National School Curriculum

INSTRUCTIONAL GUIDE FOR MATHEMATICS

CLASS: PP-III

ཤེས་རིག

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

Table of Contents

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 of 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.

Instructional Guide
Class PP
Mathematics

Topic: PP-A1 Describing Attribute of Objects *[300 minutes]*

Introduction

Attributes of an object are things like colour, shape, size, mass, sound, position, its use, the material it is made of, etc. Characteristics are specific examples of those attributes. For example, an item might be red with respect to the attribute of a colour; red is a characteristic of that item.

Utility and Scope

Learning visual attributes has been shown to be beneficial not only for improving performance of object recognition but also for transferring learned knowledge to new categories.

Source: https://plato.stanford.edu/entries/spinoza-attributes/

A. Competency

- Demonstrate the ability to identify different attributes of objects and apply the concepts to describe objects in the real world.

B. Objectives

- Identify different attributes of objects.
- Describe objects based on colour and material.
- Describe objects based on shape, size and texture.

C. Learning Experiences

- Students name common objects in the environment.
- Students explore concrete objects and manipulatives and discuss their attributes.
    - Examine the variation in colours.

    Name the colours.

    Learning colour names in this lesson could be related to learning colours in English and Dzongkha lessons.

    Describe objects based on colours.
    - Examine the variation in materials that common objects are made of.

    Name the materials.

    Describe objects based on the materials they are made of.

Discuss objects in the classroom and discuss the materials they are made of (plastic, metal, wood, etc.)

This activity can be related to Science and Social Studies lessons in later stages of their life.

- Examine the variation in sizes of objects.

Describe objects based on their size, using appropriate terms. (To be accepted in any language used by a child).

- Examine the variation in shapes of objects.

Describe objects based on their shape.

(Note: Students need not be able to name shapes at this stage.)

- Examine the variation in texture of objects.

Describe objects based on their texture.

Learning words related to texture and touch can be related to learning describing words in English and Dzongkha lessons.

- Watch the video https://youtu.be/fuDFz8AijfM to learn how to describe objects based on different attributes.

- Students explore objects in the environment.
  - Describe the objects based on their attributes.

Examples:

- Take students for a field visit to collect and describe flowers based on colours.
- Name and describe the objects found at home which are made of different materials.
- Describe how different leaves feel upon touch.
- Discuss about leaves, like how leaves are food for animals, etc.

D. Assessment

Performance Task 1

Name objects and colours found in the environment.

Play the 'Colour Hunt' game.

(Refer Understanding Mathematics, Teacher's Guide for class PP for instruction).

Performance Task 2

Describe three objects using at least their attributes.

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

- Reflective Questions
  i. How are these the same? How are these different?
  ii. Describe your favourite toy.

Template to Record Student Achievement

<table>
<tr><td colspan="2">Strand(s): Number and operations</td><td colspan="4">Topic(s): PP-A1 Describing Attributes of Objects</td></tr>
<tr><td colspan="6">Competency:
• Demonstrate the ability to describe objects based on attributes and apply the idea to recognize and sort objects in real life.</td></tr>
<tr><td>Name of the student</td><td colspan="5">Level of achievement</td></tr>
<tr><td></td><td>Beginning</td><td>Approaching</td><td>Meeting</td><td>Advancing</td><td>Exceeding</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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</table>

E. **Resources**

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Online
  - Describing Objects and Things - https://youtu.be/fuDFz8AijfM
  - Source: https://plato.stanford.edu/entries/spinoza-attributes/

Topic: PP - A2 Sets

PP - A3 Comparing Sets

[400 minutes]

Introduction

Sets in mathematics are simply a collection of distinct objects forming a group. A set can have any group of items, be it a collection of numbers, days of a week, types of vehicles and so on. Every item in the set is called an element in the set.

Utility and Scope

In mathematics, to compare sets means to examine the differences between numbers, quantities, or values to decide if one is greater than, smaller than or equal to the other. We use comparing skills when we compare quantity, our weight, height, marks, speed, length and distance. Practising comparison improves number sense and helps students see the relation between numbers.

A. Competencies

- Identify the attributes of objects and sort objects based on the various sorting rules in familiar and new situations.
- Compare sets using appropriate terms and apply the skill to describe comparison of quantities in real life situations.

B. Objectives

- Sort objects into different sets based on sorting rules, using actual objects and pictures in familiar and in new situations.
- Distinguish between objects that belong to/do not belong to a given set.
- Differentiate between sets that have/do not have a given number of items.
- Justify estimation of quantity before counting, matching or lining.
- Compare quantities by saying words such as ‘more’, ‘fewer’ or ‘the same’ in sets (using concrete objects).

C. Learning Experiences

- Students sort concrete objects into sets based on the attributes learnt in the previous lesson.
- Watch the video https://youtu.be/2ZSWt9fyOSA to learn how to sort based on attributes.

- While using the concrete objects, discuss where the objects are found and how they are used.
- Students identify the objects that belong to / do not belong to a given set.
- Explain the sorting rules used (to be accepted in any language used by a child). Play the game 'What Doesn't Belong' to practise sorting.
  (Refer Understanding Mathematics, Teacher's Guide for class PP for instruction)

- Students identify other sets that have the same number of items as the one shown.
  - Differentiate between sets that have/do not have a given number of items. (to be accepted in any language used by a child).

- Students compare sets by:
  - Estimate the quantity of items in the sets and explain if a set has more or fewer number of items than the other (without counting or matching the items).
  - Matching items one to one.
  - Lining up the items of two sets to compare.
  - Discuss the evaluation of their estimation.
  - Watch the video https://youtu.be/YZQCUzyqn4Q to learn how to match for comparison of sets.
  - Describe the comparison of sets using terms like 'more', 'fewer' or 'the same'.

- While comparing the sets in various ways, let children use different sizes of objects to infer that:
  - Size of the object varies but the count is the same.
  - Smaller objects give a bigger count.

- Students watch the suggested video https://youtu.be/-fYv49Vd-c0 to practise comparing sets (pause the video before revealing the answers to each question) and using the appropriate terms.

D. Assessment

Performance Task 1

Sort objects in different categories based on different attributes. Explain the sorting rules.

Performance Task 2

Describe comparison of sets (concrete and pictorial), with a maximum of 10 items using terms 'more', 'fewer' or 'the same'.

Performance Task 3

Create sets which have 'more', 'fewer' or 'the same' number of items to the given set.

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

- Reflective Questions
  i. How do you know there are more____ than ___?
  ii. How do you know there is the same number of ______ as_____?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects / Manipulatives
- Online
  - Comparing Sets - https://youtu.be/YZQCUzyqn4Q
  - Fewer and More - https://youtu.be/-fYv49Vd-c0
  - Sorting one Group in Different Ways - https://youtu.be/2ZSWt9fyOSA

Topic: PP-A4 Counting Numbers till 100 *[300 minutes]*

Introduction

Counting is important because the meaning attached to counting is the key conceptual idea on which all other number concepts are based. Children have often learnt the counting sequence as a rote procedure. They need to learn the meaning of counting by using counting skills in a variety of meaningful situations.
Source: history of numbers and counting

Utility and Scope

Counting in preschool and the early elementary years supports the development of a variety of other mathematical abilities. Patterning, part-whole relationships, place value, composition and decomposition, equivalence, operations, and magnitude are all important mathematical concepts that use counting as a foundation.
Source: https://prek-math-te.stanford.edu/counting/mathematics-counting-0

A. Competency

- Apply the concept of counting till 100 in sequence to describe quantity in the environment and develop number sense.

B. Objectives

- Count in the correct sequence using concrete objects.
- Identify that the order in which objects are counted, doesn't change the amount.
- Recognize that the last number said is the count, using concrete objects.
- Recognize simple amounts without counting till 10.
- Count to 30 as '1 and 1 more is 2', '2 and 1 more is 3', etc. using concrete objects.
- Chant numbers till 100 in the correct sequence.

C. Learning Experiences

- Students practise counting till 10.
- Count in the correct sequence and recognize that the last number said is the count, using concrete objects.
- Realise that in a set, the items must be counted only once.
- Practice counting till 10 in correct sequence by singing number rhymes/songs.
- Students explore counting by starting the count from different objects in a set.

- Discuss that the order in which objects are counted doesn't change the quantity in the set.
- It doesn't matter which object a child chooses to start counting from.
- It doesn't matter if the objects are counted from left to right or right to left as long as the count is said in the correct sequence.

- Students practise subitizing counts till 10.
  - Recognise the number of objects (till10) instantly, without actually counting them.

- Students chant numbers till 100.
  - Practice counting numbers (orally) using concrete objects, pictures and 100 charts starting from different points till 100.
  - Chanting first till 10 then count numbers saying 10 and 1 more is 11 (till 30) and so on.

    Note: Chanting of numbers to be conducted in accordance to their progression and not to be completed in one lesson
  - Practice chanting till 100 by exercising and counting as shown in the video https://youtu.be/0TgLtF3PMOc

    This activity could be related to HPE activity

D. Assessment

Performance Task 1

Count till 10 in the correct sequence while playing the 'Jump and Count' game.

Use the video https://www.youtube.com/watch?v=6xtPgtveyxA

(This video provides the instruction for the game as well as other games that can be played for students to practise counting).

Performance Task 2

Count till 30 (orally) in correct sequence, using pictures or concrete objects. Choose different objects to start counting from.

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

- Reflective Questions
  - i. Which number is after____?
  - ii. How many____ are there?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects / Manipulatives
- Online
  - A brief history of numbers and counting, Part – https://bit.ly/3HOUNUZ
  - The Mathematics of Counting - https://prek-math-te.stanford.edu/counting/mathematics-counting-0
  - Let's get fit - https://youtu.be/0TgLtF3PMOc
  - Teaching numbers - https://www.youtube.com/watch?v=6xtPgtveyxA

Topic: PP-A5 Representing Numerals till 30 *[300 minutes]*

Introduction

A number is a mathematical object used to count, measure, and label. The original examples are the natural numbers 1, 2, 3, 4, and so forth. Numbers can be represented in language with number words.
Individual numbers can be represented by symbols, called numerals; for example, "5" is a numeral that represents the number five. The most common numeral system is the Hindu–Arabic numeral system, which allows for the representation of any number using a combination of ten fundamental numeric symbols, called digits.

Source: https://en.wikipedia.org/wiki/Number

Utility and Scope

Knowing that numbers can be represented in a variety of ways is important for building the number sense. It helps to develop an understanding of a number, its size and its relationship with other numbers.
Students learn to represent numbers using concrete objects and pictures. Students relate symbols to concrete and pictorial representations.

