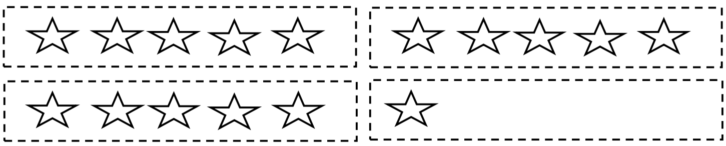
Draw two different pictures to show $3\frac{1}{5}$.

Solution

Picture 1



Picture 2



Thinking

- I used wholes that I could divide into 5 equal parts.

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Example 3 Comparing Mixed Numbers

Duptho ate $2\frac{1}{3}$ bowls of soup. Karchung ate $1\frac{2}{3}$ bowls.
Who ate more soup? Explain your thinking.

Solution

I only had to compare the whole number parts since

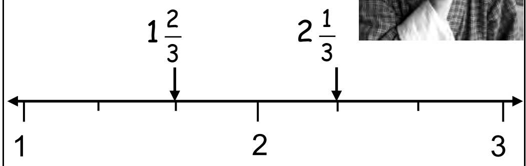
$2\frac{1}{3} = 2 + \frac{1}{3}$ and $1\frac{2}{3} = 1 + \frac{2}{3}$.

$1 + \frac{2}{3} < 2$ since $2 = 1 + \frac{3}{3}$

$2\frac{1}{3} > 1\frac{2}{3}$, so Duptho ate more soup.

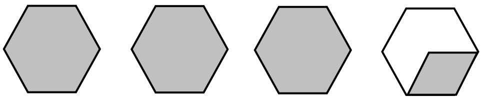
Thinking

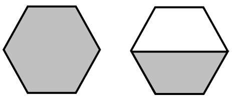
- I knew that $1\frac{2}{3} < 2$ and $2\frac{1}{3} > 2$.

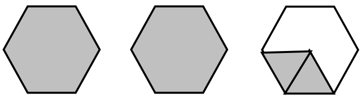


Practising and Applying

1. Describe each picture with a mixed number. (Each hexagon is 1 whole.)

a)


b)


c)


2. Use pattern block pieces to make each number of hexagons.
Sketch a picture of each.

a) $1\frac{1}{6}$ **b)** $4\frac{1}{2}$ **c)** $2\frac{1}{3}$ **d)** $3\frac{5}{6}$

3. How many hexagons can you make with each number of pattern block pieces?

a) 9 triangle pieces

b) 5 rhombus pieces

c) 7 trapezoid pieces

4. The principal says that there is only room for $5\frac{1}{2}$ classes of students in the meeting room.
What does he mean?

5. The school has 4 rooms.
$\frac{1}{2}$ of one room is empty.
How many rooms are full?

6. Which is greater in each pair?

a) $5\frac{1}{3}$ or $3\frac{2}{5}$ **b)** $1\frac{4}{5}$ or $2\frac{1}{3}$

7. Which is greater, $10\frac{5}{6}$ or $7\frac{1}{3}$?
How do you know?

8. How do you know that $4\frac{2}{5}$ is between 4 and 5?

9. Is it possible for two mixed numbers to be equivalent? Use an example to explain your thinking.

10. Describe a situation where you might use a mixed number.

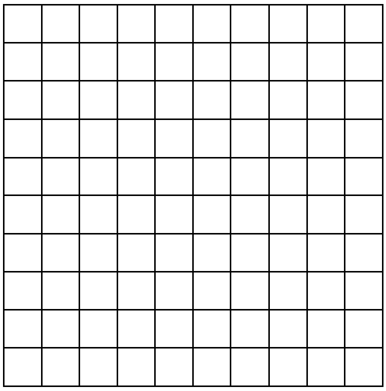
Chapter 2 Representing Decimals

4.2.1 Modelling Hundredths

Try This

A. Create a design on a 10-by-10 grid like this.

- Your design must cover 33 whole squares and use two different colours.
- Colour only whole squares, not parts of squares.
- There must be twice as many squares of one colour as of the other colour.



- You have learned about fraction tenths and how they can be written as decimals.

For example, $\frac{7}{10}$ as a decimal is 0.7. You read both as "7 tenths".

- There are parts that are smaller than tenths. They are called hundredths. You can write hundredths as decimals too.

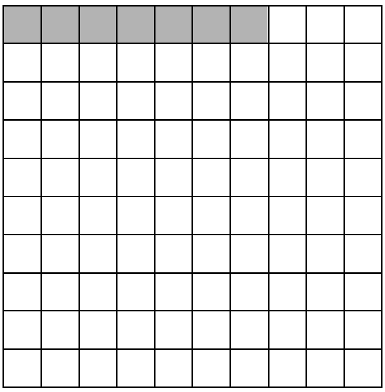
If a whole is divided into 100 equal parts, each part is $\frac{1}{100}$.

$\frac{1}{100}$ as a decimal is 0.01. You read it as "1 hundredth".

- Here are some examples of decimal hundredths:

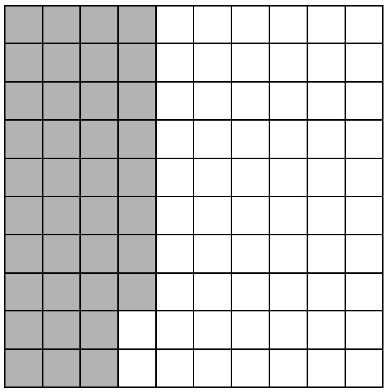
$\frac{7}{100} = 0.07$

You say, "seven hundredths".



$\frac{38}{100} = 0.38$

You say, "thirty-eight hundredths".



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• Decimal hundredths are part of the place value system. You can see in the chart below that the hundredths place is to the right of the tenths place.

10 hundredths make 1 tenth, just like 10 tenths make 1 one,
10 ones make 1 ten, and
10 tens make 1 hundred.

10 hundredths = 0.10. Since 0.10 is 1 tenth + 0 hundredths, 0.10 can be renamed as 0.1.

0.10 = 0.1

Hundreds	Tens	Ones	Tenths	Hundredths
				10
			1	0

Notice that the hundredths place is two places right of the ones place, just like the hundreds place is two places left of the ones place.

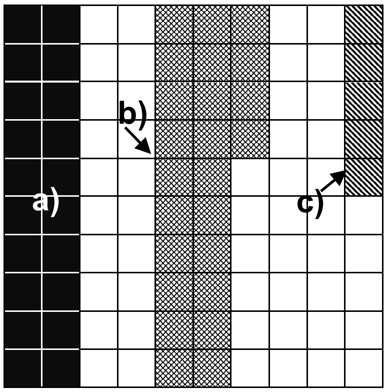
B. What decimals describe the two coloured parts of the grid from **part A**?

Examples

Example 1 Interpreting Decimal Hundredths

What decimals are shown on the grid?

How do you know?



Solution

• The **a)** rectangle is 0.20 or 0.2.

I can see it is $\frac{20}{100}$, which is 0.20.

0.20 = 2 tenths + 0 hundredths = 0.2

• The **b)** part is 0.24.

I can see it is $\frac{24}{100}$ = 0.24.

• The **c)** part is 0.05.

I can see it is $\frac{5}{100}$ = 0.05.

Thinking

• I knew each grid square was 1 hundredth, or 0.01.

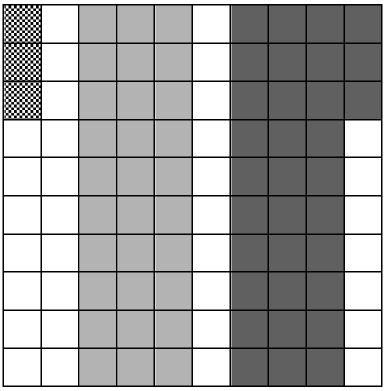
• I counted squares to figure out how many hundredths each part covered.

• For **b)**, I noticed $\frac{24}{100}$ was $\frac{2}{10} + \frac{4}{100}$, since each column of squares is $\frac{1}{10}$.

Example 2 Modelling Decimal Hundredths

Use one 10-by-10 grid to show all three decimals. 0.03 0.30 0.33

Solution



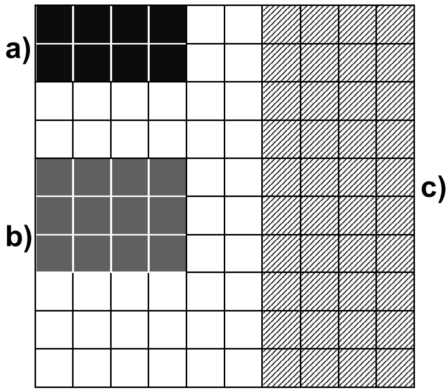
Thinking

A 10-by-10 grid is called a hundredths grid because each square is $\frac{1}{100}$ or 1 hundredth.

- *For 0.03, I coloured 3 squares because 0.03 = $\frac{3}{100}$.*
- *For 0.30, I coloured 3 columns because 0.30 = 0.3.*
- *For 0.33, I coloured 33 squares because 0.33 = $\frac{33}{100}$.*

Practising and Applying

1. What decimal describes each part of the grid?



2. Use one hundredths grid to show all four decimals.

a) 0.12 **c)** 0.21

b) 0.03 **d)** 0.49

3. Write each fraction as a decimal.

a) $\frac{9}{100}$ **b)** $\frac{64}{100}$

c) $\frac{80}{100}$ **d)** $\frac{100}{100}$

4. Suppose you coloured the first six columns of a hundredths grid. What two decimals could describe the coloured part?

5. Write a decimal to describe each part of a hundredths grid.

a) $\frac{1}{2}$ of the grid **b)** $\frac{1}{4}$ of the grid

c) $\frac{1}{10}$ of the grid **d)** all of the grid

6. Why does it make sense that the hundredths place is to the right of the tenths place in our place value system?

Ones 1.0	Tenths 0.1	Hundredths 0.01

7. To write 3 hundredths, Ugyen wrote 0.3 instead of 0.03. What would you say to help her understand what she did wrong?

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4.2.2 Comparing and Ordering Decimals

Try This

Some of the best men's long jumps in the 2004 Olympics are shown in the chart.

A. Who jumped the farthest? How do you know?

Name	Jump (metres)
C. Tomlinson	8.25
B. Tarus	8.21
Y. Lamela	7.98
V. Shkuriatov	8.03

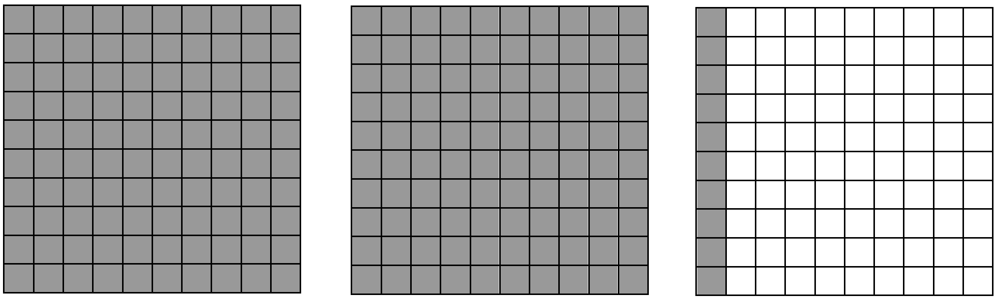
Sometimes you need to compare decimals that are measurements or money amounts.

• When the decimals have different whole number parts, you can compare the whole numbers.

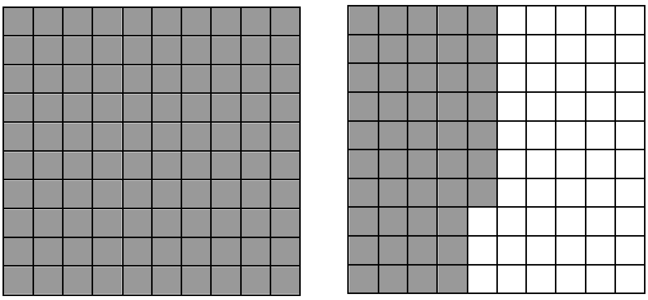
For example: $2.1 > 1.47$ because $2 > 1$.

This makes sense since 1.47 is between 1 and 2 and 2.1 is more than 2.

2.1



1.47



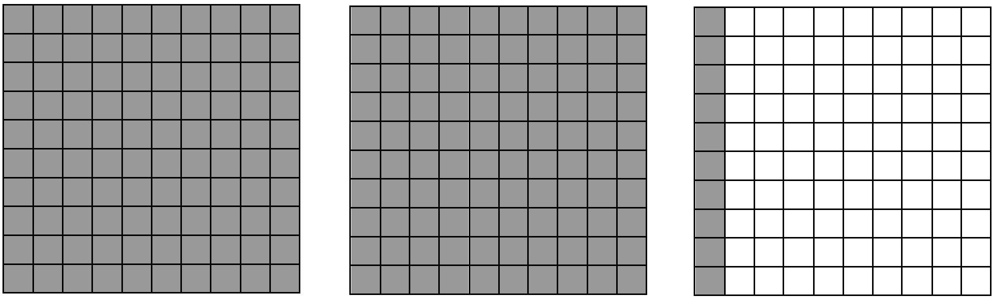
Even though 1.47 has 3 digits and 2.1 has only 2 digits, 2.1 is still greater than 1.47 because $2 > 1$.

• When the whole number parts are the same, you compare the decimal parts.

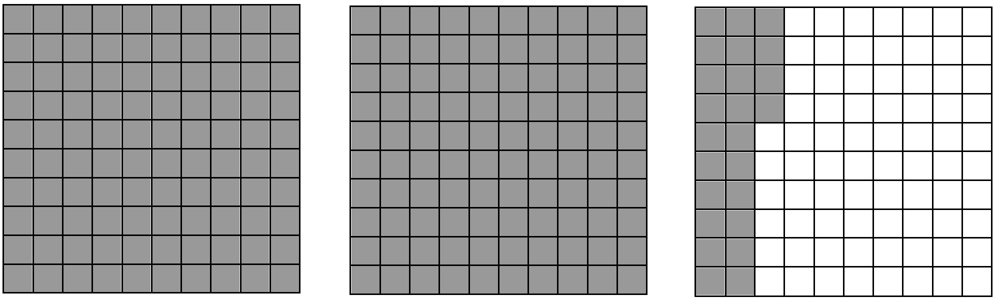
For example: $2.24 > 2.1$ because $0.24 > 0.1$.

This makes sense because 2.24 is 0.24 ($\frac{24}{100}$) more than 2 but 2.1 is only 0.1 ($\frac{1}{10}$) or 0.10 ($\frac{10}{100}$) more than 2.

2.1



2.24



2.24 > 2.1

• When you order decimals, you can compare them two at a time.

For example, this is how you can order 3.4, 0.57, and 3.19:

0.57 is less than 1 and 3.19 is more than 1, so 0.57 < 3.19.

3.19 < 3.4, since 3.4 is 3 + 0.4 ($\frac{40}{100}$) and 3.19 is only 3 + 0.19 ($\frac{19}{100}$).

In order from least to greatest: 0.57, 3.19, and 3.4

B. How can you use hundredths grids to answer **part A**?

C. Name a distance that is between 7.98 m and 8.03 m.

Examples

Example 1 Ordering Decimals

Order these decimals from least to greatest: 3.1 1.99 0.45 3.07

Solution

0.45 is less than 1.

1.99 is between 1 and 2.

3.07 is $\frac{7}{100}$ more than 3.

3.1 is $\frac{1}{10}$ or $\frac{10}{100}$ more than 3.

From least to greatest:
0.45, 1.99, 3.07, 3.1

Thinking

• I compared each number to the whole numbers 1, 2, and 3.

• To compare 3.07 and 3.1, I had to compare the decimal parts.

• I noticed that the greatest decimal had the fewest digits.

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Example 2 Creating Decimals to Fit Comparison Rules

Name a decimal that fits each.

a) greater than 3.09 but less than 4
b) less than 2.01 but greater than 1.5
c) between 2.04 and 2.1

Solution	Thinking
a) 3.09 < <u>3.10</u> < 4	**a)** I knew 3.09 was $3 + \frac{9}{100}$, so I used a greater decimal part to get $3 + \frac{10}{100}$.
b) 1 < <u>2</u> < 2.01	**b)** Since 2.01 is more than 2, I knew any number between 1.5 and 2 would work.
c) 2.04 < <u>2.07</u> < 2.1	**c)** I knew 2.04 was $2 + \frac{4}{100}$ and 2.1 was $2 + \frac{10}{100}$, so I chose a decimal part between $\frac{4}{100}$ and $\frac{10}{100}$.

Practising and Applying

1. Copy each and use a < , >, or = sign to make it true.

a) 1.2 ■ 1.37 **b)** 1.3 ■ 1.28
c) 3.04 ■ 3.40 **d)** 2.10 ■ 2.01
e) 4.1 ■ 4.10

2. Order from least to greatest.

a) 3.1, 1.25, 0.89, 1.28, 3.02
b) 3.87, 3.71, 2.49, 4.92, 2.4
c) 1.10, 0.11, 0.01, 1.01

3. What numbers are missing in each, if you count by hundredths?

a) 3.07, 3.08, ____, ____, ____, 3.12
b) 3.97, 3.98, 3.99, ____, ____

4. How can 0.99 be less than 1.2 when 99 is more than 12?

5. Write a decimal to fit each rule.

a) greater than 3.91 but less than 5
b) less than 4.0 but more than 3
c) between 2.5 and 2.6
d) between 2.09 and 2.11

6. Sometimes you see money amounts like Nu 5.45, which means 5 ngultrums and 45 chhetrums. Which is the least amount of money?

Nu 5.34 Nu 4.21 Nu 5.43

7. a) Complete each decimal with a digit from 4 to 9. Use the same digit in each. Then order them from least to greatest.

0.4[ ] 3.4[ ]
3.44 3.[ ] 4
[ ].43 [ ].34

b) Repeat **part a)** but replace each digit with 0.

c) Why was the order different in **part a)** than in **part b)**?

8. Use examples to help you explain each.

a) Comparing decimal hundredths is like comparing whole numbers.
b) Comparing decimal hundredths is not like comparing whole numbers.

Chapter 3 Decimal Addition and Subtraction

4.3.1 Adding Decimals

Try This

Dorji was weaving a kira. She did not have enough thread to finish it, so she had to buy Nu 6.20 of black thread and Nu 17.25 of white thread.

A. How much did Dorji spend on thread?

Nu 6.20 Nu 17.25

- You add decimals the same way you add whole numbers, by adding values with the same place value.

For example:

This is how to add the whole numbers 135 + 48:

	Hundreds	Tens	Ones
	1	3	5
+		4	8
			13

→

	Hundreds	Tens	Ones
		1	
	1	3	5
+		4	8
	1	8	3

A sum of 183 makes sense because 135 + 48 is about 130 + 50 = 180.

This is how to add the decimals 1.35 + 4.8:

	Ones	Tenths	Hundredths
	1	3	5
+	4	8	
		11	5

→

	Ones	Tenths	Hundredths
	1		
	1	3	5
+	4	8	
	6	1	5

A sum of 6.15 makes sense because 1.35 + 4.8 is about 1 + 5 = 6.

- When you add decimals, the numbers are not always lined up on the left or on the right. It depends on the place value of the digits you are adding. However, the decimal points always line up.

For example:

$$\begin{array}{r} 5.45 \\ +\ 0.2 \\ \hline \end{array} \qquad \begin{array}{r} 12.6 \\ +\ 10.38 \\ \hline \end{array} \qquad \begin{array}{r} 15.29 \\ +\ 4.57 \\ \hline \end{array}$$

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• To add decimals with whole number parts of hundreds and tens, you can add the whole number parts the way you always have.	For example: $\begin{array}{r} {\scriptstyle 1\,1\,1\,1} \\ 412.45 \\ +\ \underline{397.85} \\ 810.30 \end{array}$

B. How would you estimate the sum in **part A** to check your answer?

C. Why do you not line up the numbers on the left to add 6.20 + 17.25?

Examples

Example 1 Adding Decimals Using Grids

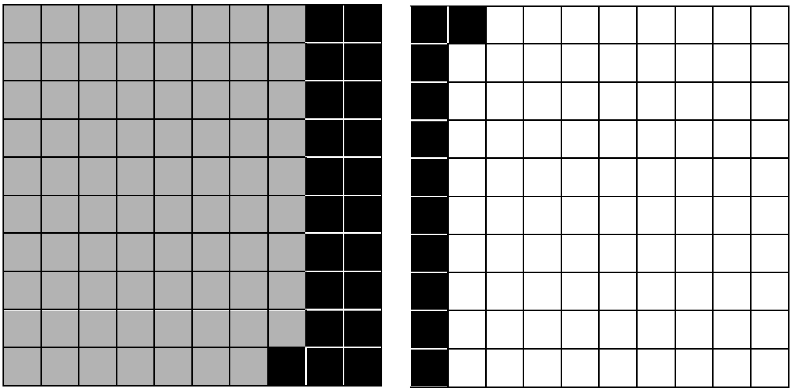
Use hundredth grids to add 0.79 + 0.32.

Thinking

• I thought of 0.79 as 79 squares in a hundredths grid and of 0.32 as 32 squares.

• There were only 21 squares left in the grid after I coloured 79 squares, so I used a second grid for the last 11 squares.

Solution



0.79 + 0.32 = 0.79 + 0.21 + 0.11 = 1.11

Example 2 Solving a Decimal Problem by Adding

Karma measured two pieces of fabric. One piece was 3.42 m long and the other piece was 4.8 m long. What was the total length?

Solution

$$\begin{array}{rl} 3.42 & \\ +\ \underline{4.8} & \\ 7 & [3 + 4] \\ 1.2 & [0.4 + 0.8] \\ +\ \underline{0.02} & [0.02 + 0] \\ 8.22 & \end{array}$$

She measured 8.22 m of fabric altogether.

Thinking

• I decided to add the ones, tenths, and hundredths separately.

• 8.22 makes sense since 3.42 + 4.8 is about 3 + 5 = 8.

Practising and Applying

1. Add.

a) 5.27 + 13.8

b) 4.19 + 0.03

c) 124.2 + 67.89

d) 0.74 + 33.29

2. Singye measured a 3.42 m length of wood. She then measured a 4.89 m length of wood. What was the total length?

3. Pelden wove a piece of fabric with an area of 0.45 square metres. She then increased its size by 0.35 square metres. What is the new area?

4. Estimate each sum.

a) 1.37 + 42.5

b) 0.37 + 0.29

c) 18.39 + 5.8

d) 104.8 + 94.32

5. How many times can you add 0.13 to itself before the total is greater than 1? Show your work.

0.13 + 0.13 + 0.13 + ...

6. What are the missing digits?

a) 36.[ ]4 + 8.2[ ] = [ ]4.42

b) 1.[ ]8 + 3.5[ ] = 5.55

c) [ ]1.[ ]83 + 74.[ ] = 190.63

7. Write a word problem that you can solve using 4.12 + 5.89. Solve your problem.

8. How many different pairs of decimal hundredths can you add to make 1.00? How do you know?

0.[ ][ ] + 0.[ ][ ] = 1.00

9. What is the most important thing to remember when adding decimals? Why?

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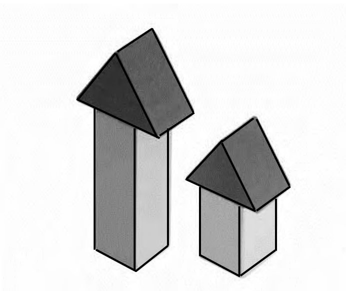
4.3.2 Subtracting Decimals

Try This

Thinley and Yeshi created two towers.
One tower was 1.12 m high.
The other tower was 0.47 m high.

A. How much higher is the taller tower?



- You subtract decimals the same way you subtract whole numbers, by subtracting values with the same place value.

For example:

To subtract the whole numbers 132 – 46, you can begin by subtracting the ones and regrouping as you go.

	Hundreds	Tens	Ones
	1	3	2
–		4	6

→

	Hundreds	Tens	Ones
	~~1~~	12 ~~3~~	12 ~~2~~
–		4	6
		8	6

A difference of 86 makes sense since 132 – 46 is about 130 – 50 = 80.

To subtract the decimals 4.6 – 1.32, you can use the same strategy:

	Ones	Tenths	Hundredths
	4	6	
–	1	3	2

→

	Ones	Tenths	Hundredths
	4	~~6~~ 5	10
–	1	3	2
	3	2	8

A difference of 3.28 makes sense since 4.6 – 1.32 is about 4.5 – 1 = 3.5.

- When you subtract decimals, the numbers are not always lined up on the left or on the right. It depends on the place value of the digits you are subtracting. However, the decimal points always line up.

For example:

$$\begin{array}{r} 5.45 \\ -\ 0.2 \\ \hline \end{array} \qquad \begin{array}{r} 12.6 \\ -\ 10.38 \\ \hline \end{array} \qquad \begin{array}{r} 15.29 \\ -\ 4.57 \\ \hline \end{array}$$

- To subtract decimals with whole number parts of hundreds and tens, you can subtract the whole number parts the way you always have.

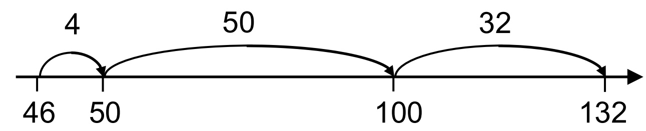
For example:

$$\begin{array}{r} 12\ \ 9 \\ 10\ \ \cancel{13}\ \ \cancel{10}\ \ 16 \\ \cancel{1}\,\cancel{1}\,\cancel{3}.\cancel{0}\,\cancel{6} \\ -\ \ 4\,9.8\,7 \\ \hline 6\,3.1\,9 \end{array}$$

• Other strategies that you use for subtracting whole numbers can also be used to subtract decimals. For example:

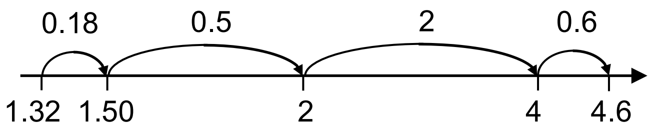
To subtract the whole numbers 132 – 46, you can add up from 46 to 132.

You can sketch a number line to help you do this.



From 46 to 132 is
4 + 50 + 32 = 50 + 32 + 4
= 86
So 132 – 46 = 86.

To subtract the decimals 4.6 – 1.32, you can add up from 1.32 to 4.6.



From 1.32 to 4.6 is
0.18 + 0.5 + 2 + 0.6
= 2 + 0.6 + 0.5 + 0.18
= 3.28
So 4.6 – 1.32 = 3.28.

B. Which strategy would you use to subtract the decimals in **part A**? Describe how you would do it.

Examples

Example 1 Subtracting Decimals by Adding Up

Subtract 103.2 – 51.48. Show your work.

Thinking

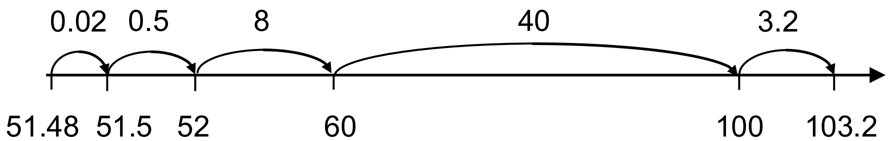
• I decided to add up from 51.48 to 103.2.

• I sketched a number line to help me.

• I rearranged the numbers to make them easier to add:

0.02 + 0.5 + 8 + 40 + 3.2 = 40 + 8 + 3.2 + 0.5 + 0.02

Solution



From 51.48 to 103.2 is

0.02 + 0.5 + 8 + 40 + 3.2 = 40 + 8 + 3.2 + 0.5 + 0.02 = 51.2 + 0.52 = 51.72

So 103.2 – 51.48 = 51.72.

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Example 2 Solving a Problem by Subtracting Decimals

A snake was 0.62 m at birth and grew to 2.11 m long. How much did it grow?

Solution

2.11 – 0.62

	Ones	Tenths	Hundredths
	2	1	1
–		6	2

	Ones	Tenths	Hundredths
	~~2~~ 1	~~1~~ 10	~~1~~ 11
–		6	2
	1	4	9

The snake grew 1.49 m.

Thinking

- I knew I needed to subtract to find how much longer 2.11 m was than 0.62 m.
- I decided to use a place value chart to help me subtract because I had to regroup.

Practising and Applying

1. Estimate each difference. Show how you estimated.

a) 4.37 – 2.94

b) 102.4 – 37.94

c) 8.1 – 7.32

d) 84.32 – 5.8

2. A snake was 0.47 m at birth and grew to be 1.53 m long. How much did it grow?

3. Calculate each difference.

a) 3.11 – 1.48

b) 0.8 – 0.38

c) 200.3 – 37.45

d) 36.4 – 17.28

4. The difference between two decimals is 1.45. List three possible pairs of decimals. Do not use whole numbers.

[ ] . [ ][ ] – [ ] . [ ][ ] = 1.45

or

[ ] . [ ][ ] – [ ] . [ ] = 1.45

5. Start with 1. How many times do you have to subtract 0.09 to get to 0.1? Show your work.

1 – 0.09 – 0.09 – 0.09 – ... = 0.1

6. Sithar is running a 10 km race. She stops for a drink at 6.5 km. How much farther does she have to run?

7. Write a word problem that you can solve using 5 – 3.12. Solve your problem.

8. What are the missing digits?

a) 3.1[ ] – [ ].[ ]9 = 1.65

b) 12.[ ]4 – [ ].8[ ] = 3.17

c) 14.[ ]2 – [ ].8[ ] = 6.1[ ]

9. Find two decimals that have a difference of 1.16 and a sum of 5.12.

[ ].[ ][ ] – [ ].[ ][ ] = 1.16

[ ].[ ][ ] + [ ].[ ][ ] = 5.12

10. a) How is subtracting decimals like subtracting whole numbers?

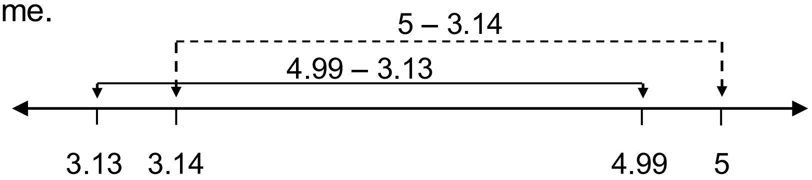
b) How is it different?

CONNECTIONS: Decimals from Whole Numbers

Here is a trick for subtracting a decimal from a whole number.
If you decrease both values by 0.01, it makes the subtraction easier.

For example, to subtract 5 – 3.14, you can subtract 4.99 – 3.13 instead.
Both values are 0.01 less. 5 – 0.01 = 4.99
3.14 – 0.01 = 3.13

When you subtract the same amount from both numbers, you do not change the difference because the distance between the numbers stays the same.



Subtracting 4.99 – 3.13 is easier because you do not have to regroup:

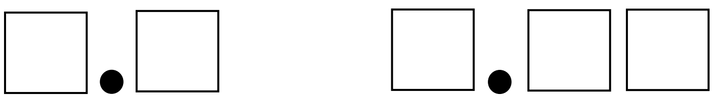
$$\begin{array}{r} 5 \\ -\underline{3.14} \end{array} \quad \Rightarrow \quad \begin{array}{r} 4.99 \\ -\underline{3.13} \\ 1.86 \end{array}$$

1. Use this strategy to subtract. **a)** 10 – 3.86 **b)** 7 – 4.38 **c)** 8 – 1.27

GAME: Aim for Five

Play in a group of 2. You need two dice, one for each player.
Each player does these things:

- Draw boxes and decimal points like this:



- Roll a die five times. After each roll, write the digit in one of the boxes.
- Add or subtract the numbers.

The player with the answer closer to 5 scores one point.
The first player to get 10 points wins the game.
For example:

Tshering rolled 6, 1, 3, 4, and 4.

$\boxed{3}\,\bullet\,\boxed{6}$ $\boxed{1}\,\bullet\,\boxed{4}\,\boxed{4}$

3.6 + 1.44 = 5.04

Bijoy rolled 1, 5, 2, 6, and 6.

$\boxed{6}\,\bullet\,\boxed{2}$ $\boxed{1}\,\bullet\,\boxed{5}\,\boxed{6}$

6.2 – 1.56 = 4.64

5.04 is only 0.04 away from 5, but 4.64 is 0.36 away from 5.
Tshering scores 1 point.

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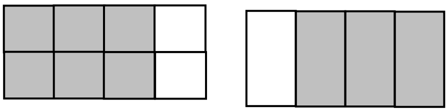
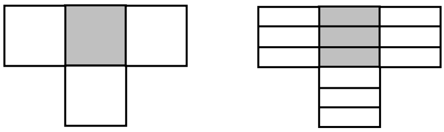
UNIT 4 Revision

1. Name the two fractions that are shaded in each pair. Then tell whether or not the fractions are equivalent.

a)



b)



2. Which pairs are equivalent fractions?

A. $\frac{3}{8}$ and $\frac{9}{24}$ **B.** $\frac{5}{6}$ and $\frac{9}{12}$

C. $\frac{9}{12}$ and $\frac{20}{40}$ **D.** $\frac{3}{6}$ and $\frac{10}{20}$

3. For each fraction, create two equivalent fractions.

a) $\frac{2}{5}$ **b)** $\frac{8}{10}$ **c)** $\frac{4}{9}$ **d)** $\frac{3}{8}$

4. Which fraction in each pair is greater?

a) $\frac{2}{7}$ or $\frac{6}{7}$ **b)** $\frac{4}{5}$ or $\frac{4}{8}$

c) $\frac{2}{100}$ or $\frac{9}{10}$ **d)** $\frac{6}{10}$ or $\frac{8}{9}$

5. Name a fraction for each.

a) greater than $\frac{3}{10}$

b) less than $\frac{5}{9}$

c) between $\frac{1}{5}$ and $\frac{4}{5}$

d) between $\frac{3}{8}$ and $\frac{3}{15}$

6. What could be the missing number in each? Find all possible answers.

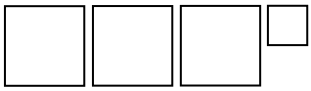
a) $\frac{[\ ]}{3} < \frac{2}{3}$

b) $\frac{5}{[\ ]} > \frac{5}{10}$

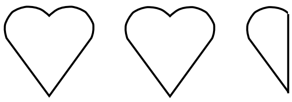
c) $\frac{1}{[\ ]} > \frac{3}{7}$

7. What mixed number does each picture show?

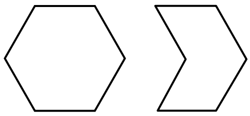
a)



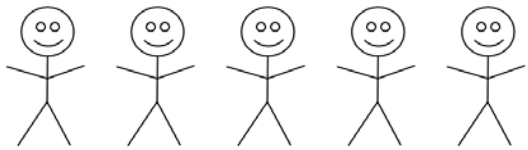
b)



c)



8. a) This picture shows $1\frac{2}{3}$ groups. How many people are in one group?



b) Suppose the picture was of $2\frac{1}{2}$ groups. How many are in one group?

c) What other mixed number of groups could the picture show? Explain your mixed number.

9. Draw a picture to show each mixed number.

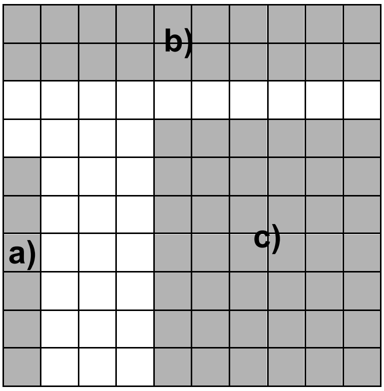
a) $4\frac{2}{3}$ **b)** $3\frac{5}{6}$

10. Name a mixed number for each.

a) between 8 and $8\frac{1}{2}$

b) between $3\frac{1}{3}$ and $3\frac{3}{4}$

11. Write the decimal for each shaded part of the hundredths grid.



12. Show all three decimals on one hundredths grid.

a) 0.04 **b)** 0.23 **c)** 0.40

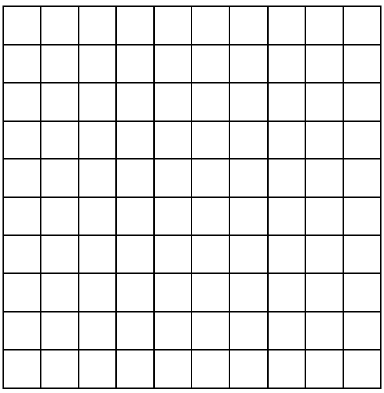
13. Write a decimal hundredth for each.

a) greater than 0.12 but less than 1

b) less than 0.9 but greater than 0.5

c) between 0.8 and 0.9

14. How many more squares of the grid do you need to shade to show 0.2 than to show 0.02?



15. Order from least to greatest.

a) 1.47, 0.92, 0.8, 3.0

b) 8.08, 8.80, 0.88

c) 2.22, 2.02, 3.14, 3.41

16. Write a decimal with 3 digits that is less than a decimal with 2 digits. Explain how you know it is less.

17. Add.

a) 3.2 + 8.97 **b)** 4.9 + 1.85

c) 2.67 + 0.74 **d)** 10.32 + 8.79

18. Norbu walked 3.25 km and then another 4.85 km. How far did he walk altogether?

19. Estimate. Show how you estimated.

a) 19.34 + 2.87 **b)** 0.34 + 0.87

c) 12.3 – 4.56 **d)** 93.25 – 6.89

20. Subtract.

a) 5.38 – 1.87 **b)** 12.12 – 1.85

c) 4.1 – 1.33 **d)** 11.3 – 7.83

21. Kinzang is 1.49 m tall. He was 0.53 m at birth. How much did he grow?

22. Find two decimals to make each true.

a) [ ] . [ ] + [ ] . [ ] [ ] = 4.12

b) [ ] . [ ] [ ] – [ ] . [ ] = 1.83

23. The same digit goes in all three blanks. What digit is it?

1[ ].42 – 9.[ ]6 = [ ].66

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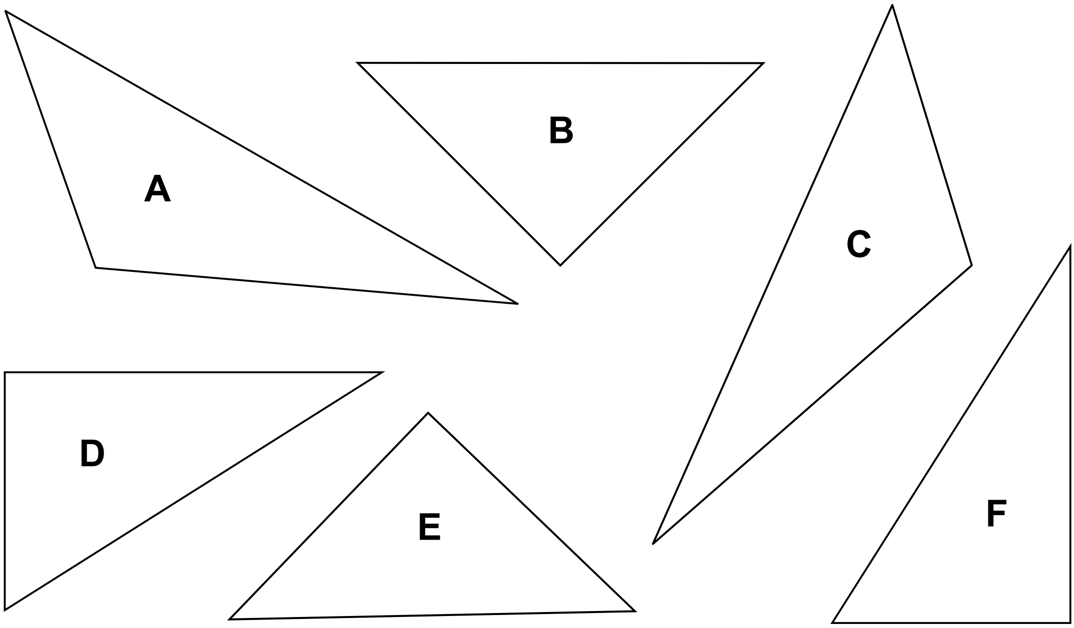
UNIT 5 GEOMETRY

Getting Started

Use What You Know

Use triangles like these.



A. i) Make three pairs of triangles by matching each triangle with a triangle that looks the same.

ii) Do this for each pair:

• Combine the triangles to make a larger shape. Make sure the triangles match along whole sides.

• Trace the larger shape. Label it with the letters of the two triangles.

• Find at least one more way to combine the two triangles.

B. Which triangle pairs make each larger shape?

i) a square **ii)** a non-square rectangle **iii)** a parallelogram

C. i) Which triangle pairs make a larger triangle?

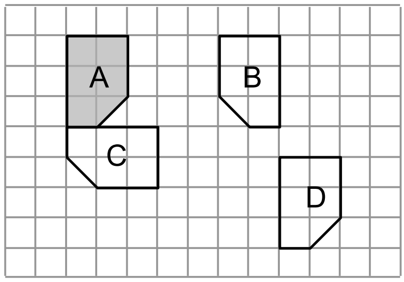
ii) Compare the corners of these triangles to the triangles that do not make a larger triangle. How are these triangles different?

Skills You Will Need

1. a) Which shape shows a $\frac{1}{4}$ turn of Shape A?

b) Which shape shows a slide of Shape A?

c) Which shape shows a flip of Shape A?



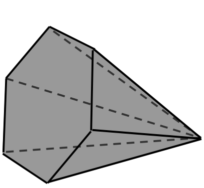
2. Match each 3-D shape below with its name.

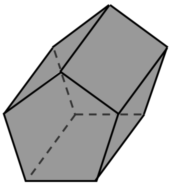
a) pentagon-based prism

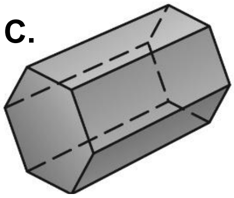
b) hexagon-based prism

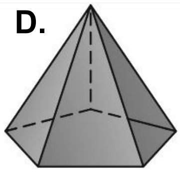
c) pentagon-based pyramid

d) hexagon-based pyramid

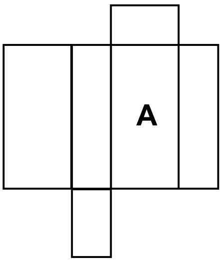
A.


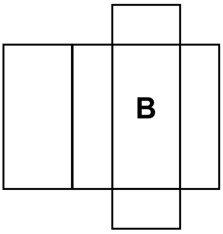
B.


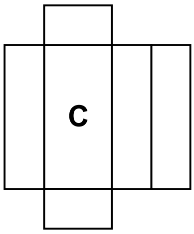
C.


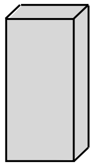
D.


3. Which is NOT a net for the rectangle-based prism?



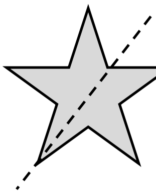


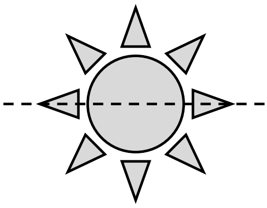


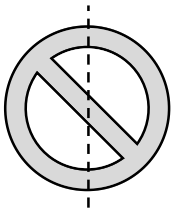


Rectangle-based prism

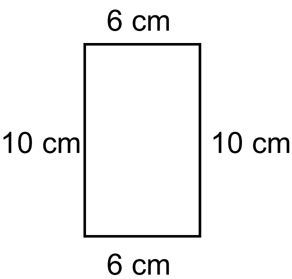
4. Which dashed lines are lines of symmetry?

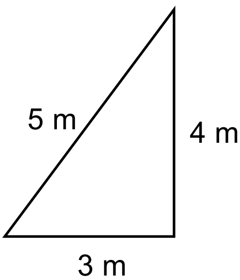
A.


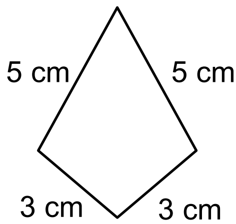
B.


C.


5. What is the perimeter of each shape? Show your work.

a)


b)


c)


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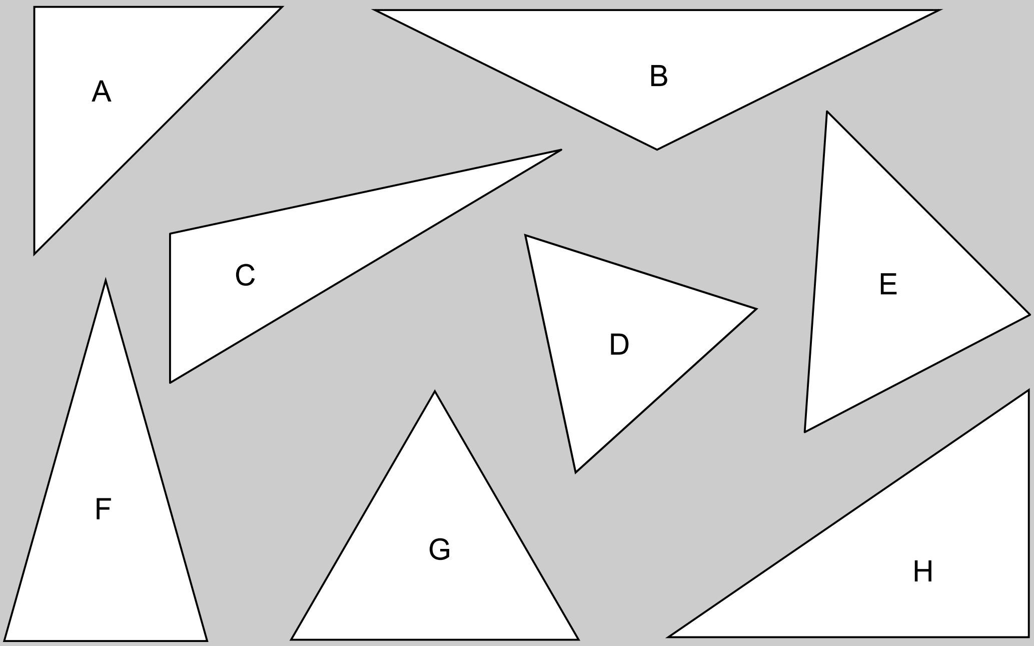
Chapter 1 Triangles and Quadrilaterals

5.1.1 Sorting and Drawing Triangles

Try This

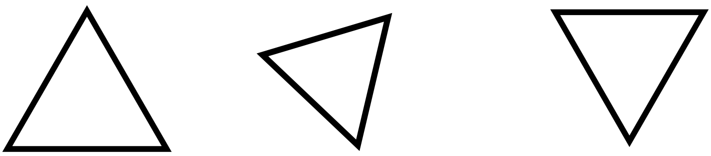
Use triangles like these.



A. Sort the triangles into two or more groups. Tell your sorting rule.

• One way to sort triangles is to look at the number of equal, or **congruent**, sides in each triangle.

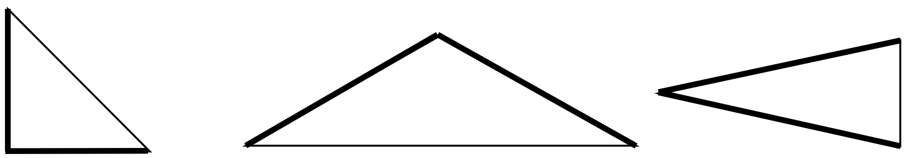
- An **equilateral triangle** has three congruent sides.



Examples of equilateral triangles

The three congruent sides are shown with dark lines.

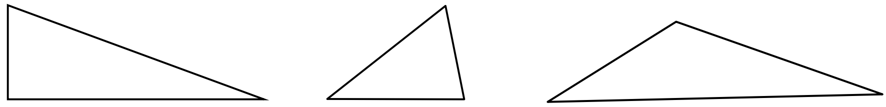
- An **isosceles triangle** has only two congruent sides.



Examples of isosceles triangles

The two congruent sides are shown with dark lines.

- A **scalene triangle** has no congruent sides. All the sides are different.

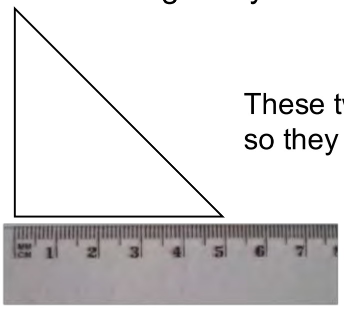


Examples of scalene triangles

• There are different ways to figure out whether a triangle has congruent sides.

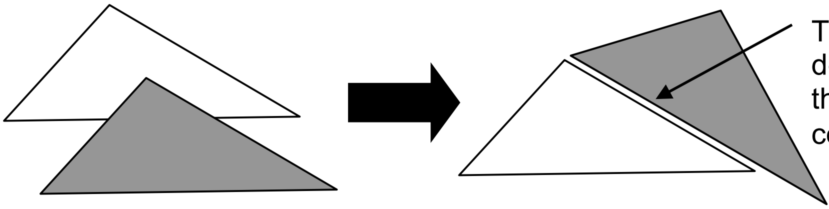
- You can compare side lengths by measuring:

5 cm



These two sides are both 5 cm so they are congruent.

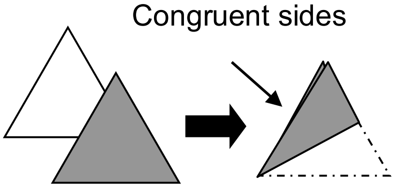
- You can make a copy of the triangle and try to match the sides.



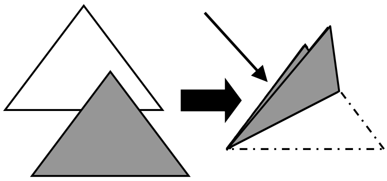
These two sides do not match so they are not congruent.

- You can make a copy and then fold the copy to see if the sides match:

Congruent sides



These sides are not congruent.



• Sometimes you can tell whether the sides are congruent just by looking.
For example:
You can see that the side lengths of this triangle are all different.

B. Which triangles in **part A** belong in each group?
i) equilateral **ii)** isosceles **iii)** scalene

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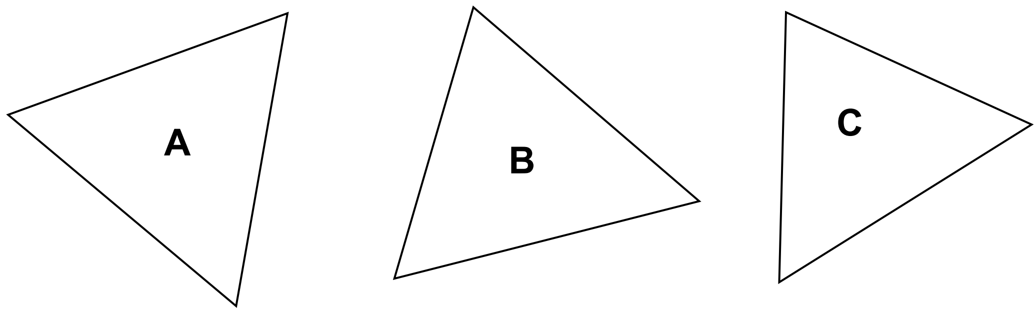
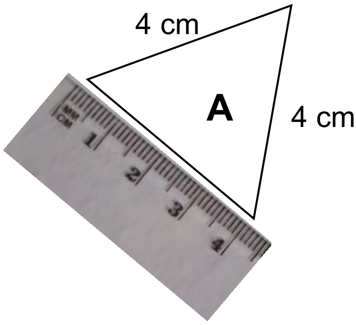
Examples

Example 1 Identifying Types of Triangles

Choose one triangle. Decide whether it is scalene, equilateral, or isosceles.



Solution 1

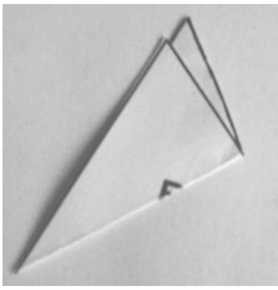


Triangle A is equilateral.

Thinking

- I chose Triangle A.
- I measured each side.
- It had three congruent sides, so I knew it was equilateral.

