National School Curriculum

INSTRUCTIONAL GUIDE FOR MATHEMATICS

CLASS: IV-VI

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

“Your parents, relatives, and friends would be very proud of what you have achieved. At your age, to have completed your studies is your personal accomplishment. Your knowledge and capabilities are a great asset for the nation. I congratulate you for your achievements.

Finally, your capabilities and predisposition towards hard work will invariably shape the future of Bhutan. You must work with integrity, you must keep learning, keep working hard, and you must have the audacity to dream big.”

- His Majesty Jigme Khesar Namgyel Wangchuck

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Foreword

COVID-19 has caused unforgiving disruptions in public education all over the world, and brought about threats of fragmentation in the society due to disparities in accessibility and connectivity in many systems. In Bhutan too, continuity of education and learning has been severely affected as a result of sporadic nationwide school closures, restrictions and health protocols. The disruptions exposed the limitation of the existing ideologies and practices in education. This has deprived children living in poverty worldwide, who rely on the physical settings of their schools for educational materials and guidance, of the learning and other essential educational services. Cognizant of the global trend to embrace competency based learning as education for the 21st century, the current priority of the Government is to transform the knowledge and textbook based learning to competency based learning through open source and experiential learning.

In the new normal education, human interaction and well-being is a priority. Technology, particularly digital technology that enables communication, collaboration and learning across distance, is a formidable tool though not a panacea but a source of innovation and expanded potential. As we embrace this exceptional opportunity to transform education, it is imperative to reimagine the organisation of our educational institutions and learning environments. In the post COVID 19 era, we must prioritise the development of the whole person, not just the acquisition of academic knowledge. Inspiration for the change can be drawn from the 1996 Delors report, learning the treasure within. Its four pillars of learning as “learning to know”, “learning to do”, “learning to be”, and “learning to live together” are the current global ethos of teaching and learning. Therefore, curricula must be increasingly perceived as an integrated, themes based and problems based orientation that allows learners to develop a strong base of knowledge about one’s self and about the world, and find purpose in life and be better able to participate in social and political milieu.

The National School Curriculum is, not just a mere response to the pandemic, but also culmination of the curriculum reform work for the last four years by the erstwhile Royal Education Council. It is an attempt to transform education from the teaching of “what” to learning of “how” and “why” towards empowering learners with the transversal competencies and the 21s t century skills, and preparing them to be lifelong learners. In tandem with this initiative, we are optimistic that the paradigm shift in Mathematics education orients our education process in empowering the young generation with the Mathematics mind-set and disposition, and skills towards nurturing nationally rooted and globally competent citizens.

With this guide, we are optimistic that our learners and teachers are ushered through a life enriching experiential Mathematics education.

Tashi Delek

(Karma Galay**)**
DIRECTOR GENERAL

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CLASS VI

Introduction

The 21st Century Education framework emphasises on the theme-based learning approach that broadens opportunities for experiential learning contextualised to the learner's physical, social, political, economic, spiritual and cultural setting. This requires learning through active engagement of learners. The role of teachers therefore, is transformed from knowledge transmitter to facilitation, guide, evaluator, researcher and motivator.

The conventional education system is predominantly knowledge based and examination centred. This system comprises the development of psychomotor and affective domains of learning thereby affecting the holistic development of students.

Despite the devastating effect caused by COVID-19 pandemic, it presented scopes for creation, innovation, generally perceived as more efficient and effective in work and social activities. The pandemic situation explicated that the old ways of working, teaching and learning, and lifestyle have limitations. Consequently, new normal ways of how we work and live, teach and learn must be critically analysed and embraced.

Therefore, the education system needs to be transformed to meet contemporary requirements. Students should learn to critically filter information that is flooded on the internet. Classroom instruction should facilitate learners to construct knowledge, develop essential skills and values which are crucial for learners to realise their potential towards becoming locally rooted and globally competent citizens who would contribute towards making a just and harmonious society. Accordingly, classroom instruction from teacher centred to learner centred calls for the following adjustment, or even the overhaul of a few practices.

i. Reduction of learning content to facilitate deep learning as opposed to the width of the teaching through the active engagement of students.

ii. Integration of ICT as tools and ends of learner's education. The use of multimedia and ICT software is commonly utilised in teaching and learning as innovation to introduce variation in stimuli and sustain learner's interest and zeal in learning.

iii. Adoption of theme-based learning content, which facilitates to broaden the horizon of learning beyond the four walls, and stimulates the transfer of learnt concepts to the learner's immediate environment. This arrangement makes students aware of the realities of the social, political, economic and cultural practices and ethos of the society. Being aware of the immediate environment of the scopes and challenges, students are sensitised to the opportunities and issues, which may need attention for a better future for the society.

iv. Consideration to ground the curriculum design and instruction approaches the epistemological theories is imperative to facilitate deep learning as opposed to factual learning. However, the selection and use of them is subject to the nature of the respective subject. For instance, constructivism is more apt for science, while connectivism is relevant for languages and ICT curricula.

v. Active engagement of students is imperative for competency-based education and learning. Inevitably, summative assessment has limitations in gauging the progressive development of the learner. This is achieved objectively by the use of the continuous formative assessment (CFA). However, if summative assessment evidence is used to provide feedback to help students in learning, it can serve as one of the techniques of CFA.

Purpose of the Instructional Guide

This instructional guide provides a suggestive direction to the teachers to facilitate them to transform the classroom instruction to the contemporary requirements stated above. The content of the instructions in the guide are aligned with the mathematics curriculum framework with references to the existing textbooks.

The instructional guides are developed to achieve the following objectives:

i. Facilitate learning anywhere, any time with the learner being responsible for the learning.

ii. Facilitate deep learning with awareness and sensitivity of the realities of the world around.

iii. Strengthen competency based learning and experiential learning to foster sensitivity of realities of life and environment.

iv. Strengthen blended learning and flip classroom with multimedia, digital pedagogies and ICT devices and websites as the tools and learning content.

v. Guide parents in facilitating learning of their children.

vi. Inspire teachers to assume the roles of facilitation, guide, motivator and evaluator.

vii. Helps in the prioritisation of learning content with emphasis to create time and space for active engagement of learners. Facilitate the use of CFA for learning through objective observation and guidance.

The effective and efficient use of this guide is subject to the nature of the topic(s) and the target class.

ORGANISATION OF THE INSTRUCTIONAL GUIDE

This is the main part of the instructional guide. It contains suggested approaches to teaching to guide students to achieve the desired competency(ies) through the identified topic(s).

a. Broad theme /Strand/Chapter/Topic

Under this heading, the topic/topics under one strand or under different strands that can be addressed together is/are listed. The topics are taken from the framework and not from the textbooks.

b. Introduction, Utility and Scope

Knowing history, utility and scope of topic(s) or concept (s) may provide an inspiration to learn certain things. It arouses curiosity, interest, and motivates the learners if they know why and how something was invented or discovered. Due to these reasons, the teachers are expected to explore and express the history, utility, and scope of the topic(s). It is advisable to do so while introducing the topic or concept because if students know the history and utility of what they learn, learning becomes much more engaging and captivating.

c. Competency(ies)

Under this heading, the main competency(ies) associated with the topic(s) is/are listed.

d. Objective(s)

Lesson objective(s) which are directly linked with the competency is/are given.

e. Essential Skills/Process

When students discuss and do mathematics, they use various skills and at the same time learn new skills. All learning processes are intended to facilitate students to acquire and develop certain skills. Each lesson in this guide contains few suggestive skills for each topic. However, since the list of essential skills for each *topic is not* exhaustive, teachers may explore helping students to acquire or develop some other essential skills through the topics covered.

f. Learning Experiences

In each lesson, learning experiences linked to the objectives which are further *linked* to the competency(ies) are suggested. These suggested learning experiences are to provide directions for the teachers to leverage the lesson to enable students to achieve the desired competency(ies). It can be used for both face to face and virtual mode to make the teaching learning more authentic. Both indoor and outdoor learning experiences (experiential learning) with possible cross pollination and thematic approaches are suggested for each lesson.

Teachers are expected to use the approaches of cross pollination (multidisciplinary), thematic (intra and inter topic(s)/concept(s)), place-based education pedagogies, project based learning, and flip classroom to offer greater flexibility and opportunities to enable students to generate new knowledge and associated skills. Students should also be provided opportunities to connect, communicate, and represent mathematical ideas and be given avenues for thinking divergently and reflecting on their learning.

g. Assessment

Achievement of learning shall be recorded based on bands of achievement for all students in all classes from IV to XII. The evidence from assessment is to identify individual learning needs, design, and deliver appropriate interventions to support students falling in the beginning and approaching category and to further provide appropriate support to the ones falling under the higher bands.

Teachers shall assess the objectives in a cumulative manner and ensure that competency(ies) are achieved at the end of the lesson. In each class, marks obtained for each strand from the formative assessment can be converted using appropriate conversions for summative purposes.

$$CA\ Marks = \frac{Sum\ of\ scores\ obtained\ of\ all\ competencies}{Total\ scores\ of\ all\ competencies} \times CA\ for\ the\ term.$$

- Performance Task

Each lesson consists of one or two suggestive performance tasks. The performance tasks are intended to assess the students' achievement of the desired competency(ies) through that particular lesson. Through performance tasks students can demonstrate knowledge and skills that they have acquired or developed, and how they can apply the knowledge and skills in real situations. Teachers should try and design performance tasks where students will be able to use the immediate objects around them to show their ability to transfer/apply the learning and assess higher order thinking.

The performance tasks should be assessed through Performance-based Assessment (PBA) wherein not only knowledge and skills are assessed but the ability to apply the knowledge and skills are also assessed.

- Reflective Questions

  Suggestive reflective questions that can be included in a performance task are mentioned below each performance task. Also, in some cases, reflective questions are mentioned after the completion of the performance tasks. These reflective questions are suggested, mainly, to help students to reflect on their learning and make personal connections to the topics being learnt.

h. Resources

All resources required for the suggested learning experiences and tasks are listed under each lesson both for face to face and virtual mode. Some lengthy worksheets are provided as annexure at the end.

i. Annexure

For the effective implementation of the NSC, certain worksheets are suggested for each lesson and annexed at the end of each lesson. However, teachers are expected to use it or further develop similar authentic worksheets for the teaching learning purposes.

Instructional Guide
Class IV
Mathematics

Topic: IV-A1 Place Value

[450 minutes]

Introduction

Place value plays an important role in dealing with numeral figures especially while reading large numbers. Only three cultures, as far as we know, invented a place value numeration system: the Mayans, the Babylonians (sexagismal (base 60), and the Hindu people of India (the Indians were the first to use it with a decimal base (base 10). The current, almost planetary wide, place value numeration system is derived from the Hindu system. It was transmitted to western Europe by the Moslem world. The place value is the value of the location of a digit in a number. The place values are determined by how many places the digit lies to the right or the left of the decimal point.

Source: Place Value

Utility and Scope

Place value helps us make decisions that are used in our daily lives for example: costs, weight, distances, time etc. Our number system is based on a Base Ten system. Base ten means our number system has a base of ten. We group our numbers by clusters of ten.

A. Competency

- Exhibit the understanding of reading, writing and *modelling* whole numbers to 5 places and apply it in operations of numbers.

B. Objectives

- Recognize the actual value of each digit of a number.
- Read and record numbers in several ways.
- Incorporate 'zero' within the numbers and understand the value of zero in each.
- Write numbers in standard and expanded form.

C. Essential Skills/Process

- Estimating
- *Modelling*

D. Learning Experiences

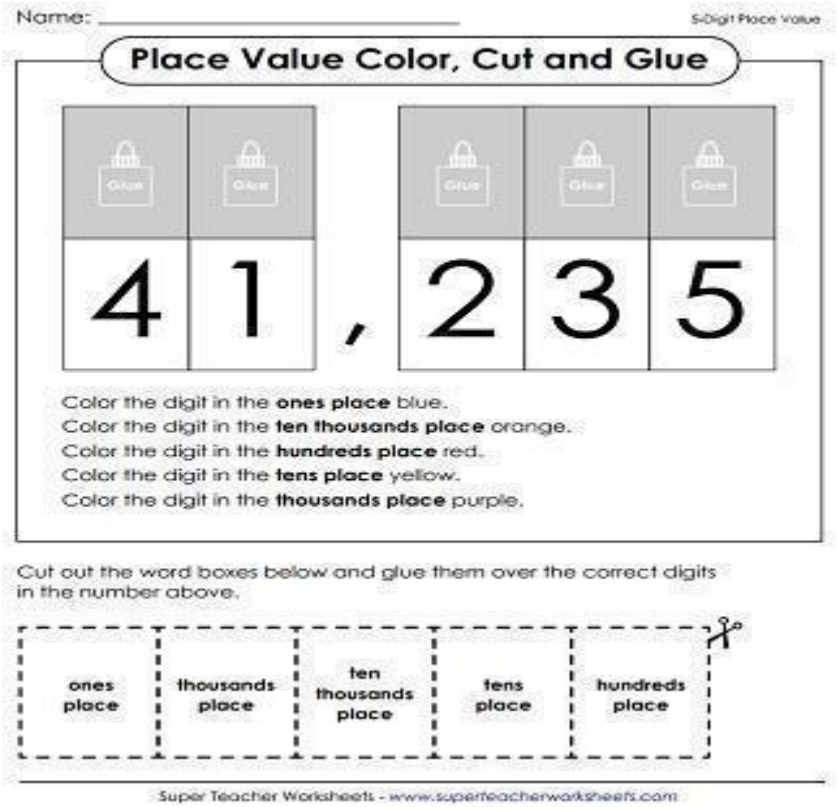
- Pre-assessment on recognizing value of each digit in 4-digit numbers with place value chart, in standard form and expanded form.
- Use base ten blocks to introduce 5-digit numbers.
- Example: Use base ten blocks to represent a number (1,342). Add thousand blocks at a time in thousands *places* until it reaches ten thousand. Do the regrouping to introduce ten thousand *places*.
- Provide base ten blocks and let them represent numbers in several ways. Allow them to read the numbers as well.
- Demonstrate on representing a standard number in place value chart and expanded form in two different ways.
- Let students round a few numbers nearest to tens, hundreds and thousands.
- Use suggested video clips available at 5 digit Place value to introduce 5-digit numbers.

E. Assessment

Performance Task 1

Provide base ten blocks to represent, recognize and read 5-digit numbers.

Use the suggested worksheet below to assess learning on Place value till 5-digit number.



Name: _____ 5-Digit Place Value

Place Value Color, Cut and Glue

Glue	Glue		Glue	Glue	Glue
4	1	,	2	3	5

Color the digit in the **ones place** blue.
Color the digit in the **ten thousands place** orange.
Color the digit in the **hundreds place** red.
Color the digit in the **tens place** yellow.
Color the digit in the **thousands place** purple.

Cut out the word boxes below and glue them over the correct digits in the number above.

ones place	thousands place	ten thousands place	tens place	hundreds place

Super Teacher Worksheets - www.superteacherworksheets.com

Performance Task 2

Let students write numbers close to 10,000 (can be more than or less than 10,000).

(Design appropriate assessment tool and record the student learning based on the template in the annexure)

- Reflective Questions
  i. When you say the year twenty twenty for 2020, and twenty twenty-one for 2021. Do you think you are using the correct place value here?
  ii. How do you read the year 2020 and 2021 in Dzongkha? Which one (in the previous or in Dzongkha) do you think is the correct way of reading the above years?
  iii. Why do you think 35,500 and 35,005 are two different numbers?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Manipulatives and/or concrete objects
- BLM (Place value chart)
- Self-Instructional Materials Key Stage II
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Place Value definition
  ➔ Place Value Concept

G. Annexure

i. Template to record assessment

Strand(s): Number and operations	**Topic(s)**: A1 Place Value				
Competency: Demonstrate an understanding of reading, writing and modelling whole numbers to 5 places and apply it while shopping.					
Name of the student	**Level of achievement**				
	Beginning	**Approaching**	**Meeting**	**Advancing**	**Exceeding**

Topic: IV-A2 Compare and Order Whole Numbers to 5-digits

[450 minutes]

Introduction

A whole number is simply any positive number that does not include a fractional or decimal part. This means that, for example, the numbers 0, 1, 2, 3, 4, 5, 6, and 7 are all whole numbers. Numbers such as -3, 2.7, or 3 ½ are not whole numbers.
Source: Meaning of Whole number

Utility and Scope

We use numbers in time, date, year and weather. We use numbers in school and work, counting money, measurements, phone numbers, password on our phone, locks, reading, page numbers, and TV channels. Engineers use numbers for their calculation to construct buildings and roads. Doctors use it for blood counts and medicines.

A. Competency

- Compare and order whole numbers to 5-digits, and apply the understanding in day-to-day activities.

B. Objectives

- Identify numbers greater or less than a given number.
- Identify numbers between given numbers.
- Order two or more numbers and justify.

C. Essential Skills/Processes

- Justifying
- Identifying
- Comparing

D. Learning Experiences

- Pre-assessment on comparing whole numbers less than 5-digits.
- Demonstrate how to compare and order 5-digits whole numbers.
- Let students choose five different digits, with a zero (0) as one of the digits.
  - Create different numbers using those digits and order from least to greatest or vice-versa.
  - Create the greatest possible number and the least possible number.

- Use suggested video clips available at Comparing Whole Numbers to compare and order 5-digit numbers.

E. Assessment

Performance Task 1

Prepare a worksheet with several 5-digit numbers in groups and give them to learners in the group or individual if sufficient. Ask them to arrange in order (once in ascending and then descending) and justify.

Performance Task 2

Let students create different 5-digit numbers on their own and order from least to greatest or vice-versa.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. If there was no place value system, how would we write numbers greater than 9? Is it possible? Why?
  ii. When do we compare 5-digit numbers? Tell three situations.
  iii. Tell us at least three reasons why we compare numbers.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Manipulatives and/or concrete objects
- Self-Instructional Materials Key Stage II
- Technological gadgets for learning (mobile, desktop, laptop...)
- BLM (Place value chart)
- Online
  - Meaning of Place Value
  - Comparing Whole Numbers

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-A3 Modelling Mixed Numbers
IV-A4 Renaming Fractions
IV-A5 Compare & Order Fractions

[550 minutes]

Introduction

The word 'fraction' has been derived from the Latin 'fractus' which means "broken". The earliest fractions were reciprocals of integers: ancient symbols representing one part of two, one part of three, one part of four, and so on. The Egyptians used fractions in 1000 BC. about 4000 years ago. Fractions are numbers that aren't whole, and mean just like they sound: a fraction, or a part of something bigger. Fractions have two numbers, a numerator (the part) and a denominator (the whole). When you first learn fractions, you probably will not see a point to learning them, but you know that fractions are so useful, you already use them in your everyday life?

Source: History of Fraction

Meaning of Fraction

Utility and Scope

When you first learn fractions, you probably will not see a point to learning them, but you know that fractions are so useful, you already use them in your everyday life? Fractions surround our everyday activities. Here are some examples of fractions in real life: equal slices of pizza, fruit, cake, a bar of chocolate, test and exam, Time and recipe.

A. Competency

- Demonstrate the ability to compare, rename and order fractions and use them for day-to-day life activities.

B. Objectives

- Develop visual images for fractions and mixed numbers through concrete materials.
- Use contexts which include part of a whole and part of a group.
- Investigate using concrete materials to conclude that two or more fractions can have different names but the same value.

- Investigate number patterns in equivalent fractions.
- Compare fractions visually in different situations.
- Compare fractions with same denominators and numerators.

C. Essential Skills/Processes

- Modelling
- Visualising
- Patterning
- Renaming
- Comparing
- Application

D. Learning Experiences

- Pre-assessment on parts of a shape as shaded or unshaded.
- Provide concrete materials to help them visualize fraction images and mixed numbers.
  Examples: Number of black/blue pens to the total number of pens in a group. Use pattern blocks to visualize fraction images and mixed numbers. Introduce the concept of 'part of a whole' and 'part of a group' as they play with the pattern blocks.
- Use suggested interactive simulation available at: Equivalent fraction to find number patterns in equivalent fractions.
- Demonstrate on comparing fractions with the same denominators and with the same numerators.
- Let students compare in terms of fractions having the same denominators and the same numerators.
- Use suggested video clips available at:

  - Mixed Number for introducing fractions and mixed numbers.
  - Equivalent fraction for introducing equivalent fractions.
  - Compering fraction for comparing fractions with the same denominators and numerators.

E. Assessment

Performance Task 1

- Compare fractions with the same denominators and the same numerators including mixed numbers.

- Design an appropriate activity on ordering and renaming fractions.

Performance Task 2

Provide printed 5-digit numbers in groups and ask them to stand in order (ascending or descending), let them justify.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Show the following quantity in mixed numbers.
     a. 2 kg and half, b. 5 kg and one third c. 6 kg and two third
  ii. How would our life be without fractions?
  iii. How can we divide 3 apples among 5 children? How much of an apple will each child get?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Manipulative/or concrete objects
- Self-Instructional Materials Key Stage II
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ History of fraction
  - ➔ Meaning of fraction
  - ➔ Equivalent fractions
  - ➔ Mixed number
  - ➔ Comparing fractions

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV- A6 Model and Record Hundredths
IV-A7 Compare and Order Hundredths

[400 minutes]

Introduction

Decimal comes from the Latin word decimus, meaning tenth, from the root word decem, or 10. The decimal system, therefore, has 10 as its base and is sometimes called a base-10 system. Decimal can also specifically refer to a number in the decimal system. As an adjective, decimal means something related to this numbering system. The decimal point, for example, refers to the period that separates the ones place from the tenths place in decimal numbers.
Source: Meaning of Decimal

Utility and Scope

We use decimals everyday while dealing with money, weight, length etc. Decimal numbers are used in situations where more precision is required than the whole numbers can provide. For example, when we calculate our weight on the weighing machine, we do not always find the weight equal to a whole number on the scale.

A. Competency

- Demonstrate the understanding of *modelling*, recording, comparing and ordering decimals to hundredth and use the concept in operations of decimals.

B. Objectives

- Develop the concept of hundredths in the place-value system.
- Relate the decimal hundredth to models.
- Explore the relationship between decimals and fractions.
- Compare the decimal numbers appropriately.

C. Essential Skills/Processes

- Modelling
- Patterning
- Recording
- Relating
- Comparing

D. Learning Experiences

- Use 'The Exposition – Presenting the Main Ideas' of Modelling Hundredths from the manual.
- Use hundredth grids to compare decimals with the same whole number part. When they compare values, they have to consider the fact that one decimal is in hundredths and the other is in tenth.
- Use suggested video clips available at:
  Introduction to hundredth of modelling and recording hundredths.

E. Assessment

Performance Task 1

- Provide students to come up with a minimum of four different decimals. Let them predict the order (in ascending or descending).
- Let students use decimal grids to help students verify their predictions.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Question
  i. Do you need the ideas of decimals when shopping? Give some examples.
  ii. Do you think it would be accurate to calculate something if there was no decimal system? Why?
  iii. Where can you use the knowledge of decimals? Tell us at least three situations.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- BLM (Hundredth grid)
- Manipulative /or concrete objects
- Self-Instructional Materials Key Stage II
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Meaning of Decimal
  ➔ Introduction of Hundredth

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-A8 Addition and Subtraction of Decimals and Wholes:

[350 minutes]

Introduction

Addition and subtraction with decimals are just the same as addition and subtraction with the whole number. The most important thing to remember is to line up the decimal points so that when you stack them, they are directly on top of each other. Doing this stacks the place values so that the ones are on top of the ones, the tens on the tens, the tenths on the tenths, and so forth. If there are any times when there aren't as many digits after the decimal place in one number as there are in another, remember that you can fill in any places to the right of the decimal with a 0. In numbers, this looks like 3.15 = 3.150 = 3.150000000 and so on.

Source: Adding and subtracting decimals
Adding and subtracting decimals 2

Utility and Scope

Addition and subtraction are used to represent and solve many different kinds of problems. Many different types of problems can be represented by addition or subtraction. It is important to learn how to recognize these situations and represent them symbolically, building on counting with whole numbers. Perhaps one of the most common everyday uses for addition and subtraction of decimals is when working with money. For example, adding up bills and receipts.

A. Competency

- Display the understanding of adding and subtracting of decimals, (10ths and 100ths) whole through solving questions related to price of things, mass and length.

B. Objectives

- Recognize the actual value of each digit.
- Develop strategies for adding and subtracting decimals tenth or hundredth.
- Discover, through investigation, that the process of adding and subtracting tenths or hundredths is the same as adding and subtracting whole numbers.
- Estimate the sum and difference of the whole number and decimal number.

C. Essential Skills/Processes

- Estimating

- Recognizing

D. Learning Experiences

- Pre-assessment on addition and subtraction of decimal tenths.
- Discuss the value of each digit in decimal numbers.
- Carry out some decimal addition and subtraction problems by relating with addition and subtraction of whole numbers.
  Example:
  - Add two whole numbers by arranging the digits with the same place.
  - Then add two decimal tenths by relating with how they have added whole numbers.
  - Similarly add decimal hundredths
  - Repeat the steps for subtraction of decimals.
- **PBE approach (*Inquiry method*)** Let the students refer to the recorded information or measure their own height, weight (with decimal to hundredth place) and record in their notebook. Then in a group of 3 or 4, let them find the total height and weight of their group. Let each group move around and ask the height and weight of other groups. Estimate first and then total up to see which group has the largest number of height and weight separately.
- Shows how to estimate the sums and differences to nearest whole, nearest tenths and nearest hundredths.
- Use suggested video clips available at: Addition decimal hundredth to add decimal hundredths and similarly use online videos to show subtraction of decimal hundredths.

E. Assessment

Performance Task 1

- Provide a few questions about addition and subtraction of decimal tenths and hundredths.
- Let students do some decimal addition and subtraction problems where they have to estimate sums and differences.
- May provide the interactive activity link game for addition and subtraction of decimals.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Question
  i. How would you explain to someone to subtract 1.75 from 4.3?
  ii. How are adding decimals and whole numbers the same? How are they different?
  iii. Tell us at least three situations where we can use the knowledge of decimals.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- BLM (decimal place value)
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Use suggested video clips available at
  ➔ addition and subtraction
  ➔ Addition and subtracting decimals
  ➔ game
  ➔ adding and subtracting of decimals

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-A9 Multiplication Meanings.
IV-A10 Multiplication Properties.
IV-A11 Multiplication Facts.
IV-A12 3-digit x 1-Digit Multiplication with or without Regrouping

[650 minutes]

Introduction

A mathematical operation performed on a pair of numbers in order to derive a third number called a product. Multiplication is defined as to calculate the result of repeated additions of two numbers. An example of multiplication is 4 times 2 equals 8.

Multiplication has existed ever since time began. The systems of multiplication began in Babylon four thousand years ago. They used multiplication in the way that we do. In Babylon they were using a number by doubling, tripling, quadrupling simply by addition and then they would add the separate sectors together so that they ended up with what appeared to be a multiplication. That is a very similar system to our own system when we do long multiplication.

Source: Multiplication

Utility and Scope

Multiplication is a main tool for many forms of *maths* such as algebra, calculus, equations and more. This is a very useful tool for children because it helps them develop their skills with mental *maths*, which can become an important skill in adulthood. Research has also shown that using multiplication table worksheets can improve memory tremendously.

A. Competency

- Multiply 3-digit by 1-digit with and without regrouping after learning the fact and properties of multiplication and solve real world problems.

B. Objectives

- Explore and explain various meanings of multiplication.
- Show multiplication as skip counting, arrays and repeated addition.
- Recognise multiplication as a combination of rate time quantity.
- Explore the properties of multiplication (commutative, distributive, associative, zero and identity property).
- Develop facts through concrete and pictorial representations till 9 × 9.

- Solve 3-digit numbers by 1-digit numbers using standard algorithms.
- Use estimation to predict and verify the products.

C. Essential Skills/Processes

- *Conceptualising*
- Computing
- Comparing
- Representing
- Predicting
- Estimating

D. Learning Experiences

- Pre-assessment on the multiplication they encountered in Class III.
- Use 'EXPLORE' from the textbook and manual or any other relevant materials to explain the meaning of multiplication, which includes: repeated addition, an array, a set of equal groups, a rate, the area of a rectangle and the number of combinations if all the items of one are matched with all the items of another group.
  (Although students have already met the repeated addition, array, and equal groups meaning of multiplication, the other three meanings may be new to them.)
- Design an appropriate activity in exploring properties of multiplication.
- Ensure students can multiply by tens and hundreds to multiply 2-digit and 3-digit numbers and also to estimate products.
  Example, to multiply 6 × 23, students need to know how to calculate 6 × 20
- Use suggested video clips available at: multiply 3-digit by 1-digit.
- Let students explore the meaning and properties of multiplication.
- **PBE approach (*Community as classroom*)** The meaning of multiplication can be used in real life for problem solving. Let the students go to a nearby shop and ask the cost of some items. Then let them find out the total cost if they buy several numbers of the same items. Need to give clear instructions before they proceed for the activity.

E. Assessment

Performance Task 1

Make an activity to check if students can correctly multiply by tens and hundreds. Ask them the usefulness of multiplication skills in daily life with relevant examples.

Performance Task 2

Let students identify a problem in real life situations where multiplication skills helped them to solve it.

(Design appropriate assessment tool and record the student learning based on the template in the annexure)

- Reflective Questions
    i. Where do you apply the concept of multiplication in your day to day activities?
    ii. Do you know how to tell the multiplication table using your fingers?
    iii. What can 4 × 5 mean? Tell us at least 3 things 4 × 5 represents.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Technological gadgets for learning (mobile, desktop, laptop…)
- Online
    ➔ Multiplication
    ➔ multiply 3-digit by 1-digit.

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-A13 Division Meanings
IV-A14 Division Properties of 0 and 1
IV-A15 Multiplication and Division Facts
IV-A16 2, 3-Digit ÷ 1-Digit without or with Regrouping

[500 minutes]

Introduction

In multiplication, the numbers being multiplied are called factors; the result of the multiplication is called the product. In division, the number being divided is the dividend, the number that divides it is the divisor, and the result of the division is the quotient.

Source: Multiplication using array

Utility and Scope

Usefulness of Division can be known simply using objects from our daily life like slices of pizza or a bar of chocolate. For example, if we divide a pizza into 4 slices, we do division. Thus, 1 ÷ 4 = 0.25. This means that each piece of the slice of this pizza is 0.25 times the total pizza.

A. Competency

- Display the ability to divide 3-digit by 1-digit numbers without and with regrouping after learning the facts and properties of division and solve related real-world problems.

B. Objectives

- Read division as groups or shares.
- Recognize division in contexts of rate, comparison, combinations.
- Demonstrate that order matters in division (opposite to multiplication).
- Explain multiplication and division as two ways of looking at the same situation.
- Relate division facts by connecting with multiplication.
- Connect algorithms to models.
- Justify remainders in real life as a fraction, ignored, rounded, addressed specifically (depending on context).
- Estimate quotient.