A. Competency

- Represent and identify numbers till 30 concretely, pictorially, symbolically, and apply the skill to deal with quantity and numbers in real life.

B. Objectives

- Represent numbers till 30 concretely and pictorially.
- Identify symbolic representation of numbers till 30.

C. Learning Experiences

- Students recall chanting of numbers in correct sequence till 30.
- Students represent numbers till 30.
    - Counts objects in a set till 30, concretely and pictorially.
    - Use counters, snap cubes, base-ten blocks, and real objects outside the class, etc.
    - Create sets for a given number till 30 concretely.
    - Draw sets of items till 30.

- Students explore the use of ten frames to represent numbers.
  - Represent numbers till 30 using the counters on ten frames.
  - Draw dots on ten frames to show numbers till 30.
- Students identify symbolic representation of numbers till 30.
  - Identify the 10 numerals.

    First identify numerals till 9 and then introduce the numeral 0 in order to identify numbers10 till 30.
  - Relate concrete and pictorial representations to symbols.
  - Recognize number words till 30.
  - Note: Students do not need to memorise the spelling of the number words.
  - Play 'Show These Many' game to practise representing numbers using concrete materials and to identify numerals using a number card.

D. Assessment

Performance Task 1

Identify numerals on a number card and represent the number with concrete objects.

Performance Task 2

Match pictures of sets to symbolic representation of numbers (till 30) correctly.

Performance Task 3

Mention at least three places outside the classroom and home where numbers are seen.

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

- Reflective Questions
  1. Can you read this number?
  2. What would you like to use to represent the number____? Why did you choose that?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP

- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects/Manipulatives
- Ten frames
- Counters
- Online
  - Numbers- https://en.wikipedia.org/wiki/Number

F. Game

Game: Show These Many

Material Required:

Concrete Materials/Manipulatives

Flash Card with symbols of numbers and Number words

Instruction:

Students play in teams.

Teacher flashes a number card. .

Students identify the number cards and quickly represent the number using the concrete materials they have.

The team that finishes representing the number first takes the point.

Teacher flashes the number cards a few more times.

The team with the highest point wins.

Topic: PP-A6 Writing Numerals till 30

[400 minutes]

Introduction

In the process of writing, students clarify their own understanding of mathematics and improve their communication skills. They must organise their ideas and thoughts more logically and structure their conclusions in a more coherent way. Competency in writing can only be accomplished through active practice; solving mathematics problems is a natural way for increasing students' writing competence.

Source: https://sciencing.com/teach-children-write-numbers-4870627.html

Utility and Scope

Writing numerals can help children express the counts, recognize numbers and solve problems. Learning to write numbers is a key skill required in laying the foundation for handwriting and maths skills later in life.

A. Competency

- Demonstrate the ability to write numbers to 30 and express quantity symbolically in real life.

B. Objectives

- Form numerals by tracing in the air, on sand or on modelling clay.
- Write numerals on paper by tracing and self-writing in sequence.
- Represent numbers in a set symbolically.

C. Learning Experiences

- Students revisit representing numbers concretely and pictorially, till 30.
  - Match concrete or pictorial representation of numbers in a set to numerals.
- Students practise writing numerals till 30 correctly.

  Teacher demonstrates how to write numerals from 0- 9 first.

  Example: show 1 concrete object, let students tell how many and then show how to write:
  - in the air, then on the floor/sand/soil
  - trace on paper

    Note: Students might write large numerals first. It should be accepted and students should be encouraged to reduce the size of the numerals to acceptable size.

- Watch the video https://youtu.be/divGGsmpQC8 (Video time: From start till 8: 34) to learn how to write numerals from 0-10.
- Write the numerals for the counters shown on ten frames (0 till 30)
- Count number of items in a set and write the numerals till 20, then till 30

D. Assessment

Performance Task 1

Count concrete objects in a set and write numerals (till 30) appropriately.

Performance Task 2

Identify the numbers represented with ten frames and write the numerals correctly.

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

- Reflective Questions
  i. Can I write number ___ like this? Why or why not?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Tracing sheet
- Online
- How to Teach Children to Write Numbers - [writing numbers]()
  - Mathematics Key Stage 1: Representing Numbers - https://youtu.be/divGGsmpQC8

Topic: PP-A7 Addition

[450 minutes]

Introduction

Addition is the process of adding two or more items together. In maths, addition is the method of calculating the sum of two or more numbers. It is a primary arithmetic operation that is used commonly in our day-to-day life. One of the most common uses of addition is when we work with money, calculate our grocery bills, or calculate the time.

Utility and Scope

Addition helps students master the relationships between numbers and understand how quantities relate to one another. Even when kindergartners can't reliably answer addition problems or manipulate large numbers, basic addition skills give them a framework for mastering maths in elementary school.
At this stage students use addition to find the total number of items they possess, total score achieved while playing games, etc.

A. Competency

- Demonstrate the ability to interpret the meaning of addition, using concrete and pictorial models and solving simple addition problems.

B. Objectives

- Explain 'addition' as putting together by combining sets of concrete objects, with the sum till 10.
- Estimate sums before adding.
- Relate addition to increase in quantity.
- Recognize that addition involves finding out 'how many are there altogether' in a set.

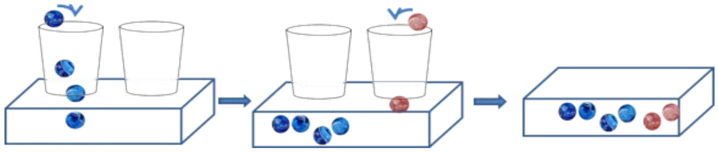
C. Learning Experiences

- Revisit students' ability to recognize and count numbers till 30.

- Students explore addition by combining objects (quantities) till ten.

  Note: Signs (+) used for addition are **NOT** to be introduced at this stage.
  - Teacher demonstrates the concept of addition as putting together.

    Example:



- ○ Express their understanding of addition as putting together only verbally, concretely and pictorially.
- ○ Use concrete objects to show increasing quantities by combining objects till 10.

- Students practise addition by:
  - ○ Adding objects to an existing set and counting on from the set.
    Show a set. Let students estimate the quantity and then count. Add objects to see the increase in quantity.
  - ○ Estimate the total number of items in the set before actually adding on items to a given set.
  - ○ Combining two existing sets and counting all items, using real objects.
    Show two sets and count the items in each set. Let them estimate the total.
    Note: Sets when combined should not contain more than 10 items.
  - ○ Estimate the total number of items after combining the sets before actually combining the items.
  - ○ Watch the video https://www.youtube.com/watch?v=sgRL0abO6_I to learn addition as putting together.

- Students explore the online worksheet to practise addition, to realise the increase in quantity. Use Pictures to Add To worksheet.
- Students discuss some simple and relatable real life situations where addition is applied.

Example: Finding out the total number of toys they and their friends have.

D. Assessment

Performance Task 1

Perform addition by adding on and explaining the increase in quantity.

Performance Task 2

Explain addition as putting together by combining sets, with total till 10.

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

- Reflective Questions
    i. You have 3 candies with you and your mom gives you 5 more candies. How many candies will you have altogether?

Refer Annexure of PP-A1 for the template to record student achievement

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete Objects/Manipulatives
- Online
    - What is One More Than a Number - https://www.youtube.com/watch?v=sgRL0abO6_I
    - Addition - https://www.liveworksheets.com/du1114027zg

Topic: PP-A8 Subtraction

[350 minutes]

Introduction

Like addition, subtraction is also one of the oldest and the most basic arithmetic operations. The word subtraction is derived from the two words, ‘sub’ and ‘tract,’ which mean under or below and to pull or carry away, respectively. Therefore, subtraction means to carry away the lower part.

Utility and Scope

Real life is full of opportunities for children to subtract, e.g., lending some toys to a friend and calculating how many toys will be left, or spending some money and working out how much money they should still have. Problems like this – about real things that children can see and touch – bring subtraction to life.

A. Competency

- Interpret the meaning of subtraction as ‘taking away’, using concrete and pictorial models, and solve simple real life problems.

B. Objectives

- Relate subtraction to decrease in quantity while taking away objects from a given set.
- Estimate the difference before carrying out subtraction.
- Compare two sets to find how many more items need to be added to the smaller set to make it equal to the bigger set.

C. Learning Experiences

- Students estimate and count the number of objects in sets.
- Students explore subtraction by taking away objects from a set.
  - Demonstrate taking away objects one by one to show the decrease in quantity.
  - Estimate the remainder after taking away, before actually taking away items from a set.
  - Watch the video Early Subtraction | Teach Your Child how to 'Take Away' - YouTube to help understand the meaning of subtraction as taking away.
  - Explain subtraction as taking away.
- Students experience finding the difference as a result of subtraction by:
  - Counting the remainder

- Counting backwards from the total.

- Students explore comparison of sets and perform subtraction.
  - Compare sets and state how many objects need to be added to the smaller set to make it equivalent to the larger set.
  - Relate subtraction to ‘how many more’.
  - Watch the video https://www.youtube.com/watch?v=mARCcT39eVw to learn how to compare sets for subtraction.

- Students practise representation of subtraction pictorially.
- Students discuss some simple real life situations where subtraction is applied.

Example: Sharing candies with a friend and finding the leftovers.

D. Assessment

Performance Task 1

Perform subtraction by taking away items from a set to show decrease in quantity.

Performance Task 2

Explain subtraction as the difference between two sets using concretely or pictorially.

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

- Reflective Questions
  i. How many is left when______ is taken away?
  ii. What is the difference between two sets?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher’s Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects/ Manipulatives
  - Early Subtraction | Teach Your Child how to 'Take Away'
    Early Subtraction | Teach Your Child how to 'Take Away' - YouTube
  - Compare sets:
    https://www.youtube.com/watch?v=mARCcT39eVw

Topic: PP-A9 Ordinal Numbers Till 10th *[500 minutes]*

Introduction

Ordinal numbers tell us the positions of an item in an arrangement. Since the counting process requires labelling things with numbering, when objects or things are placed in an order, ordinal numbers tell their exact position, or they help to put things in an order in a collection.
The word “ordinal” comes from the Latin “ordo,” meaning “row or series,” which also gave us the word “order.” Ordinals can be used as nouns, pronouns or adjectives, and can be written either as words (“third”) or as numerals with suffixes approximating the sound of the word (1st, 2nd, 3rd, 4th, etc.).

Source: http://www.word-detective.com/2014/07/first-second-third/

Utility and Scope

Ordinal numbers are commonly used in mathematics, sciences, literature, and every walk of life. The purpose of using ordinal numbers is to indicate position, or order of things or objects. It is used to describe a way to arrange a collection of objects in order, one after another. It can be used to describe rank, seating arrangements, reading dates on a calendar, etc.