Solution 2

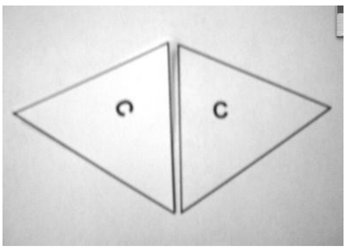


Triangle B is scalene.

Thinking

- I chose Triangle B.
- I traced it to make a copy. Then I cut it out.
- I folded the copy to see if any of the sides matched.
- All three sides were different lengths, so I knew it was a scalene triangle.

Solution 3



Triangle C is isosceles.

Thinking

- I chose Triangle C.
- I traced it to make a copy. Then I cut it out.
- I compared the sides of the copy to the sides of the original triangle.
- Only two sides were congruent, so I knew it was an isosceles triangle.

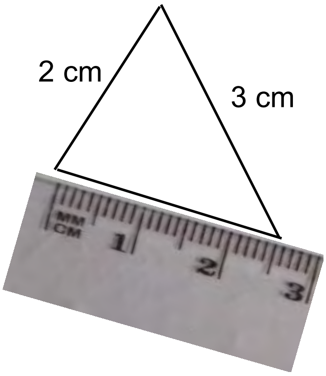
Example 2 Drawing Different Types of Triangles

Draw a triangle of each type.

a) scalene **b)** isosceles **c)** equilateral.

Solution

a) Scalene

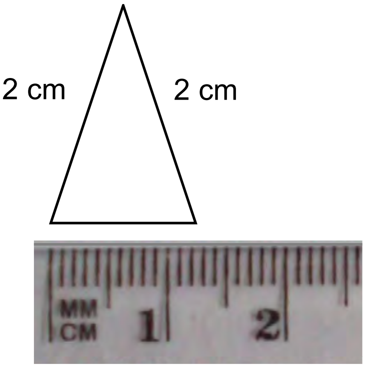


Thinking

a) I used a ruler to draw two sides that were different lengths — 2 cm and 3 cm.

• After I drew the third side, I measured it to be sure it wasn't congruent to either of the other two sides.

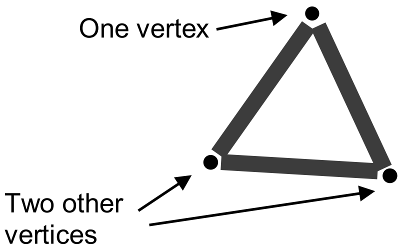
b) Isosceles



b) I used a ruler to draw two sides that were congruent.

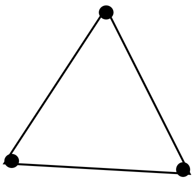
• After I drew the third side, I measured it to be sure it wasn't congruent to the other two sides.

c) Equilateral



c) I used three sticks that were the same length to make a model of an equilateral triangle.

• I marked the vertices, or corners, on the paper.



• I drew lines to connect the vertices.

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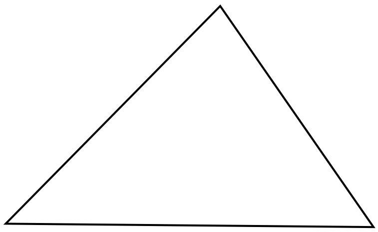
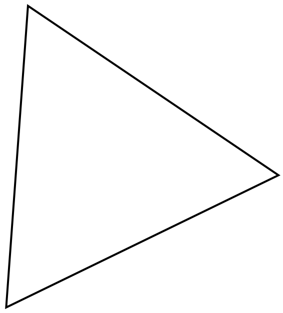
Practising and Applying

1. For each triangle, predict whether it is equilateral, isosceles, or scalene. Check your prediction. Explain what you did to check your prediction.

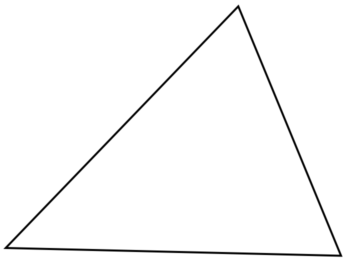
a)



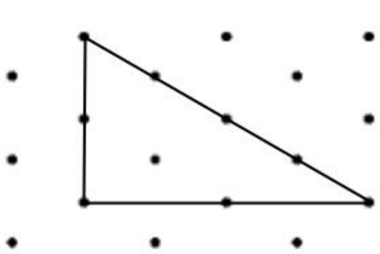
b)



c)



2. Trace the triangle and dots below. Change the scalene triangle into an equilateral triangle by moving only one vertex to another dot. Measure to check whether you are right.



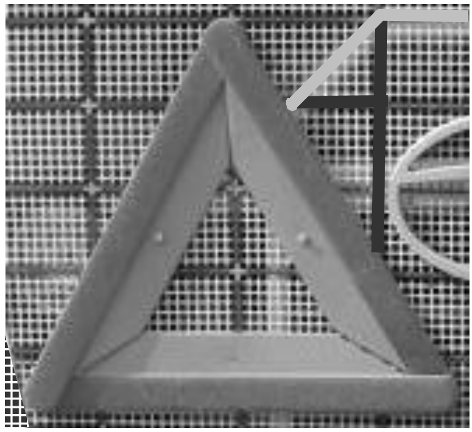
3. Draw an example of each triangle. Label the side lengths.

a) equilateral triangle

b) isosceles triangle

c) scalene triangle

4. In this photo of the front grille of a truck, identify three triangles: equilateral, isosceles, and scalene.



5. A triangle has a perimeter of 12 cm.

a) Suppose it were an equilateral triangle. Sketch what it might look like. Label each side with its length.

b) Repeat **part a)** for an isosceles triangle.

c) Repeat **part a)** for a scalene triangle.

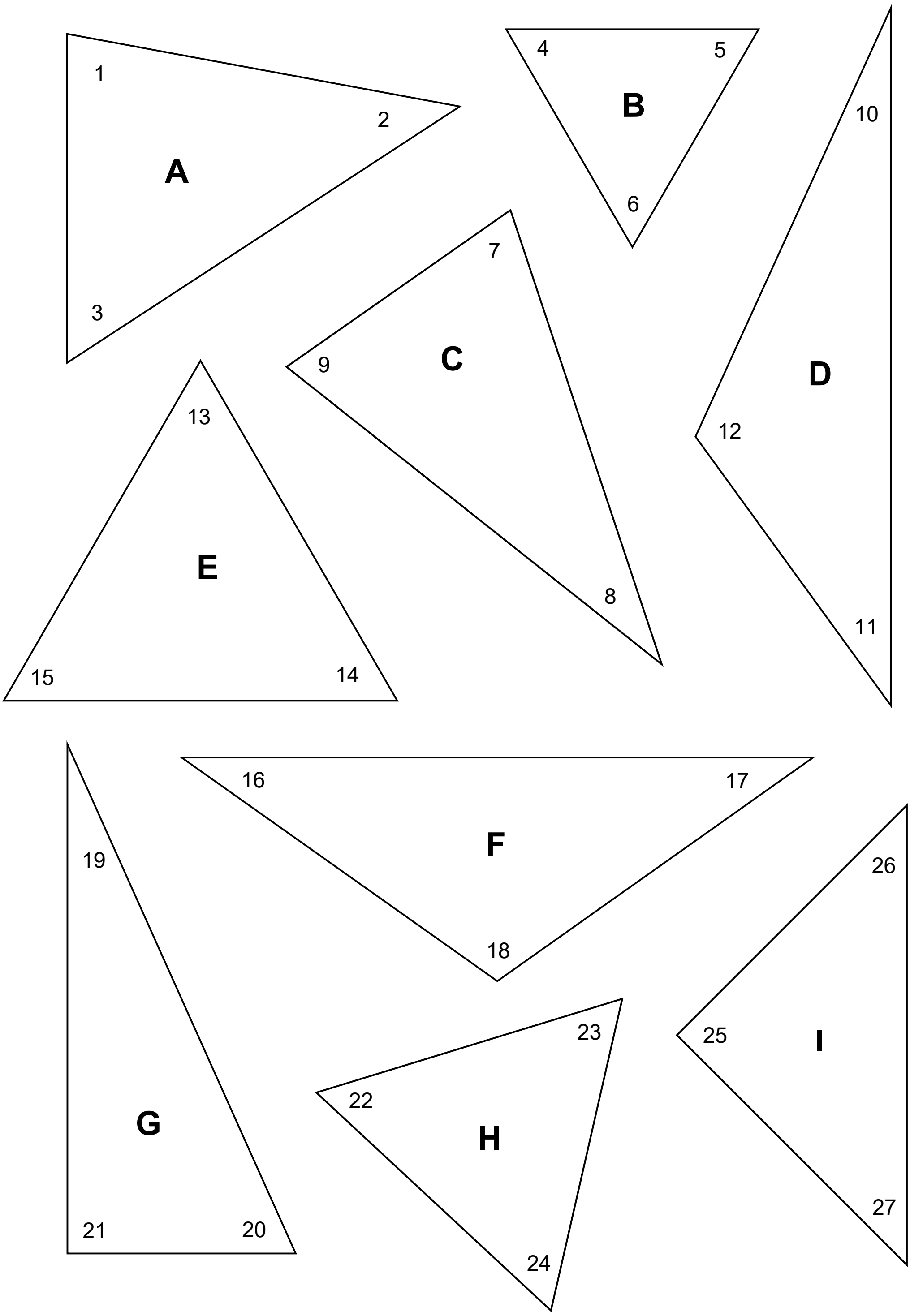
d) Can you draw another triangle for **part a)**? **part b)**? **part c)**? Explain your thinking.

6. Which method would you use to decide whether a triangle is equilateral, isosceles, or scalene? Why?

- measure
- make a copy and try to match the side lengths of the copy and the original triangle
- make a copy and fold it to try to match side lengths

5.1.2 EXPLORE: Properties of Triangles

Use triangles like these.



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Copy this chart.

Triangle	Type of Triangle: equilateral, isosceles, or scalene	Number of lines of symmetry	Number of congruent angles
A			
B			
C			
D			
E			
F			
G			
H			
I			

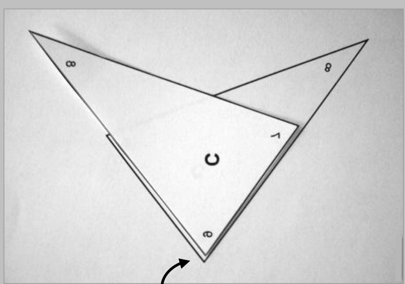
Complete the chart.

A. Measure the sides to determine what type of triangle it is.

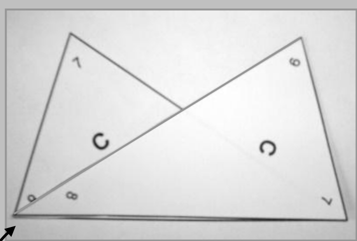
B. Fold each triangle to see how many lines of symmetry it has.

C. Compare each copy to the original triangle on **page 136**.
How many of the angles are congruent (the same size)?

For example, compare the angles in Triangle C:



These angles are congruent.



These angles are not congruent.

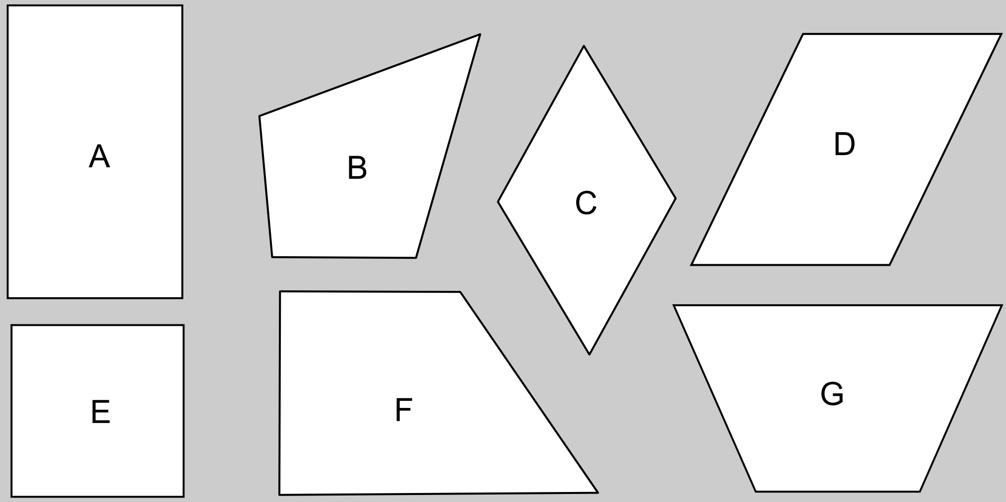
Triangle C has two congruent angles.

Look at your completed chart.

D. What do you notice about each type of triangle?

5.1.3 Sorting Quadrilaterals

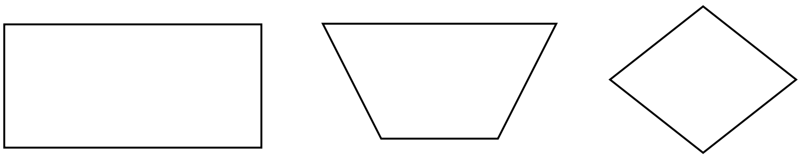
Try This



A. i) What is the same about all of these shapes?

ii) Show how the shapes are different by sorting them into two or more groups. Tell your sorting rule.

• A shape with four sides is called a **quadrilateral**. “Quad” means four and “lateral” means sides.



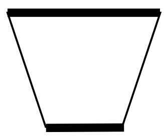
Examples of quadrilaterals

• Some quadrilaterals have pairs of sides that are **parallel**. Parallel sides go in the same direction.

- This quadrilateral has parallel top and bottom sides. It also has left and right sides that are parallel. Notice that this quadrilateral also has two pairs of congruent sides.

This shape has two pairs of parallel sides.

- This quadrilateral has parallel top and bottom sides. The left and right sides are not parallel. Notice that this quadrilateral has one pair of congruent sides.



This shape has one pair of parallel sides.

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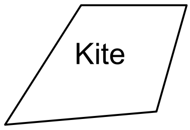
• Quadrilaterals are named by whether their sides are parallel or congruent.

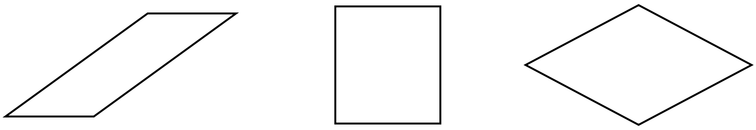
- A **kite** is a quadrilateral that has two pairs of congruent sides but no parallel sides.



- A **trapezoid** is a quadrilateral that has one pair of parallel sides.

If a trapezoid has one pair of congruent sides, it is called an **isosceles trapezoid**.

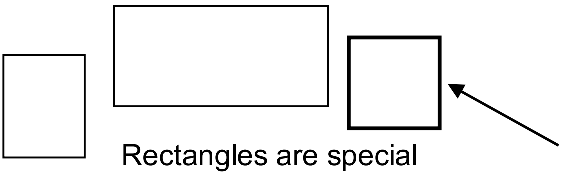
- A **parallelogram** is a quadrilateral with two pairs of congruent sides. The congruent sides are also parallel.



Examples of parallelograms

• There are special types of parallelograms.

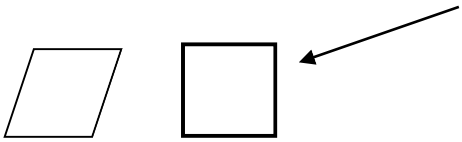
- A **rectangle** is a parallelogram with four right angles.



Rectangles are special parallelograms.

A **square** is both a special rhombus and a special rectangle.

- A **rhombus** is a parallelogram with all sides equal.



Rhombuses are special parallelograms.

B. i) Which shapes in **part A** are rhombuses?

ii) Which shapes are parallelograms?

iii) Which shapes are trapezoids?

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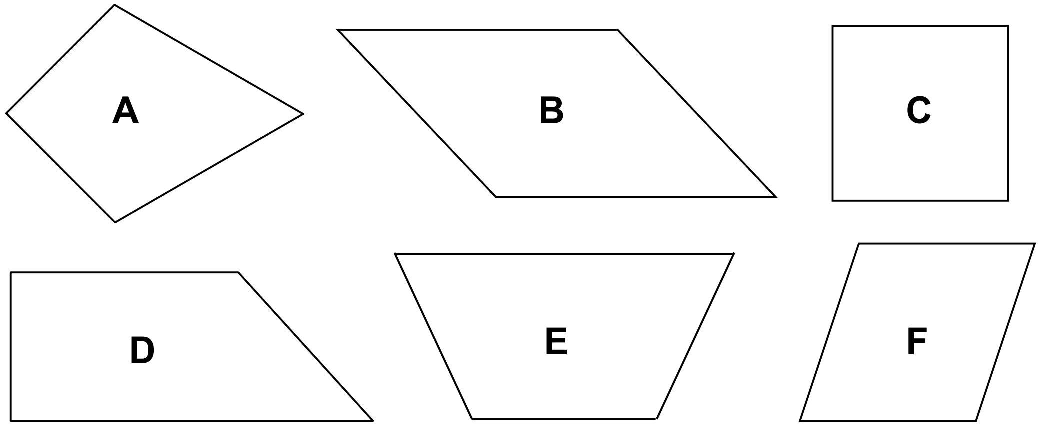
Examples

Example 1 Sorting Quadrilaterals by Different Properties

Sort these quadrilaterals into groups. Tell your sorting rule.



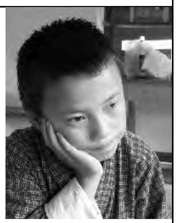
Solution 1

I sorted by the number of congruent sides.

No sides congruent:	D
3 sides congruent:	E
2 pairs of sides congruent:	A, B
All sides congruent:	C, F

Thinking

- I measured the sides to see if they were congruent.



Solution 2

I sorted by the number of right angles.

0 right angles:	B, E, F
1 right angle:	A
2 right angles:	D
4 right angles:	C

Thinking

- I compared each angle to a square corner to see if it was a right angle.

Solution 3

I sorted by the number of parallel sides.

No sides parallel:	A
1 pair of parallel sides:	D, E
2 pair of parallel sides:	B, C, F

Thinking

- I looked to see which sides were parallel.

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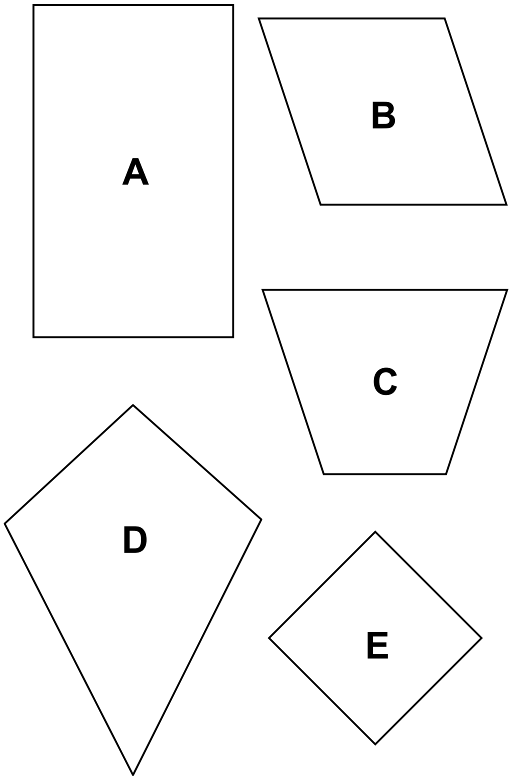
Practising and Applying

1. Sort these quadrilaterals into two or more groups.
Tell your sorting rule.

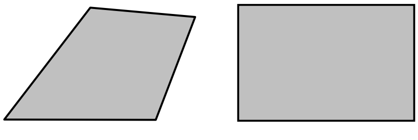


2. a) Sort the quadrilaterals from **question 1** in a different way.
Tell your new sorting rule.

b) In what other way might you sort the quadrilaterals in **question 1**?

3. Name each quadrilateral in **question 1**.

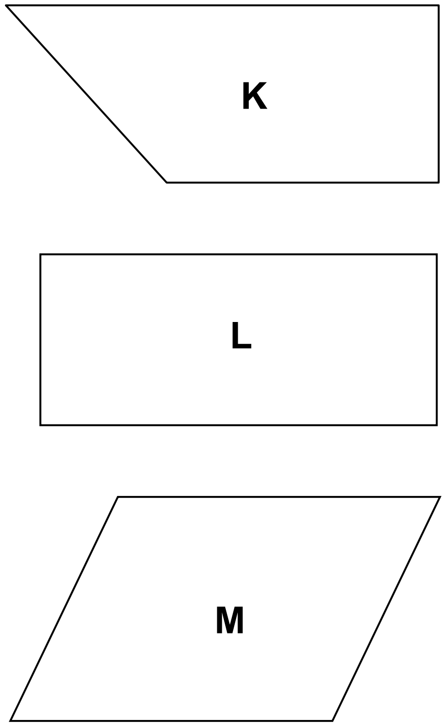
4. How are a kite and a rectangle alike? How are they different?



5. Look at quadrilaterals K, L, and M.

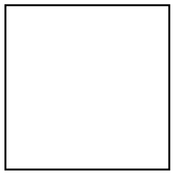
a) How are K and L alike but different from M?

b) How are L and M alike but different from K?



6. Name each quadrilateral in **question 5**.

7. Tandin drew this quadrilateral and called it a square.



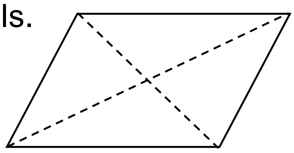
Tshering called it a rhombus.
Ugyen called it a parallelogram.

Who is correct? Explain your thinking.

5.1.4 EXPLORE: Diagonals and Symmetry

A **diagonal** joins opposite vertices in a quadrilateral.

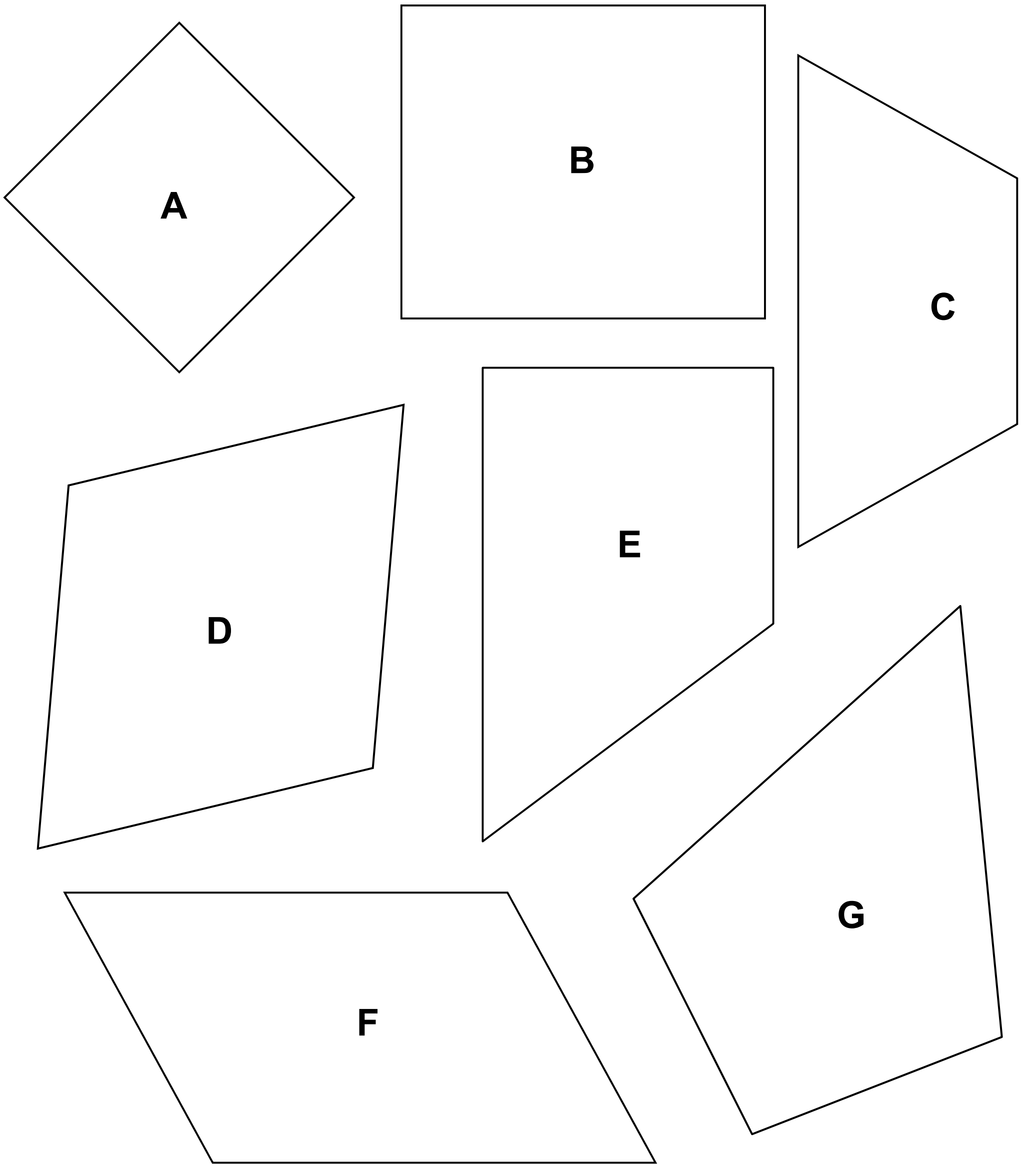
Every quadrilateral has two diagonals.



The two diagonals of a parallelogram.

Some diagonals are also lines of symmetry.

You need quadrilaterals like these to answer the questions on the next page.



Reprint 2024

Copy this chart.

Quadrilateral	Name	Number of lines of symmetry	Number of diagonals that are lines of symmetry
A			
B			
C			
D			
E			
F			
G			

***Complete the chart*.**

A. Name each quadrilateral.

B. Fold each quadrilateral to see how many lines of symmetry it has. Use a coloured pencil to draw the lines of symmetry.

C. Draw the diagonals on each quadrilateral in a different colour. For each shape, how many diagonals are also lines of symmetry?

***Look at your completed chart*.**

D. i) Which quadrilaterals are symmetrical? Name them.

ii) Which quadrilaterals have more than one line of symmetry?

E. i) Name the quadrilaterals that have lines of symmetry on both diagonals.

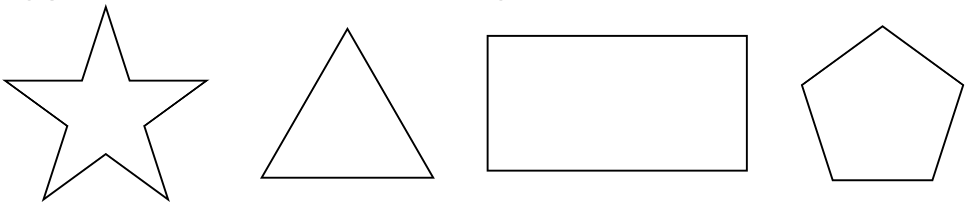
ii) Name the quadrilaterals that have a line of symmetry on only one diagonal.

iii) Name the quadrilaterals that have lines of symmetry that are not on diagonals.

Chapter 2 Polygons and Transformations

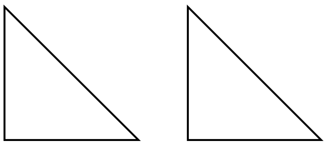
5.2.1 EXPLORE: Congruent Polygons

A **polygon** is a closed shape with straight sides.

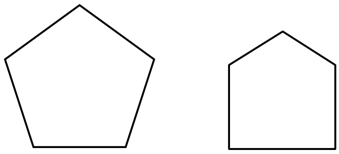


Examples of polygons

Polygons are congruent if they are an exact match in size and shape.



These triangles are congruent.



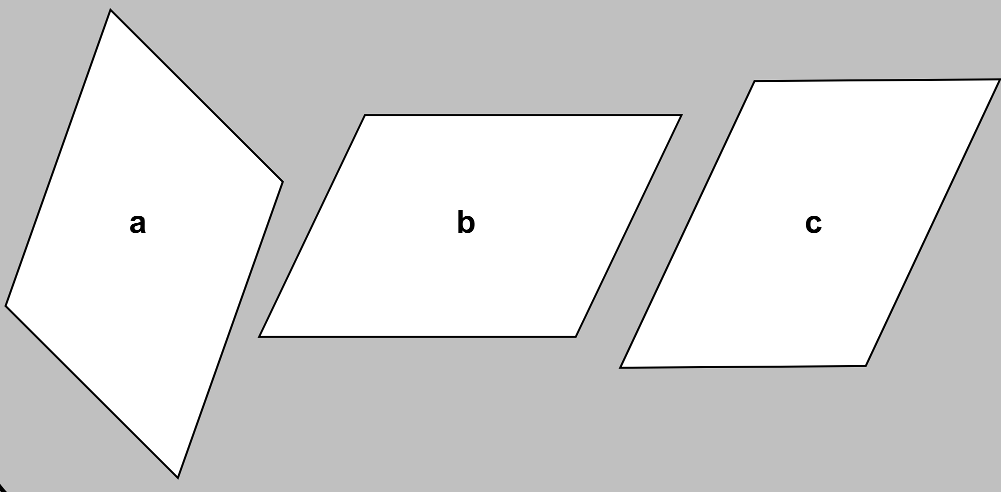
These **pentagons** are <u>not</u> congruent.

A. *When shapes are turned different ways, it can be difficult to tell whether they are congruent.*

Predict which of these parallelograms are congruent.

Trace the parallelograms and label them with their letters.

Cut them out and compare them. Which shapes are congruent?



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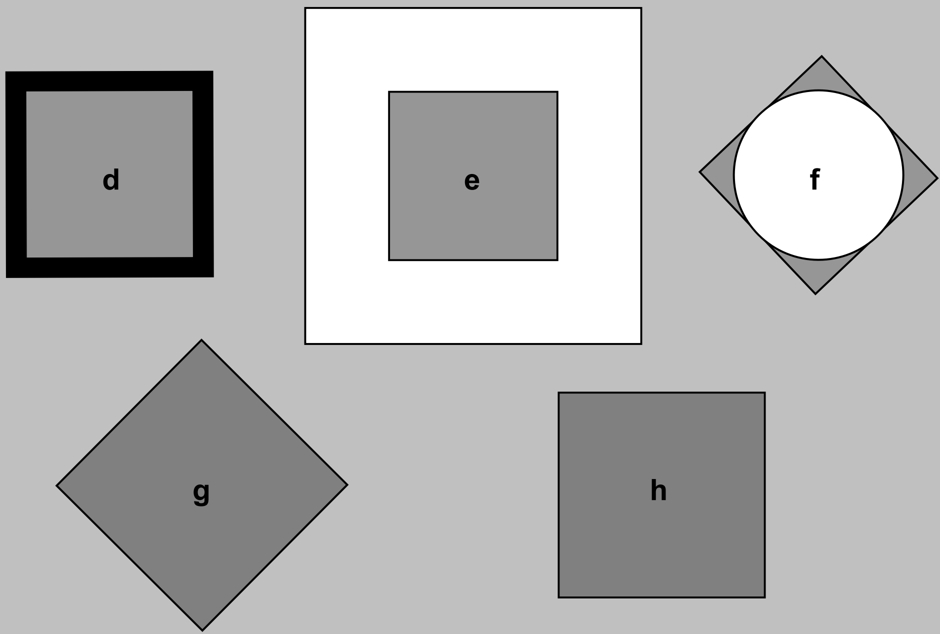
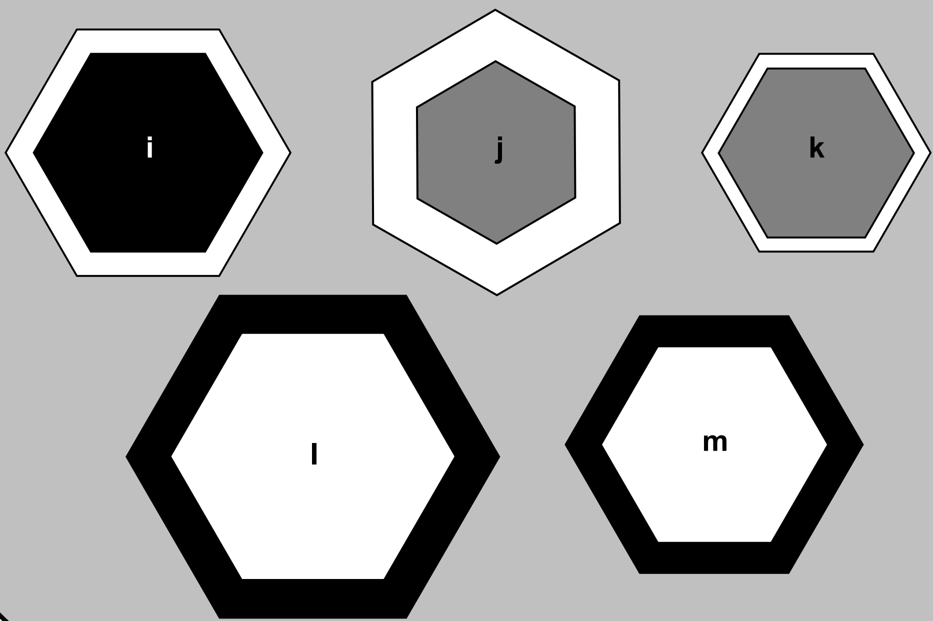
B. *When shapes have other shapes around them, it can also be difficult to tell whether they are congruent.*

Predict which of the grey squares below are congruent.

To check your predictions, trace each grey square and cover each other square with the traced square.



C. Which of the white hexagons below are congruent?

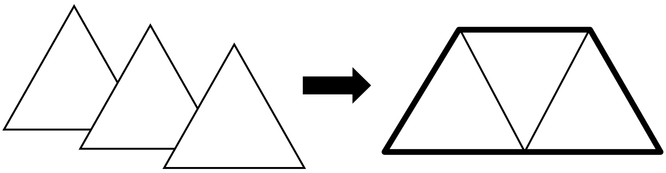


5.2.2 EXPLORE: Combining Polygons

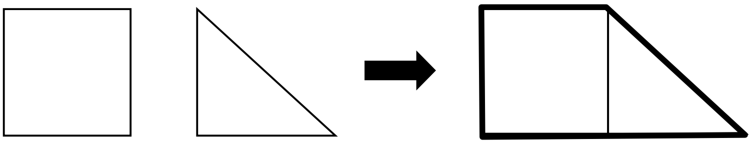
You can combine polygons to make different shapes.

For example:

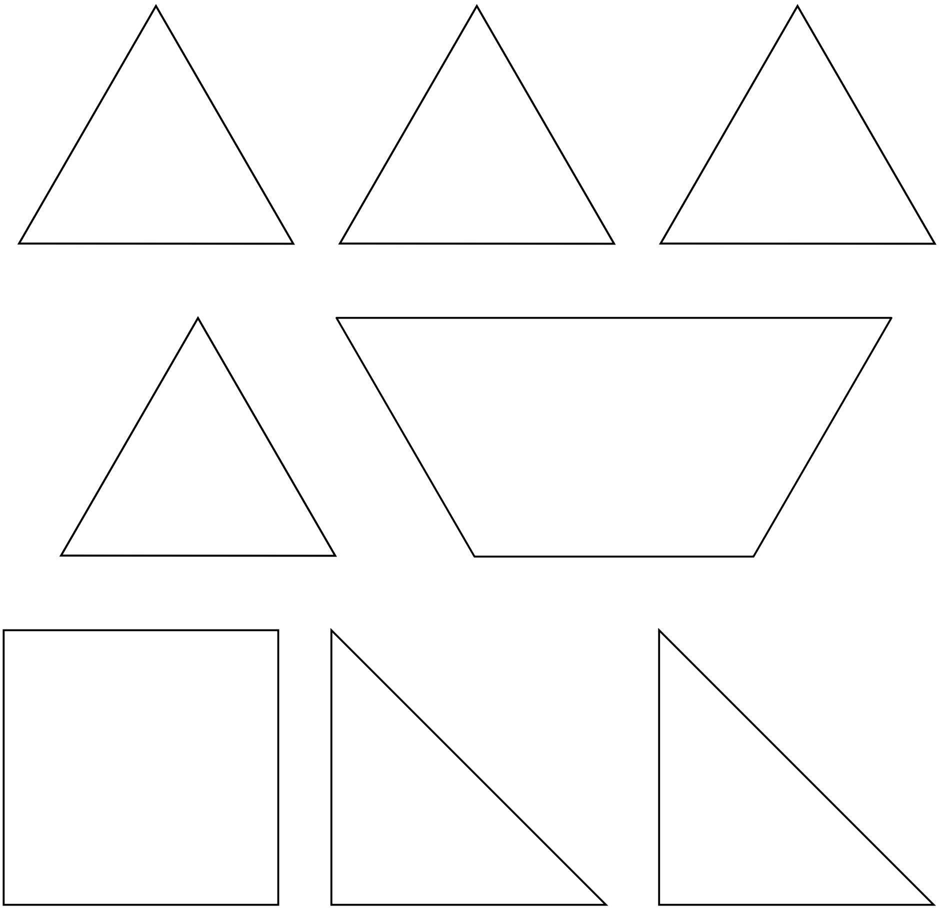
You can combine three congruent equilateral triangles to make an isosceles trapezoid.



You can combine a square and a triangle to make a trapezoid.



Cut out polygons like these to do the questions on the next page.



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A. i) Predict which shapes below you can make using two or more of the polygons you cut out.

- parallelogram	- square	- rectangle
- isosceles triangle	- equilateral triangle	- hexagon
- kite	- rhombus	- trapezoid

Try to make each shape to check your predictions. For each shape you make, trace it and draw lines inside to show the polygons you used.

ii) For each shape you made in **part i)**, try to find one other way to make it by combining polygons. Trace it and show the polygons you used.

B. Choose any three of the polygons you cut out.

Predict which shapes you can make by combining them.

Combine your three polygons to make as many different shapes as possible. Trace each shape and draw lines to show the polygons you used.

C. Repeat **part B** using any four polygons.

GAME: Shape Puzzles

Play with 2 to 4 players.

Use Shapes and Puzzle Cards.

Shapes: Give each player 4 squares, 12 small triangles, 1 large triangle, and 3 trapezoids.

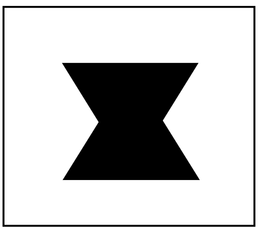
Puzzle Cards: Spread them out on the table face down and mix them up.

Each player chooses a Puzzle Card and tries to use his or her Shapes in different ways to make the shape shown on the card.

Each player scores 1 point for each different combination.

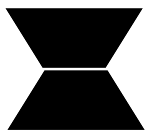
All players then take another Puzzle Card and repeat.

For example, you would score 2 points for the two combinations below:

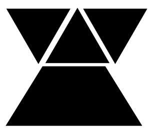


Puzzle Card

Here are two ways to make the puzzle:



Two trapezoid Shapes



One trapezoid Shape and three triangle Shapes

The first player to score 10 points wins the game.

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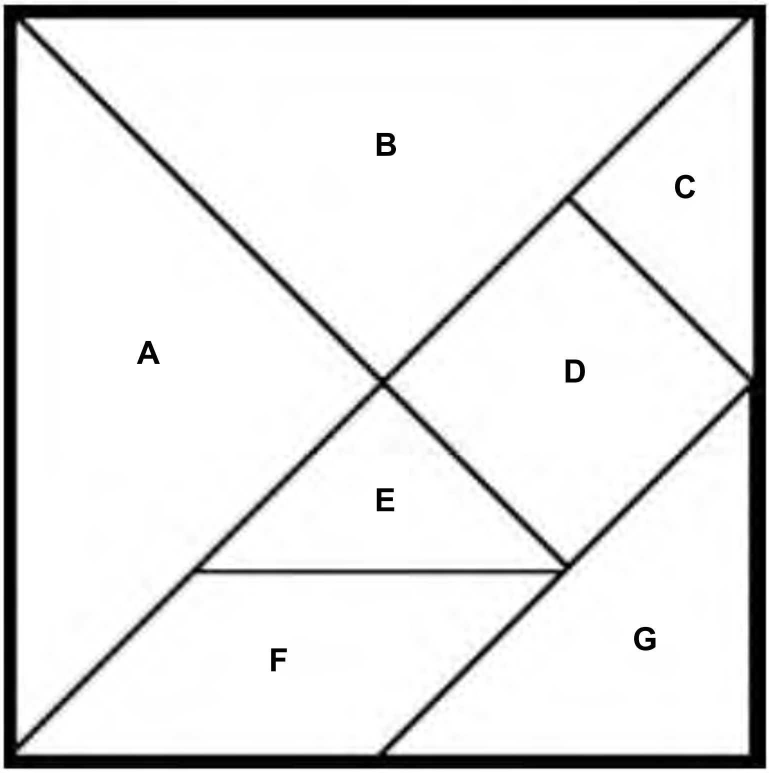
CONNECTIONS: Tangrams

The tangram is an old Chinese puzzle consisting of seven pieces (called tans) that can be arranged to form a large square.



Tangrams can be found in many puzzles, games, and books.

1. Which of the tans are congruent?

2. How many ways can you combine two or more tans to make each?

- A parallelogram that is not a rectangle
- A rectangle that is not a square
- A square
- A trapezoid
- An isosceles triangle

Trace the shapes and show the tans you used in each.

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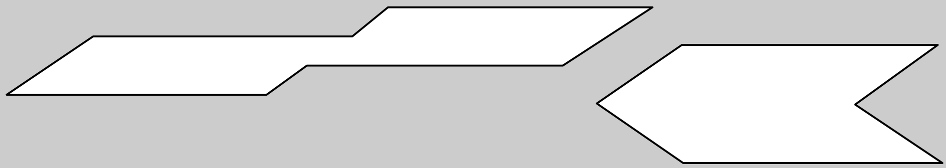
5.2.3 Slides and Flips

Try This

Trace four copies of this shape and cut them out.

A. Use all four copies to make these two shapes.



• **Slides** and **flips** are ways to move a shape to create a copy of it in a different place.

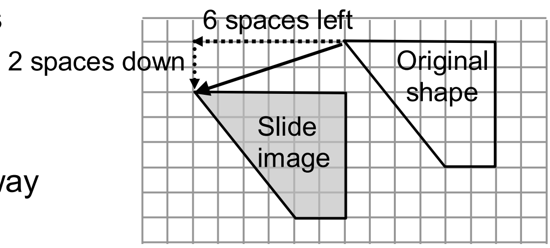
• The shape you start with is sometimes called the **original shape**. The copy is called the **image**.

SLIDES

• A **slide** moves a shape left, right, up, down, or diagonally in one motion without changing the shape.

• Every point in the shape moves the same distance and direction. That is why the **slide image** is congruent to the original shape.

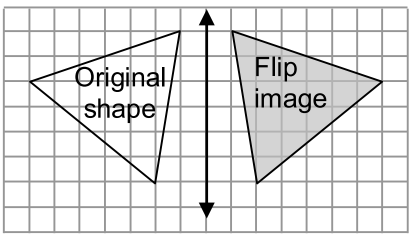
• A slide image faces the same way as the original shape.



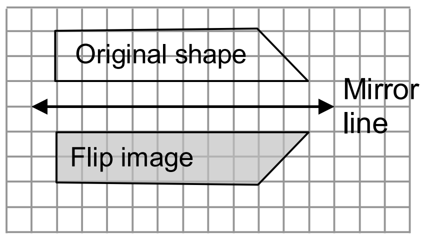
Even though this shape moved diagonally in one motion, we describe how it moved as (6 spaces left, 2 spaces down).

FLIPS

• A **flip** moves a shape in one motion so that its image looks like a reflection in a mirror.



Mirror line



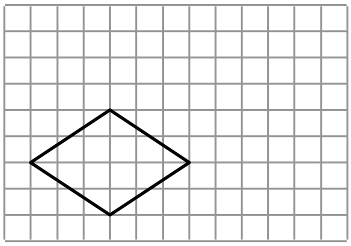
• The original shape and its **flip image** are congruent, even though they face opposite ways.

B. Which motion do you see in each shape you made in **part A**?

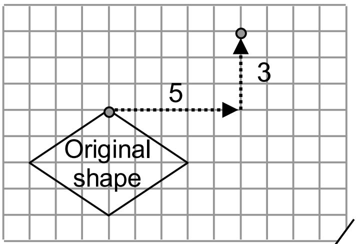
Examples

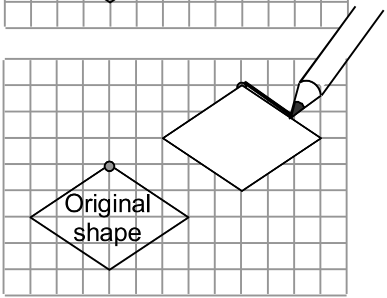
Example 1 Drawing a Slide Image

In one motion, slide the rhombus so that it ends up in a position that is (5 spaces right, 3 spaces up).
Draw the slide image.



Solution 1

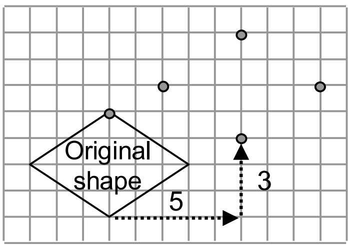


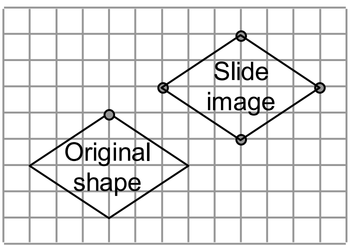


Thinking

- I started with the top vertex and went 5 spaces right and 3 spaces up. I plotted the image vertex in that position.
- I traced the rhombus and cut it out.
- I slid the copy of the rhombus diagonally, up and to the right, so that its top vertex matched its image.
I was careful not to turn the shape as I moved it.
- I traced the shape to create the slide image.

Solution 2





Thinking

- I started with the bottom vertex and went 5 spaces right and 3 spaces up. I plotted the image vertex in that position.
- I repeated this for each vertex.
- I connected the slide images of the vertices to create the slide image.

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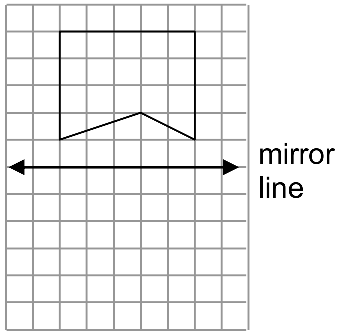
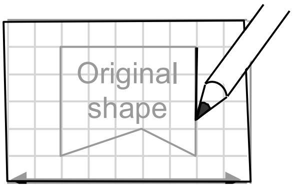
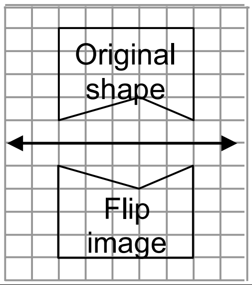
Example 2 Drawing a Flip Image

Draw the image of this polygon after it has been flipped across the mirror line.



Solution





Thinking

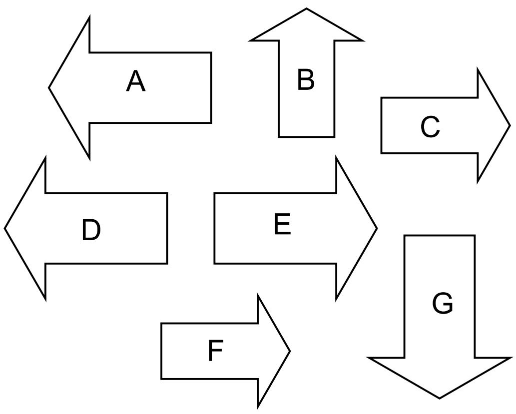
• I folded the paper along the mirror line. Then I traced the polygon onto the back side of the other half of the paper.

• I opened the paper and traced the image on the same side as the original shape.

Practising and Applying

1. a) Look at the shapes below. Which pairs show a slide? How do you know?

b) Which pairs show a flip? How do you know?

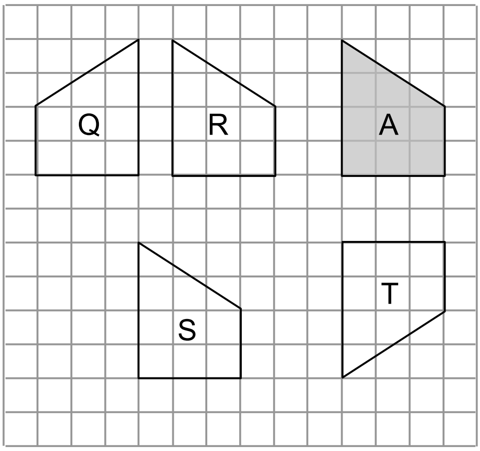


2. Identify slides and flips in this design. Trace the original shape and the image for each. For each flip, show the mirror line.

3. a) Which polygons below are slide images of A?

b) Describe each slide like this:

(__ spaces right or left, __ spaces up or down)



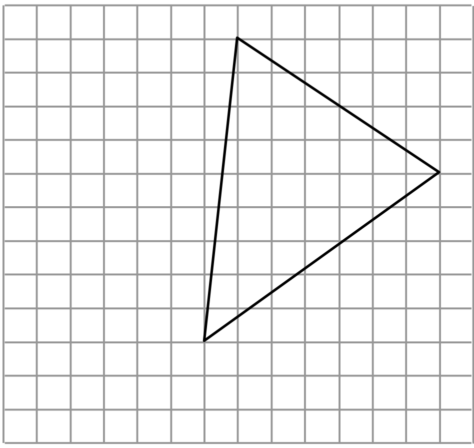
c) Which polygons above are flip images of A?

d) For each flip, trace shape A and its image. Then draw the mirror line.

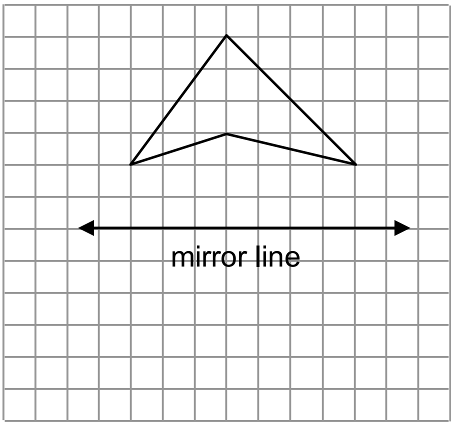
4. a) Predict what the image will look like and where it will end up when you slide the triangle below (3 spaces left, 2 spaces down).

b) Draw the slide image described in **part a)**. How does the image compare with your prediction?

c) Describe a slide that will take the image back to the original triangle.



5. a) Predict what the flip image of this quadrilateral will look like and where it will be after it is flipped it across the mirror line. Sketch your prediction.



b) Check your prediction by flipping the quadrilateral on grid paper. How does the flip image compare with your prediction?

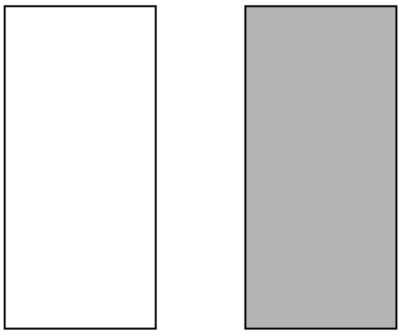
6. a) How many spaces did each vertex move in the flip from **question 5**?

b) Describe how each vertex moved for the slide in **question 4**.

c) What do you notice?

7. How are flips and slides different? How are they alike?

8. Pema says that this shows a flip. Bijoy says that it shows a slide. Who is right? Explain your thinking.



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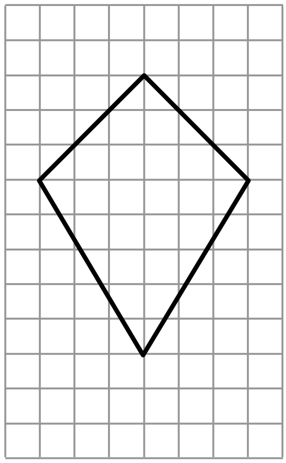
5.2.4 Turns

Try This

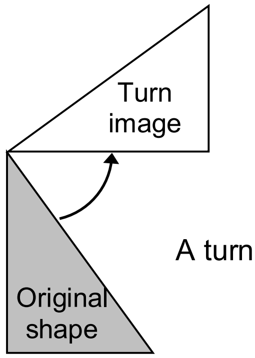
A. Draw this kite on grid paper. Cut it out. Then draw its diagonals.