C. Essential Skills/Processes

- *Conceptualising*
- Connecting
- Estimating
- Modelling
- Reasoning

D. Learning Experiences

- Pre-assessment on concept of division.
- Use different examples to share the meaning of division. Relate the concept of division with rate, comparison and combination problems.
- Demonstrate how division is opposite to multiplication using some examples.
- Design a task for sharing and grouping division algorithms. They may use models to know the concept clearly.
- Use suggested worksheet available at: Sample questions

➔ Use suggested video clips available at:

  ➔ Division of 1 digit number for division without regrouping.

  ➔ Worksheet (Division) for division with regrouping.

- **PBE approach (*Local to global, Content Rich*)** Use different manipulations to make them learn the division meaning and facts. Next, take the students outside and let them use flower plants, stones, trees (Doma, apple, orange) in the orchards (if possible) or any other possible objects to learn to divide among themselves. They should find out like...
  - How many doma trees would they get if it were divided among 5 students. etc.
  - They may also find out how much money they would earn by selling fruits. Whereby they would learn to value fruit trees and how money is earned**.** ***(Ecology and Economy)***
- Prepare a powerpoint presentation that shows concepts of division, fact families of multiplication and division and division without/with regrouping.

E. Assessment

Performance Task 1

Design a task to assess students' ideas about division with and without regrouping.

Performance Task 2

Assign some real life situations that involve division where they get remainders. Let students share what they could do with remainders.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Compare the properties of multiplication and division.
  ii. What can 10 ÷ 2 mean? Tell at least 3 things 10 ÷ 2 represents.
  iii. Can you do division without the knowledge of multiplication? Why?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Base ten blocks
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online

Use suggested worksheet available at:

➔ Multiplication using array
➔ Division
➔ Division of 1 digit number
➔ worksheet (Division)

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-A17 Add and Subtract Mentally (up to 4-digits)

[100 minutes]

Introduction

Mental *maths* is a group of skills that allow people to do *maths* "in their head" without using pencil and paper or a calculator. One of these skills is remembering *maths* facts, like 8 × 5 = 40. Other skills include rounding numbers and estimating calculations.

Source: Adding and subtracting mentally

Utility and Scope

Mental *maths* actually keeps our brains quick and sharp. The brain, like the muscles, gets stronger and more efficient with use. Mental *maths* also greatly improves a person's number sense, the ability to understand the relationships between quantities.

A. Competency

- Demonstrate the ability to use mental strategies to add and subtract mentally up to 4-digit numbers and *apply them in the* real- world situation.

B. Objectives

- Develop and use mental strategies: front end, compensation, counting on/back, compatible numbers.
- Determine if a problem can be solved mentally.

C. Essential Skills/Processes

- Strategizing
- Analysing

D. Learning Experiences

- Create a poster or prepare a presentation that *summarises* some of the methods or strategies to add and subtract mentally.
- Let students use various methods of adding and subtracting numbers less than 5-digit mentally. They may do it in groups or pairs or individually.
- Facilitates learners on determining if a problem can be solved mentally.

- Provide any relevant materials (downloaded video, prepared presentation, created/screen recorded video, etc...) on performing mental addition and subtraction.
- Use the link Mental addition to know about mental addition.
- Use the link Mental subtraction to know about mental subtraction.

E. Assessment

Performance Task 1

Provide some activities and let them solve mentally.

Performance Task 2

Let students think and come up with real life situations where mental addition and subtraction can be used to solve problems.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
    i. Have you ever used mental addition or subtraction before? When and how?
    ii. When do we use mental *maths*? Tell us at least three situations.
    iii. In the world of technology, why do we need to learn mental *maths*? Explain.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Chart papers
- Online
    ➔ Addition and subtraction mentally
    ➔ Mental addition
    ➔ Mental subtraction

H. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-A18 Multiply Mentally by 10 and 100

[100 minutes]

Introduction

Mental *maths* is a group of skills that allow people to do *maths* "in their head" without using pencil and paper or a calculator. One of these skills is remembering *maths* facts, like 8 × 5 = 40. Other skills include rounding numbers and estimating calculations.

Source: Mental Maths

Utility and Scope

Mental *maths* actually keeps our brains quick and sharp. The brain, like the muscles, gets stronger and more efficient with use. Mental *maths* also greatly improves a person's number sense, strongly associated with better memory skills. Mental *maths* can help kids understand *maths* concepts better and get to the answer faster.

It stimulates children's interest in *maths*. the ability to understand the relationships between quantities. There are many great strategies for improving mental *maths* abilities. Mental *maths* is useful in school and in everyday life.

A. Competency

- Demonstrate the ability to develop and use mental strategies to multiply mentally by 10 and 100 and use the concept in solving related daily life problems.

B. Objectives

- Develop visual images of whole numbers multiplied by 10 or 100.
- Read numbers in different ways (e.g., 5300 is often read as 53 hundred, rather than 5 thousand, 3 hundred)

C. Essential *Skills/Processes*

- *Conceptualising*
- Reading Numbers

D. Learning *Experiences*

- Pre-assessment to test the knowledge of multiplying small whole numbers. Ask what patterns they observe as they multiply simple whole numbers.
- Use base ten blocks or other concrete materials to multiply whole numbers by 10 and 100.
- Use a place value chart to show the multiplication.
- Design an activity to show how to read numbers in different ways.
  Example:
  5300 = 53 thousand
  = 5 thousand, 3 hundred
- Use suggested video clips available at:
- **PBE approach** (***Connection***) Use dummy currency notes to give them the hands on experience in multiplying by 10 and 100 and relate with the real currency. They can find out how much money there would be in a packet of Ngultrum 1, 5, 10, 20, 50,100, 500, and 1000 notes. Talk on how to save money and its importance.

Multiplying 10, 100 and 1000 that shows the whole number multiplication by 10 and 100.

E. Assessment

Performance Task 1

Design an activity for multiplying whole numbers by 10 and 100.
Suggested worksheet is available at Sample question.

Performance Task 2

Show some multiplication sentences (whole number multiplied by 10 and 100), then ask students to rename it in different ways.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. When will you need to multiply mentally by 10 and 100?
  ii. Why is it easier to multiply numbers by 10, 100, 1000...?
  iii. Tell us at least one different number which is easier to multiply with other numbers.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Concrete materials
- Base ten blocks
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ Mental Maths
  - ➔ Multiplying 10, 100 and 1000
  - ➔ Sample question.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-A19 Open Frame as Numbers or Digits

[100 minutes]

Introduction

The number frames are open-ended educational tools, ideal for elementary classrooms and other learning environments. They come in five, ten, twenty, and one hundred.

Utility and Scope

Number Frames help students to structure numbers to five, ten, twenty, and one hundred. Students use the frames to count, represent, compare, and compute with numbers in a particular range. The frames allow students to see quantities as equal groups of other quantities and in relation to benchmark quantities. This helps them to move away from one-by-one counting towards more efficient ways of counting and computing. As they advance, open frames can also help them to *visualise* factors, products, fractional parts and more.
Source: Number frames

A. Competency

- Demonstrate the ability to use open frame equations as numbers or digits and use the concept in solving related problems in their daily life.

B. Objective

- Explain that an open frame equation can be represented as a number or a digit (__ × 5 = 30)
- Calculate the unknown value to make the sentence true.

C. Essential Skills/Processes

- Representing
- Computing

D. Learning Experiences

- Write a multiplication sentence (perhaps a product having more than one pair of factors) on a board. Replace a factor with an open frame (any shape). Replace the other factor with another open frame (any shape).
- Let students observe those open frames as a number making the multiplication sentence true.
- Provide materials (such as pictures, video link, downloaded video, books, screen recorded video, etc.) explaining representation of a variable number with a frame.
- Suggested worksheet is available at Game on missing numbers. This activity lets learners find the missing multiplier.

E. Assessment

Performance Task 1

Provide a worksheet to identify the missing numbers.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
    i. When can we use the idea of an open frame equation? Tell us three situations.
    ii. How can we use the idea of fact families in solving open frame equations? List a few examples.
    iii. Write at least three open frame equations as an example.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
    ➔ Number frames
    ➔ Game on missing numbers.

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-B1 Apply Pattern to Solve Computation Problems

[100 minutes]

Introduction

A pattern is a regularity in the world, in human-made design, or in abstract ideas. As such, the elements of a pattern repeat in a predictable manner. A geometric pattern is a kind of pattern formed of geometric shapes and typically repeated like a wallpaper design. Patterns in nature are visible regular forms found in the natural world. The patterns can be modelled mathematically and they include **symmetries, trees, spirals, meanders, waves, foams, tessellations, cracks and stripes**.

Utility and Scope

Patterns help learners learn sequencing and to make predictions which leads to mathematical skills, logic structure in algebra, and to establishing order in life. A toddler will sort green blocks from yellow ones as he builds a tower. He begins to notice things repeat in a certain order by size, shape or colour. An older preschool child notices slightly more complicated sequencing such as knowing the days of the week, months of the year or odd and even numbering.

A. Competency

- Demonstrate the ability to apply patterns to solve computational problems in real life situations.

B. Objective

- Apply patterns to solve computation problems related to multiplication (e.g., multiplying by 8, 9, 10, 11)

C. Essential Skills/Processes

- Exploring
- Applying

D. Learning Experiences

- Help students recognize that it is helpful to use patterns in mathematical situations. In particular, by thinking about what multiplication means, they can see how changing one factor affects a product. Suggested to refer the textbook and manual on ‘EXPLORE: Multiplication Patterns’

- Provide similar problems and let students solve them.
- Use the link Identify patterns (it talks about the using multiplication chart to teach multiplication patterns.
- The learner uses the pattern to solve multiplication correctly with a proper justification.

E. Assessment

Performance Task 1

Assess the learner's scientific observation skill, recording skill and reflecting skill to comprehend how the result affects as one of the factors is changed.
(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. What pattern do you see in the multiplication table of 8?
  ii. How will the pattern help us to solve multiplication problems?
  iii. What patterns do you see around us?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Use the link Identify patterns (it talks about the using multiplication chart to teach multiplication patterns

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-B2 Open Sentences and Computation Patterns: Multiplication and Division

[200 minutes]

Introduction

An open sentence in maths means that it uses variables, meaning that it is not known whether or not the mathematical sentence is true or false. Open sentence is a statement (as in mathematics) that contains at least one blank or unknown and that becomes true or false when the blank is filled or a quantity is substituted for the unknown.

A closed sentence, on the other hand, is a mathematical sentence that is known to be either true or false.

Source: Open and close sentences

Utility and Scope

Understanding open sentences is a stepping stone for understanding more complex maths problems.

A. Competency

- Solve open sentences involving multiplication and division using patterns.

B. Objectives

- Describe open and closed sentences with examples.
- Solve open sentences involving multiplication and division.
- Generate rules about how a change in one factor affects the result.

C. Essential Skills/Processes

- Reasoning
- Computing
- Creating

D. Learning Experiences

- Design an activity to discuss open sentences.

  For example: What number can replace in each of the following number sentences to make the statement true?

  i. 5 × 7= ..... ii. 3 × .....= 24 iii. 18 ÷ 3 = ... iv. 24 ÷ ..... = 4

- Ask the student, “What should we write in the blank to make the sentence true? If the blank is replaced with a letter, ask, “What number could stand for the letter to make the sentence true?”
- Solves some related questions and explain
- Use an example question to generate rules about how a change in one variable affects the result.
  Example: i. 4 ×10 =40 ii. 5 × 10 = 50 (as 4 increases by 1 the product increases by 10)
- Use the link Open sentence (it talks about open and closed sentences)

E. Assessment

Performance Task 1

Ask/give the questions shown below to assess the learning of the students

- Which of the following is an open sentence? Why?
  4 is an even number
  n is an even number
  12 is odd number
  5 is an odd number
- Which of the following mathematical statements is a false closed sentence?
  4 is an even number
  n is an even number
  12 is odd number
  5 is an odd number

Performance Task 2

Refer to the link below and prepare questions on open sentences for multiplication and division to assess the learning. Solving open sentences

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Tell three number sentences that are closed.
  ii. Tell three number sentences that are open.
  iii. Which is easier to solve, open or closed number sentences? Why?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ Open and close sentences
  - ➔ Open sentence
  - ➔ Solving open sentences

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-B3 Multiplying by 10, by 100 and by 1000

[150 minutes]

Introduction

A power of 10 is as many number 10s as indicated by the exponent multiplied together. Thus, shown in long form, a power of 10 is the number 1 followed by 'n' zeros, where 'n' is the exponent and is greater than 0; for example, 10^6 is written as 1,000,000.

Source: Introduction to a power

Utility and Scope

Noting numbers in the powers of 10 is a useful way for engineers, mathematicians and students alike to write down very large numbers (or small numbers) instead of having to write a lot of zeros in a row.

A. Competency

- Ability to identify patterns visually and represent symbolically for increasing power of 10.

B. Objective

- Identify patterns with increasing powers of ten; visually & symbolically.

C. Essential Skills/Processes

- Estimating
- Recognizing

D. Learning Experiences

- Design an activity that shows patterns when multiplying numbers with increasing powers of 10 (multiplying by 10, by 100 and by 1000). Let students identify the patterns visually and then record the pattern.
- Use the link Multiplying Patterns that shows patterns while multiplying whole numbers with powers of ten.
- Use appropriate videos Multiply pattern with whole number that shows patterns while multiplying whole numbers with powers of ten.

(Note: The video used/made should ensure multiplying whole numbers with powers of ten)

E. Assessment

Performance Task 1

Use the link (Worksheet) to assess the children Worksheet on multiplying patterns

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Will the knowledge of noting numbers in the powers of 10 useful to shop keepers also? How?
  ii. Why do you think it is much easier to multiply numbers by 10 and 100?
  iii. What pattern do you see when we increase the number by 10?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Worksheet
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - Multiplying Patterns (For multiplying with powers of 10)
  - Use the linkMultiply pattern with whole number that shows patterns while multiplying whole numbers with powers of ten.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-C1 Estimate & Measure Lengths in mm, cm, m, km

[300 minutes]

Introduction

The Egyptian cubit, the Indus Valley units of length and the Mesopotamian cubit were used in the 3rd millennium BC and are the earliest known units used by ancient peoples to measure length. Cubit was the length of the arm from the elbow to the tip of the middle finger (about 18 inches).

Source: History of estimation

In maths, estimation means having a rough calculation of the value, number, quantity, or extent of something. We use estimates of numbers to make it easier and quicker to do mental calculations when we are happy to accept an answer, which is very close to the actual answer.

Source: Process of estimation

Utility and Scope

Measurements continue to play an important role throughout everybody's life, for example, during a medical check-up, a sports competition, when building a house, when controlling temperature in appliances, or while cooking.

A. Competency

- Exhibit the ability to estimate, measure and develop unit relationships between different units of measuring length (mm, cm, m, km) and apply it in real life situations.

B. Objectives

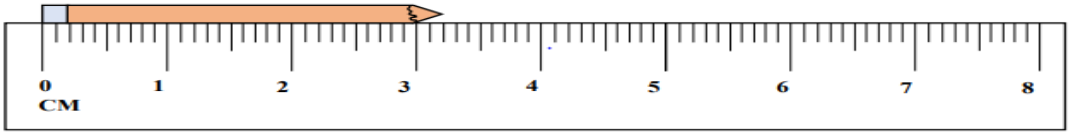
- Estimate and measure the length in various units (mm, cm, m and km).
- Develop a sense of longer units (deca, hecto and kilo).
- Investigate and develop unit relationships.
- Explore the relationship between roots of words: milli, centi, deci, m, deca, hecto, kilo.

C. Essential Skills/Processes

- Estimating
- Investigating
- Comparing

D. Learning Experiences

- Pre-assessment on measurement.
- Have students choose an item to measure whose length falls between two centimetre markings on the ruler.
  - Example: a pencil, ask them how they would describe the length of their pencils. (Students might say it is about 10 cm, or little more than 10 cm, or between 10 and 11 cm.) Repeat this process with two or three objects.
- Have them to look at their rulers? Point out that their rulers have 10 small markings that make up each centimetre. Indicate that each mark represents one millimetre. Write the abbreviated form, 1 mm. Have students notice that their fingernails might be about 1 mm thick. This gives them a referent for 1 mm.
- Make sure students understand that 1 cm = 10 mm. Then, explain how to measure the length of smaller objects in different units. Look at the example given below.



The pencil above can be described in these three ways:

a) using only millimetres: 32 mm

b) using only centimetres: 3.2 cm

c) using both centimetres and millimetres: 3 cm 2 mm

- Introduce other length units (dm, m, dam, hm, and km). (The units like dm, dam, hm are used less frequently).
- Develop a sense of how long each unit is.

  Example: our hand is about 1 dm wide. The length of the table is about 1 m. (Discuss the examples in their context).

  (The smallest length unit is mm and the longest is km)
- Let students explore the relationships between the length units.

  1 dm = 10 cm, 1 m = 10 dm, 1 dam = 10 m, 1 hm = 10 dam, 1 km = 10 hm

E. Assessment

Performance Task 1

Provide a set of classroom objects and instruct them to estimate the length. Then, ask them to measure the length of the items using appropriate units.

Performance Task 2

Provide a prepared worksheet and let students convert one unit to another. Use suggested worksheet available at Sample worksheet on estimation

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Can you tell, some of the tips for estimation?
  ii. How does estimation help us to do day-to-day activities?
  iii. Why do you think there are many units such as km, m, cm, mm to measure the length/distance?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Concrete materials
- Conversion chart
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ History of estimation
  ➔ Process of estimation
  ➔ Sample worksheet on estimation

G. Annexure

Use template given in IV-A1 to record student achievement

Topic: IV-C2 Area

[350 minutes]

Introduction

Area is the amount of space occupied by a two-dimensional figure. In other words, it is the quantity that measures the number of unit squares that cover the surface of a closed figure. The standard unit of area is square units, which is generally represented as square inches, square feet, etc.
Source: Area

Utility and Scope

Area is a measure of how much space there is inside a shape. Calculating the area of a shape or surface can be useful in everyday life – for example you may need to know how much paint to buy to cover a wall or how much grass seed you need to sow a lawn. Johannes Keppler, measured the area of sections of the orbits of the planets as they circled the sun using formulas for calculating the area of an oval or circle. Archimedes from Greece discovered the area of the circle.

A. Competencies

- Demonstrate the ability to estimate, measure and describe the relationship between the dimensions and area.
- Apply the concept of area to calculate the area of rectangular and square shapes in the immediate surroundings.

B. Objectives

- Demonstrate meaning of area as the number of units required to cover a given surface.
- Estimate and measure area using square centimetre (cm^2) units.
- Investigate areas of different objects with the same perimeter, and perimeters of different objects with the same area.
- Relate dimensions of rectangles to area concretely.

C. Essential Skills/Processes

- Conceptualizing
- Estimating
- Connecting
- Computing

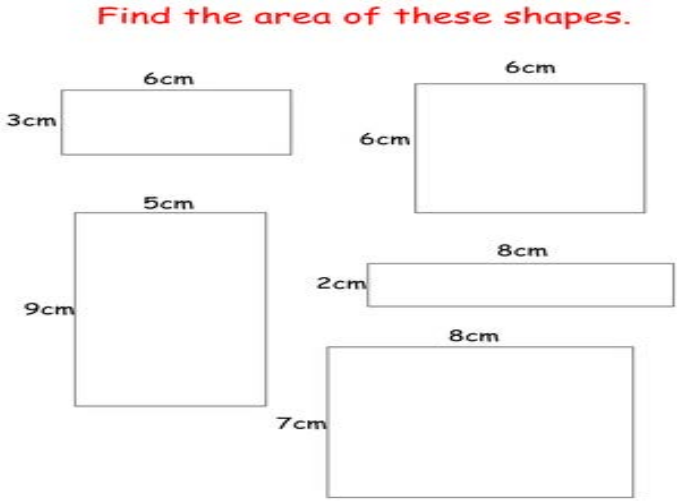
D. Learning Experiences

- Pre-assessment on area (comparing area without measuring).
  - *Example:* Draw a few shapes on board and ask them to compare.
    Which shape has a bigger area?
- Draw a rectangle and fill it with congruent circles. Ask, how many circles fit the given rectangle? Then, fill it with small congruent rectangles. Ask, how many small rectangles fit the given shape?
- Have students discuss why rectangles make better area units than circles.
- Provide the drawn rectangle and ask them to estimate the area. Then, place the 1 cm^2 cut out shape on the given rectangle and measure the area.
- **PBE approach *(Community as Classroom, Connection, Content Rich)*** Let students work out areas of some places in the school compound like *volleyball court, basketball court, badminton court, football field* (if they are interested) *classroom, library* and other possible areas. Ask them to relate the area with the perimeter. Let them experience and learn how finding out areas is applied in real life.
- Conclude that the area is the product of two dimensions (length x width). Let them find the area of rectangles with different dimensions.
- Provide a few examples of shapes having the same perimeter with different areas and shapes having the same area with different perimeter.
- Use PhEt simulation to explore about area and perimeter of a rectangle or use this link: Area Builder

E. Assessment

Performance Task 1

Use the worksheet to assess the children on finding the area



Performance Task 2

Create rectangles having the same area with different perimeter and vice-versa

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Areas of rectangles are always greater than the perimeters. Do you agree? Why?
  ii. What happens to the area of a rectangle when you double one of its dimensions?
  iii. Two different rectangles can have the same area but different perimeters. Do you agree? Why?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- PhET simulation
- Self-Instructional Materials Key Stage II, Volume 3
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online

  Area
  - Use PhEt simulation to explore about area and perimeter of a rectangle or use this link: Area Builder

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-C3 Volume

[250 minutes]

Introduction

Volume is the amount of space occupied by an object or a material. Volume is said to be a derived unit, since the volume of an object can be known from other measurements. In order to find the volume of a rectangular box, for example, one only needs to know the length, width, and depth(height) of the box. Volume can be calculated from the formula, **V = l × w × h.**

Utility and Scope

We use the knowledge of volume in everyday activities. We measure the amount of rice needed to cook food depending on the number of people in the family. Every container can hold a certain amount of things according to its capacity.
Finding the volume of an object can help us **to determine the amount required to fill that object**, like the amount of water needed to fill a bottle, an aquarium or a water tank.

A. Competency

- Estimate and measure volume using standard and non- standard units and implement its understanding while measuring/finding volume in a real situation.

B. Objectives

- Recall volume as the number of cubes it takes to build a solid.
- Estimate and measure volume in non-standard units and by using standard unit (cm cubes).
- Estimate, then calculate to verify the volume of rectangular prisms.
- Determine the volume of a rectangular prism and build prisms with a specified volume.
- Relate volume to dimensions (dimensions of first layer x number of layers) from any side.

C. Essential Skills/Processes

- Conceptualising
- Estimating
- Connecting
- Computing

D. Learning Experiences

- Conduct pre-assessment on volume (comparing volume without measuring).
- Example: Show a few 3-D shapes and ask which shape has more volume.
- Use linking cubes to estimate and find the volume in non-standard units.
- Use one's block (1 cm^3) to find the volume of a shape in standard units.
- Provide one's block to prepare a rectangular prism with a specified volume.
- Use linking cubes to connect volume to dimensions (dimensions of first layer × number of layers) from any side.
- **PBE approach (*Content Rich, Local to Global*)** Let students bring different containers preferably different sizes of cartons to the class OR let them visit school stationery stores and choose several different cartons. Ask them to work out the volume of several different cartons that they chose using the unit cm^3. Doing this they would also learn to choose the right container according to the stuff they need to put in.
- Use the link Measuring Volume to know more about volume.

E. Assessment

Performance Task 1

Provide numbers of printed shapes and ask them to estimate the volume of the shape.

Performance Task 2

Let students create a rectangular prism using 10's block with the given volume. Example: 20 cm^3. (2 ten's block can be used)

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why do you think the unit for volume is cubic unit?
  ii. How is volume different from area?
  iii. Why do you think you are learning to calculate the volume of shapes?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Linking cubes
- Base ten model (one's block and ten's block)
- Self-Instructional Materials Key Stage II, Volume 3
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
    - Use the link Measuiring Volume to know more about volume.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D1 Triangles.

[350 minutes]

Introduction

Triangle comes from the Latin word triangulus, "three-cornered" or "having three angles," from the roots tri-, "three," and angulus, "angle or corner." A triangle is a polygon, which is a closed shape like a square or a hexagon, but a triangle has only three sides.

Utility and Scope

Similar triangles can be used for many different things. In architecture similar triangles are used to represent doors and how far they swing open. Also, when you use shadows that make triangles to find the height of an object. You can use that to find the height of actual objects and they can also be used to stabilize a bridge.

A. Competency

- Create triangles after discovering the properties and give appropriate names for each of the triangles.

B. Objectives

- Use concrete materials to discover the properties of equilateral, isosceles, scalene.
- Sort by various properties like number of lines of symmetry, number of identical angles.
- Recognize and draw or create three different triangles based on sides.
- Examine and sort the quadrilaterals by congruent sides, right angles and parallel sides.

C. Essential Skills/Processes

- Conceptualizing
- Classifying
- Connecting

D. Learning Experiences

- Use concrete objects (ten's block, sticks, ruler, linking cubes, and pencils) to show equilateral, isosceles, and scalene triangles.
- Discuss the properties of different triangles classified by sides.

- Discuss the properties of different triangles by lines of symmetry.
- Discuss the properties of different triangles by the number of identical angles.
- Recognize and construct all three types of triangles.
- **PBE approach *(Content Rich)*** Let them find out where triangles are used in their locality, school compound and town areas. Let them also investigate why triangles were used in the structures or in the places.
- Use this link to know more about triangle by side Classifying Triangles
- Trim and use the video from the link below to know more on the line of symmetry of triangles. Lines of symmetry
- Sort quadrilaterals by congruent sides, right angles and parallel sides

E. Assessment

Performance Task 1

Let students classify the triangles based on sides, line of symmetry and number of identical angles.

Performance Task 2

Ask students to use any concrete objects of their choice and construct three different triangles.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
    i. Why do you think triangles have different names?
    ii. Tell the names of at least three different triangles. Why are they given such names?
    iii. What are the differences between triangles and quadrilaterals?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Concrete objects (ten's block, stick, ruler, linking cubes, and pencils)
- Technological gadgets for learning (mobile, desktop, laptop...)
- Worksheet (questions on classifying of triangles)

- Online
  - Use this link to know more about triangle by side Classifying Triangles
  - Trim and use the video from the link below to know more on the line of symmetry of triangles. Lines of symmetry

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D2 Composite Shapes

[250 minutes]

Introduction

A composite shape (or composite figure), also known as a compound shape, is one that is made up of a number of different shapes when deconstructed. For example: a square and a triangle, a square and a rectangle, two triangles etc.

Utility and Scope

Hundreds, if not thousands, of examples of composite materials, exist in today's world. Applications in the medical, aerospace, automotive, and military fields exist in abundance. Composite materials are generally used for buildings, bridges, and structures such as boat hulls, swimming pool panels, racing car bodies, shower stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks and countertops. They are also being increasingly used in general automotive applications.

A. Competency

- Demonstrate the ability to predict and verify the shapes by combining smaller and known shapes and draw the conclusion that any 2-D shapes can be decomposed in different ways or say that they are combinations of different shapes.

B. Objectives

- Predict what new shapes can be created by combining two or more 2-D shapes and then verify by combining.
- Create composite shapes using manipulatives like tangram, pattern blocks, linking cubes.

C. Essential Skills/Processes

- Predicting
- Constructing

D. Learning Experiences

- Pre-assessment (names of different polygons).
- Make students predict the composite shapes.
  Ask questions like;

What shape will you get if you combine two triangles?
What shape will you get if you combine two triangles and one square?
If you combine two squares, what shape will you get? (Teacher can ask similar questions)

- Provide tangrams to construct different composite shapes to confirm their prediction. Then, let them name the shapes used in constructing the composite shapes.
- Make them draw the composite shape they have constructed.
- **PBE approach *(Local to global, Content Rich)*** Ask the students to identify composite shapes in the classroom and let them name the shapes that constitute the composite shapes. Let them go out and identify composite shapes on the structures, vehicles, floor, footpaths, playground etc.
- Let students watch the video on how composite shapes are made. (Suggested link Composite Shapes or look for appropriate video on composite shapes.
- Let them look for composite shapes in and around their home or on the way. Then draw and show it to their friends in the class.

E. Assessment

Performance Task 1

Let students create five different composite shapes using tangrams/pattern blocks.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Is square a composite shape? What shapes do you find in it?
  ii. Which pairs of congruent shapes when combined will form a square?
  iii. What shapes would you get by cutting (decomposing) a square?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Tangrams/patterns blocks
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online

- Let students watch the video on how composite shapes are made. (Suggested link Composite Shapes or look for appropriate video on composite shapes.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D3 Construct Models of cylinders, cones, prisms and pyramids

[100 minutes]

Introduction

In geometry, 3-D shapes are solid shapes or figures that have three dimensions. Generally, length, width and height are the dimensions of 3-D shapes (three-dimensional shapes). The common names of these shapes are cube, cuboid, cone, cylinder and sphere. 3-D shapes are defined by their respective properties such as edges, faces, vertices, curved surfaces, lateral surfaces and volume.
The relationship between a cylinder and a cone is **similar to the relationship between a pyramid** and a prism. If a cone and a cylinder have the same height and a circular base with the same area, then we can place the cone inside the cylinder, and the cone will take up 1/3 of the space in the cylinder.
Source: model of cylinder,cone, pyramid and prism
Nets of solid shapes

Utility and Scope

A rectangular prism, pyramid, cone and cylinder are the basic 3-dimensional shapes we see around us. We can see a prism in a Rubik's cube and a die, a rectangular prism in a book and a box, a cone in carrot and an ice cream cone and a cylinder in a bucket fruit juice cane and a barrel, pyramid is found on the top of the tower and the real pyramid in Egypt.

A. Competency

- Demonstrate the ability to model and construct skeletal models of cylinders, cones, prisms and pyramids.

B. Objectives

- Construct 3-D skeletal models using straw, modelling clay, dough etc.
- Examine the similarities and differences between any pair of 3-D shapes.

C. Essential Skills/Processes

- Constructing
- Connecting

D. Learning Experiences

- Pre-assessment (show 3-D models and let the students name them).

- Build skeletal models of 3-D shapes using straw, clay, and dough. (model one or two shapes).
- Use suggested video clips available at: This video is about building skeletal models for 3-D shapes Skeletal model of 3D shape . (Watch and trim the video clip as per lesson required).
- Allow students to construct the skeletal models of 3-D shapes from the clay or dough after watching the video.
- Discuss the similarities and differences between any pair of 3-D shapes.

E. Assessment

Performance Task 1

Let students make five different skeletal models of 3-D shapes (prism, pyramid, cone and cylinder). This task should be project based.