A. Competency

- Apply the concept of ordinal numbers (till 10th) to identify and express the position of objects in the real environment.

B. Objectives

- Describe the position of objects from 1st to 10th.
- Identify ordinal numbers from 1st to 10th as symbols.
- Read ordinal numbers from 1st to 10th.
- Continue sequence of ordinal numbers from different starting places.
- Write ordinal numbers from 1st till 10th appropriately in correct sequence.

C. Learning Experiences

- Revisit counting from 1 – 10 orally as well as writing symbolically in correct sequence.
- Explore how we describe the position of things and people in our everyday life to introduce ordinal numbers.

  Example:

- Race and describe the position of runners using ordinal numbers.
  - This activity could be related to HPE lessons, use of appropriate simple sentences for English and Dzongkha lessons.
  - It also allows teachers and students to discuss values of honesty, integrity and leadership skills.

- Students practise chanting ordinal numbers from 1st till 10th in correct sequence.

  Example:
  - Display ten objects and describe their position by chanting ordinal numbers from 1st till 10th in correct sequence.
  - Chant ordinal numbers while climbing and descending stairs.
  - Practice saying ordinal numbers in continuation from different starting places.

    Example:

    Line up to describe position with ordinal numbers continuing from different starting places.
  - Watch the video https://www.youtube.com/watch?v=BaO1E21SpkI to learn ordinal numbers from 1st till 10th.
  - Play 'Remember my place' game to help students practise ordering, to learn correct sequencing of ordinal numbers. (Refer Annexure for instructions for the game)
  - Note: discuss the difference of cardinal numbers and ordinal numbers briefly, in a simple way, with the students.

- Students practise reading ordinal numbers when presented as symbols.
  - Identify the symbolic representation of ordinal numbers by matching ordinal numbers with position of objects, pictorially.
  - Read the shown ordinal numbers appropriately.

- Students practise writing ordinal numbers from 1st till 10th.
  - Practice writing ordinal numbers in the air or on the sand, etc.
  - Trace ordinal numbers on provided tracing sheets.
  - Describe position of objects by writing ordinal numbers for each.
  - Practice writing ordinal numbers 1st till 10th in correct sequence, on their own, without a copy.

D. Assessment

Performance Task 1

Use ordinal numbers to describe the position of objects placed in advance, orally.

Performance Task 2

Write ordinal numbers appropriately, 1st till 10th, in correct sequence.

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

- Reflective Questions
  i. What comes after the __position?
  ii. Which object is first/last?
  iii. Where can you use ordinal numbers in your daily life?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete Objects/Manipulatives
- Online
  - Ordinal Numbers: https://www.youtube.com/watch?v=BaO1E21SpkI
  - Source: http://www.word-detective.com/2014/07/first-second-third/

F. Game

Game: 'Remember My Place'
Materials Required:
Common objects / manipulatives

Instruction:
Students play the game in teams of 5 members each.
Display 10 objects in order.
Students observe the position of those objects.
Shuffle the objects displayed earlier.
Players from each team take turns to place the objects in their correct position and read the position, as ordinal number, out loud.

Each player gets 1 point for correct placement of the object and 1 point for reading out the ordinal number correctly.

At the end of the game, the players will add their scores.
The team with the highest score wins the game.

i. Refer Annexure of PP-A1 for the template to record student achievement.

Topic: PP-B1 Repeating Patterns

[300 minutes]

Introduction

When things are structured in a certain way that is predictable, it is a pattern. When some things repeat over and over again, there is a pattern. Patterns are seen everywhere in nature. For example: the pattern on *kira/gho*, on plants, in and around the classrooms, cycle of moon, etc.

Utility and Scope

The ability to recognize patterns helps children make predictions, as they begin to understand what comes next. Examining and identifying patterns can be used in singing rhymes, following norms, etc. It helps enhance students' ability to interpret creative arts.

Patterns will help children in understanding the working of the number system, including place value concepts, number naming system, and the basic number operations.

A. Competency

- Identify repeating patterns in their environment and predict what follows in simple real life situations.

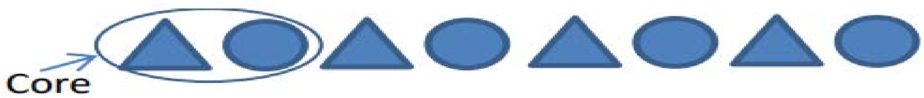
B. Objectives

- Examine simple repeating patterns in their immediate environment.
- Identify repeating patterns with concrete objects based on size, colour and shape.
- Examine sound and action-based patterns that repeat and predict the sound/action that would follow.

C. Learning Experiences

- Students explore repeating patterns in the environment.
    - Examine patterns observed on *Kira/Gho*, paintings of Bhutanese pillars, flowers, etc.
    - Discuss the patterns they have noticed.
    - Examine and describe patterns based on shape, size and colour.
    - Discuss the term repeating pattern and how a pattern is a repeating pattern.
    - Identify the 'terms' and the 'core' of a repeating pattern.

- The objects or elements that form a pattern are called 'Terms'.
- The core is the part of a repeating pattern, the shortest string of elements, which stays the same and repeats itself.
- In the example given below, the triangle and circle are the terms of the repeating pattern. The triangle appearing first, followed by the circle, forms the core of the pattern.
- Note: It is difficult to identify a pattern from a small part of the pattern. Therefore, the pattern core should be repeated at least more than twice.



- Watch the video repeating pattern to learn the concept of repeating patterns (video to be shown till repeating pattern only).
- Describe places where they can find repeating patterns and explain how they are repeating patterns.

- Students explore sound and action patterns.
  - Listen to repeating sound patterns and predict the sounds that will follow.
  - Examples: Beating on the table, snapping, clapping or humming
  - Observe repeated actions and predict the actions which will follow.
    Example: taking a step to the left, then a step to the right.
  - Discuss the real life situations where they experience sound and action patterns.
    These activities help students enhance their skills and interest in musical arts and also help with poetry in literature in the later stages.

D. Assessment

Performance Task 1

Identify simple repeating patterns in the environment and describe them based on colour, shape, size, sound or action.

Performance Task 2

Justify why a given pattern is a repeating pattern.
Example: Show a piece of a painting or a picture which has a repeating pattern, and ask students to identify the pattern there. Ask how it is a repeating pattern?

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

- Reflective Questions
    i. What makes this a pattern?
    ii. What part of the pattern is being repeated?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Self-Instructional Material, Key Stage I, Class PP, Volume-II
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online
    - Mathematics Key Stage 1 : Patterns- https://www.youtube.com/watch?v=LvqFjQ29tFo&list=PL8WWToQ5Kvkea-a3QdyRkXrRUxOE2icIN&index=58

Topic: PP-B2 Representing Patterns Concretely

[350 minutes]

Introduction

When things are structured in a certain way that is predictable, it is a pattern. When some things repeat over and over again, there is a pattern. Patterns are seen everywhere in nature. For example: The pattern on *kira/gho*, patterns on plants, patterns in and around the classrooms, cycle of moon, etc.

Utility and Scope

The ability to recognize and create patterns helps us make predictions based on our observations. This is an important skill in mathematics. Understanding patterns help prepare children for learning complex number concepts and mathematical operations. Patterns allow us to see relationships between numbers and operations, and develop generalisations.

A. Competency

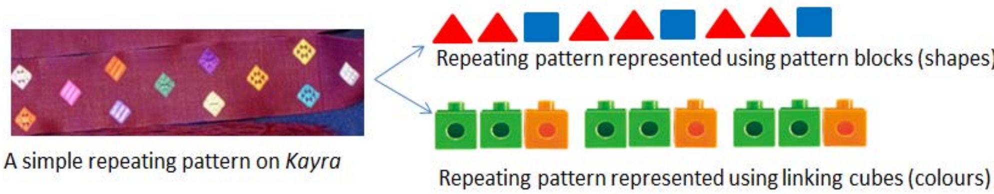
- Interpret and create repeating patterns in various ways and apply the concept to solve simple real life problems.

B. Objectives

- Represent repeating patterns in different ways (e.g., a snap, clap, snap, clap, snap, clap pattern could be represented by a blue, red, blue, red, blue, red pattern or by a 1, 2, 1, 2, 1,2 pattern)
- Read repeating patterns in different ways (e.g., ABC pattern can be read as 1 2 3)
- Create their own pattern using the concept of a repeating pattern.

C. Learning Experiences

- Students explore representing repeating patterns in various ways.
  - Identify repeating patterns in the environment.
  - Interpret the pattern.
  - Identify and discuss the pattern’s core and its terms.
  - Represent the terms of the core using concrete objects/manipulatives.
    Example:



A simple repeating pattern on *Kayra*

- Represent the terms of the core using sounds and actions.
  Example: The pattern on the *kayra* can be represented as
  clap, clap, snap, clap, clap, snap, clap, clap, snap… pattern.
- Represent the terms of the core using letters.
  The terms of the core can be represented using letters such as A, B, C, etc.
  Example: The pattern on the *kayra* can be represented as
  A, A, B, A, A, B, A, A, B… pattern.
- Represent the terms of the core using numbers.
  Example: The pattern on the *kayra* can be represented as
  1, 1, 2, 1, 1, 2, 1, 1, 2… pattern.

• Students explore different ways of reading a repeating pattern.
Repeating patterns can be read as letter or number patterns.
- Interpret a repeating pattern.
- Identify and discuss the pattern's core and its terms.
- Read repeating patterns using letters.
  Example: AB pattern, AAB pattern, ABB pattern or ABC pattern.
  The pattern on the *kayra,* in the example given above, can be read as an AAB pattern.
- Read repeating patterns using numbers.
  Example: 12 pattern, 112 pattern, 122 pattern, or 123 pattern.
  The pattern on the *kayra* can be read as a 112 pattern.

• Students further practise representation of repeating patterns.
- Watch the video https://www.youtube.com/watch?v=pztRAgQFVec to learn how repeating patterns can be created/extended
- Extend given repeating patterns.
- Model given repeating patterns in various ways.

• Students create repeating patterns of their own.
- Explain the terms of the core of their pattern.
- Describe their pattern as colour, shape, size, letter or number patterns.

D. Assessment

Performance Task 1

Interpret any repeating pattern (given by teacher) and connect it to the pattern they have seen in the environment.

Performance Task 2

Create at least two repeating patterns of their choice using concrete objects found in the environment. Explain the pattern.

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

- Reflective Questions
  i. How are these two patterns the same?
  ii. How are they different?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class PP, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete objects / Manipulatives
- Online
  - Learn patterns- https://www.youtube.com/watch?v=pztRAgQFVec

Topic: PP- C1 Comparing Length Directly and Indirectly

[600 minutes]

Introduction

The term "length" refers to a measurement that determines the distance between two places. It is used to measure how long or tall an object is or how far away a place is. Length is one of the most common measurements used every day.