• Place the kite on another piece of grid paper so that one diagonal is on a grid line. Trace the kite.

• Put the cut-out kite on top of the tracing. Use your pencil tip to hold one vertex of the cut-out kite in place. Turn the kite until one of its diagonals lines up with a different grid line. Trace the kite in this new position.



• A **turn** is another way to move a shape to create a congruent image.

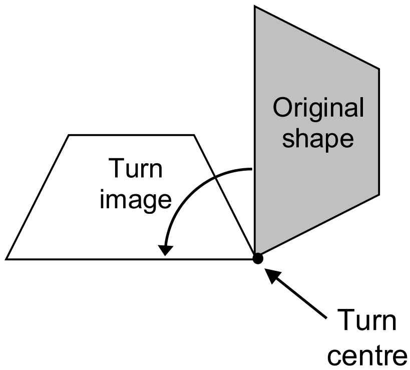


• A turn is described by three things:
1) where the **turn centre** is
2) the direction of the turn
3) the size of the turn

THE TURN CENTRE

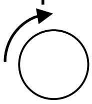
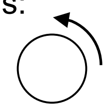
• When a shape is turned, the turn centre does not move. The rest of the shape moves around it.

• In this example, the turn centre is one of the vertices of the shape.



THE DIRECTION OF THE TURN

A turn moves a shape in one of two possible directions:

clockwise (**cw**)  or **counterclockwise** (**ccw**) 

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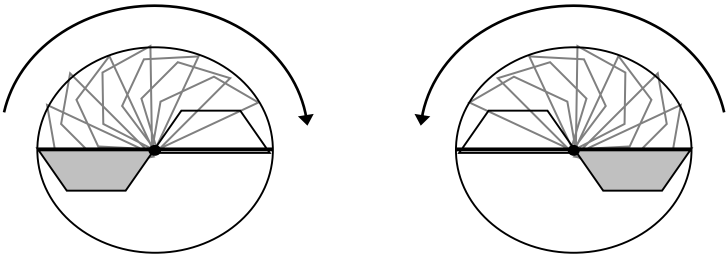
THE SIZE OF THE TURN

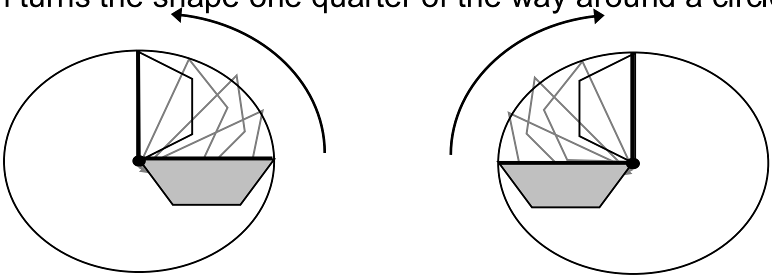
You can measure the size of a turn using a fraction of a whole turn.

- A $\frac{1}{2}$ turn turns the shape halfway around a circle.



turn cw   turn ccw

- A $\frac{1}{4}$ turn turns the shape one quarter of the way around a circle.



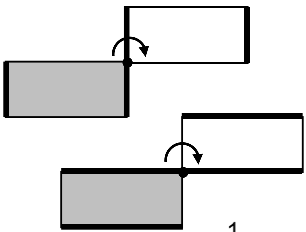
turn ccw   turn cw

THE TURN IMAGE

The images of $\frac{1}{2}$ turns and $\frac{1}{4}$ turns are different in some ways.

- For a $\frac{1}{2}$ turn:

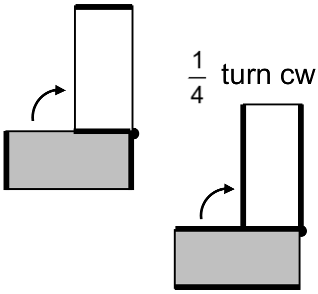
- Sides that are vertical in the original shape are vertical in the image.
- Sides that are horizontal in the original shape are horizontal in the image.



$\frac{1}{2}$ turn cw

- For a $\frac{1}{4}$ turn:

- Sides that are vertical in the original shape are horizontal in the image.
- Sides that are horizontal in the original shape are vertical in the image.



$\frac{1}{4}$ turn cw

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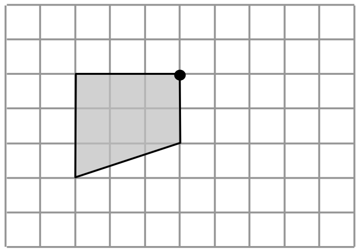
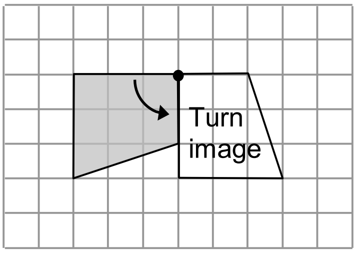
Examples

Example 1 Drawing the Image of a 1/4 Turn

Draw the turn image of this quadrilateral after a $\frac{1}{4}$ turn ccw around the turn centre shown.



Solution

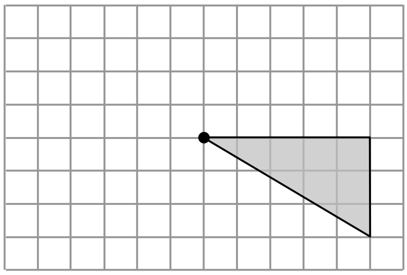


Thinking

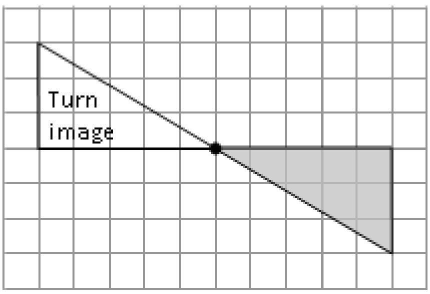
- I drew the trapezoid on a grid. Then I traced it to make a copy.
- I put the copy on top of the trapezoid and held the turn centre in place with my pencil tip.
- Since it was a $\frac{1}{4}$ turn ccw, I turned the copy counterclockwise until the horizontal side was vertical.
- I traced the copy to make the turn image.

Example 2 Drawing the Image of a 1/2 Turn

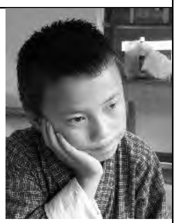
Draw the image of this triangle after a $\frac{1}{2}$ turn cw around the turn centre shown.



Solution



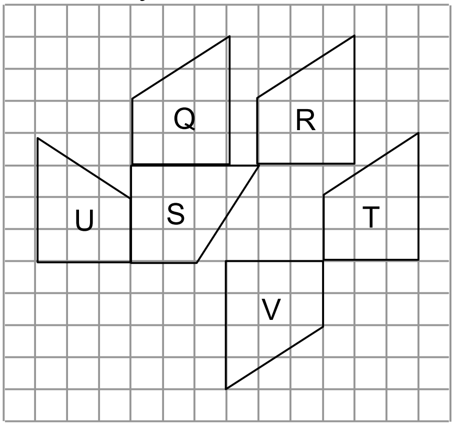
Thinking



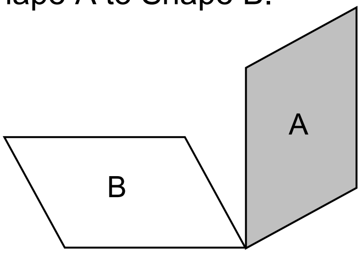
- I drew the triangle and then made a copy.
- Since it was a $\frac{1}{2}$ turn cw, I turned the copy clockwise until the vertical side was vertical again, making sure the turn centre didn't move.
- I traced the copy to make the turn image.

Practising and Applying

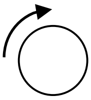
1. Predict which pairs show a turn. How can you tell?

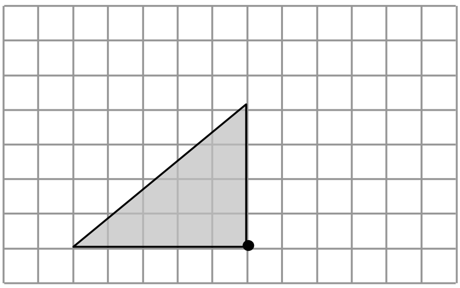


2. Describe the turn that moved Shape A to Shape B.



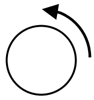
3. a) Sketch what you think the image of the shape below will look like after a $\frac{1}{4}$ turn cw around the turn centre shown.

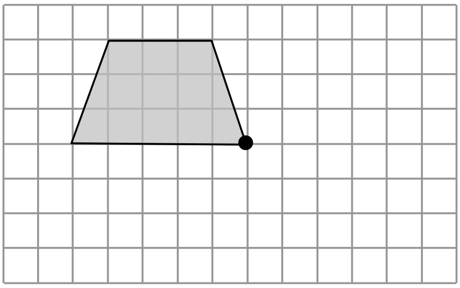




b) Draw the turn image on grid paper to check your prediction.

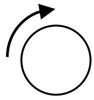
4. a) Describe what you think the image of the shape below will look like after a $\frac{1}{2}$ turn ccw around the turn centre shown.

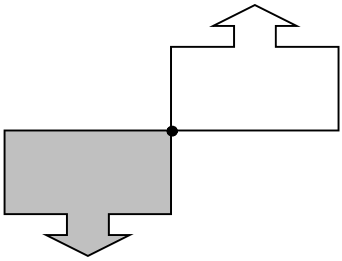




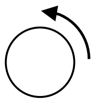
b) Draw the turn image on grid paper to check your prediction.

5. Kinley says that the two shapes below show a cw turn around the turn centre.





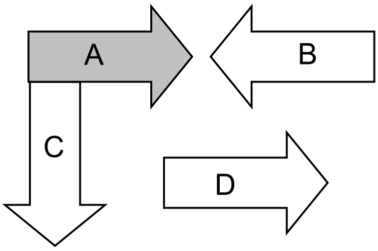
Dorji says it is a ccw turn around the turn centre.



Who is right?

6. Which shape is the image of Shape A after each motion? Tell how you know for each.

a) turn **b)** flip **c)** slide



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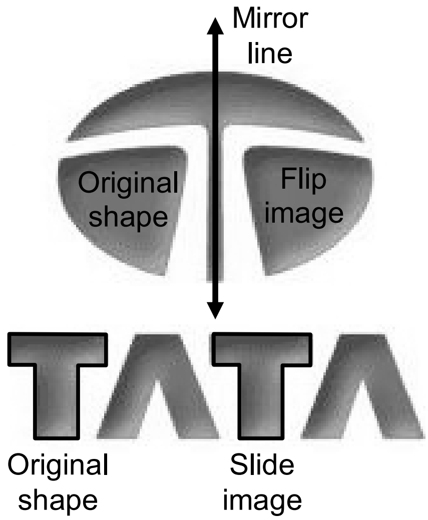
CONNECTIONS: Logos

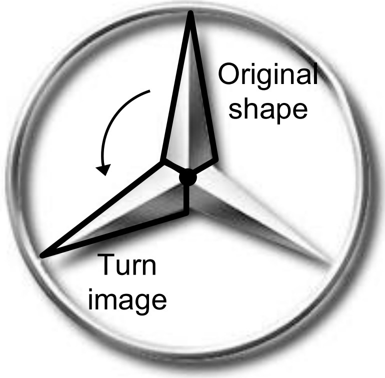
Many companies have a symbol, or logo, to make people think of the company whenever they see it. Many logos are created with slides, flips, and turns.

The logos shown below are found on cars in Bhutan.

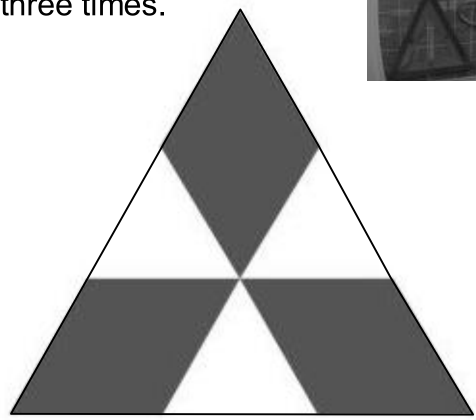
In this logo, a flip and a slide are shown:



In this logo a turn is shown:



1. Trace this car logo three times.



a) On one copy, look for a slide. Label the original shape and the slide image. Draw an arrow to show how the shape slid.

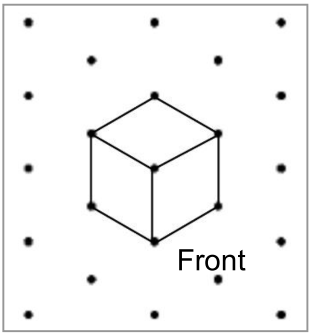
b) On another copy, look for a flip. Label the original shape, the flip image, and the mirror line.

c) On another copy, look for a turn. Label the original shape, the turn image, and the turn centre.

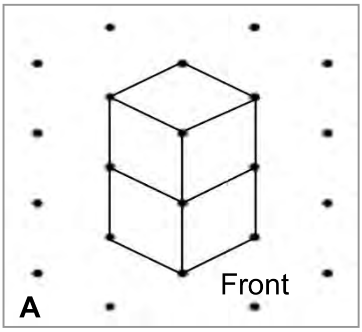
5.3.1 EXPLORE: Building Shapes from Drawings

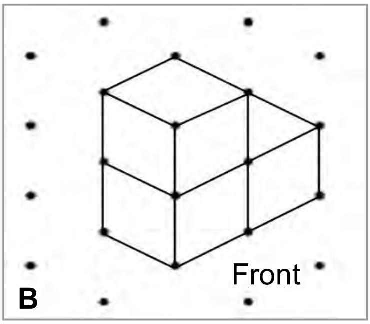
An **isometric drawing** is a picture of a 3-D shape that is drawn on special dot paper. The dot paper helps the drawing look 3-D, even though the picture is flat.

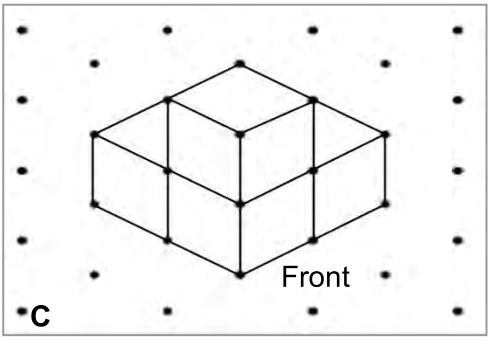
This is an isometric drawing of a single cube:

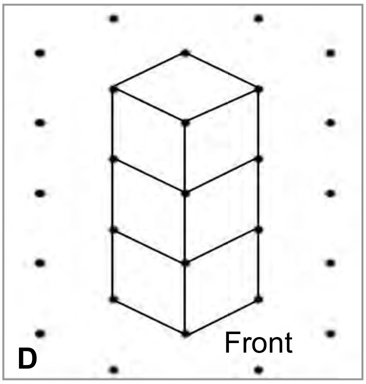


These are isometric drawings of some cube structures:









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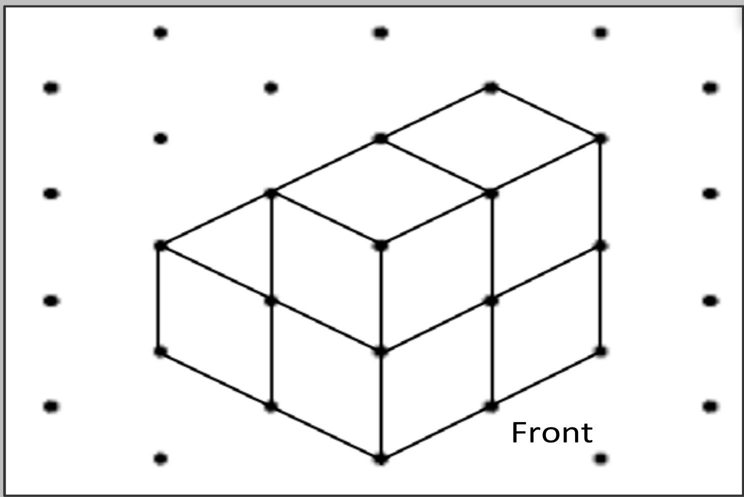
A. i) Build Cube Structure A. How many cubes did you use?

ii) If you add a cube to your structure, can it still match the drawing? If it can, where did you add the cube?

B. Repeat **part A** for the other cube structures.

C. i) Use five cubes to build a structure to match this isometric drawing:



ii) Use six cubes to build another structure to match the drawing. Where did you put the sixth cube?

iii) Can you use more than six cubes to build a structure to match the drawing? Where could the extra cubes go?

D. i) Why is it possible for more than one structure to match an isometric drawing?

ii) What information do you need to know to be able to build the exact structure to match an isometric drawing?

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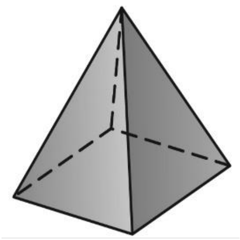
5.3.2 Describing and Comparing 3-D Shapes

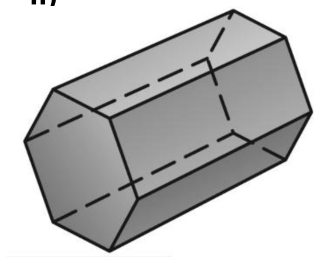
Try This

A. How are these three shapes alike? How are they different?

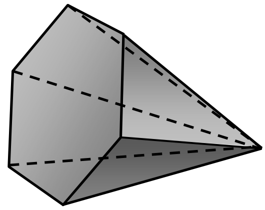
i)



ii)

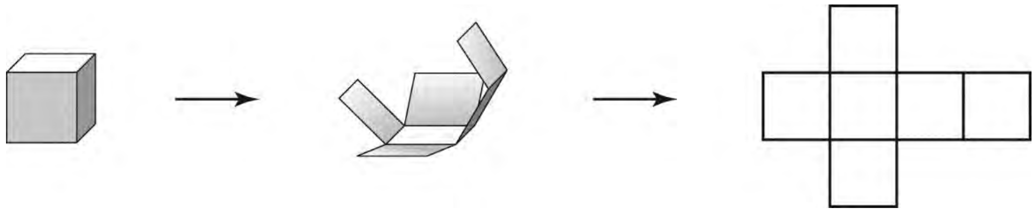


iii)



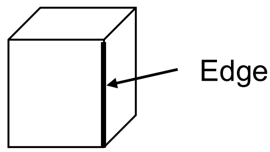
• A 3-D shape has many different parts.

- A 2-D shape that forms a flat surface on a 3-D shape is called a **face**.



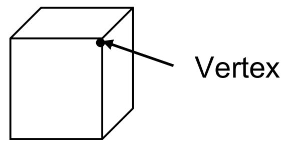
- An **edge** is a line where two faces meet.

A cube has 12 edges.



- A **vertex** is a point where three or more edges meet.

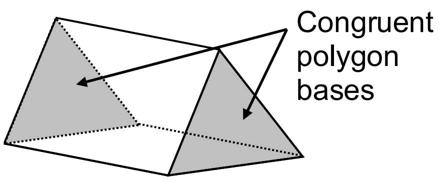
A cube has 8 vertices.

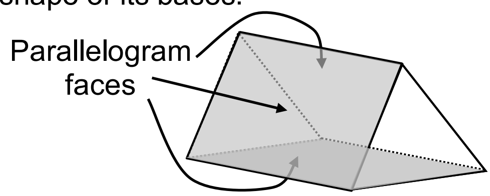


• You can describe a 3-D shape by telling about its parts.

- A **prism** has two congruent polygon faces called **bases**. The bases are connected by parallelogram faces, often rectangles.

A prism is named by the shape of its bases.





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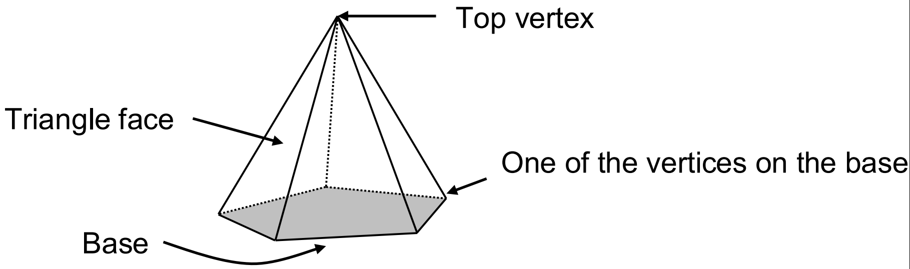
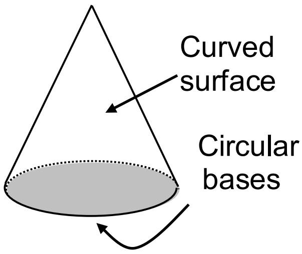
- A pyramid has one polygon base and triangle faces that connect the base to its top vertex.

A pyramid is named by the shape of its base.

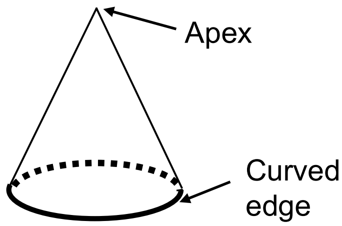


A pentagon-based pyramid has six faces: one pentagon base and five triangle faces.

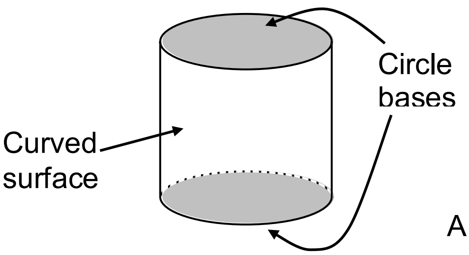
- A **cone** has one circular base and a **curved surface**.
It also has a **curved edge** and a point called the **apex**.



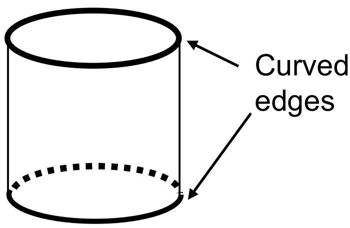
A cone



- A **cylinder** has two congruent circular bases and one **curved surface**.
It also has two **curved edges**. A cylinder has no vertices.



A cylinder



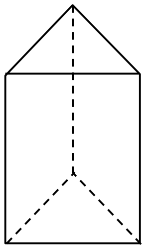
• You can compare 3-D shapes by comparing their parts.
For example, you can compare:
- the number of faces
- the shape of the faces
- the shape of the bases
- the number of edges
- the number of vertices
- whether there are curved surfaces or curved edges

B. Describe each shape in **part A** by its faces, edges, and vertices.
Then name each shape.

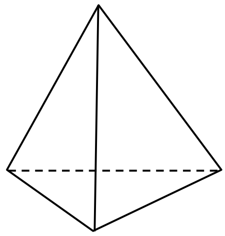
Examples

Example Comparing 3-D Shapes

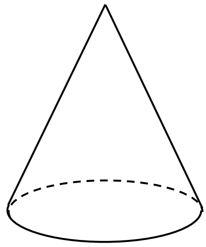
How are these shapes alike? How they are different?



Triangle-based prism



Triangle-based pyramid



Cone

Solution 1

- The prism and pyramid are alike because they both have triangle bases. The cone is different because it has a circle base.
- The pyramid and cone are alike because each has one base. The prism is different because it has two bases.

Thinking

- I compared the shape and the number of bases.

Solution 2

- The prism and pyramid are alike because they have only polygon faces. The cone is different because of its circle face and curved surface.
- The prism and pyramid are also alike because they have many edges. The cone is different because it has only one curved edge.

Thinking

- I compared the types of faces and whether or not they had curved surfaces and edges.

Solution 3

- They are all different because each has a different number of vertices:
  - the prism has six vertices
  - the pyramid has four vertices
  - the cone has no vertices
- The pyramid and cone are alike because they both have a point that is opposite the base.

Thinking

- I compared the vertices.
- In a pyramid, the point is called a vertex because it's where edges meet. But in a cone, it's not called a vertex because no edges meet at that point. That's why it has a special name, apex.

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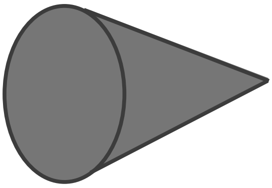
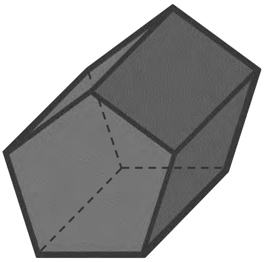
Practising and Applying

1. Name each shape. Describe its faces, vertices, and edges.

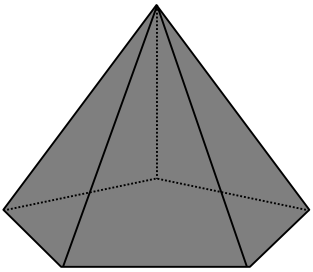
a)



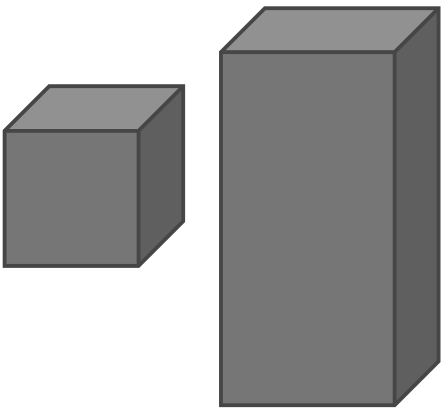
b)



c)

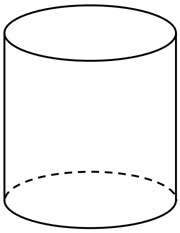


2. How are these two prisms alike? How are they different?

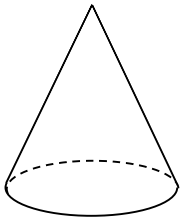


3. Compare each pair of shapes. How are they alike? How are they different?

a)

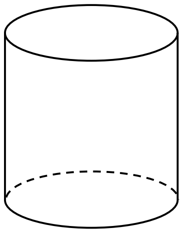


Cylinder

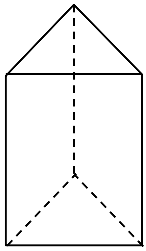


Cone

b)

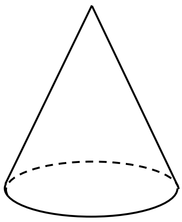


Cylinder

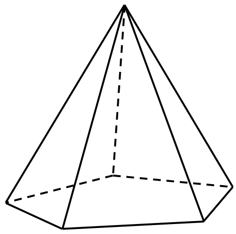


Triangle-based prism

c)

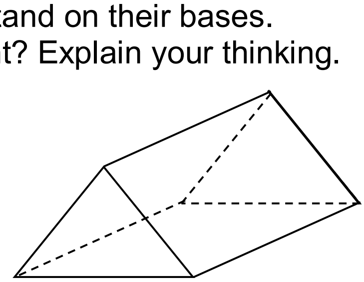


Cone



Pentagon-based pyramid

4. Thinley thinks this is a rectangle-based prism because prisms always stand on their bases. Is he right? Explain your thinking.



5. Samten says a cone is like a pyramid. Karma says that a cone is like a cylinder. Both are right. How is that possible?

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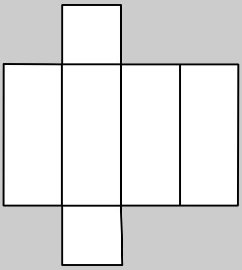
5.3.3 Folding and Making Nets

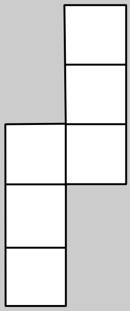
Try This

Each of these nets can be folded to make a different 3-D shape.

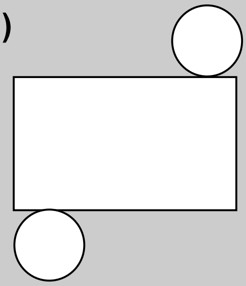
i)



ii)



iii)



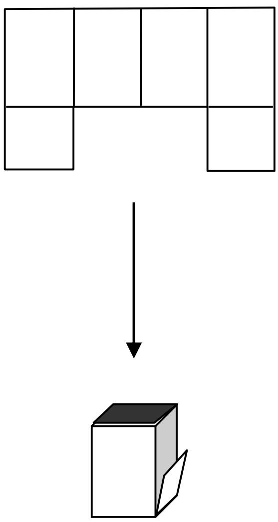
A. What 3-D shape do you think each net will make?

• A **net** is a 2-D shape that can be folded to make a 3-D shape. Each part of the net represents a face or a curved surface.

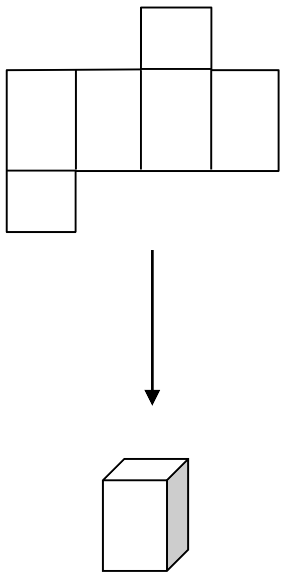
• A net has the same shapes as the faces or surfaces of the 3-D shape. How those shapes are arranged in the net is important.

For example:

Both of these use the same 6 shapes but only one is a net of a prism:



When folded, this does not make a 3-D shape



When folded, this makes a square-based prism.

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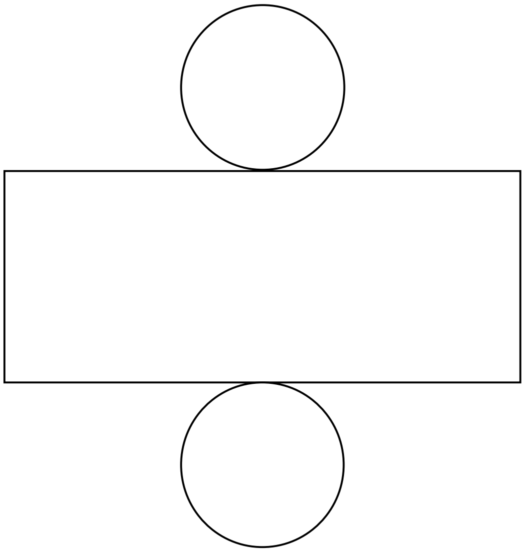
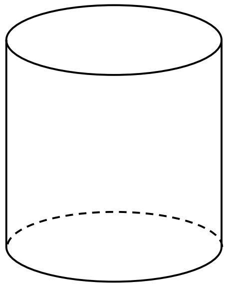
• You can make your own net for any rectangle-based prism by tracing its faces. Roll the prism from face to face to make sure the shapes in your net are arranged correctly.

• Because cones and cylinders have circle bases and curved surfaces, their nets are easy to identify.

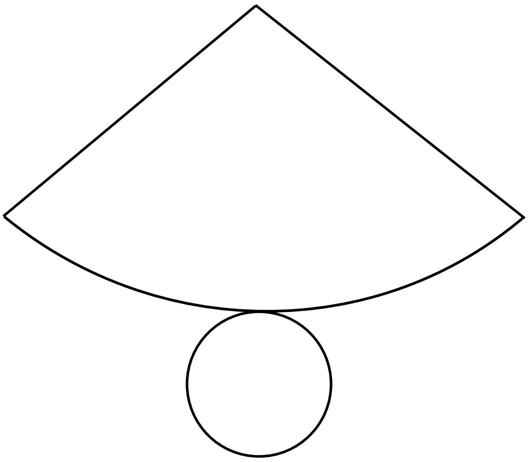
- This is a net for a cylinder.

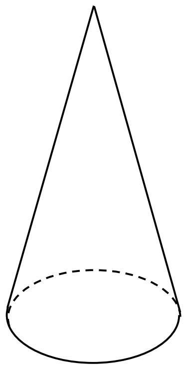




Cylinder

- This is a net for a cone.





Cone

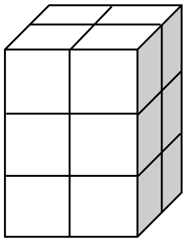
Nets are useful models of 3-D shapes because they make it easy to study the number and shape of the faces. They also show how the faces are arranged.

B. What clues did you use to decide the shape for each net in **part A**?

Examples

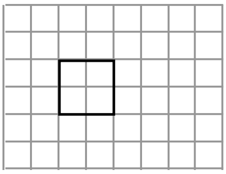
Example Drawing a Net for a Rectangle-based Prism

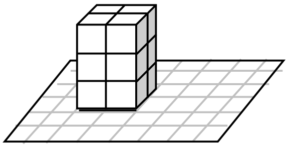
This prism is made from centimetre cubes.
Draw a net for the prism on centimetre grid paper.



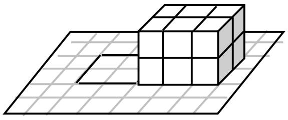
Solution

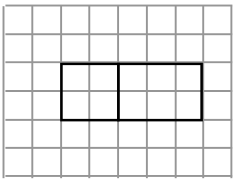
Step 1

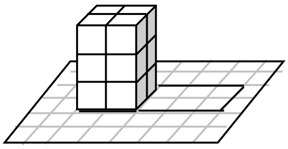




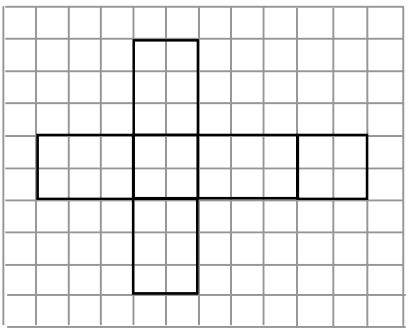
Step 2







Step 3



Thinking

- I drew a 2 cm-by-2 cm square on the grid to represent the base.
- Then I placed the prism on the base.
- I rolled the prism onto one of its rectangles face and traced it.
- Then I rolled it back to its original position.
- I repeated this for the other three rectangle faces.
- After I finished tracing the last rectangle face, I rolled it onto its other square base and traced it.

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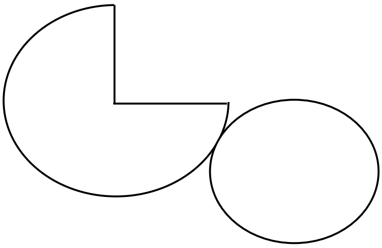
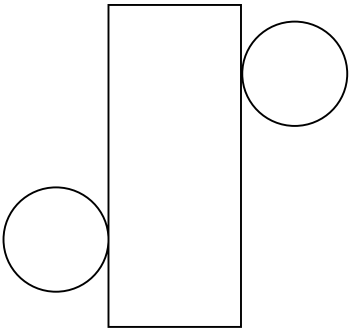
Practising and Applying

1. Identify the shape for each net.

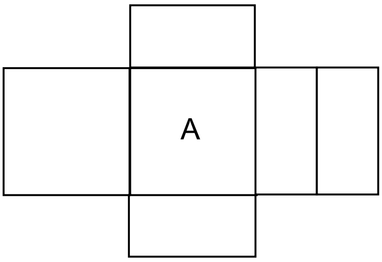
a)

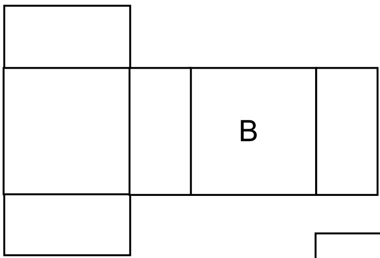


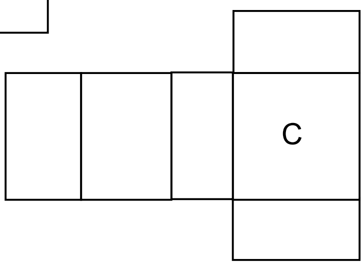
b)



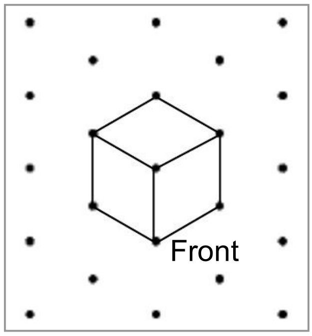
2. Which is a net for a rectangle-based prism? How do you know?



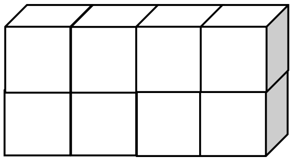




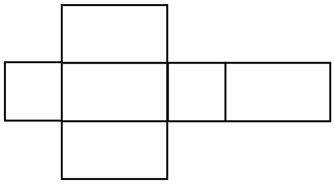
3. Create two different nets for this cube.



4. This rectangle-based prism is made of eight cubes. Create a net for it on grid paper.

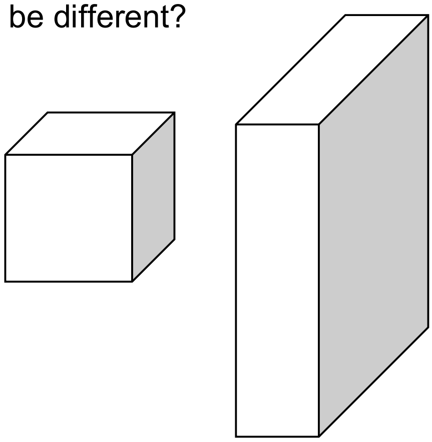


5. a) What shape does this net make?



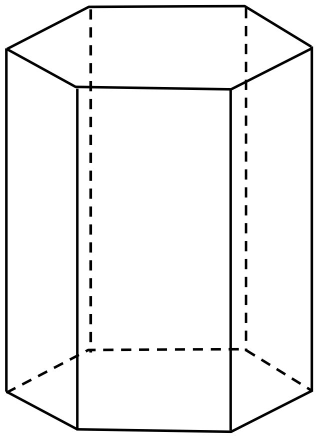
b) Rearrange the net to make another net for the same shape.

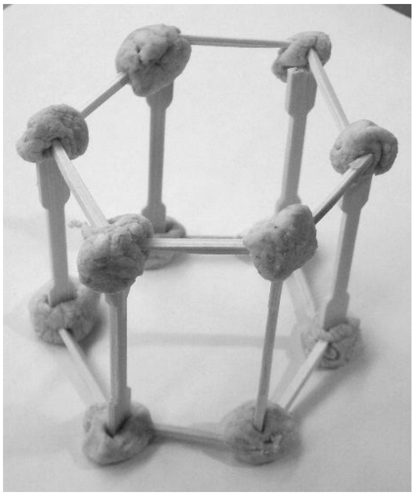
6. How might the nets for these shapes be alike? How might they be different?



5.3.4 EXPLORE: Building Skeletons

• The **skeleton** below is a model of a 3-D shape made with sticks and clay. The sticks represent the edges. The clay balls represent the vertices.

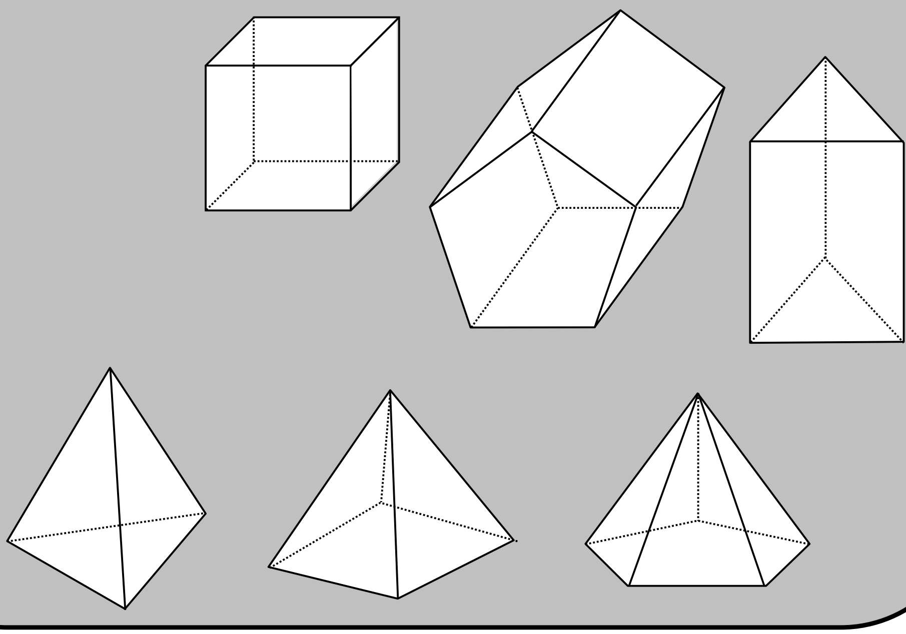




• You can create a skeleton of a 3-D shape using sticks and a material like clay to hold the sticks together at the vertices.

• Skeletons are useful models of 3-D shapes because they make it easy to study the vertices and edges.

A. Build a skeleton model for each 3-D shape. You can use sticks of two different lengths.



B. Copy these charts. Use your skeletons to help you complete them.

Name of prism	Number of sides of the base	V Number of vertices	E Number of edges	F Number of faces

Name of pyramid	Number of sides of the base	V Number of vertices	E Number of edges	F Number of faces

C. Look at your chart for the prisms.
Compare the number of sides of the base to each.
What do you notice? Why does that make sense?

i) the number of vertices

ii) the number of edges

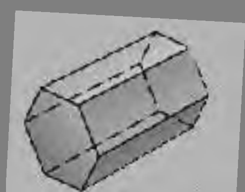
iii) the number of faces

D. Look at your chart for the pyramids.
Compare the number of sides of the base to each.
What do you notice? Why does that make sense?

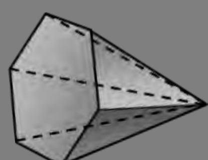
i) the number of vertices

ii) the number of edges

iii) the number of faces



Hexagon-based prism



Hexagon-based prism

E. Use what you have learned to predict the number of vertices, edges, and faces for each.

i) a hexagon-based prism

ii) a hexagon-based pyramid

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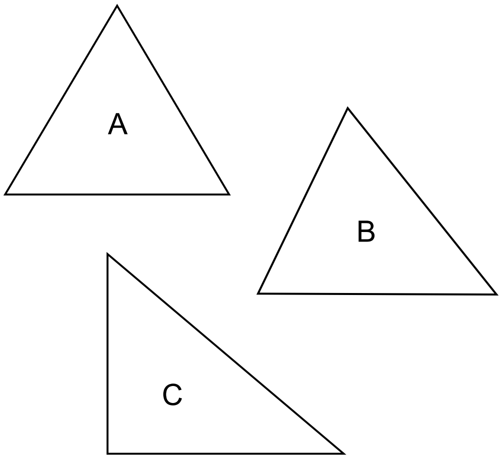
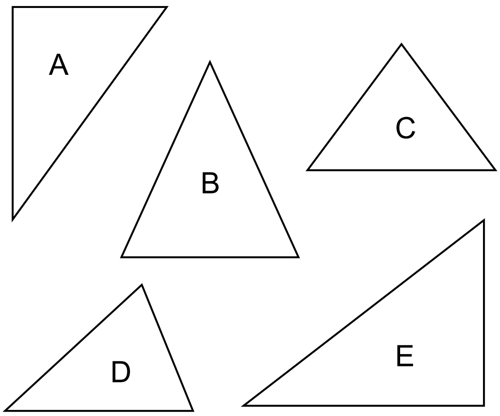
UNIT 5 Revision

1. Predict whether each triangle is equilateral, isosceles, or scalene. Then check your predictions and explain how you did it.

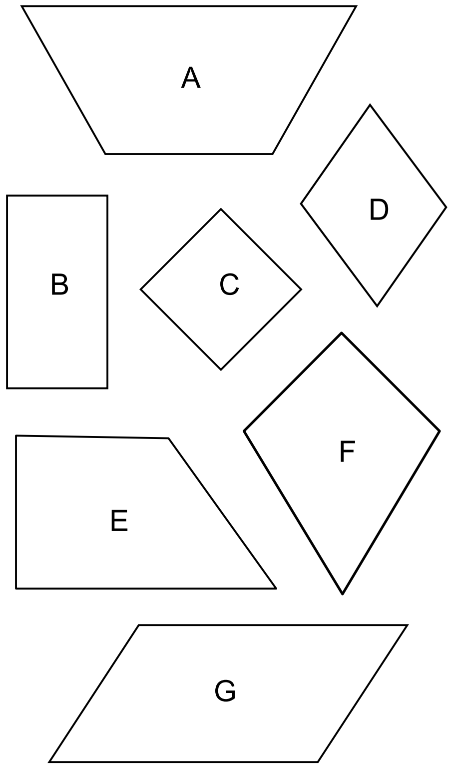


2. a) Sort these triangles into two or more groups. Tell your sorting rule.



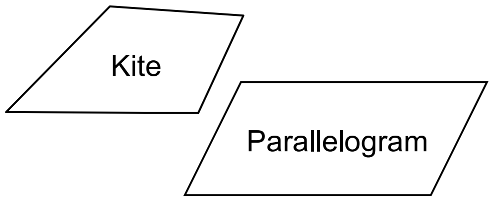
b) Sort your triangles in another way. Tell your new sorting rule.
c) How many lines of symmetry does each triangle have?
d) How many congruent angles does each triangle have?

3. a) Name each quadrilateral.



b) Sort the shapes into two or more groups. Tell your sorting rule.
c) Sort the shapes in a different way. Tell your new sorting rule.

4. a) Trace these quadrilaterals. Draw their diagonals on your tracings.



b) How are parallelograms and kites alike? How are they different?

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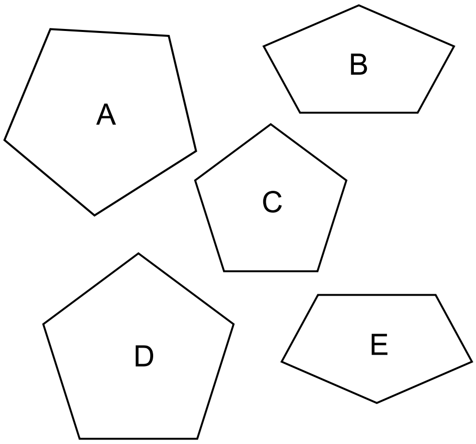
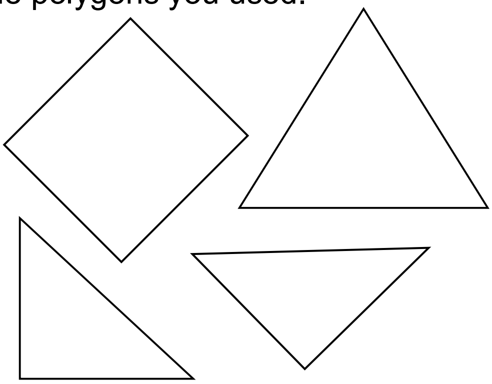
5. a) Which polygons are congruent?

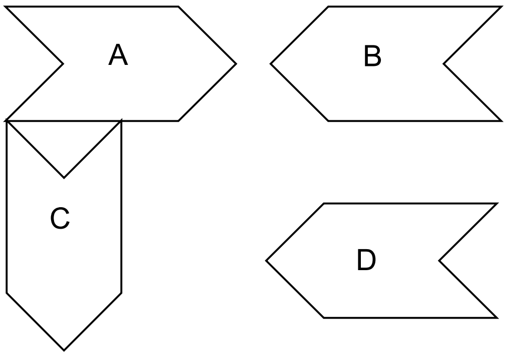
b) Tell how you know and what you did to find out.



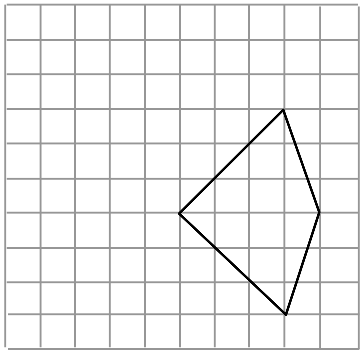
6. How many different shapes can you make by combining these polygons along whole sides? Sketch each shape, showing the polygons you used.



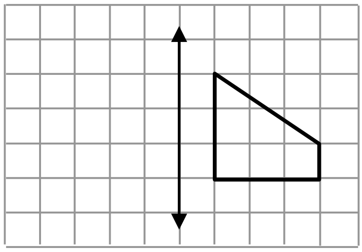
7. Which pairs of shapes show a slide? A flip? A turn?



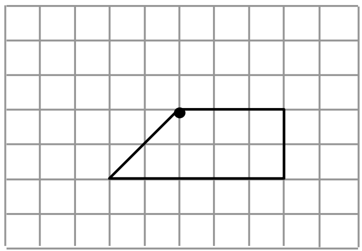
8. Draw the image of this kite after a slide that is (4 units left, 2 unit up).



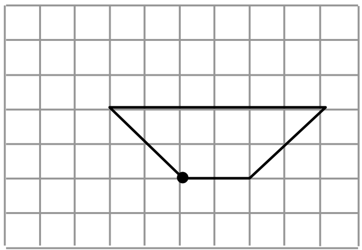
9. Draw the flip image of this trapezoid.



10. a) Draw the image of this shape after a $\frac{1}{2}$ turn cw around the turn centre shown.



b) Draw the image of this shape after a $\frac{1}{4}$ turn ccw around the turn centre shown.



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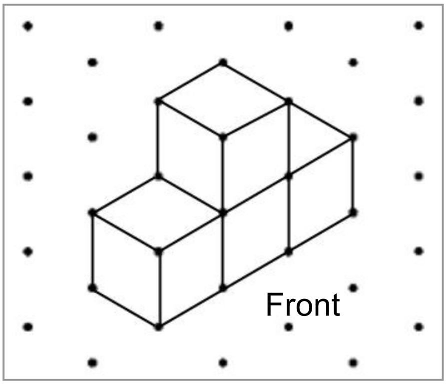
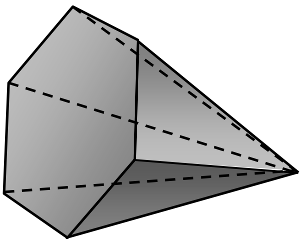
11. a) Build a cube structure that matches this isometric drawing.



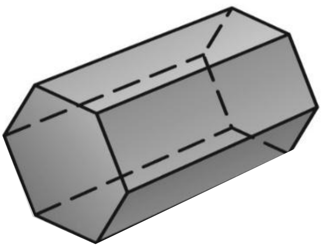
b) Is there another structure that could match the drawing? Explain your thinking.

12. Name each shape and then describe it by its faces, vertices, and edges.

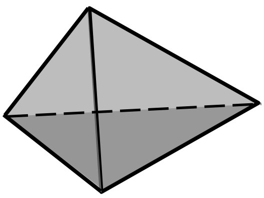
a)



b)



c)

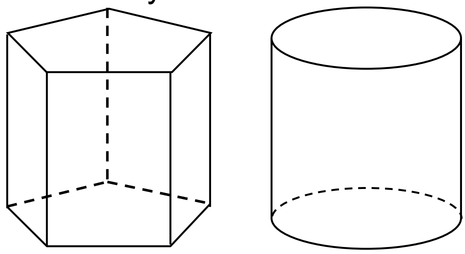


13. Compare each pair of shapes.

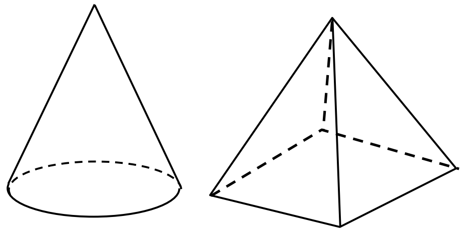
• How are they alike?

• How are they different?

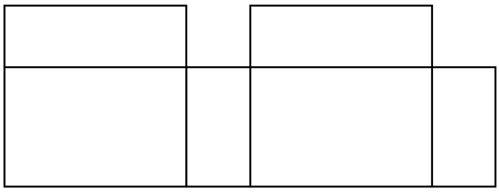
a)



b)



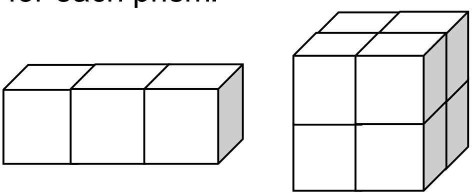
14. a) This is not a net. Rearrange the shapes so that it is a net.



b) What shape does the net make after you rearrange it and fold it?