Performance Task 2

Let students discuss and write the similarities and differences between any pair of 3-D shapes.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
    i. Which 3-D shapes do you see in nature or man-made structures that look like cylinder, cone, pyramid and prism other than what you have discussed in the classroom?
    ii. How are prisms and pyramids similar? How are they different?
    iii. Cylinders and prisms look similar. Do you agree? Why?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics Framework for PP – XII
- 3-D models

- BLM
- Improvised materials to build the skeleton
- Technological gadgets for learning (mobile, desktop, laptop...)

Online

- model of cylinder,cone, pyramid and prism
- Nets of solid shapes

- This video is about building skeletal models for 3-D shapes Skeletal model of 3D shape.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D4 Slides, Flips, Turns (half, quarter)

[300 minutes]

Introduction

"Flip, slide and turn are words **to describe how shapes can be changed, or transformed, from their original**. Flip, slide and turn are colloquial terms for reflection, translation and rotation.
Source: slide, flip and turn
They are also called transformations. Transformation means to change. Hence, a geometric transformation would mean to make some changes in any given geometric shape.

Utility and Scope

Transformations can be found everywhere. You don't have to go far to find one, Transformations are movements through space. We see them as a repeating pattern. Transformations are part of our everyday lives and we don't even know it. So many professions use transformation skills, including Architects, Artists, and Designers. They use transformation understanding to create and design patterns which can be used in so many different areas, including: textiles, buildings, models, flooring, gaming.
Source: Transforming 2D Shapes

A. Competency

- Display the ability to predict and finally confirm the results for 2-D shape transformations after doing practically (Slides, Flips, and Turns [half, quarter]).

B. Objective

- Demonstrate understanding of the concepts of slides, flips and turns.
- Predict and confirm results for 2-D shapes under transformations.

C. Essential Skills/Processes

- Conceptualizing
- Demonstrating

D. Learning Experiences

- Pre-assessment (identifying slides and flips).
- Use cut out shapes to explain the concepts of slide, flip and turn. (Terms like original shape and image need to be used frequently to help the students become comfortable with these new terminology)

- Allow students to predict the image of a given shape for slide, flip and turn. Then, let them confirm their prediction after transforming the shapes.
- Show how to transform shapes (use this video link: Transformation). (Watch and trim the video clip as per lesson required).
- **PBE approach *(Learner Centered)*** Students may investigate and identify where flips, slides and turns of shapes were done knowingly or unknowingly in and on the structures including paintings, on the footpaths and sometimes naturally in the environment.

E. Assessment

Performance Task 1

Provide a few shapes and ask them to transform the given shape as described by the teacher.

Performance Task 2

Let students predict and confirm the image of 2-D shape under transformation. (Suggestion: Use the table given below).

Original Shape	My Predicted image	Actual image
Flip		
½ turn CW		

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. There is no cw or ccw for a half turn. Explain.
  ii. Which transformation is easier for you? Why?
  iii. Look at the paintings in and around your classroom and find out the shapes which look like a

a. reflection
b. rotation
c. slide

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Cut out shapes
- Grid paper
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ Transforming 2D Shapes
  - ➔ slide, flip and turn
  - ➔ Show how to transform shapes (use this video link:Transformation. (Watch and trim the video clip as per lesson required).

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D5 Reflective Symmetry (Quadrilaterals)

[200 minutes]

Introduction

Reflective symmetry is when a shape or pattern is reflected in a line of symmetry / a mirror line. The reflected shape will be exactly the same as the original, the same distance from the mirror line and the same size.

Source: Reflection symmetry

Utility and Scope

Reflective symmetry is a type of symmetry where one-half of the object reflects the other half of the object. It is also known as mirror symmetry. For example, in general, human faces are identical on the left and right sides. The wings of most butterflies are identical.

A. Competency

- Identify properties of various quadrilaterals and confirm the reflective symmetry of shapes given to them.

B. Objectives

- Explore properties of various quadrilaterals.
- Make generalisations focusing on reflective symmetry properties.
- Examine and sort the quadrilaterals by congruent sides, right angles and parallel sides.

C. Essential Skills/Processes

- Conceptualizing
- Analyzing

D. Learning Experiences

- Pre-assessment (discuss the properties of different quadrilaterals).
    - Ask questions like;
        - How many congruent sides are there in a rectangle?
        - What are the similarities and the differences between a square and a rectangle?
        - How many lines of symmetry are there in a parallelogram?
- Show a line of symmetry in a shape and discuss reflective symmetry properties.

- **PBE approach *(Learner Centered)*** Ask students to look for reflective symmetry in and around their classroom and try to find out whether the ideas of reflective symmetry are used or not.

E. Assessment

Performance Task 1

Let students choose any two shapes and draw the lines of symmetry. Ask the students the properties of reflective symmetry.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. How many lines of symmetry do a rectangle and a square have?
  ii. Which quadrilateral has the maximum number of lines of symmetry?
  iii. Which quadrilateral does not have the symmetry line? Why do you say so?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- BLM
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Reflection symmetry

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D6 Congruence of Polygons

[350 minutes]

Introduction

Two polygons are congruent if their corresponding sides and angles are congruent. Note: Two sides are congruent if they have the same length, and angles are congruent if they have the same measure. We indicate that angles are congruent by putting the same number of slash marks through each angle.
Source: Congruent Polygon

Utility and Scope

The idea of congruence of polygons are used on the road in arrangement of footpath tiles. If the shapes chosen for the path are not congruent then they may not fit to cover the path. The most common example of polygon congruence is also with tile in the toilets and bathroom. Pages of a book are also good examples.

A. Competency

- Demonstrate the ability to explore a variety of materials to confirm that congruent polygons are a perfect match.

B. Objectives

- Determine that the congruent polygons are a perfect match.
- Use a variety of materials like pattern blocks, tangrams, pictures of shapes and tracings to show the congruence of polygons.

C. Essential Skills/Processes

- Conceptualizing
- Connecting

D. Learning Experiences

- Pre-assessment (Suggestion: Teacher shows pattern blocks/tangrams/picture of shapes and asks them to name the shape).
- Let students look for the same shapes.
- Let students look for the same/congruent shape in the classroom (For example: the table top, chart paper, and window panes)
- Explore congruent shapes in their environment.
- Use the video link given Congruence polygon to teach congruence of polygons.

E. Assessment

Performance Task 1

Let students carry out the activity on finding congruent polygons (Refer questions from students Mathematics textbook).

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. If a square and a pentagon have the same perimeter. Will they be congruent? Why?
  ii. Two different 2-D shapes have the same perimeter. Are they congruent? Why?
  iii. How will you check/test the congruence of two or more shapes?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Pattern blocks, tangrams, picture of shapes
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Congruent Polygon
  ➔ Use the video link given Congruence polygon to teach congruence of polygons.

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-D7 Angles and IV-D8 Draw Angles

[250 minutes]

Introduction

The word angle comes from the Latin word angulus, meaning "corner" an angle is the figure formed by two rays, called the sides of the angle, sharing a common endpoint, called the vertex of the angle. Angles formed by two rays lie in the plane that contains the rays. Angles are also formed by the intersection of two planes.
Source: Angle Definition

Utility and Scope

Mathematicians have considered the problem of measuring angles since ancient times. The ability to measure angles with some precision is important in fields such as astronomy, physics, engineering, and architecture, as well as in various practical supporting fields such as carpentry. It is difficult to imagine the ancient Egyptians trying to construct the pyramids without a precise system for measuring angles, particularly right angles.

A. Competency

- Describe and classify angles formed by structures, objects and landscape around them as right, acute and obtuse.

B. Objectives

- Develop the meaning of an angle as amount of turn concretely and pictorially (smaller angle = smaller turn).
- Draw a conclusion by investigating that the length of arms of an angle does not influence angle size.
- Differentiate and describe right, acute and obtuse angles.
- Draw angles using pencil, ruler and protector.

C. Essential Skills/Processes

- Investigating
- Predicting

D. Learning Experiences

- Pre-assessment finding right angles (classroom objects)
- Ask questions like;

- Which angle is greater? (Printed angles/draw the angles on the board)
- Determine the angles greater than or less than the right angle.

- Have students find the angles in the classroom objects and compare.
- Use improvised angles (sticks of different length) to show that the length of an arm does not influence angle size.
- Differentiate and describe right, acute and obtuse angles. (reference point: right angle)
- Classify the given angles as right, acute and obtuse. (provide printed angles)
- Let students explore the lesson on classifying angles in SIM for class 4, volume 2.
- Explore and share video lessons on angles.

  Suggested link Types of Triangle (watch the video on angles and trim the video clip as per the requirement before sharing)
- Let students draw angles using a protector.

E. Assessment

Performance Task 1

Provide different angles (10 different angles consisting of acute, right, and obtuse) and ask them to classify.

Performance Task 2

Draw and differentiate right, acute and obtuse angles.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. A boy walked five steps to the front and continued five steps towards his left. What angle did he make through his walk?
  ii. Which angle do you find mostly in and outside your classroom?
  iii. How would our life be without angles?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics for PP – XII
- Improvised angles (sticks, linking cubes, ten's block)
- Printed angles

- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ Angle Definition
  - ➔ Video lessons on angles suggested link Types of Triangle (watch the video on angles and trim the video clip as per the requirement before sharing)

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-E1 Collect, Organise and Describe Data

[300 minutes]

Introduction

In schools, when teachers want to know their students' academic performance, they collect data, organise it and present the findings. Similarly to address the different problems/issues in the school or outside, we collect data, interpret and find the results.

Data is raw information, which is unorganised facts that need to be processed. After data is processed, organised, structured or made ready in a given context so as to make it useful, it is called information. Data can be collected using observations, interviews, questionnaires and existing databases. The method chosen for collecting the data depends on the type of research being done. Organising data is bringing it together in a systematic way that makes it easier to read (Source: https://bit.ly/3f8FgTV).

Utility and Scope

Collecting, organizing, describing, and interpreting data would help the child in the research field. Data collection helps a person or organizations to effectively determine the cause of problems in different locations, departments and systems. Explore the link given to know more about the utility and scope of data collection Information on data.

A. Competency

- Describe the collected data in multiple ways and draw conclusions about everyday issues.

B. Objectives

- Collect data using appropriate tools.
- Make decisions about the format of presentation (charts, tables, graphs).
- Determine the maximum and minimum data values from given numerical data.

C. Essential Skills/Processes

- Planning
- Organizing
- Representing

D. Learning Experiences

- Let students watch the video using the link Data Collection to learn how to collect data. After watching the video, ask questions like;
  - Why do we collect data?
  - What is data used for?
  - How would you collect the data?
- Explore numerous ways to collect data (classroom objects, nature and population) using relevant tools.
- Explain the steps involved in collecting data.
  - Identifying situations to collect data.
  - Formulating data collection tools (example; survey questionnaires and interviews).
  - Collecting data using developed tools.
  - Organizing collected data.
  - Describing the data.
- After collection of the data, allow students to decide on the format of presentation of the data they collected.
- Ask students to determine the maximum and minimum data values from the given data.
- **PBE approach *(Inter-Disciplinary, Inquiry)*** Carry out depending on the mapping competency that they have planned in the beginning,

E. Assessment

Performance Task 1(Project-Based Learning)

Students in groups identify the appropriate topic to collect data.

Suggested topics:

- *Students coming from different places.*
- *Finding the number of petals.*
- *Number of siblings.*
- *Number of books read in the last two months.*

Collect the data in groups using the developed tools and organize in the tabular form.

Let students describe the data. Let them determine the maximum and minimum data values from given numerical data.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions

i. How will you find out the favourite fruits of class IV students?
ii. Your school wants to decide the morning reporting time of the students to the school. How can you help the school to decide the appropriate reporting time?
iii. Your class has decided to have a tea party. How will you decide to prepare a kind of tea where most of you will enjoy?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics framework for PP – XII
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  - ➔ Data vs. information https://bit.ly/3f8FgTV
  - ➔ Collecting Data (Video) https://bit.ly/34ty6au
  - ➔ Why data is so important https://bit.ly/3HVH92i

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-E2 Construct & Interpret Pictographs & Bar Graphs

[250 minutes]

Introduction

After collecting and organizing data, we need to present the data in a variety of ways to help make it easier to comprehend and interpret. It helps us understand what the data means by providing visual context in the form of maps or graphs. Students will represent the data in a bar graph and pictograph.

A bar graph is a chart that plots data using rectangular bars. A pictograph is the representation of data using images.

Utility and Scope

The purpose of a bar graph and pictograph is to convey relational information quickly as these graphs display the quantity for a particular category

Source: https://www.investopedia.com/terms/b/bar-graph.asp)

A. Competency

- Construct and interpret bar graphs and pictographs using the data from real life.

B. Objective

- Choose the appropriate scale and symbol for the pictograph.
- Construct the graphs with appropriate labelling (include both vertical and horizontal representations).
- Interpret and draw conclusions from the graphs.

C. Essential Skills/Processes

- Representing
- Constructing
- Relating
- Analysing

D. Learning Experiences

- Let the students watch a video on how to make a bar graph and pictograph. Graph tutorial.

  Ask the following questions after watching the video;
  - Why do we need to represent the data?
  - Which representation did you like the most?

- Let students choose the appropriate symbol to represent in a pictograph from the data collected in the previous lesson.
- Interpret and draw conclusions from the pictograph.
- Similarly, let students prepare a bar graph from the data collected in the previous lesson. Let them decide the value of each square for both vertical and horizontal representations.
- **PBE approach *(Inter-Disciplinary, Inquiry)*** Carry out depending on the mapping competency that they have planned in the beginning,
- Interpret and draw conclusions from the bar graph.

E. Assessment

Performance Task 1

Provide data and let students construct a pictograph and a bar graph. Then, let them interpret and draw conclusions from the graph.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why is it necessary to display data in the form of a graph?
  ii. Have you seen graphs and charts in other places? What was it about?
  iii. Which one is more attractive to our eyes? Pictures or words? Why do you think so?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics framework for PP – XII
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
  ➔ Bar graph Meaning of bar graph
  ➔ Preparing a pictograph and bar graph https://bit.ly/3nAaSqb

G. Annexure

Use template given in IV-A1 to record student achievement.

Topic: IV-E3 Coordinate Grid (Ordered pairs)

[200 minutes]

Introduction

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. 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 coordinate system we commonly use is called the *Cartesian system*, after the French mathematician René Descartes (1596-1650), who developed it in the 17th century. Legend has it that Descartes, who liked to stay in bed until late, was watching a fly on the ceiling from his bed. He wondered how to best describe the fly's location and decided that one of the corners of the ceiling could be used as a reference point.

To know more about the coordinate system, explore the link given https://bit.ly/33mXgXI.

Utility and Scope

Ordered pairs help to locate a point on the grid. The latitude and longitude lines on maps of the Earth are an important example of spherical coordinates in real life. Explore the link https://bit.ly/3nfIJ7s to know more about how to Use a Coordinate Plane in Real Life.

A. Competency

- Demonstrate the ability to plot the ordered pairs on the coordinate grid and locate the places.

B. Objectives

- Describe the importance of ordered pairs.
- Plot the points in the coordinate graph (Quadrant I) .
- Name the points in the coordinate graph.
- Use terminology: “axes,” “coordinates,” “plot,” and “origin”

C. Essential Skills/Processes

- Conceptualizing
- Plotting

D. Learning Experiences

- Show the grid and introduce the terminologies like “axes,” “coordinates,” “plot,” and “origin”.
- Explain the need for convention for naming points (ordered pairs) and why order is significant.
- Let the students watch the video on how to plot ordered pairs using the link Plotting coordinates.
- After watching, let students plot the ordered pairs on the grid.
- Let the students play a game, **Three in a Row**. Refer to the annexure for the instruction.

E. Assessment

Performance Task 1

Prepare a worksheet where students plot the ordered pairs on the grid. Check all the labels. Let students explain the need for convention for naming points.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
    i. In what ways can we use the idea of ordered pairs in our daily life?
    ii. Have you seen perpendicular lines on maps? How do the lines help us locate places on the map?
    iii. A point is at (6,8). What does this mean?

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher’s Guide for class IV
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (Grid paper)
- Technological gadgets for learning (mobile, desktop, laptop...)
- Online
    - History of Coordinate system https://bit.ly/33mXgXI
    - Use of Coordinate Plane in Real Life https://bit.ly/3nfIJ7s
    - Plotting ordered pairs Plotting coordinates.

G. Annexure

i. Game: **Three in a Row**

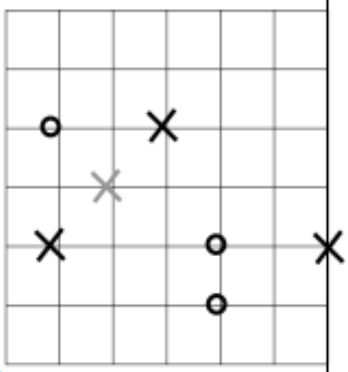
Play in a group of 2. You need one 6-by-6 grid and two dice.

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.



ii. Use template given in IV-A1 to record student achievement

Topic: IV-E4 Describing Probability Using Fractions

[350 minutes]

Introduction

Probability is the chance that something will happen, or how likely it is that an event will occur. When we toss a coin in the air, we use the word probability to refer to how likely it is that the coin will land with the heads side up. "A gambler's dispute in 1654 led to the creation of a mathematical theory of probability by two famous French mathematicians, Blaise Pascal and Pierre de Fermat.

Utility and Scope

Probability is widely used in all sectors in daily life like sports, weather reports, and blood samples, predicting the sex of the baby in the womb, statics, lottery tickets, politics and many. Explore the link https://bit.ly/3JYOQ9Q to know more about the examples of real-life probability.

A. Competency

- Describe probability using fractions and probability words and apply it to real life probability events.

B. Objective

- Predict whether an outcome is more, equally or less likely to occur.
- Relate probability of an event to fractions.
- Describe probability using probability words like likely, very likely, unlikely, and very unlikely.

C. Essential Skills/Processes

- Connecting
- Predicting

D. Learning Experiences

- Show a die and ask what number will I get if I roll this die?
  - Listening to the responses from the students, explain to the students this is a probability. Probability is simply how likely something is to happen.
- Hold up a single die. Ask students to predict how many times you will roll the number four in 12 rolls. Each student can write down his or her prediction. Roll the die 12 times and record the result.

- Ask students whether their predictions are accurate or not.
- Discuss the following events, whether it is more, equally or less likely than another. Let them explain their predictions.
  - Rolling a number less than 3 or rolling a number more than 3 on a die.
    - Roll a die 10 times and confirm the prediction.
  - Flipping Khorlo or Tashi-tagye on a coin.
    - Carry out the experiment to confirm the prediction.

- Every probability can be written as a fraction from 0 to 1.
  - probability = 0 means an event never occurs
  - probability = ½ means that there is equal chance of an event occurring or not occurring
  - probability = 1 means an event always occur

- Flip a coin 10 times and record the result. Explain how to describe the probability as fractions. Use a probability line (from 0 to 1) to show if it is closer to 0, to ½, or to 1. Then, use words very unlikely, unlikely, likely, or very likely to describe how likely it is. Carryout some more experiments using different probability devices (die, coin, spinner, cards).

E. Assessment

Performance Task 1

Let students prepare a spinner like the one below (in a group) and let them conduct the experimental probability

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Tell us an event that will never happen.
  ii. Tell us an event that is likely to happen.
  iii. Tell us an event that is certain to happen.

F. Resources

- Understanding Mathematics, Textbook for class IV
- Understanding Mathematics, Teacher's Guide for class IV
- National School Curriculum, Mathematics framework for PP – XII
- Probability devices
- Technological gadgets for learning (mobile, desktop, laptop...)

- Online
  - Examples of Real Life Probability https://bit.ly/3JYOQ9Q

G. Annexure

Use template given in IV-A1 to record student achievement

Instructional Guide
Class V
Mathematics

Topic : V-A1 Place Value of Whole Numbers to 7-Digits
V-A2 Interpret Million

[200 minutes]

Introduction

The name million is based on the Italian word *mille*, which means 1000. People sometimes use the word million to mean any big number. A person with a lot of money is called a millionaire, even if he or she has more than one million Ngultrum.

Utility and Scope

Most children learn to count at a young age and understand many of the principles of numbers on which counting is based. This learning can provide the foundation for their later mathematical development dealing with numbers of larger value.

A. Competency

- Demonstrate the ability to interpret 7-digit numbers in different ways and apply in real life situations.

B. Objectives

- Read and represent whole numbers up to 7-digits.
- Demonstrate understanding of place value patterns as groups of 3.
- Interpret whole numbers in different ways and justify.
- Develop a sense of how big a million is through meaningful investigations.

C. Essential Skills/Processes

- Representing
- Identifying
- Comparing
- Investigating
- Interpretation
- Reasoning

D. Learning Experiences

- Pre-assessment on recognizing value of each digit in 5-digit numbers.
- Use a place value chart or any other appropriate materials to introduce 6-digit numbers and 7-digit numbers.
- Use realistic examples to interpret millions in different ways.

Example: Interpreting population in different ways.

- Download and trim video available at Place value _to introduce 6-digit numbers and 7-digit numbers.

E. Assessment

Performance Task 1

Let students write 7-digit numbers to interpret in different ways. (Assign few 7-digit numbers to write in different ways)

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. How do you know 0.3 million will end in five zeros when it is written in standard form?
  ii. Can we call anyone a millionaire if s/he has ten hundred thousand Ngultrum?
  iii. How will this lesson help you in your life?

F. Resources

- Understanding Mathematics, Textbook for class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (Place value chart)
- Online
  - Introduction on millions -1,000,000 - Wikipedia
  - Introduction of digits -Place value

G. Annexure

i. Template to record assessment

Strand(s): Numbers and Operations	Topic(s): Place value of whole numbers to 7-digit/Millions				
Competency: Demonstrate the ability to use place value chart to interpret 7-digit numbers					
Name of the student	Level of achievement				
	Beginning	Approaching	Meeting	Advancing	Exceeding

Topic: V-A3 Large Numbers: Compare and Order

[200 minutes]

Introduction

The natural numbers are presumed to have started before humans began to count things. The Babylonians developed a place-value system based on the numerals for 1 (one) and 10 (ten). The ancient Egyptians added to this system to include all the powers of 10 up to one million. USA uses the Arabic-Hindu number system with decimals, based on ten, and developed around India. This was introduced to Europe around the 12th century, and pioneered by Al- Khwarizmi and Al-Kindi, among others.

Utility and Scope

Numbers are used in everyday life, for instance in simple counting or in monetary transactions, from the cells in the human body to the size of the universe, appear frequently in fields such as mathematics, cosmology, cryptography, and statistical mechanics.

A. Competency

- Compare and order 7-digit whole numbers in different notation and use it while dealing with larger numbers.

B. Objectives

- Compare and order large numbers
    - ❖ in standard notation (34,256,876 > 34,255,996)
    - ❖ in decimal notation (34.25 million < 34.3 million)
    - ❖ both (34,256,876 < 35.2 million)
    - ❖ with different units (3,423 thousand > 3,325,146)

C. Essential Skills/Processes

- Visualising
- Modelling
- Investigating

D. Learning Experiences

- Pre-assessment on recognizing value of each digit in 7-digit numbers.
- Discuss examples on comparing large numbers in different notations.

Example:

- *in standard notation (34,256,876 > 34,255,996)*
- *in decimal notation (34.25 million < 34.3 million)*
- *both (34,256,876 < 35.2 million)*
- *with different place value (3,423 thousand > 3,325,146)*

- Let the children play the game (Target 7) given in the class V textbook or use link: Target game

E. Assessment

Performance Task 1

Let students compare and order large numbers in different notations up to 7-digits. (Worksheet provided by the teacher)

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Question
  i. What is the advantage of comparing and ordering whole numbers?
  ii. How is comparison of numbers useful in our daily life?
  iii. Which form of number is easier to read and write? Decimal form or in standard form? Why?

F. Resources

- Understanding Mathematics, Textbook for Class V
- Understanding Mathematics, Teachers' Guide for Class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM
- Online
  - Game-Target game

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A4 Meaning of Fraction as Division
V-A5 Rename Fractions with and without models
V-A6 Compare and Order Fractions Using Reasoning

[550 minutes]

Introduction

The word fraction actually comes from the Latin "fraction" which means to break. The way we represent fractions today probably came from the Hindus. Around 630A.D., Brahmagupta could write the fraction two-fourths without the bar. Then, the Arabs came up with the bar. However, the notation 2/4 was mostly used due to typesetting constraints. The notion of numerator and denominator came from Latin writers.

Utility and Scope

Learning fraction helps to recognize parts and wholes both visually and numerically. Fractions help children understand the nature of numbers and their interactions (e.g., the meaning of division). If a child doesn't understand how fractions work, it will interfere with his ability to learn algebra later.

A. Competency

- Rename fractions and apply the concept of comparing and ordering fractions in appropriate situations.

B. Objectives

- Develop relationship between fractions and division.
- Link concrete, pictorial and symbolic representation of fractions.
- Explain that equivalent fractions are the same region partitioned in different ways
- Use the relationship between numerator and denominator to compare and order fractions.
- Develop referents to compare and order fractions (same denominator, same numerator and as mixed numbers)

C. Essential Skills/Processes

- Patterning
- Renaming
- Connecting
- Conceptualising
- Modelling

- Reasoning
- Comparing

D. Learning Experiences

- Conduct a pre-assessment to discuss meanings of fraction and renaming small fractions.
- Design an activity to explore the relationships between fraction and division.
  Example: *Draw a picture of a whole divided into 4 equal parts and colour one of them. Help students see that this picture clearly shows 1 whole being divided into 4 equal parts, where each part is 1/4. This shows that 1 ÷ 4 = 1/4, and it relates fractions to division.*
- Display some concrete materials and let students tell some fraction that they have observed. Also represent fractions in pictorial and symbolic form.
- Develop the concept of equivalent fraction using concrete materials. (They may use the idea of paper folding to show different equivalent fractions).
- Discuss the relationship between denominator and numerator.
- Students should learn that the denominator shows the whole thing, total numbers in a set and numerator shows the part of the whole or a set.
- Watch the link: Comparing,ordering fraction. to compare and order fractions

E. Assessment

Performance task 1

Show a shaded grid and let students describe a fraction in different ways, concretely and symbolically.

Performance task 2

Design a task to compare and order the fractions using the link; Comparing fraction worksheet.
(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why does it make sense that fractions are about division?
  ii. Why might you use a different strategy to compare
  $\frac{3}{5}$ and $\frac{3}{9}$ than to compare $\frac{3}{5}$ and $\frac{6}{5}$?

iii. Is this lesson applicable in our life? How?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Concrete materials
- BLM (Grid)
- Base ten blocks
- Online
  - Compare and order like fractions - Comparing,ordering fraction
  - Task to compare and order fractions: Comparing fraction worksheet

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A7 Model and Record Thousandths
V-A8 Compare and Order Numbers to Thousandths

[400 minutes]

Introduction

The decimal system was invented by Hindu mathematicians in India between the first and sixth centuries A.D. This *system is sometimes* also called the Hindu-Arabic numeral system because it was first introduced to Europeans by Arabs, who had acquired the system from the Hindus earlier. The third decimal digit from the decimal point is the thousandths digit. For example, 0.008 is eight thousandths. Read the whole set of three decimal digits as a number, and say "thousandths." While 0.825 is the sum of 8/10, 2/100, and 5/1000, it is also 825/1000 (825 thousandths).

Utility and Scope

We use decimals everyday while dealing with money, weight, length etc. Decimal numbers are used in situations where more precision is required than the whole numbers can provide. For example, when we calculate our weight on the weighing machine, we do not always find the weight equal to a whole number on the scale. The main advantages of the Decimal Number System are; easily readable, used by humans, and easy to manipulate.

A. Competency

- Apply the concept of comparing and ordering thousandths in appropriate situations.

B. Objectives

- Model thousandths.
- Place decimal numbers on a number line and justify the size of a decimal number.
- Read quantitative value of each digit in decimal numbers (16.5 as "sixteen and 5 tenths" or "sixteen and a half")
- Develop reference (0.432 is a little less than half)
- Explain that decimal numbers do not need the same number of places after the decimal to be compared (0.7 > 0.423)
- Explain that the number of places after the decimal does not determine size.

C. Essential Skills/Processes

- Modelling
- Reasoning
- Analysing
- Ordering

D. Learning Experiences

- Conduct pre-assessment for comparing hundredths and then link with thousandths.
- Use models to compare decimals
- Show how to read the quantitative value of each digit in decimal numbers.
- Explain thousandths using the link Introduction to thousandths.
- Carry out an activity using a place value chart to compare and order thousandths. Example: 2.5 > 2.376
- As they compare decimal numbers students conclude that
  - decimal numbers do not need the same number of places after decimal to be compared.
  - the number of places after the decimal does not determine size.
- Let the children play the game (In the Middle) from the textbook of Class V or use link: In the Middle (game).

E. Assessment

Performance Task 1

Prepare a worksheet and let the children compare and order decimals (1000ths)

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why does it make sense that the thousandths place is the next place to the right of the hundredths place?
  ii. Why would someone say that you can be more exact by using a decimal thousandth than by using a decimal hundredth?
  iii. If you are asked to explain to some classmates who missed the lesson on how to compare decimal thousandths, how would you explain?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Base Ten blocks
- Online
  - Introduction to thousandths-Introduction to thousandths
  - Game-In the Middle (game) .

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A 9 Addition and Subtraction of Decimals (1000ths)

[200 minutes]

Introduction

The decimal system was invented by Hindu mathematicians in India between the first and sixth centuries A.D. This *system is sometimes* also called the Hindu-Arabic numeral system because it was first introduced to Europeans by Arabs, who had acquired the system from the Hindus earlier. The third decimal digit from the decimal point is the thousandths digit. For example, 0.008 is eight thousandths. Read the whole set of three decimal digits as a number, and say "thousandths." While 0.825 is the sum of 8/10, 2/100, and 5/1000, it is also 825/1000 (825 thousandths).

Utility and Scope

Adding and subtracting decimals happens a lot in real life. We may find that we need to add up the cost of your groceries to see if we have enough money to pay for them. Or perhaps we need to subtract the cost of a bill from our bank account.

A. Competency

- Demonstrate the ability to add and subtract decimals up to thousandths and use the concept of it in appropriate situations.

B. Objectives

- Compute mentally the addition and subtraction of decimal thousandths.
- Add decimal numbers up to thousandths.
- Subtract decimal numbers up to thousandths.

C. Essential Skills/Processes

- Estimating
- Computing

D. Learning Experiences

- Pre-assessment on addition and subtraction of whole numbers (5-digit) and decimal hundredths.
- Demonstrate how to add and subtract decimals thousandths. Suggested link: Add and Subtract decimal.
- Demonstrate addition and subtraction of decimals using different strategies.