Comparing how much one feature of an object is compared to the identical feature of another thing is what measurement is all about. Length can be compared directly and indirectly, without the use of a unit. Direct comparison of length involves comparing by aligning the objects and just looking at them. Indirect comparison of length is the process of comparing the lengths of two objects that cannot be directly aligned, using a third object.

Source:
https://www.qcaa.qld.edu.au/downloads/p_10/kla_maths_info_measurement.pdf

Utility and Scope

Understanding length assists you in solving practical difficulties not only in the classroom but also in everyday life.

One often uses direct and indirect comparison of length in the absence of a measuring tool to describe lengths. For example, before entering a room, one makes a direct comparison of the height of the door to their own height and then decides whether to bend or not. Similarly, students make direct comparisons of the length of their pencil to the length of the pencil case and then decide to use either of the two objects, or find an appropriate solution (sharpening the pencil).

Being able to compare length directly helps in making quick judgements and decisions. Indirect comparison of length is used when the two objects whose lengths need to be compared cannot be put beside one another and aligned.

A. Competency

- Compare length directly and indirectly using appropriate terms and justify the use of indirect comparison in real life, in simple language.

B. Objectives

- Sort different objects based on their length as short or long objects.
- Compare lengths directly using the terms 'longer than' and 'shorter than'.

- Explain the importance of aligning endpoints to compare lengths.
- Compare lengths indirectly and describe lengths of objects as 'longer /shorter than', or 'of the same length' in relation to the third object.
- Order three different lengths using indirect comparison.
- Explain the use of indirect comparison in real life, in simple language.

C. Learning Experiences

- Students explore sorting based on lengths/height.
  - Discuss length as an attribute of objects.
  - Examine lengths and heights of different objects.
  - Sort different lengths as 'long' or 'short'.
  - Sort different heights as 'tall' or 'short'.

- Students compare length of objects directly (just by looking at the objects). Example: Take students for a field visit
  - Examine the length of two different objects.
  - Predict which one is longer or shorter.
  - Place the objects beside one another and compare their length by just looking at them.
  - Describe the comparison of length using the terms 'longer', 'shorter' and 'about the same'.
  - Examine comparison of lengths by aligning and not aligning the end points of the two objects.

    Then discuss the importance of aligning endpoints for fair comparison of lengths.

    This activity helps students use simple language in Dzongkha and English for communication.
  - Compare lines of different lengths directly.
  - Watch the video https://www.youtube.com/watch?v=taepCGI0vww practice comparing various lengths directly.
  - Comparer heights directly using the terms 'taller' and 'shorter'
  - Watch this video https://www.nagwa.com/en/videos/543146786264/ to learn how to compare heights directly.
  - Play 'Jump Like Me' game to practise indirect comparison of length.

    (Refer the Annexure for the instruction).
  - Compare three different lengths directly and order from shortest to longest, and vice versa.

- Students compare length of objects indirectly (using a third object).
  - Describe the length of two objects in comparison to a third object.
  - Example: Compare the length of a chalk and a ruler using a pencil as the third objects.

  - Watch this video https://youtu.be/IFP4aSRGtpE to learn how to compare using a third object and also to order length.
  - Watch the video comparing length to learn how to compare heights indirectly, using a third object.
  - Order three different lengths using indirect comparison.
  - Practise comparing lengths using the terms 'long', 'short', 'longer', 'taller', and 'shorter' through this video https://youtu.be/szZvBfCk1BU

- Students discuss the use of indirect comparison of lengths in real life situations.

  Explain the use of indirect comparison in real life, in simple language.
  - Where and when is it used?

    Example: While comparing the length of the TV at one's home and at a friend's home.
  - Why is it used?

    Example: It is used when the two lengths to be compared cannot be put beside one another and aligned for direct comparison.

D. Assessment

Performance Task 1

Compare at least 5 pairs of lengths directly using appropriate terms.

Performance Task 2

Compare at least 3 pairs lengths indirectly, using a third length and sort them based on their length, using a sorting mat.
Example of sorting mat:

Shorter than	About the same length	Longer than

Performance Task 3

Order lengths of various objects from shortest to longest/tallest and vice versa, concretely and pictorially.

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

- Reflective Questions
  i. Do you think ___ is longer than ____? Why?
  ii. Can you build something that is as tall as ...?
  iii. How would you compare the length of the table at your home and the length of the table in the classroom?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class PP, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete objects / Manipulatives
- Online
  - About Measurement: Information for Teachers - https://www.qcaa.qld.edu.au/downloads/p_10/kla_maths_info_measurement.pdf
  - Longer and Shorter activities - https://www.youtube.com/watch?v=taepCGI0vww
  - Identifying which Object is the Tallest or Shortest - https://www.nagwa.com/en/videos/543146786264/
  - Order three objects by length; compare the lengths of two objects indirectly by using a third – https://www.youtube.com/watch?v=IFP4aSRGtpE
  - Ordering by length - https://www.khanacademy.org/math/cc-1st-grade-math/cc-1st-measurement-geometry/copy-of-cc-early-math-length-intro/v/order-by-length
  - Comparing lengths- https://youtu.be/szZvBfCk1BU

F. Game

Game: Jump like Me

Materials Required:

- Marker (Chalk)
- A common object to measure length (e.g. a rope or a long stick)

Instruction:

- Let students stand on common starting line
- Make them jump forward as far as they can
- Take turns to jump
- Let one child from the team mark their landing spot with a chalk
- All the students in a team would be given a common object of certain length to compare the distances jumped.
- Student with the longest distance wins the game from each team.
  Discuss the value of respect, responsibility, resilience, acceptance and cooperation. They can enhance their social skills through this game.

Topic: PP-C2 Comparing Capacity Directly and Indirectly *[300 minutes]*

Introduction

The capacity of a container is the amount of something it can hold or contain. How much a container can hold depends on the space it has inside. A container which has more space inside has greater capacity than a container which has less space inside. For example, the amount of oil in the tank, amount of water in the swimming pool, etc…

Like length, capacity of containers can also be compared directly and indirectly, without the use of a unit. Direct comparison of capacity involves comparing the space inside containers just looking at them. Indirect comparison of capacity is the process of comparing the capacity of containers by using a third container.

Utility and Scope

Understanding capacity is especially important when one is dealing with liquid measurement. Being able to compare capacity of containers directly helps in making quick judgements and decisions: in choosing appropriate containers or estimating the amount of liquid a container can hold. Indirect comparison of capacity is used when the two containers whose capacities need to be compared cannot be put beside one another for direct comparison. For example, one would use indirect comparison of capacity while purchasing a new container to replace the one at home.

A. Competency

- Demonstrate the ability to compare capacity of containers used in their daily life directly and indirectly, using appropriate terms.

B. Objectives

- Compare capacity of different containers directly.
- Describe comparison of capacity using the phrases ‘holds more’, ‘holds less’ and ‘holds the same’.
- Compare capacity of containers indirectly (using a third container) and describe comparison using appropriate phrases.

C. Learning Experiences

- Students explore different sized containers and make estimation of capacity directly (without measuring)
    - Discuss the meaning of capacity.

- Examine space inside containers and estimate their capacity.
- Examine the capacity of containers by actually filling them up with water or grains.
- Examine same sized containers but with different capacities.
  Discuss that although containers may be of the same size, their capacity may vary depending on the space inside them.
- Compare the capacity of containers using the terms 'holds more', 'holds less' or 'holds the same'.
- Watch this video https://www.youtube.com/watch?v=mHK3-D2Y_YU4 to learn to compare capacity directly.

- Students explore comparing the capacity of containers indirectly.
  - Demonstrate how to compare capacity of containers indirectly (using third container)
    Example: Compare the capacity of a glass and a jug using a bottle.
    The glass holds less than a bottle. The jug holds more than a bottle. So, the glass holds less than a bottle.
  - Find containers that would hold more/less than a given container.
  - Discuss when we use indirect comparison of capacity in real life.

- Students compare the capacity of containers used in their daily life.
  Example: Compare the capacity of containers used while preparing Bhutanese cookies (Khabzey).
  (Refer annexure for the instruction)
  Students can enhance their motor skills, incorporate shapes and apply in their real life while shopping, cooking, buying and drinking using capacity words through this activity.
  Learning capacity in this lesson could be related to English, Dzongkha lessons.

D. Assessment

Performance Task 1

Find three containers that will hold more water than a given container and three that will hold less water.

Performance Task 2

Compare the capacities of the pair of containers and write which 'holds more', 'holds less', and 'holds the same'. (Refer Student Activity book)

Performance Task 2

Compare the capacity of pairs of containers using a third container of their choice. Explain the choice of the third container.

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

- Reflective Questions
  - i. Do you think this jug will hold more than the cup?
  - ii. What makes you think that it will hold more (or less) than the cup?
  - iii. How would you check if a container can hold more or less?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class PP, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Containers with various capacity
- Online
  - Measuring Capacity and area - https://www.youtube.com/watch?v=hFO1I0dgmuU

F. Annexure

i. Preparations of Bhutanese cookies (Khabzey)
   Material Required:
   flour,
   water,
   oil,
   salt,
   bowls (of different sizes)
   spoons (of different sizes)
   cups (of different sizes)

   Instruction:
   - Students work in teams
   - Students prepare the dough in a bowl by measuring water, oil and salt with a spoon and cups.
   - Discuss the comparison of the capacity of the different containers used.

Example: Ask which holds more, the spoon or the cup? So which one are we using more, sugar or water?

- Students make shapes having triangular, rectangular and circle faces.
- Display the fried shapes and let them choose the shape they want to eat. Ask: Why do you choose the shapes?

Topic: PP-C3 Comparing Mass Directly and Indirectly *[600 minutes]*

Introduction

The mass of an object is the amount of matter in it. How heavy or light an object is depends on its mass. An object which is heavier has more mass than an object which is lighter.

Mass is something that students cannot observe; it must be felt. This is different from other types of measurements. It makes the need for concrete experiences rather than the use of pictures or diagrams

Utility and Scope

We use mass every day from weighing vegetables to weighing ourselves. Teaching mass is about how heavy or light something is and mass is important because of two major factors affecting how things move in space: inertia and gravity. The more mass something has the more of both its experiences.

Being able to compare mass of objects directly helps in making quick judgements and decisions: in choosing to carry a certain object or while choosing a container to carry the object. Indirect comparison of mass helps students describe the mass of an object using the mass of other objects. This develops a student's ability to make appropriate estimations of mass.