15. How do you know that a cube is a special rectangle-based prism?

16. a) On grid paper, create a net for each prism.



b) Choose one prism in **part a)** and make a skeleton model.

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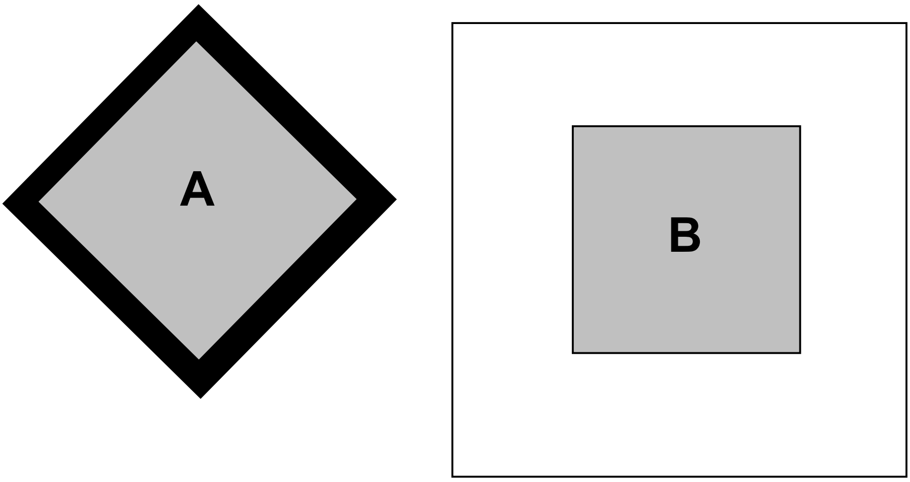
UNIT 6 MEASUREMENT

Getting Started

Use What You Know

An optical illusion is a picture that tricks us into thinking that shapes are a different size than they really are.

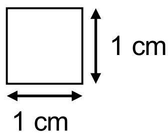
Here is an example of an optical illusion.



A. Estimate which grey shape has a greater area, A or B.

B. Measure the area of each grey shape using square centimetre tiles.

A square centimetre tile is a square tile that is 1 cm on each side. It has an area of 1 square centimetre.



What is the area of each shape in square centimetres?

C. Was your estimate in **part A** correct? Explain your thinking.

D. What do you think makes the picture above an optical illusion?

Skills You Will Need

1. Use a ruler to help you find the perimeter of each shape in centimetres.

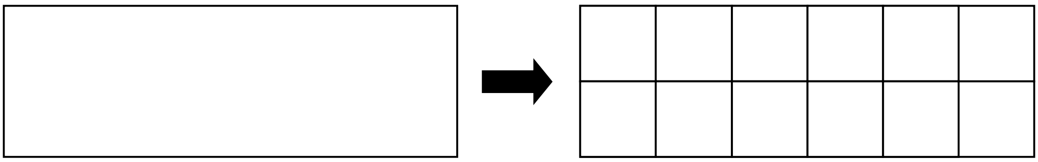
a)

b)

c)

2. Use square centimetre tiles to measure the area of each shape in **question 1**.

3. Padam covered the rectangle below with square centimetre tiles.



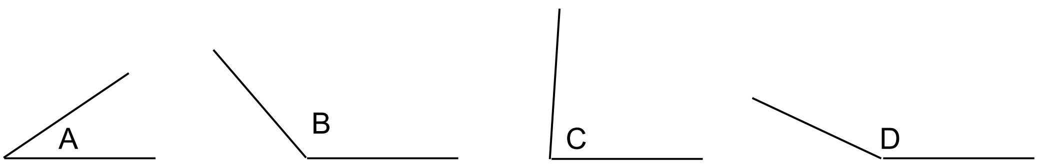
a) How many rows of tiles are there?

b) How many columns of tiles are there?

c) Padam says that you can use the answers to **parts a) and b)** to find the area of the rectangle. Do you agree? Explain your thinking.

4. a) Which angles below are less than a right angle?

b) Which angles below are greater than a right angle?



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Chapter 1 Length and Area

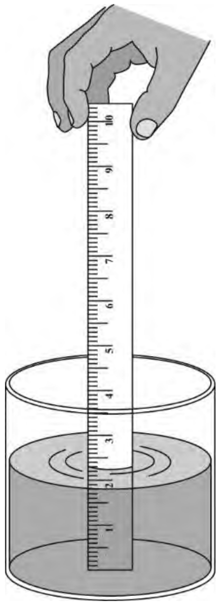
6.1.1 Introducing Millimetres

Try This

A rain gauge is a tool you can use to measure the amount of rain that falls.

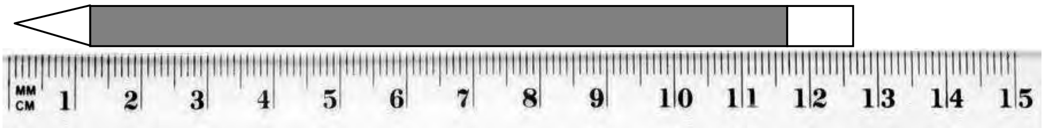
Choki used a rain gauge to collect rain one day. The gauge was marked in centimetres. It looked like this after the rainfall.

A. Estimate the number of centimetres of rain that fell.



• Measurements often fall between centimetres. It is helpful to have A a smaller unit to describe these measurements more exactly.

For example, this pencil is longer than 12 cm but shorter than 13 cm.

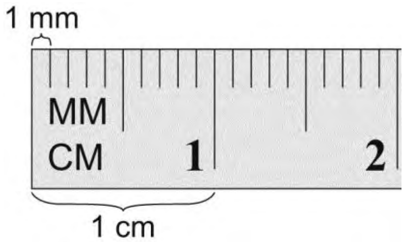


You can use **millimetres** (**mm**) to be more exact.

There are 10 millimetres in 1 centimetre.

Since 10 mm = 1 cm,

$$1 \text{ mm} = \frac{1}{10} \text{ cm or } 0.1 \text{ cm.}$$



• You can measure objects in different ways
  - using both centimetres and millimetres,
  - using only centimetres, or
  - using only millimetres.

For example, the pencil above can be described in these three ways:

12 cm, 7 mm   12.7 cm   127 mm

• There are 1000 millimetres in 1 metre (1000 mm = 1 m). This makes sense since 10 mm = 1 cm and 100 cm = 1 m, and 10 × 100 = 1000.

B. i) Describe the amount of rain that fell in **part A** using millimetres.
ii) How does the amount compare to your estimate from **part A**?

Examples

Example 1 Measuring Length in Different Ways

Measure each line in these three ways. Show your work.

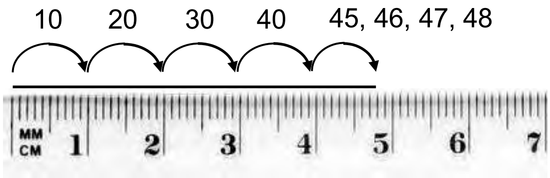
- using only millimetres
- using centimetres and millimetres
- using only centimetres

a)

b)

Solution

a)



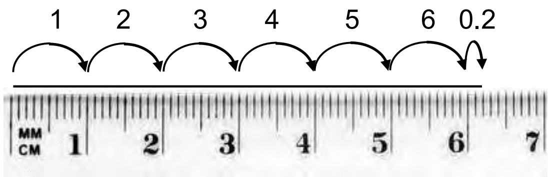
The line is **48 mm** long.

48 mm is 40 mm + 8 mm.

40 mm = 4 cm, so 48 mm = **4 cm, 8 mm**.

8 mm = 0.8 cm, so 4 cm, 8 mm = **4.8 cm**.

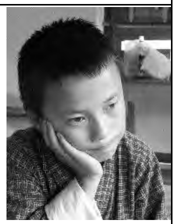
b)



The line is **6.2 cm** long.

6.2 cm = 6 cm + 0.2 cm, and 0.2 cm = 2 mm, so
6.2 cm = **62 mm**.
6.2 cm = **6 cm, 2 mm**.

Thinking



a) To measure in millimetres, I started at 0 and counted by 10s to 40 and then by 5 and by 1s.

b) To measure in centimetres, I counted whole centimetres and then tenths of centimetres.

Example 2 Drawing a Line of a Given Length

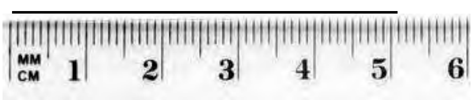
Draw a line that is 51 mm long. Explain what you did.

Solution

51 mm = 50 mm + 1 mm

50 mm = 5 cm

So, 51 mm = 5 cm + 1 mm.



Thinking

• I thought about how many centimetres 51 mm was.

• I used my ruler to draw a line that was 5 cm long.
Then I went past 5 cm by 1 mm.

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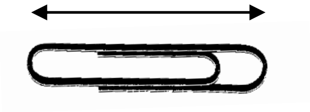
Practising and Applying

1. Measure the length of the paperclip below in each way.

a) using millimetres

b) using centimetres

c) using both

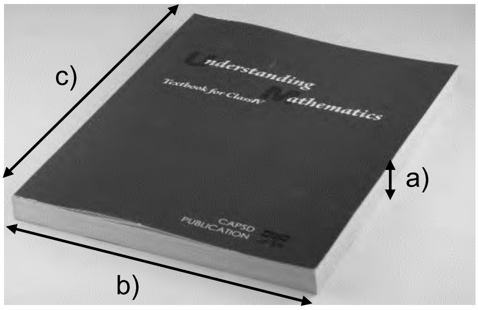


2. Measure each part of your textbook in millimetres.

a) the thickness

b) the width

c) the length



3. Draw a line of each length.

a) 98 mm **b)** 5.2 cm

c) 4 cm, 7 mm **d)** 112 mm

4. a) Use a straight edge to draw a line that you think is 45 mm long.

b) Check your line by measuring with a ruler. How close were you?

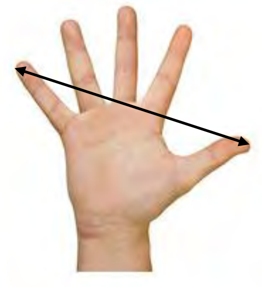
5. Which statements are true?

A. You are shorter than 2000 mm.

B. Your finger is longer than 5 mm.

C. Your fingernail is more than 5 mm thick.

D. Your hand, when stretched, is less than 50 mm across.



6. An object is 560 mm long.

a) Is it longer or shorter than your ruler? How do you know?

b) How many centimetres long is the object?

c) How do you know the object is more than half a metre long?

d) Name an object that is about 560 mm long.

7. Name three things you would measure using each unit.

a) only millimetres

b) only centimetres

c) only metres

8. Why do people usually not measure short distances in kilometres or measure long distances in millimetres? Use examples to help you explain.

9. “Milli” means 1 out of 1000. Why does it make sense that the <u>milli</u>metre has that name?

6.1.2 Estimating and Measuring Area

Try This

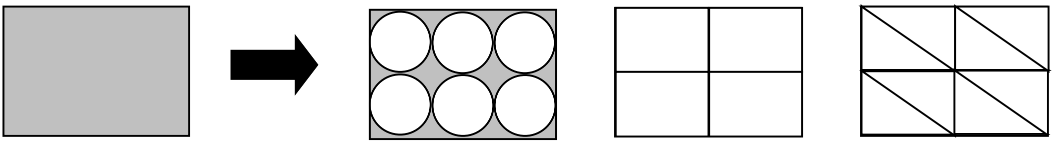
Pelden wants to know which of these two shapes would give him more room to draw on.

A. Which shape do you think has more room? Why do you think that?

• The **area** of a shape is the number of units needed to cover the shape. You can measure the area by covering it with area units.

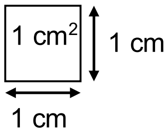
• The units you use to measure area must fit together with no gaps. Circles are not good area units, but shapes like rectangles and triangles can be good area units.

For example, here are some ways to measure the area of the grey shape:

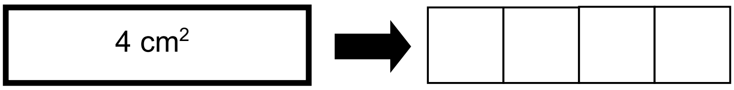


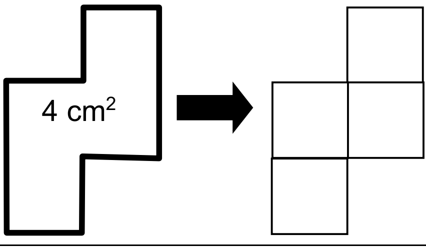
The circle units leave gaps but the rectangle units and triangle units cover the whole shape.

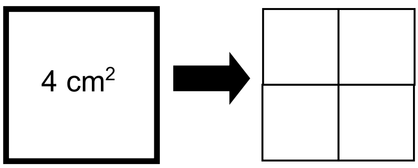
• A square is often used as an area unit. If the square has side lengths of 1 cm, the unit is called a **square centimetre**. You write an area of 1 square centimetre as 1 **cm^2**.



• Each shape below has an area of 4 cm^2 because it can be covered by four 1 cm^2 squares.







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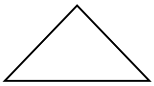
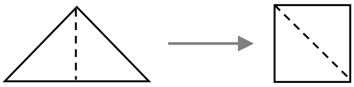
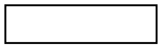
• Other shapes can have an area of 1 cm².

For example, each shape below has an area of 1 cm² since it is made up of all the pieces of a 1 cm² square.

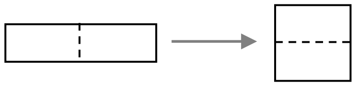


This triangle has an area of 1 cm².



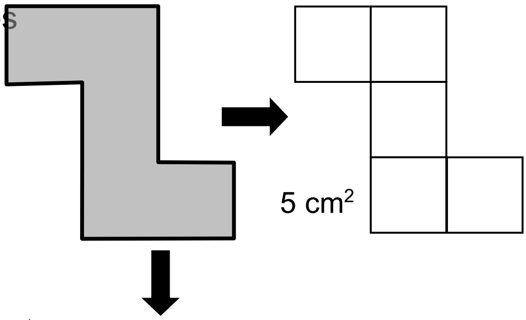


This rectangle has an area of 1 cm².



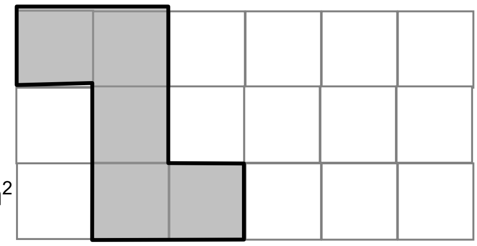
• Here are some ways to measure the area of a shape:

- You can cover it with square pieces of paper that are each 1 cm².



- You can draw the shape on centimetre grid paper and then count the squares.

5 cm²

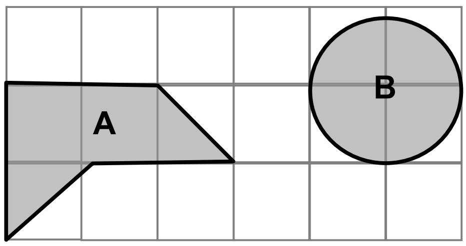


• Sometimes you combine parts of whole square centimetres to find the area of a shape. Other times you can only estimate.

For example:

- The area of shape A is 3 cm², since $2\text{ cm}^2 + \frac{1}{2}\text{ cm}^2 + \frac{1}{2}\text{ cm}^2 = 3\text{ cm}^2$.

- The area of shape B is a bit less than 4 cm².



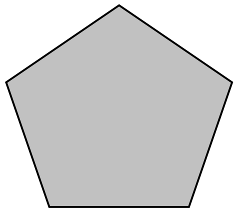
B. i) Draw the shapes in **part A** on centimetre grid paper.

ii) Which shape has a greater area? How is this possible, when the two shapes look so different?

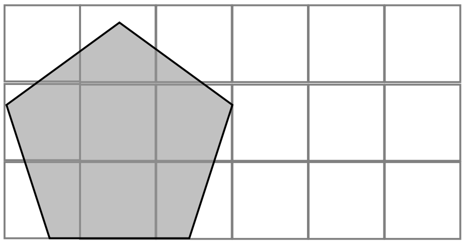
Examples

Example 1 Estimating Area

Estimate the area of this shape in square centimetres.
Show your work.



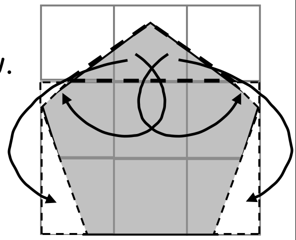
Solution



2 whole squares +
4 almost whole squares
The area is about 6 cm^2.

Thinking

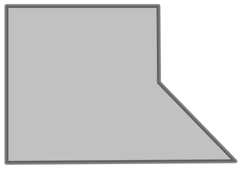
- I drew the shape on centimetre grid paper and then counted squares.
- I estimated that the part at the top would fill in the empty parts of the 4 squares below.



Example 2 Measuring Area

a) Estimate the area of this shape.

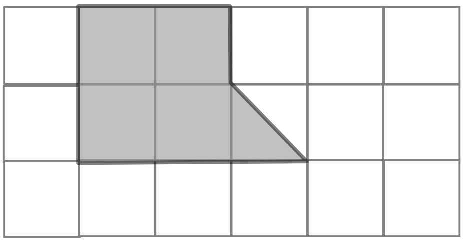
b) Measure to find the exact area.
Show your work.



Solution

a) A bit more than 4 cm^2

b)



4 whole squares + 1 half square

The area is $4\frac{1}{2}$ cm^2 = 4.5 cm^2.

Thinking

a) My fingertip covers about 1 cm^2. I was able to move my fingertip over the shape to cover it about 4 times.

b) I drew the shape on centimetre grid paper. Then I looked for whole squares and half squares.

- I wrote the fraction as a decimal since we are supposed to use decimals, not fractions, with metric units.

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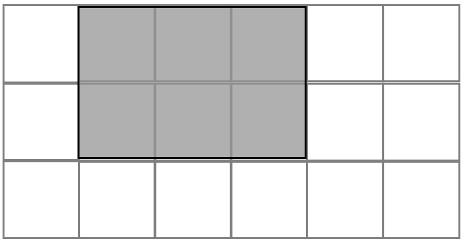
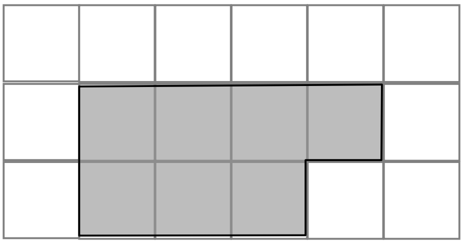
Practising and Applying

1. Each shape below is on a centimetre grid. What is the area of each shape?

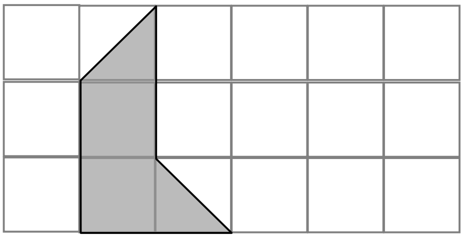
a)



b)



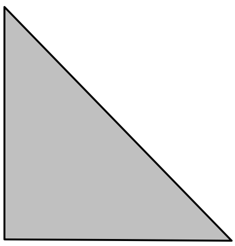
c)



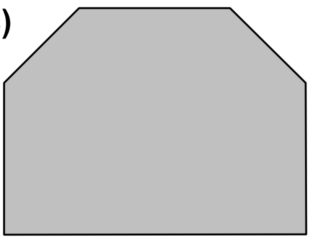
2. Estimate the area of each shape in square centimetres. Then draw it on a centimetre grid to measure the area.

a)

b)



c)



3. On grid paper draw two different shapes, each with an area of 6 cm^2. Explain how you drew each shape.

4. Which of these is likely to be true?

A. The area of a leaf from an apple tree is about 40 cm^2.

B. The area of the paw of a dog is about 3 cm^2.

C. The area of the bottom of a fish tin is 10 cm^2.

5. Find three items in your classroom that each have a flat surface with an area that is less than a sheet of centimetre grid paper.

a) Estimate each area.

b) Measure each area.

6. For some of the shapes on this page you can find the exact area but for others you can only estimate. Explain why.

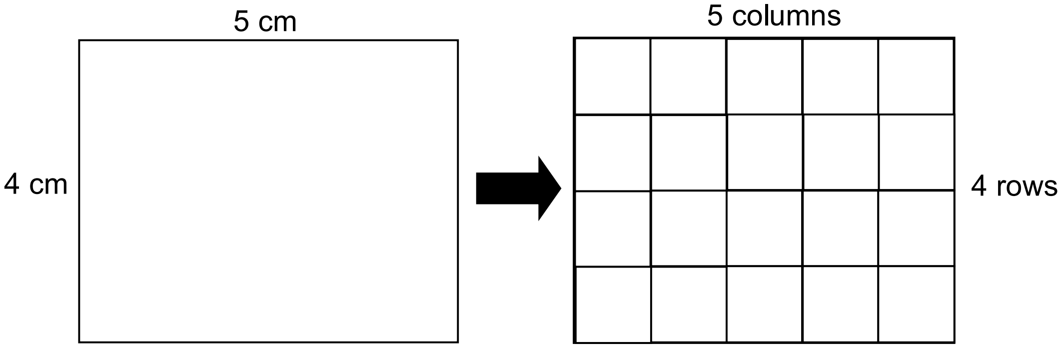
6.1.3 Relating the Area of a Rectangle to Multiplying

Try This

Devika thinks it is impossible to draw a rectangle with an area of 14 cm^2.

A. Do you agree with Devika? Why or why not?

You can use an array of square centimetres to cover a rectangle with **dimensions** 4 cm by 5 cm.



Since the squares are in an array, you can multiply the number of rows (one dimension) by the number of columns (the other dimension) to find the total number of squares (the area).

A 4 cm-by-5 cm rectangle has an area of 4 cm × 5 cm = 20 cm^2.

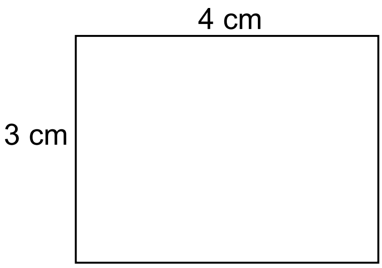
B. Use multiplication facts to show why Devika is wrong in **part A**.

Examples

Example Using Multiplication to Draw a Rectangle with a Given Area

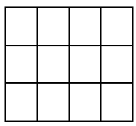
Draw a rectangle with an area of 12 cm^2. Label its dimensions.

Solution 1



Thinking

- I knew the dimensions had to be two numbers that multiplied to 12, like 3 × 4 = 12.
- I was sure my rectangle was right because I could picture it in my mind covered by a 3-by-4 array of square centimetres.



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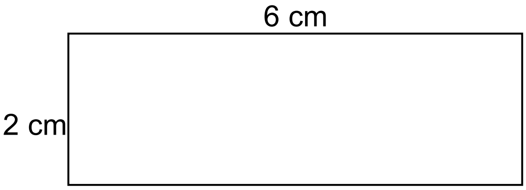
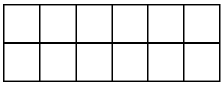
Solution 2



Thinking

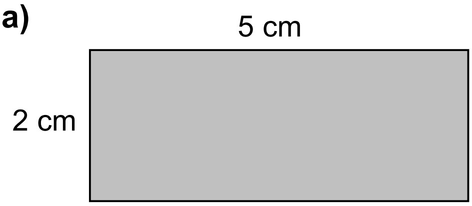
- I used dimensions 2 and 6 because 2 × 6 = 12.
- In my mind, I could see 2 rows of 6 square centimetres covering the rectangle.



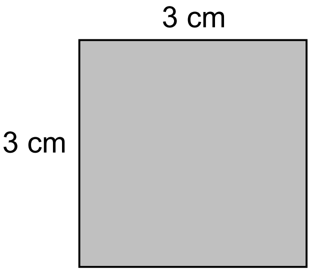
Practising and Applying

1. Calculate each area.

a)



b)



2. a) A rectangle is 5 cm by 6 cm.

- Draw the rectangle.
- Calculate its area.
- Check using a centimetre grid or using square centimetre tiles.

b) Repeat **part a)** for a rectangle that is 8 cm by 3 cm.

c) Repeat **part a)** for a 10 cm square.

3. Paint is measured by how much area it can cover. You have only one can of paint. It will cover a total area of 50 cm^2. You have enough to paint only two of these rectangles.

Rectangle A: 3 cm by 7 cm

Rectangle B: 4 cm by 8 cm

Rectangle C: 5 cm by 5 cm

Which two rectangles can you paint? How do you know?

4. a) Draw two rectangles, each with an area of 36 cm^2.
Label each with its dimensions.

b) Repeat **part a)** for an area of 15 cm^2.

5. a) Draw two rectangles that have a total area of 20 cm^2.
Label each with its dimensions.

b) Repeat **part a)** for a total area of 30 cm^2.

6. You can draw more 36 cm^2 rectangles than 23 cm^2 rectangles if the side lengths must be whole numbers. Why is that?

7. Why do you need only a ruler to find the area of this rectangle?

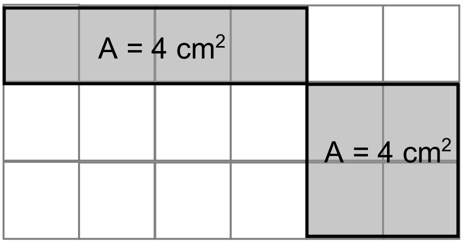
6.1.4 EXPLORE: Rectangle Perimeters with a Given Area

You can draw different shapes that have the same area but different perimeters.

For example:

The rectangle and the square below have the same area but different perimeters.

P = 1 cm + 4 cm + 4 cm + 1 cm = 10 cm

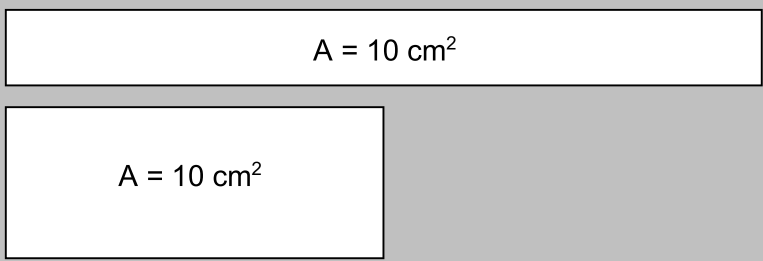


P = 2 cm + 2 cm + 2 cm + 2 cm = 8 cm

A. Draw two rectangles, each with an area of 9 cm^2.
Label each with its dimensions. What is the perimeter of each?

B. Draw three rectangles, each with an area of 12 cm^2.
Label each with its dimensions. What is the perimeter of each?

C. i) Predict which rectangle below has the greater perimeter.
Explain your prediction.



ii) Measure to check your prediction in **part i)**.

D. If you know the area of a rectangle, can you predict its perimeter?
Explain your thinking.

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GAME: Filling a Grid

Play in a group of two or three.

Use a sheet of 10-by-10 grid paper and two dice.

Take turns. Do this on your turn:

- Roll the two dice and multiply the numbers to get an area.
- Make a shape with that area in an empty part of the grid.
The perimeter of the shape must follow the lines of the grid.

You get points for the shape you created:

5 points for a square

3 points for a rectangle that is not a square

1 point for any other shape

The game is over when no one can create a shape in the space available.

The player with the greatest number of points wins.

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CONNECTIONS: Relating Perimeter and Area

- Sometimes people need to find a shape with the least possible perimeter.

For example, a family might want to fence a garden with the least amount of fencing material to save time and money.

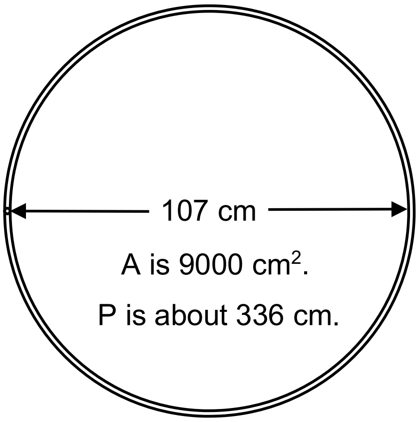
- Different shapes can have the same area but different perimeters:
  - The shape with the least perimeter is a circle.
  - The rectangle with the least perimeter is a square.

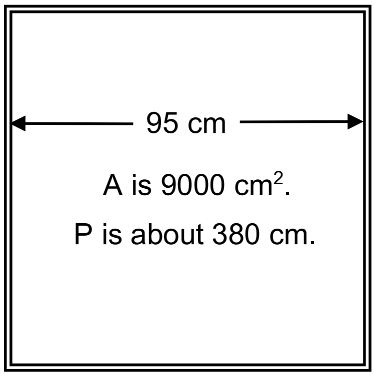
For example:

Suppose you want to put a border around an area that is 9000 cm^2, and you want to use the shortest border possible.

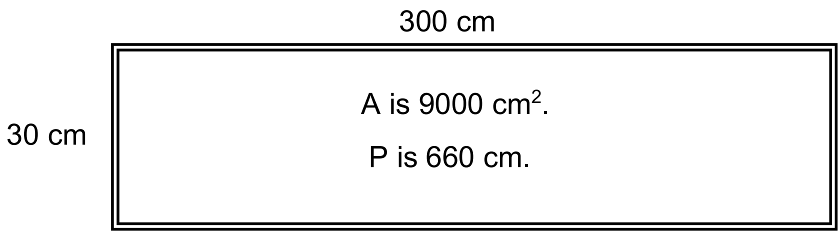
If you want the shape to be a circle, it would be about 107 cm across.

If you want it to be a square, it would be about 95 cm wide.





Both shapes above have a shorter perimeter than the rectangle below, even though the area is the same:



1. Draw three rectangles, each with an area of 64 cm^2. Make one of them a square. Which has the shortest perimeter?

2. a) Draw a circle that is about 9 cm across. Its area will be about 64 cm^2.

b) Use a string and ruler to measure its perimeter. Is the perimeter shorter than any of the perimeters in **question 1**?

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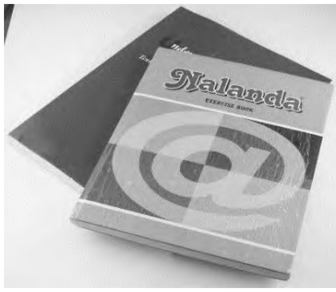
Chapter 2 Volume

6.2.1 Measuring Volume Using Cubes

Try This

Choose two books of different sizes.

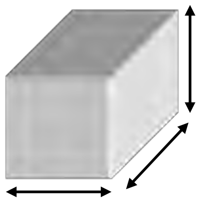
A. Which book do you think would take up more space in your school bag?



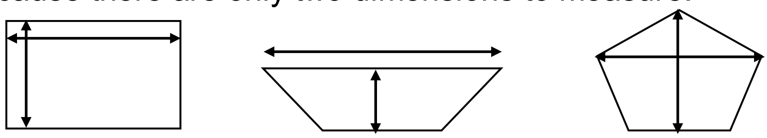
• An object or shape that has three dimensions: width, length, and height, is called **three-dimensional** (**3-D**).

For example:

A **prism** is called a 3-D shape because you can measure three dimensions.



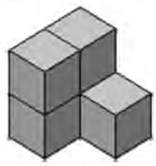
The three shapes below are **two-dimensional** (**2-D**) because there are only two dimensions to measure.



• The **volume** of a 3-D object tells how much space the object takes up. The more material it takes to build an object, the greater its volume.

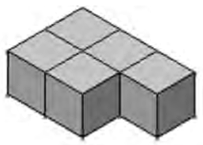
• To measure the volume of an object, you can build a model of the object with cubes that are the same size. The number of cubes you use is a measure of the volume.

For example, the volume of this object is 5 cubes.

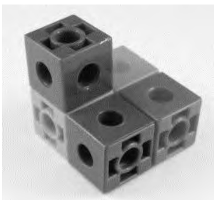


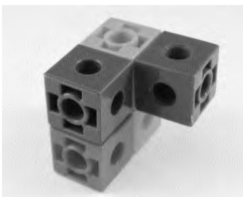
• Different objects can have the same volume.

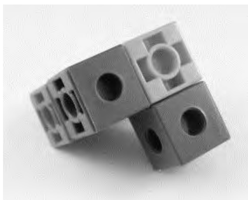
For example, the volume of this object is also 5 cubes.



• If you move an object, its volume does not change, since it still takes the same amount of material to make it.







This object has a volume of 5 cubes no matter how it is moved.

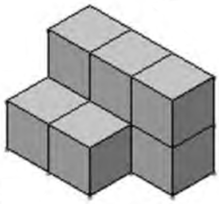
B. What does the question in **part A** have to do with volume?

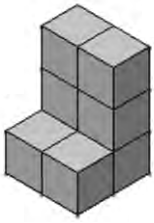
Examples

Example Creating Objects with a Given Volume

Build two different objects, each with a volume of eight cubes.

Solution





Thinking

- I arranged 8 cubes in two different ways. The volume is 8 cubes for each.

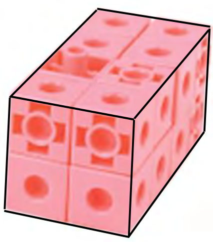
Practising and Applying

1. Build each object with cubes. What is the volume of each?

a)

b)

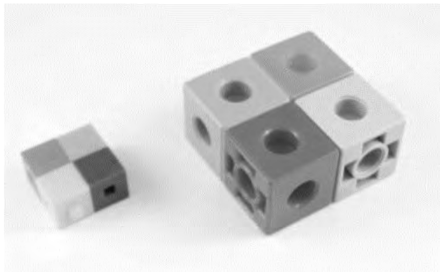
c)



2. Build two objects with each volume.

a) 12 cubes **b)** 20 cubes

3. Each object below is built with four cubes.



Do they have the same volume? Explain your thinking.

4. Norbu modelled the volume of a box using 60 cubes like these.

Is this enough information to know what the box looks like? Explain your thinking.

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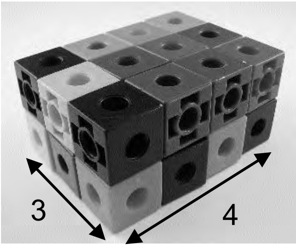
6.2.2 EXPLORE: Volume of Rectangle-based Prisms

Many everyday objects are in the shape of a **rectangle-based prism**.

You can find the volume of a rectangle-based prism if you know its height and the area of its **base**.

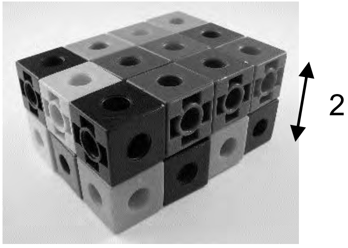
For example:

To find the area of the base of a prism, you multiply the length of the base by the width of the base.

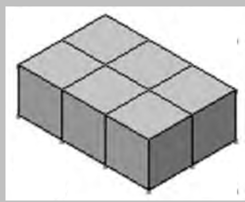


The area of the base is 3 × 4 = 12.

To find the volume, you count the layers of the prism. The number of layers is the height of the prism.



The prism has a height of 2 layers.

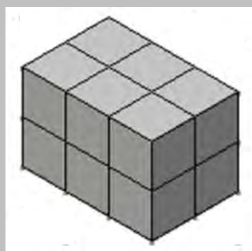


A. Use 6 cubes to build the first layer of a prism.

i) How do you know its volume is 6 cubes?

ii) What is the area of its base? How many layers are there in the prism?

iii) How can you use the two numbers in **part ii)** to find the volume?



B. i) Add a second layer to the prism in **part A**. What is the new volume?

ii) How can you use the area of the base and the number of layers to find the volume?

C. i) Add a third layer. What is the new volume?

ii) How can you use the area of the base and the number of layers to find the volume?

D. Repeat **parts A to C**, but start with a 4 cube-by-3 cube layer.

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E. Predict the volume of each prism below. Explain your prediction.

i) length = 6 cubes	width = 3 cubes	height = 2 layers
ii) length = 4 cubes	width = 2 cubes	height = 4 layers
iii) length = 5 cubes	width = 5 cubes	height = 3 layers

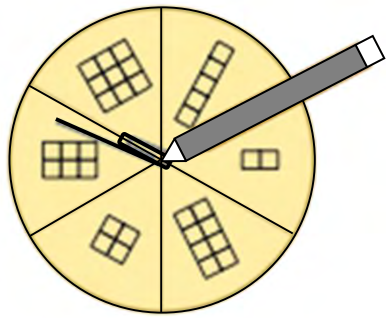
F. What could be the dimensions of a rectangle-based prism with each volume? Use cubes to build each prism to check your answer.

i) 20 cubes **ii)** 30 cubes **iii)** 40 cubes

GAME: Building Bigger Boxes

Play this game in a group of two or three.

You need one or two dice and a spinner.
You can make the spinner yourself.



Take turns. Do this on your turn:

- Spin the spinner to get the shape of the base of a box.
- Roll a die to tell how many layers the box will have.
- Find the volume of the box.

The player with the greatest volume scores 1 point.
If the volumes are the same, no one scores.

Play until a player has 5 points to win the game.

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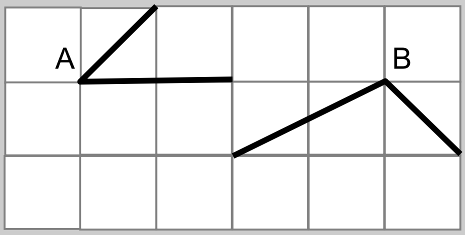
Chapter 3 Angles

6.3.1 Classifying Angles

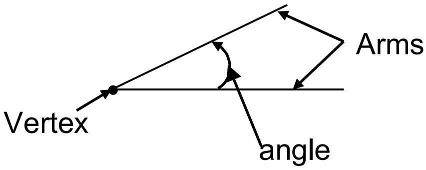
Try This

A. Which angle on the grid is greater? How do you know?

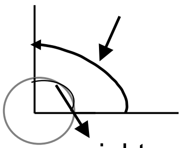
B. Copy the grid and the two angles. Draw a third angle that is greater than both. How do you know it is greater?



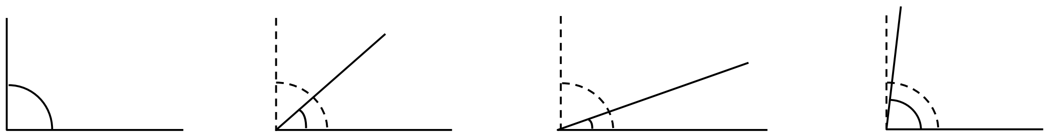
We know that angle is the amount of turn. An angle is made of two arms that meet at a point called the vertex.



When one arm is turned away $\frac{1}{4}$ of the way from the other arm, it makes a right angle.



An angle that is turned less than a right angle is called an **acute angle**.



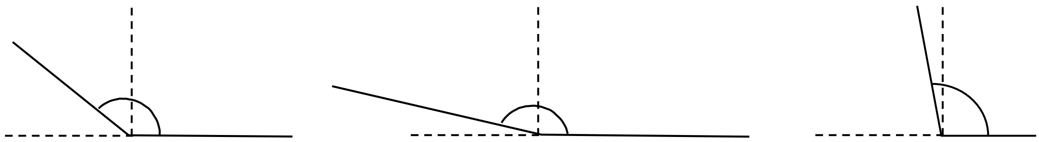
A right angle

Examples of acute angles

• A **straight angle** is made up of two right angles joined together.

• The top arm of a straight angle is turned halfway around a full circle.

• An angle that is turned more than a right angle but less than a straight angle is called an **obtuse angle**.



Examples of obtuse angles

C. i) What type of angle is Angle A?

ii) What type of angle is Angle B?

D. i) What type of angle did you draw? How do you know?

ii) Could you have drawn a right angle or an acute angle for **part B**? Why or why not?

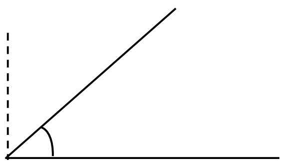
Examples

Example Drawing Acute and Obtuse Angles

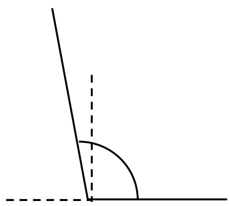
Draw each angle. **a)** an acute angle **b)** an obtuse angle

Solution

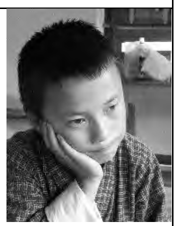
a) Acute angle



b) Obtuse angle



Thinking



• I traced the corner of a book to make a right angle that I could use to compare each angle.

a) The acute angle had to turn less than the right angle.

b) The obtuse angle had to turn more than the right angle, but not as much as a straight angle.

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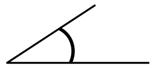
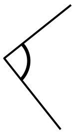
Practising and Applying

1. Is each angle acute, right, or obtuse?

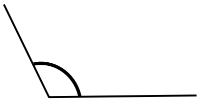
a)



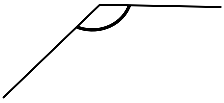
b)



c)



d)



2. Draw each angle.

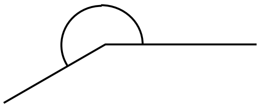
a) an acute angle

b) an obtuse angle

c) a straight angle

d) a right angle

3. How do you know this angle is not an obtuse angle?



4. Samten says that if you put two acute angles together, you always get an obtuse angle. Do you agree? Explain your thinking.

5. Find one or more example of each type of angle in your classroom:

- an acute angle
- a right angle
- an obtuse angle

6. Choden says that if she knows one angle is acute and another angle is obtuse, she does not need to see them to tell which is greater. Is she right? Explain your thinking.

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Chapter 4 Time

6.4.1 Writing Times before and after Noon.

A. Try This
Describe an activity that you usually do at around 6 o'clock.

One day has 24 hours. Here, the day means both the daytime and the night time.

The hour hand makes 2 rounds from 12 and back to it in one day.

An analog clock shows times only up to 12 hours. So, in one day, the hour hand of the clock makes two rounds around the face of the clock, because, 2 sets of 12 hours make 24 hours.

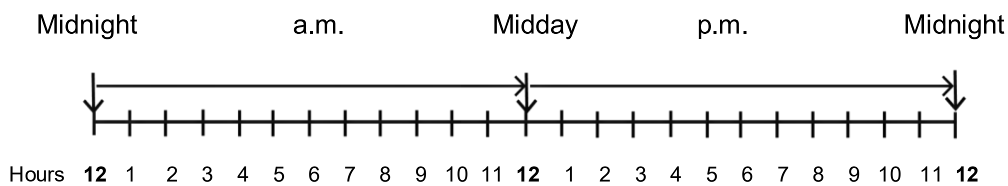
The clock strikes every hour (from 1 to 12) two times every day. It strikes 12 o'clock once at midnight, and once at midday.

The clock makes its first round from midnight to midday. Then, it makes its second round from midday to midnight.

To help us understand which part of the day we mean when we talk about a time, we write and say **a.m.** and **p.m**. after it.

For the times between midnight and midday, we write a.m., and between midday and midnight, we write p.m. after the numbers. For example, 6 o'clock in the morning is written as 6:00 a.m. because it falls between midnight and midday. And, 6 o'clock in the evening is written as 6:00 p.m.

> **Notes**
> When the time is exactly 12 o'clock, we will not write either a.m. or p.m. with it.
>
> If it is 12 o'clock midday, we write **12:00 noon, or 12:00 midday**.
> If it is 12 o'clock midnight, we write, **12:00 midnight**.



B. What time of the day were you thinking when you described what you usually do around 6 o'clock in the above **Try This** problem? Would you write a.m.or p.m. for your 6 o'clock? Why?

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Example 1 Brisk walking is a good exercise for health. Yangchen says that her parents go for a brisk walk everyday at 6 o'clock, and that she joins them often. Is it clear to you whether the walk happens in the morning or in the evening? Why? How could Yangchen have made it clear?
Solution No, it is not clear to me whether the walk happens in the morning or in the evening. That is because there are two 6 o'clocks in a day, one in the morning and another in the evening, and she did not make it clear which one it is. Yangchen could have said 6 a.m. if the walk happens in the morning, or 6 p.m. if it happens in the evening. She could also have said 6 o'clock in the morning, or 6 o'clock in the evening.

Practising and Applying

1. Complete the statements with an appropriate time in digital clock format. Do not forget to write either a.m., p.m., noon, or midnight for your times.

a. The morning assembly in our school starts at ____.
b. Our school day end at ____.
c. The sun would be directly over our heads at around ____.
d. The time that is exactly in the middle of the night is ____.

2. Describe an activity that you have done, or will do today at each time below.
   a. 6:00 a.m.
   b. 12:00 noon
   c. 12:00 midnight
   d. 5:00 p.m.

3. Karma says that he would normally be in deep sleep at 11 o'clock. Would that be 11:00 a.m. or 11:00 p.m.? Why?

4. Kaka studied from 5:00 p.m. to 6:30 p.m. yesterday.
a. How many hours did he study?
b. How many minutes was that?

5. Arjun started walking from his house at 9:00 a.m. and reached the town at 11:30 a.m. How many hours did he walk?

6. Tshering follows the timetable below on Sundays at home.

Activity	Start	Finish
Eat breakfast	7:00 a.m.	7:30 a.m.
Read books	7:30 am	10:30 am
Take bath	10:30 a.m.	11:30 a.m.
Polish shoes	11:30 a.m.	12:00 noon
Eat lunch	12:00 noon	12:30 p.m.

a. How long is the reading time?
b. How long is the lunch time?
c. What is the total time for all the above activities?

6.4.2 Measuring Times in Hours, Minutes and Seconds.

Try This

Pem and Yangki are telling the time by looking at the analog clock.

A. Pem says the time is 50 minutes past 1 o'clock.
Yangki says it is 10 minutes to 2 o'clock.

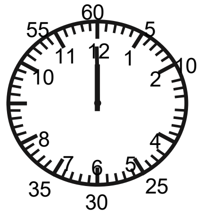
i) What time does the clock show? How do you know?

ii) Who told the time correctly? Explain your thinking.

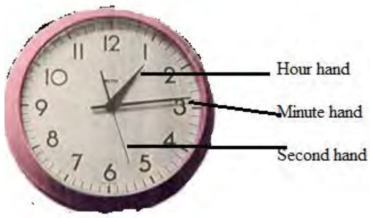
Just like we use units (such as metres, centimetres, millimetres and kilometres), to measure lengths or distances, we also use units to measure time. Some of the units to measure time are hours, minutes, seconds, days, weeks, months, seasons and years.

In this lesson, you will learn to measure time in hours and minutes. We use clocks or watches to help us measure time.

There are 60 minutes in 1 hour (60 minutes = 1 hour). This fact can be explained with an analog clock. On the face of the clock, there are 60 markings, for the 60 minutes. In the diagram on the right, the numbers on the outside of the clock show the minutes, while the number inside show the hours.



The thin fastest running hand in the clock is called the **second hand**. When the second hand makes one complete round, it becomes one minute. Therefore, **60 seconds = 1 minute**



What time does the clock show?
The hour hand has crossed 1, so the time is 1 o' clock. The minute hand is at 53. The time is 1 hour 53 minutes. so, we say the time as:

53 minutes past 1 o' clock.

or

7 minutes to 2 o' clock.

The time can be written in digital as **1: 53.**

To measure how long an event or an activity takes place, we have to note the time at the start of it and the time at the end of it. The difference of the two times tells the time the event has taken, or its duration.

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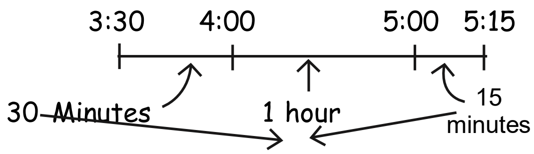
Examples

Example 1 A football match was played from 3:30 to 5:15 in the afternoon. How long did the match last? Show how you calculate the time.

Solution



The match lasted 1 hour 45 minutes.

Thinking

can make a time line from 3:30 to 5:15.
3:30 to 4:00 is 30 minutes,
4:00 to 5:00 is 1 hour,
5:00 to 5:15 is 15 minutes.

30 minutes plus 15 minutes are 45 minutes.
So, the total time is 1 hour 45 minutes.

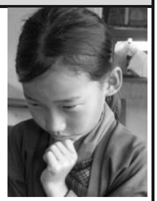
Example 2 How many minutes is 1 hour 45 minutes?

Solution

hour → 60
+ 45
100
+ 5
105

1 hour 45 minutes = 105 minutes

Thinking



1 hour has 60 minutes. So, I can add 60 minutes and 45 minutes.

I added 60 and 45, by first adding the tens in each number. 6 tens and 4 tens is 10 tens, or 100. Then, I added 5 ones to 100 to get the sum of 105.

Practising and Applying

1. A baby slept from 1:30 to 2:30 in the afternoon. How long did the baby sleep?

2. How many minutes are in each? Show how you calculated these amounts. (1 hour = 60 minutes)
   - **a.** 2 hours
   - **b.** Half an hour
   - **c.** 2 and a half hours
   - **d.** 3 hours

3. Dechen follows the timetable below on Sundays at home.

Activity	Start	Finish
Eat breakfast	7:00	7:30
Take bath	10:30	11:30
Polish shoes	11:30	12:00
Eat lunch	12:00	12:30

   - **a.** How long is the bathing time?
   - **b.** How long is the lunch time?
   - **c.** What activity took the longest time?

UNIT 6 Revision

1. Measure each line in millimetres.

a)

b)

2. Draw a line of each length.

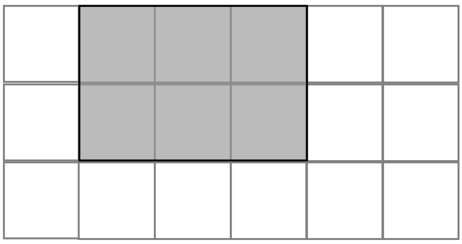
a) 33 mm **b)** 4 cm, 3 mm

3. An object is 4 cm long.
How many millimetres long is it?
How do you know?

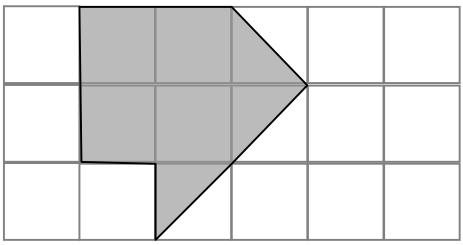
4. Sketch a line that you think is 92 mm long. Measure to see how close you were.

5. Each shape is on centimetre grid paper. What is the area of each? Explain how you got your answer.

a)



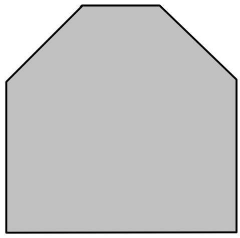
b)



6. Estimate the area of each shape in the next column in square centimetres. Then draw each shape on a centimetre grid to check your estimate.

a)

b)



7. a) Draw two shapes on centimetre grid paper. Each shape should have an area of 15 cm^2.

b) Explain how you made the shapes.

8. Name a surface of something in your classroom that might have each area.

a) about 150 cm^2

b) about 50 cm^2

9. a) Draw two rectangles, each with an area of 60 cm^2. Label the dimensions.

b) Repeat **part a)** for an area of 28 cm^2.

10. Describe three different rectangles that each have an area of 16 cm^2.
Find the perimeter of each.

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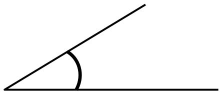
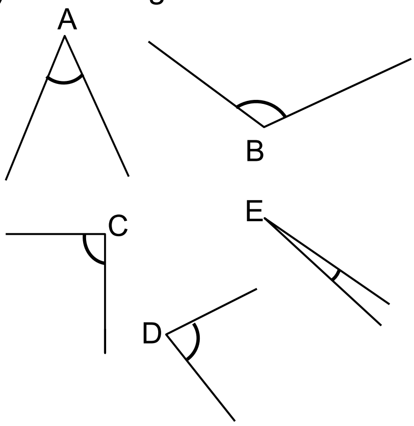
11. a) Draw an angle that is greater than this angle. What type of angle did you draw?



b) Draw an angle that is less than the angle shown in **part a)**. What type of angle did you draw?