- Let students play the game (Big Sum, Little difference) from the textbook of class V or use link- Big Sum, little difference. *(Instead of playing cards, let them use 4 sets of numbered cards from 0 to 9)*

E. Assessment

Performance Task 1

Let students carry out the task on addition and subtraction of decimals (1000ths) prepared by the teacher.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Questions
  i. How would you explain to someone to subtract 1.895 from 4.3?
  ii. What is the advantage of knowing addition and subtraction of decimals in life?
  iii. Is it possible to calculate something accurately without using the idea of decimal? Why'?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (Hundredths grid)
- Online
  - Addition and subtraction of decimals- Add and Subtract decimal.
  - Game-Big sum, little difference.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A10 Explore Ideas about Ratio and Rate

[300 minutes]

Introduction

The first known use of the ratio was in 1660. Da Vinci created the illustrations for "De Divina Proportione" (On the Divine Proportion), a book about mathematics written by Luca Pacioli around 1498 and first published in 1509. The ratio is the relationship of two numbers or quantities. A rate is a comparison of measurements that have different units, like Nu. and grams. A unit rate is a rate with a denominator of 1.

Utility and Scope

Ratios are used for basic tasks such as cooking and making financial transactions. Ratios are used to determine specific amounts of substances, such as the different coat colours of animals in a litter or their genders. A rate is a ratio that compares quantities in different units. Rates are commonly found in everyday life. The prices in grocery stores and department stores are rates. Rates are also used in pricing gasoline, tickets to a movie or sporting event, in paying hourly wages and monthly fees.

A. Competency

- Explore the idea of ratios and rates and apply it appropriately as per the situation in their daily life.

B. Objectives

- Describe ratio as a comparison of two numbers or quantities of the same type.
- Describe rate as a comparison of two quantities described in different units.
- Make connections to common ratio and rate in real life situations.

C. Essential Skills/Processes

- Comparing
- Connecting

D. Learning Experiences

- Discuss that ratio compares like units.
  Example: 11 girls and 7 boys in a class. 7 boys in a class of 18 students.
- Discuss that rate compares different types of units.
  Example: Five chart papers cost Nu 50.
- Use the link : Ratio and rate. or prepare a powerpoint presentation on:

- Ratio and examples
- Rate and examples

- Discuss some examples of making connections of common ratio and rate situations in geometric, numerical and measurement situations.

E. Assessment

Performance Task 1

Take students outside and explore the ratios of different types of flowers, leaves, plants etc. (or Design a task to solve problems on ratio and rate.)

Performance Task 2

Let the students write some examples of rate in real life situations.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Question
  i. How do learning ratios and rates help you in daily life?
  ii. Provide an example of how our farmers use the idea of ratio and proportion in their daily life.
  iii. Do we use the idea of ratio in mixing something at home? How?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Online
  - Ratios and rate - Ratio and rate.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A11 4-digit x 1-digit Multiplication
V-A12 2-digit x 2-digit Multiplication
V-A13 3-digit x 2-digit Multiplication
V-A14 Multiply Mentally Whole Numbers by 0.1, 0.01 and 0.001

[650 minutes]

Introduction

William Oughtred was an English mathematician who is best known for his invention of an early form of the slide rule. He invented many new symbols including '×' for multiplication and ':: ' for proportion. Today it seems that William is best known for his invention of an early form of the slide rule. He added and subtracted lengths by using a pair of dividers, operations that were equivalent to multiplying and dividing. Multiplication is repeated addition.

Utility and Scope

Multiplication is a main tool for many forms of mathematics such as algebra, calculus, equations and more. The ability to rehearse and understand multiplications up to and including 12 by the final year of primary school will enable your child to confidently and skillfully tackle the more complex mathematical subjects. Mental maths actually keeps our brains quick and sharp. The brain, like the muscles, gets stronger and more efficient with use. Mental maths also greatly improves a person's number sense, the ability to understand the relationships between quantities.

A. Competency

- Demonstrate the ability to multiply numbers (2 digits by 2 digits, 2 digits by 3 digits and 4 digits by 1 digit) and use the concept while dealing with large-digit numbers.

B. Objectives

- Use a variety of strategies to estimate products.
- Relate models to algorithms.
- Multiply 2-digit by 2-digit, 3-digit by 2-digit and 4-digit by 1-digit.
- Relate concrete models to place value charts to multiply.
- Multiply mentally by 10, 100, 1000 using various strategies (distributive, double/half, compatible factor).
- Use basic facts to multiply by 0.1, 0.01, 0.001

C. Essential Skills/Processes

- Modelling
- Connecting
- Analysing
- Creating
- Relating
- Computing
- Estimating

D. Learning Experiences

- Pre-assessment on multiplying mentally by 10 and 100, 3-digit by 1-digit.
- Demonstrate on multiplying two numbers as determining the area of a rectangle with the dimension by using base ten blocks.
- Use the link -Area model multiplication. to multiplying 2-digit by 2-digit.
- Demonstrate multiplying 2-digit by 3-digit and 4-digit by 1-digit.
- Let students discuss why multiplying tens results in hundreds.
  (Refer teacher's guide on multiplying 2-digit numbers by 3-digit numbers)
- Demonstrate various multiplying strategies with examples.
- Let students use basic multiplication facts to multiply by 0.1, 0.01 and 0.001.
- Let children play the game (Greatest Product) from the textbook of class V or use link: Greatest Product.

E. Assessment

Performance Task 1

Let students multiply 2-digit by 2-digit, 4-digit by 1-digit and 2-digit by 3-digit using any strategies.

Performance Task 2

Design some activities on mental multiplication by 0.1, 0.01, 0.001, 10, 100 and 1000 for students to solve.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions

i. Why is 70 × 30 just as easy as multiplying 7 × 3 even though the numbers are bigger?
ii. Is mental multiplication important? Why?
iii. How will this lesson help you in your daily life?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Base ten blocks
- PhET simulation
- Online
  - Utility and scope-Importance of multiplication
  - 2-digit by 2-digit multiplication-Area model multiplication.
  - Game-: Greatest product.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A15 4-digit by 1-digit Division

[400 minutes]

Introduction

The form of the obelus as a horizontal line with a dot above and a dot below" ÷" was first used as a symbol for division by the Swiss mathematician Johann Heinrich Rahn in 1659. This gave rise to the modern mathematical symbol ÷, used in English speaking countries as a division sign. Division is a repeated subtraction.

Utility and Scope

Learning of division allows us to divide or 'share' numbers to find an answer. For example, let's consider how we would find the answer to 10 ÷ 2 (ten divided by two). This is the same as 'sharing' 10 sweets between 2 children. It will help us to solve the problems while dealing with large numbers.

A. Competency

- Demonstrate the ability to divide 4-digit by 1-digit numbers with or without regrouping and apply its understanding outside the classroom.

B. Objectives

- Use estimation to predict quotients.
- Use models to divide and link to algorithms.
- Divide 4-digit by 1-digit numbers with or without remainders.
- Explore divisors which are multiples of 10 only (10, 20,....90)

C. Essential Skills/Processes

- Modelling
- Connecting
- Analysing
- Creating

D. Learning Experiences

- Pre-assessment about dividing 3-digit by 1-digit numbers.
- Use concrete objects or base ten blocks to divide 4-digit by 1-digit number.
- Let students estimate and predict the quotient before actual division. Similarly, use a place value chart to show the division.
- Then relate division with models to algorithm division.

- Use appropriate video links- Box method division. that shows dividing 4-digit by 1-digit number.
- Use an online link-Interactive division worksheet for the students to check their understanding.
- Explore divisors which are multiples of 10
  Example: 3570 ÷40 = 357 tens ÷ 4 tens
  = 357 ÷ 4
  = 89 R10
- Discuss together to explore their own division methods related to standard algorithms.
- Let student play the game (Target 2000) from the textbook of class V or use link- Target 2000

E. Assessment

Performance Task 1

Let students divide 4-digit by 1-digit using any strategies. Provide a worksheet.

Performance Task 2

Design a task to divide a 4-digit number by multiples of 10.

(*Design appropriate assessment tools and record the students' learning based on the template in the annexure.*)

- Reflective Questions
  i. Describe a situation when you might need to use 4500÷5 in calculation.
  ii. Why is it a good idea to estimate even when you are calculating an exact answer?
  iii. How do you use the idea of multiplication in solving division problems?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Concrete materials
- Base ten blocks.

- Online
  - 4-digit by 1-digit division- links Box method division.
  - Practising exercise on division 4-digit by 1-digit- Interactive division worksheet.
  - Game-Target 2000

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-A16 Applying Number Sense

[250 minutes]

Introduction

The term was popularised by Stanislas Dehaene in his 1997 book "The Number Sense". Number sense refers to a group of key maths abilities. It includes the ability to understand quantities and *concepts* like more and less. Some people have stronger *senses* than *others*.

Utility and Scope

Number sense is so important for young maths learners because it promotes confidence and encourages flexible thinking. It allows children to create a relationship with numbers and be able to talk about maths as a language. Well, every digit has a value and when you put those digits together, they make numbers.

A. Competency

- Demonstrate number sense with respect to whole numbers and decimals drawing relationships that are true, not true or sometimes true and be able to solve problems in new situations.

B. Objectives

- Apply number sense to explore numerical situations which are always, sometimes or never true
- Work with open number sentences involving four basic operations in isolation and in combination
- Recognize that a number can also be expressed as a letter variable or any other shapes or symbol.

C. Essential Skills/Processes

- Applying
- Analysing
- Strategizing
- Conceptualizing

D. Learning Experiences

- Pre-assessment on simple number sentences (*Example: 2+.... = 7)*
- Design an activity to discuss open sentences. Present different number sentence situations which are always, sometimes and never true.

Example: a) 7+ .....> 5 (always true) b) .... – 4 < 5 (sometimes true) c) 8 = 9 × .... (never true)

- Use a link: Open and closed sentences. to explain about the open and closed sentences.
- Similarly introduce open number sentences that involve combinations of different operations.
- Explore creating different number sentences using any two whole numbers.

  Example: 7 and 9 9>7, 9-2=7, 9+7=16, 9 × 7=63

E. Assessment

Performance Task 1

Let students create different number sentences using any two whole numbers.

Performance Task 2

Design a task to create a number sentence each, which is always true, sometimes true and never true.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why is there always more than one number sentence using any pair of numbers?
  ii. Where can you apply the concept of Number sense in your life?
  iii. Tell us one number sentence that is sometimes true.

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Online
  - Explanation of open and close sentences -Open and closed sentences .

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-B1 Place Value Pattern Base Ten System to Millions
V-B2 Open Sentences: Patterns in Addition, Subtraction, Multiplication and Division

[350 minutes]

Introduction

The concept of patterns was first described by Christopher Alexander in a Pattern Language. Mathematics is all about numbers. It involves the study of different patterns. There are different types of patterns, such as number patterns, image patterns, logic patterns, word patterns etc. Number patterns are especially common in Mathematics. Number patterns are all predictions. In this topic, we will discuss patterns in number operations.

Utility and Scope

Patterns are at the heart of maths. The ability to recognize and create patterns help us make predictions based on our observations; this is an important skill in maths. We use patterns to represent identified regularities and to form generalisations. Patterns allow us to see relationships and develop generalisations.

A. Competency

- Demonstrate the application of patterns of basic operations (addition, subtraction, multiplication and division) and apply while solving related problems.

B. Objectives

- Use patterns in dividing by 10, 100 and 1000
- Use patterns in multiplying by 0.1, 0.01 and 0.001
- Develop a rule for placement of the decimal point.
- Generate rules about how a change in one variable affects the result for all 4 operations
- Re-arrange factors to simplify computation
- Realise that dividing one factor and multiplying the other by the same amount produces no change in the final result.

C. Essential Skills/Processes

- Patterning
- Conceptualising
- Investigating

- Analysing
- Reasoning
- Creating
- Computing

D. Learning Experiences

- Pre-assessment on basic operations.
- Investigate patterns in dividing by 10, 100 and 1000
- Investigate patterns in multiplying by 0.1, 0.01 and 0.001
- Show the pattern of multiplication by decimal powers of 10.
- Explain multiplying by 0.1, 0.01, or 0.001 is equivalent to dividing by 10, 100 or 1000 respectively.
- Explore the patterns of addition, subtraction, multiplication and division.
  Example;

12 +3=15 *9+3=12* *6+ 3=9*	*12-3=9* *9-3=6* *6-3=3*
12 ×3=36 *9×3=27* *6×3=18*	*12÷3=4* *9÷3=3* *6÷3=2*

  - Do you see any patterns in division?
  - What are the patterns in addition?
  - How do the patterns change in subtraction?
  - Why does the product change by 3?
- Let students come up with a variety of patterns on addition, subtraction, multiplication and division.
- Demonstrate on rearranging factors to simplify computation.
  Example: 24 × 250 is more difficult than 6 X 1000, though both have the same product.

E. Assessment

Performance Task 1

Provide a worksheet on investigating patterns in dividing by power of tens and multiplying by decimal power of tens. Let students investigate and generate pattern rules.

Performance Task 2

Design the worksheet on basic operations pattern (suggested link: Number pattern worksheet)

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Questions
  i. How is multiplying by 0.1, 0.01 and 0.001 the same as dividing by 10, 100 and 1000?
  ii. How are patterns in basic operations going to help you in calculation?
  iii. Our life is full of patterns. Do you agree? Why?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Base Ten blocks
- Online
  - Basic operation exercise-: Number pattern worksheet

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-B3 Explore Equivalent Fraction

[250 minutes]

Introduction

The word fraction actually comes from the Latin "fractio" which means to break. Equivalent fractions are two or more fractions that are all equal. A fraction is a part of a whole: the denominator (bottom number) represents how many equal parts the whole is split into; the numerator (top number) represents the amount of those parts.

Utility and Scope

Equivalent fractions and “fraction families” are not only used to help us add and subtract fractions with unlike denominators, but they are a big part of understanding how to simplify fractions. This makes it very easy for students to visualise the size of each fraction and how they are related to each other.

A. Competency

- Interpret equivalent fractions in different ways and apply it in appropriate situations.

B. Objectives

- Explain that the multiplicative relationship of numerator/denominator remains constant for equivalent fractions.
- Create an equivalent fraction by dividing numerator and denominator by common factor.
- Explain the result when numerators of equivalent fractions differ by a constant amount

C. Essential Skills/Processes

- Estimating
- Investigating
- Reasoning

D. Learning Experiences

- Pre-assessment on representing and interpreting fractions of a whole.
- Demonstrate an equivalent fraction by using a piece of paper or PhET simulations (Equivalent fraction)
- Write a few fractions on the board or chart paper and let children guess or estimate the equivalent fraction of it.

- Investigate the multiplicative relationship of numerator/denominator (constant for equivalent fractions)
- Let the students find equivalent fractions of a given fraction with explanation.

E. Assessment

Performance Task 1

Prepare a worksheet and let students explore equivalent fractions (or use offline PhET simulations)

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.*)

- Reflective Questions
  i. How do you know that there are more than 1000 fractions equivalent to $\frac{3}{9}$?
  ii. Tell us a few situations where we have to use the idea of equivalent fractions.
  iii. $\frac{2}{3}$ is equivalent to $\frac{4}{6}$ and $\frac{4}{6}$ is equivalent to $\frac{6}{9}$. Will $\frac{6}{9}$ be equivalent to $\frac{2}{3}$? Why?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Online
  - Explore equivalent fraction-(Equivalent fraction)

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-B4 Area and Perimeter

V-C1 Area and Perimeter of Composite shapes

[650 minutes]

Introduction

The architects of the pyramids at Giza, which were built about 2,500 B.C., knew how large to make each triangular side of the structures by using the formula for finding the area of a two-dimensional triangle. The Chinese knew how to calculate the area of many different two-dimensional shapes by about 100 B.C. And the concept became even more useful in practical applications once simple formulas were developed to find the area of various two-dimensional shapes.

Utility and Scope

In everyday life area and perimeter are used constantly – for example, for describing the size of a house by talking about its floor area, or for working out how much wire is needed to fence off a field.

A. Competency

- Explore the relationship between area and perimeter of rectangles to investigate patterns and use the idea in solving problems related to it.
- Calculate the perimeter and area of polygon (rectangles and squares) and solve the problems related to it.

B. Objectives

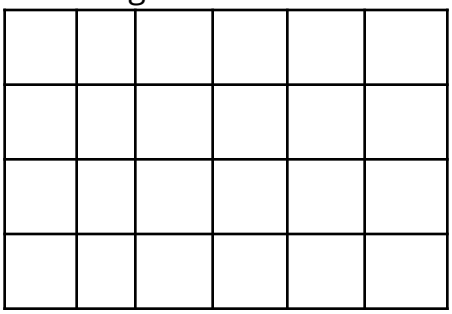
- Use models to discover patterns about area and perimeter of rectangles.
- Connect models to symbols: if one dimension is multiplied by a factor, the other must be divided by that factor (e.g., 24 × 5 = 12 × 10)
- Develop a relationship between the length and perimeter of rectangles to investigate patterns.
- Draw a conclusion through investigation that squares have the same area and perimeter.
- Draw conclusion through investigation that rectangles with the same area can have different perimeters & vice versa.
- Calculate the area of composite shape formed by two or more rectangles.

C. Essential Skills/Processes

- Investigating
- Modelling
- Analysing
- Connecting

D. Learning Experiences

- Pre-assessment to recollect information about area and perimeter of rectangles.
- Design an activity where they use concrete objects or base ten blocks to see patterns about area and perimeter of rectangles.
- Provide a rectangle with the centimetre grid inside (example given below).



- Let the students count the number of squares inside the rectangle. (It is the area of a rectangle).
- Let students add all the sides. (It is the perimeter of the rectangle).
- Allow students to develop a formula to find the area and perimeter of a rectangle.
- Draw the conclusion through investigation that a square with the same perimeter has the same area & vice versa (the square with side length of 4 units).
- Conclude through investigation that rectangles with the same area can have different perimeters & vice versa.
- Design an activity where they use concrete objects or base ten blocks to see patterns about area and perimeter of rectangles. (Eg: Longest rectangle with same area will have greatest perimeter and longest rectangle with same perimeter will have least area).
- Use PhET interactive simulation Area builder .This link shows the relationship between area and perimeter of rectangles.
- Let students calculate the area of a composite shape by dividing into rectangles.
- Discuss and find the perimeter of a composite shape.

E. Assessment

Performance Task 1

Students will design and draw a floor plan for a small house. They will determine how much carpet they will need for two rooms and how much fencing they will need to go around the yard.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.*)

- Reflective Questions
    i. Explain why you add values to calculate the perimeter of the rectangle but you multiply to calculate the area.
    ii. What are the things you have to know to calculate the area and perimeter of a 2-D shape?
    iii. Where can we use the concept of area and perimeter in our life?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (Grid)
- PhET Simulation
- Online
    - Relationship between area and perimeter-Area builder.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-C2 Estimating and Measuring Angles

[300 minutes]

Introduction

The Introduction of the mathematical measurement of angles, possibly dates back to 1500 BC in Egypt, where measurements were taken of the Sun's shadow against graduations marked on stone tables, examples of which can be seen in the Egyptian Museum in Berlin.

An angle is a form of geometrical shape that is constructed by joining two rays to each other at their end-points. The angle can also be represented by three letters of the shape that define the angle, with the middle letter being where the angle actually is (i.e. Its vertex).

Utility and Scope

Angles are used in daily life. Engineers and architects use angles for designs, roads, buildings and sporting facilities. Athletes use angles to enhance their performance. Carpenters use angles to make chairs, tables and sofas.

A. Competency

- Explore and estimate the measurement of different angles using protractor and apply it in immediate surroundings.
  Example: Drawing the corners of the play field, while constructing the roof of the house, temple, chorten etc.

B. Objectives

- Use a benchmark (paper wedge) to estimate angles.
- Link wedges to degrees (degree is just a very small wedge).
- Measure angles of 45, 90, 135, 180 degrees using a protractor.
- Estimate angles relative to common referents: 45, 90, 180 degrees (about the same as, more than, less than)

C. Essential Skills/Processes

- Investigating
- Reasoning
- Comparing
- Estimating

D. Learning Experiences

- Pre-assessment (ask the names of different angles)

- Use an improvised paper wedge (non-standard unit) to measure the given angles. Use wedges to construct angles.
- Link wedges to degrees (degree is just a very small wedge).
- Demonstrate how to use a protractor to measure the angles (45, 90, 135, 180 degrees).
- Allow students to estimate angles 45, 90, 180 degrees (about the same as, more than, less than). Or use the link-Estimating angles to give the concept of estimating angles.

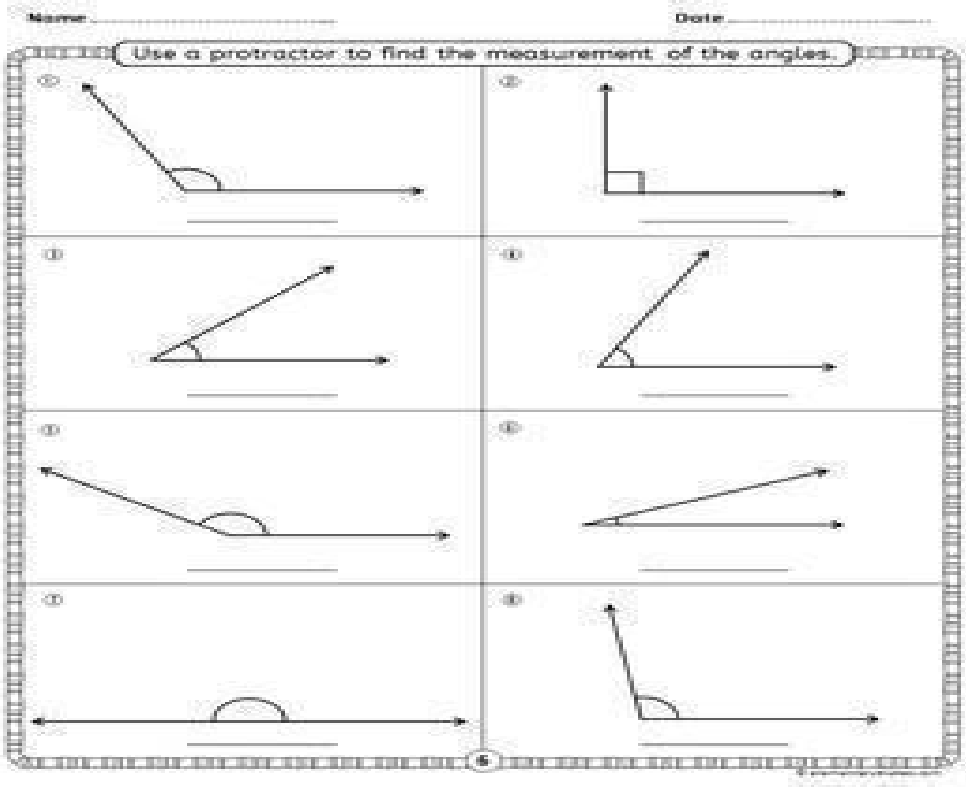
E. Assessment

Performance Task 1

Estimate the size of the angles by comparing with benchmark angles (45, 90, 135, 180 degrees).

Performance Task 2

Use worksheets (on angles) and instruct them to measure using a protractor.



(Design appropriate assessment tools and record the students' learning based on the template in the annexure.)

- Reflective Questions
  i. Explain how you could fold an improvised protector to estimate an angle of 22^0.
  ii. Where can we use the idea of angles in our daily life?
  iii. How would our life be without angels?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Wedge
- Protractor
- Online
  - Estimating angles-Estimating angles

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-C3 Volume and Capacity

[450 minutes]

Introduction

The volume of a given substance refers to the total amount of space that it covers, that is when you measure the space region that is taken up by a solid object it is referred to as volume. Conversely, capacity refers to the quantity of something that a container holds. In short, capacity is known as the container's volume. Due to many similarities between the two, the volume is usually confused with the capacity. However, there are a few but significant differences between volume and capacity that one can understand when they learn their meaning, unit of the measurement, etc. In this, we will learn about the difference between volume and capacity, the measurement of volume, and the measurement of capacity.

Utility and Scope

For measuring ingredients for a recipe, filling up a car's tank, adding detergent to the washing machine, cleaning houses, swimming pools, capacity and volume are used often in daily life.

A. Competency

- Demonstrate the ability to solve basic problems related to volume and capacity and use the idea in solving real life situations.

B. Objectives

- Demonstrate understanding of volume as the amount of space an object occupies or how much it takes to build it.
- Find capacity as to how much a container is capable of holding.
- Develop a sense of size and referents for a cubic unit (cm^3, mm^3, m^3) and calculate the volume of a rectangular prism.

C. Essential Skills/Processes

- Investigating
- Comparing
- Computing
- Estimating

D. Learning Experiences

- Pre-assessment (let students build a structure using linking cubes).

- Demonstrate understanding of volume as the amount of space an object occupies (explain using available resources).
- Use the link - Concept of volume. to supplement the teacher's explanation.
- Let students develop a sense of size for a cubic cm, mm, m (if possible model $1cm^3$ and $1\ m^3$.)
  - A cubic centimetre is about the size of a very small sweet.
  - A cubic metre can be modelled by using a large box of that size or by extending five metre sticks (to represent edges of a 1 m by 1 m by 1 m cube) out from a corner of the room.
  - A cubic millimetre is so small it is hard to model.
- Explore the meanings of capacity. Introduce the millilitre (mL) and its abbreviation. Model some objects in terms of how many millilitres they might hold, such as a measuring cup, a spoon, and a drinking glass. Then show students a container that might hold 1 L. For example, you could build a 10 cm cube out of paper.
- Demonstrate a few larger items such as buckets or jugs and have students estimate how many litres they might hold. If it is possible, test their estimates by filling the containers using 1 L container units.
- Point out that it takes 1000 mL to make 1 L just like it takes 1000 mm to make 1 m.
- Use the link Litre and millilitre to give information on capacity relationship.

E. Assessment

Performance Task 1

Let students find the volume of the different cubic structures. Provide the worksheet.

Performance Task 2

Let students sketch rectangular prisms with the given volume. Provide the volume of the prism.

Performance Task 3

Let the students use the worksheet given below:

II. Choose the Most Suitable units of capacity litre or Millilitre

a. a bottle of hair oil---------- 

b. a glass of juice ---------- 

c. a bottle of cough syrup---------- 

d. a diesel can ---------- 

d. a bottle of milk ---------- 

e. a bucket of water ---------- 

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions

i. Why is it useful to have both litre and millilitre units for measuring capacity?
ii. Where can you apply the understanding of this lesson in life?
iii. How difficult would it be if there was only one unit to measure the capacity?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Online
  - Volume introduction- Concept of volume
  - Information on capacity-Litre and millilitre.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-C4 Relation Between various SI units (Length, Mass and Capacity)

V-B5 SI Measurement

[100 minutes]

Introduction

The International System of Units, sometimes as the SI system is world's most widely used system. The SI was established in 1960 by the 11th General Conference on Weights and Measures. The Convention, modified slightly in 1921, remains the basis of all international agreement on units of measurement.

Measuring is an important part of our life. We can use the measurement of one item to estimate the measurements of other items.

Utility and Scope

Young children apply early concepts of measurement in many of their everyday activities. Eventually young children's sense of measurement develops to include new skills. They build on their abilities to compare and learn to order three or more objects. Knowing the relationship between one unit to another unit helps us to read the measurement accurately.

A. Competency

- Demonstrate how to use relationships among various SI units and apply its understanding in daily life situations.

B. Objectives

- Explain pattern of change in units when converting from smaller units to larger units and vice versa
- Apply the pattern relationship to convert units from smaller to larger and vice versa (linear unit: Litre,metre and gram).
- Rename measures among SI units.
- Apply referents for various measurement standards (30 cm is like a ruler, 1 dm is about a small hand span, etc.)

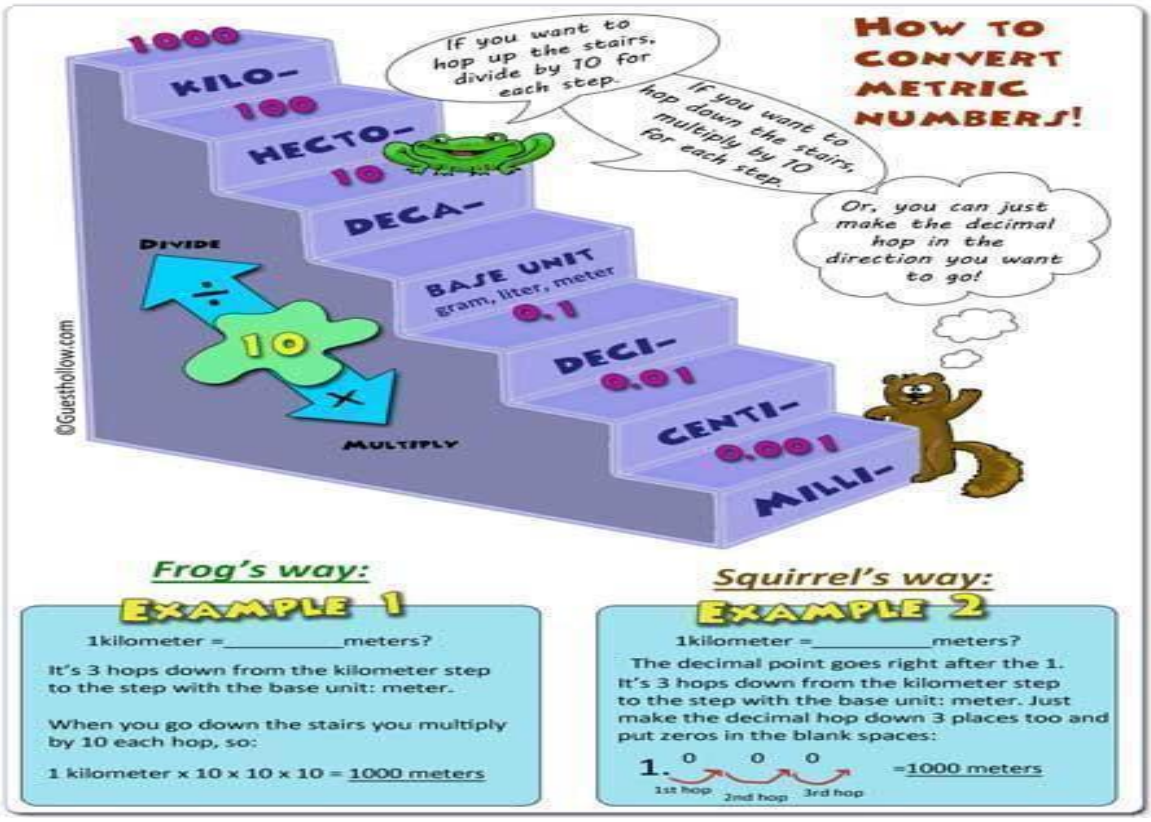
C. Essential Skills/Processes

- Investigating
- Connecting
- Applying
- Representing

D. Learning Experiences

- Pre-assessment (ask students to recall what they know about cm, m and mm) Ask question like;
  - How many cm makes 1 m?
  - How many mm makes 1 cm?
  - How many m make 1 km?
  - Where do we use the units cm, m and km ?
- Introduce the other metric prefixes: hecto, deca, and deci. Explain that these are used less frequently.
- Develop a sense of how long each unit is.