A. Competency

- Demonstrate the ability to compare mass and describe objects as heavier/lighter objects in the environment.

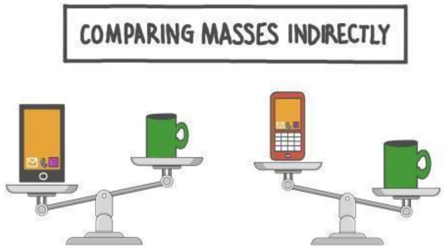
B. Objectives

- Compare mass directly (with no units) by hand or using pan balance.
- Compare mass indirectly, using the mass of a third object.
- Describe comparison of mass using terms like 'heavier/lighter than'/ 'about the same'
- Discuss the common misconceptions such as:
  - objects of same mass but of different size
  - objects of same size but of different mass
  - objects which are large but light
  - objects which are small but heavy
- Sort different objects according to their mass.

C. Learning Experiences

- Students explore a mass of objects.
  - Discuss the meaning of mass.
  - Guess if the objects would be heavy/light by looking at them.
  - Feel the mass of different objects by lifting them.
  - Compare their guess with how the objects actually feel (mass).
    Discuss that the mass of an object cannot be described by just looking at the object, it needs to be felt.
  - Compare the mass of objects by lifting them.
  - Describe comparison of mass using the phrases 'heavier than', 'lighter than' 'about the same'
  - Compare mass of different objects using pan balance.
  - Demonstrate how to use a pan balance.
  - Observe which pan goes down/up.
  - Learn how a heavier object pulls down the pan.
    Discuss the places where they have seen pan balance being used.
  - Watch the video https://www.youtube.com/watch?v=pEot9b07lnk to learn how to compare two objects based on mass.
  - Students explore common misconceptions of mass by comparing mass of various objects.
  - Objects of different sizes but having the same mass
    Example: a bag of potatoes and a bag of cotton
  - Objects of the same size but having different mass.
    Example: same-sized brick and sponge.
  - Objects which are large but can be light
    Example: paper cards or plastic bags.
  - Objects which appear small but can be heavy.
    Example: a stone or a metal bar.

  - Students explore the comparison of mass indirectly.
  - Compare the mass of pairs of objects using a third object.
  - Compare the mass of each of the two objects against the mass of a third object.



- Students use the concept of comparing mass of objects indirectly to arrange objects according to their mass, using appropriate terms.
- Play the game 'Pull Me' to practise ordering objects based on their mass.
  (Refer Annexure for instructions)

D. Assessment

Performance Task 1

Compare the mass of objects directly and choose appropriate terms to describe the comparison.

(Refer Annexure for a sample worksheet)

Performance Task 2

Compare the mass of objects indirectly, using a third object, and sort the objects based on their mass.

Sample of sorting mat to be used:

Lighter than ____________	Heavier than ____________	About the same ____________

Performance Task 3

Use indirect comparison of mass to order objects from heaviest to lightest and vice versa.

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

- Reflective Questions

i. Which object is heavier? How do you know?
ii. If something is big, does it have to be heavy? Explain.
iii. Can you look at something to decide if it is heavy?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class PP, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Common objects with different mass.
- Online
    - Comparing mass: https://www.youtube.com/watch?v=pEot9b07lnk

F. Game

Game: Pull Me!

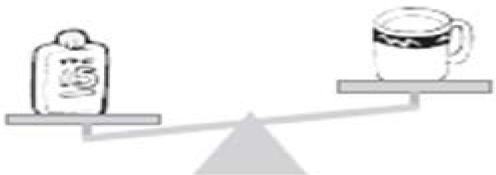
Materials Required: Collection of objects with various masses.

- Instruction:
- Students estimate and explain which is heaviest or lightest.
- Students work in pairs.
- Each pair selects three objects
- Tie a rope/ thread around each object.
- Pull the objects across the floor.
- Then place the items in order of their mass
- Explain how the mass of the objects were compared and how they were arranged.
- The pair to complete the task first wins the game.

Sample worksheet for performance Task 1

Heavier or lighter

Circle the correct word



heavier

lighter

The bottle is __________ than the mug

heavier

lighter

The apple is __________ than the bottle

heavier

lighter

The ball is __________ than the chick

Topic: PP-D1 Spatial Sense: Position in Space *[300 minutes]*

Introduction

Spatial sense is an understanding of shape, size, position, direction, and movement – being able to describe and classify the physical world we live in. ' For little ones, spatial sense is mainly about their awareness of themselves in relation to the people and things around them.

Source:
https://www.learningpotential.gov.au/articles/early-maths-skills-2-spatial-sense

Utility and Scope

Spatial awareness allows us to be conscious of the things in our environment as well as our position relative to them. This ability is important for several reasons, such as:

Location: helps relate objects to location. E.g., Knowing that a cup is on a table as opposed to under it.

Movement: informs you of how people and objects move through the environment. This can help you navigate your surroundings.

Social: affects social functions like respecting personal space.

Reading and writing: helps in using appropriate space while writing. Also helps understanding sentence structure and grammar.

Mathematics: enhances mathematical understanding. Examples include geometry and ordering or arranging numbers.

A. Competency

- Examine the position of an object in real life and describe them in relation to the position of another object and the observer.

B. Objectives

- Describe position in space, including the relative position of:
    - one object to another,
    - the object to the observer.
- Explain positions using terms like 'beside', 'above', 'below', 'between', 'in front of', 'through', 'behind', etc.
- Connect perception to action (experiential) where the child moves.

C. Learning Experiences

- Student explore position of objects in space in relation to another object
  - Describe the position of objects using prepositions such as 'beside', 'above', 'below', 'between', 'in front of', 'behind', etc.
    Example: The chair is behind the table.
  - Watch the video https://www.youtube.com/watch?v=ykmFyHJq6FY to learn different ways to describe an object's position in space.
    The activity is related to learning prepositions in English and Dzongkha.
  - Discuss the fact that the object remains the same in shape and size, irrespective of its position in the space.
  - Play the game 'Treasure hunt' to practise understanding of the terms to describe position of objects in space.
    (Refer annexure for the instruction).

- Students explore the position of objects in relation to the observer.
  - Describe the position of objects using prepositions such as 'beside', 'above', 'below', 'between', 'in front of', 'behind', etc.
    Example: The chair is in front of me.

- Students explore the difference in position of objects after moving around.
  - Describe the position of an object in relation to another object and the viewer.
  - Then, move to a different position and again describe the position of the object in relation to the other object and the viewer.
  - Compare their description of the positions and explain how position changes when they move.

D. Assessment

Performance Task 1

Identify three objects in the classroom and describe their position in relation to other objects using appropriate terms.

Performance Task 2

Describe position of objects, presented pictorially, using appropriate terms.

Performance Task 3

Explain how the movement of an observer affects the way position of an object is described by demonstrating an example.

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

- Reflective Questions
  i. Where is ____ ?
  ii. Will the shape change if you move it?

E. Resources

- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects /Manipulatives
- Online
  - All Around the Farm | Directional Words & Spatial Concepts https://www.youtube.com/watch?v=ykmFyHJq6FY
  - Source: https://www.learningpotential.gov.au/articles/early-maths-skills-2-spatial-sense

F. Game

Game: Treasure Hunt

Materials required: Common objects.

Instruction:

- Students play the game in teams.
- Players of the teams take turns to find treasures which are hidden in various places, following the descriptions by the teacher.
  Note: The teacher must describe the position of the object in relation to another object.
- The team whose player finds the object first wins a point.
- The team with maximum treasures discovered wins the game.

Topic: PP-D2 3-D and 2-D Shapes *[600 minutes]*

Introduction

2-D shapes are flat and can be drawn on paper. 3-D shapes are solid shapes and occupy space. You can draw diagrams of 3-D shapes on paper, but these diagrams only show the view from one perspective.

Utility and Scope

Learning shapes not only helps children identify and organise visual information, it helps them learn skills in other curriculum areas including reading, maths, and science. Learning shapes also helps children understand other signs and symbols.

A. Competency

- Explain the attributes of given 3-D and 2-D shapes and classify them as 3-D or 2-D shapes, to recognize shapes in their immediate surroundings.

B. Objectives

- Identify and discuss attributes of 3-D and 2-D shapes to compare and sort the shapes in different ways, through hands-on experiences.
- Use shape names (not memorise) such as triangle, circle, rectangle, cylinder, cone, sphere, rectangular prism.
- Examine how shapes can be transformed into other shapes by building various shapes and structures, focusing on the attributes.
- Distinguish 3-D and 2-D shapes by exploring non-examples in their surroundings.
- Explore perceptual constancy concept (a shape can be moved by sliding, flipping or turning, and still be exactly the same shape).

C. Learning Experiences

- Students explore 3-D shapes**.**
  - Play the game 'what is in the bag?' to examine and describe 3-D shapes to check students' prior knowledge of shapes.
    (Refer the Annexure for the instruction)
  - Identify real objects which resemble the 3-D manipulatives.

- Students explore the attributes of 3-D (Rectangular prism, Cylinder, Cone and Sphere).
  - Examine the 3-D shapes.
  - Compare the 3-D shapes with one another.

- Identify attributes of the 3-D shapes and describe the attributes using simple appropriate terms.
- Name the shapes.
  Note: Students need not memorise the names of the shapes at this stage.
- Explore non-examples of the above mentioned 3-D shapes.
- Watch the video https://www.youtube.com/watch?v=guNdJ5MtX1A to learn the song of 3-D shapes. (Modify the song by replacing the term cube with 'Rectangular Prism' as 'Cube' is not introduced at this stage).

- Students explore constructing different structures using the 3-D shapes.
  - Build structures using the 3-D manipulatives of the learnt 3-D shapes.
  - Explain their structure with simple descriptions.
  - Explain the way the structure has been built (describing the attributes of the shape)
    Example: The sphere is round, so it doesn't hold other shapes on top of it.

- Introduce 2-D shapes
  - Introduce 2-D shapes as the face of 3-D shapes
  - Use shadows of 3-D shapes to represent 2-D shapes.
  - Present 2-D shapes as drawings on charts.
    Note: If the outlines are cut out, they no longer remain 2-D shapes.

- Students explore the attributes of 2-D shapes. (Rectangle, triangle and Circle).
  - Examine the 2-D shapes.
  - Compare the 2-D shapes with one another.
  - Identify attributes of the 2-D shapes and describe the attributes using simple appropriate terms.
  - Name the shapes.
    Note: Students need not memorise the names of the shapes at this stage.
  - Explore non-examples of the above mentioned 2-D shapes.
  - Watch the video https://www.youtube.com/watch?v=OEbRDtCAFdU to learn the song of 2-D shapes. (Omit square from the song, as it is not introduced at this stage).
  - Practice drawing the 2-D shapes, in the air, on the sand and on paper.