12. a) Which of the angles below are obtuse?

b) Which angles are acute?

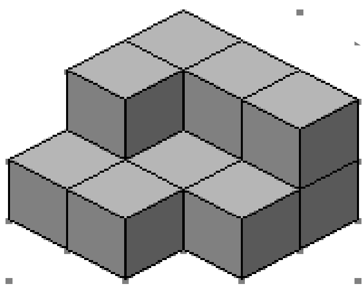


13. a) Draw an obtuse angle that is just a bit greater than a right angle.

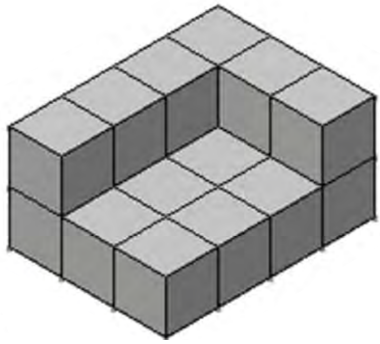
b) How do you know your angle is obtuse?

14. Tenzin says that a taller rectangle-based prism is always bigger than a shorter rectangle-based prism. Do you agree?

15. a) What is the volume of each?



b)



16. Build two objects, each with a volume of 16 cubes.

17. a) What is the volume of a rectangle-based prism with these measurements? Show your work.

length = 3 cubes
width = 2 cubes
height = 2 cubes

b) Describe the length, width, and height of a different rectangle-based prism with the same volume. How do you know you are right?

18) One of the places that Druk Air regularly flies to is Bangkok. On a Sunday, the Druk Air plane took off from the Paro airport at 11:40 a.m. It landed at the Bangkok airport at 4:00 p.m. (Bhutan time). How many minutes did the Druk Air plane take to reach Bangkok from Paro on that day?

UNIT 7 DATA AND PROBABILITY

Getting Started

Use What You Know

A. Suppose you want to know where Class IV students are in their families. How many are the only child, the oldest child, the youngest child, or a child in the middle?

i) Who might you ask to find out? Explain your choice.

ii) Does it matter whether you ask at the beginning of the school year or at the end of the school year? Explain your thinking.

iii) How would you ask the question so that it is clear?

iv) Ask your question of 20 students in your class. Record the results in a chart like this.

Place in family	Number of students
Youngest	
In the middle	
Oldest	
Only child	

B. i) Graph your results in a bar graph or a pictograph. Your graph should use a scale.

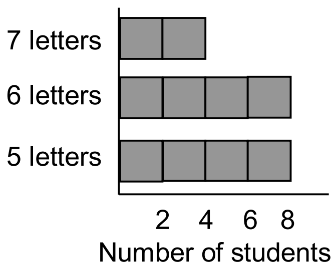
ii) Explain why you used the scale you did.

Skills You Will Need

1. A student collected data from three different groups of students about the total number of letters in their names. For example, Gayatri has 7 letters. Which graphs below are bar graphs?

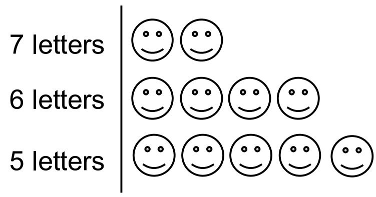
A.

Number of Letters in Our Names



B.

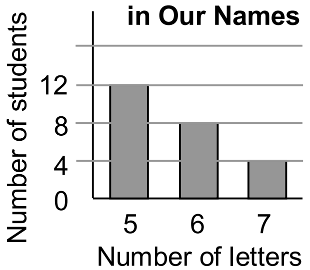
Number of Letters in Our Names



Each ☺ is 5 students.

C.

Number of Letters in Our Names



2. a) Name two things that **graph C** in **question 1** shows.

b) Name two things that **graph B** shows.

3. Pelden flipped five Nu 1 coins. He got 2 Tashi-Tagyes.

Tashi-Tagye Khorlo Tashi-Tagye Khorlo Khorlo

He flipped the five coins again. This time he got 3 Tashi-Tagyes.

Khorlo Tashi-Tagye Khorlo Tashi-Tagye Tashi-Tagye

He did this 18 times altogether. He recorded his results in a list and then in a chart.

Number of Tashi-Tagyes in five coin flips:
2, 3, 1, 1, 2, 3, 2, 3, 4, 1, 2, 5, 2, 3, 1, 5, 2, 4

Number of Tashi-Tagyes in five flips	Number of times it happened
1	4
2	6
3	4
4	2
5	2

Use Pelden's results to create two graphs.

a) a bar graph using a scale of 2

b) a pictograph using a scale of 2

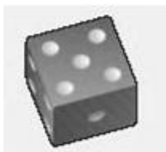
4. a) Describe two things that you think are very likely to happen.

b) Describe two things that you think are not very likely to happen.

5. a) Roll a die 20 times and record your results.

b) Tell how many times you rolled the number five.
Use this form:

I rolled a five ___ out of ___ times.



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Chapter 1 Collecting and Displaying Data

7.1.1 Interpreting and Creating Pictographs

Try This

A. Roll a die 30 times.

i) Record your results in a chart like this one.

ii) Sketch a pictograph to show your results.

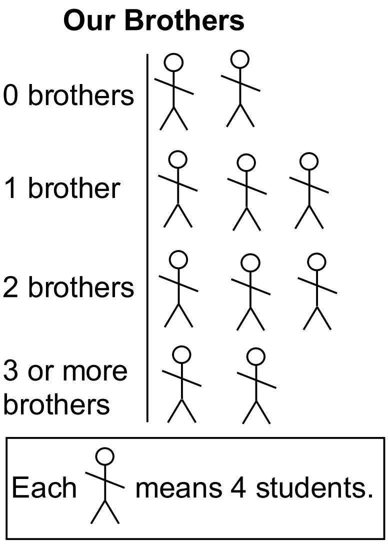
Number rolled	Number of times
Even	
Odd	

• A **pictograph** is a way to show the number of data values that are in different groups or **categories**.

• A pictograph uses pictures or **symbols** to show the numbers. The symbol could be a simple shape, like a circle or square, but more often the symbol makes sense for the topic of the data.

For example:

This pictograph shows the number of brothers of the students in Rinzin's class. It uses pictures of stick men for symbols.



- The same symbol is repeated over and over. The symbols are lined up so they match from row to row.
- You can read a pictograph to get information.
  For example:
  12 students have 2 brothers.
  There are 3 pictures in the row for 2 brothers.
  Each picture is 4 people ($3 \times 4 = 12$).
  8 people have 0 brothers ($2 \times 4 = 8$).
- You can make conclusions from a pictograph.
  For example:
  40 students altogether were asked about their brothers ($10 \times 4 = 40$).
  A lot more students have brothers than do not have brothers ($12 + 12 + 8 = 32$ and $4 + 4 = 8$, and $32 > 8$).

• To make a pictograph, you need to collect data values that you can count and sort into different categories.

For example, in the graph above the categories are numbers of brothers.

• Suppose you want to make a pictograph about how often the students in your class attended a celebration during the last year.

- You need to decide what categories to use. Then you collect the data. The chart below shows the data collected in three categories.

Number of celebrations	Number of students
1	20
2	18
3 or more	4

- Once you have collected the data, look at the numbers to decide whether you need to use a scale for your graph. If you need a scale, decide what **scale** to use.

You might use a scale of 4 because most of the data values are in groups of 4.

A scale of 4 means that each symbol is 4 students.

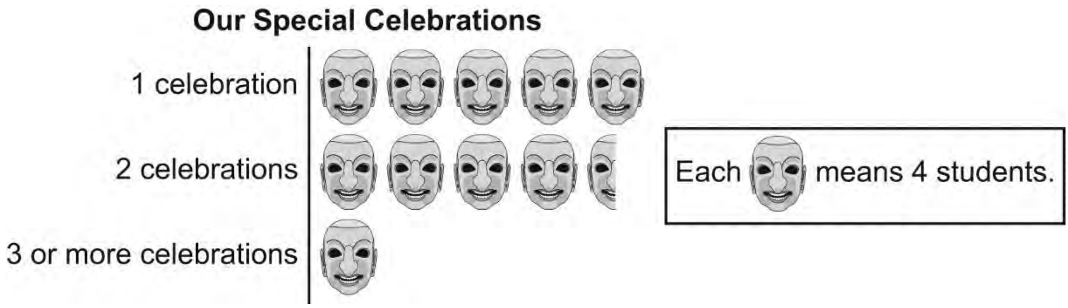
For the 1 celebration category you need 5 symbols since $20 = 5 \times 4$.

For 2 celebrations you need 4 symbols and $\frac{1}{2}$ symbol since

$18 = 16 + 2$, and $16 = 4 \times 4$, and 2 is $\frac{1}{2}$ of 4.

For 3 or more celebrations, you need 1 symbol to show 4 students.

- Your pictograph might look like this:



• The graph can be horizontal like the graph above or it can be vertical like the birthday season pictograph on **page 205**.

• You want anyone who reads it to understand your pictograph, so you should give it a title and tell what each symbol means.

B. i) What scale did you use for your pictograph in **part A**?

ii) Why did you choose that scale?

C. What information can you read or what conclusions can you make from your pictograph?

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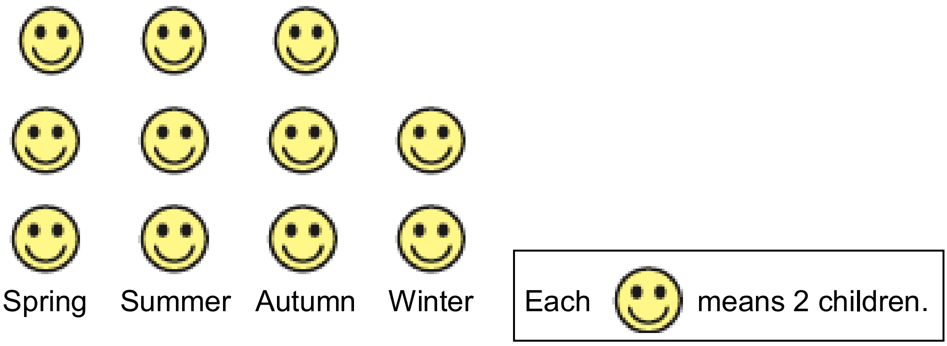
Examples

Example 1 Interpreting a Pictograph

This pictograph shows how many children have a birthday in each season.

Our Birthday Seasons



a) How many children altogether does the graph tell about?

b) What else does the graph tell you? Show your work.

Solution

a) The graph tells about 21 children:
2 × 10 = 20 and 20 + 1 = 21

b) *Reading information*:

• 5 children were born in the spring:
2 + 2 + 1 = 5

• 6 children were born in the summer and in autumn: 3 × 2 = 6

Making conclusions:

• The same number of children were born in the summer as in autumn, 6.

• The least number of children were born in the winter, 4: 2 × 2 = 4

Thinking

a) To find out how many children there are, I counted
the whole symbols, 10.
Then I multiplied by the scale, 2. Then I added 1 for the $\frac{1}{2}$ symbol.

b) Since the symbols are lined up, I can compare how tall the columns of symbols are.

Example 2 Creating a Pictograph

Here are the ages in a group of Class IV students:

Age	Number of students
9 years	14
10 years	25
11 years	11

a) Make a pictograph of this data set.

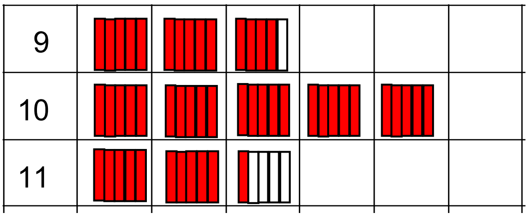
b) What conclusions can you make about the ages of the students?

[Continued]

Example 2 Creating a Pictograph [Continued]

Solution

a) **Ages of Class IV Students**

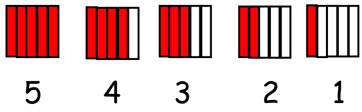


Each means 5 students.

b) Most students are 10 years old. There are as many 10 year olds as 9 and 11 year olds combined.

Thinking

- I knew a scale of 5 would work if I used parts of symbols for 14 and 11.
- I used a symbol I could easily divide into 5 parts. This is what the symbol means each time:

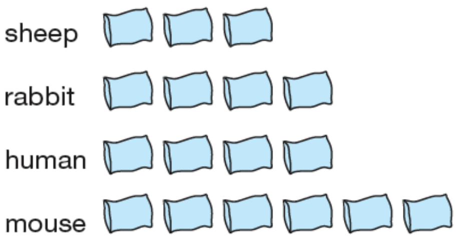


- I used grid paper to make it easy to line up the symbols.

Practising and Applying

1. This graph tells about how long people and animals usually sleep.

Hours Spent Sleeping in a Day



Each means 2 hours.

a) Why does a scale of 2 make sense for this set of data?

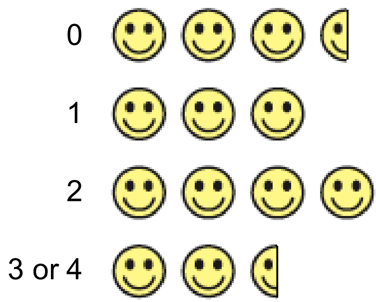
b) How many hours a day does each person or animal sleep?

c) Read three pieces of information from the graph.

d) What conclusions does the graph help you make about animals sleeping?

2. This graph tells about the number of sisters of the students in Class IV.

How Many Sisters We Have



Each means 10 students.

a) How many students have 3 or 4 sisters? How do you know?

b) How many students altogether were asked about their sisters? How do you know?

c) What conclusions can you make from the graph?

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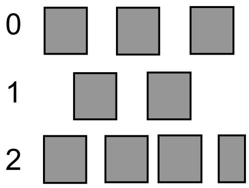
3. Find two things that are wrong with this pictograph.

How Many Pets We Have



4. This chart tells how many children, teenagers, and adults were at a village tsechu.

Age group	Number of people
Children	10
Teenagers	15
Adults less than 50 years old	20
Older adults	10

a) Make a pictograph using a scale to show the data.

b) Explain why you chose the scale you did.

c) Choose a different scale.

d) Predict how the pictograph will change using the new scale. Explain your prediction.

e) Draw the pictograph with the new scale.

5. This chart tells how far students walk from home to school.

Distance from school	Number of students
Very close	4
Close	14
Far	20
Very far	5

a) Make a pictograph of the data.

b) Explain how you chose your scale.

c) Explain why you used the symbol you did.

6. a) Graph the data shown in the pictograph in **question 1** using a scale of 4 hours instead of 2 hours.

b) Do the two graphs show the same information? Explain your thinking.

c) Which scale do you think is better, 4 hours or 2 hours? Why?

7. Tashi says that a square or a circle is a good shape for a pictograph symbol. Why do you think he says that?

8. What are the important things to think about when you make a pictograph? List three or more things.

7.1.2 Interpreting and Creating Bar Graphs

Try This

A. Choose any page in your math text.

i) Count the number of times each letter below appears on the page you chose.

A R N

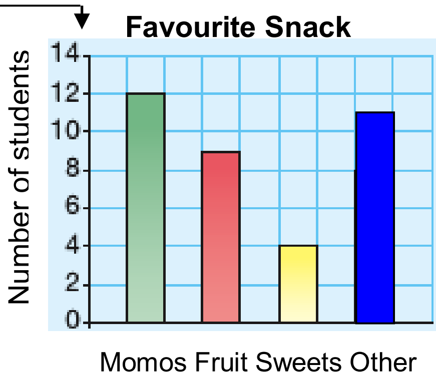
ii) Sketch a bar graph to show what you found out.

• A **bar graph** is like a pictograph because it shows in a picture form how many data values are in each category.

• A bar graph uses the length of its bars to tell how many there are in each category, while a pictograph uses rows or columns of symbols.

• Suppose the students in a class were asked to choose their favourite snack from momos, fruit, sweets, or other (something else). The bar graph below shows the results.

- Notice that the numbers on the **vertical** scale go up by 2s. Each time a bar crosses a **horizontal** line, it means that 2 more people chose that snack.



- You can read the graph for information.

For example: 12 students chose momos
9 chose fruit
4 chose sweets
10 prefer something else
35 students were asked altogether

- You can tell that the **maximum** data value is 12 by looking at the longest bar and that the **minimum** value is 4 by looking at the shortest bar.
- The graph can also help you make **conclusions** about the data. To make conclusions, you can compare data values or combine data values.

For example, you might make these conclusions:

- Many more students chose momos over sweets.
- The number of students who chose momos is about the same as the combined number who chose fruit and sweets.

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• To make a bar graph, you need to collect data that you can count about different groups, or categories.

For example:

In the Favourite Snack graph, the categories are the different snacks. The person who made the graph counted the number of students who chose each snack.

• Suppose you wanted to find out how likely it is to roll three dice and get one, two, or three fives. You could graph the results in a bar graph.

- To collect the data:

  You could group the data in two categories: 1, 2, or 3 fives rolled

  No fives rolled

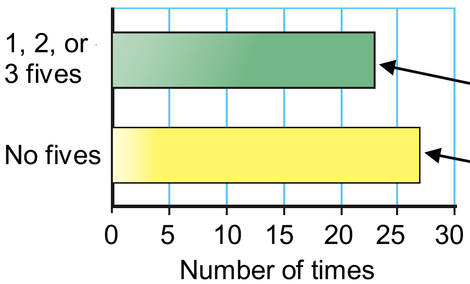
  You count the

Rolling Three Dice

What was rolled	Number of times	
I, 2, or 3 fives	卌 卌 卌 卌 III	23
No fives	卌 卌 卌 卌 卌 II	27

- To draw the graph, you need to use a scale so that the bars will not be too long. In the graph below, a horizontal scale of 5 was used.

Rolling Three Dice



You have to estimate the length of the bars because the values are between 5s:

23 is a little more than halfway between 20 and 25.

27 is a little less than halfway between 25 and 30.

- The graph shows that, when you roll three dice, rolling no fives is more likely than rolling one, two, or three fives.

• The bars in the graph above are horizontal but they could have been vertical like in the Favourite Snack graph.

• You should always give your graph a title and make sure everything is labelled. If you do, your graph will make sense to anyone who reads it.

B. i) What scale did you choose for your bar graph in **part A**?

ii) Why did you choose that scale?

C. What conclusions can you make about how often the three letters appear on a page?

Examples

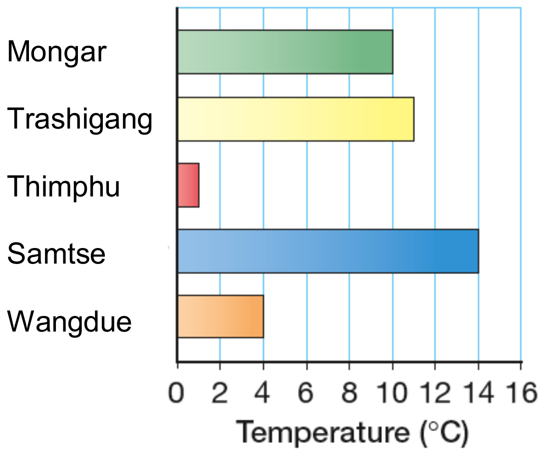
Example 1 Reading and Making Conclusions about a Bar Graph

a) Read three pieces of information from the graph.

b) Use the bar graph below to help you solve this problem:

The temperature in one place was 7°C colder than in another place. What were the two places? Show your work.

Temperature in Five Places



c) Make two conclusions about the data in the graph.

Solution

a) The temperature in Thimphu is 1°C.

The temperature in Wangdue is 4°C.

The temperature in Mongar is 10°C.

b) The longest bar, Samtse, is 14.

If a place were 7°C colder than that, its bar would be 14 – 7 = 7 long.

There is no bar that is 7 long.

The next longest bar, Trashigang, is 11.

If a place were 7°C colder than that, its bar would be 11 – 7 = 4 long.

The bar for Wangdue is 4 long.
The places are Trashigang and Wangdue.

c) Samtse is the warmest of the five places.
It is 3°C warmer than Trashigang.

Thimphu is the coldest place.
It is 3°C colder than Wangdue.

Thinking

a) I listed three temperatures that the graph shows.

b) I started with the longest bar and looked for a bar that was 7°C less.

- When that didn't work, I tried the same thing with the next longest bar. That time it worked.

c) To make conclusions, I compared temperatures.

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Example 2 Creating a Bar Graph

Create a bar graph to show the number of students in five classes:

A. 40 students **B.** 42 students **C.** 35 students **D.** 45 students **E.** 40 students

Solution

Using a scale of 10:

40 = 4 tens (4 lines)

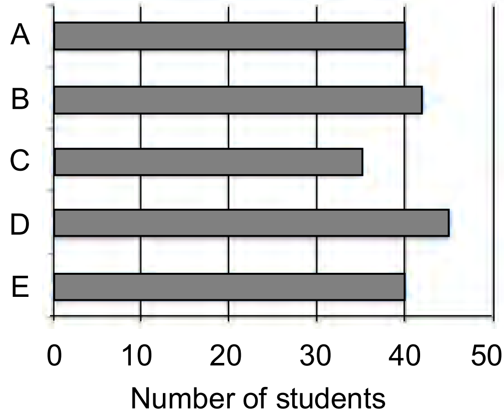
42 = a little more than 4 tens
(4 lines and a bit)

35 = 3 tens and a half ($3\frac{1}{2}$ lines)

45 = 4 tens and a half ($4\frac{1}{2}$ lines)

40 = 4 tens (4 lines)

Sizes of Five Classes



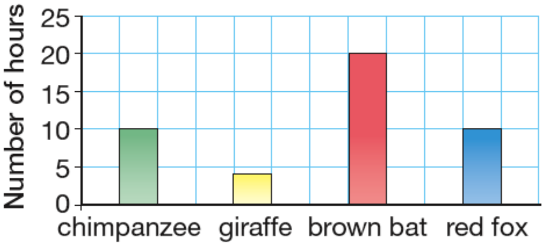
Thinking

- I turned my notebook sideways and used the lines to draw my graph.
- The numbers were big, so I used a big scale of 10.
- A scale of 10 meant that the lines were like counting by 10s.
- I figured out how many lines long each bar should be.
- I estimated for 42, but for 35 and 45, I ended the bar right in the middle between two lines.
- I added labels for the classes and for the scale.
- I gave the graph a title.

Practising and Applying

1. This graph shows data about how long some animals sleep in a day.

Hours Spent Sleeping in a Day



a) How many more hours does a brown bat sleep than a giraffe?

b) Which two animals sleep the same amount each day?

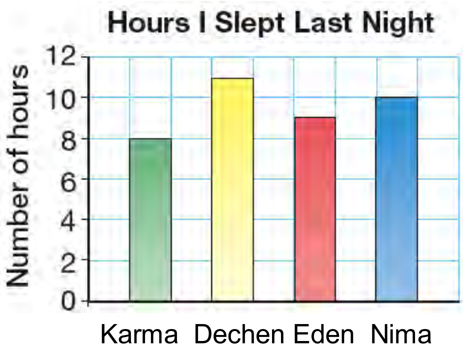
c) What are the maximum and minimum data values?

d) What conclusions can you make about animals sleeping?

e) What is the scale of the graph?

f) Think of another scale that would make sense to use. Tell how the graph would change.

2. This graph shows data about how long four children slept one night.



a) What is the scale of the graph?

b) How many hours did Nima sleep?

c) How many more hours did Dechen sleep than Nima?

d) What conclusions can you make about how much the children slept?

3. This chart shows how many pets the students in Chandra's class have.

Chandra's Classmates' Pets

Number of pets	Number of students
0	15
1	12
2	14

a) Graph the data in a horizontal bar graph.

b) What scale did you use? Why?

c) How does the graph show that there were 12 students with 1 pet?

d) What conclusions can you make from the graph?

4. a) Make a pictograph to show the data in **question 3**.

b) Compare how your pictograph and your bar graph from **question 3** show the same data.

5. This chart shows how many people were at four archery competitions.

Archery Competition Attendance

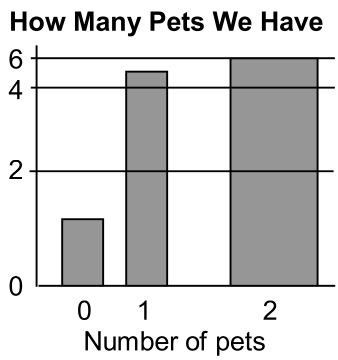
Competition	Number of people
1	120
2	60
3	130
4	150

a) Graph the data in a bar graph

b) What scale did you use? Why?

c) How does the graph show that there were about twice as many people at Competitions 1 and 3 as at Competition 2?

6. List two or more things that are wrong with this graph.



7. Why might you use a different scale to graph the data in Group 1 than the data in Group 2?

Data group 1: 12, 16, 20

Data group 2: 13, 11, 9

8. Describe a situation that where you might graph data in a bar graph. Do not choose a situation that was used in this lesson.

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7.1.3 Using a Coordinate Grid

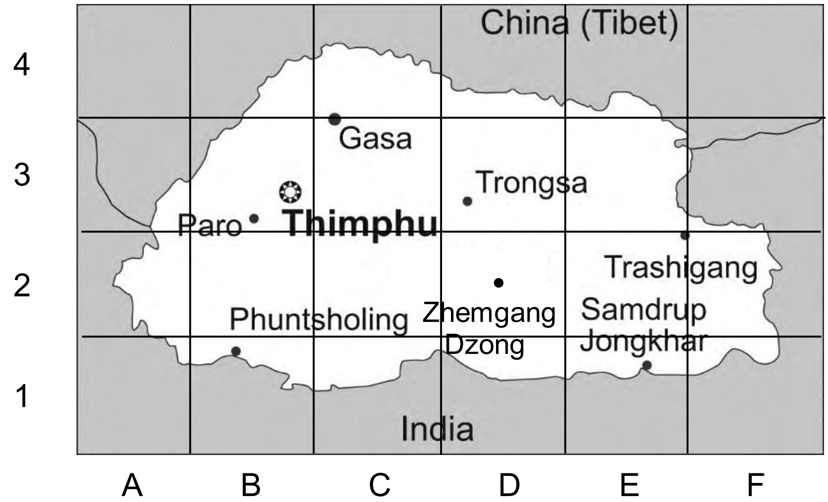
Try This

A. Sketch a rectangle to be a map of your classroom. Use words to tell where your teacher's desk is on the map, without showing where it is.

- Some maps show a lot of information. It is sometimes difficult to find a place on the map. That is why maps often have grids.

For example:

If you wanted to tell someone where Zhemgang Dzong is on this map, you could say it is somewhere in section D2. However, the description D2 does not tell exactly where the dzong is in that section.



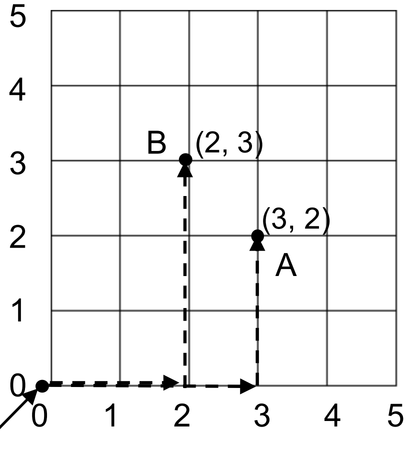
- To be more exact, you can use a **coordinate grid**. On a coordinate grid, it is the lines that have names, not the spaces. Each point where the lines cross is named by an **ordered pair** of two numbers:

- The first number tells how far to the right to go from the **origin** of the grid.
- The second number tells how far up to go.

For example:

Point A is (3, 2) since it is 3 spaces to the right of the origin and 2 spaces up. Point B is (2, 3) since it is 2 spaces to the right of the origin and 3 spaces up.

You can see that it is important to use the right order to locate, or **plot,** a point. (3, 2) is not in the same location as (2, 3).



The origin is at (0, 0).

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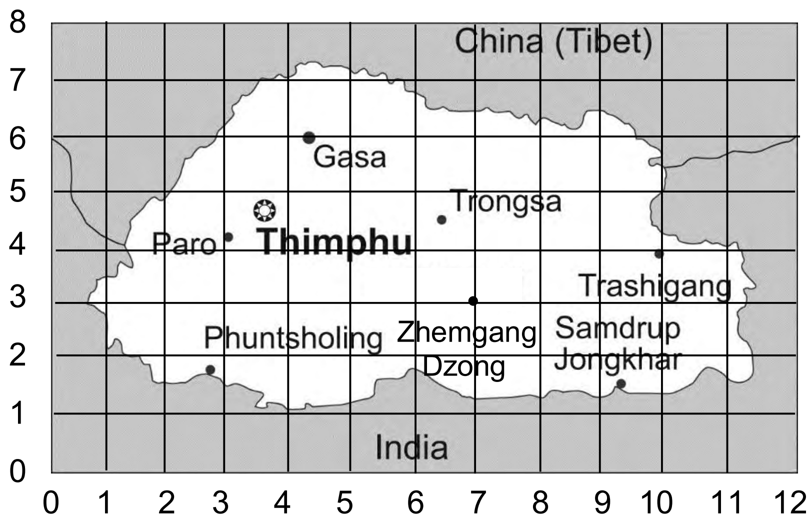
• If you place a coordinate grid on the map of Bhutan and use more lines, you can describe the location of the Zhemgang Dzong exactly as (7, 3).



B. Sketch grid lines on your map from **part A** to make it a coordinate grid. What ordered pair tells where the teacher's desk is?

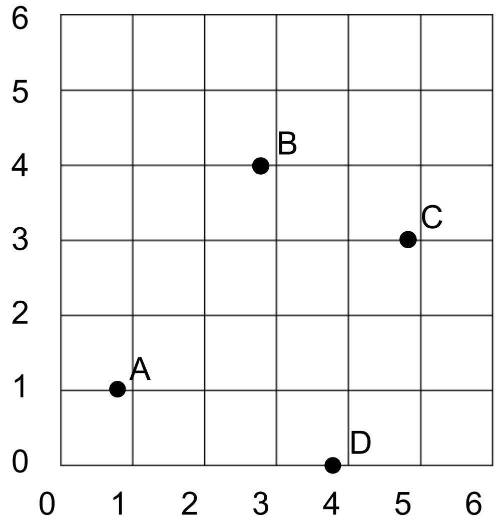
Examples

Example 1 Naming and Plotting Points on a Coordinate Grid

Use ordered pairs to tell where points A, B, C, and D are.

Then plot three more points, E, F, and G:

Plot point E at (5, 2), point F at (0, 4), and point G at (2, 5).



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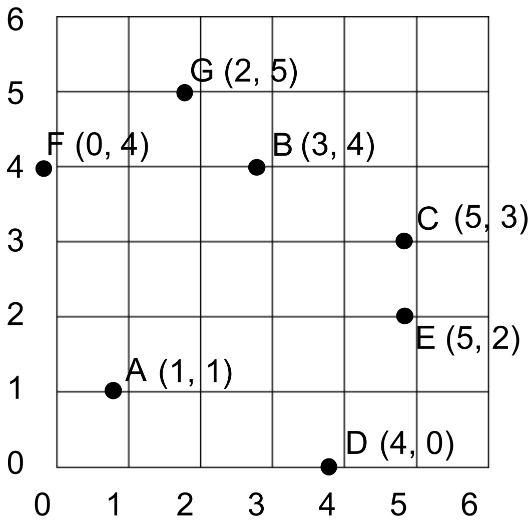
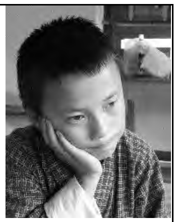
Solution



Thinking



- To figure out where points A, B, C, and D are, I counted spaces to figure out how far each point was to the right of (0, 0) and then how far up each was.
- To plot points E, F, and G, I did the same thing:

- For E (5, 2), I counted 5 spaces to the right of (0, 0) and then I counted 2 spaces up.

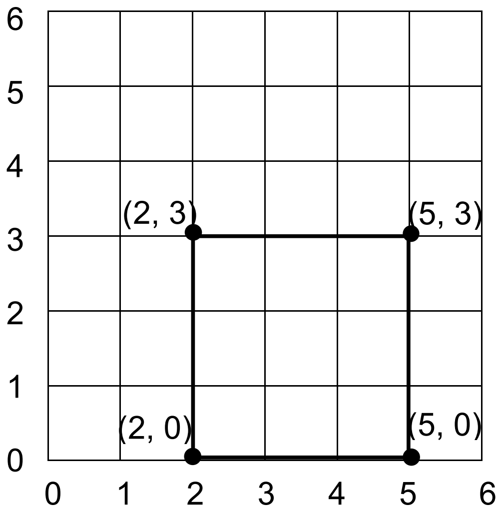
- F (0, 4) was 0 spaces to the right, so I only had to count 4 spaces up from (0, 0).

- For G (2, 5), I counted 2 spaces to the right and then 5 spaces up.

Example 2 Solving a Problem Using a Grid

A square was drawn on a coordinate grid. One vertex of the square is at (2, 3) and another vertex is at (5, 3). Where might be the two other vertices?

Solution



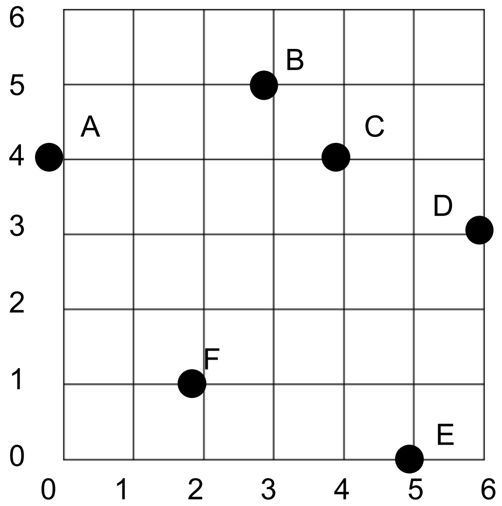
The other vertices are at (2, 0) and (5, 0).

Thinking

- I plotted points at (2, 3) and (5, 3).
- I knew that all the sides of a square are the same length. Since the length from (2, 3) to (5, 3) is 3 spaces, I went down 3 spaces from each point to find the other two points.
- I could have gone up instead and put the vertices at (2, 6) and (5, 6).

Practising and Applying

1. Use an ordered pair to tell where each point is.



2. Draw a grid like the grid in **question 1** and then plot each point.

a) (3, 0) **b)** (0, 1) **c)** (6, 1) **d)** (1, 6)

3. A square has vertices at (3, 4) and (5, 6). Where might be the other vertices?

4. a) i) Plot the points (3, 4), (4, 5), and (5, 6) on a grid. What pattern do the three points make?

ii) Tell where a fourth point could be in the pattern.

b) Repeat **part a)** for these points.

(3, 3), (2, 5), (4, 1)

c) Repeat **part a)** for these points.

(4, 4), (2, 3), (0, 2)

5. A triangle has a vertex at (3, 5) and two equal side lengths. Where might be the other two vertices?

6. Why is the order of the numbers in an ordered pair important?

GAME: Three in a Row

Play in a group of 2. You need one 6-by-6 grid and two dice.

How to play:

• Each player chooses a symbol to use for plotting points on the grid. One player might use X and the other player might use O.

• Take turns rolling the die twice to get two numbers for an ordered pair. Plot the pair on the grid. (You can choose which number goes first in the ordered pair.)

• The winner is the first player to get three marks in a row (vertical, horizontal, or diagonal) with no gaps.

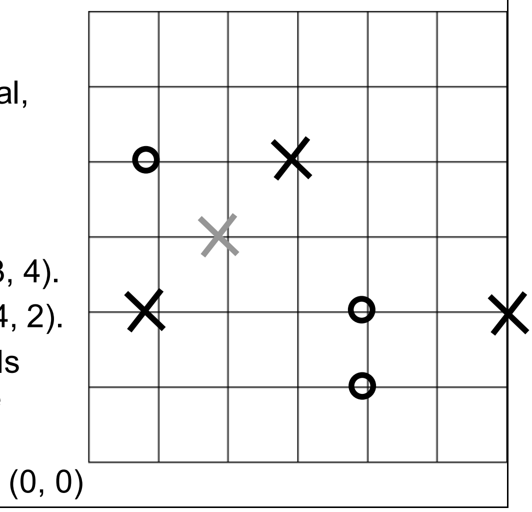
For example:

In the game shown here,

Player X has rolled (1, 2), (6, 2), and (3, 4).

Player O has rolled (1, 4), (4, 1), and (4, 2).

It is now Player X's turn. If Player X rolls a 2 and 3 and plots (2, 3), he will make a diagonal line and win the game.



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7.1.4 EXPLORE: Collecting Data

Bijoy wants to find out what her friends' favourite colours are.
She plans to collect data from 20 of her friends, record the data, and then graph the data to show other people what she found out.

A. i) Bijoy wants to give choices to the friends, instead of just asking them to name their favourite colour. Why?

ii) How many choices should she give them? Explain your thinking.

iii) What choices should she give? Explain your thinking.

B. i) What should Bijoy do to collect the data?

ii) Use the method you described in **part i)** to collect data about favourite colours from 20 students.

C. i) Why might you choose to show your data in a graph instead of in a chart?

ii) Graph your data in a bar graph or a pictograph using a scale.

D. What conclusions can you make about favourite colours? Tell three or more things.

E. If you were to do it again, what might you do differently? Why?

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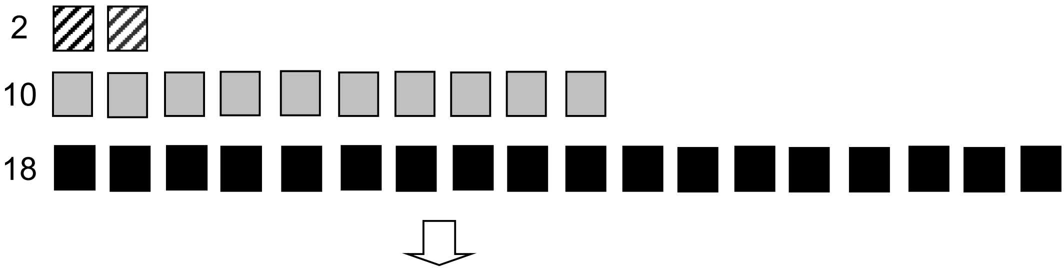
7.1.5 EXPLORE: Interpreting the Mean

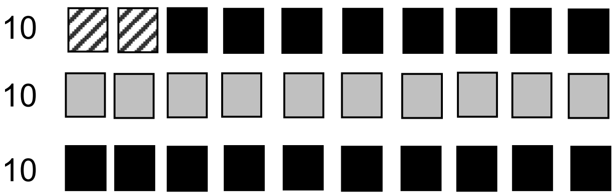
Sometimes you have a set of data with many numbers and you want to describe it using just one number.

For example:

Suppose a class has students that are 8, 9, and 10 years old. You could say that the students in the class are all about 9 years old.

• For the set of data 2, 10, and 18, the number 10 might be a good description because if you combined all the data values and then shared them equally, each share would be 10.





10 is the **mean** of the set of data since it is the value of each share if the total of the data values is shared equally.

• In the example above, the mean of the set of data is one of the data values. Sometimes the mean is not one of the values in the set.

A. What is the mean of 5, 6, and 7? Tell how you know.

B. What is the mean for each set of data?

i) 12, 15, 18, 11 **ii)** 13, 15, 18, 10 **iii)** 14, 15, 18, 9

C. What do you notice about the answers to **part B**? Why does this make sense?

D. Make up three different sets of five data values. Each set should have a mean of 15.

E. Look at the data sets in **part B** and your data sets from **part D**. Is the mean more likely to be the minimum value, the maximum value, or a value in between?

F. i) A set of data has three data values, including 1 and 10. The mean is 4. What is the third data value? How do you know?

ii) Repeat **part i)** for a mean of 5.

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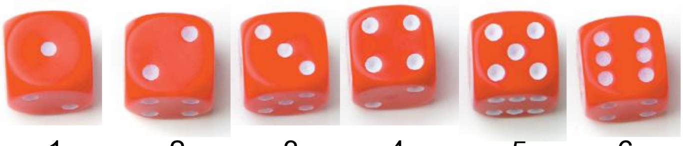
Chapter 2 Probability

7.2.1 EXPLORE: Conducting Experiments

In some games, you **predict** what will happen when you roll a die.
Each time you roll, you will get a 1, 2, 3, 4, 5, or 6.



1 2 3 4 5 6

You might predict that if you roll a die many times, you will get a 4, 5, or 6 on half the rolls. You can **conduct an experiment** to test your prediction.

A. Suppose you roll a die many times. Why do you think you will roll one of the numbers 4, 5, or 6 half the time?

B. i) Predict how times you will roll a 4, 5, or 6 in 12 rolls.

ii) Roll a die 12 times. Record your results in a chart like this:

Number rolled	Number of times
4 or 5 or 6	
1 or 2 or 3	

iii) Tell how many times you rolled a 4, 5, or 6 using this form:

____ out of ____ rolls were a 4, 5, or 6.

iv) Compare your results with your prediction. Were they close?

C. Repeat **part B** using 24 rolls.

D. Did you roll a 4, 5, or 6 closer to half the time in 24 rolls or in 12 rolls?

E. Below are some other things that can happen when you roll a die. For each, conduct an experiment.

Experiment I Roll an even number
Experiment II Roll a 5 or a 6
Experiment III Roll a number less than 4

Do this for each experiment:

- Predict how many times it will happen in 24 rolls.
- Conduct an experiment and record your results.
- Compare your results to your prediction.

7.2.2 Predicting Likelihood

Try This

Use 10 blank slips of paper. Write your name on 4 slips and put them all in a bangchung.

A. i) Suppose you take out a slip 10 times, each time putting it back. Predict which you will get more often:

A blank slip or A slip with a name on it

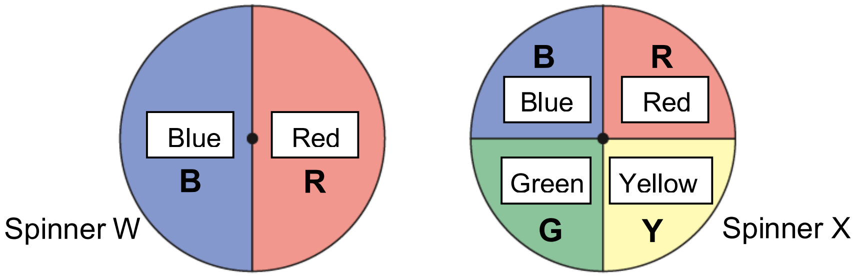
Explain your prediction.

ii) Conduct an experiment to test your prediction. What happened?

When you conduct an experiment, you can never be certain what will happen. But your prediction about what will happen is more likely to be correct if you do the experiment many times.

For example:

- Jigme predicted that he would spin Blue more often on Spinner W than on Spinner X because the Blue section on Spinner W is bigger.



- He spun each spinner 10 times. Here are his results:

  Spinner W: B, B, R, R, R, R, R, B, R, R   3 Blue

  Spinner X: Y, G, G, B, R, B, B, G, B, Y   4 Blue

  He spun Blue more often on Spinner X.

  His results did not match his prediction.

- He decided that 10 spins was not enough to test his prediction because he still thinks he is more likely to spin Blue on Spinner W.

He did another experiment where he spun each spinner 20 times.

Here are his results:

Spinning blue on	Tally	Number of blues
Spinner W	𝍸 𝍸 |	11
Spinner X	𝍸 |	6

He spun Blue more often on Spinner W.

This time his results matched his prediction.

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Jigme now knows that his prediction about the results of an experiment is more likely to be correct if he does the experiment many times.

B. Do the experiment in **part A** 30 times. What happened?

Examples

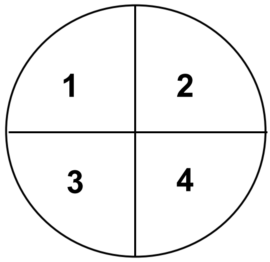
Example 1 Making a Prediction and Conducting an Experiment

Suppose you spin this spinner 20 times.

Do you predict you will spin more 3s or more 4s?

Conduct an experiment to test your prediction.

What happened?



Solution

Prediction:

I predict that I will spin about the same number of 3s as 4s.

Results of 20 spins:

Number spun	Tally	Number of times
1	𝍸 I	6
2	𝍸 II	7
3	IIII	4
4	III	3

I spun four 3s and three 4s, which is about the same number.

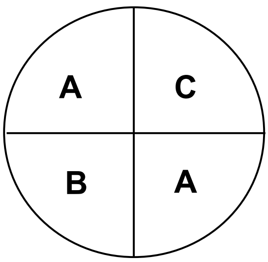
Thinking

• I predicted about the same number of each because the section for 3 and the section for 4 are the same size.

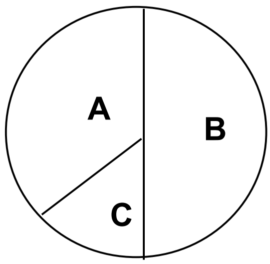
• My results matched my prediction.

Example 2 Making Good Predictions

Yeshi is playing a game with these two spinners. To win the game,
Yeshi chose Spinner Y because its A section looks bigger than each
A section on Spinner X. Bhagi says that Yeshi should have chosen Spinner X.



Spinner X



Spinner Y

How could Bhagi show that Yeshi made the wrong choice?

[Continued]

Example 2 Making Good Predictions [Continued]

Solution 1

Bhagi could do an experiment many times and show Yeshi the results.

Results on Spinner X for 20 spins:

Number spun	Tally	Number of times
A	卌 卌 I	11
B	卌 III	8
C	II	2

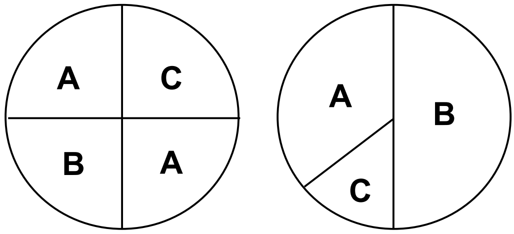
Results on Spinner Y for 20 spins:

Number spun	Tally	Number of times
A	卌 III	8
B	卌 I	6
C	卌 I	6

Bhagi spun A more often on Spinner X than on Spinner Y, so Yeshi should see that he made the wrong choice.

Thinking

• Bhagi knows that Yeshi is wrong because the total area covered by A on Spinner X is greater than the area covered by A on Spinner Y.

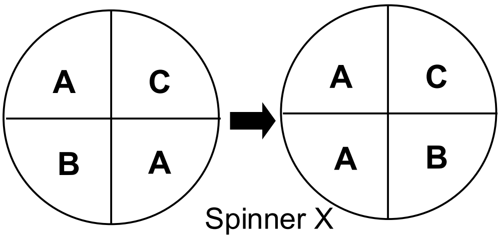


Spinner X Spinner Y

• I thought Bhagi should do at least 20 spins on each spinner or the results might not show that A is more likely on Spinner X.

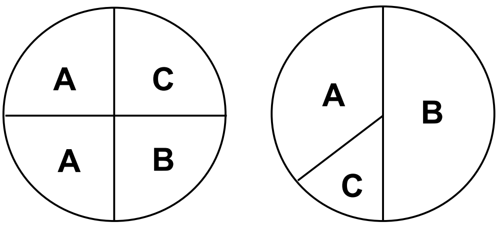
Solution 2

Bhagi could cut up Spinner X and rearrange the sections.



Spinner X

Then he could show Yeshi Spinner X and Spinner Y again.



Spinner X Spinner Y

Now it is easier to see that it is more likely to spin A on Spinner X.

Thinking

• It was clear that Yeshi was having trouble comparing the A sections in the two spinners in his head.
I thought that Bhagi could make it easier for him to compare them.

• With the new Spinner X, it is easy to see that the section for A is bigger on Spinner X.

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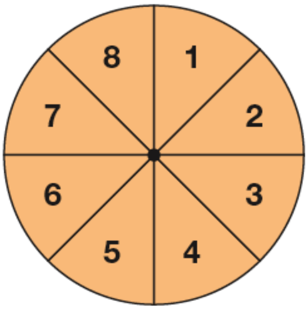
Practising and Applying

*Use Spinner P for **question 1 and question 2**.*



Spinner P

1. Predict which is more likely. Explain your prediction for each.

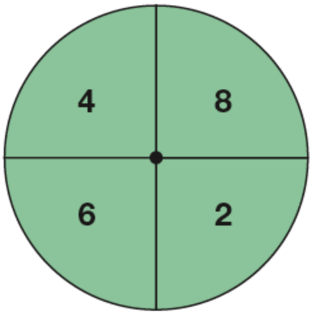
a) spinning a number less than 4
or spinning a number greater than 6

b) spinning an even number
or spinning an odd number

c) spinning a 4
or spinning a number less than 4

2. Spin Spinner P 20 times to test each of your predictions from **question 1**. What happened?

*Use Spinner Q for **question 3 and question 4**.*



Spinner Q

3. Predict which is more likely. Explain your prediction for **part b)**.

a) spinning a number greater than 2
or spinning a 2 or a 4

b) spinning a number greater than 5
or spinning a number less than 5

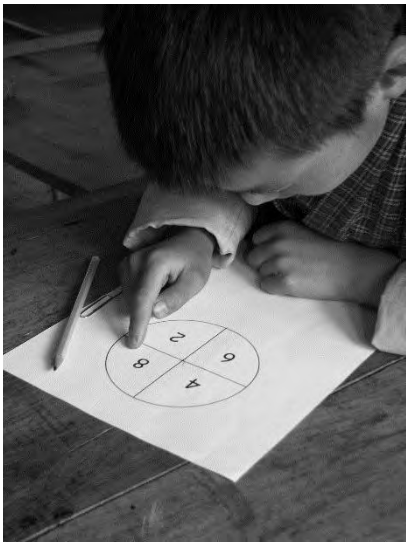
4. Spin Spinner Q 20 times to test each of your predictions from **question 3**. What happened?

5. a) Draw a spinner on which you are just as likely to spin a number less than 5 as a number greater than 5.

b) Explain why you drew the spinner the way you did.

c) Test your spinner by spinning it 20 times. What happened?

6. Mindu predicted that he would spin a 4 more often than a 2 on spinner Q. He spun the spinner four times and he got what he expected: more 4s than 2s. Does that mean he made a good prediction?



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7.2.3 Using Fractions to Describe Probability

Try This

Suppose you put 4 red cubes and 2 blue cubes into a bag. You then take out a cube 12 times, putting it back each time.

A. i) Predict how many times you will take out a red cube.

ii) Do an experiment to test your prediction. What happened?

- You can describe a **probability** using words like "4 times out of 5". You can also use a fraction.

For example, if you flip a Nu 1 coin 10 times, you might predict that you will get a Tashi-Tagye "5 times out of 10", or you might say, "half the time".

- Every probability can be written as a fraction from 0 to 1.
  - If something never happens, the probability is 0.
  - If it always happens, the probability is 1.
  - If it happens as often as it does not happen, the probability is $\frac{1}{2}$.

0 $\quad \frac{1}{2} \quad$ 1

Never happens $\quad$ Always happens

- If something happens 4 times out of 5, it is likely, so the probability is closer to 1 than to 0. You can use the fraction $\frac{4}{5}$ to describe it.

0 $\quad \frac{1}{2} \quad \frac{4}{5} \quad$ 1 $\quad \frac{4}{5}$ is closer to 1 than to $\frac{1}{2}$.

Likely

- If something happens 1 time out of 3, it is not likely, so the probability is closer to 0 than to 1. You can use $\frac{1}{3}$ to describe it.

0 $\quad \frac{1}{3} \quad \frac{1}{2} \quad$ 1 $\quad \frac{1}{3}$ is closer to $\frac{1}{2}$ than to 0.

unlikely

B. i) What fraction describes the probability of taking out a red cube in **part A ii)**? Would you describe it as likely or not likely?

ii) Sketch a number line to show if it is closer to 0, to $\frac{1}{2}$, or to 1.