  Example: Our hand is about 1 dm wide. The length of the table is about 1 m. (Discuss the examples of other units in their context).
- Use the metric unit chart given below to show the relationships among SI units and rename one unit to another.
- Let students develop references for various measurement standards (30 cm is like a ruler, 1 dm is about a small hand span, etc.).



E.

F. Assessment

Performance Task 1

Provide the worksheet on conversion of smaller units to bigger units (suggested link: Metric unit conversion worksheet.

(Design appropriate assessment tool and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why is it necessary to convert from one unit to another?
  ii. How do we change/convert from one unit to another?
  iii. Why do you think that there are many units for measuring the distance, mass, capacity, and volume?

G. Resources

- Understanding Mathematics, Textbook for class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics for PP – XII
- Measuring tape/ruler
- Classroom objects
- Online
  - Conversion of units-Metric unit conversion worksheet.

H. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-D1 Triangles
V-D2 Combined Triangle

[350 minutes]

Introduction

The triangle was known by the 14th century and was sometimes trapezoidal in form; until about 1800 it often had jingling rings. It is named for the 17th-century French mathematician Blaise Pascal, but it is far older. Chinese mathematician Jia Xian devised a triangular representation for the coefficients in the 11th century. Thales of Miletus (624–547 BC) is credited with bringing geometry from Egypt into Greece and laying some early groundwork for the study of triangles.

Utility and Scope

The ability to recognize and differentiate between shapes prepares learners to recognize letters and numbers. It helps learners identify, sort, and classify—basic skills they will need in maths and science. Triangles possess a number of key advantages that make them ideal for both architects and curious students: these shapes are incredibly common, structurally sound, and easy to apply and use in everyday life. The strength of a triangle derives from its shape, which spreads forces equally between its three sides.

A. Competency

- Describe the properties and spatial sense of triangles using concrete and pictorial representations.

B. Objectives

- Explore and write the characteristics of triangles by angles and side lengths to solve related problems.
- Describe spatial sense using:
  - two congruent equilateral triangles.
  - two congruent isosceles right triangles.
  - two congruent isosceles triangles.
  - two congruent right triangles.
  - two congruent acute/obtuse triangles.
  - two different isosceles triangles with a base of the same length.

C. Essential Skills/Processes

- Investigating
- Comparing
- Representing

- Conceptualising

D. Learning Experiences

- Pre-assessment (Discuss the properties of different triangles classified by sides).
- Use cut-out triangles from BLM and investigate the characteristics of different triangles (equilateral, isosceles and scalene).
- Try out using technology (GeoGebra /PowerPoint).
- Use cut-out shapes of different triangles from BLM and let students combine to make other shapes.
- Play the game (Triangle dominoes) from the textbook of class V or use link: Triangle dominoes.
- Use the link Drawing triangles . and play the game on construction of triangles.
- Explore and classify triangles by angles.

E. Assessment

Performance Task 1

Describe the characteristics of different triangles after investigation of the cut-out triangles from BLM.

Performance Task 3

Let students create new shapes using different triangles. (Suggestions; triangles to be provided by the teacher, or students themselves, or they can use ICT for this task).

(*Design appropriate assessment tool and record the student learning based on the template in the annexure.)*

- Reflective Questions
  i. Look around and find any triangular structure, name it and justify why you gave that name?
  ii. How many types of triangles are there? Name them.
  iii. Which type of triangles are mostly found in our area? Why do you think so?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM

- GeoGebra
- Online
  - Game on drawing triangles- link Drawing triangles.
  - Game-Triangle dominoes.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-D3 Diagonal Properties of Squares and Rectangles

[250 minutes]

Introduction

The word *diagonal* derives from the ancient Greek διαγώνιος *diagonios*,[1] "from angle to angle" (from διά- *dia-*, "through", "across" and γωνία *gonia*, "angle", related to *gony* "knee") it was used by both Strabo and Euclid to refer to a line connecting two vertices of a rhombus or cuboid, and later adopted into Latin. The line segment joining two corners of a square is known as its diagonal. Properties of the Diagonals in a Square. The diagonals of a square bisect each other.

Utility and Scope

Diagonals in squares and rectangles add strength to construction, like house wall, bridge, or tall building. We see diagonal wires used to keep bridges steady. When houses are being built, look for diagonal braces that hold the walls straight and true. Bookshelves and scaffolding are braced with diagonals.

A. Competency

- Deduce, through exploration, the diagonal properties of squares and rectangles and its importance in construction.

B. Objectives

- Experiment concretely (by folding), visually (using technology) and develop generalisations for diagonals:
  - of squares.
  - which bisect each other.
  - which intersect to form four right angles (perpendicular bisectors).
  - which form two pairs of equal opposite angles at the point of intersection.
  - which form two angles at each vertex of the rectangle that sum to 90° and have the same measures as the two angles at the other vertices.
  - which form two pairs of congruent isosceles triangles

C. Essential Skills/Processes

- Investigating
- Comparing
- Representing
- Conceptualising

D. Learning Experiences

- Conduct pre-assessment (discuss the lines of symmetry in a rectangle and a square).
- Use a cut-out square and a rectangle to investigate and develop generalisation for diagonals.
- Use technology to investigate and develop generalisation for diagonals in a square and rectangle.
- Use this video link Properties of rectangle, rhombus and square it shows the diagonal properties of square and rectangle. (W*atch and trim the video clip as per lesson required*).
- Let students explore the diagonals of rectangular surfaces like volleyball court, basketball court, classroom floors etc.

E. Assessment

Performance Task 1

Use the worksheet link https://www.liveworksheets.com/w/en/math/7021630 and assess the child's learning.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Question

i. Will the diagonals always divide any shapes into two equal parts? Why?
ii. Do you agree that any 2-D shape will have 2 diagonals? Why or Why not?
iii. Name all the shapes that can have only 2 diagonals.

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (square and rectangle)
- Online
  - Diagonals of Square, Rectangle- Properties of rectangle, rhombus and square.
  - Worksheet- https://www.liveworksheets.com/w/en/math/7021630

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-D4 Parallelism and Perpendicularity of Lines and line segments

[250 minutes]

Introduction

There exists a pair of straight lines that are at constant distance from each other. Two lines that are parallel to the same line are also parallel to each other. The word 'perpendicular' has its origin from the late Middle English which exactly means “at right angles'', from Latin 'perpendicularis', 'perpendiculum' meaning “plumb line” and from 'perpendere' where 'per' means “through” and 'pendere' means “to hang”.

Euclid discussed parallel and perpendicular lines over 2,000 years ago, but the complete description had to wait until Rene Descartes put a framework on Euclidean space with the invention of Cartesian coordinates in the 17th century.

Utility and Scope

Parallel Lines are of critical importance when marking out roads, pedestrian crossings, car parks, and airport runways. Parallel Lines are also vital on basketball, tennis, volleyball, netball, badminton, and squash courts, as well as on athletics tracks. Real life examples of perpendicular lines surround us. They are in buildings, in rooms, television sets, bookshelves and so on. If you are in a room, more than likely you are surrounded by four walls that are all perpendicular to each other.

A. Competency

- Describe the parallelism and perpendicularity along with lines and line segments and realise its importance in the environment.

B. Objectives

- Construct using geometry tools and also using appropriate mathematical software to show lines which are:
  - parallel to one another.
  - Intersecting.
  - perpendicular at an endpoint.
  - perpendicular at end points.
  - perpendicular to another line at its midpoint.
  - bisecting another line but not perpendicular.
  - bisecting another line and perpendicular.
  - bisect each other and are perpendicular

C. Essential Skills/Processes

- Investigating
- Comparing
- Representing
- Conceptualising

D. Learning Experiences

- Demonstrate how to construct parallel, intersecting and perpendicular lines using the link
- Use the link Construction of parallel and perpendicular lines to construct parallel and perpendicular lines
- Use mathematical software like GeoGebra to construct different parallel, intersecting and perpendicular lines.
- Allow students to explore different parallel, intersecting and perpendicular lines in and around school.

E. Assessment

Performance Task 1

Look for some examples of line segments in and around the school that are parallel, perpendicular and intersecting.

Performance Task 2

Let the students construct using geometry tools or using appropriate mathematical software to show lines which are:

- parallel to one another.
- perpendicular at an endpoint.
- perpendicular to another line at its midpoint.
- bisecting another line and perpendicular

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why can two lines not be both perpendicular and parallel?
  ii. Where can we find the parallel and perpendicular lines?
  iii. Which lines do we find more around us? Perpendicular or parallel lines? Why do you think so?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- BLM (shapes)
- Online
    - Parallel and perpendicular line Construction of parallel and perpendicular lines.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-D5 Translations & Reflections using Horizontal and Vertical lines.

V-D6 Rotation: ¼, ½, ¾ turns

[550 minutes]

Introduction

Transformation helps us to move a shape from one place to another. ***Translation*** is sliding a figure in any direction without changing its size, shape or orientation. A translation is a change in location. ***Reflection*** is flipping an object across a line without changing its size or shape. The line that a shape is flipped over is called a line of reflection. ***Rotation*** is rotating an object about a fixed point without changing its size, shape. The point a figure turns around is called the centre of rotation.

Utility and Scope

Use the link Transformations - Xcelerate Math to find the scope of utility and scope of translation, reflection and rotations.

A. Competency

- Describe changes in the orientation and position of different 2-D shapes using properties of translations, reflections and rotations, concretely and pictorially.

B. Objectives

- Record properties of:
  - a shape and its translated image
  - a shape and its reflected image
  - a shape and its congruent image,
  - a shape and its rotated image through investigation.
- Compare orientation of corresponding parallel sides of a shape and the reflected image.
- Describe through investigation that corresponding points of a shape and the reflected image are equidistant from the mirror line.
- Describe through investigation that a mirror line is the perpendicular bisector of all segments joining corresponding points (use appropriate mathematical technology)
- Predict, draw & identify quarter, half and 3-quarter turns.
- Explain the results of a variety of turn centres (pivot point).
- Relate 90 degrees to quarter turns, 180 degrees to half turns

C. Essential Skills/Processes

- Investigating
- Comparing
- Analysing
- Conceptualising
- Estimating
- Constructing
- Identifying

D. Learning Experiences

- Pre-assessment (ask questions based on transformations).
- Play the transformation song using the link Transformation song. for pre-assessment.
- Demonstrate how to transform the shapes (Translation, reflection, rotation) and discuss their properties.
  - Can anyone guess what it might mean to translate an object?
  - Can anyone tell what it means to rotate an object?
  - Can someone tell where you might see a reflection in everyday life?
- Investigate to compare orientation, corresponding parallel sides of a shape and the reflected image.
- Investigate a variety of rotations.
- Look for an appropriate video link and share it to the students.
- Let students explore how to transform shapes using appropriate mathematical technology (e.g. GeoGebra, PhET Simulation,)

E. Assessment

Performance Task 1

Provide the worksheet on translation (suggested link: Transformation worksheet
Provide the worksheet on reflection (suggested link: Mirror image
Provide the worksheet on rotation (suggested link: Single turn,CW,CCW

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. When do you use/see transformations in your daily life?
  ii. How do our traditional painters use the idea of transformations?
  iii. We can rotate, slide and reflect a single shape as many times as we want. Do you agree? Why?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Geo Board
- BLM (shapes)
- GeoGebra, PhET,
- Online
    - Utility and scope-Transformations - Xcelerate Math.
    - Transformation song
    - Worksheet on translation-Transformation worksheet
    - Worksheet on reflection-Mirror image
    - Single turn,CW,CCW

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-D7 Nets for Cone, Cylinder, Prisms and Pyramids.

[200 minutes]

Introduction

A net is a flattened out 3-dimensional solid. It is the basic skeleton outline in two dimensions, that can be folded and glued together to obtain the 3D structure. Nets are used for making 3D shapes.

Utility and Scope

Nets of shapes are a great way to help children learn about 3D shapes in the classroom or at home. Nets can also help children understand and visualise mathematical concepts and terms, such as faces, edges and vertices. Nets are useful in finding the surface area of the solids.

A. Competency

- Demonstrate the ability to create and interpret a variety of nets of rectangular prisms, cones and cylinders and then interpret it accordingly.

B. Objectives

- Create and interpret various nets for cones, cylinders and rectangular Prisms.

C. Essential Skills/Processes

- Interpreting
- Connecting
- Constructing

D. Learning Experiences

- Pre-assessment (show 3-D models and let students name them).
- Draw a net and ask questions like;
  - How many shapes are there?
  - How many of the shapes in each net are congruent?
- Use the link: Net of cone, Geogebra to explore the net of a cone.
- Use the link : Net of cylinder,Geogebra to explore the net of a cylinder.
- Explore various nets for prisms and pyramids using the suggested link: Net of different 3D shapes,Geogebra
- Provide models of prisms and pyramids, cone and cylinder. Then, let students sketch a net for the given models.

E. Assessment

Performance Task 1

Let students list down as many real-life examples of cones, cylinders and prisms and pyramids as possible.

Then let the students sketch possible nets of the above examples.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why might two people create different nets for the same structure?
  ii. What is the advantage of learning about nets?
  iii. How will you check that the net you have drawn is correct?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- 3-D models
- GeoGebra
- Online
  - Net of cone - Net of cone,Geogebra
  - Net of cylinder-Net of cylinder,Geogebra
  - Net of prism -Net of different 3D shapes,geogebra

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-E1 Collect, Organise & Describe Data

[200 minutes]

Introduction

Data collection is gathering the facts and figures needed for the research. Organising data is bringing it together in a systematic way that makes it easier to read. We can organise data by using tallies and frequency tables.

Utility and Scope

Data collection enables a person or organisation to answer relevant questions, evaluate outcomes and make predictions about future probabilities and trends. Accurate data collection is essential in maintaining the integrity of research, making informed business decisions and ensuring quality assurance. Organising data also helps in reducing data loss and reduces errors. Data organisation also helps us to understand why the data was collected.

A. Competency

- Ability to collect the data on identified issues using relevant tools and describe the organised data.

B. Objectives

- Collect data using relevant tools.
- Organise and describe the collected data (maximum, minimum, range and mean)

C. Essential Skills/Processes

- Planning
- Representing
- Describing

D. Learning Experiences

- Explore numerous ways to collect data (examples: classroom objects, nature and population) using relevant tools (Interviews, Questionnaires, etc.).
- Allow students to decide on the format of presentation (examples**: tally, frequency table)** of the data they collected.

Age	Tally	Number of times (Frequency)

- Show how to organise the collected data in tally or in frequency table. Describe the data collected (maximum, minimum, range and mean).

E. Assessment

Performance Task 1

Let students collect data on any information (example; students coming from different places, age of their siblings, household items, no books read).
Then let them organise and describe the data.

(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Question

i. Name a few strategies to collect data?
ii. Your school wants to conduct online lessons for the students. For this, the school needs to find out whether the students have the required gadgets. How can you help your school to decide on this?
iii. Which one do you find attractive, pictures or words? Why?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-E2 Double Bar Graphs

[300 minutes]

Introduction

William Playfair lived from 22 September 1759 to 11 February 1823. He was an engineer and political economist remembered primarily for his innovations in the presentation of quantitative information by means of graphs and charts. He invented the time series graph or line chart, the bar chart, and the pie chart. A double bar graph is used to show and compare data of two types on one graph.

Utility and Scope

A double bar graph is used to display two sets of data on the same graph. For example, if you wanted to show the number of hours that students worked in one month compared to another month, we would use a double bar graph. The information in a double bar graph is related, and it compares one set of data to another.

A. Competency

- Demonstrate the ability to construct and interpret double bar graphs on identified issues.

B. Objectives

- Construct double bar graphs.
- Interpret double bar graph to draw conclusions on the identified issues.

C. Essential Skills/Processes

- Representing
- Reasoning
- Analysing
- Interpreting

D. Learning Experiences

- Pre-assessment (interpreting single bar graph).
- Demonstrate how to construct a double bar graph.
- Use the link Bar and double bar graph. on constructing and interpreting double bar graph.
  - ❖ What are the differences between single and double bar graph?

- Discuss, interpret and draw conclusions from the double bar graph.
- Use ICT to construct a double bar graph (example: Ms Excel).

E. Assessment

Performance Task 1

Let students collect data on any information and prepare a double bar graph (number of boys and girls in different classes, siblings of the students etc.).
Let students interpret and draw conclusions from the graph prepared.
(Design appropriate assessment tools and record the student learning based on the template in the annexure.)

- Reflective Questions
  i. Why are scales and levels important for the construction of bar graphs?
  ii. Give an example of a set of data that would be appropriate to display using a double bar graph.
  iii. Why do you think that the double barograph is important?

F. Resources

- Understanding Mathematics Textbook for Class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics for PP – XII
- Online
- Constructing and interpreting Double bar graph- Bar and double bar graph.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-E3 Coordinate Graphs

[250 minutes]

Introduction

The coordinate system we commonly use is called the *Cartesian system*, after the French mathematician René Descartes (1596-1650), who developed it in the 17th century. Legend has it that Descartes, who liked to stay in bed until late, was watching a fly on the ceiling from his bed. He wondered how to best describe the fly's location and decided that one of the corners of the ceiling could be used as a reference point.

Source: History of coordinates

A coordinate grid has a horizontal x-axis and a vertical y-axis. When you plot a point on the grid given its coordinates, the first number in the ordered pair (the x-coordinate) tells how far right to go from the origin(0,0), and the second number(the y-coordinate) tells how far to go up**.** Coordinates are numbers which determine the position of a point or a shape in a particular space (a map or a graph). Points are marked by how far along they are on the x axis (the horizontal axis) and how far up they are on the y axis (the vertical axis).

Utility and Scope

The Cartesian coordinate plane works well with many simple situations in real life. For instance, if we are planning where to place different pieces of furniture in a room, we can draw a two-dimensional grid representing the room and use an appropriate unit of measurement. The idea of coordinate graphs is used to write the latitude and longitude in the map.

A. Competency

- Construct coordinate graphs using appropriate labels and scales to locate position of things in 2-D space.

B. Objectives

- Construct coordinate graphs using appropriate labels and scales.
- Use coordinate graphs for purposes of location.

C. Essential *Skills/Processes*

- Representing
- Reasoning
- Analysing
- Interpreting

D. Learning *Experiences*

- Pre-assessment (identifying the coordinates of the points).
- Demonstrate how to plot the coordinates on the grid with appropriate labels and scales.
  - ❖ Why do you think coordinate graphs are useful?
- Discuss that the coordinate graph is used for the purposes of location.
- Explore how to plot the coordinates using technology. Suggested links: Coordinate plane,Geogebra

E. Assessment

Performance Task 1

Let students find coordinates for the points on the grid (to be provided by the teachers).

Performance Task 2

Let students plot the points on the coordinate grid (coordinates to be provided by the teachers) and interpret the data.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Questions

  i. Why are scales important in coordinate graphs?
  ii. How will the learning of coordinate graph help in our life?
  iii. Have you heard about latitudes and longitudes? What are they for?

F. Resources

- Understanding Mathematics, Textbook for class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII

- Online
  - ❖ History of coordinate system History of coordinates
  - ❖ Plotting coordinates-Coordinate plane,Geogebra.

G. Annexure

Use the template given in V-A1 to record student achievement.

Topic: V-E4 Experimental Probability and Theoretical Probability

[300 minutes]

Introduction

Blaise Pascal (1623 – 1662) and Pierre de Fermat (1601-1665) were two seventeenth century French mathematicians who were the founders of Probability Theory. Theoretical probability is what we expect to happen, where experimental probability is what actually happens when we try it out. The probability is still calculated the same way, using the number of possible ways an outcome can occur divided by the total number of outcomes. As more trials are conducted, the experimental probability generally gets closer to the theoretical probability.

Utility and Scope

Probability is widely used in all sectors in daily life like sports, weather reports, blood samples, predicting the sex of the baby in the womb, congenital disabilities, statics, and many others.

A. Competency

- Demonstrate the ability to conduct experimental probability and describe the probability using words, fractions and decimals

B. Objectives

- Determine experimental probability through simple experiments using devices (dice, cards, spinners and coins)
- Use fractions and decimals to describe theoretical probability & experimental results.

C. Essential Skills/Processes

- Connecting
- Analysing
- Representing

D. Learning Experiences

- Pre-assessment (Describing experimental probability using fractions and probability words).
- Conduct simple experimental probability using devices (spinners, dice etc) and describe it using fractions and decimals.

- Let students watch the video on experimental probability and theoretical probability from this web link Experimental probability
- Explain the differences between experimental probability and theoretical probability with examples.
- Use fractions and decimals to describe theoretical probability & experimental results.
- Let students work out a few questions on experimental probability and theoretical probability.

E. Assessment

Performance Task 1

Provide them with different devices (coins, spinners, cards, dice etc.) and let them determine the experimental probability and the theoretical probability.

Use words, fractions and decimals to describe theoretical probability & experimental results.

Let students relate the above experiment using different devices in their life.

(*Design appropriate assessment tools and record the student learning based on the template in the annexure.)*

- Reflective Questions
  i. Why can the theoretical probability of an event never change but the experimental probability changes?
  ii. How do we use the probability words/language in our daily life? Provide a few examples.
  iii. Is theoretical probability always true? Why?

F. Resources

- Understanding Mathematics, Textbook for class V
- Understanding Mathematics, Teacher's Guide for class V
- National School Curriculum, Mathematics Framework for PP – XII
- Online
  - Experimental probability and theoretical probability- Experimental probability.

G. Annexure

Use the template given in V-A1 to record student achievement.

Instructional Guide
Class VI
Mathematics

Topic: VI - A1 Factors of Whole Numbers
VI - A2 Common Factors Whole Numbers

[300 minutes]

Introduction

A factor of a whole number is a whole number that divides into another whole number with no remainder. **Factorization** or **factoring** consists of writing a number as a product of several *factors*, usually smaller numbers. For example, 3 × 5 is a factorization of 15. So, 3 and 5 are the factors of 15.

The history of the concept of factoring reaches back to ancient Rome, whose wealthy producers and merchants employed a mercantile agent or "factor" to manage the sale and delivery of their goods. Records show that such factors continued to be employed with increasing frequency throughout the Middle Ages. Refer link to know more about the history of factors History of factors.

Utility and Scope

The factors and multiplies of a number can assist a **mathematician** in using the number in a variety of operations and equations. In real life, factoring is a useful skill. Divide something into equal portions, exchange money, compare prices, grasp time, and make computations while travelling are all common applications.

This link https://www.youtube.com/watch?v=378zkdABlPk provides the importance of learning factors in real life.

A. Competency

- Apply the concept of factors and common factors to navigate the relationships of the numbers effectively.

B. Objectives

- Explain that the number is always a multiple of any of its factors and find the factors of a 2-digits number.
- Investigate and explain that the greatest factor is always the number itself and the least factor is always 1.
- Investigate and explain that the second greatest factor is always ½ the number or less.
- Find and list the factors and common factors of the numbers in a systematic way using different methods (Dividing and Multiplying).

- Reason out that 1 is a common factor of any set of numbers.

C. Essential Skills/Processes

- Factoring
- Investigating

D. Learning Experiences

- Provide a few numbers and let students discuss and interpret it into different forms of multiplication.

  Example: 12 can be interpreted into different ways, as 1×12, 2×6 and 3×4.

  - Explain that these interpreted numbers are called factors.
- Let students factorise the numbers by dividing and multiplying.

Example: Factorize 24 by dividing	Example: Factorize 24 by multiplying
24 ÷ 1 = 24 24 ÷ 2 = 12 24 ÷ 3 = 8 24 ÷ 4 = 6 24 ÷ 6 = 4 24 ÷ 8 = 3 24 ÷ 12 = 2 24 ÷ 24 = 1 Factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24	1 × 24 = 24 2 × 12 = 24 3 × 8 = 24 4 × 6 = 24 Factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24

- Refer the suggested link https://www.youtube.com/watch?v=0NvLtTwnUHs. This video explains how to identify factors with the help of a multiplication table.
- Provide a worksheet and let students find factors of the given numbers. Include the following in your worksheet.
  - When both the numbers are even (e.g., 8 and 10)
    - When both the numbers are even, the common factors are 1 and the even numbers.
  - When both the numbers are odd (e.g., 15 and 27)
    - When both the numbers are odd, the common factors are 1 and the odd numbers.
  - Similarly let students explore other number combinations (odd and even).
- **Game**: refer the suggested link in the annexure

E. Assessment

Performance Task 1

Provide a worksheet and let students factorise and identify common factors (refer to the questions from the students' textbook). Assess if students could reason out that 1 is a common factor of any set of numbers or not.

Performance Task 2

Refer the suggested website for an online interactive worksheet Factors and multiples (Choose an appropriate worksheet). There are many different worksheets given. Choose the most appropriate worksheet.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Where can we apply the concept of factors in our life?
  ii. Which method did you enjoy the most while finding the factors for a given number?
  iii. Do you think knowing the multiplication table can help you to find the factors for a given number? How?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - History of Factoring History of factors.
  - Factors in Real Life https://www.youtube.com/watch?v=378zkdABlPk
  - Video on Factoring https://www.youtube.com/watch?v=0NvLtTwnUHs
  - Worksheet on factors and multiples https://www.liveworksheets.com/w/en/math/130932
  - Factor Game Factor game, NCTM.org

G. Annexure

i. **Game:** Let the students explore and play games using the link: Factor game, NCTM.org This link provides the students to find the factors.

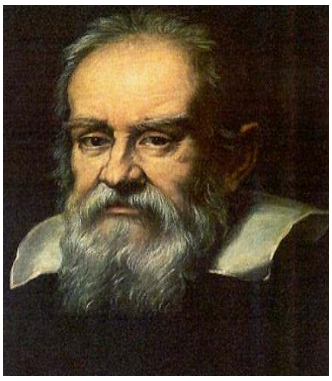
ii. Template to record assessment

Strand(s): Number and operations	**Topic(s):** A1 Factors of Whole Numbers A2 Common Factors Whole numbers				
Competency: • Demonstrate the ability to apply the concept of factors and common factors to navigate the relationships of numbers effectively.					
Name of the student	**Level of achievement**				
	Beginning	**Approaching**	**Meeting**	**Advancing**	**Exceeding**

Topic: VI – A3 Prime Numbers: Distinguish from Composites

[200 minutes]

Introduction



The Sieve of Eratosthenes, invented by Eratosthenes around 200 B.C., is an algorithm for calculating prime numbers. Leonhard Euler, a Swiss mathematician, presented the first known proof of this theorem in 1749.

Prime numbers are numbers that have only 2 factors: 1 and itself. For example, the first 5 prime numbers are 2, 3, 5, 7, and 11. A composite number is a number that has more than two factors. Examples of composite numbers are 4, 6, 8, 9, 10, 12, 14 etc.

Utility and Scope

Prime numbers are very important to number theorists because they are the building blocks of whole numbers, and important to the world because their unusual mathematical properties make them perfect for our contemporary needs. The most prominent practical use of prime numbers is in cryptography. Encryption codes can be created by multiplying two prime numbers together.
To know more about the application of prime and composite numbers, explore the given link https://www.youtube.com/watch?v=1xHbTDuXB5o

A. Competency

- Ability to distinguish prime numbers from composite numbers and list them till 100.

B. Objectives

- Define prime numbers and distinguish them from composite numbers.
- Investigate and explain that 1 is not a prime number.
- List all prime numbers till 100.

C. Essential Skills/Processes

- Investigating
- Understanding

- Reasoning

D. Learning Experiences

- Conduct pre-assessment on different types of numbers they have learned. Discuss even numbers and odd numbers.
- Explore the link; Prime Numbers and Composite Numbers - Sieve of Eratosthenes, Definition, List, Facts and Examples | CK-12 Foundation to define prime numbers.
- After exploring phET simulation students draw conclusions:
  - Numbers which are arranged in rectangles in only one way are prime numbers.
  - Number 1 is not a prime number (doesn't have 2 factors).
  - Prime numbers apply only to whole numbers other than 0.
- The video in the link explains prime and composite numbers Prime and composite numbers Let the students watch the video.
- To find the prime number, use Sieve of Eratosthenes (Refer the annexure for the instruction).

E. Assessment

Performance Task 1

Design an assessment task where students find numbers by relating the area of the rectangle. Provide at least 7 numbers that consist of both prime numbers and composite numbers.
Let students list all the prime numbers till 100.

Performance Task 2

Let students explore the worksheet link Prime number, live worksheets to distinguish between prime numbers and composite numbers.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Did you enjoy the Eratosthenes Method of finding the prime numbers? What did you learn from his method?
  ii. Why is 2 only an even prime number?

iii. Why do you think numbers have different numbers of factors?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- BLM
- Online
  - Prime Protection https://www.youtube.com/watch?v=1xHbTDuXB5o
  - Area Builder phet.colorado.edu
  - Video on Prime and composite number Prime and composite numbers
  - Worksheet on prime and composite numberPrime number, live worksheets

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

ii. The Sieve of Eratosthenes

The Greek mathematician Eratosthenes found a way to figure out which numbers are prime numbers. You can use a 100 chart to find them.

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
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Topic: VI – A4 Reading and Writing Large Numbers (billion)
VI – A5 Decimal Place Value (ten thousandth)

[450 minutes]

Introduction

In the late 1600s, the word billion was adopted from the French to denote the number one million raised to the power of two, or a million million—a quantity represented by a 1 and 12 zeros. However, the French later changed their naming conventions so that a billion became a thousand million (a 1 followed by 9 zeros) and a trillion became a thousand thousand million (or a million million, the old billion).

The French have since returned to the older system, but it was this new system that was adopted by American English speakers in the 1800s. In Britain, the newer system has seen increasing use since the 1950s, but the older sense is still sometimes used there as well. **Source**: billion definition

Utility and Scope

Numbers are a valuable language for counting, measuring, and identifying things, regardless of the numerical system we employ. We use numbers in a variety of ways, including mathematical calculations, phone calls, and account identification.

Every day, we employ numeracy in all aspects of our life. Our financial, social, and professional success is influenced by our confidence and proficiency with numbers. It even has an impact on our health and happiness.

A. Competency

- Demonstrate the ability to read, write and rename whole numbers and decimals to solve problems related to day-to-day life.

B. Objectives

- Read and write numbers in words, decimals and in expanded form.
- Read and write rounded decimals (345.3 million).
- Explain that numerical positions are grouped in 3s for the purpose of reading them.
- Rename numbers and apply it to solve related problems (whole numbers).
- Show that the place values in the decimal number system follow patterns.
- Read and write decimal numbers.

- Compare and order decimal numbers.

C. Essential Skills/Processes

- Patterning
- Connecting
- Representing
- Conceptualising
- Modelling

D. Learning Experiences

- Display different numbers till million, and let students read them.
- Introduce billion. The column to the left of the hundred million place is the one billion place.