- Students explore creating new designs by combining 2-D shapes.
  - Draw new images by drawing combinations of the learnt 2-D shapes.
  - Explain their drawing with simple descriptions.(describing the attributes of the shape)

Example: The triangle drawn above the rectangle creates the image of a house.

- Students explore the difference between 3-D and 2-D shapes.
  - Describe 3-D shapes as solid object that can be held and 2-D shapes as flat surfaces that cannot be held,
  - Distinguish shapes and sort as 2-D or 3-D shapes.

- Students explore perceptual constancy of shapes in space.
  - Slide, flip, roll and turn the 3-D manipulatives and objects.
    Examine and discuss whether the shapes are 3-D shapes or not.
  - Slide, flip, and turn the drawings of 2-D shapes.
    Examine and discuss whether the shapes are 2-D shapes or not.
  - Discuss how a shape remains exactly the same even when the above actions are applied to it.

D. Assessment

Performance Task 1

Sort pictures of shapes as 3-D and 2-D shapes and explain the difference of 3-D and 2-D shapes in simple sentences.

Performance Task 2

Describe the attributes of 3-D shapes and 2-D shapes using simple phrases.

Performance Task 3

Trace the 2-D shapes given on a worksheet (Refer Student Activity Book).

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

- Reflective Questions
  i. Where can you see shapes?
  ii. How is the shape____ different from the shape ____?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional Material, Key Stage I, Class PP, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete Objects / Manipulatives
- Drawings of 2-D shapes
- Online
  - 3-D Shapes Song - https://www.youtube.com/watch?v=guNdJ5MtX1A
  - 2-D shapes Song - https://www.youtube.com/watch?v=OEbRDtCAFdU

F. Game

Game 'What is in the bag?'

- Materials Required:
- 3-D shapes (Small concrete objects or manipulatives)
- Instruction:
- Put the shapes in a bag.
- Students take turns to pick a shape from the bag.
- Students describe the shape in the words or language.
- Check if students can name the shape using a common language or even local language.
- Example: Students might say ball for a sphere, box for a rectangular prism, or can for a cylinder.
- Students can be rewarded with candies or points for successful attempts in describing the shapes.

Topic: PP-D3 3-D and 2-D Shapes in Real Life *[300 minutes]*

Introduction

Geometry is the study of shapes, both 2-Dimensional and 3-Dimensional – their features like sizes, positions, orientations; relationships among the various features of a shape; effects on the position and orientation of shapes due to certain transformations applied to them.

Utility and Scope

Learning shapes not only helps children identify and organise visual information, it helps them learn skills in other curriculum areas including reading, maths, and science. For example, an early step in understanding numbers and letters is to recognize their shape

A. Competency

- Discover various examples of learnt 3-D and 2-D shapes in the environment and foster spatial sense for real life context.

B. Objectives

- Identify examples of 3-D and 2-D shapes in the environment.
- State names of learnt 3-D and 2-D shapes.
- Identify shapes inside other shapes in the environment.

C. Learning Experiences

- Students explore 3-D shapes in the environment.
  - Identify structure or objects that are similar in shape to the 3-D shapes learnt in the class.
  - Draw the pictures of the structures/objects identified.
  - Model the identified 3-D shapes using dough/clay.
  - Name the 3-D shapes.
- Students Explore 2-D shapes in the environment.
  - Examine the faces of structures or objects in the environment.
  - Identify the learnt 2-D shapes and on the faces of structures/objects.
  - Use Microsoft paint to draw 2-D shapes.
  - Name the 2-D shapes.To
- Students explore the connection between 3-D and 2-D shapes.

- ○ Draw the outline of the 3-D shapes and recognize the 2-D shapes which appear in the outline.
- ○ Use shadow of 3-D shapes to see the 2-D shapes on them
- ○ (Students learn properties of light and shadow simultaneously)
- ○ Play the game 'Who am I' to practise naming shapes correctly.
  (Refer Annexure for the instruction)

D. Assessment

Performance Task 1

Show them a picture and let the students name all the shapes that they see in the picture.

Performance Task 2

Instruct children to use any shape they see in their environment and using a torch ask them to say which 2-D shape do we get on the wall as a shadow.

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

- Reflective Questions
  - i. What is this shape called?
  - ii. What shape can you see inside this shape?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- Self-Instructional material, Key Stage I, Class PP, Volume -IV
- National School Curriculum, Mathematics for PP – XII
- Concrete Objects

F. Game

Game: Who am I game?
Instruction:
Teacher reads out the attributes 3-D and 2-D shapes.
Students take turns to identify the shape described.
Students will be rewarded with candies or points for correct identification of the shapes.

Topic: PP-E1 Collect and Organise Data and Interpret Data (Pictorially, in Chart Form)

[450 minutes]

Introduction

Data is a collection of facts or opinions. Data may be collected for a purpose through a planned design, or may be already available. Collecting data can help measure a general state of affairs, not limited to specific cases or events. When data is gathered, tracked and analysed in a credible way over time, it becomes possible to measure progress and success (or lack of it).

Utility and Scope

We use data to extract certain understanding and meaning out of it; to predict future events under similar situations; to confirm certain assumptions; and to help make decisions.

A. Competency

- Collect, organise and interpret data using pictures and charts and answer simple questions related to real life situations.

B. Objectives

- Respond to questions of interest (weather, favourite snack, more boys or girls, etc.)
- Perform Simple experiments and record the responses.
- Establish and organise the collected data pictorially (using pictures, or charts)
- Predict results and discuss the finding of the collected data.

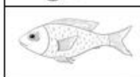
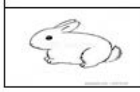
C. Learning Experiences

- Students explore how to collect data using simple questions.
  - Respond to simple questions of interest.
    Example: Which animal is your favourite?
  - Record responses on a chart.
    Tick beside the picture of their favourite animal on a chart.
    Teacher might like to be the first respondent and show the class how to do that.

The size of the group from whom students collect data should be fairly small at this stage, for example 10 or fewer.

Discuss values of loving and taking care of animals.

Example of a chart:

- ○ Students interpret the collected data in their own language.

- Students explore performing experiments to collect data.
  - ○ Perform simple experiments.
  - ○ Example: Picking out coloured cubes from a jar.
  - ○ Record responses using appropriate charts.
  - ○ The maximum number of trials/responses is to be 10 or fewer.
  - ○ Interpret the collected data.

- Students explore collecting data using yes/no questions.
  - ○ Ask questions with 'Yes'/'No' responses.
  - ○ Record data using the chart.

    The size of the group from whom students collect data should be fairly small at this stage (10 or fewer).

    Display appropriate charts and demonstrate how the chart is used for collecting the data from children with a 'yes' 'no' question.
  - ○ Discuss their interpretations.

- Students discuss how collecting data pictorially or using charts makes it easier to interpret data.

  Discuss where they can use data collection in real life experiences.

D. Assessment

Performance Task 1

Collect and record data by conducting a simple experiment.

Example: Landing the pebble on coloured circles while throwing it from distance

Performance Task 2

Collect data for a Yes or No question from a small group (Question could be of student's choice). Share the collected data to the class. Interpret the collected data. Share how this data can be used.

Example, are you coming to my birthday party tonight?

After collecting data, students interpret their data and share how this data can help them organise a party.

Performance Task 3

Collect the data from their family members and predict the results. (Class PP Activity Book)

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

- Reflective Questions
  i. What can you conclude about our class?
  ii. How do you know which is more by looking at the collected data?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects /Manipulatives.

Topic: PP-E2 Concrete Graphs: (Actual Objects and People Graphs)

[400 minutes]

Introduction

Graphs are a common method to visually illustrate relationships in the data. The purpose of a graph is to present data that are too numerous or complicated to be described adequately in the text and in less space.

Utility and Scope

Graphs and charts condense large amounts of information into easy-to-understand formats that clearly and effectively communicate important points.

A. Competency

- Examine concrete graphs involving real objects and people to Interpret information presented through concrete graphs.

B. Objectives

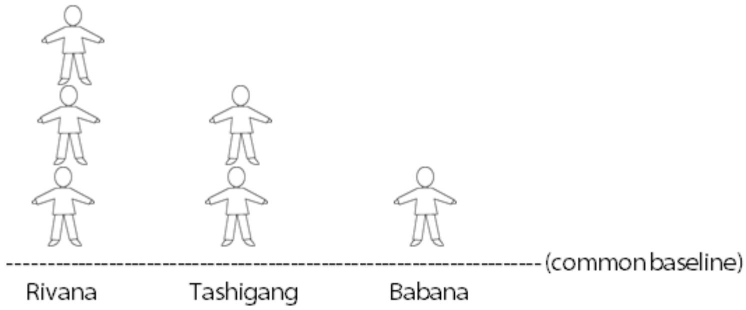
- Study concrete graphs using real objects and people.
- Exhibit the understanding of the importance of a common start line.
- Describe data focusing on one-to-one correspondence.
- Discuss interpretation of the formed graphs and its application.

C. Learning Experiences

- Students examine concrete graphs using real objects/people.

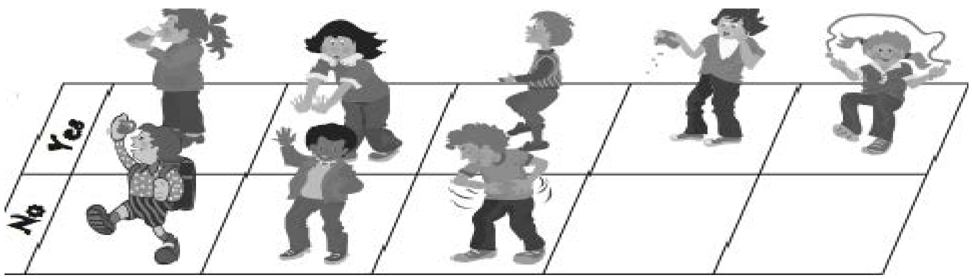
  Demonstrate how to construct a concrete graph on a graphing mat.
  - Decide on an appropriate topic for the graph. Then write it and place it on top of the graph.
  - Example: The name of their village/ the locality they come from.
  - Write the labels (name of the villages) and place it at the bottom of the graph.
  - Have students stand in the line of their village.

    Ensure the following:
    - A common baseline for students to start their line from.
    - If the students are standing in one -to -one correspondence.



- ○ Describe the concrete graph that has been created.
- ○ Compare the data presented for each village.
- ○ Explain the use of one-to-one matching as a strategy for comparing data.
- ○ Ask questions like: From which village do most of the students come from? This activity caters to other subjects such as geography as well as place-based approach.
- ○ Explains how graphs can be formed using real objects or people.