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Examples

Example Writing Probabilities as Fractions

Lobzang rolled a die 20 times. He got these results:

1, 2, 1, 4, 5, 1, 2, 6, 3, 4, 5, 1, 6, 3, 2, 5, 4, 3, 2, 6

Write a fraction to describe the probability of rolling each.

a) a 6 **b)** a 1, 2, 3, or 4 **c)** an even number **d)** a number less than 3

- Tell if each is closer to 0, to $\frac{1}{2}$, or to 1.
- Then tell if each is *very unlikely*, *unlikely*, *likely*, or *very likely*.

Solution

a) Probability of rolling 6: $\frac{3}{20}$

Closer to 0, so it is *very unlikely*.

b) Probability of rolling 1, 2, 3, or 4: $\frac{14}{20}$

Closer to $\frac{1}{2}$ but more, so it is *likely*.

c) Probability of rolling even: $\frac{10}{20}$

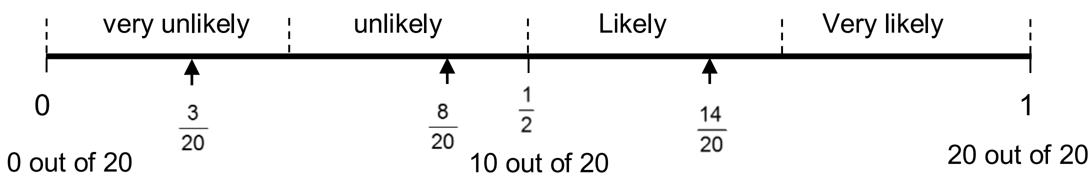
$\frac{10}{20} = \frac{1}{2}$, so it is *as likely to happen as not to happen*.

d) Probability of rolling less than 3: $\frac{8}{20}$

Closer to $\frac{1}{2}$ but less, so it is *unlikely*.

Thinking

- Each fraction's denominator is 20 because he rolled 20 times.
- The numerator tells how many times each result happened.
- To compare each fraction to 0, $\frac{1}{2}$, and 1, I sketched the probability number line below to help me.



Practising and Applying

1. Devika flipped a Nu 1 coin many times. She wrote a K for each Khorlo she got and a T for each Tashi-Tagye.

K T T T K K K T T K T K

a) Write the probability of getting a Khorlo as a fraction. Is it closer to 0, to $\frac{1}{2}$, or to 1?

b) How likely is it to get a Khorlo.

2. Repeat **question 1** for these results: K T T K K T K T K K K T

3. Repeat **question 1** for these results: T T K K T K T T K K

4. Repeat **question 1** for these results: T K T K T T T K T K T K

5. Roll a die 12 times and record your results. Use a fraction to describe the probability of rolling each.

a) a 3

b) an even number

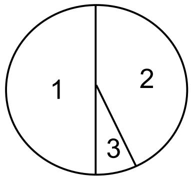
c) a number greater than 2

6. Do these things for each part of **question 5**:

• Tell whether the probability is closer to 0, to $\frac{1}{2}$, or to 1.

• Use words to describe how likely it is.

7. Suppose you spun this spinner 10 times. What number or numbers might have each probability below?



a) close to 0

b) close to 1

c) close to $\frac{1}{2}$

8. How is using a fraction to describe a probability the same as using words like "__ times out of __"?

CONNECTIONS: Predicting Probability Runs

• If someone flips a Nu 1 coin and gets two or more Khorlos or Tashi-Tagyes in a row, it is called a "run".

For example:

K K T T T T K T K T

The results K K T T T T K T K T show a run of two Ks and a run of four Ts.

The longest run is four Ts.

<u>K K</u> <u>T T T T</u> K T K T

• Mathematicians have found that if you flip a coin 20 times, it is very unlikely that you will get a run of Ks or Ts longer than four.

1. Flip a coin 20 times and record your results.

a) What was your longest run?

b) Compare your results with three other students. Did the same thing happen to them?

2. What do you predict will be the longest run if you flip 40 times? Test your prediction. What happened?

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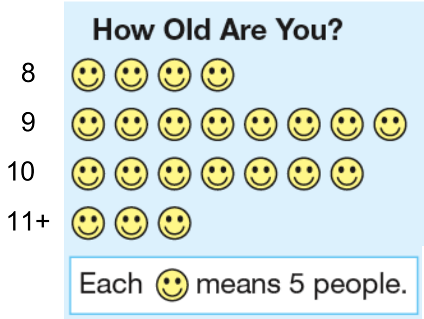
UNIT 7 Revision

1. This graph shows information about the ages of some children.



a) How many of the children are 8 years old?

b) How many children were asked about their age?

c) Tell two conclusions you can make from the graph.

2. Redraw the pictograph in **question 1** but change the scale. Make each face mean 10 people.

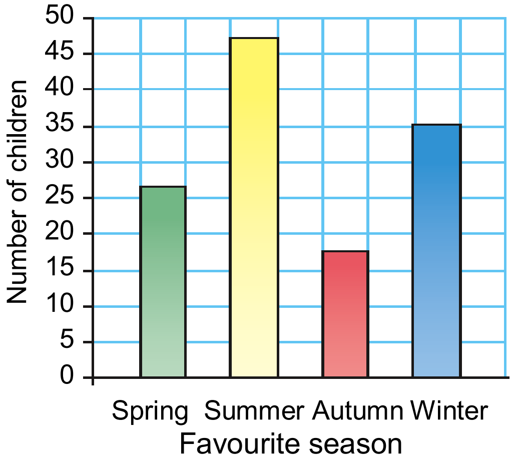
3. This chart tells how many people were shopping in four shops.

Shop	Number of shoppers
Shop 1	8
Shop 2	6
Shop 3	10
Shop 4	7

a) Draw a pictograph that uses a scale to show the data.

b) Explain your choice of scale.

4. This graph shows information about children's favourite seasons.



a) What is the scale of the graph?

b) Tell two pieces of information that you can read from the graph.

c) Tell two things you can conclude from the graph.

5. This chart shows how many biscuits the students in Karma's class ate this morning.

Number of biscuits	Number of students
0	20
1	12
2	9

a) Make a bar graph to show the data.

b) What scale did you use? Explain your choice.

c) What does the graph show about the number of biscuits the students ate? Tell three or more things.

6. Why is it important for the lines of a bar graph to be the same distance apart?

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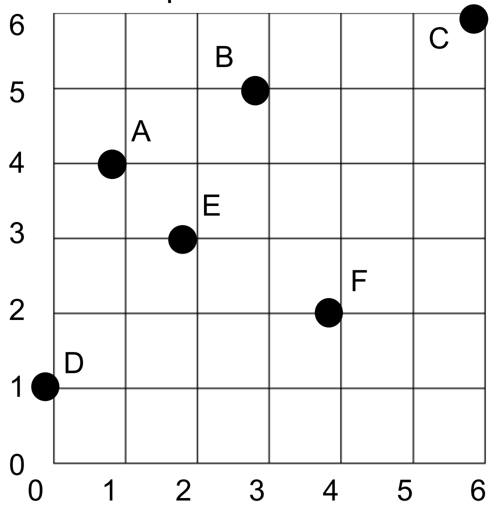
7. Name each point on the grid using an ordered pair.



8. Draw a grid like the grid in **question 7**. Plot each point.

a) (1, 3) **b)** (4, 1)

c) (5, 3) **d)** (3, 6)

9. Use your grid from **question 8**. Draw a rectangle that has one vertex at (2, 3). Tell where the other vertices might be.

10. What is the mean of each set of data?

a) 17, 12, 4

b) 13, 7, 15, 25

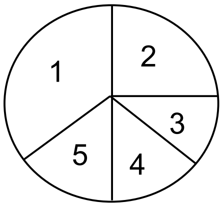
c) 6, 12, 1, 13

11. Suppose you put three red cubes and five blue cubes in a bag. Then you take out a cube ten times, putting it back each time.

a) Predict if you will take out more reds or more blues.

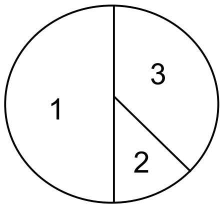
b) Do an experiment to test your prediction. Record your results. What happened?

12. Predict which number you will spin most often with this spinner. Spin Spinner X 20 times to test your prediction. Record your results in a chart. What happened?



Spinner X

13. a) Which spinner would you choose if you wanted to spin a 3, Spinner X above or Spinner Y below? Why?



Spinner Y

b) Test your prediction. What happened?

14. Roll a die 10 times and record your results.

a) Use a fraction to describe the probability of rolling a 2 or a 4.

b) Is it closer to 0, to $\frac{1}{2}$, or to 1?

c) How likely is it to roll a 2 or a 4?

15. If something is very likely, which probability below you use to describe it? Why?

$\frac{2}{10}$ $\frac{4}{5}$ $\frac{7}{12}$

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GLOSSARY

Instructional Terms

calculate: Figure out the number that answers a question; compute

classify: Sort things into groups according to a rule and name the groups; e.g., classify triangles as equilateral, isosceles, and scalene

compare: Look at two or more objects or numbers and identify how they are the same and how they are different; e.g., compare the numbers 6.5 and 5.6; compare the size of the students' feet; compare two shapes

create: Make your own example or problem

describe: Tell, draw, or write about what something is or what something looks like; tell about a process in a step-by-step way

determine: Decide what the answer or result is for a calculation, a problem, or an experiment

draw: 1. Show something using a picture **2.** Take out an object without looking; e.g., draw a card from a deck

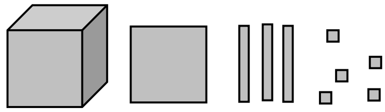
estimate: Use what you know to make a sensible decision about an amount; e.g., estimate how long it takes to walk from your home to school; estimate how many leaves are on a tree; estimate the sum of 3210 + 789

explain (your thinking): Tell what you did and why you did it; write about what you were thinking; show how you know you are right

explore: Investigate a problem by questioning and trying new ideas

measure: Use a tool to tell how much something is; e.g., use a ruler to measure a height or distance; use cubes to measure volume

model: Show an idea using objects, pictures, words, and/or numbers; e.g., you can model 1135 using base ten blocks:



predict, or make a prediction: Use what you know to figure out what is likely to happen; e.g., predict the number of times you will roll a 2 when you roll a die 30 times

show (your work): Record all the calculations, drawings, numbers, words, or symbols that you used to calculate an answer or to solve a problem

sketch: Make a quick drawing to show your work; e.g., sketch a picture of a field with given dimensions

solve: 1. Find an answer to a problem **2.** Find a missing number in a calculation; e.g., to solve $3 + \blacksquare = 7$, you find the value of $\blacksquare$, which is 4 because $3 + \underline{\mathbf{4}} = 7$

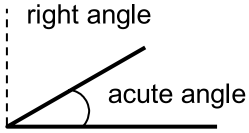
strategy: A way to solve a problem; e.g., to add 199 + 199 mentally, you can use a mental math strategy like this:

$$\begin{aligned} 199 + 199 &= 200 + 200 - 2 \\ &= 400 - 2 \\ &= 398 \end{aligned}$$

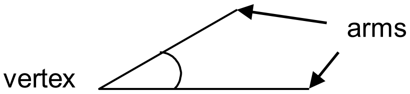
Definitions of Mathematical Terms

A

acute angle: An angle less than a right angle; e.g.,

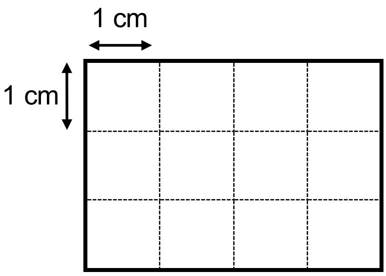


angle: A figure formed by two arms and a vertex; the measure of an angle is the amount that one arm is turned away from the other arm



anticlockwise: Another name for counterclockwise See *counterclockwise*

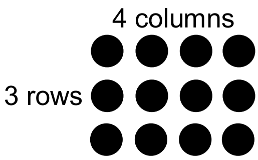
area: The total number of square units (often square centimetres or square metres) needed to cover a shape; e.g., the rectangle below has an area of 12 cm^2



The area of this rectangle is 12 cm^2.

arm (of an angle): See *angle*

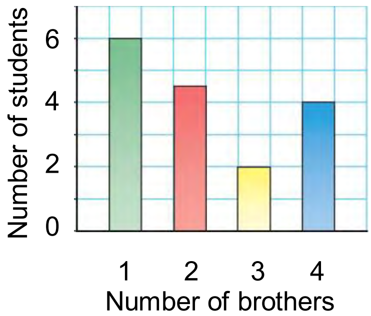
array: A rectangular arrangement of items in rows and columns; e.g., this array has 3 rows and 4 columns



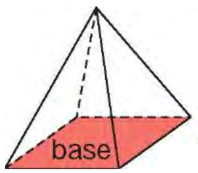
B

bar graph: A graph that uses bars of certain lengths to represent the number of data values in different categories of a set of data; e.g.,

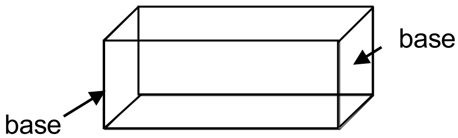
How Many Brothers Do We Have?



base: The single face that determines the name of a pyramid or one of the two faces that determine the name of a prism; e.g.,



A square-based pyramid



A square-based prism

categories: A set of data can be sorted into groups or categories; the four categories used in the bar graph above are different numbers of brothers; the three categories used in the pictograph on **page 235** are different sports or games

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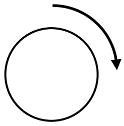
C

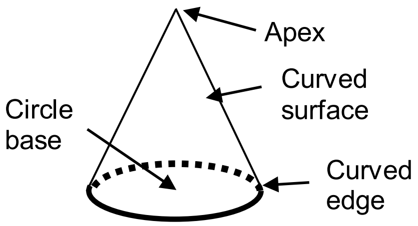
clockwise (cw): The direction that the hands of a clock move; used to describe the direction of a turn



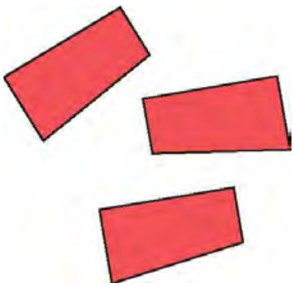
column (in an array): See *array*

conclusion: When you make a conclusion about a set of data, you compare and combine data values to make a decision about what the data set tells you; e.g., from the bar graph on **page 230**, you could conclude that more students surveyed had 1 brother than any other number of brothers

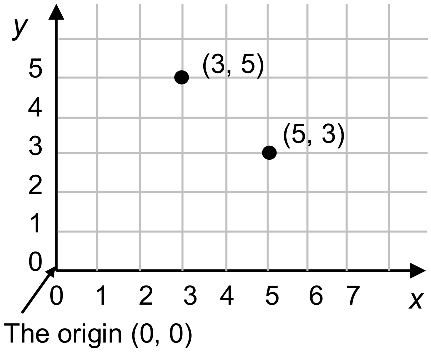
cone: A 3-D shape with one circle base, one curved edge, a curved surface, and a point called the apex



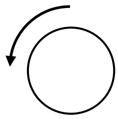
congruent: Identical in size and shape; shapes, side lengths, and angles can be congruent; e.g., these three shapes are congruent



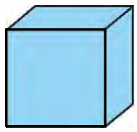
coordinate grid: A system of vertical and horizontal grid lines that is used to plot points; the grid lines are named by their distance from the origin; e.g., two points have been plotted on the coordinate grid below See *ordered pair*



counterclockwise (ccw): The direction opposite to the direction the hands of a clock move; used to describe the direction of a turn



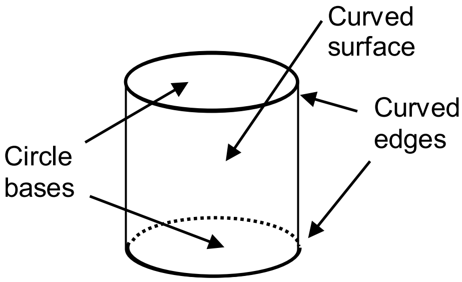
cube: A 3-D shape that has six congruent square faces



cuboid: Another name for a rectangle-based prism See *rectangle-based prism*

curved surface: A part of some 3-D shapes See *cone* and *cylinder*

cylinder: A 3-D shape with two congruent circle bases, one curved surface, and two curved edges

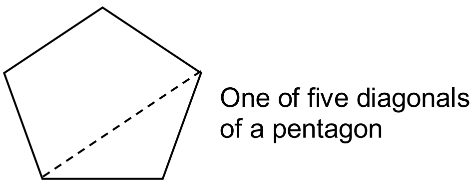


D

data: Information collected in a survey, in an experiment, or by observing; the word data is plural, not singular; e.g., a set of data can be a list of students' names and the numbers of their quiz marks

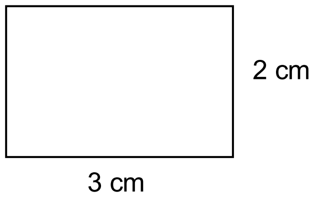
denominator: The number in a fraction that represents the total number of parts in a set or the number of parts the whole has been divided into; e.g., in $\frac{4}{5}$, the denominator 5 means the whole has 5 equal parts

diagonal: A line joining two vertices of a polygon that are not next to each other; e.g., this pentagon has five diagonals



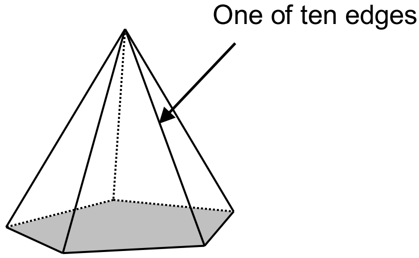
difference: The result of a subtraction; e.g., in 45 – 5 = 40, the difference is 40

dimension: The size or measure of an object, usually length (or width, height, depth, or breadth); e.g., the dimensions of this rectangle are 3 cm long by 2 cm wide

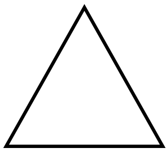


E

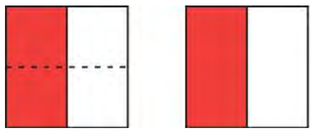
edge: A line where two faces of a 3-D shape meet; e.g., this pyramid has 10 edges



equilateral triangle: A triangle with three sides of equal length



equivalent fractions: Fractions that represent the same part of a whole or set; e.g., $\frac{2}{4}$ is equivalent to $\frac{1}{2}$



$$\frac{2}{4} = \frac{1}{2}$$

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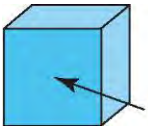
even number: A number in the skip counting sequence 0, 2, 4, 6, …; a number that can be divided by 2 without a remainder; e.g., 6 is an even number because 6 ÷ 2 = 3 with no remainder

expanded form: A way of writing a number that shows the place value of each digit; e.g., 1209 in expanded form is 1 × 1000 + 2 × 100 + 9 × 1 or 1 thousand + 2 hundreds + 9 ones

F

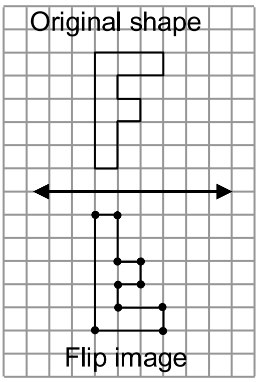
face: A 2-D shape that forms a flat surface of a 3-D shape; e.g., this cube has six square faces



fact family: A set of facts that share the same three numbers; e.g., here is the multiplication and division fact family for 3, 4, and 12:

3 × 4 = 12   4 × 3 = 12
12 ÷ 3 = 4   12 ÷ 4 = 3

flip: A motion that produces a mirror image of a shape; e.g., here is a flip of the F-shape across a horizontal mirror line:

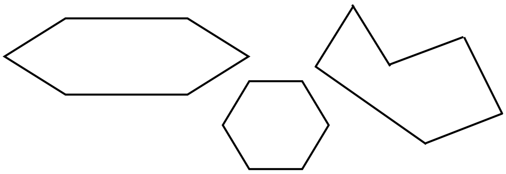


flip image: See *flip*

formula: A general rule stated in mathematical language; e.g., the formula for the area of a rectangle is Area = length × width or $A = l \times w$

H

hexagon: A six-sided polygon; e.g.,



Examples of hexagons

horizontal line: A line that goes right and left

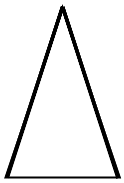
A horizontal line

See *vertical*

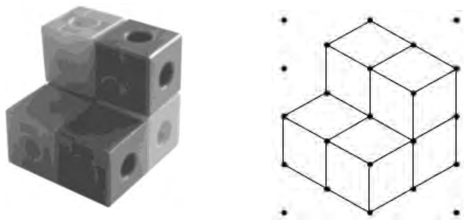
I

image: The new shape that you get after you flip, slide, or turn a shape; e.g., after a flip, the new shape is called the flip image See *original shape*, *flip*, *slide*, and *turn*

isosceles triangle: A triangle with two sides of equal length; e.g.,

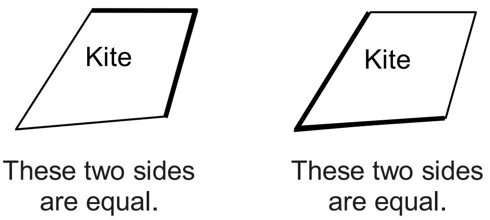


isometric drawing: A drawing of a 3-D shape, often done on special dot paper; e.g.,



K

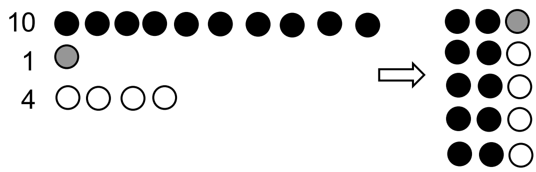
kite: A quadrilateral with two pairs of equal sides and no parallel sides; e.g.,



M

maximum data value: The greatest data value in a set of data; e.g., in the data set 2, 4, 8, 9, 12, the maximum value is 12

mean: A single number that can represent a set of data; e.g., in the data set 10, 1, and 4, the mean is 5 because you can rearrange all the data values into 3 equal groups, with 5 in each group



metre (m): A unit of measurement for length; e.g., 1 m is about the distance from a doorknob to the floor; 1000 mm = 1 m; 100 cm = 1 m; 1000 m = 1 km

minimum data value: The least data value in a set of data; e.g., in the data set 2, 4, 8, 9, 12, the minimum value is 2

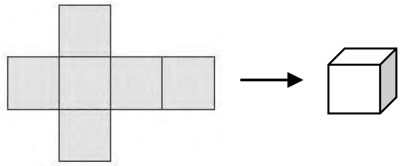
millimetre (mm): A unit of measurement for length; e.g., 1 mm is about the height of a stack of 10 sheets of paper; 10 mm = 1 cm; 1000 mm = 1 m

mirror line: See *flip*

mixed number: A number made up of a whole number and a fraction less than 1; e.g., $5\frac{1}{7}$

N

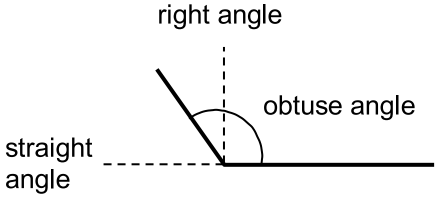
net: A 2-D pattern you can fold to create a 3-D shape; e.g., this is a net for a cube:



numerator: The top number in a fraction that shows the number of equal parts the fraction represents; e.g., in $\frac{4}{5}$, the numerator 4 means 4 out of 5 equal parts

O

obtuse angle: An angle greater than a right angle and less than a straight angle; e.g.,



ordered pair: A pair of numbers in a particular order that tell where a point is on a coordinate grid; e.g., the ordered pairs (3, 5) and (5, 3) describe the locations of two different points on a grid See *coordinate grid*

origin: A point on a coordinate grid represented by the ordered pair (0, 0) See *coordinate grid*

original shape: The shape you start with before you do a flip, slide, or turn See *image*, *flip*, *slide*, and *turn*

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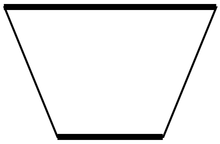
P

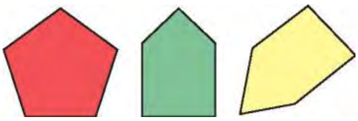
parallel sides: Side lengths of a polygon that go in the same direction; e.g., this trapezoid has two parallel sides



parallelogram: A quadrilateral with pairs of opposite sides that are parallel; e.g.,

These sides are parallel. And, these sides are parallel.

pentagon: A polygon with five sides; e.g.,



Examples of pentagons

perimeter: The boundary or outline of a 2-D shape; e.g., the perimeter of this rectangle is 10 cm because 2 cm + 2 cm + 3 cm + 3 cm = 10 cm

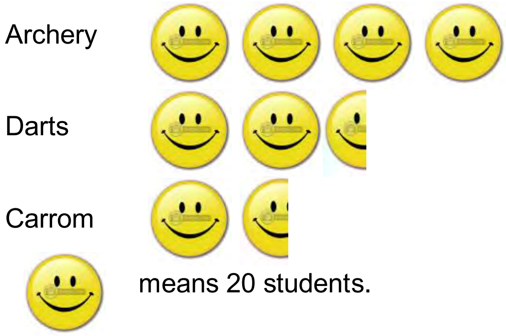
3 cm

2 cm  2 cm

3 cm

pictograph: A graph that uses the same picture or symbol to represent data; e.g., the pictograph below uses happy faces for symbols

Our Favourite Sport or Game

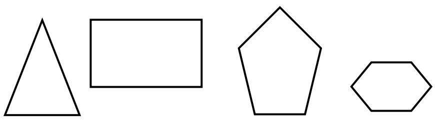


place value: The value of a digit depends on its place in the number; e.g., in the number 23.4,

- the digit 2 has a value of 2 tens or 20 because it is in the tens place
- the digit 3 has a value of 3 ones or 3 because it is in the ones place
- the digit 4 has a value of 4 tenths or 0.4 because it is in the tenths place

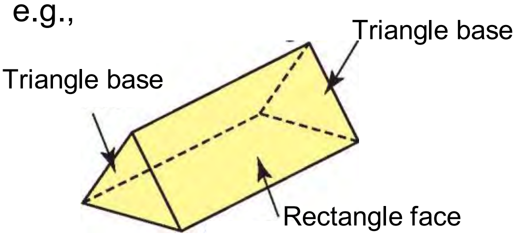
plot (a point): Locate a point on a coordinate grid using its ordered pair See *ordered pair* and *coordinate grid*

polygon: A closed 2-D shape with three or more sides; e.g., a triangle, a quadrilateral, a pentagon, and a hexagon are all polygons



Examples of polygons

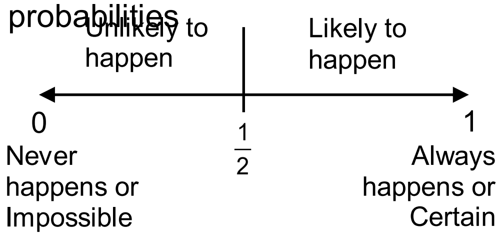
prism: A 3-D shape with two parallel opposite congruent bases; the other faces are rectangles; the shape of the two bases determines the name of the prism; e.g.,



A triangle-based prism

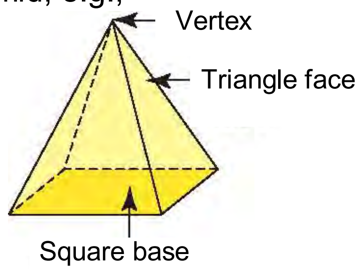
probability: A fraction from 0 (never happens) to 1 (certain to happen) that tells how likely it is that an event will happen; sometimes it is called chance or likelihood; e.g., when you roll a die, the probability of getting an even number is 3 out of 6 or $\frac{3}{6}$ because there are 3 even numbers out of 6 numbers that can be rolled

probability line: A number line from 0 to 1 used to compare probabilities



product: The result of multiplying numbers; e.g., in 5 × 6 = 30, the product is 30

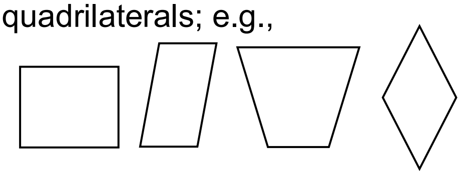
pyramid: A 3-D shape with one polygon base; the other faces are triangles that meet at a single vertex; the shape of the base determines the name of the pyramid; e.g.,



A square-based pyramid

Q

quadrilateral: A four-sided polygon; rectangles, parallelograms, trapezoids and rhombuses are all quadrilaterals; e.g.,

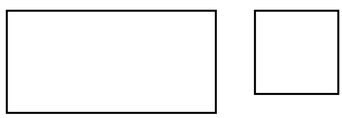


Examples of quadrilaterals

quotient: The result of dividing one number by another number; e.g., in 45 ÷ 5 = 9, the quotient is 9

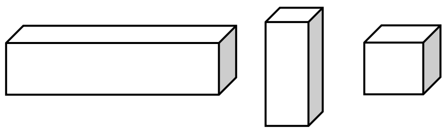
R

rectangle: A parallelogram with four right angles; a square is a special rectangle that has four equal sides; e.g.,



Examples of rectangles

rectangle-based prism: A prism with six rectangle faces; e.g.,



Examples of rectangle-based prisms

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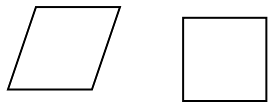
regroup: See *rename*

remainder: What is left over after dividing; e.g., 9 ÷ 2 = 4 has a remainder of 1 (9 ÷ 2 = 4 R 1)

rename (a number): Change a number to another form to make it easier to calculate or compare; e.g., you can rename 41,200 as 41 thousands + 2 hundreds or as 412 hundreds

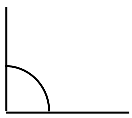
repeated addition: Adding the same number over and over again; you can write a repeated addition sentence as a multiplication; e.g., 3 + 3 + 3 + 3 = 4 × 3

rhombus: A parallelogram with all sides equal; a square is a special rhombus that has four right angles; e.g.,

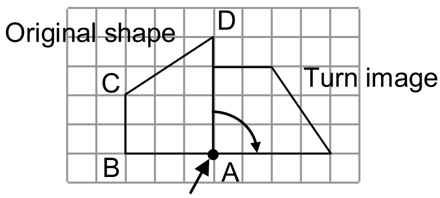


Examples of rhombuses

right angle: An angle that looks like a square corner



turn: A motion in which each point in a shape moves around a point (the turn centre) clockwise (cw) or counterclockwise (ccw); e.g., this is a $\frac{1}{4}$ turn cw turn of the trapezoid

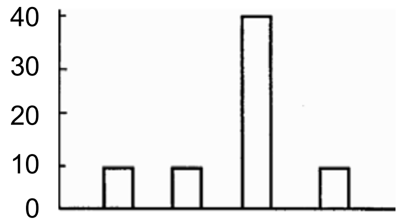


round a number: Change a number to make it easier to use for estimating; e.g., to estimate the sum 23 + 76, you might round 23 to 25 and round 76 to 75: 23 + 76 is about 25 + 75 = 100

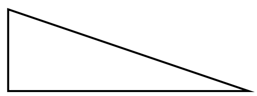
row (in an array): See *array*

S

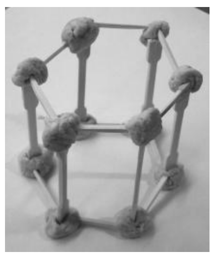
scale (on a graph): The scale of a graph tells you how to read the graph; e.g., the scale on the pictograph on **page 235** is 20; the scale on the graph below is 10



scalene triangle: A triangle with no congruent sides; e.g.,



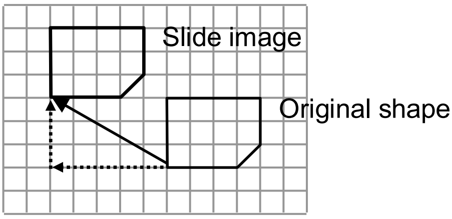
skeleton: A model of a 3-D shape that shows its edges and vertices



A skeleton of a hexagon-based prism

skip count: Count in a pattern by skipping the same number of numbers each time; e.g., 3, 6, 9, 12, ... is skip counting by 3

slide: A motion in which each point of a shape moves the same distance and in the same direction; e.g., the pentagon below has been slid diagonally in one motion but the slide is described as 5 units left and 3 units up

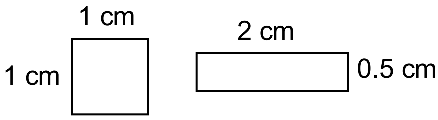


slide image: See *slide*

solution: **1.** The complete answer to a problem **2.** The value that makes an open sentence true; e.g., in ■ + 4 = 39, the solution is ■ = 35 because **<u>35</u>** + 4 = 39

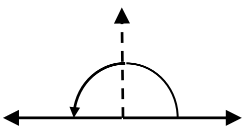
square: A rectangle with all sides equal; a square can also be defined as a rhombus with four right angles

square centimetre (cm^2): A unit of measure for area; a square that is 1 cm along each side has an area of 1 cm^2; e.g., both these shapes have an area of 1 cm^2



standard form (of a number): The usual way to write numbers; e.g., 23,650 is in standard form

straight angle: An angle that forms a straight line; a straight angle is the same as two right angles put together

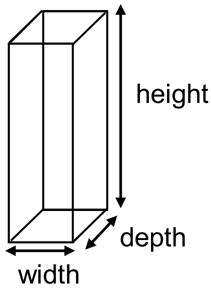


sum: The result of adding numbers; e.g., in 5 + 4 + 7 = 16, the sum is 16

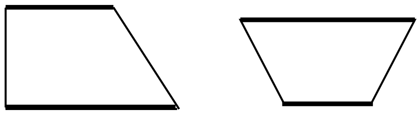
symbols on a pictograph: Pictures used to represent data on a pictograph See *pictograph*

T

three-dimensional (3-D) shape: A shape with three dimensions: width, depth, and height; e.g.,



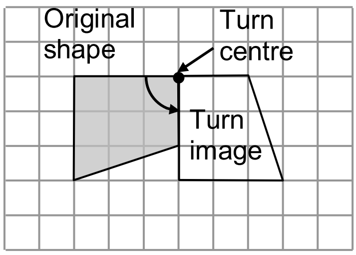
trapezoid: A quadrilateral in which one pair of opposite sides are parallel; an isosceles trapezoid is a special trapezoid that has two congruent sides; e.g.,



Trapezoid Isosceles trapezoid

triangle: A polygon with three sides

turn: A motion in which each point of a shape turns around a turn centre the same distance and in the same direction; e.g.,



turn centre: The point around which all points in a shape turn in a clockwise (cw) or counterclockwise (ccw) direction See *turn*

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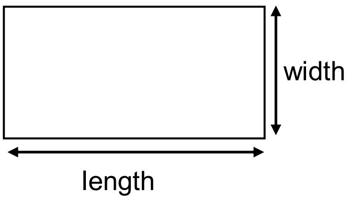
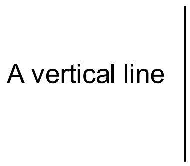
two-dimensional (2-D) shape: A shape with two dimensions: length and width (or breadth); e.g.,



vertex (vertices): The point at the corner of an angle or shape where two or more sides or edges meet; e.g., a cube has eight vertices, a triangle has three vertices, an angle has one vertex

vertical line: A line that goes up and down See *horizontal line*



volume: The amount of space that an object takes up; you can measure volume using cubes that are all the same size

W

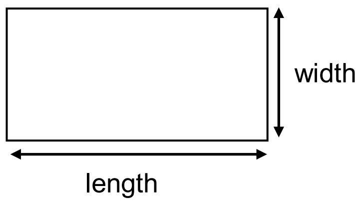
whole numbers: The set of numbers that begins at 0 and continues forever in this pattern: 0, 1, 2, 3, …

MEASUREMENT REFERENCE

Abbreviations and Symbols

Time	
minute	min
hour	h
Length	
millimetre	mm
centimetre	cm
metre	m
kilometre	km
Mass	
gram	g
kilogram	kg
Capacity	
millilitre	mL
litre	L
Area	
square centimetre	cm^2

Measurement Formula



Area of a rectangle = length × width

Metric Prefixes

Prefix	kilo × 1000	unit 1	centi $\times \frac{1}{100}$	milli $\times \frac{1}{1000}$
Example	*kilo*metre km	metre m	*centi*metre cm	*milli*metre mm
	1000 m	1 m	$\frac{1}{100}$ m	$\frac{1}{1000}$ m

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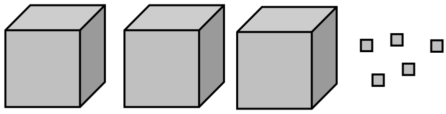
ANSWERS

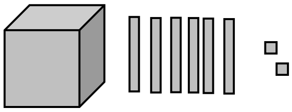
UNIT 1 NUMERATION, ADDITION, AND SUBTRACTION pp. 1–34

Getting Started — Skills You Will Need p. 2

1. a)



b)



2. a) 4 **b)** 3

3. a) 40 **b)** 4000
c) 400 **d)** 4

4. a) *Sample response*: 5402 **b)** 5778

5. a) 5 thousands + 9 hundreds + 2 ones
b) 6 thousands + 8 ones

6. a) **40** hundreds + **5** tens + **6** ones
b) **3** thousands + **10** tens + **8** ones

7. a) 899, 1245, 4217
b) 1037, 4923, 5101, 9764

8. a) 899 **b)** 1402 **c)** 876 **d)** 1123

9. a) 211 **b)** 26 **c)** 34 **d)** 827

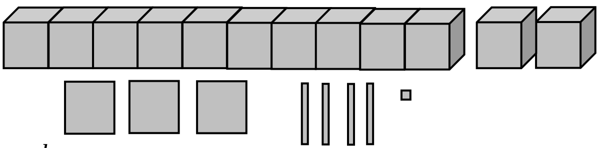
1.1.3 Place Value: 5-digit Numbers p. 10

1. a) 3 ten thousands + 2 thousands + 1 hundred + 2 tens + 1 one OR 30,000 + 2000 + 100 + 20 + 1
b) *Sample response*:

Ten thousands	Thousands	Hundreds	Tens	Ones
3	2	1	2	1

c) 32,121

2. a)



b) *Sample response*:

Ten thousands	Thousands	Hundreds	Tens	Ones
1	2	3	4	1

c) 1 ten thousand + 2 thousands + 3 hundreds + 4 tens + 1 one AND 10,000 + 2000 + 300 + 40 + 1

3. *Sample responses*:
a) 32,143
b) 10,432
c) 12,345

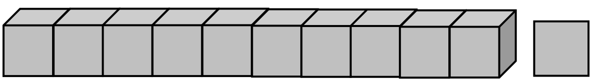
4. *Sample responses*:
a) 49,823
b) 49,723

5. *Sample responses*:
a) 21,113; 31,112; 11,213
b) 8 counters for each.
c) The sum is 8 for each.

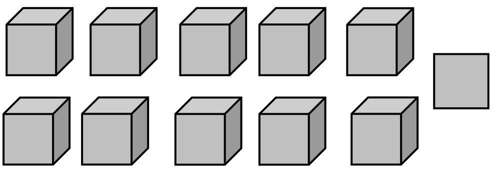
6. *Sample response*:
69,152 and 51,269

1.1.4 Renaming Numbers p. 14

1. a)

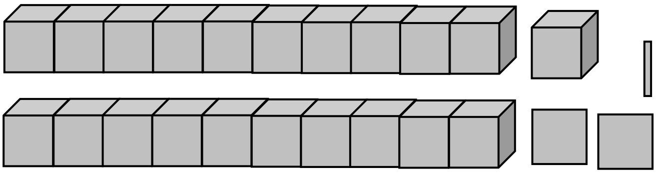


b)

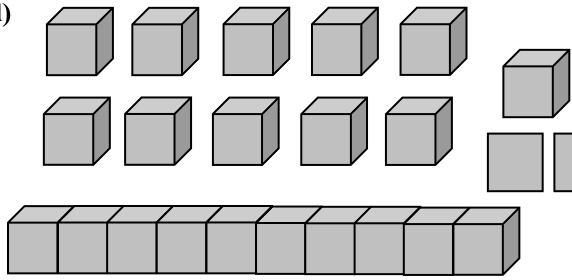


1.1.4 Renaming Numbers [Continued] p. 14

1. c)



d)



2. a) **30** thousands + **4** hundreds + **7** tens
b) **124** hundreds + **8** tens
c) 3 ten thousands + **10** thousands + **2** hundreds + **81** ones

3. a) 42,003
b) 51,070
c) 17,025
d) 48,000
e) 15,208

4. a) 121 boxes
b) 150 boxes
c) 162 boxes (with 80 pencils left over)
d) 82 boxes (with 45 pencils left over)

5. a) 130 m

6. a) 27 km

1.1.5 Comparing and Ordering Numbers p. 17

1. a) 42,978 **b)** 51,302
c) 82,135 **d)** 53,299

2. a) 10,003 < 13,287 < 15,149
b) 7820 < 28,147 < 32,875

3. The number of homes with 3 or 4 people

4. *Sample response*:
15,900; 16,000; 16,001

5. *Sample responses*:
a) 70,124 **b)** 10,247 **c)** 24,107 **d)** 14,072

6. a) 2 (ten thousands)
b) It could have 0 or 1 thousand

1.2.1 Adding and Subtracting Mentally p. 22

1. a) 9000 **b)** 6839

2. a) 4126

b) 5202

4. a) 2100 – 1476 = 624 **b)** 1476 + 624 = 2100

5. *Sample response*: 3999

6. *Sample response*: 2999

1.2.2 Estimating Sums and Differences p. 26

1. *Sample responses*:
a) About 70,000 **b)** About 70,000
c) About 60,000 **d)** About 58,000

2. *Sample responses*:
a) About 25,000 **b)** About 6000
c) About 35,000 **d)** About 60,000

3. *Sample response*: 16,999 and 29,999

4. *Sample response*: 41,999 and 30,121

5. *Sample response*: 21,999 and 14,111

1.2.4 Adding 5-digit Numbers — p. 29

1. a) 71,061 **b)** 64,467 **c)** 90,700

2. B

3. a) 61,127 **b)** 73,000

4. 97,568 insects

5. *Sample response*:
17,397 + 29,999; 17,398 + 29,998; 17,399 + 29,997

6. a)
$$\begin{array}{r} 78{,}\mathbf{123} \\ +\ \underline{\mathbf{14{,}25}1} \\ 9\mathbf{2}{,}374 \end{array}$$

b)
$$\begin{array}{r} 17{,}3\mathbf{2}6 \\ +\ \underline{\mathbf{34{,}5}91} \\ 5\mathbf{1}{,}917 \end{array}$$

7. 23,345, 23,355, and 23,365

1.2.3 Subtracting 5-digit Numbers — p. 32

1. a) 15,444 **b)** 13,178 **c)** 38,835

2. *Sample response*: 20,500; 20,501; 20,502

3. 36,659 km

4. a)
$$\begin{array}{r} 42{,}8\mathbf{1}6 \\ -\ \underline{15{,}\mathbf{3}78} \\ \mathbf{2}7{,}438 \end{array}$$

b)
$$\begin{array}{r} 30{,}\mathbf{0}41 \\ -\ \underline{\mathbf{17}{,}\mathbf{38}5} \\ 12{,}65\mathbf{6} \end{array}$$

5. C

6. a 5-digit difference

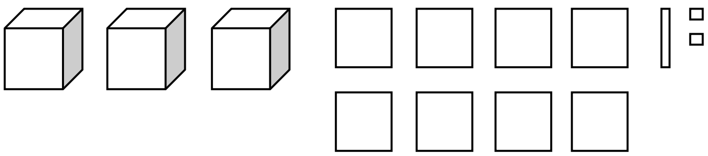
7. *Sample response*:
I would add up.

CONNECTIONS: A Different Way to Subtract — p. 32

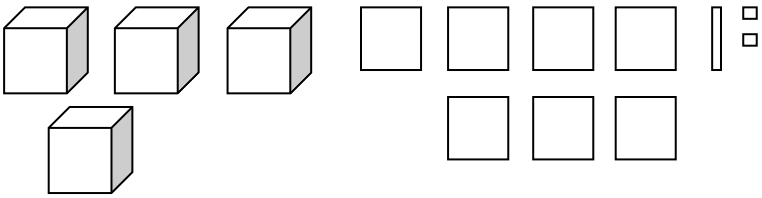
1. 2106 **2.** 175 **3.** 4363

UNIT 1 Revision — p. 33

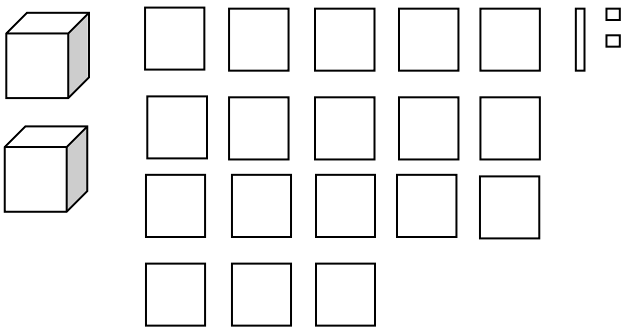
1. a)



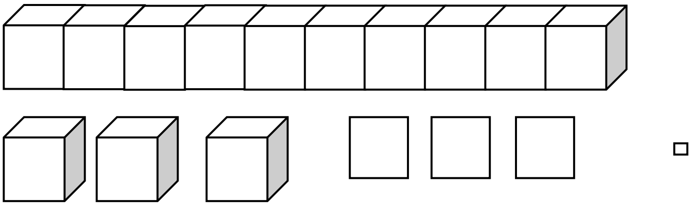
b) *Sample response*: 4712



c) *Sample response*: 23 blocks



2. a)



b) 10,000 + 3000 + 300 + 1
c) 1 ten thousand + 3 thousands + 3 hundreds + 1 one
d)

Ten thousands	Thousands	Hundreds	Tens	Ones
1	3	3	0	1

3. *Sample responses*:
a) 40,504 **b)** 52,301 **c)** 94,121

4. a) **534** hundreds + **17** ones
b) **16** thousands + **7** ones
c) **2** ten thousands + **13** hundreds + **8** tens + **9** ones

5. *Sample response*:
578 hundreds + 1 ten
5 ten thousands + 78 hundreds + 1 ten

6. 412 full trips

7. 34 km and a bit more

8. a) **4**4,217 > **3**8,217
b) **3**1,384 > **3**0,562 or **4**1,384 > **4**0,562 or **4**1,384 > **3**0,562

9. a) 8945; 23,179; 30,045
b) 8976; 16,127; 18,000; 99,434

11. *Sample response*:
23,219; 24,000; 24,100;
24,200; 24,500; 25,000

12. a) 4125 + 3897 = 8022
b) 6225 + 4875 = 11,100
c) 8120 – 3798 = 4322
d) 6245 – 3512 = 2733

13. D

14. a) 80,587 **b)** 59,504
c) 21,493 **d)** 32,832

15. a) 49,357 **b)** 12,913

UNIT 2 MULTIPLICATION AND DIVISION FACTS pp. 35–66

Getting Started — Skills You Will Need p. 36

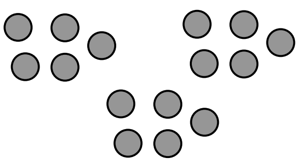
1. a) 4 + 4 + 4 + 4 + 4 + 4 **b)** 7 + 7 + 7
c) 9 + 9 **d)** 6 + 6 + 6 + 6

2. a) It is an array with 3 rows and 4 columns.
b) There are 4 groups of 3 diamonds.
c) There are 4 jumps of 3 spaces.

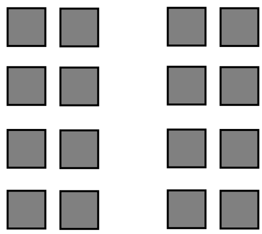
3. *Sample response*: 12 ÷ 3 = 4

4. A, C, E, F

5. *Sample responses*:
a)



b)



6. a) 24 **b)** 7 **c)** 24

7. a) 42 **b)** 45 **c)** 6 **d)** 8

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2.1.1 Multiplying by Skip Counting p. 40

1. a) 24 **b)** 15 **c)** 18 **d)** 24

2. a) 7 × 2 = 14 **b)** 6 × 3 = 18 **c)** 4 × 6 = 24

4. 25 books

5. 48 legs

6. a) Dorji: 9 apples, Tashi: 6 apples, Tenzin: 9 apples

6. b) 24 apples

7. He might have skip counted by 2s (or 3s, 4s, or 6s).

9. *Sample response*:
I choose to count by the second number.
I stop when I have said as many numbers as the first number.

2.1.2 Multiplying Using Arrays pp. 43–44

1. a) 3 × 6 = 18 **b)** 4 × 3 = 12 **c)** 3 × 8 = 24

2. a) 6 × 3 = 18 for a)
3 × 4 = 12 for b)
8 × 3 = 24 for c)

3. a)
X X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X X X X

b)
X X X X X X X
X X X X X X X
X X X X X X X

c)
X X X X X X
X X X X X X

d)
X X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X X X X

4. 7 × 4 = 28 or 4 × 7 = 28

5. *Sample responses*:
a)
X X X X X X X X
3 × 8 = 24 X X X X X X X X
X X X X X X X X

X X X X X X X X
3 × 8 = 24 X X X X X X X X
X X X X X X X X

So 6 × 8 = 24 + 24 = 48.

b)
X X X X X X X | X X
X X X X X X X | X X
X X X X X X X | X X
X X X X X X X | X X

4 × 7 = 28 + 4 × 2 = 8
So 4 × 9 = 28 + 8 = 36.

6. *Sample responses*:
a)
X X X X X X
X X X X X X
X X X X X X
X X X X X X

X X X X X X X X
X X X X X X X X
X X X X X X X X

b) 4 × 6 = 24 and 3 × 8 = 24

7. a) They all have only one column.

2.1.4 Relating Facts by Doubling and Halving p. 50

1. a) 54 **b)** 28 **c)** 72 **d)** 56

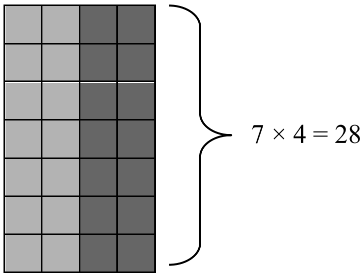
2. a) 45 **b)** 25

3. a) i) 3 × 8 = 24
ii) 3 × 10 = 30
b) i) 3 × 8 → 6 × 4 = 24
ii) 3 × 10 → 6 × 5 = 30

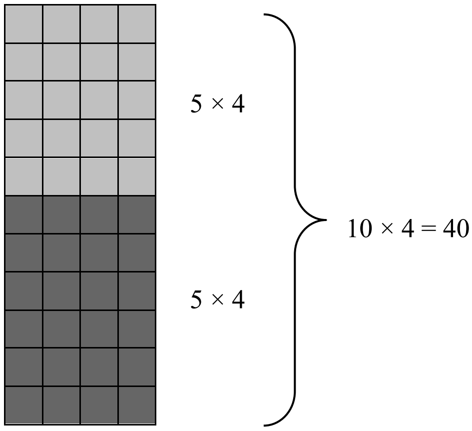
2.1.4 Relating Facts by Doubling and Halving [Continued] p. 50

4. *Sample responses*:

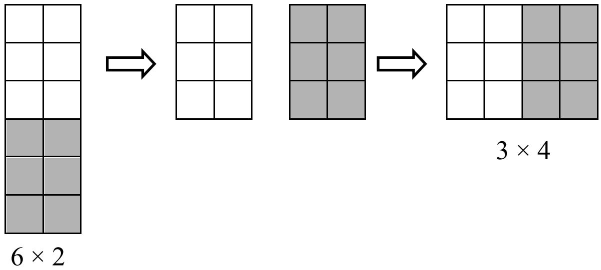
a) $7 \times 2 + 7 \times 2$



b)

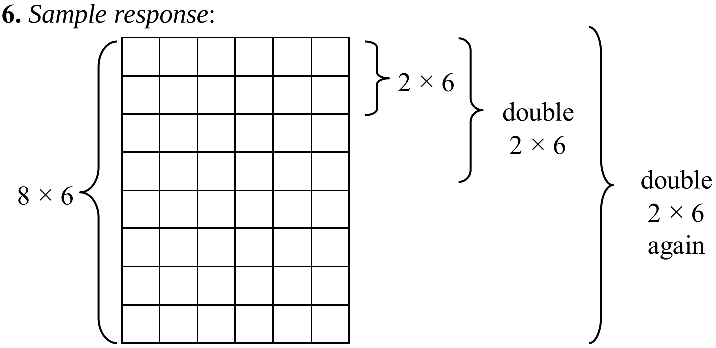


c)



5. a) 6 children **b)** 12 children and 24 children

6. *Sample response*:



8. The row for 2 is double the row for 1. The row for 4 is double the row for 2.
The row for 6 is double the row for 3. The row for 8 is double the row for 4.