Billions	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

  - Discuss a few examples of 10-digit numbers (billion) and read. Let them write the numbers in place value charts and in expanded form.
  - Discuss a few examples of where the concept of rounded decimals are being used in relevant situations. (Example: The government spent Nu 3.45 million in the bridge construction)
  - Discuss how to rename a large number as decimal when the number ends in many zeros.
    Example: 4,340,000,000 can be renamed as follows;
    - 4.34 billion
    - 43.4 hundred million
    - 434 ten million
    - 4340 million

- Introduce decimals place value till Ten thousandths.

Tens	Ones	Tenths	Hundredths	Thousandths	Ten thousandths

- Discuss how to read decimals.
  Example
  - 1.204 is read as "*one and two hundred four thousandths*."
  - 12.0006 is read as "*twelve and six ten thousandths.*"
  - 0.0235 is read as "*two hundred thirty-five ten thousandths.*"

Let students compare and order decimal numbers.

E. Assessment

Performance Task 1

Prepare a worksheet and let students write whole numbers and decimal numbers in expanded form. Let them also rename the numbers.
Prepare word problems on whole numbers and decimal numbers relating to real life situations.

Example 1: Mr. Thinley's monthly salary is Nu 10,500. Write his annual income in the expanded form.

Example 2: The population of Bhutan at present is about 750,000. It is expected to increase by 100,000 after every 10 years. What will be the estimated population after 10 years?

Example 3: Seven people in Paro are about 0.0001 of its population. Estimate Paro's population.

Performance Task 2

Let students describe the pattern in place value in whole numbers and decimal numbers.
Let students explain the purpose of grouping the numbers in 3s in large whole numbers.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why do you think there are different ways to name/write numbers?
  ii. Which one is easier to read and write, 2.04 million or 2,040,000? Why do you say so?

iii. How would you read and write 2,040,000 in the Indian way of reading and writing numerals?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- BLM
- Online
  - Billion https://www.merriam-webster.com/dictionary/billion

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

Topic: VI – A6 Renaming Mixed Numbers and Improper Fractions

[3000 minutes]

Introduction

Fractions are the numbers that represent a part of the whole group or set. When an object or a group of objects is divided into equal parts, then each individual part is a fraction. A fraction is usually written as 1/2 or 7/10 or 25/37. Explore the link https://bit.ly/3zMUs2t to know about the history of fractions and its importance.

Generally, there are three types of fractions namely; **proper**, **improper**, and **mixed** fractions that are differentiated based on numerator and the denominator. Proper fractions are the fractions having smaller numerator and greater denominator (e.g., ⅖). An improper fraction is a fraction whose numerator is greater than the denominator (e.g., $\frac{6}{5}$). Mixed fraction/number is a mixture of the whole number and the proper fraction (e.g., 2 ⅗). Mixed numbers can be renamed as improper fraction and vice-versa.

Utility and Scope

Fractions tell us how much of something we need, have, or want. Baking a cake, for example, specifies how much of each ingredient should be used. Fractions are used in telling time; each minute is a fraction of the hour.

Discuss and ask students to think of real-life examples where mixed numbers are used. If they need help getting started, give them a few examples. Possibilities include baker, chef, construction worker, nurse, architect, anyone who uses a measuring tape for his/her job, etc.

A. Competency

- Apply the concept of renaming the mixed numbers to improper fractions and relate it to real-life situations.

B. Objectives

- Use pictorial models to illustrate improper fractions and mixed numbers.
- Convert improper fractions to mixed numbers and vice versa, and apply the concept to solve real world problems.

C. Essential Skills/Processes

- Relating

- Representing
- Modeling

D. Learning Experiences

- Conduct pre-assessment on the different types of fractions: proper, improper and mixed numbers.
  - Where do we use the concept of fractions?
  - How do we use fractions in our daily life?
  - What are the different types of fractions?
- Let students watch the video using the link given below.
  - o https://bit.ly/3thcw3l This video explains about changing a Mixed Number to an Improper Fraction.
  - o https://bit.ly/3r43Dr6 This video explains about changing an Improper Fraction into a Mixed Number.
- Illustrate improper fraction and mixed numbers through pictorial models. Explain how to convert mixed fractions to improper fractions and vice-versa.
  Example: *Changing improper fraction to mixed number*

  $\frac{10}{3}$

  There are 3 whole and $\frac{1}{3}$ part. So, $\frac{10}{3}$ can be written as $3\frac{1}{3}$.
- Discuss and connect the concept of mixed numbers and improper fractions to real life situations.

o Example 1: I drank $1\frac{1}{2}$ glass of milk this morning. Write this in an improper fraction?

o Example 2: My brother ate $2\frac{1}{4}$ of the apples yesterday. Write this in an improper fraction?

- Let students play a Matching **Game**. Refer to the Annexure for the instruction.

E. Assessment

Performance Task 1

Let students think of any mixed numbers they have encountered with and let them write it in improper fractions. (Refer to the above two examples).

Performance Task 2

Use the live worksheet link https://bit.ly/3r45v36 to convert improper fractions and mixed numbers and vice-versa. Or prepare a similar kind of worksheet if you do not have internet accessibility.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Give a few examples where mixed numbers are being used in real life?
  ii. Which one is easier for us to read and understand, $2\frac{2}{3}$ *or* $\frac{8}{3}$? Why?
  iii. Why do we need to convert mixed numbers to improper fractions?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - History of fractions https://bit.ly/3zMUs2t
  - Video on how to convert mixed to an improper Fraction https://bit.ly/3thcw3l
  - Video on how to convert improper to mixed number https://bit.ly/3r43Dr6
  - Conversion worksheet https://bit.ly/3r45v36

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

ii. **Game:** Matching - mixed number and improper fraction

Materials- Card sets
Sample Cards

Mixed Numbers	**Improper Fractions**

Instructions – whole class

- Prepare two sets of cards- mixed number and improper fraction cards.
- Take students outside.

- Provide a card each to every student from the mixed number or improper fraction sets.
- On the blow of the whistle, students should mingle with each other to find a matching pair.
- When students get the matching pair, let them call out BINGO.
- Then, have students call out their mixed number and improper fraction set.

Extension - group

- Divide the class into two or more groups.
- Give each team a set of cards (mixed number and improper fraction cards mixed together).
- On the blow of the whistle, the teams must race to get their cards matched up correctly.
- The group who finishes first should call out BINGO.
- Teacher should go around and check.

Topic: VI – A7 Converting Simple Fractions to Decimals
VI – A8 Comparing Fractions
VI – A14 Explore Equivalent Fractions

[450 minutes]

Introduction

Decimal fractions were first developed and used by the Chinese in the end of the 4th century and then later it was spread to the Middle East and from there to Europe. Decimal comes from the Latin word *decimus*, meaning tenth, from the root word *decem*, or 10.

Comparing fractions is determining the larger and the smaller fraction among two parts. The fraction comparison is done based on the numerator and denominator using different methods.

Equivalent fractions are the fractions that have different numerators and denominators but are equal. For example, 2/5 and 4/10 are equivalent fractions, because they are equal.

Utility and Scope

Explore and discuss the utility and scope of the topic with the students. Discuss where fractions can be used in real life. Learning equivalent fractions would help in adding and subtracting fractions in the later part of the lesson.

A. Competency

- Compare and convert simple fractions to decimals and apply the concept in relevant situations.

B. Objectives

- Convert simple fractions to decimals. (fractions with denominators that are factors of 10, 100, 1000...)
- Compare fractions based on common denominator and common numerator.
- Compare fractions using equivalent decimals and benchmarks.
- Investigate the constant multiplicative relationship of numerator/denominator and find the equivalent fractions.
- Demonstrate equivalent fraction by subdividing equally.
- Show by equally grouping the fractional pieces that make up the whole.

- Demonstrate the ability to order fractions.

C. Essential Skills/Processes

- Modeling
- Renaming
- Relating
- Comparing
- Estimating
- Investigating
- Reasoning

D. Learning Experiences

- Let students convert simple fractions to decimals.
- Use a grid to represent fractions and convert to decimals (decimal tenths and decimal hundredths).
- Watch the video using the link given below to compare fractions with common denominator and common numerator.

  Comparing Fractions with Common Denominators

  Comparing Fractions with the Same Numerator
- Show how to compare fractions using equivalent decimals and benchmarks.

  For example: to compare $\frac{7}{10}$ and $\frac{3}{4}$, we can use equivalent decimals.

  $\frac{7}{10}$ = 0.7 = 0.70

  $\frac{3}{4} = \frac{75}{100}$ = 0.75

  0.75 > 0.70 so $\frac{3}{4}$ and $\frac{7}{10}$.
- Discuss and compare fractions having different denominators.
- Design an activity to investigate and explore about equivalent fractions:
  - Multiplicative relationship of numerator/ denominator.

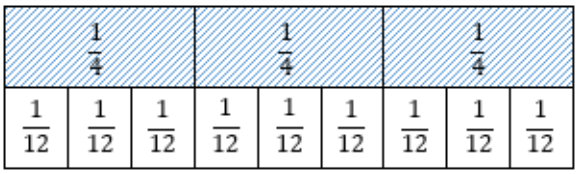
$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$$

$$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$$

$$\frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$$

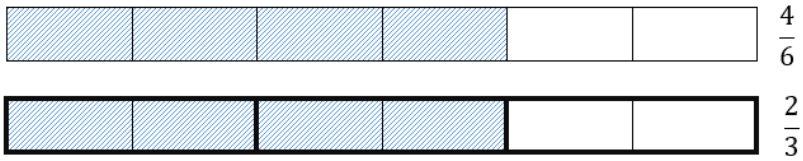
$\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$, and $\frac{4}{8}$ are equivalent fractions.

- Demonstrate equivalent fraction by subdividing equally.
  For example, ¾: subdivide each fourth into 3 parts = 9/12



$$\frac{3}{4} = \frac{9}{12}$$

- Show by equally grouping the fractional pieces that make up the whole (group 4 sixths in groups of 2 = 2 thirds).



E. Assessment

Performance Task 1

Prepare a worksheet and let students convert and compare simple fractions to decimals. Also design an activity and let students solve word problems by comparing fractions.

Sample question:

Sonam spent 6/8 h reading and 4/7 h cooking. In which activity did she spend more time?

Performance Task 2

Use the worksheet given in Compare Fractions with same denominator worksheet to compare fractions based on common denominator and common numerator.

Performance Task 3

Prepare questions on equivalent fractions and let students solve it.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why do you think you need to learn about decimals?
  ii. Why is it easier to compare fractions when the denominators are the same?
  iii. How are decimals and fractions related?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - Video on Comparing fractions
  - Comparing Fractions with Common Denominators
  - Comparing Fractions with the Same Numerator
  - Comparing fractions worksheet Compare Fractions with same denominator worksheet

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

Topic: A9 Ratio: Part to part and Part to whole
A10 Equivalent ratios
A11 Percent: Developing Benchmarks
A12 Rates: Relating to Ratios

[600 minutes]

Introduction

Ratio is a way to compare numbers. The numbers in a ratio may be quantities of any kind, such as counts of people or objects, or such as measurements of lengths, weights, time. For example, if there are 22 boys and 20 girls in the class, then the ratio of boys to girls is 22 to 20 (22:20). The concept of ratio was discovered by Greek Mathematician, Euclid. Mediaeval writers used the word *proportio* ("proportion") to indicate ratio.

A rate is like a ration because it compares quantities. It is different from ratio because the terms in a rate have different units. A percent (%) is a special part-to-whole ratio where the second term is always 100. In Ancient Rome mathematical computations were expressed in fractions of 100 before the existence of decimals. This concept later evolved into percentage.

Utility and Scope

Ratios are common in everyday life and can assist to simplify many of our interactions by putting numbers into context. Ratios make it easier to measure and express quantities.

Many real-world problems are solved using rate and unit rate. For example, we prefer buying 4 candies for Nu 50 than buying 3 candies for Nu 45.

Percentages are used in a wide range of situations. Academic grades are given in percentages at school. Store discounts, bank interest rates, and a variety of media statistics are all expressed as percentages. Percentages are necessary for understanding financial aspects of everyday life.

A. Competency

- Demonstrate the ability to connect the relationships among ratios, percent, and rates and apply the concept in solving the real-world problems.

B. Objectives

- Explain that ratios and fractions are both comparisons.

- Compare a part to a whole and part to part ratio.
- Connect models and symbols to develop multiplicative relationships for equivalent ratios and apply it to solve related problems related to part to part and part to whole ratios. For example: 3:5, 6:10, 12:20…
- Explain that percent is viewed as a special ratio where the second term is 100.
- Convert percent as fraction, decimal and ratio.
- Represent percentage pictorially (grid) and ratio pictorially.
- Find percent equivalents for common ratios like ¼, ½ and ¾ (benchmarks).
- Explain that rates are just like ratios except that they are comparisons of items in different units.
- Describe rate in more than one way and use the concept to solve simple related problems.

C. Essential Skills/Processes

- Modelling
- Patterning
- Analysing
- Relating
- Connecting
- Interpreting
- Recognizing
- Comparing

D. Learning Experiences

- Ask questions on identifying fractions of a set or group.
  Examples,

$\frac{2}{6}$ of this set are stars.

$\frac{3}{4}$ of this group are boys.

$\frac{2}{5}$ of this group are dogs.

- Let students watch the video on ratio using the link; Ratio | Mathematics Grade 5 | Periwinkle.
  - Explain the meaning of ratio with examples (use classroom objects/concrete models to introduce the concept of ratio). Tell them how to read it.
  - Introduce two types of ratios: Part-to-part and part-to-whole ratio with examples.
- Discuss and compare ratios.
- To learn about equivalent ratios, let students use the concept of equivalent fractions.
- Let students investigate how a change in one term affects the other.
- Let students read and simplify ratios to interpret for easier situations. It is often easier to understand a ratio when it is in lower terms.
  - *For example: There are 12 chairs and 3 tables in the class.*
    With the ratio 12:3, you can divide 12 by 3 and then divide 3 by 3 to get the ratio in lower terms, 4:1. Now it is easy to tell that there are 4 chairs for every 1 table.
- Show with examples that adding on or subtracting from a term does not result in equivalent ratios.
- Watch video on percentage using the link Percentage | Mathematics Grade 5 | Periwinkle. Then, introduce percentage and let students represent percentages in a hundredths grid. Explain why percent is viewed as a special ratio.
  - Discuss where the concept of percent is used in our daily life.

- Introduce rate with examples.
  - Discuss where the concept of rate is used in our daily life.
  - 1 kilogram of potatoes cost Nu 50. We can write it as 1 kg/Nu 50 or Nu 50/1 kg.
- Solve simple problems related to rate, ratio and percent.
- Explore the relationship among ratio, percent and fraction.
- **Game: Ratio Match** (Refer the annexure for the instruction)

E. Assessment

Performance Task 1

Prepare a worksheet on ratio, rate, and percent. Refer to the questions from the textbook class VI. Include the word problems.

Sample word problems:

1. *Sushma is a teacher earning an annual income of Nu 288,000. Her annual savings amount to Nu 36,000. What is the ratio of her savings to her expenditure?*
2. *Sonam took a maths test and got 25 correct and 15 incorrect answers. What was the percentage of correct answers?*
3. *Mr. Sangay walks 12 kilometres in 3 hours. How many kilometres does he walk per hour?*

Performance Task 2

Let students solve ratio and rate questions given in the worksheet link Ratio, Rate worksheet.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How are equivalent ratios like equivalent fractions?
  ii. Provide a few examples where percent is used in our everyday life.
  iii. Why do you think the academic marks are described as percent?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Classroom objects
- Online
- Video on introducing Ratio https://bit.ly/3zO3Djc
- Video on introducing Percent https://bit.ly/3HY6g4J
- Worksheet on Ratio and Rate Ratio, Rate worksheet

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

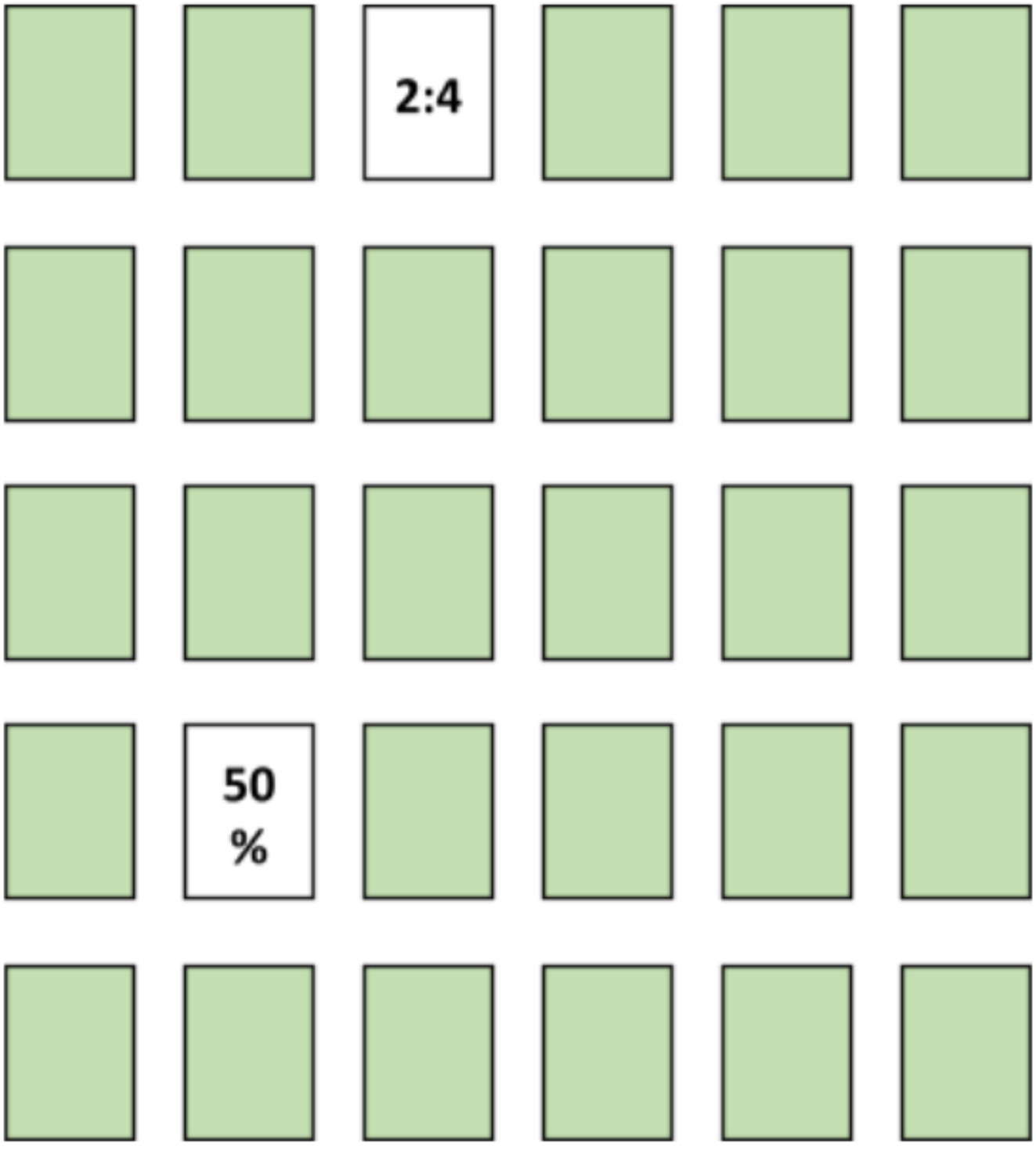
ii. **Game (Ratio Match)**

This game is for 2 or 3 players. You need a set of Ratio Match Game Cards.

How to play:

- Shuffle the cards and place them face down in a 5-by- 6 array.
- Take turns. On your turn, flip over any two cards.
- If the ratios, percent, fractions, or decimals shown are equivalent, pick up and keep those cards and take another turn.
- If the cards are not equivalent, flip them face down. Your turn is over.
- Play until all the cards have been turned over and matched. The player with the most cards at the end wins.

For example:


2:4
50
%

Topic: VI – A13 Multiplication and Division Computation Patterns

[150 minutes]

Introduction

Mathematics is built on the foundation of patterns. The ability to recognize and develop patterns helps us in making predictions based on our observations; it is an important mathematical skill. Understanding patterns benefits children because it prepares them to learn complex numerical concepts and mathematical processes.

Patterns are the visible expression of an ordered structure and provide knowledge about how things are connected and arranged.

Utility and Scope

Multiplication is an important tool in mathematics, including algebra, calculus, equations, and more. If students can practise and master multiplications up to 12 by the end of primary school, he or she will be able to confidently and expertly tackle the more difficult mathematical courses.

It also helps students be more familiar with and confident in the teachings that are offered to them as they progress through their schooling.

Patterns and their interactions can help us in appreciating and understanding living beings, non-living objects, and our surroundings.

A. Competency

- Demonstrate the ability to use the multiplication and division patterns to simplify computations and solve related computational problems.

B. Objectives

- Re-arrange factors to simplify computation.
- Show how a change in either factor affects the product.
- Investigate that dividing one factor and multiplying the other by the same number produces no change in the final result.

C. Essential Skills/Processes

- Reasoning
- Computing
- Investigating

D. Learning Experiences

- Demonstrate on simplifying computation by rearranging factors.
  Example: 28 X 250 is more difficult than 7 X 1000, though both have the same product.
- Let students investigate and justify the effect of a result as a factor is changed.
  Example: __ X 100: as __ increases by 1, the product increases by 100. Similarly, when __ increases by 2, the product increases by 200.
- Discuss that dividing one factor and multiplying the other by the same number produces no change in the final result.
  Example: 28 x 50 = **1400**
  28 **÷ 2** x 50 **x 2**
  14 x 100 = **1400**

E. Assessment

Performance Task 1

Provide a worksheet on simplifying computation by rearranging factors.
Let students find out how change in either factor affects the product.

Performance Task 2

Prepare a worksheet and let students find out that dividing one factor and multiplying the other by the same number produces no change in the final result.
Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why do we need to rearrange the factors while calculating?
  ii. How is pattern useful in solving the multiplications and division problems?
  iii. What relationship do you see between multiplication and division?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII

G. Annexure

i. Use the template given in VI-A1 to record student achievement

Topic: VI – A15 Addition and Subtraction of Simple Fractions with Various Denominators

[300 minutes]

Introduction

The word fraction actually comes from the Latin "fractio" which means to break. To understand how fractions have developed into the form we recognise, we'll have to step back even further in time to discover what the first number systems were like. Explore the given link History of Fractions to know more about the history of fractions.

Utility and Scope

There are many opportunities in daily life to help your child understand fractions, as well as to help them see the importance of fractions. Explore the link Why Are Fractions so Important? to know more about the importance of fractions.

A. Competency

- Display the ability to add and subtract fractions with different denominators and apply the concept to solve appropriate word problems.

B. Objectives

- Add/subtract fractions with different denominators using models and symbolically. (pattern blocks, fraction strips).
- Solve word problems related to addition and subtraction of fractions with different denominators.

C. Essential Skills/Processes

- Conceptualising
- Problem solving

D. Learning Experiences

- Let students add and subtract fractions with the same denominator.
- Explain how to add and subtract fractions using the same denominator using diagrams or use models like pattern blocks and fractions circles.
- Let students discuss how to add and subtract fractions with different denominators using fraction strips.

- Let the students watch the video on how to add and subtract fractions with different denominator using these links
  - o Adding Fractions with Unlike Denominator using Fraction Strips
  - o 5-2: Subtracting Fractions With Fraction Strips
    (*Watch and trim the video before letting students watch*)
- Let students solve word problems (refer questions in the textbook).

E. Assessment

Performance Task 1

Prepare a worksheet and let students add and subtract fractions with various denominators. Let them use the fraction strips.

Performance Task 2

Design word problems related to adding and subtracting fractions and let students solve it.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why is it easier to add and subtract fractions when the denominators are the same?
  ii. Why is it helpful to use fraction strips to compare fractions when denominators are not the same?
  iii. Tell some situations where we need to add or subtract decimals having different denominators.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ History of Fractions https://nrich.maths.org/2515
  - ❖ importance of fractions https://bit.ly/3tm9knc

- ❖ Video on adding and Subtracting Fractions
  https://www.youtube.com/watch?v=HBU6k25wSj4

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

Topic: VI – A16 Multiplication and Division of Decimals

[250 minutes]

Introduction

Just as there is the right way to multiply and divide whole numbers, there is the right way to multiply and divide decimal numbers.

While multiplying decimals, we first multiply the two numbers ignoring the decimal points. Next, count the number of digits after the decimal in each factor. Finally, put the same number of digits behind the decimal in the product.

When we divide decimals, we change the divisor to a whole number by moving the decimal point all the way to the right. In this lesson, you will learn how to multiply and divide decimals using various methods in detail.

Utility and Scope

Decimals are a shorter way to write fractions and mixed numbers with denominators of powers of ten, such as 10,100,1000,10000, and so on. If a number has a decimal point, the number of tenths is shown by the first digit to the decimal point. The decimal 0.3, for example, is the same as the fraction 310.

A. Competency

- Demonstrate an understanding of multiplication and division of decimals using algorithms and use the concept in solving related problems.

B. Objectives

- Connect multiplying and dividing of decimals to whole number multiplication and division.
- Link pictorial models to algorithms.
- Apply estimation strategies.
- Explain and apply order of operation, excluding exponents.

C. Essential Skills/Processes

- Connecting
- Estimating
- Applying

D. Learning Experiences

- Pre-assessment on multiplying and dividing whole numbers.
  - Provide a few questions and let students multiply and divide whole numbers.
- Discuss on how to estimate a product. To estimate decimal products, use whole numbers. For example: $2.4 \times 0.9 \rightarrow 2 \times 1 = 2$
- Let students use hundredths grid (pictorial) to show the multiplication of decimals.
- Use this link to learn how to multiply decimals using models
  - Spectrum Math Tutor: Multiplying Decimals Using Models
- Let students solve a few problems and link a pictorial model to an algorithm.
- Discuss on how to estimate a quotient. To estimate decimal quotients, use whole numbers or simpler decimals.
  - For example: Tashi travelled 72.4 km in 2.3 h. At about what speed was he travelling?
    72.4 ÷ 2.3 is about 72 ÷ 2 = 36 km/h.
- Use hundredths grid (pictorial) to divide decimals.
  - This video link shows how to divide decimals using models: Spectrum Math Tutor: Dividing Decimals Using Models
- Demonstrate how to divide and multiply decimals using algorithms. Let them also multiply and divide decimals by a whole number.
- **Game: Target 10** [Refer the annexure for the instructions]

E. Assessment

Performance Task 1

Let students solve a few questions on multiplying decimals using models. Let them link pictorial models to algorithms.
Provide some problems on multiplying decimals to assess a student's estimation skills.

Performance Task 2

Let students solve some problems on dividing decimals.

Let students explore and solve problems on multiplying and dividing decimals in the links provided.

- https://www.liveworksheets.com/yx2585379dl
- https://www.liveworksheets.com/worksheets/en/Math/Multiplying_Decimals

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How is multiplication of decimals like multiplying a whole number? How are they different?
  ii. How is division of decimals like dividing a whole number? How are they different?
  iii. Tell some situations where we need to multiply or divide decimals.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - Video on Multiplying Decimals using models https://www.youtube.com/watch?v=xVqIndbswnw&feature=emb_logo
  - Video on Dividing Decimals using models https://www.youtube.com/watch?v=HbmZBLstwz0
  - Worksheets https://www.liveworksheets.com/yx2585379dl https://bit.ly/3tmyNwN

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

ii. **Game: Target 10**

Read the instruction below

Two to four players can play. You need a die.

- Each player draws four boxes with decimals and a multiplication sign:

$$\square.\square \times \square.\square$$

- To play one round, each player rolls a die four times to fill in his or her boxes with digits.
- You can wait until you have done all your rolls before you decide which digit to put in which box. Once you have recorded a digit in a box, you cannot move it.
- The player with the product closest to 10 wins 1 point for the round.
- The winner is the player with the most points after five rounds.

For example:

Player 1

2.1 × 4.5 = 9.45

About 0.5 away from 10

Player 2

6.3 × 1.4 = 8.82

More than 1 away from 10.

Player 1's product is closest to 10 so he wins 1 point for the round.

Topic: VI – B1 Explore Area Patterns

[100 minutes]

A. Competency

- Draw conclusions on how changes in base or height affect the area of rectangles, parallelograms and triangles.

B. Objectives

- Explore concretely how changes in base/length affect area of rectangles, parallelograms,and triangles
- Link concrete to symbols which represent the changes e.g., parallelograms: A = bh so if b and h are both doubled, area is doubled if b is doubled but h is halved the area remains the same.

C. Essential Skills/Processes

- Conceptualising
- Connecting

Note: The Learning Experiences and Assessment for this topic has been included with the topics in strand C.

Topic: VI – B2 Explore Volume Patterns

[150 minutes]

A. Competency

- Explore to infer that the changes in one dimension affects the volume of a rectangular prism.

B. Objectives

- Explore how changes in one dimension of the formula affects the volume of a rectangular prism and relate this to the volume formula V = l × w × h.

C. Essential Skills/Processes

- Investigating
- Relating

Note: The Learning Experiences and Assessment for this topic has been included with the topics in strand C.

Topic: VI – B3 Square and Triangular Numbers

[200 minutes]

Introduction

A number that can be modelled as a square is called a square number. 1, 4, 9, and 16 are the first four square numbers.

Triangular number is a number that can be modelled as a triangle where each row is one more than the row above it, starting with 1. The first four triangular numbers are 1, 3, 6, and 10.

Explore the link given to know more about square and triangular numbers.

- Who created square numbers? (Square number)
- Pascal's triangle | mathematics | Britannica (Triangular number).

Utility and Scope

Knowing the square numbers will help in solving a variety of different maths problems, including long multiplication and area. It would also help the child in finding the square root when they reach higher grades.

Explore more about the about triangular and square number using the link The truth about triangles and squares | NZ Maths.

A. Competency

- Represent geometric and numerical patterns for square and triangular numbers.

B. Objectives

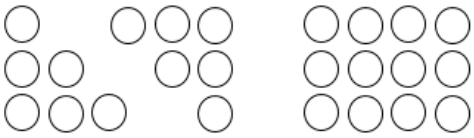
- Show square and triangular numbers in geometric and numerical patterns.
- Conclude that square numbers are represented in square arrays and are the products of numbers multiplied by themselves.
- Show that a triangular number can be modelled as a triangle where each row is one more than the row above it, starting with 1.
- Explore pattern rules for square and triangular numbers and apply it to solve related problems.
- Demonstrate an understanding of the relationships in the pattern and find the missing values in simple patterns.