- Students explore concrete graphs with people using Yes/No questions.



- ○ Discuss the information presented by the concrete graph.
- ○ Interpret the graph.
- ○ Along with the teacher, students learn to collect data (recording the answers) on charts and simultaneously describe one to one correspondence.

- Students explore interpretation of concrete graphs with actual objects.

D. Assessment

Performance Task 1

Examine a concrete graph, made using actual objects, and answer simple questions related to the graph.

Performance Task 2

Create a simple concrete graph using actual objects on a provided graphing mat.

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

- Reflective Questions
  i. How does the graph make it easy to tell which there is more of?
  ii. Why is it important to match items when we make the graph?

E. Resources

- Understanding Mathematics, Student Activity Book for class PP
- Understanding Mathematics, Teacher's Guide for class PP
- National School Curriculum, Mathematics for PP – XII
- Concrete objects

Instructional Guide
Class I
Mathematics

Topic: I-A1 Compare Sets

[300 minutes]

Introduction

Sets in mathematics are simply a collection of distinct objects forming a group. A set can have any group of items, be it a collection of numbers, days of a week, types of vehicles, and so on. Every item in the set is called an element of the set.
Introduction on sets: https://www.cuemath.com/algebra/sets/

Utility and Scope

In maths, to compare sets means to examine the differences between numbers, quantities, or values to decide if it is greater than, smaller than, or equal to another quantity. We can use comparing skills when we compare our weight, height, marks, speed, sometimes distance, quantity, etc. So, practising comparing improves number sense.

A. Competency

- Demonstrate the ability to use familiar vocabulary to compare quantities in real life.

B. Objectives

- Estimate to compare the sets that total up to 20, using terms such as 'more', 'fewer', 'the same' (orally).
- Compare quantities by using words such as 'more', 'fewer', or 'the same' in sets (using concrete objects).
- Create sets where the number of items is made equal or added or taken away to use the words 'more', 'fewer', 'the same'.
- Use appropriate words to describe the comparison of sets found in their daily life.

C. Learning Experiences

- Students estimate the number of items in a set using terms such as 'more', 'fewer', 'the same' (orally) by looking at the materials found in the classroom.
  Example: Comparing the number of chalks and the number of pencils
- Students compare sets.
  - Demonstrate first and let students match objects one to one.
  - Line up the items of the two sets, parallel to one another to compare the number of items in each set.

- Use words like ‘more’, ‘fewer', or ‘the same’ to describe the comparisons made.
- Watch the video 'more', 'fewer' or 'same' to learn how to use the terms ‘more’, ‘fewer’ or ‘the same’.

- Students create sets with more, fewer, or the same number of items as the given set.
  Note: A maximum of 20 items to be used.
  - Count the number of items in the given set.
  - Create other sets with more, fewer, or the same number of items as the given set.
    Example: Go out to a flower garden and create sets with stones, sticks, and flowers.
  - Describe the sets created using the terms ‘more’, ‘fewer', or 'the same' accordingly.

D. Assessment

Performance Task 1

Describe comparison of sets (concrete and pictorial), with a maximum of 20 items using terms ‘more’, ‘fewer', or 'the same’.

Suggested worksheet: https://www.liveworksheets.com/qn869151yg

Performance Task 2

Create sets of their own (up to 20 items) by adding and taking away and then explain by comparing the sets using the words ‘more’, ‘fewer', or 'the same’

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

- Reflective Questions
  iii. How do you know whether one set has more than another?
  iv. 10 books are more than 10 pencils? Do you agree? Why?
  v. How would you count the number of students in your class? Why?

Template to Record Student Achievement

Strand(s): Number and operations	**Topic(s):** I-A1 Compare sets: Use phrases 'more', 'fewer', 'the same' Creating equivalent sets				
Competency: • Demonstrate the ability to use familiar vocabulary to compare quantities in real life.					
Name of the student	**Level of achievement**				
	Beginning	**Approaching**	**Meeting**	**Advancing**	**Exceeding**

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Introduction on sets : https://www.cuemath.com/algebra/sets/
  - More, Fewer Same | Good to Know | WSKG https://www.youtube.com/watch?v=ciJ_qM5rnv4
  - worksheet to compare sets -'more', 'fewer' or 'the same' - https://www.liveworksheets.com/qn869151yg

Topic: I-A2 Counting Numbers till 500 *[300 minutes]*

Introduction

Counting numbers/ natural numbers are the collection of numbers that we use to count, 1, 2, 3, 4, 5 and so on. Count defines the quantity or the total number of objects in a set or a group.

Numbers and counting began about 4,000 BC in Sumeria, one of the earliest civilizations to organise or to keep track of their crops, livestock and goods.
Egyptians invented different types of symbols for different numbers. They had symbols for one, which was just a line and for ten was just a rope.
Read more at: https://bit.ly/3L9MOED

Utility and Scope

Counting is important because the meaning attached to counting is the key conceptual idea on which all other number concepts are based. Children have often learnt the counting sequence as a rote procedure. They need to learn the meaning of counting by using counting skills in a variety of meaningful situations.

It develops an understanding of many ways that numbers are related to each other and to understand the relationship between numbers and quantities.

It enhances the numeracy skills, the ability to recognize and apply maths concepts in real life situations. Example: while counting, comparing, shopping, sharing and cooking.
Read more at: https://bit.ly/35ROrXn

A. Competency

Apply the concept of counting till 100 in sequence to describe quantity in real life situations and develop the number sense.

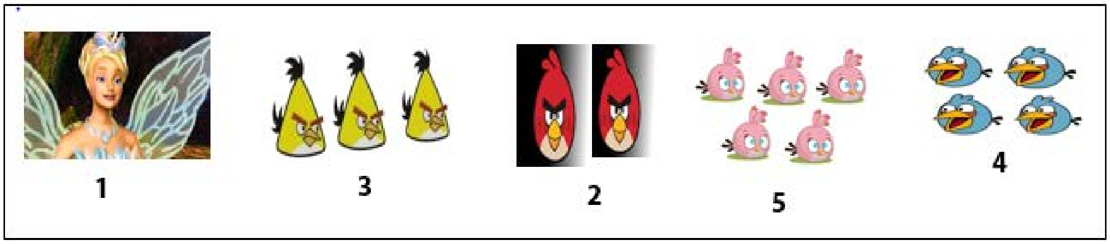
- Recognize the number arrangement patterns and use the concept to chant numbers beyond 100 till 500 from any starting point in the correct sequence.

B. Objectives

- Explain, counting order doesn't change the amount.
- Count in the correct sequence and recognize that the last number said is the count, using the concrete objects from the environment and singing counting rhymes.
- Recognise and count numbers till 100 in correct sequence.
- Chant numbers till 500 from any starting point in the correct sequence.

C. Learning Experiences

- Students practice counting till 100 in correct sequence.
  - Count from different points to realise that counting order does not change the amount.
  - Count in correct sequence and recognise that the last number said is the count, using base ten blocks, 100 charts, rice, puffed rice (zaw), seeds, twigs and pebbles, starting from different points till 100.



  - Point at the objects while counting and assign a number to each object.

    Example 1:
    Distribute a handful of bean seeds to each child.
    Put their fingers on the first bean seed and say, 1
    Count along touching the next ...2, 3....
    Count till their bean seed finishes. (till 100)
    Watch this video to count numbers from 1 to 100:
    https://www.youtube.com/watch?v=bGetqbqDVaA
    Number Song 1 to 100:
    https://www.youtube.com/watch?v=B5iAW-jnkPw

- Students explore and recognise number till 100

  Example: Develop two sets of number cards (1 -100). Paste one set of numbers on the chairs and distribute another set to the students. Send students out of the classroom. Let them enter and look for the same numbers on the chairs. They get to sit only if they can match their number with the numbers on the chairs.

  Discuss/ ask:
  Example: What number did you get?
  Are you looking for number 50?
  Which number do you need for you to sit on the chair?

- Students recognise numbers while playing, 'Pick Me, place me' game.

  Game: Pick Me, Place Me

  Materials required:

- A box / container
- Number cards from 1- 100 (small size)
- 100 chart without numbers
- A dice
- Counter

Instructions:

- Divide the class into a team of 6 members each.
- Tag each child with a number from 1 -6.
- Put the number cards in the box.
- Place the 100 chart and the box at the centre of the table.
- The first player rolls the dice and if he gets his number.
- The player can pick a number card from the box and read out the number.
- Then place/ paste it on the 100-chart.
- The player earns a counter and gets a second chance to roll the dice.
- If the player fails to get his number, the next player takes turn.
- The player with the maximum counters will read the numbers from 1 -100 on 100-chart.

- Students chant numbers till 500 from any starting point in the correct sequence.
    - Practice chanting numbers (orally) along with the song or rhymes.

  Watch this video: Number chant till 100 chant along and Number chant till 500 learning to count from 1 to 500.

- Students hop and chant greater than 100 but less than or equal to 500.

  Game: Hop you Go the Numbers

  Materials required:

- Ankle skip rope/ skipping rope/ rope
- Paper ball / soft ball

Instruction:

- Divide the class into teams of 5 members each.
- The first player will tie ankle skip/ skipping rope to their ankles.
- The player starts hopping by swinging the skip rope and other members chant the numbers.
- If the player stops, the next player takes over and starts chanting the numbers from where the first player has stopped.
- All the players take their turns to hop while chanting the numbers.

- The team which can chant greater than 100 but less than or equal to 500 shall get to play again.

D. Assessment

Performance Task 1

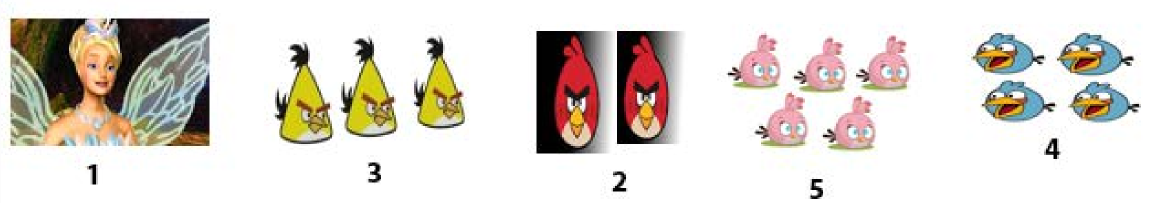
Provide 100-chart and counters/ bottle tops to each team/ individual child. Call out any numbers, students cover that number with bottle tops/ counters on 100-chart.

Performance Task 2

Provide cut out number strips of 100-chart to each team. Students arrange the number strips in the correct sequence and put it back.