2.1.5 Multiplying by 7, 8, and 9 p. 53

1. a) 63 **b)** 54 **c)** 48 **d)** 64

2. a) 9 **b)** 18 **c)** 27
d) 36 **e)** 45 **f)** 54

3. *Sample responses*:
a) The ones digit goes down by 1 while the tens digit goes up by 1.
b) $8 \times 9 = 72$

5. a) 8, 16, 24, 32, 40, 48, 56, 64
b) 8, 7, 6, 5, 4, 3, 2, 1
c) The numbers decrease by 1 each time.

6. 24 bananas

7. *Sample response*: The teacher grouped our class into groups of 5. There are 8 groups. How many students are there? ($8 \times 5 = 40$)

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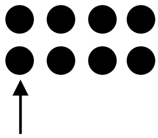
CONNECTIONS: Multiplication Fact Digit Circles p. 55

You get a pentagon for 4, 6, and 8; a 10-sided shape for 7 and 9, and a vertical line for 5.

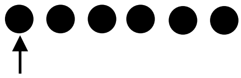
2.2.1 Division as Sharing p. 58

1. a) 8 ÷ 4 = 2



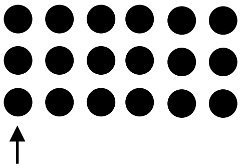
one share is 2

b) 6 ÷ 6 = 1



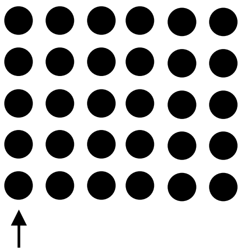
one share is 1

c) 18 ÷ 6 = 3



one share is 3

d) 30 ÷ 5 = 6

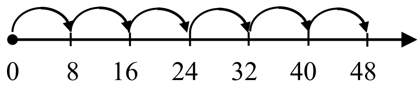


one share is 6

2. 5 students

3. a) 5 toys
b) 4 toys

5. a)



b) 8

6. *Sample response*:
There were 30 momos and 5 people eating them. How many momos should each person get if they each get the same amount?

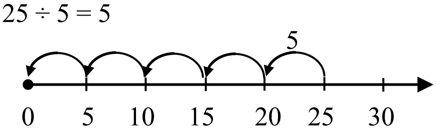
7. *Sample response*:
6, 12, 18, or 24 items

8. *Sample response*:
12, 24, or 36 tins

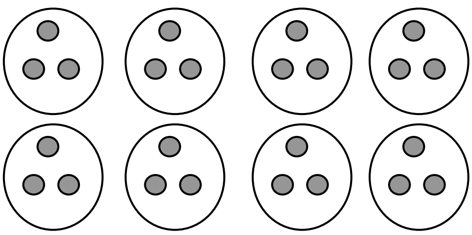
9. *Sample response*:
Sharing 36 counters into 9 equal groups
Finding what to multiply 9 by to get 36:
9 × ? = 36

2.2.2 Division as Grouping p. 60

1. *Sample responses*:
a) 25 ÷ 5 = 5



b) 24 ÷ 3 = 8



c) 36 ÷ 9 = 4

Group 1	X	X	X	X	X	X	X	X	X
Group 2	X	X	X	X	X	X	X	X	X
Group 3	X	X	X	X	X	X	X	X	X
Group 4	X	X	X	X	X	X	X	X	X

2. 4 cars

3. 7 nights

4. *Sample response*: 6 teams of 5, 5 teams of 6, 3 teams of 10, 10 teams of 3

5. 32 ÷ 8 = 4, 56 ÷ 7 = 8, 24 ÷ 6 = 4

7. *Sample response*:
• 72 students are divided up into groups of 9. How many groups are there? (8 groups)
• 72 students are formed into 9 groups. How many students are in each group? (8 students)

2.2.3 Multiplication and Division Fact Families p. 62

1. $9 \times 7 = 63$
$7 \times 9 = 63$
$63 \div 7 = 9$
$63 \div 9 = 7$

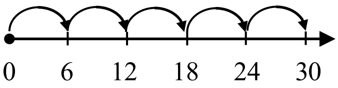
2. a) $5 \times 5 = 25$ and $25 \div 5 = 5$
b) $4 \times 8 = 32$
$8 \times 4 = 32$
$32 \div 4 = 8$
$32 \div 8 = 4$

4. a) $9 \times 4 = 36$ and $36 \div 4 = 9$
b) $5 \times 5 = 25$ and $25 \div 5 = 5$

5. a) $5 \times 9 = 45$ and $45 \div 9 = 5$
b) $42 \div 6 = 7$ and $7 \times 6 = 42$

8. Yes

UNIT 2 Revision pp. 65–65

1. a) $4 \times 6 = 24$
b)


2. 40 books

3. b) $5 \times 7 = 35$

4. $2 \times 5 = 10$

5. $3 \times 9 = 27$ or $9 \times 3 = 27$

6. a)

X X X X X X X X X
X X X X X X X X X
X X X X X X X X X $5 \times 9 = 45$
X X X X X X X X X
X X X X X X X X X

b)
X X X X X X
X X X X X X
X X X X X X $6 \times 6 = 36$
X X X X X X
X X X X X X
X X X X X X

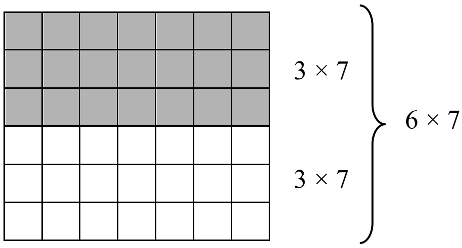
7. a) and b) *Sample responses*:

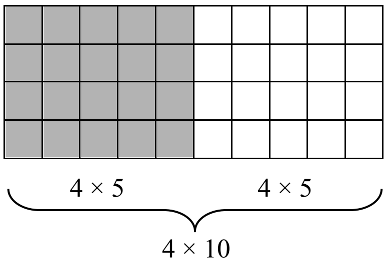
X X X X X X | X X X
X X X X X X | X X X
X X X X X X | X X X
X X X X X X | X X X
X X X X X X | X X X
$5 \times 6 = 30$ | $5 \times 3 = 15$
$5 \times 9 = 30 + 15 = 45$

7. a) and b) [Continued] *Sample responses*:

X X X X X X
X X X X X X $3 \times 6 = 18$
X X X X X X
X X X X X X
X X X X X X $3 \times 6 = 18$
X X X X X X

$6 \times 6 = 18 + 18 = 36$

9. *Sample responses*:
a)


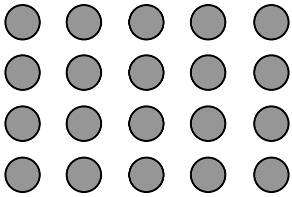
b)


10. a) 48 **b)** 40

12. *Sample responses*:
a) I could use 7×4 and double it **b)** 56

13. *Sample responses*:

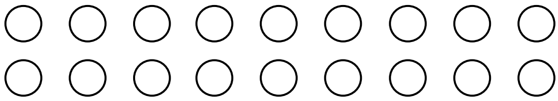
a) P1 P2 P3 P4 P5



$20 \div 5 = 4$

P = person

b) P1 P2 P3 P4 P5 P6 P7 P8 P9



$18 \div 9 = 2$

14. $18 \div 2 = 9$ pairs

15. *Sample responses*:
a) Six students are sharing 30 sweets. How many candies can each student have?
b) The teacher is dividing 30 students into groups of 6. How many groups can the teacher make?

16. 9 triangles

17. 5 days

18. $2 \times 8 = 16$
$8 \times 2 = 16$
$16 \div 2 = 8$
$16 \div 8 = 2$

UNIT 3 MULTIPLICATION AND DIVISION WITH GREATER NUMBER pp. 67–102

Getting Started — Skills You Will Need p. 68

1. a) 0 **b)** 7 **c)** 36
e) 32 **f)** 36 **g)** 0

2. a) i) 78 **ii)** 273 **iii)** 210
b) *Sample responses*:
i) |... |... |... |... |... |...

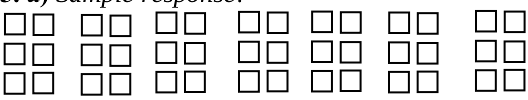
ii) |||......... |||......... |||......... |||......... |||......... |||......... |||.........

iii) ||||.. ||||.. ||||.. ||||.. ||||..

3. A

4. a) 5 × [ ] = 50 **b)** 4 × [ ] = 49 **c)** 9 × [ ] = 98

5. a) *Sample response*:



6. a) 4 **b)** 8 **c)** 0 **d)** 1
e) 9 **f)** 7 **g)** 9 **h)** 8

7. a) $8 \times 6 = 48$ **b)** $48 \div 8 = 6$

3.1.1 Multiplying by Tens and Hundreds p. 73

1. a) 70 **b)** 230 **c)** 800 **d)** 5300
e) 200 **f)** 360 **g)** 2800 **h)** 8000

2. 20 trips

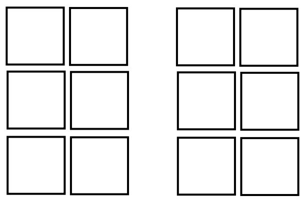
3. a) 16 **b)** 15 **c)** 12
d) 4 **e)** 25 **f)** 100

4. 4000 times

5. *Sample responses*:
a) 8×100 or 4×200 **b)** 10×56 or 20×28

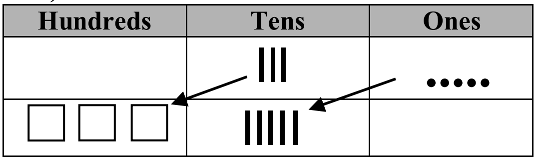
6. a) 400 times **b)** 800 times
c) 1200 times **d)** 3200 times

7. *Sample responses*:
a)

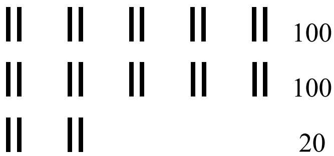


3.1.1 Multiplying by Tens and Hundreds [Continued] p. 73

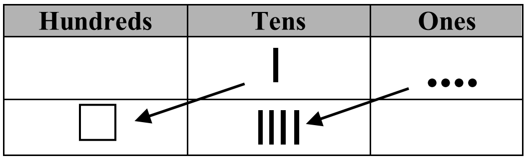
7. b)



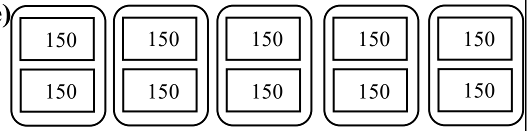
c)



d) 7 × 20 = 7 × 2 tens = 14 tens = 14 × 10



e)



3.1.2 Estimating Products p.75

1. *Sample responses*:
a) About 1600 **b)** About 3600
c) About 2500 **d)** About 2500

2. *Sample responses*:
a) About 4000 **b)** About 1400
c) About 4500 **d)** About 900

3. *Sample responses*:
a) 5 × 600 = 3000, 6 × 500 = 3000
b) 9 × 700 = 6300, 10 × 650 = 6500

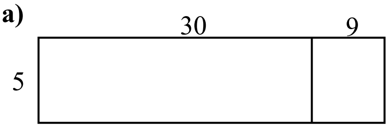
4. *Sample responses*:
a) 421 is between 400 and 500.
7 × 400 = 2800 and 7 × 500 = 3500, so 7 × 421 is between 2800 and 3500.
b) 9 < 10, so 9 × 627 < 10 × 627 = 6270.
c) 8 × 300 = 2400 and 8 × 400 = 3200.
352 is about halfway between 300 and 400, so 8 × 352 is about halfway between 2400 and 3200. The halfway mark is less than 3000.

5. *Sample response*: 42 × 100, 42 × 102, 42 × 104

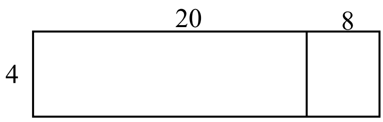
6. *Sample response*: There are 6 schools, each with about 525 students. About how many students are there in total?

3.1.3 Multiplying Using Rectangles pp. 78–79

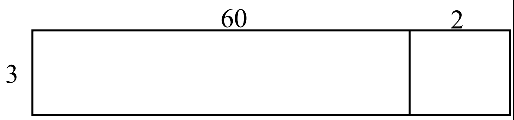
1. a)



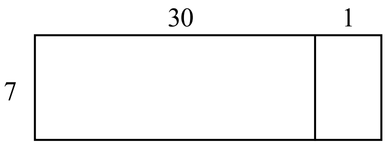
b)



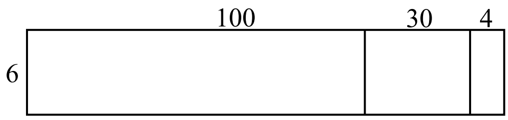
c)



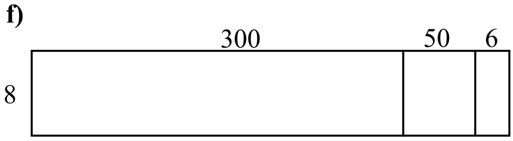
d)



e)



f)



2. a) 318 **b)** 185 **c)** 1704

3. a) 140 **b)** 108 **c)** 942 **d)** 528

4. a) 160; 20
184

b) 360; 9
72; 9
432

c) 560
49; 7
609

d) 1500; 300
300
1810

5. a) 111 **b)** 464 **c)** 465
d) 336 **e)** 3078 **f)** 1264

6. There are more flowers.

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3.1.4 Multiplying a 3-Digit Number by a 1-Digit Number p. 83

1. a) 2436 **b)** 1820

2. a) 5 × 228 = 1140 **b)** 4 × 318 = 1272

3. a)
$$\begin{array}{r} 300 + 20 + 8 \\ \times \quad 6 \\ \hline \underline{\mathbf{48}} \\ 120 \\ +\ 1800 \\ \hline \mathbf{1968} \end{array}$$

b)
$$\begin{array}{r} 400 + 30 + 9 \\ \times \quad 9 \\ \hline \underline{\mathbf{81}} \\ 270 \\ +\ 3600 \\ \hline \mathbf{3951} \end{array}$$

4. A. 1476 **C.** 1794 **D.** 2720

5. Nu 720

6. a) B and D **b)** B

7. *Sample response*: There were 382 students. Each had 7 pebbles. How many pebbles were there altogether? (2674 pebbles)

8. 524 people

9. a) 2 **b)** 4 **c)** 3

10. 8 × 642

3.2.1 Dividing Tens and Hundreds p. 88

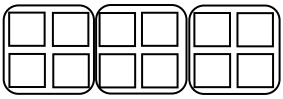
1. 70

2. a) 300 ÷ 6 = 50 **b)** 2000 ÷ 5 = 400
c) 3200 ÷ 4 = 800 **d)** 480 ÷ 8 = 60

3. a) They are equal. **b)** 280 ÷ 4 is greater.

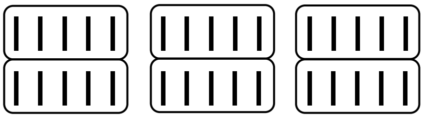
4. a) 40 **b)** 900 **c)** 80 **d)** 700

5. *Sample response*:



6. *Sample response*:
240 ÷ 6; 200 ÷ 5; 280 ÷ 7

7. *Sample response*:



3.2.2 Estimating Quotients p. 90

1. a) *Sample response*: 280
b) About 70 birds

2. *Sample responses*:
a) About 100 **b)** About 80
c) About 90 **d)** About 20
e) About 90 **f)** About 70

3. *Sample response*: About 35 plates;

4. a) 8 or 9 **b)** 6 or 7 **c)** 2
d) 3 **e)** 6 **f)** 2

5. No

6. *Sample response*: About 18 fish

8. *Sample response*: There are 3 people sharing Nu 257 and I want to know about how much money each person will get.

3.2.3 Dividing by Multiplying and Subtracting p. 92

1. a) 28 teams **b)** 23 teams

2. *Sample responses*:
a) 31 **b)** 111
c) 128 **d)** 77 R 1
e) 228 **f)** 74 R 2

3. a) 41 R 2 windows
b) There are 2 window panes left over.

4. 121 notes

5. 93 squares

6. 84 groups

3.2.4 Dividing in Parts — p. 94

1. 131 stamps

2. *Sample responses*:
a) 360 + 18 **b)** 140 + 35 + 3
c) 500 + 100 + 45 + 3 **d)** 600 + 210 + 2
e) 630 + 81 + 4 **f)** 400 + 160 + 4 + 2

3. a) 63 **b)** 25 R 3 **c)** 129 R 3
d) 270 R 2 **e)** 79 R 4 **f)** 141 R 2

4. *Sample response*:
92 g with 2 g of meat left over.

5. Yes; *Sample response*:
There is 1 fewer group of 3 in 297 than in 300 since 300 – 3 = 297.

6. *Sample response*:
594 = 600 – 6; 594 = 300 + 270 + 24

3.2.5 Dividing by Sharing — p. 99

1. a) 40 m **b)** 50 m **c)** 25 m

2. a) 67 R 1 **b)** 57
c) 73 R 4 **d)** 205 R 2

3. a) *Sample response*: About 30 sha balay
b) 29 R 5
c) *Sample response*: I would give 1 extra sha balay to 5 of the families.

4. *Sample response*:

154 R 1

$$4\overline{)\,400+200+16+1}\quad\text{with quotient } 100+\ 50+\ 4+0$$

$$\begin{array}{r} 154\ \text{R}\ 1 \\ 4\overline{)617} \\ -\underline{400} \\ 217 \\ -\underline{200} \\ 17 \\ -\ \underline{16} \\ 1 \end{array}$$

5. a) 70 R 7 **b)** 79 R 1 **c)** 56 R 3

6. a) Her sister's friends
b) Tshering's friends: 35 momos
Her sister's friends: 39 momos

7. 83 people

8. 259 fish

9. *Sample response*:
a) 100 g of meat is divided into 3 packages. How many grams of meat are in each package?
b) 100 students are divided into groups of 3. How many groups are there?

10. *Any of the following numbers*:
213, 220, 227, 234, 241, 248, 255, 262, 269, 276

CONNECTIONS: When do Remainders Change? — p. 100

1. a) By 2: The remainder changes.
By 3: The remainder is always 1.
b) By 2: The remainder changes.
By 3: The remainder is always 2.
c) By 2: The remainder changes.
By 3: The remainder is always 0.

2. *Sample responses*:
a) 417 ÷ 9 = 46 R 3
b) 471 ÷ 9 = 52 R 3; No.
c) 714 ÷ 9 = 79 R 3; No.

3. *Sample responses*:
a) 424 ÷ 4 = 106 R 0; 442 ÷ 4 = 110 R 2; the remainder changes.
b) 35 ÷ 5 = 7 R 0; 53 ÷ 5 = 10 R 3; the remainder changes.
c) 522 ÷ 6 = 87 R 0; 225 ÷ 6 = 37 R 3; the remainder changes.

UNIT 3 Revision — pp. 101–102

1. a) 40 **b)** 360 **c)** 600 **d)** 3600
e) 90 **f)** 480 **g)** 1400 **h)** 4600

2. a) 32 **b)** 48 **c)** 8 **d)** 5

3. *Sample responses*:
a) About 1800 **b)** About 3600
c) About 3500 **d)** About 5600

4. a) 4 × 33 = 132; 120, 12
b) 5 × 226 = 1130; 1000, 100, 30

5. a) 4 × 28 = 80 + 32 = 112

	20	8
4	80	32

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5. b) $6 \times 59 = 300 + 54 = 354$

	50	9
6	300	54

c) $5 \times 63 = 300 + 15 = 315$

	60	3
23	300	15

d) $9 \times 71 = 630 + 9 = 639$

	70	1
9	630	9

6. a) 8, 10, 8
b) 1600;
80, 8, 10;
56, 8;
1736

7. a) 168 **b)** 222 **c)** 201
d) 1512 **e)** 1032 **f)** 4696

8. a) $4 \times 218 = 872$ **b)** $3 \times 352 = 1056$

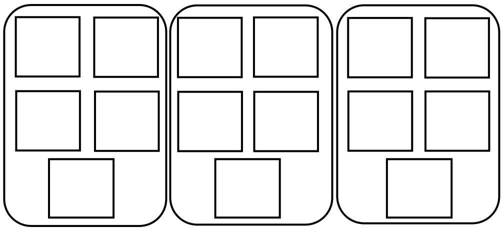
9. a) B and D **b)** D

10. a) 4 **b)** 6 **c)** 3

11. a) $320 \div 8 = 40$ **b)** $1800 \div 6 = 300$
c) $2100 \div 7 = 300$ **d)** $180 \div 2 = 90$

12. a) 40 **b)** 600 **c)** 40 **d)** 500

13. *Sample response*:



14. *Sample responses*:
a) About 300 **b)** About 90
c) About 130 **d)** About 40
e) About 200 **f)** About 50

15. *Sample response*: About 30 packages

16. *Sample responses*:
a) 5 **b)** 8 **c)** 2 **d)** 2 **e)** 2 **f)** 1

17. 163 notes

18. *Sample responses*:
a) 360 + 16 + 2 **b)** 700 + 70 + 42 + 4
c) 500 + 300 + 20 + 3 **d)** 600 + 120 + 21 + 2
e) 360 + 42 + 2 **f)** 360 + 27 + 4

19. *Sample response*:
815 = 500 + 300 + 15;
815 = 500 + 200 + 100 + 15

20. a) 200 R 2 **b)** 87 R 3
c) 55 R 3 **d)** 38 R2

21. 64 people

22. a) 99 **b)** 129
c) 76 R 1 **d)** 29

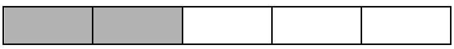
23. *Any of the following numbers*:
322, 326, 330, 334, 338, 342, 346, 350, 354, 358

UNIT 4 FRACTIONS AND DECIMALS pp. 103–130

Getting Started — Skills You Will Need p. 104

1. *Sample response*: $\frac{2}{3}$ boys and $\frac{1}{3}$ girls

2. a) $\frac{2}{5}$
b) *Sample response*:



3. *Sample responses*:
a) About $\frac{1}{2}$ **b)** About $\frac{1}{8}$ **c)** About $\frac{5}{6}$
d) $\frac{1}{1}$ (or 1) if the glass looks full
or $\frac{0}{1}$ (or 0) if the glass looks empty

4. A and B

Getting Started — Skills You Will Need [Continued] p. 104

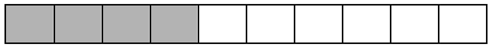
5. $\frac{2}{10}$; 0.2

6. 0.8 is shaded or 0.2 is white

7. *Sample responses*:

a)

b)



c)

8. 0.3, 0.8, 0.9, 1.0, 2.5

4.1.2 Equivalent Fractions p. 108

1. a) $\frac{2}{3}$ and $\frac{4}{6}$; Equivalent

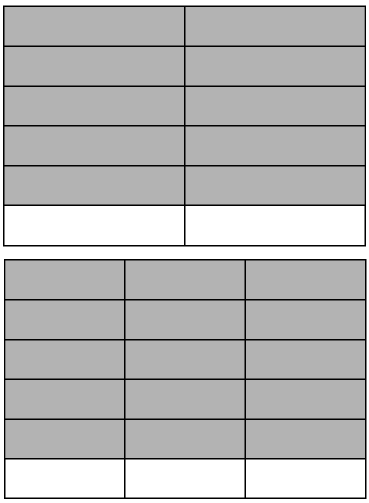
b) $\frac{3}{5}$ and $\frac{8}{10}$; Not equivalent

c) $\frac{1}{4}$ and $\frac{2}{8}$; Equivalent

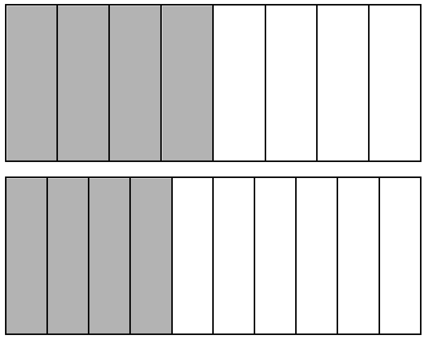
d) $\frac{1}{3}$ and $\frac{2}{6}$; Equivalent

2. a) Equivalent

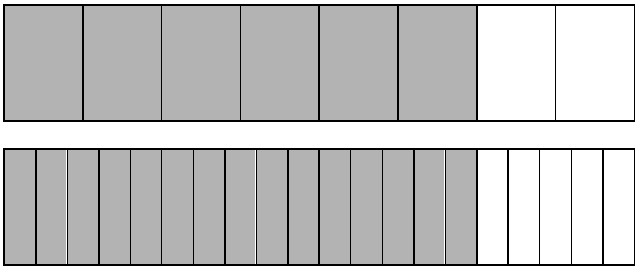
b) Equivalent



c) Not equivalent



d) Equivalent



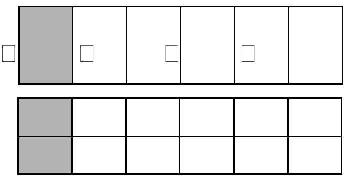
3. *Sample responses*:

a) $\frac{8}{10}$ and $\frac{16}{20}$ **b)** $\frac{6}{16}$ and $\frac{9}{24}$ **c)** $\frac{1}{3}$ and $\frac{4}{12}$ **d)** $\frac{2}{2}$ and $\frac{8}{8}$

5. *Sample response*:

$\frac{1}{6}$

$\frac{2}{12}$



4.1.3 Comparing and Ordering Fractions pp. 111-112

1. a) $\frac{2}{7}$ and $\frac{3}{7}$; $\frac{3}{7}$ is greater.

b) $\frac{5}{6}$ and $\frac{5}{8}$; $\frac{5}{6}$ is greater.

c) $\frac{1}{3}$ and $\frac{1}{2}$; $\frac{1}{2}$ is greater.

d) $\frac{2}{5}$ and $\frac{2}{8}$; $\frac{2}{5}$ is greater.

2. a) $\frac{7}{10}$ **b)** $\frac{6}{9}$ **c)** $\frac{3}{8}$

d) $\frac{7}{10}$ **e)** $\frac{3}{5}$ **f)** $\frac{11}{15}$

3. *Sample responses*:

a) $\frac{4}{4}$ **b)** $\frac{1}{10}$ **c)** $\frac{4}{10}$ **d)** $\frac{3}{5}$ **e)** $\frac{7}{9}$

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4. a) 0, 1, 2, or 3 **b)** 4 or 5
c) 0, 1, 2, 3, 4 **d)** 5

5. Yanka

6. *Sample responses*:
a) $\frac{2}{3}$ and $\frac{1}{3}$ **b)** $\frac{5}{7}$ and $\frac{6}{10}$

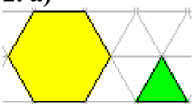
4.1.4 Modelling Mixed Numbers p. 115

1. a) $3\frac{1}{3}$

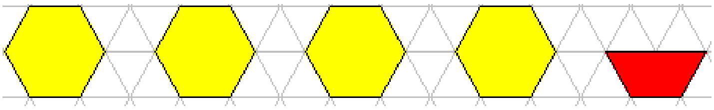
b) $1\frac{1}{2}$

c) $2\frac{2}{6}$

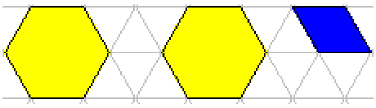
2. a)



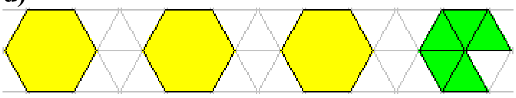
b)



c)



d)



3. a) $1\frac{3}{6}$

b) $1\frac{2}{3}$

c) $3\frac{1}{2}$

4. There is room for 5 whole classes and half of a sixth class.

5. $3\frac{1}{2}$

6. a) $5\frac{1}{3}$ **b)** $2\frac{1}{3}$

7. $10\frac{5}{6}$

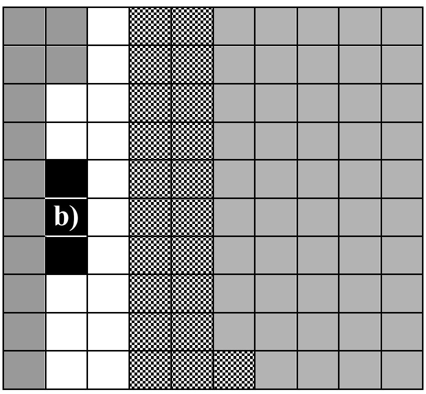
9. Yes

10. *Sample response*:
If there were 4 cakes at a party and 1 was half eaten, I could use a mixed number to tell how many cakes are left ($3\frac{1}{2}$).

4.2.1 Modelling Hundredths p. 118

1. a) 0.08 **b)** 0.12 **c)** 0.40

2. *Sample responses*:
a) **c)** **d)**



3. a) 0.09
b) 0.64
c) 0.80 or 0.8
d) 1.00 or 1.0 or 1

4. 0.60 and 0.6

5. a) 0.50 or 0.5
b) 0.25
c) 0.10 or 0.1
d) 1.00 or 1.0 or 1

4.2.2 Comparing and Ordering Decimals p. 121

1. a) 1.2 < 1.37 **b)** 1.3 > 1.28
c) 3.04 < 3.40 **d)** 2.10 > 2.01
e) 4.1 = 4.10

2. a) 0.89, 1.25, 1.28, 3.02, 3.1
b) 2.4, 2.49, 3.71, 3.87, 4.92
c) 0.01, 0.11, 1.01, 1.10

3. a) 3.09, 3.10, 3.11 **b)** 4.00, 4.01

5. *Sample responses*:
a) 4 **b)** 3.9
c) 2.54 **d)** 2.10

6. Nu 4.21

7. a) *Sample response using the digit 9*:
0.49, 3.44, 3.49, 3.94, 9.34, 9.43
b) 0.34, 0.40, 0.43, 3.04, 3.40, 3.44

4.3.1 Adding Decimals p. 124

1. a) 19.07 **b)** 4.22 **c)** 192.09 **d)** 34.03

2. 8.31 m

3. 0.80 square metres

4. *Sample responses*:
a) 43 **b)** 0.67 **c)** 24 **d)** 200

5. 7 times

6. a) 36.**1**4 + 8.2**8** = **4**4.42
b) 1.**9**8 +3.5**7** = 5.55
c) **1**1**5**.83 + 74.**8** = 190.63

7. *Sample response*: I measured a crooked wall. There was 4.12 m before the wall turned. Then there was another 5.89 m after the turn. How long was the wall? (10.01 m)

8. 50 pairs

4.3.2 Subtracting Decimals p. 127

1. *Sample responses*:
a) About 1 **b)** About 60
c) About 1 **d)** About 78

2. 1.06 m

3. a) 1.63 **b)** 0.42 **c)** 162.85 **d)** 19.12

4. *Sample responses*:
2.46 – 1.01 = 1.45
2.35 – 0.9 = 1.45
2.78 – 1.33 = 1.45

5. 10 times

6. 3.5 km

7. *Sample response*: I must walk 5 km to school. I have already walked 3.12 km. How much farther do I have to walk? (1.88 km)

8. a) 3.1**4** – **1**.**4**9 = 1.65
b) 12.**0**4 – **8**.8**7** = 3.17
c) 14.**0**2 – **7**.8**9** = 6.1**3**

9. 3.14 and 1.98

10. *Sample responses*:
a) I can use the same strategies that I use to subtract whole numbers.
b) There might be fewer digits in the greater number than in the lesser number.

CONNECTIONS: Decimals from Whole Numbers p. 128

1. a) 10 – 3.86 = 9.99 – 3.85 = 6.14
b) 7 – 4.38 = 6.99 – 4.37 = 2.62
c) 8 – 1.27 = 7.99 – 1.26 = 6.73

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UNIT 4 Revision pp. 129–130

1. a) $\frac{6}{8}$ and $\frac{3}{4}$; Equivalent. **b)** $\frac{1}{4}$ and $\frac{3}{12}$; Equivalent.

2. A and D

3. *Sample responses*:
a) $\frac{4}{10}, \frac{6}{15}$ **b)** $\frac{4}{5}, \frac{16}{20}$ **c)** $\frac{8}{18}, \frac{12}{27}$
d) $\frac{6}{16}, \frac{9}{24}$

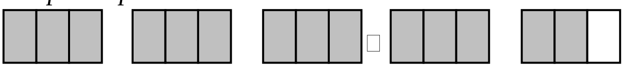
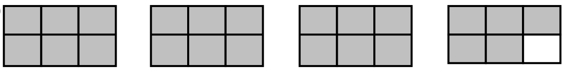
4. a) $\frac{6}{7}$ **b)** $\frac{4}{5}$ **c)** $\frac{9}{10}$ **d)** $\frac{8}{9}$

5. *Sample responses*:
a) $\frac{4}{10}$ **b)** $\frac{4}{9}$ **c)** $\frac{3}{5}$ **d)** $\frac{3}{10}$

6. a) 0 or 1 **b)** 1 to 9 **c)** 2 (or 1)

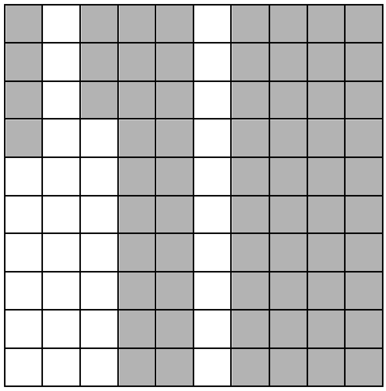
7. a) $3\frac{1}{4}$ **b)** $2\frac{1}{2}$ **c)** $1\frac{2}{3}$

8. a) 3 **b)** 2
c) $1\frac{1}{4}$; One group of 4 plus 1 more person is $1\frac{1}{4}$.

9. *Sample responses*:
a)

b)


10. *Sample responses*:
a) $8\frac{1}{4}$ **b)** $3\frac{1}{2}$

11. a) 0.06 **b)** 0.20 **c)** 0.42

12.
a) **b)** **c)**


13. *Sample responses*:
a) 0.13 **b)** 0.89 **c)** 0.84

14. 18 squares

15. a) 0.8, 0.92, 1.47, 3.0
b) 0.88, 8.08, 8.80
c) 2.02, 2.22, 3.14, 3.41

16. *Sample response*: 1.24 < 3.5; 1.24 is less than 2 and 3.5 is greater than 2.

17. a) 12.17 **b)** 6.75
c) 3.41 **d)** 19.11

18. 8.10 km

19. *Sample responses*:
a) About 23 **b)** About 1.22
c) About 7 **d)** About 86

20. a) 3.51 **b)** 10.27
c) 2.77 **d)** 3.47

21. 0.96 m

22. *Sample responses*:
a) 2.1 + 2.02 **b)** 4.93 – 3.1

23. 7

UNIT 5 GEOMETRY pp. 131–174

Getting Started — Skills You Will Need p. 132

1. a) Shape C **b)** Shape D **c)** Shape B

2. a) Shape B **b)** Shape C
c) Shape D **d)** Shape A

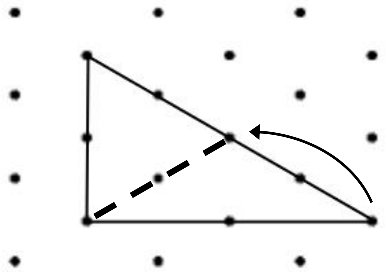
3. C **4.** A and B

5. a) 32 cm **b)** 12 m **c)** 16 cm

5.1.1 Sorting and Drawing Triangles p. 137

1. a) Scalene **b)** Equilateral **c)** Isosceles

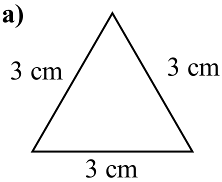
2.



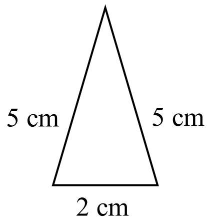
Each side length is 2 grid units long so I know I am right.

3. *Sample responses*:

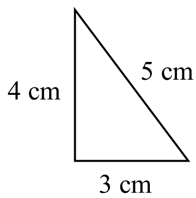
a)



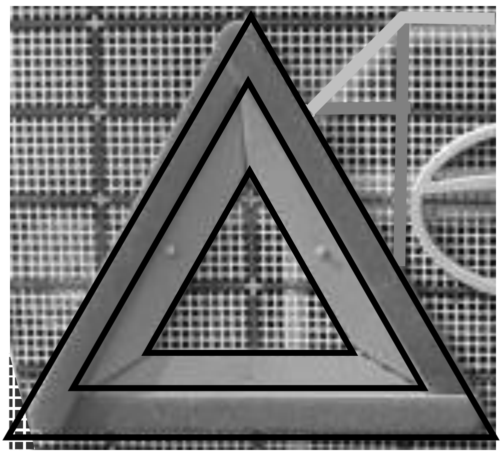
b)



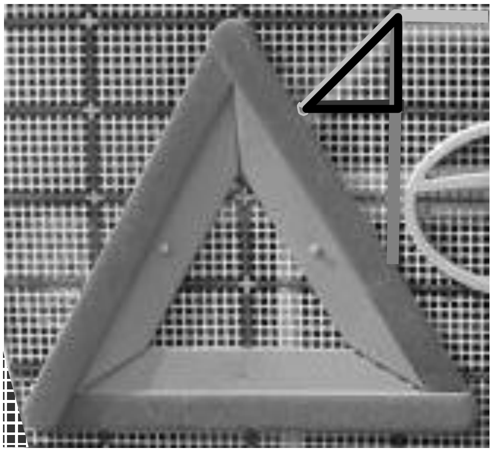
c)



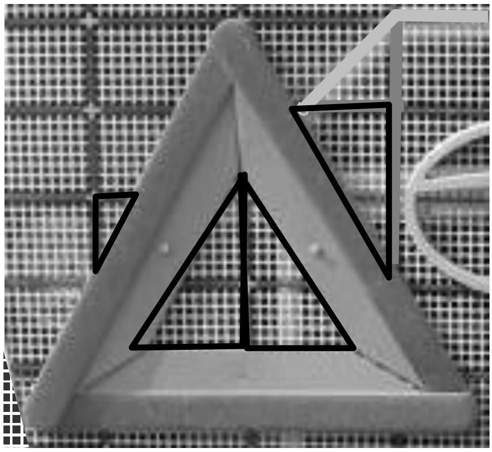
4. Equilateral:



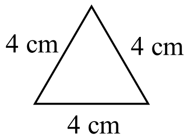
Isosceles:



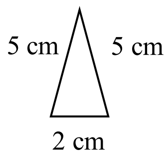
Scalene:



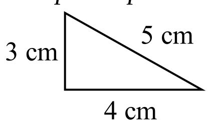
5. a)



b) *Sample response*:



c) *Sample response*:



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5.1.3 Sorting Quadrilaterals p. 143

1. and 2. *Sample responses*:
By number of right angles:
4 right angles: A, E
1 right angle: D
0 right angles: B, C

By parallel sides:
2 pairs of parallel sides: A, B, E
1 pair of parallel sides: C
No parallel sides: D

By congruent sides:
4 congruent sides: B, E
2 pairs of congruent sides: A, D
1 pair of congruent sides: C

3. A: Rectangle (or parallelogram)
B: Rhombus (or parallelogram)
C: Isosceles trapezoid (or trapezoid)
D: Kite
E: Square (or rectangle, rhombus, or parallelogram)

4. Alike: Both have two pairs of congruent sides.
Different: A rectangle has two pairs of parallel sides but a kite has no parallel sides.

5. a) K and L have a right angle, but M does not.
b) L and M have two pairs of parallel sides, but K has only one pair of parallel sides.

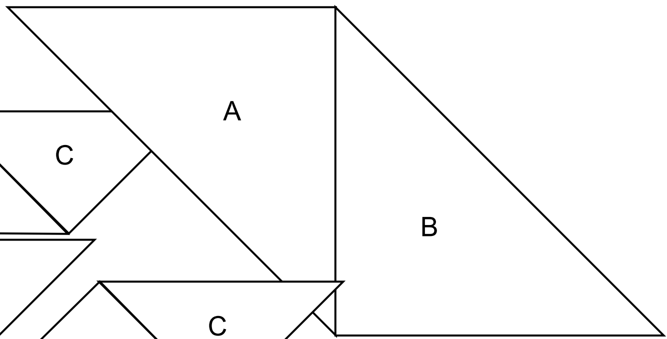
6. K: Trapezoid
L: Parallelogram or rectangle
M: Parallelogram

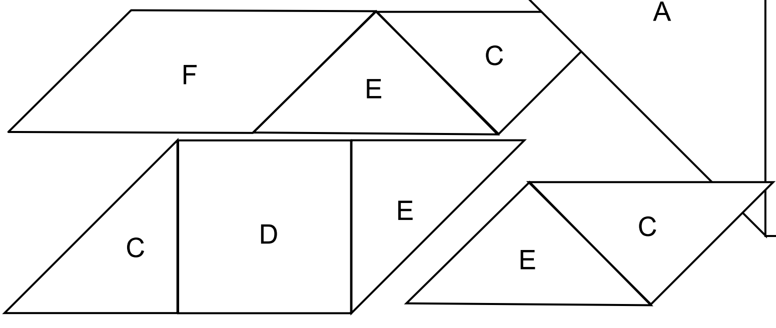
7. They are all correct.

CONNECTIONS: Tangrams p. 150

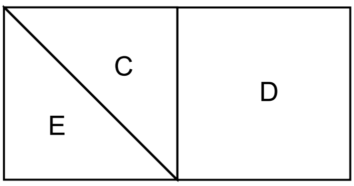
1. A and B, C and E

2. Parallelogram: four ways

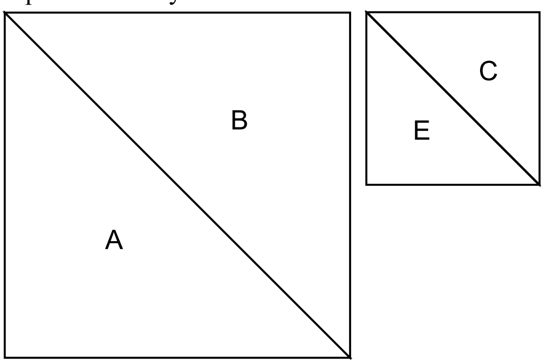




Rectangle: one way

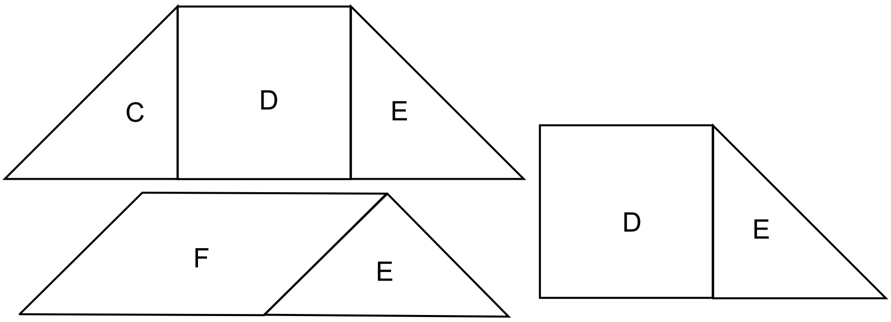


Square: two ways

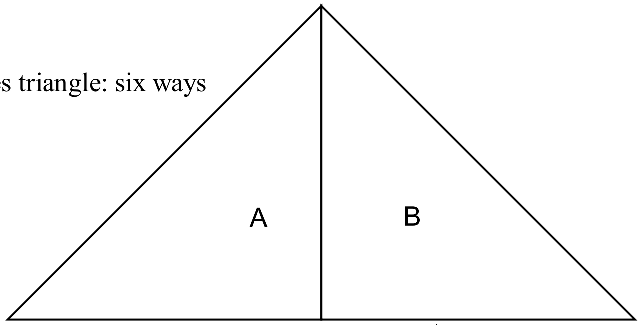


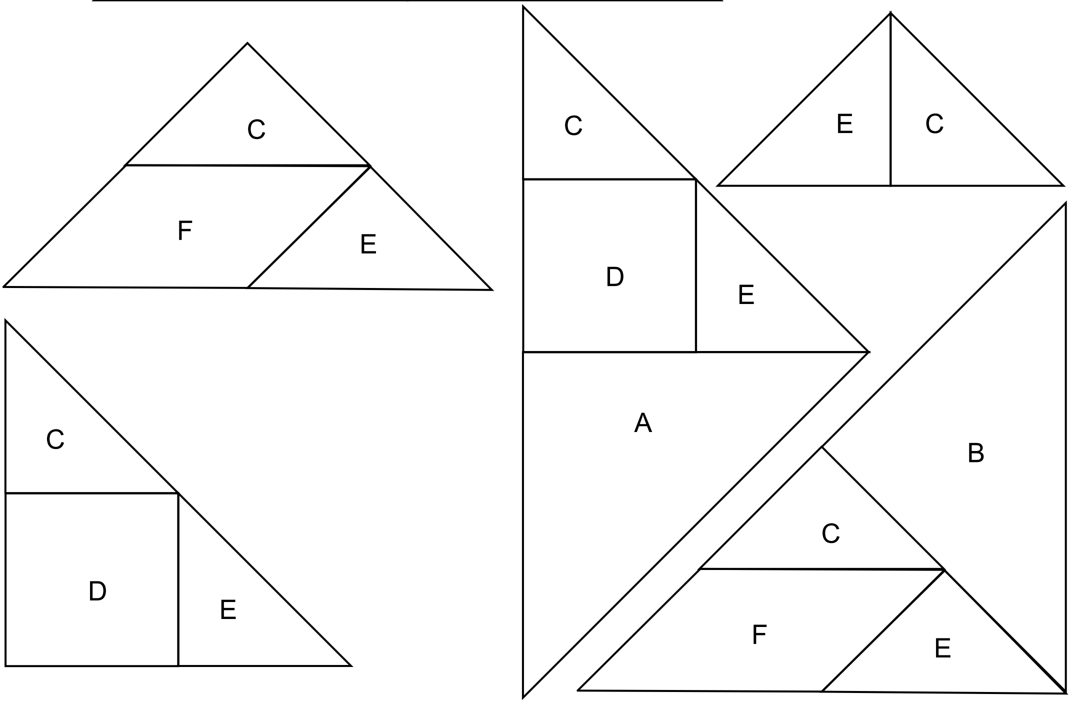
CONNECTIONS: Tangrams [Continued] p. 150

Trapezoid: three ways



Isosceles triangle: six ways





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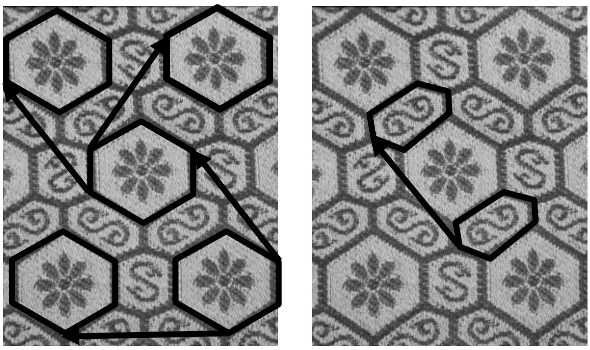
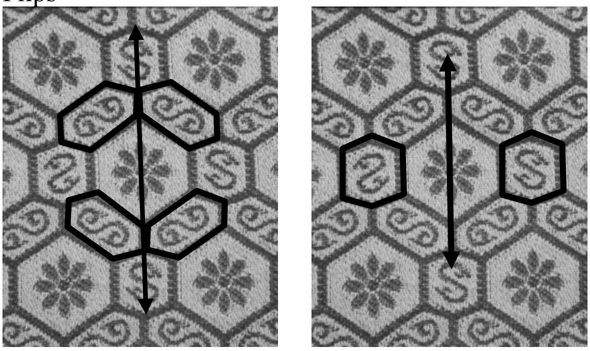
5.2.3 Slides and Flips pp. 153–154

1. a) A and D, C and F
b) D and E

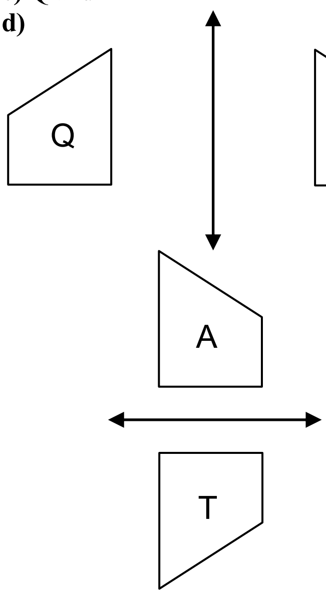
2. *Sample responses*:
Slides



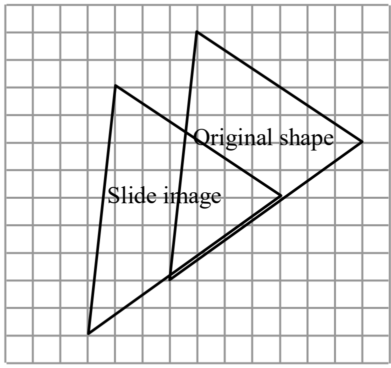
Flips



3. a) R and S
b) R: (5 spaces left) or (5 spaces left, 0 spaces up or down)
S: (6 spaces left, 6 spaces down)
c) Q and T
d)

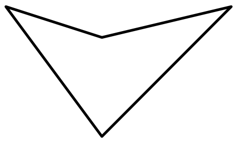


4. a) *Sample responses*:
It will be congruent and face the same way, but farther down and to the left.
b)

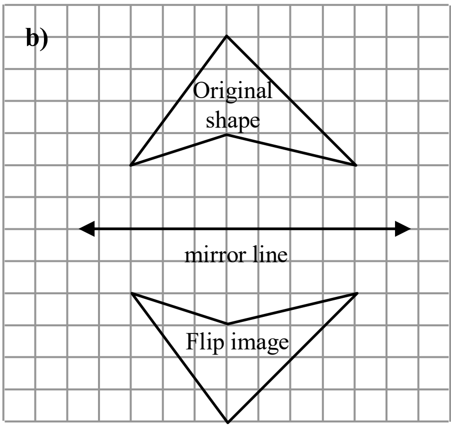


c) (3 spaces right, 2 spaces up)

5. a) *Sample responses*:
It will be congruent, but it will face the opposite way (it will point down instead of up) and it will be below the mirror line.



b)



Sample response: My prediction was correct.

6. a) The top vertex moved 12 squares (down).
The left and right vertices moved 4 squares (down).
The bottom middle vertex moved 6 squares (down).
b) Each vertex moved (3 spaces left, 2 spaces down).
c) *Sample response*:
The vertices all move the same way for slides, but they move differently for flips.

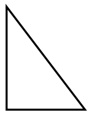
8. They are both right.

5.2.4 Turns p. 158

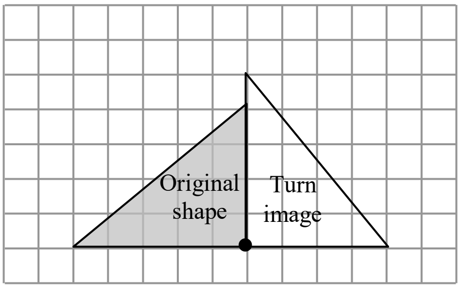
1. U and S, V and T

2. $\frac{1}{4}$ turn ccw around the point where the two shapes touch.