C. Essential Skills/Processes

- Conceptualising
- Representing
- Connecting

D. Learning Experiences

- Watch videos on square and triangular numbers using the link below.
  - What Are Square Numbers | | Maths | FuseSchool
  - Triangular Numbers Numbers
- Provide identical materials (one's blocks/counters) to each group.
- Instruct students to create growing squares using these materials. Let them share what they have created. Confirm that the square numbers are the products of numbers multiplied by themselves.
- Demonstrate on representing square numbers in square arrays.
- Similarly, allow students to create growing triangles using these materials. Ask them to share their observations.
- Show that if a triangular number is doubled, a rectangle is obtained that has a width and length that are 1 unit apart.
  Example:



E. Assessment

Performance Task 1

List all the square numbers from 1 to 200.
List all the triangular numbers from 1 to 100.

Performance Task 2

Let students show the 13th square number using models/counters.
Let students show the 10th triangular number using models/counters

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. What pattern do you see in triangular numbers?
  ii. What pattern do you see in squares?
  iii. How are squares different from triangular numbers?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - Square number https://moviecultists.com/who-created-square-numbers
  - Triangular number https://www.britannica.com/science/Pascals-triangle
  - Truth about square https://nzmaths.co.nz/resource/truth-about-triangles-and-squares
  - Video on square number https://www.youtube.com/watch?v=PDyyvPdi1tI
  - Video on triangular number https://www.youtube.com/watch?v=0BE2agOG4z4

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

Topic: VI – B4 Linear Equations: Using open frames

[200 minutes]

Introduction

We are often faced with a calculation involving multiple variables in our daily lives. For example, you want to buy beef for a party and you've got Nu 3000 in your pocket. A linear equation tells you how much you can afford.

Sir William Rowan Hamilton invented the linear equation in 1843. Learn more about the history of Linear Equation using the link given (https://cutt.ly/gUF43Vy).

Utility and Scope

Linear equations are useful in science and a variety of other fields. They enable scientists to explain relationships between two variables in the physical world, make predictions, calculate rates, and perform conversions. Graphing linear equations help in the identification of trends. Explore the link Use of algebra in real life to learn about its uses in our everyday life.

A. Competency

- Solve simple linear open frame equations in context to real life situations.

B. Objectives

- Replace open frames with letters to represent linear equations.
- Solve simple linear equations to find the unknown value. (one variable)
- Create simple linear equations to solve word problems.

C. Essential Skills/Processes

- Applying
- Computing

D. Learning Experiences

- Conduct pre-assessment on finding the missing number.
  Example: 3 + • = 8, 7 = • - 3

- Tell students that this open frame can be replaced with any letters of the alphabet to make it linear equations.
- Design an activity to solve simple linear open frame equations that involve single operations and combined operations.
  Example: a. 8 + n = 17 b. 6 + f x 4 =48
- Look at the example given below to frame the simple linear open frame equations.

  Sample 1

  Convert the following statements into equations.

  (a) 7 added to a number is 9. (**Answer: x + 7 = 9**)

  (b) 3 subtracted from a number is equal to 15. (**Answer: x - 3 = 15**)

  (c) 5 times a number decreased by 2 is 3. (**Answer: 5x - 2 = 3**)

  (d) 2 times the sum of the numbers x and 7 is 13. (**Answer: 2(x + 7) = 13**)

  Sample 2

  The sum of two numbers is 20. If one number is 8 more than the other, find the numbers by framing a linear equation.

  Solution

  Let one number be x.

  So, the other number is x + 8.

  We know that the sum of both the numbers is 20.

  Therefore, the linear equation can be framed as, x + x + 8 = 20.

  This results in, 2x + 8 = 20.

  Now, let us solve the equation by isolating the variable on one side and by bringing the constants on the other side.

  This means 2x = 20 - 8.

  After this step, 2x = 12,

  So, the value of x = 6.

  This means, one number is 6 and the other number is 6 + 8 = 14.

  Therefore, the two numbers are 6 and 14.

  - Refer to the given link https://www.youtube.com/watch?v=L0_K89UJfJY to discuss how to develop simple open frame equations. Then provide related questions and solve those questions.

E. Assessment

Performance Task 1

Prepare a worksheet on simple linear open frame equations for students to solve. Refer the link https://cutt.ly/PkWGb3I to prepare the questions.
Sample word problems

- Sonam bought two books for Nu 260. He does not remember the price of the books, but remembers that one book costs Nu 20 more than the other. What is the cost of each book?
- Karma has a rectangular garden of perimeter 342 m. The length of the garden is two times that of its width. What is the length and width of the garden?
- Tshering is 8 years older than Dorji. The sum of their ages is 32. Find their age.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why is it important to change mathematical statements into an equation?
  ii. Why do you think we are using letters in linear equations?
  iii. Which letters are mostly used in linear equations? Why do you think so?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - History of linear equation https://cutt.ly/gUF43Vy
  - Algebra in real life Use of algebra in real life
  - Video on open frame equation https://www.youtube.com/watch?v=L0_K89UJfJY
  - Worksheet https://cutt.ly/PkWGb3I

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

Topic: VI – C1 Calculate Area; Context Based Problems

[200 minutes]

Introduction

Areas were initially recorded in ancient Babylon, when they were used to calculate the amount of land possessed by various people for revenue purposes. Later, in 287 BC, the famous Greek mathematician Archimedes discovered the circle's area and perimeter.

Area is the space occupied by the surface of an object or any flat shape. In this lesson, students will be learning to measure and calculate the area of the rectangular surface objects/things around them.

Utility and Scope

Area measures the space within a shape. Knowing how to calculate the area has many uses in our daily lives. For example, knowing the area of a wall can help you calculate the amount of paint needed for a wall. Knowing the floor area of your kitchen makes it easy to calculate how many tiles/planks you need for that floor. Explore the link to know more about the practical application Importance of the Math Concept Area.

A. Competency

- Demonstrate the ability to find the area of the things/objects around us using appropriate units.

B. Objectives

- Calculate the area of objects/things with rectangular or square shape using appropriate units (cm^2, m^2, km^2).

C. Essential Skills/Processes

- Applying
- Computing

D. Learning Experiences

- Allow students to discuss and share different units used to measure lengths in our everyday life. For example: measuring the length of the football ground, classroom and distance between two places etc.

- Let students identify objects having rectangular/square shapes in the classroom e.g. table top, chalkboard and paper etc.
- Ask them to measure the dimensions and find the area.
- Take students outside and let them measure the dimensions of the objects that can be measured in metres. For example, basketball court, volleyball and badminton court and find their area.
- Similarly, allow students to share where square kilometres can be used.

E. Assessment

Performance Task 1

Let students measure the dimensions of things/objects at home. Example: photo frame, table top, TV screen and find their area.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Where can we apply the concept of area in our life?
  ii. Discuss where the square kilometres are being used in real life?
  iii. Why do we use squares while measuring the area? Why can't we use circles or other shapes?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Measuring tape/ruler
- Classroom objects
- Online
  - ❖ Importance of the Math Concept Area
    https://www.thoughtco.com/definition-of-area-2312366

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – C2 Relate Bases, Heights and Areas of Parallelograms

[100 minute]

Introduction

A quadrilateral with opposite sides parallel is defined as a parallelogram and therefore opposite angles are equal. A rhombus is a quadrilateral with equal sides, whereas a rectangle is a parallelogram whose angles are all right angles. A parallelogram's polygon diagonals are bisected by each other. Few examples of a parallelogram are rhombus, rectangle, and square.

The word "parallelogram" comes from the Greek word "parallelogrammon" (bounded by parallelogram). The concept of parallelograms was first explained by the Greek mathematician, Euclid. It forms an integral part of the Euclidean geometry put forth by him and has been explained in his book on geometry, The Elements.

Source: https://kids.kiddle.co/Parallelogram

Utility and Scope

There are four straight sides to a parallelogram. Each of the two opposing pairs of sides is the same length and parallel. Understanding the properties of parallelograms helps to easily relate its angles and sides.

A. Competency

- Explore the relationship between the area of a parallelogram and the area of the rectangle having the same base and height and draw conclusions.

B. Objectives

- Show that the area of a parallelogram is the same as the area of a related rectangle.
- Find the base or height, given the area and the other dimensions.
- Show that a variety of parallelograms can have the same area.

C. Essential Skills/Processes

- Relating
- Computing

D. Learning Experiences

- Let students find the area of the rectangle with the given dimensions.
- Use the area of the rectangle to develop a formula for the area of parallelogram (refer mathematics textbook class VI).
- This video link shows how to find the area of parallelogram Area of a Parallelogram (Introduction) (Watch and trim the video clip as per lesson required).
- Show how to find the base or height, if the area and other dimensions are given.
- Let students explore a variety of parallelograms having the same area with different dimensions.
- Let students explore how change in base/height affects the area of parallelograms.
- When the base is doubled, the area gets doubled. If the base is doubled but height is halved the area remains the same.

E. Assessment

Performance Task 1

Let students solve the questions on the area of parallelogram. Refer questions from Mathematics textbook and SIM class VI or other relevant sources.

Performance Task 2

Let students show that the area of a parallelogram is the same as the area of a related rectangle with the same base and height.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why do you think there are many parallelograms with the same area?
  ii. Rectangles are also parallelograms. Do you agree? Why?
  iii. How are the rectangles and parallelograms the same? How are they different?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Video on area of parallelogram
    https://www.youtube.com/watch?v=PKzE3OWxDfQ
  - ❖ History of parallelogram
    http://infomory.com/facts/facts-about-parallelograms/

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – C3 Area of a Triangle and Composite shape

[300 minutes]

Introduction

The triangle is a three-sided polygon. It is also called trigon (but not very common). There are different types of triangles classified by sides and angles. In this lesson, students will learn to use the parallelogram formula, A = b × h, to develop a formula for the area of a triangle.

Utility and Scope

Explore and discuss the utility and scope of the topic with the students. The uses of triangles are discussed in strand D under D2-Drawing Triangles.

A. Competency

- Display that the area of a triangle is one-half of the related parallelogram.

B. Objectives

- Explain that the area of a triangle is one-half of the related parallelogram and calculate the area of different triangles.
- Describe that as long as the base and height are the same, the areas of visually-different triangles are the same.
- Calculate the missing dimension when the area and one of the dimensions is given.
- Apply the concept of computing area to solve related real-life problems (area of rectangle, parallelogram and triangle).
- Apply the formula to calculate the area of a composite shape (rectangle, parallelogram and triangle).

C. Essential Skills/Processes

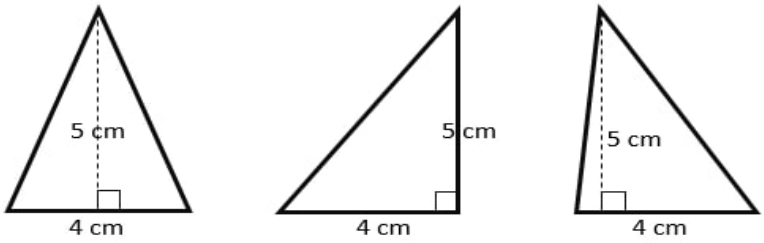
- Comparing
- Connecting

D. Learning Experiences

- Let students find the area of a parallelogram.

- Let students explore that the area of a triangle is one-half of the related parallelogram.
  - ❖ Let students watch the video using this link [Formula for Area of a Triangle - Why?]
  - ❖ Let students calculate the area of different triangles.
- Demonstrate with examples that as long as the base and height are the same, the areas of visually-different triangles are the same.

  Example



$A = \frac{b \times h}{2}$ $A = \frac{4 \times 5}{2}$ $= \frac{20}{2}$ $A = 10\ cm^2$

$A = \frac{b \times h}{2}$ $A = \frac{4 \times 5}{2}$ $= \frac{20}{2}$ $A = 10\ cm^2$

$A = \frac{b \times h}{2}$ $A = \frac{4 \times 5}{2}$ $= \frac{20}{2}$ $A = 10\ cm^2$

- Let students explore how change in base/height affects the area of a triangle. (If the base/height of the triangle is doubled, the area will be doubled).
- Let students explore lessons on the area of a triangle in SIM class VI (volume 3).
- Let students calculate the area of a composite shape formed by triangles and rectangles.
- Show the video to let them understand more: [Area of Composite Figures with Triangle Shapes]

E. Assessment

Performance Task 1

Let students solve the question on the area of the triangle. (Refer questions from Mathematics text book class VI or design questions).

Performance Task 2

Let students show with examples that the area of a triangle is one-half of the related parallelogram.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Question
  i. A parallelogram and a triangle have the same base and area. Will their heights also be the same? Explain with examples.
  ii. Any triangle is half of a parallelogram. Do you agree? Why?
  iii. Why does the formula area = (base × height) ÷ 2 make sense to find the area of any triangle?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - Area of triangle (video) Formula for Area of a Triangle - Why?

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – C4 Relationships between Linear SI Units

[400 minutes]

Introduction

SI Units (International System of Units**)** are the most widely used system of units. The SI was established in 1960 by the 11th General Conference on Weights and Measures (CGPM). The metric system was officially adopted in France after the French Revolution. During the history of the metric system, a number of variations have evolved and their use spread around the world replacing many traditional measurement systems. It is important to have a standard unit system because it allows people all around the world to interpret measurements in one system. Explore the link Understanding Metric | NIST to know more about the historical and international aspects of the SI.

Utility and Scope

Measurement is there in every aspect of human life. We are surrounded by measurements and have become accustomed to them, so we overlook the importance of measurements. Only when our measurement tools fail or are unavailable, do we begin to understand how important they are.

Most quantities require a unit to convey the value of this physical quantity. For example, it is impossible to tell someone a particular length without using certain units, because you cannot describe a length without a reference used to understand a given value.

A. Competency

- Apply the knowledge of relationships of linear SI units to find the relation of square and cubic SI units.

B. Objectives

- Investigate the relationship between linear, square and cubic SI units and apply the concept in converting SI units.

C. Essential Skills/Processes

- Comparing
- Connecting

D. Learning Experiences

- Let students convert from one unit to another.
  For example;
  - 1 m = ____cm
  - 500 m = _____km
  - 250 mm = _____m
- Use the metric unit chart to show the relationships between SI units and convert one unit to another.

Linear SI units

mm	cm	dm	m	dam	hm	km

- Explain how to convert area SI units (for example; 1 m^2 = 10,000 cm^2). [Here, the students should know that they have to convert m to cm].
  1 m^2 = 1 m × 1 m, we know that 1 m = 100 cm
  So, 100 cm × 100 cm = 10,000 cm^2.
- Similarly, let students explore how to convert cubic SI units.

E. Assessment

Performance Task 1

Let students measure the length of different objects/things in different units.
Sample format

Sl no		Objects	mm	cm	m
1		Length of Table			
2		Length of chalkboard			
3		Length of basketball court			

Provide a set of questions on conversion of SI units. (Refer questions from the textbook, SIM or other relevant sources.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Discuss some of the measurement units (to measure length) used by our parents at home?
  ii. Why is it important to use SI units for measurement?
  iii. Why do you think there are many units to measure the length?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Measuring tape/ruler
- Classroom objects
- Online
  - ❖ historical and international aspects of the SI Understanding Metric | NIST

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – C5 Calculate Volume and Relate to Capacity

[250 minutes]

Introduction

The most famous anecdote about Archimedes tells how he invented a method of determining the volume of irregularly shaped objects. Archimedes is a Greek Mathematician and he was considered to be the greatest mathematician of ancient history.

Volume is the amount of space taken up by an object, while capacity is the measure of an object's ability to hold a substance, like a solid, a liquid or a gas. Volume is measured in cubic units, while capacity can be measured in litres.

Utility and Scope

Volume and capacity are used frequently in our everyday life, whether it's for measuring ingredients for a recipe, filling a car's gas tank, or simply adding detergent to the washing machine. Volume is required for everything from measuring liquids to calculating drinking amounts.

Explore the link Volume and Capacity *EXPLAINED* Science for Kids! to know more about their application in daily life.

A. Competency

- Demonstrate the ability to calculate the volume of a rectangular prism and relate it to capacity.

B. Objectives

- Estimate the volume (cubic unit) and capacity (litres) of different containers.
- Investigate and apply the formula to determine the volume of a rectangular prism.
- Find the missing length.
- Relate volume to capacity of rectangular prisms containers and apply it to solve related problems.

C. Essential Skills/Processes

- Applying
- Computing

D. Learning Experiences

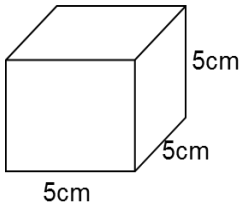
- Let students discuss and tell the units for measuring volume and capacity.
- Let students watch the video on how to find the volume using the link given below;
  - ❖ How to calculate the volume of a rectangular prism.wmv
- Provide a few questions to find the volume after watching the video.
- Let students explore how changes in one dimension of the formula affects the volume of a rectangular prism.
- When the length of the rectangular prism is doubled, the area will be doubled.
- Explain the differences between volume and capacity.
- Relate volume to capacity of containers shaped in the form of rectangular prisms.

E. Assessment

Performance Task 1

Allow students to investigate to show that 1 cm^3 = 1 mL.

Students in groups will design a cube of any volume. For example, make a cube with the volume of 125 cm^3 and check if 125 mL of water/sand exactly fills the cube or not.



Performance Task 2

Provide a set of questions on calculating volume and relate it to capacity (refer questions from the mathematics textbook class VI).

Performance Task 3

Let students find the volume of the classroom objects (e.g. book, chalk box, rectangular prism).

Design appropriate assessment tool and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Do you think it is useful to learn about volume and capacity? Why or why not?
  ii. How difficult would it be if there was only one unit to measure the capacity?
  iii. How are the volume and capacity similar? How are they different?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Uses of volume in daily life https://www.youtube.com/watch?v=GKCE8ohIBqE
  - ❖ Video on finding the volume https://www.youtube.com/watch?v=u1nWI2b0fT4

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – C6 Mass: Concept of Tonnes

[100 minutes]

Introduction

We use either **kilograms** or **grams** to measure mass. There is a unit bigger than a kilogram. It is the **tonne** (t) or **metric ton**. The term derives from *'tun'*, denoting a large barrel used in wine trade. Source https://www.britannica.com/science/ton.

Utility and Scope

Tonne or metric ton is a unit of mass that is equal to 1000 kg. Knowing about a tonne would help the students relate the mass of the bigger things/objects in their daily life. *For example, a truck carries 7 tonnes of bricks*.

A. Competency

- Demonstrate the ability to relate tonne to kg and g and solve relevant real-life problems.

B. Objectives

- Explore that 1 Tonne is equivalent to 1000 kg (metric ton)
- Relate tonne to kg and g and solve related real life problems.

C. Essential Skills/Processes

- Comparing
- Connecting

D. Learning Experiences

- Pre-assessment on the conversion of mass units. Recall how grams and kilograms are related. Then provide a few questions to convert kg and g and vice-versa.
- Let students watch the video on tonne using the link provided.
    - ❖ Measurement of Mass (Tonne, kilogram, gram and milligram)
- Introduce tonne and let students give examples of where tonne is being used in real life situations.

  1 t = 1000 kg **1 kg = 1000 g**
- Show the video to convert tonne to kg/g: Kilograms and Grams | Converting kg to g and Converting g to kg | Math with Mr. J

- Let students solve a few questions related to the tonne used in real life (Refer Mathematics Textbook class VI).

E. Assessment

Performance Task 1

Prepare a worksheet on tonne and let students solve it. (Refer Mathematics Textbook class VI or explore questions related to tonne from relevant sources).

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Have you heard about tonne before? Where?
  ii. Where can the concept of the tonne be used in our life?
  iii. Tonne is the same as the metric tonne. Explain.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Measuring tape/ruler
- Online
  - Tonne https://www.britannica.com/science/ton
  - Video on tonne https://www.youtube.com/watch?v=zXUICZRXDwQ

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D1 Estimate, Measure and Draw Angles

[300 minutes]

Introduction

The history of the mathematical measurement of angles, possibly dates back to 1500 BC in Egypt. The first known instrument for measuring angle was possibly the Egyptian Groma. The Groma consisted of 4 stones hanging by cords from sticks set at right angles. Refer to the link History of Angle Measurement to learn more about the history of angle measurement.

An **angle** is a figure formed by two lines meeting at a point called vertex. An angle measure can be expressed as a fraction of a full turn. It can also be measured in units called **degrees**. A **protractor** is a tool measuring angles in degrees.

Utility and Scope

Angles are important to defining and studying polygons such as triangles and quadrilaterals. They are used in a variety of disciplines, ranging from animation to carpentry to physics. Construction, architecture, sports, engineering, art, dance, etc. make use of the concept of angles.

A. Competency

- Demonstrate the ability to estimate, measure and draw angles between 0 and 180 degrees.

B. Objectives

- Demonstrate the ability to measure angles using protractor.
- Estimate the measures of angles using 45°, 90° and 180° as reference angles.
- Identify different types of angles (Obtuse, acute, right and straight angles).
- Draw angles between 0 and 180 degrees.

C. Essential Skills/Processes

- Estimating
- Measuring
- Drawing

D. Learning Experiences

- Pre-assessment

- ❖ Ask questions like;
- ❖ What is angle? Name different types of angles; right, acute, obtuse, and right.
- ❖ Why do you learn about angles?

- Provide a printed copy of the angles in pairs/groups and let students estimate the angles.
- Demonstrate how to use the protractor to measure angles.
- Let students use a protractor to measure the given angles.
- Let students use a protractor to draw angles between 0 to 180 degrees.

E. Assessment

Performance Task 1

Provide a set of angles and let students estimate and measure the angles using a protractor.

Performance Task 2

Let students draw the angles using a protractor

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  - i. What is the most common angle you have seen? Why do you think it is so common?
  - ii. Measuring angles with a protractor is very easy. What would have been if the protractor was not invented?
  - iii. Can we make furniture without angles? Why?
  - iv. We can draw/construct one angle exactly by just using a pencil and ruler? Which angle is that?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII

- Ruler
- Protractor
- Online
  - ❖ History of angle measurement [History of Angle Measurement]

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D2 Drawing Triangles

[250 minutes]

Introduction

Thales of Miletus (624–547 BC) is acknowledged for bringing geometry from Egypt to Greece and laying some early groundwork for the study of triangles. Pythagoras, whose famous theorem is still in use, is hailed as the first 'pure mathematician' to study geometry by applying abstract mathematical concepts.

A triangle is a drafting tool that is used to make precise parallel, vertical, and angled lines. Students have learned about linear measurement and drawing angles in the previous lessons. Here, they will be learning about drawing triangles given the side lengths and the angles.

Utility and Scope

Triangles are important not only in mathematics, but also in the way we construct our physical and virtual worlds. The concept of triangles is used to support bridge structures because they uniformly distribute weight without distorting dimensions. The house's roof is triangular in shape, allowing rain and snow to gently glide off. Learning this topic would help the students in constructing different triangles in their higher grades.

A. Competency

- Demonstrate the ability to apply the concept of measuring angles to construct triangles.

B. Objectives

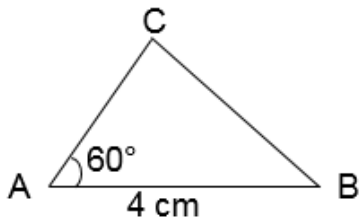
- Draw triangles with the given side lengths and angles.
- Demonstrate that the sum of the interior angle of a triangle is 180^0.
- Explain that the sum of the length of any two sides of a triangle is greater than the length of the third side.

C. Essential Skills/Processes

- Drawing
- Reasoning

D. Learning Experiences

- Recall about the different types of triangles learned in the lower classes.
- Let students draw any triangles and ask them to measure the angles. (Conclude that the sum of the angles in a triangle is always 180 degrees.
- Let students draw the triangles when the following information is given; One side length and two angles or Two side length and one angle.
  Example
  - ❖ Draw a triangle ABC given that AB = 4 cm, ∠A = 60° and AC=3 cm



- Let students create triangles using straws/sticks of different length. (Let them explore and conclude when it is not possible to create a triangle).
- Explore the link https://www.youtube.com/watch?v=pCTa8LoFSEk and let students draw triangles with given angles.

E. Assessment

Performance Task 1

Let students draw triangles with side lengths and angle measurement given.
Sample questions:

1. Draw a triangle ABC in which AB = 6 cm, ∠A= 50°, ∠B=40°,
2. Draw a triangle PQR in which PQ = 7 cm, QR = 4 cm, ∠P = 45°.
3. Draw a right triangle XYZ in which ∠Y = 90°, XY = 5 cm and YZ = 7 cm.
4. Is it possible to draw angle with these measurements; RS = 5 cm, ST = 4 cm, TR = 10 cm.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Do you think that learning about triangle construction is important? Why?

ii. Any triangle will have the sum of its interior angle 180°. Do you agree? Why?

iii. Can a triangle have the following side lengths? Why?
AB = 6 cm, BC = 6 am, and AC = 12 cm.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Protractor
- Online
  - ❖ Video on drawing triangles with given angles
    https://www.youtube.com/watch?v=pCTa8LoFSEk

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D3 Rotation 1/4, 1/2, and 3/4 turns

[200 minutes]

Introduction

A rotation is a transformation that turns a shape around a point called the turn centre. A rotation is described by three things: *Position of the turn centre*, *size of the turn*, often described with a fraction, *direction of the turn*, either clockwise (cw) or counterclockwise (ccw). A rotation image is congruent to the original shape.

In **social studies,** rotation is the spinning of the earth around the axis. Farmers use the concept of crop rotation to improve the soil fertility (crop rotation is the practice of growing different crops sequentially on the same plot of land).

Utility and Scope

Rotation can be seen in a variety of situations like windmill, ferris wheel and wheel of the car and many more.

A. Competency

- Demonstrate the ability to rotate shapes using various turn centres.

B. Objectives

- Use a variety of turn centres to rotate a shape by ¼, ½, and ¾ turns.

C. Essential Skills/Processes

- Drawing
- Creating

D. Learning Experiences

- Provide few shapes in groups and let students rotate the given shapes with a turn centre on the vertex of the shape.
- Let students rotate the shapes with different turn centres.
- Let students identify the turn centres in the rotation.
- Let students explore how to rotate a shape using **GeoGebra**. Refer to the link Rotations in Geogebra (the video explains how to rotate a shape in GeoGebra).

E. Assessment

Performance Task 1

Prepare a worksheet and let students rotate a shape using various turn centres.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Which size of the turn (½, ¼ or ¾) is easier for you while rotating the shape? Why?
  ii. What differences have you noticed between the rotations that you have learned in social studies and in mathematics?
  iii. For a $\frac{1}{2}$ turn, we can rotate a shape in any direction we like. Why?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Rotation on GeoGebra https://www.youtube.com/watch?v=7JD6AgRqjTk

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D4 Properties of Rotational Symmetry

[150 minutes]

Introduction

A shape has turn symmetry, or rotational symmetry if it looks the same when it is rotated less than one full turn around a turn centre. The number of times the shape looks the same during one full turn is called the order of turn symmetry.

For example: Equilateral triangle has turn symmetry of order 3 because it looks the same 3 times in one full turn.

If a shape has no turn symmetry, it has a turn symmetry of order 1 because it looks the same only once in one full turn (i.e., at the end of the turn). The order of turn symmetry for a regular polygon is equal to the number of its sides.

Utility and Scope

Rotational symmetry is essential for many machines. Without rotational symmetry, motors would freeze, wheels would stop turning, and the world would come to a halt.

A. Competency

- Explore the properties of rotational symmetry and the order of turn symmetry of 2-D shapes and then define the term rotational symmetry and order of turn symmetry.

B. Objectives

- Investigate whether the shape has rotational symmetry or not.
- Describe that the number of times it appears in the identical position during one complete rotation is the order of rotational symmetry.
- Explore the properties of the rotational symmetry for quadrilaterals and regular polygons.
- Relate rotational symmetry of squares and rectangles to other properties of squares and rectangles.

C. Essential Skills/Processes

- Recognizing
- Investigating
- Relating

- Generalising
- Understanding

D. Learning Experiences

- Revisit the previous lesson learned on rotation. Let students rotate a few shapes.
- Let students watch this video on rotational symmetry and ask questions. (Reflectional Symmetry and Rotational Symmetry | Don't Memorise). (*Watch and trim the video clip as per the lesson requirement*).
- Explain that a shape has turn symmetry, or rotational symmetry if it looks the same when it is rotated less than one full turn around a turn centre with examples.
- Use cut out shapes and let students investigate whether the shape has a turn symmetry or not.
- Let students relate rotational symmetry of squares and rectangles to other properties of squares and rectangles.
- Discuss different examples of rotational symmetry in everyday life such as, wheels or tires on vehicles and bicycles, designs in textiles, the pattern on a checkerboard.
- Explain and discover how many orders of turn symmetry each shape has.

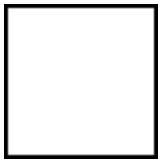
E. Assessment

Performance Task 1

Provide shapes and let students identify whether the shape has turn symmetry or not. Let them state and justify the order of turn symmetry a shape has.

Performance Task 2

Relate rotational symmetry of squares and rectangles to other properties of squares and rectangles.
Let students describe the properties of rotational symmetry of quadrilaterals and regular polygons.
Sample format

Shape	Name	Turn symmetry	Order of turn symmetry
	Square	Yes	4

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Tell us at least three different polygons having the turn symmetry order of more than 4.
  ii. Which regular polygon has the turn symmetry order of 3?
  iii. All irregular polygons have the turn symmetry order of 1. Do you agree? Why?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Video on turn symmetry https://www.youtube.com/watch?v=s4tS-ZmpJfw

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D5 Combining Transformations

[200 minutes]

Introduction

The first systematic effort to use transformations as the foundation of geometry was made by Felix Klein in the 19th century. Congruent shapes can always be transformed onto one another, but it may be necessary to combine transformations to do it.

Utility and Scope

Transformations are all around us, and they've always been a part of our daily lives. They function to make our lives easier and more convenient. Their applications are truly relevant as they improve the efficiency of our work and lifestyle. Students must understand transformation geometry in order to perform analysis and synthesis, solve problems, and think spatially.

Real world examples: elevators, Cars moving through streets, and moving homes from place to place.

A. Competency

- Describe that the two congruent shapes on the same plane are the images of one another under translation, reflection, rotation or any combination of these three transformations.

B. Objectives

- Perform translation and reflection of 2-D shapes.
- Identify key properties of three different transformations and differentiate them.
- Identify a combination of successive transformations of 2 D shapes and describe the transformation.
- Perform a combination of transformation (Reflection and translation; Rotation and reflection; Rotation and translation; Combination of all three transformation) on a single 2D shape.

C. Essential Skills/Processes

- Predicting
- Relating

D. Learning Experiences

- Ask a few questions on transformations and discuss what transformation is and what different types of transformations are. Ask them what they know about the image of any transformations with the original shape. (They are congruent)
- Explain and show that two congruent shapes on the same plane are images of one another under a translation, reflection, rotation or any combination of these three transformations.
- Use cardboard or paper shapes to model combining transformations.
- Let students predict what transformations are being used and confirm through investigation.

E. Assessment

Performance Task 1

Provide questions on combining transformations (Refer question from the textbook or explore from the internet).