3. a)

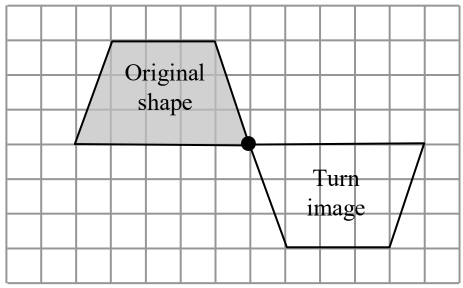


b)



4. a) It will be congruent, but it will be upside down.

b)



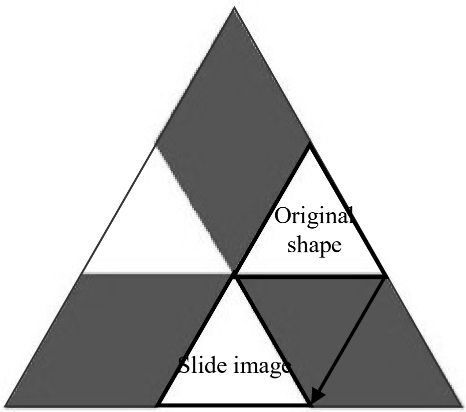
5. They are both right.

6. a) C
b) B
c) D

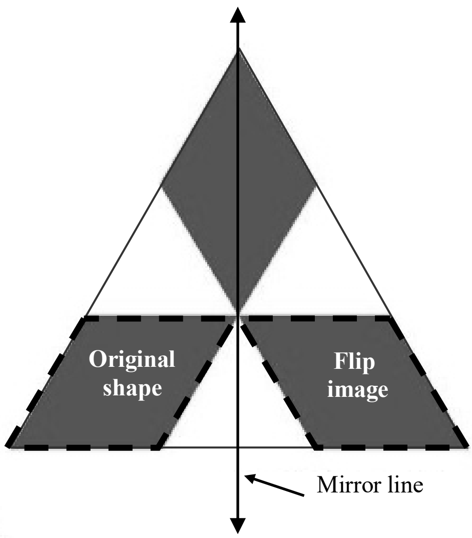
CONNECTIONS: Logos p. 159

Sample responses:

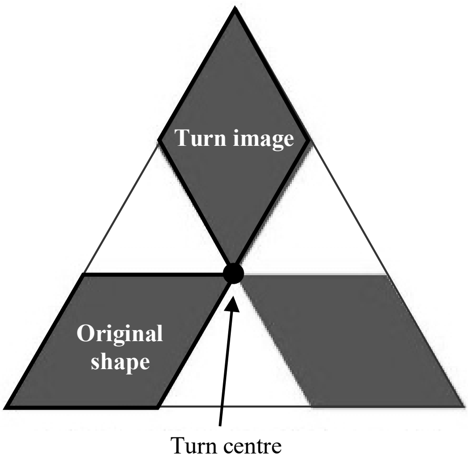
1. a)



b)



c)



5.3.2 Describing and Comparing Shapes p. 165

1. a) Cone; 1 circle base, 1 curved surface, no vertex (has an apex), 1 curved edge.
b) Pentagon-based prism; 7 faces (2 pentagon bases and 5 rectangle faces), 10 vertices, 15 edges.
c) Pentagon-based pyramid; 6 faces (1 pentagon base and 5 triangle faces), 6 vertices, 10 edges.

2. *Sample response*:
Alike:
- Both are prisms.
- Both have 4 rectangle faces, 2 square bases, 8 vertices, and 12 edges.

Different:
- One can be called a cube and the other a square-based prism.
- The cube has all faces congruent and the square-based prism has 2 congruent bases and 4 congruent side faces.
- The cube has all square faces and the square-based prism has 2 square faces and 4 non-square rectangle faces.

3. *Sample responses*:
a) Alike:
- Both have circle bases and one curved surface.
- Both have one or more curved edges.
- Neither has any vertices.

3. a) [Cont'd]
Different:
- The cylinder has two bases and the cone has one base.
- The cylinder has two curved edges and the cone has one curved edge
- The cone has an apex; the cylinder doesn't.

b) Alike: Both have two bases.
Different:
- The cylinder has circle bases and the prism has triangle bases.
- The cylinder has a curved surface but the prism does not.
- The cylinder has two curved edges and the prism has none.
- The prism has some rectangle faces and the cylinder has none.

c) Alike:
- Both have one base.
- Both have a point opposite the base.

Different:
- The cone has a circle base while the pyramid has a pentagon base.
- The cone has a curved surface; a pyramid does not.
- The cone has a curved edge but pyramid does not.
- The pyramid has some triangle faces but the cone has none.
- The cone has an apex, but the pyramid has a vertex.

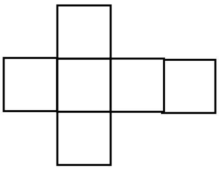
4. No, he is wrong.

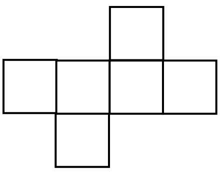
5.3.3 Folding and Making Nets p. 169

1. a) Cone
b) Cylinder

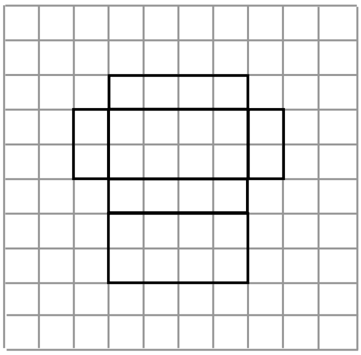
2. B

3. *Sample response*:

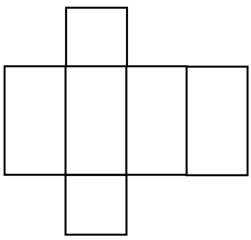




4. *Sample response*:



5. a) Square-based prism
b) *Sample response*:



1. A is equilateral, B is isosceles, C is scalene.

2. *Sample responses*:
a)
- Has a right angle: A, E
- Does not have a right angle: B, C, D

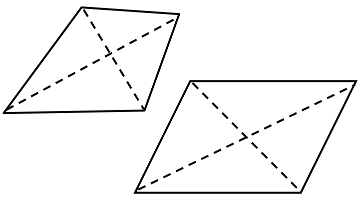
b)
- Scalene: A, D
- Isosceles: B, E
- Equilateral: C

c) A: 0; B: 1; C: 3; D: 0; E: 1
d) A: 0; B: 2; C: 3; D: 0; E: 2

3. a) A: trapezoid or isosceles trapezoid
B: rectangle or parallelogram
C: parallelogram, rhombus, rectangle, or square
D: parallelogram or rhombus
E: trapezoid
F: kite
G: parallelogram
b) *Sample response*:
- Has parallel sides: A, B, C, D, E, G
- Does not have parallel sides: F

c) *Sample response*:
- Has one pair of congruent sides: A
- Has two pairs of congruent sides: B, C, D, F, G
- Has no congruent sides: E

4. a)

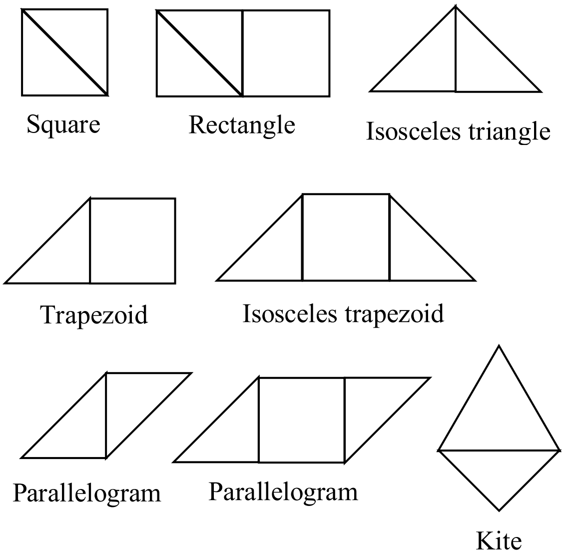


b) *Sample response*:
Alike:
- They both have two pairs of congruent sides

Different:
- The congruent sides are across from each other in the parallelogram and beside each other in the kite.
- The parallelogram has parallel sides. The kite does not.
- The kite has a diagonal that is a line of symmetry. The parallelogram does not.

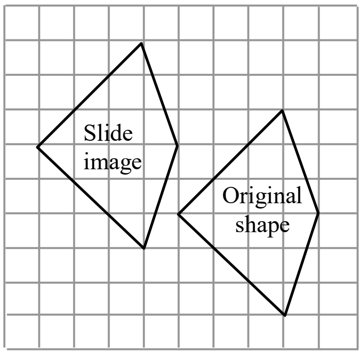
5. a) A and D, B and E

6. Eight shapes:

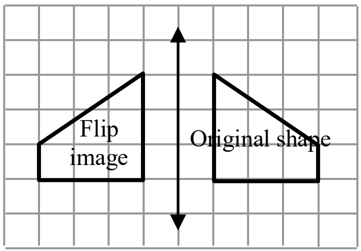


7. Slide: B and D; Flip: A and B; Turn: A and C

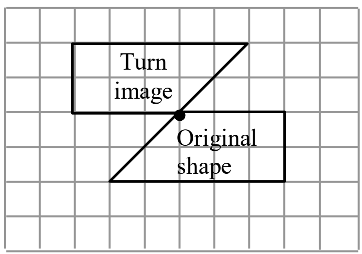
8.



9.



10. a)



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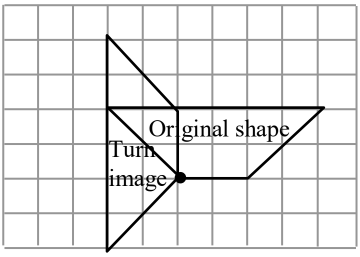
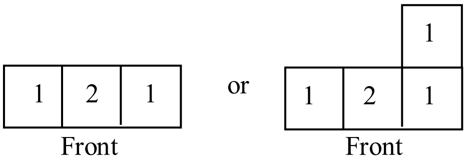
10. b)



11. a) *Sample response*:
The two possible structures look like this when viewed from above; the numbers indicate the number of cubes in each position:



b) Yes

12. a) Hexagon-based pyramid; 7 faces (1 hexagon base and 6 triangle side faces), 12 edges, 7 vertices.
b) Hexagon-based prism; 8 faces (2 hexagon bases and 6 rectangle side faces), 18 edges, 12 vertices.
c) Triangle-based pyramid; 4 faces (1 triangle base and 3 triangle side faces), 6 edges, 4 vertices.

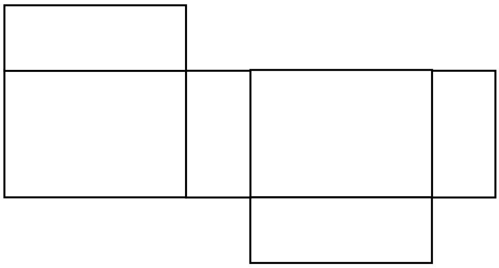
13. *Sample responses*:
a) Alike:
- They both have two bases.

Different:
- The cylinder has circle bases but the prism has pentagon bases.
- The cylinder has a curved surface and curved edges. The pentagon-based prism does not.

The prism has vertices but the cylinder does not.
b) Alike:
- The both have one base.
- Each has a point across from the base.

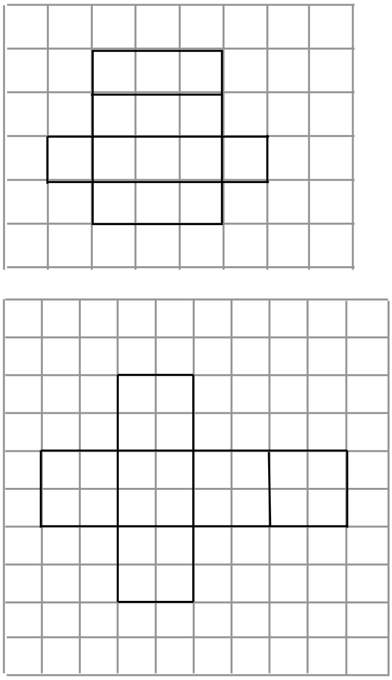
Different:
- The cone has a circle base, while the pyramid has a square base.
- The cone has a curved surface and a curved edge. The square-based pyramid does not.

14. a) *Sample response*:

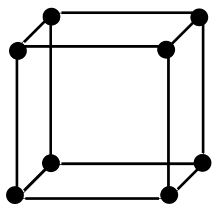


b) Rectangle-based prism

16. *Sample responses*:
a)



b)



UNIT 6 MEASUREMENT pp. 175-202

Getting Started — Skills You Will Need p. 175

1. *Sample responses:*
a) 16 cm **b)** 20 cm **c)** 22 cm

2. *Sample responses:*
a) 12 square centimetres
b) 24 square centimetres
c) 24 square centimetres

3. a) 2 rows
b) 6 columns
c) Yes

4. a) A, C
b) B, D

6.1.1 Introducing Millimetres p. 179

1. a) 31 mm **b)** 3.1 cm **c)** 3 cm, 1 mm

2. a) 15 mm **b)** 182 mm **c)** 240 mm

3. a)
b)
c)
d)

4. *Sample responses*:
a)
b) My line was 2 mm longer than 45 mm.

5. A and B

6. a) Longer; *Sample response*:
My ruler is 15 cm long, which is 150 mm.
b) 56 cm
c) Half a metre is 50 cm and 56 cm > 50 cm.
d) *Sample response*: The width of my desk.

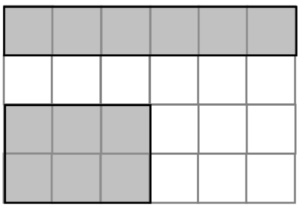
7. *Sample response*:
a) The width of a button, the thickness of my notebook, the width of a pencil.
b) The length of a desk, the height of a chair, the width of a book.
c) The length of a room, the length of a hallway, the distance down a street.

6.1.2 Estimating and Measuring Areas p. 183

1. a) 6 cm^2 **b)** 7 cm^2 **c)** 3 cm^2

2. a) About 5 cm^2; 6 cm^2.
b) About 5 cm^2; 4.5 cm^2.
c) About 9 cm^2; 11 cm^2.

3. *Sample response*:



4. A

5. *Sample responses*:
a) and b)
My eraser: about 10 cm^2; 12 cm^2
A calculator: about 70 cm^2; 81 cm^2
My ruler: about 45 cm^2; 48 cm^2

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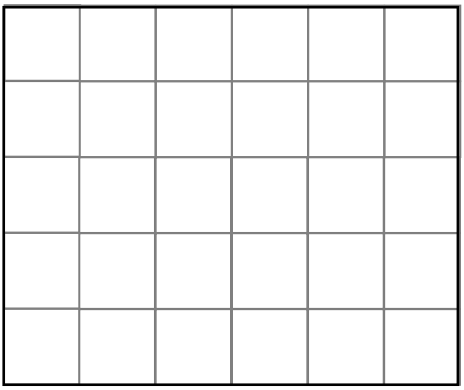
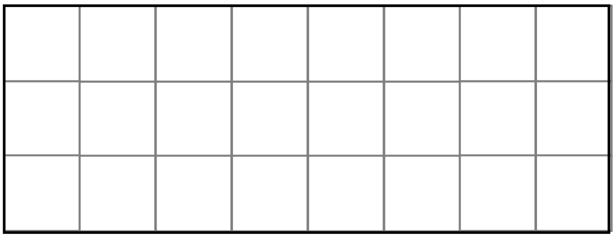
6.1.3 Relating the Area of a Rectangle to Multiplying p. 185

1. a) 10 cm^2 **b)** 9 cm^2

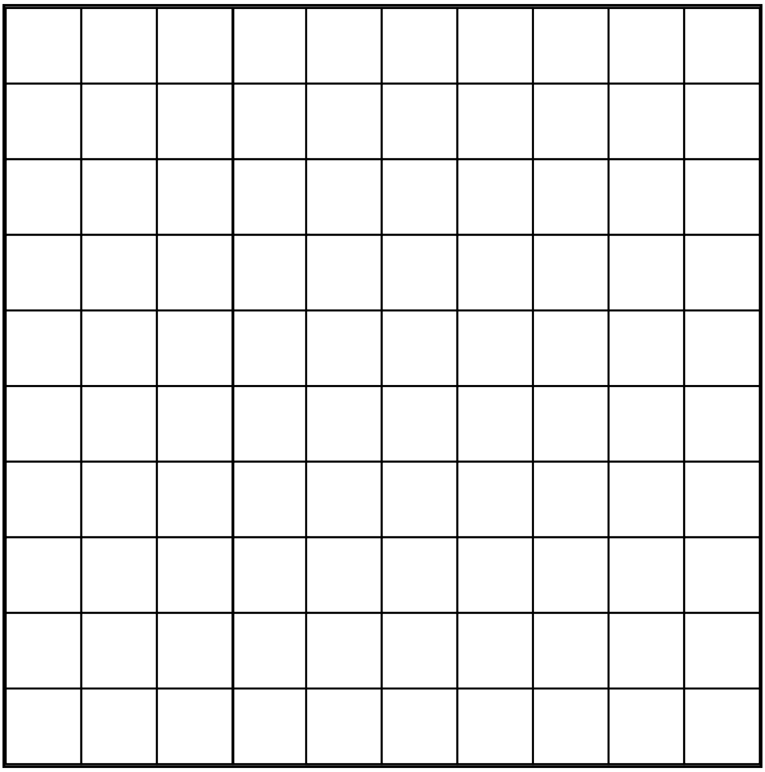
2. a) 30 cm^2



b) 24 cm^2



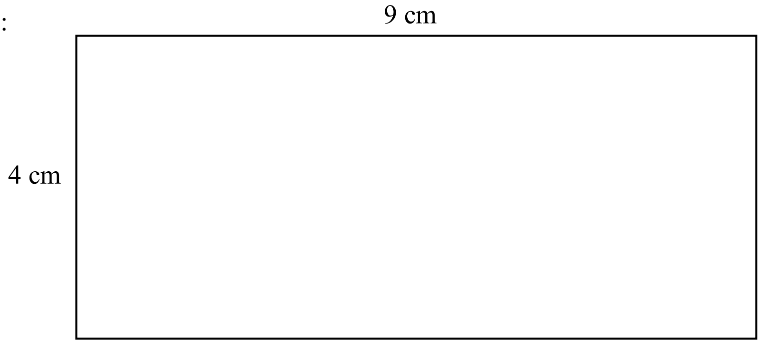
c) 100 cm^2

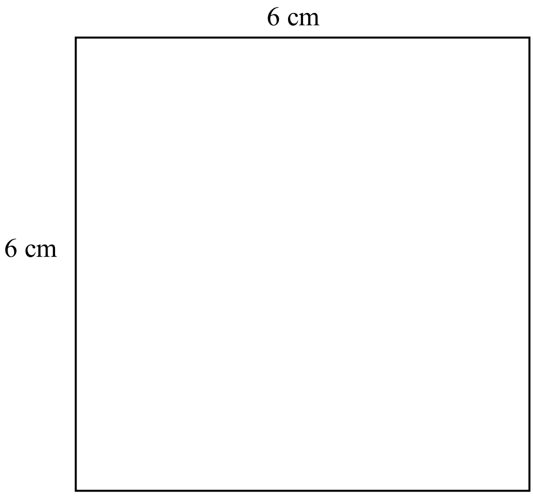


3. Rectangles A and C

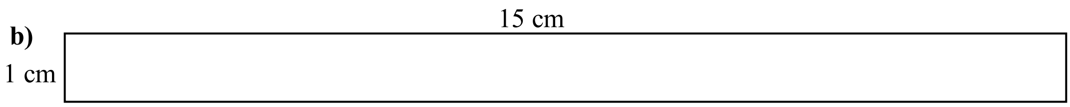
4. *Sample responses*:

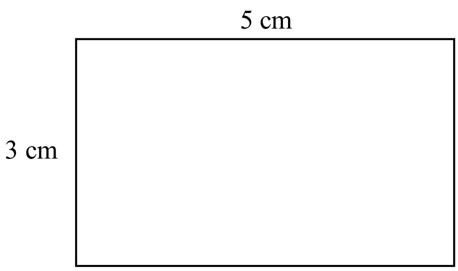
a)





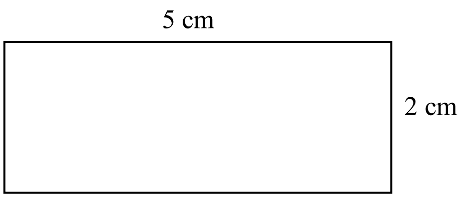
b)

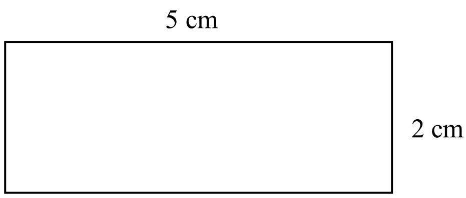




5. *Sample responses*:

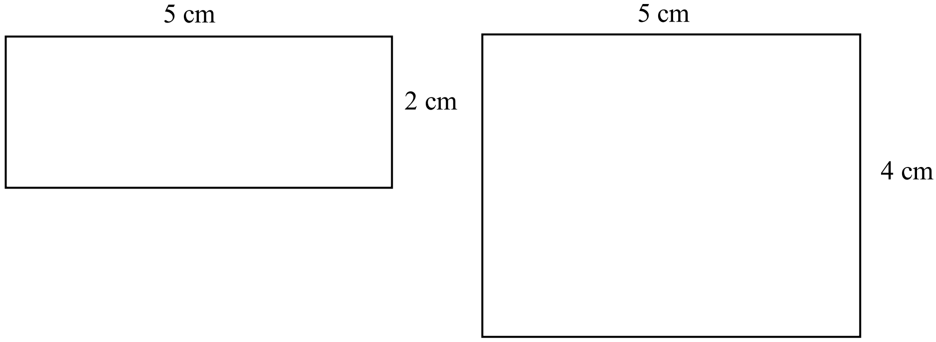
a)





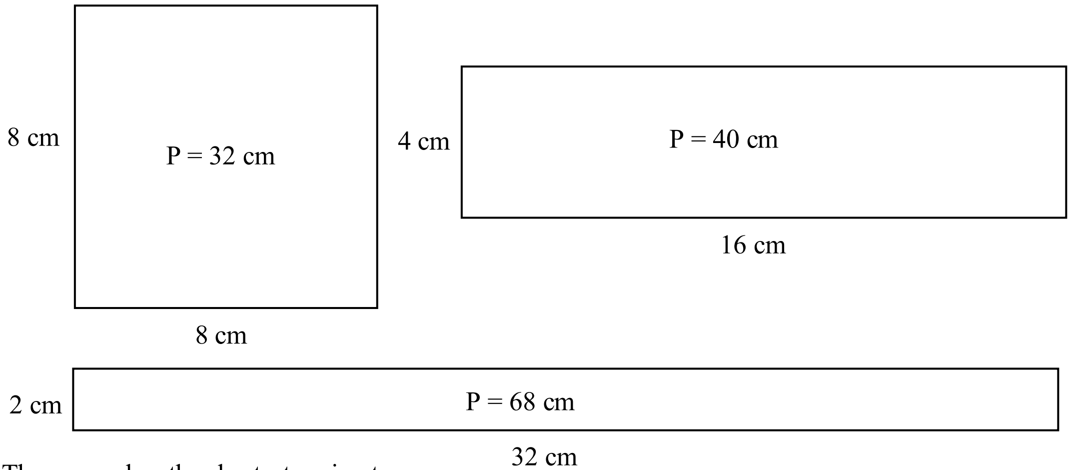
6.1.3 Relating the Area of a Rectangle to Multiplying [Cont'd] p. 185

b)



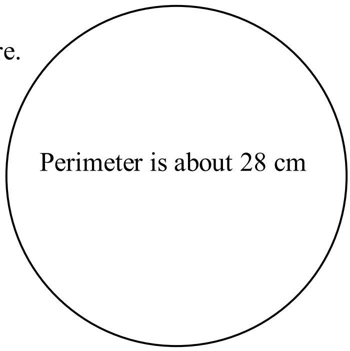
CONNECTIONS: Relating Perimeter and Area p. 188

1. *Sample response*:



The square has the shortest perimeter.

2. Yes; It is even shorter than the square.

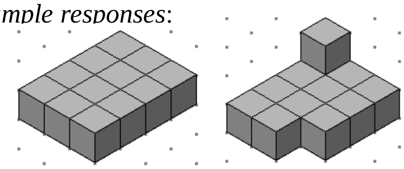


6.2.1 Measuring Volume Using Cubes p. 190

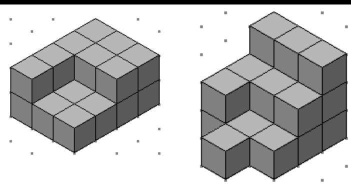
1. a) 20 cubes **b)** 12 cubes **c)** 16 cubes

2. *Sample responses*:

a)



b)



3. No

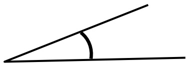
4. No

6.3.1 Classifying Angles p. 195

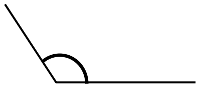
1. a) Acute **b)** Right
c) Obtuse **d)** Obtuse

2. *Sample responses*:

a)

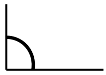


b)



c)

d)



4. No

5. *Sample responses*:
Acute: the angle made by the door when it is open a bit
Right: the angle formed by the walls in each corner of the classroom
Obtuse: The angle formed by the door when it is open all the way

6. Yes

6.4.1 Writing Times before and after Noon p. 197

1. *Sample responses :*
a) 8: 40 a.m (Note: It may differ from school to school)
b) 3: 50 p.m (Note: It may differ from school to school
c) 12:00 noon **d)** 12:00 midnight

2. *Sample responses :*
a) will wake up **b)** will take lunch
c) will be in deep sleep **d)** will watch TV

4. He studied for 1 and half hours. It is equal to 90 minutes

5. He walked for 2 and half hours to reach the town.

6. **a)** 3 hours
b) half an hour / 30 minutes
c) 5 and a half hours

6.4.2 Measuring Times in Hours, Minutes and Seconds p. 199

1. The baby slept for 1 hour / 60 minutes

2. **a)** 120 minutes **b)** 30 minutes
c) 150 minutes **d)** 180 minutes

3. **a)** 30 minutes / half an hour
b) 30 minutes / half an hour
c) Taking bath took the longest time.

UNIT 6 Revision p. 200-201

1. a) 38 mm **b)** 52 mm

2. a)
b)

3. 40 mm; 1 cm = 10 mm, so 4 cm = 40 mm.

4.

5. a) 6 cm^2 **b)** 5.5 cm^2

6. a) *Sample response*:
About 16 cm^2; Area: 20 cm^2

b) *Sample response*:
About 10 cm^2; Area: 8 cm^2

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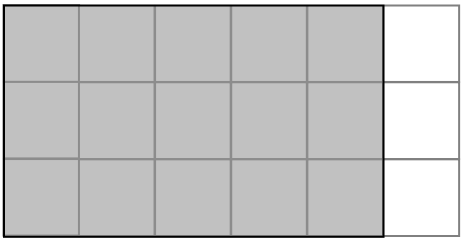
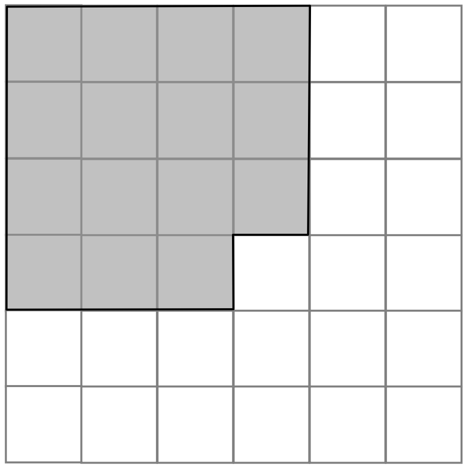
7. *Sample responses*:

a)





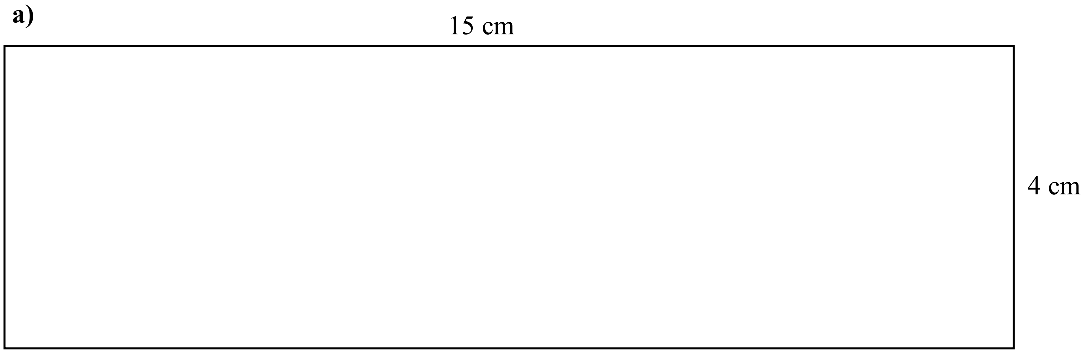
8. *Sample responses*:

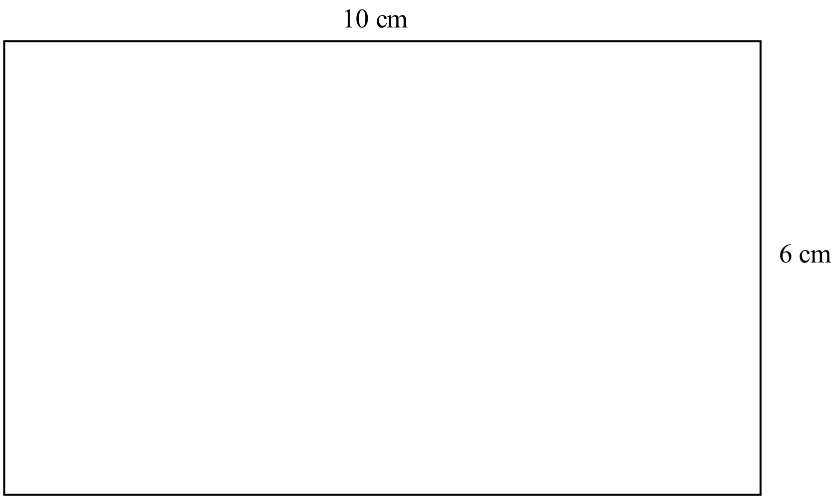
a) Geometry box

b) Chocolate bar

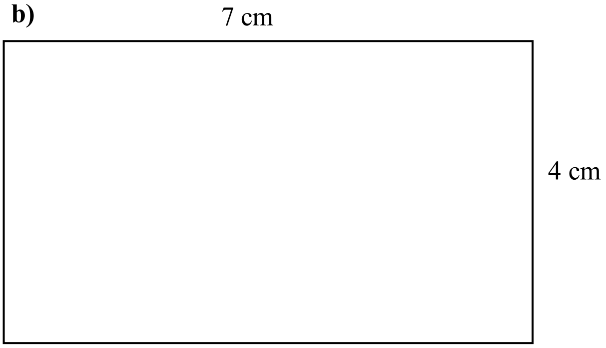
9. *Sample responses*:

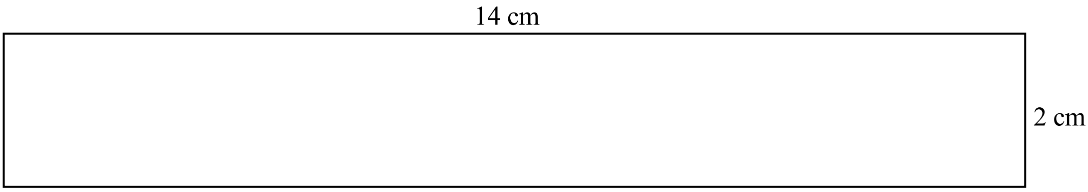
a)





b)

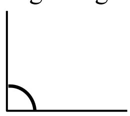




10. 4 cm-by-4 cm rectangle; Perimeter = 16 cm.
8 cm-by-2 cm rectangle; Perimeter = 20 cm.
1 cm-by-16 cm rectangle; Perimeter = 34 cm.

11. a) Angle B **b)** Angle C **c)** Angle E

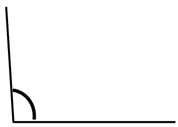
12. *Sample responses*:
a) A right angle



b) An acute angle

13. a) B **b)** A, D, and E

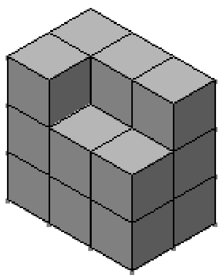
14. a) *Sample response*:

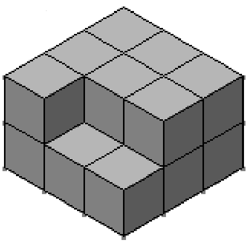


15. No; *Sample response*: A taller prism could have a much smaller base. For example, if the base is only 1 cube and the prism is 10 cubes tall, it has less volume than if the base were 3 cubes by 2 units and the prism had only 2 layers

16. *Assuming no hidden cubes or gaps*: **a)** 12 cubes **b)** 18 cubes

17. *Sample response*:





18. a) 12 blocks; 3 × 2 = 6 and 6 × 2 = 12.

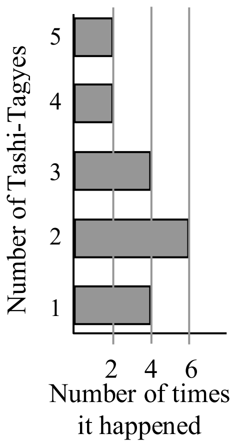
UNIT 7 DATA AND PROBABILITY pp. 203–230

Getting Started — Skills You Will Need pp. 203–204

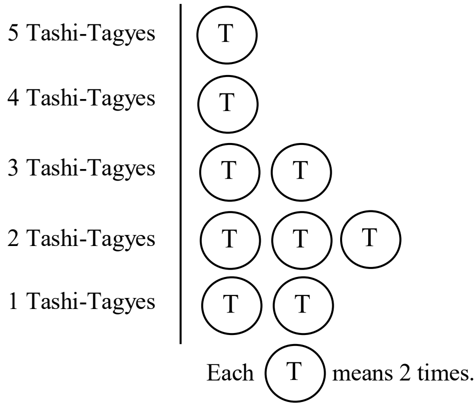
1. A and C

2. *Sample responses*:
a) 12 students had 5 letters in their name.
4 more students had 5 letters in their name than had 6 letters in their name.
b) 20 people had 6 letters in their name.
More people had 5 letters in their name than had 6 letters or 7 letters.

3. a) **Flipping Five Coins**



b) **Flipping Five Coins**



4. *Sample responses*:
a) The sun will rise tomorrow morning.
I will be in Bhutan tomorrow.
b) I will be in Australia tomorrow.
I will buy a car tomorrow.

5. *Sample responses*:
a) 6, 1, 4, 6, 1, 5, 3, 1, 2, 3, 6, 5, 5, 2, 2, 4, 3, 6, 3, 5
b) I rolled a five **<u>4</u>** out of **<u>20</u>** times.

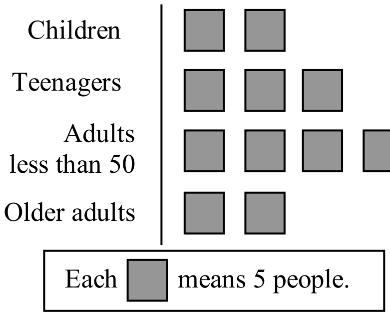
7.1.1 Interpreting and Creating Pictographs pp. 208–209

1. b) Sheep: 6 hours Rabbit: 8 hours
Human: 8 hours Mouse: 12 hours
c) *Sample response*: Sheep sleep 6 hours each day, rabbits sleep 8 hours each day, and mice sleep 12 hours each day.
d) *Sample response*: Mice sleep more than sheep, rabbits, or humans. Mice sleep twice as long as sheep.

2. a) 25 students **b)** 130 students
c) *Sample response*: More students have sisters than do not have sisters. There are 10 more students with no sisters than with three or four sisters.

3. *Sample response*: The squares are not lined up. The scale is not given.

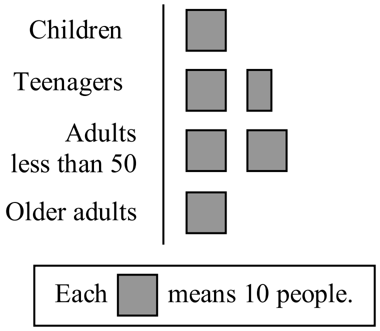
4. *Sample responses*:
a) **Ages of People at a Tsechu**



c) I chose a scale of 10.
d) There will be half as many squares in each line. There will be some half-squares. I predict this because 10 is twice as much as 5 and some of the numbers are groups of 5, but only half a group of 10.

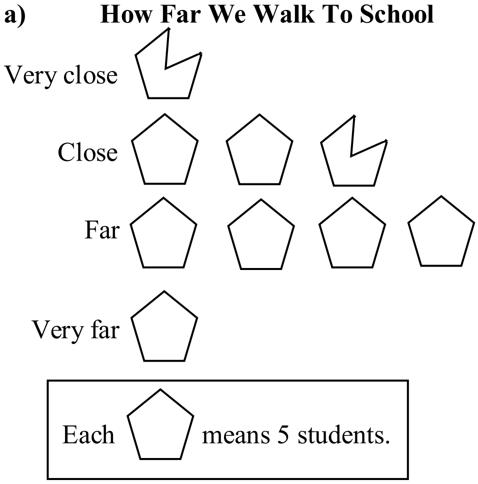
7.1.1 Interpreting and Creating Pictographs [Contd] pp. 208–209

4 e) **Ages of People at a Tsechu**

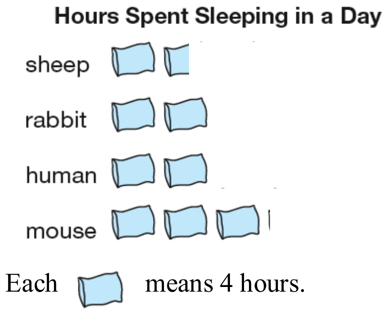


5. *Sample responses*:

a) **How Far We Walk To School**



6. a)



b) Yes.

c) *Sample response*: The graph with the 2 hour scale

8. *Sample response*:

- Use a scale that does not make the graph too big or small and where I do not have to use a lot of part symbols.
- Line up the symbols.
- Use the right number of symbols in each row.
- Use a symbol that is easy to divide into parts if necessary.

7.1.2 Interpreting and Creating Bar Graphs pp. 213–214

1. a) 16 hours **b)** Red fox and chimpanzee

c) 20 hours and 4 hours

d) *Sample response*:

Brown bats sleep most of the day. Chimpanzees sleep over twice as long each day as giraffes.

e) 5

f) *Sample response*:

A scale of 4

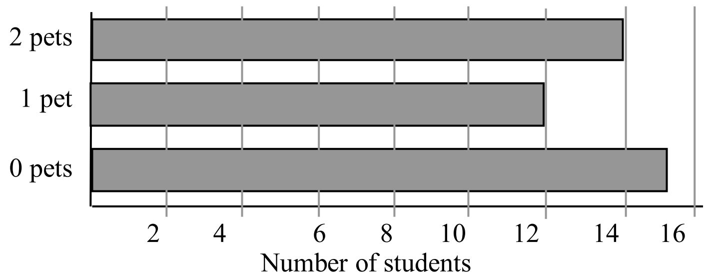
2. a) 2 **b)** 10 hours **c)** 1 hour

d) *Sample response*:

Dechen slept the most. Karma slept 1 hour less than Eden.

3. *Sample responses*:

a) **Chandra's Classmates' Pets**



b) 2

c) The bar for 1 pet went as far as the sixth line. Each line means 2, and $6 \times 2 = 12$.

d) 41 students were asked about their pets. More students have no pets than have 1 pet or 2 pets. There are three more students with 0 pets than with 1 pet.

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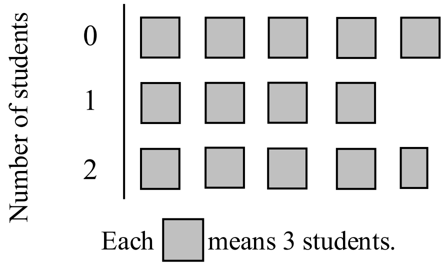
4. *Sample responses*:

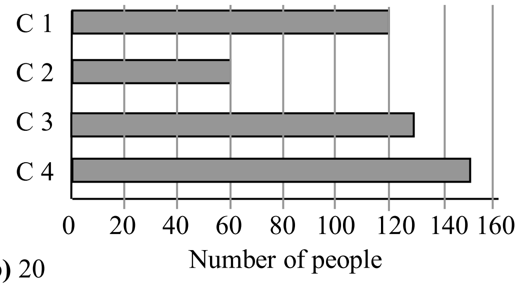
a) **Chandra's Classmates' Pets**



b) Both show the data in the same way.
They both show
- the longest line for 0 pets
- the shortest line for 1 pet
- an in-between line for 2 pets

5. *Sample responses*:

a) **Archery Competition Attendance**



b) 20

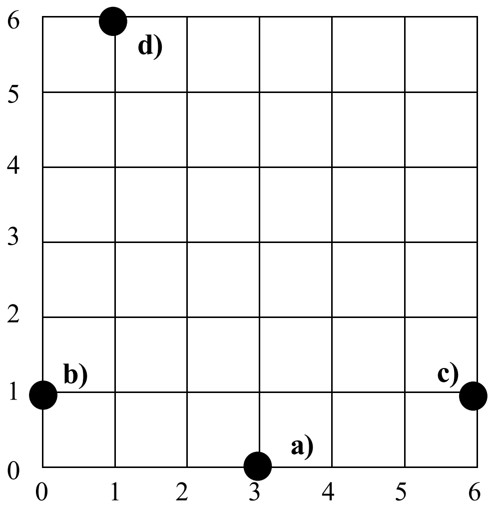
6. *Sample response*:
The lines for the scale numbers 0, 2, 4, and 6 should be equally spaced. The bars should be the same width and they should be equally spaced.

8. *Sample response*:
I could use a bar graph to show how many students ate different kinds of food for supper last night.

7.1.3 Using a Coordinate Grid p. 218

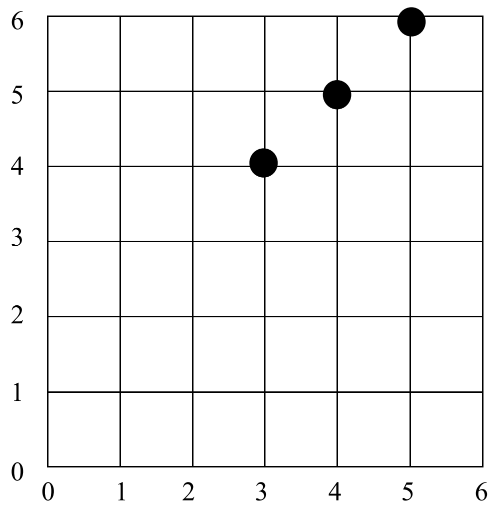
1. A(0, 4), B(3, 5), C(4, 4), D(6, 3), E(5, 0), F(2, 1)

2.



3. *Sample response*: (3, 6) and (5, 4)

4. a) i)

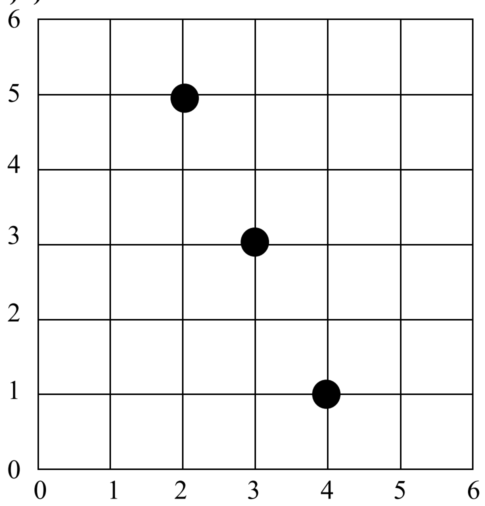


The three points make a line.

ii) *Sample response*: (2, 3)

7.1.3 Using a Coordinate Grid [Continued] p. 218

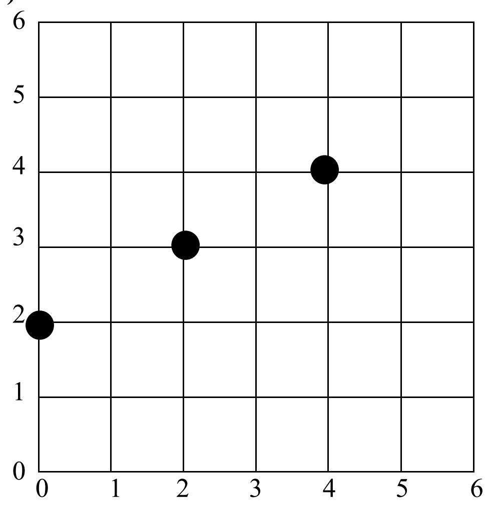
b) i)



The three points make a line.

ii) *Sample response*: (1, 7)

c) i)



The three points make a line.

ii) (6, 5)

5. *Sample response*: (2, 2) and (4, 2)

7.2.2 Predicting Likelihood p. 225

1. a) Less than 4
b) About the same
c) Less than 4

2. *Sample responses*:
a) My prediction was correct.

Less than 4	7
Greater than 6	4

b) My prediction was not correct, but it was close.

Even	11
Odd	9

c) My prediction was correct.

4	2
Less than 4	8

3. a) Greater than 2
b) About the same

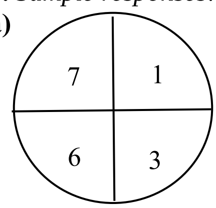
4. *Sample responses*:
a) My prediction was correct.

Greater than 2	12
2 or 4	8

b) My prediction was correct.

Greater than 5	10
Less than 5	10

5. *Sample responses*:
a)



c) My prediction was correct.

Less than 5	10
Greater than 5	10

6. No

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7.2.3 Using Fractions to Describe Probability pp. 227–228

1. a) $\frac{6}{12}$; It is exactly $\frac{1}{2}$.
b) As likely to happen as not to happen.

2. a) $\frac{7}{12}$; It is closer to $\frac{1}{2}$ but a bit greater than $\frac{1}{2}$.
b) Likely.

3. a) $\frac{5}{10}$; It is exactly $\frac{1}{2}$.
b) As likely to happen as not to happen.

4. a) $\frac{5}{12}$; Closer to $\frac{1}{2}$ but a bit less than $\frac{1}{2}$.
b) Not likely.

5. *Sample responses*: 3, 2, 6, 3, 2, 4, 1, 1, 4, 6, 5, 2
a) $\frac{2}{12}$
b) $\frac{7}{12}$
c) $\frac{7}{12}$

6. a) Closer to 0; Not very likely.
b) Closer to $\frac{1}{2}$ but greater than $\frac{1}{2}$; Likely.
c) Closer to $\frac{1}{2}$ but greater than $\frac{1}{2}$; Likely.

7. *Sample responses*:
a) 3
b) 1 or 2
c) 1

CONNECTIONS: Predicting Probability Runs p. 228

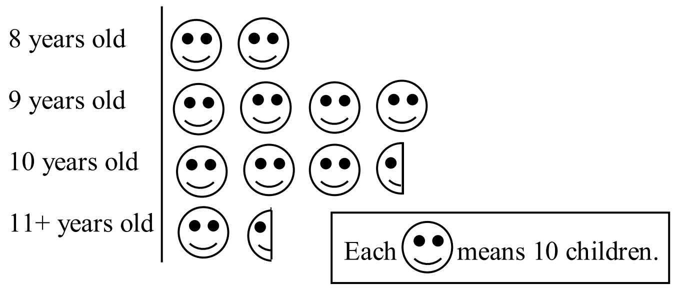
1. *Sample responses*:
a) KKTTTTKKKTKTTKKKTTTT
The longest run was four Ts.
b) Two students had a run of four and the other student's longest run was two.

2. *Sample response*:
I predict a run of four Ts or four Ks;
My results show a run of six Ks:
KTTKKTKTTKTKTKTTTTTKTTTTKKKKKKTTKTTKKKKK

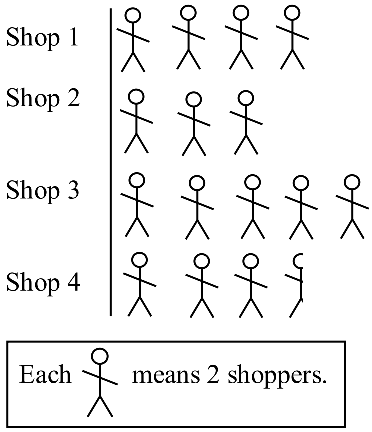
UNIT 7 Revision pp. 229–230

1. a) 20 children
b) 110 children
c) *Sample response*:
More children are 9 years old than any other age. There are fewer children that are 11+ years old than any other age.

2. **How Old Are You?**



3. *Sample responses*:
a) **People in Four Shops**

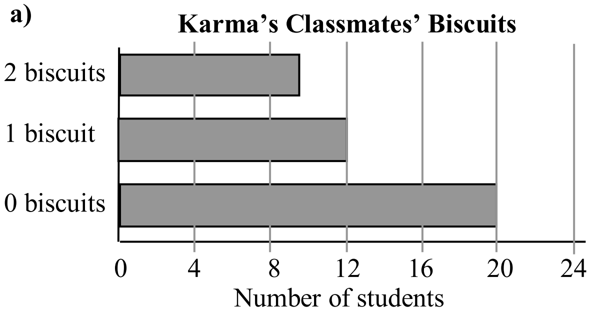


b) I chose a scale of 2 because the numbers were small and mostly even.

UNIT 7 Revision [Continued] pp. 229–230

4. a) 5
b) *Sample response*:
47 children chose summer and 26 chose spring.
c) *Sample response*:
Autumn is the least popular season.
Over 70 children chose spring or summer.

5. *Sample responses*:
a)

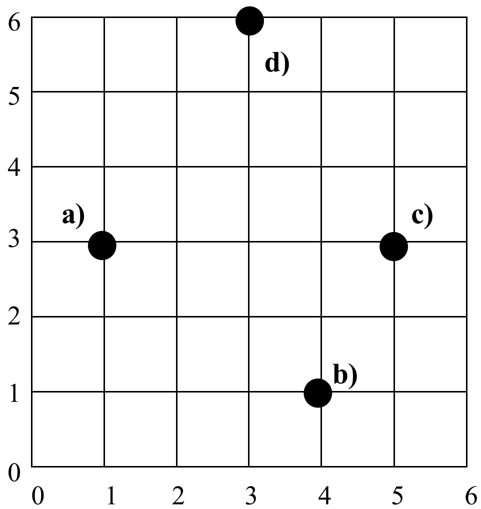


b) 4; Two of the data values, 12 and 20, can be grouped in 4s.
c) About half the class did not have a biscuit.
More students ate 1 biscuit than ate 2 biscuits.
There are 41 students in the class.

6. *Sample response*: If they are not evenly spaced, it is hard to compare the categories. One category might look like it is double the size of another when it really is not.

7. A (1, 4) B (3, 5) C (6, 6)
D (0, 1) E (2, 3) F (4, 2)

8.



9. *Sample response*: (2, 5), (5, 3), (5, 5)

10. a) 11 **b)** 15 **c)** 8

11. *Sample responses*:
a) I predict that I will take out more blues.
b) I took out blue 6 times out of 10, so my prediction was correct.

12. *Sample response*:
I predict that I will spin 1 most often.

Section	1	2	3	4	5
Number of spins	6	5	2	3	4

I did spin 1 the most.

13. *Sample responses*:
a) Spinner Y
b) I spun each spinner 20 times.
On X, I spun three 2 times out of 20.
On Y, I spun three 8 times out of 20.
My prediction was correct.

Spinner X

Number	**1**	**2**	**3**	**4**	**5**
Number of spins	7	5	2	3	3

Spinner Y

Number	**1**	**2**	**3**
Number of spins	11	1	8

14. *Sample responses*:

Number rolled	**1**	**2**	**3**	**4**	**5**	**6**
Number of rolls	2	1	1	2	3	1

a) $\frac{3}{10}$
b) Closer to $\frac{1}{2}$
c) Not very likely

15. a) $\frac{4}{5}$

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