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Two congruent polygons lying on the same plane will look like a turn, slide, flip image of one another. Do you agree? Why?
  ii. Have you seen a design created by combining transformations? What shapes were used to create the design?
  iii. Tessellations and transformations of the regular polygons will look exactly the same. Explain.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Cardboards/cut-out shapes

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D6 Bisectors, Angles and Line Segments

[150 minutes]

Introduction

In geometry, bisection is the division of something into two equal or congruent parts by a line, which is then called a *bisector*. In this lesson, students will be learning about two types of bisectors (i.e. line bisector and angle bisector).

A **line bisector** is a line that divides a line segment into two equal halves. An **angle bisector** divides the angle into two equal angles. **Perpendicular bisector** and **non-perpendicular bisector** are two types of line bisectors.

Utility and Scope

The concept of bisecting angles and other geometrical constructs are used by architects when they are drafting the designs of buildings. Similarly, the programmers who write the programs for the computers which do drafting and sewing design need to know about the angle bisectors. Explore the link to know more about the application of bisectors in real life Real life application of bisectors.

Knowing about angle and line bisectors will help the students to learn about the construction geometry in the higher grades.

A. Competency

- Demonstrate the ability to identify line bisector and angle bisector in the immediate surroundings.

B. Objectives

- Recognize and describe angle bisector and line bisector including perpendicular bisectors.
- Draw and bisect angles and line segments.

C. Essential Skills/Processes

- Sorting
- Describing

D. Learning Experiences

- Ask students what they know about bisectors.

- Explain the concept of bisector with examples on line bisector and angle bisector. Also, tell the differences between perpendicular and non-perpendicular bisectors with examples.
- Let students identify angle and line bisectors (prepare the activity beforehand).
- Let students draw and bisect angles and line segments using a protector.
- Let students watch the video on line and angle bisector:

  Construction of bisector of an angle

  Perpendicular Bisector of a Line Segment

E. Assessment

Performance Task 1

Prepare a worksheet on angle and line bisector (refer textbook or online resources). Let students explain that a perpendicular bisector is also an angle bisector).

Performance Task 2

Let students identify the angle and line bisectors in and outside the classroom.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How is an angle bisector different from line bisector?
  ii. Any bisector will divide something into two equal parts. Explain.
  iii. How can we use the idea of bisector in our daily life?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - Angle bisectors of triangles in real life Real life application of bisectors

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D7 Nets of Prisms and Pyramids

[100 minutes]

Introduction

The concept of net was initially introduced by E. H. Moore and Herman L. Smith in 1922.

A geometric net is a two-dimensional shape that can be folded into a three-dimensional shape or solid.

Utility and Scope

Nets are useful in finding the surface area of the solids. Prism, pyramid, cylinder, and cone are some examples of solid nets. A solid may have different nets.

In the classroom or at home, nets of shapes are a great way to help students learn about 3D shapes. Nets can also help children understand and visualise mathematical concepts and terms, such as faces, edges and vertices.

A. Competency

- Explore nets to learn more about three-dimensional shapes and their properties in a hands-on, constructive way.

B. Objectives

- Create and interpret various nets for prisms and pyramids.

C. Essential Skills/Processes

- Creating
- Drawing
- Interpreting

D. Learning Experiences

- Let students identify the nets for different rectangular prisms (nets are given in the BLM). Then, let them cut and fold the nets.
- Let students draw and interpret nets for different prisms and pyramids.
- Explore various nets for prisms and pyramids using GeoGebra. (Suggested link: https://www.geogebra.org/m/fw3PHEBu).

E. Assessment

Performance Task 1

Allow students to create nets for different prisms and pyramids.

Performance Task 2

Let students interpret nets for different prisms and pyramids.

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How will you differentiate between the nets of prisms and pyramids?
  ii. For a given prism or pyramid, different students may draw different nets. Why?
  iii. How many different nets can you draw for a rectangular prism? How do you know?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Cardboards/cut-out shapes
- Online
  - Net https://www.geogebra.org/m/fw3PHEBu

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – D8 Sorting Quadrilaterals by Attributes
D9 Generalize Diagonal Properties

[150 minutes]

Introduction

Quadrilaterals were invented by the Ancient Greeks. It is said that Pythagoras was the first to draw one. In those days quadrilaterals had three sides and their properties were not very clear. It was the genius of the Romans to add a fourth side and they were the first to make a list of the different kinds of quadrilaterals but it wasn't until 1813 that an English mathematician, J.P. Smith discovered the trapezium. (Source: There Are Two Sides to Every Story. And for a Lot of Them, There Are Four).

A quadrilateral is a polygon that has exactly four sides. It means that a quadrilateral has exactly four vertices, and exactly four angles. The examples of quadrilaterals are; square, rectangle, rhombus, trapezoid, kite and parallelogram.

Utility and Scope

Everything is made up of quadrilaterals, including designs of buildings, doors, windows, swimming pools, boxes, football grounds, and paper. Mobile phones, laptops, computers, televisions, and other technological gadgets, books, copies, and chart-papers are some examples of quadrilaterals.

A. Competency

- Sort and explain the diagonal properties of quadrilaterals and use the concept in real life situations.

B. Objectives

- Describe quadrilaterals based on various attributes.
- Sort quadrilaterals by attributes.
- Explain diagonal properties of the quadrilaterals through exploration.

C. Essential Skills/Processes

- Sorting
- Representing
- Generalising
- Relating

- Exploring

D. Learning Experiences

- Conduct pre-assessment on identifying the diagonals in quadrilaterals.
- Sort and describe the attributes of different quadrilaterals like rhombus, kite, parallelogram and trapezoid (Use quadrilaterals from BLM).
- Generalize about diagonals for a rhombus: the diagonals are perpendicular bisectors of each other, form four congruent right triangles, bisect the angles of the rhombus, and are its two lines of reflective symmetry.
- Similarly, explore the diagonals of other quadrilaterals like parallelogram, kite, trapezoid, square and rectangle.
- Let students watch this video on diagonal properties of various quadrilaterals. (https://www.youtube.com/watch?v=3lQ6fjww9ow) (*Watch and trim the video clip as per lesson required*).

E. Assessment

Performance Task 1

Let students fill up the table 1 given in the annexure.

Performance Task 2

Let students fill up the table 2 given in the annexure.

Design appropriate assessment tool and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Diagonal(s) of a shape will always divide the shape into two equal parts. Do you agree? Why?
  ii. Length of the two diagonals of a quadrilateral will be always congruent. Do you agree? Why?
  iii. What do you think a diagonal is? Explain.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI

- National School Curriculum, Mathematics for PP – XII
- BLM
- Online
  - ❖ Quadrilaterals: https://www.covalentlogic.com/news/522
  - ❖ Video on diagonal properties: https://www.youtube.com/watch?v=3lQ6fjww9ow

G. Annexure

i. Use the template given in VI-A1 to record student achievement.

ii. Copy the charts below. Write the letters of the quadrilaterals that match each description. (The quadrilaterals are given in BLM)

Table 1

The diagonals bisect each other	
One diagonal bisects the other	
Neither diagonal bisects the other	
The diagonals are perpendicular to each other	

Table 2

Both diagonals bisect the angles of the quadrilateral	
One diagonal bisects the angles of the quadrilateral	
Both diagonals are lines of symmetry	
One diagonal is a line of symmetry	
Neither diagonal is a line of symmetry	

four congruent right scalene triangles	
four congruent right isosceles triangles	
two pairs of congruent triangles - one pair obtuse scalene - one pair acute scalene	
two pairs of congruent triangles - one pair obtuse isosceles - one pair acute isosceles	
two pairs of congruent right scalene triangles	
one pair of congruent acute scalene triangles and two non-congruent triangles	
four non-congruent triangles	

Topic: VI – D10 Planes of Symmetry of 3-D Shapes

[150 minutes]

Introduction

In the 19th century the French mathematician, Evariste Galois, discovered the concept of symmetry. A line of symmetry is a reflection line for two matching congruent halves of the 2-D shape.

Some 3-D shapes have mirror symmetry. The imaginary surface that cuts a 3-D shape into congruent matching halves is called a **plane of symmetry**.

Utility and Scope

Symmetry is a fundamental part of geometry, nature, and shapes. In real life, you've probably seen symmetry a lot. You can see a reflection of yourself whenever you look in a mirror, glass, or even water. This is called symmetry.

Slicing a round apple with a knife into two equal halves creates a plane of symmetry of the apple.

A. Competency

- Explain the planes of symmetry of different 3-D shapes using appropriate representations and and determine the number of planes of symmetry in a variety of 3-D shapes.

B. Objectives

- Explain that some 3-D shapes have planes of reflective symmetry.
- Describe, through investigation, that a cube has 9 different planes of symmetry.
- Explore the planes of symmetry of cones, cylinders, prisms, and pyramids.

C. Essential Skills/Processes

- Generalising
- Relating
- Exploring
- Investigating

D. Learning Experiences

- Pre-assessment on transformations (discuss the lines of symmetry and diagonals in different 2-D shapes).

- Use linking cubes to introduce the concept of planes of symmetry of 3-D shapes.
- Explain that some 3-D shapes have planes of reflective symmetry – planes that bisect 3-D shapes such that all points in one-half are mirror images of the corresponding points in the other half.
- Prepare a few 3-D models (with available materials) to show planes of symmetry.
- Use this video link on planes of symmetry
  - ❖ https://www.youtube.com/watch?v=ivyxxMLZCvE (Explain the video as it doesn't explain about the lesson).

E. Assessment

Performance Task 1

Let students sketch the planes of symmetry for prisms and pyramids.
Let students explore the planes of symmetry using concrete models (**instruct students to prepare the model in advance**).

Design appropriate assessment tool and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How can you tell the number of planes of symmetry for a given 3-D shape?
  ii. Which 3-D shapes have an infinite number of planes of symmetry?
  iii. How are symmetry lines and planes of symmetry similar? How are they different?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Cubes
- 3-D models
- Online

- Video on plane of symmetry
  https://www.youtube.com/watch?v=ivyxxMLZCvE

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – E1 Data Collection and Handling
E2 Data Organizing and Describing

[550 minutes]

Introduction

Data collection is the systematic process of acquiring and evaluating information on variables of interest, allowing researchers to answer research questions, test hypotheses, and evaluate outcomes. The main goal of collecting data is to collect information in a measured and systematic manner to ensure accuracy and make data analysis easier.

The first forms of early data were in the form of tally or tick marks. These were gathered in order to keep track of or record ancient civilizations' inventories, such as food. The abacus was later constructed to help in the calculations of such records.

Utility and Scope

Collecting, organising, describing, and interpreting data would help the child in the research field. Data collection helps a person or organisations to effectively determine the cause of problems in different locations, departments and systems.

Explore the link given to know more about the utility and scope of data collection.

Why Data Is So Important – .

A. Competency

- Evaluate sampling results and describe that larger samples generally produce more reliable probabilities.

B. Objectives

- Identify the situation/problem.
- Formulate tools (Interview/questionnaire/document record/ observations) to collect data.
- Generate samples avoiding bias
- Calculate mean, mode and median.
- Find the missing value when the mean and other data is given.
- Create the set of data from the given mean, median and mode.
- Organise data in groups with intervals.

C. Essential Skills/Processes

- Identifying
- Formulating
- Generating
- Collecting
- Recording
- Organizing
- Computing

D. Learning Experiences

- Explain the steps involved in collecting data.
  - Identifying situations to collect data.
  - Formulating data collection tools (example; survey questionnaires and interviews).
  - Generating samples using random sampling to avoid bias.
  - Collecting data using developed tools.
  - Organising collected data in tabular form.
  - Describing the data in the table.
- Let students reason out that the larger samples generally produce more reliable probabilities.
- Let students choose a topic/problem. Then, allow them to choose appropriate data collection tools.
- After the data collection, explain and show how to calculate mean, mode and median.
- Use this video link (https://bit.ly/2LsBWHO). It shows about finding mean, median and mode.
- Explain how to find the missing value when the mean and other data is given. Refer to the questions given in the textbook (Understanding Mathematics, Class VI).
- Let students create the set of data from the given mean, median and mode.
  For example, create a set of numbers for each.
  - 6 numbers with a median of 5
    Sample answer: 1, 4, 6, 7, 9, 1
  - 5 numbers with a mean of 10

Sample answer: 20, 3, 10, 7, 10

- Let students explore exercises on mean, median and mode in class VI SIM, volume 3.

E. Assessment

Performance Task (Project-based learning)

Students in groups identify the appropriate topic to collect data.

Suggested topics:

- *Students coming from different places*
- *age of the students*
- *time spent on different activities*
- *finding the number of petals*
- *distance from home to school*
- *number of siblings*

Collect the data in groups using the developed tools and organise in the tabular form. Let students describe the data (use measures of central tendency).

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  - *i.* Why do you think data collection is important?
  - *ii.* Why do we need to organise and describe data after collecting the data?
  - *iii.* If you want to know the favourite fruits of the students of our school, will it be fair to collect data only from class VI? Explain how you will make your data reliable.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
  - Online
  - Importance of data collection https://bit.ly/3K7GRHS
  - Video on mean, median and mode https://bit.ly/2LsBWHO

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – E3 Data Representation

[300 minutes]

Introduction

After collecting and organising data, we need to present the data in a variety of ways to help make it easier to comprehend and interpret. It helps us understand what the data means by providing visual context in the form of maps or graphs. This makes the data more natural to understand for the human mind, making it easier to see trends and patterns.

Explore the link Data representation if you have internet accessibility.

Utility and Scope

Collecting, organising, describing, and interpreting data would help the child in the research field. Data collection helps a person or organisations to effectively determine the cause of problems in different locations, departments and systems.

The purpose of representing data is to convey relational information quickly as these graphs display the quantity for a particular category.

A. Competency

- Demonstrate the ability to represent data in various formats and interpret the data.

B. Objectives

- Construct line graphs from collected data.
- Describe that the purpose of a line graph is to focus on trends implicit in the data (e.g., for temperature).
- Construct and interpret bar graphs and double bar graphs using intervals.
- Display the data using stem and leaf plot.

C. Essential Skills/Processes

- Constructing
- Interpreting
- Representing
- Reasoning
- Analysing
- Computing

D. Learning Experiences

- Allow students to look at the double bar graph in the student text. Ask them to indicate some of the things that the bar graph shows. Make sure they recall how double bar graphs are created and in what situations they are used.
- Collect and organise the numerical data (for double bar graph and line graph).
- Use data to construct double bar graphs and line graphs.
- Interpret bar graph and double bar graphs.
- Interpret line graphs and look for trends in the data.
- Let students use MS Excel (or other relevant ICT tools) to construct bar graphs, double bar graphs and line graphs.
- Let students discuss, collect and record any data (e.g. height of the students).
- Display the collected data in stem and leaf plot (demonstrate how to prepare stem and leaf plot).
- Use this video link (https://www.youtube.com/watch?v=j9PL-nrE6iM). It is about preparing a stem and leaf plot.

E. Assessment

Performance Task 1

Let students construct a double bar graph using the data they collected in the previous lesson (see the relevancy of the data collected). Then, let them interpret the graph.

Performance Task 2 (project-based learning)

Suggested topic: Temperature of a place

Instruct students to keep a record of the daily temperature of their place for a week. Then, let students construct a line graph. Let them find out the trend in the graph.

Performance Task 3

Let students carry out tasks on stem and leaf plot (Use Mathematics textbook cl. VI).

Design appropriate assessment tool and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Which format of data representation did you like the most? Why?
  ii. Why is it important to represent the data?
  iii. Why do you think graphs, charts, and diagrams are beautifully drawn to represent data?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Data Representation https://www.khanacademy.org/test-prep/praxis-math/praxis-math-lessons/gtp--praxis-math--lessons--statistics-and-probability/a/gtp--praxis-math--article--data-representations--lesson
  - ❖ Video on preparing stem and leaf plot https://www.youtube.com/watch?v=_7m0Q_m2ppg

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – E4 Plotting Coordinates

[200 minutes]

Introduction

The coordinate system we commonly use is called the *Cartesian system*, after the French mathematician René Descartes (1596-1650), who developed it in the 17th century. Legend has it that Descartes, who liked to stay in bed until late, was watching a fly on the ceiling from his bed. He wondered how to best describe the fly's location and decided that one of the corners of the ceiling could be used as a reference point.

Source:

https://wild.maths.org/ren%C3%A9-descartes-and-fly-ceiling

A coordinate grid has a horizontal x-axis and a vertical y-axis. When you plot a point on the grid given its coordinates, the first number in the ordered pair (the x-coordinate) tells how far right to go from the origin(0,0), and the second number(the y-coordinate) tells how far to go up**.** Coordinates are numbers which determine the position of a point or a shape in a particular space (a map or a graph). Points are marked by how far along they are on the x axis (the horizontal axis) and how far up they are on the y axis (the vertical axis).

Utility and Scope

Coordinates systems are often used to specify the position of a point, but they may also be used to specify the position of more complex figures such as lines, planes, circles or spheres. The latitude and longitude lines that we see on the maps and globe are an important example of coordinates in real life.

A. Competency

- Demonstrate the ability to plot coordinates in all four quadrants of coordinate graphs.

B. Objectives

- Explain the application of coordinate graphs (describing location and in navigation).

- Plot ordered pairs in all four quadrants of coordinate graphs using appropriate labels and scales.
- Use an ordered pair of vertices of a given polygon to draw on a coordinate graph.
- Apply coordinate in real life problems such as in chess board.

C. Essential Skills/Processes

- Evaluating
- Constructing
- Plotting
- Interpreting

D. Learning Experiences

- Let students discuss and share on the application of coordinate graphs (Example: describing and showing exact location of any place)
- Introduce a grid showing all four quadrants. Ask students to name a point they think is located in each of the quadrants.
- Demonstrate how to plot the coordinates on the grid in all the four quadrants.
- Use an ordered pair of vertices of a given polygon to draw on a coordinate graph.
- This video link (Plotting Points on the Coordinate Plane) is about plotting points on the coordinate grid. (*Watch and trim the video clip as per lesson required*).

E. Assessment

Performance Task 1

Let students name points in all the four quadrants (Refer questions from Mathematics textbook cl. VI).

Let students plot the given points (Refer questions from Mathematics textbook cl. VI).

Performance Task 2

Let the students explore the given link Coordinate Plane-Test - Quizizz.

Design appropriate assessment tool and record the student learning based on the template in the annexure.

- Reflective Questions
  i. Why do you think it is important to learn about plotting coordinates?
  ii. What differences did you find between the 'coordinate graphs' you learned in class V with the one you learned this time?
  iii. Why do you think the maps have perpendicular lines on them?

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI
- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ History of coordinate system Rene Descarate
  - ❖ Plotting coordinates https://www.youtube.com/watch?v=s7NKLWXkEEE
  - ❖ Worksheet worksheet

G. Annexure

Use the template given in VI-A1 to record student achievement.

Topic: VI – E5 Determine Theoretical Probability

[200 minutes]

Introduction

Blaise Pascal (1623 – 1662) and Pierre de Fermat (1601-1665) were two seventeenth century French mathematicians who were the founders of Probability Theory. However, there were many others who shaped the life of this field of mathematics.
There are two kinds of probability:
Experimental probability is based on the results of repeating an experiment many times. Each time is called a trial.

Theoretical probability of an event is the fraction of the time you expect the event to happen if you repeat the event many times.

Utility and Scope

In everyday life, you use probability to make decisions when you don't know for sure what will happen. For example, it is used in sports, weather reports, blood samples, predicting the sex of the baby during pregnancy and many more.

A. Competency

- Describe theoretical probability and relate it with decimal, percentage, and ratio.

B. Objectives

- Define theoretical probability and apply it to solve simple theoretical probability problems.
- Create an event to describe theoretical probability.
- Use percentage and decimals to describe probabilities.

C. Essential Skills/Processes

- Conceptualising
- Describing

D. Learning Experiences

- Ask the following questions:
  - What numbers are the multiples of 5? (5, 10, 15, 20, ...)
  - How many multiples of 5 are there between 1 and 100? (There are 20.)

- How does that help you calculate the probability? (20 numbers out of 100 are multiples of 5, so use the fraction 20/100).

- Explain theoretical probability and show how to find theoretical probability.

$$\text{Theoretical probability of an event} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

- Let students watch this video on Theoretical probability. (Watch and trim the video clip as per lesson required).
- Let students relate probability events as fractions, decimals, ratio and percent.
- Explain with examples on how to create an event for each theoretical probability.

E. Assessment

Performance Task 1

Let students describe theoretical probability (Refer questions from Mathematics textbook cl. VI). Then, let them use percentages and decimals to describe theoretical probabilities.

Performance Task 2

Let students create an event for the theoretical probability. (Refer questions from Mathematics textbook cl. VI).

Design appropriate assessment tools and record the student learning based on the template in the annexure.

- Reflective Questions
  i. How will you use the percentage and decimal to describe the probability in our daily life?
  ii. Tell us an event that has 0.5% chances of happening.
  iii. Tell us an event that has 0% chances of happening.

F. Resources

- Understanding Mathematics, Textbook for class VI
- Understanding Mathematics, Teacher's Guide for class VI

- National School Curriculum, Mathematics for PP – XII
- Online
  - ❖ Video on theoretical probability
    https://www.youtube.com/watch?v=9M4VvNlinok

G. Annexure

Use the template given in VI-A1 to record student achievement.

Assessment Structures for KS- 2 (Class IV - VI)

Assessment Structure

Key Stage	Assessment									
	Term I					Term II				
	CA (25)			Mid Term Examination	Total	CA (25)			Annual Examination	Total
	CW	HW	PT			CW	HW	PW		
II	10	10	5	25	**50**	10	10	5	25	**50**

For both Term I and Term II, assess each competency through appropriate performance tasks and assessment tools.

Performance Tasks(PT): quiz, question and answer, presentation, making models, small projects, etc.

Project Work(PW): One mandatory project must be completed annually. Refer rubrics and planning sample at the end of IG).

Assessment Tools: checklist, rating scale or rubrics.

Assessment Areas: ***Content***: Formulating situations mathematically, applying concepts, facts, and procedures, and interpreting mathematical results.

Skills and attitude: Collaboration, communication, creativity, time management, learning attitude, feedback reception,etc.

NOTE: Project work assessment is mandatory for class IV and VI

Weightage for Key stage II (Classes IV - VI)

Strand	Time Allocation (Mins.)			Weighting(%)		
	IV	V	VI	IV	V	VI
Strand A: Numbers and Operations	3750	3250	3000	45	39	37
Strand B: Patterns and Algebra	550	900	750	7	10	10
Strand C: Measurement	1000	1400	1350	12	17	17
Strand D: Geometry	1900	1700	1550	22	20	20
Strand E: Data and Probability	1200	1150	1250	14	14	16

Mark Distribution for Formative Assessment

Assessment	Term I	Term II
Class work	10	10
Home work	10	10
Performance task	5	
Project work		5
Total	**25**	**25**

Class work Assessment Rubrics

Criteria	Exceeding (5)	Advancing (4)	Meeting (3)	Approaching (2)	Beginning (1)
Understanding	-Demonstrates a deep and thorough understanding of the concepts covered. -Consistently applies knowledge to solve problems.	-Shows a good understanding of the concepts. -Applies knowledge effectively in most situations.	-Demonstrates a basic understanding of the concepts. -Struggles with consistent application.	-Limited understanding of the concepts. -Inconsistently applied knowledge.	-Minimal understanding of the concept. -Unable to apply knowledge effectively.
Effort and participation	-Actively engages in class discussions and activities. -Displays an exceptional commitment to learning, actively seeking opportunities to contribute beyond expectations	-Engages in class activities with enthusiasm. -Demonstrates a strong commitment to learning, willing to take on additional responsibilities when appropriate	-Participates at a basic level. -Effort is inconsistent. -Demonstrates a commitment to learning, however lacks consistency in engaging with course content.	-Shows limited effort and participation. -Often disengaged in class. -Demonstrates a basic commitment to learning, with room for improvement in engagement.	-Minimal effort and participation Frequently disengaged.
Independence	-Demonstrates a high level of independence in completing classwork. -Rarely requires assistance.	-Generally works independently but may seek clarification when needed.	-Works somewhat independently but often requires assistance.	-Requires frequent assistance to complete classwork.	-Constantly relies on others to complete classwork.
Seeking support	-Proactively seeks support when faced with challenging concepts or problems. -Collaborates effectively with peers and	-Willingly seeks support when needed. -Demonstrates effective collaboration with peers and teachers.	-Occasionally seeks support but may be hesitant. -Limited collaboration with peers and teachers.	-Rarely seeks support.- -Minimal collaboration with peers and teachers.	-Does not seek support. -No collaboration with peers and teachers.

	teachers to enhance understanding.				
Collaboration	-Demonstrates excellent collaboration skills in group activities. -Encourages and supports peers, fostering a positive and inclusive class atmosphere	-Collaborates well with peers in group activities. -Generally fostering a positive class environment.	-Participates in group activities but with limited collaboration -Inconsistent contributions.	-Struggles to collaborate effectively in group activities. -Offers occasional contributions, with room for improvement in depth of insights	-Unable to collaborate effectively. -Rarely contributes ideas or insights to class conversations.

Homework Assessment Rubrics

Criteria	Exceeding (5)	Advancing (4)	Meeting (3)	Approaching (2)	Beginning (1)
Understanding	-Demonstrates a deep and thorough understanding of the homework assigned. -Consistently applies knowledge to solve problems.	-Shows a good understanding of the homework concepts. -Applies knowledge effectively in most situations.	-Demonstrates a basic understanding of the homework concepts. -Struggles with consistent application.	-Limited understanding of the homework concepts. -Inconsistently applies knowledge.	-Minimal understanding. Unable to apply knowledge effectively.
Completion	-All homework are completed accurately and thoroughly. -Consistently submits high-quality work.	-Most homework tasks are completed accurately and thoroughly. -Few minor errors are present.	-Some homework tasks are completed accurately, but there are notable gaps. -Several errors are present.	-Numerous incomplete or inaccurately completed homework tasks. -Completion is inconsistent.	-Virtually all homework tasks are incomplete or inaccurately completed.
Accuracy of response	-All calculations and solutions are accurate and precise. -Demonstrates meticulous attention to detail.	-Most calculations and solutions are accurate and precise. -Few minor errors are present.	-Some calculations and solutions are accurate but lack precision. -Several errors are present.	-Numerous errors in calculations and solutions. -Accuracy and precision are major issues.	-Virtually all calculations and solutions are incorrect or imprecise.
Neatness and organization	-Homework is exceptionally well-organized and neatly presented. -All text is highly legible, and there are no smudges or	-Overall organization is good, with a clear presentation-Most text is legible, and there are minimal	-Organization is acceptable but may lack some neatness. -Legibility varies, and there may be occasional	-Organization is somewhat lacking, and there is some difficulty in following the work. -Legibility issues are	-Poor organization makes it challenging to follow the homework. -Legibility is compromised, and there are

	unintended marks. -Clear headings, labels, and steps enhance the overall organization	smudges or unintended marks. -Headings, labels, and steps contribute to effective organization.	smudges or unintended marks. -Clear headings and labels help maintain a basic level of organization	noticeable, and there are frequent smudges or unintended marks. -Headings and labels are consistently not clear.	significant smudges or unintended marks throughout. -Chaotic presentation hinders understanding, and headings and labels may be unclear or absent.
Follow up and improvement	-Actively seeks feedback on homework. -Demonstrates a commitment to improving based on feedback. -Makes corrections and improvements on subsequent submissions.	-Open to feedback and uses it to make improvements in subsequent homework. -Shows a willingness to learn from mistakes.	-Occasionally seeks feedback but inconsistently incorporates it into subsequent work. -Limited improvement over time.	-Rarely seeks feedback and seldom makes improvements. -Little evidence of learning from mistakes.	-Does not seek feedback or make improvements. -Repeated mistakes persist
Timeline	-Submits homework/assignments consistently on time.	-Generally submits homework on time but may occasionally be late.	-Submits homework somewhat late on a regular basis.	-Frequently submits homework late.	-Consistently submits homework/ assignments late.

Project work Assessment Rubrics – Classes IV - VI

Criteria	Exceeding (5)	Advancing (4)	Meeting (3)	Approaching (2)	Beginning (1)
Content Knowledge	Demonstrates a profound and comprehensive understanding of the mathematical concepts presented. -Concepts are explained with precision and depth	- Presents a clear understanding of the mathematical concepts. - Few minor errors are present. -The majority of concepts are accurate, demonstrating a strong grasp of mathematical content.	- Demonstrates a basic understanding of the topic with occasional errors. – - Most concepts are accurate, but there are noticeable gaps in understanding.	- Limited understanding with several errors in mathematical concepts. Some concepts may be misrepresented, impacting the overall accuracy of the project.	Numerous inaccuracies and a lack of understanding of key mathematical concepts. Misinterpretations and errors are prevalent, hindering comprehension.
Presentation of ideas or model	Exceptionally clear and organized presentation. The chart or model is highly detailed, visually appealing, and enhances the overall project presentation	Neat and well-organized presentation with clarity and attention to detail. The chart or model effectively communicates the intended information, enhancing understanding.	- Organization is somewhat lacking. - Presentation is clear but lacks some key elements.	Limited organization with some clarity issues Some attempt at presenting the model, but there are clarity issues. The chart or model may not effectively communicate the intended information.	The presentation is disorganized, unclear, or absent. The chart or model lacks necessary details or is poorly constructed.
Creativity and originality	- Demonstrates exceptional innovation and creativity in presenting the information. -	- Presents information in a creative manner. - Some originality in the approach.	- Limited creativity in the presentation. - Mostly adheres to traditional	- Lacks creativity and originality. - Relies heavily on standard methods.	- No evidence of creativity. Completely adheres to standard methods.

	Outstanding creativity and originality; innovative elements make the project stand out..	Creative and original approach with a few duplication elements	methods -Adequate creativity with a few original elements. The project demonstrates some innovation.	-Some attempt at innovation but lacks uniqueness.	-The project is conventional and shows no innovation.
Mathematical reasoning	- Exceptional ability to reason mathematically. - Provides clear and logical reasoning.	- Displays good mathematical reasoning skills. - Reasoning is generally clear and logical.	- Demonstrates basic mathematical reasoning. - Reasoning is somewhat clear.	- Limited mathematical reasoning. - Difficulty in presenting clear logic.	- Lacks mathematical reasoning. Unable to articulate logical steps.
Durability	Excellent durability. The project is well-built, demonstrating resilience and long-lasting quality.	Good durability. Project components are robust and resistant to damage.	Adequate durability. While most components are sturdy, there may be some areas of concern.	Limited durability. Some components may be prone to damage, impacting the overall robustness of the project.	Project components are fragile or easily damaged. Durability is a significant concern.
Timeline	Exceptional time management. All components completed well before the deadline.	Well-managed timeline with all components completed on schedule.	Adequate time management with most components completed on time.	Partially meets deadlines. Some aspects of the project are incomplete or delayed.	Poor time management. Project components are incomplete or significantly delayed.