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

- Reflective Question
  i. What number comes after 99?
  ii. Tell us the greatest number you know.
  iii. Do you think that counting order will change the amount? Look at the following diagram.



E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Count to 100 song: https://www.youtube.com/watch?v=bGetqbqDVaA
  - Introduction Source : https://bit.ly/3L9MOED
  - Utility and scope: https://bit.ly/35ROrXn
  - Number song 1 to 100, Learn to Count: https://www.youtube.com/watch?v=11eckLmJEMw

- Chant along (1-100): https://youtu.be/jQMUa2zIchs?feature=shared
- Learning to count from 1 to 500: https://www.youtube.com/watch?v=J5zesBIJrMU

Topic: I-A3 Representing Numbers concretely till 100 *[300 minutes]*

Introduction

A number is a mathematical object used to count, measure and label. The original examples are the natural numbers 1, 2, 3, 4, and so forth. Numbers can be represented in language with number words.

Individual numbers can be represented by symbols, called *numerals*; for example, "5" is a numeral that represents the number five. The most common numeral system is the Hindu–Arabic numeral system, which allows for the representation of any number using a combination of ten fundamental numeric symbols, called digits.

Source- https://en.wikipedia.org/wiki/Number

Utility and Scope

Knowing that numbers can be represented in a variety of ways is important for building the number sense. It helps to develop an understanding of numbers, their size, and their relationship with other numbers. Students will learn to represent numbers using concrete objects and symbols. Students relate symbols to concrete representations and number words.

A. Competency

- Represent and identify numbers to 100 using concrete objects, ten frames, and symbols, and use it in their daily life.

B. Objectives

- Students can chant numbers to 100 in sequence.
- Represent numbers to 100 using concrete objects (counters, snap cubes, base-ten blocks, fingers in teams and ten frames).
- Identify and write numerals in symbols and words till 100.
- Explain some situations where we count in our day-to-day life.

C. Learning Experiences

- Students explore representation of numbers till 100.
    - Go outside the classroom and count sets of objects they come across.
    - Demonstrate representation of numbers from 30 to 50 using different concrete objects.
    - Demonstrate representation of numbers using Ten Frames, and Base ten blocks.

Count and represent as: 30 and 1 more is 31, '31 and 1 more is 32', etc., 30 and 10 more is 40', '40 and 10 more is 50', etc.,

- Students read and write the numerals as well as the number names in sequence till 100.
  - Write numerals from 30 till 50.
  - Write numerals from 50 till 70.
  - Write numerals from 70 till 100.
  - Relate number words to numerals.
  - Further explore to write numbers for the representation and name numbers to 100 using the fun online activity [Activity link to write number names]

D. Assessment

Performance Task 1

Represent any five numbers from 0-100 using concrete objects.

Performance Task 2

Represent given numbers on ten frames concretely and pictorially.

Performance Task 3

Match number words to symbols correctly.

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

- Reflective Questions
  i. Show me a number that is more than ____ and less than ____?
  ii. How do you know ____is more than ____?
  iii. Count back from 100 to 50 in groups of 4.

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Online

Introduction to Numbers: https://en.wikipedia.org/wiki/Number

  - Write and Name Numbers to 100 (By 10s): https://www.iknowit.com/lessons/a-write-name-numbers-to-100-by-10s.html

Topic: I -A4 Ordinal Numbers: Recognizing ordinal numbers from 1st till 20th. Sequencing real life events

[250 minutes]

Introduction

Ordinal numbers tell us the positions of an item in an arrangement. Since the counting process requires labelling of things with numbering when objects or things are placed in an order, ordinal numbers tell their exact position, or they help to put things in order in a collection. The word "ordinal" comes from the Latin "ordo," meaning "row or series," which also gave us the word "order." Ordinals can be used as nouns, pronouns or adjectives, and can be written either as words ("third") or as numerals with suffixes approximating the sound of the word (1st, 2nd, 3rd, 4th, etc.).
Source: http://www.word-detective.com/2014/07/first-second-third/

Utility and Scope

Ordinal numbers are commonly used in mathematics, sciences, literature, and every walk of life. The purpose of using ordinal numbers is to indicate the position or order of things or objects. It is used to describe a way to arrange a collection of objects in order, one after another. It can be used to describe rank, seating arrangements, reading dates on the calendar, etc.
Source: https://en.wikipedia.org/wiki/Ordinal_numerical_competence

A. Competency

- Read and write ordinal numbers (1st-20th) and apply the concept to describe sequence in real life situations.

B. Objectives

- Read ordinal numbers till the 20th.
- Describe the position in the correct sequence, using ordinal numbers from 1st till 20th.
- Connect to real-life situations, stories, actions (situational, not symbolic)
- Write ordinal numbers from given samples (1st till 20th)
- Relate ordinal numbers in words to symbols (1st – First).

C. Learning Experiences

- Students recall reading and writing ordinal numbers, in correct sequence, till 10th.
  - Play the game 'Put Me Together' to practise sequencing of ordinal numbers till 10th.

  (Refer Annexure for instructions)

- Describe the position of things and people in our everyday life using ordinal numbers.
  - Students race and describe the position of runners using ordinal numbers.
    This activity could be related to the HPE lesson, the use of appropriate simple sentences for English.
    This activity also allows teachers and students to discuss values of honesty, integrity, and leadership skills.
    Examples of questions to discuss:
    i. Who stood first in the race?
    ii. Why do you think he/she was the first person to reach the end?
    iii. Can you give some situations where the ordinal numbers are used?
- Students explore the occurrence of events.
  - Describe occurrence of events and ordering events using terms such as 'before', 'after', 'first', 'then', and 'last'. Ask a series of questions about the event that happened.
    Example: Activities carried out daily from the time they wake up to the time they go to bed.
    The procedure to prepare a simple *Kewa Datshi* dish.

- Students practise using ordinal numbers from 1st till 20th in the correct sequence.
  - Display twenty objects and describe their position by chanting ordinal numbers from 1st till 20th in the correct sequence.
  - Chant ordinal numbers while walking in front of the classroom.
  - Describe position with ordinal numbers continuing from the different starting places.
  - Practice using ordinal numbers to describe positions using the online fun activity Ordinal numbers activity link

- Student practice reading and writing ordinal numbers both in symbols and words
  Example: 1st = first

  - Watch the video to learn about ordinal numbers Ordinal numbers

- Match ordinal numbers with the position of objects (pictures) to identify the symbolic representation of ordinal numbers.
- Match ordinal numbers with ordinal words.
- Practise relating ordinal numbers to words with the online worksheet https://www.liveworksheets.com/fv75473xh.
- Play 'Remember' game to practise matching ordinal numbers with words.

D. Assessment

Performance Task 1

Arrange ordinal numbers till 20th in correct sequence and read them correctly.

Performance Task 2

Write ordinal numbers (as word and as symbol) till 20th in correct sequence.

Performance Task 3

Describe position of students in a line using ordinal numbers, orally, and symbolically.
(Note: Maximum number of students in the line must be 20)

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

- Reflective Questions
    i. If I am in 15th place, how many are there in front of me?
    ii. Think of some situations where the ordinal numbers are used?
    iii. How will you use st, nd, rd, and th?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
    - Introduction to ordinal numbers-http://www.word-detective.com/2014/07/first-second-third/
    - Ordinal numerical competence - https://en.wikipedia.org/wiki/Ordinal_numerical_competence

- Ordinal numbers (Up to 20), worksheet - https://www.iknowit.com/lessons/a-ordinal-numbers-up-to-20.html
- Maths Ordinal numbers 1 -20: https://www.youtube.com/watch?v=Si7Wkt7AdfI
- Matching ordinal numbers with ordinal words- https://www.liveworksheets.com/fv75473xh
- Ordinal Numbers (Printable sheet for Game-Put Me Together) - https://www.superteacherworksheets.com/ordinal-numbers/ordinal-numbers-1.pdf

F. Game

A. **Game: Put Me Together**

Materials Required:

Picture cut into strips (Refer Resources for the printable samples of pictures to be cut)

Glue or cello tapes

Blank paper

Instruction:

Students work in teams.

Each team gets a set of paper strips.

In teams, students must:

- Identify the ordinal numbers written on the strips of papers.
- Arrange the strips of papers according to the ordinal numbers, in the correct sequence, from 1st to 10th.
- Paste the strips on to the blank paper to complete the whole picture.
- Identify the whole picture.

The team to complete the picture first wins.

B. **Game: Remember Remember**

Number of Players: In teams (4 to 5 students)

Materials Required: Ordinal Number cards with symbols (1st -20th)

Ordinal Number cards with words (First – Twentieth)

Instruction:

Each team gets a set of cards each (both ordinal numbers and ordinal number words).

Shuffle the cards to mix evenly.

Then display the cards upside down on the table.

Students take turns to pick up two cards at a time and they keep the cards if the two cards match (e.g. 10th and tenth) and they get to pick once more.

They put the cards back if the two cards do not match but they need to remember them so that they can pick up that card next time with the matching ones. Then the next member gets to pick up the cards.

Students take turns to pick up the cards until all the cards are finished.

The member with the highest number of cards in a team wins the game.

Topic: I-A5 Estimating Amounts to 20 *[200 minutes]*

Introduction

Estimation is a part of our everyday experience. It is an important aspect of quantitative thinking and critical life skills in a world in which we often need to make decisions based on inexact or undefined information. When we estimate, we find an answer that is close to, but not exactly, the accurate answer for a problem. Students at every grade level, from kindergarten to high school, should learn estimation skills.

Source: https://en.wikipedia.org/wiki/Estimation

Utility and Scope

Estimating skill is useful to figure out quantities at a glance. It is useful when one is shopping in a grocery store or sharing money or objects, etc. Estimation also helps students determine the reasonableness of answers to mathematical calculations.
Learning how to estimate is important, not only because estimating is something we need to do all the time, but also because proficiency at estimation is substantially correlated with many aspects of numerical understanding. Estimation can be used to develop a sense of numbers.
Source: Early development of estimation skills

A. Competency

- Demonstrate the ability to estimate the amounts till 20 using different strategies and effectively estimate fewer quantities encountered in their daily life.

B. Objectives

- Estimate simple amounts till 20.
- Develop estimation strategies such as chunking and using referents.
- Relate estimation to real-life situations.

C. Learning Experiences

- Practice subitizing (instantly recognizing the number of objects without actually counting them) till 10.
- Students try estimating quantities till 10.
  - First, estimate quantity in a handful (maximum of 5 items)
  - Validate their estimation by counting and check the closeness of their estimation.

- Next try estimating quantities till ten and again validate their estimation.
- Discuss the meaning of estimation.

- Students explore strategies for estimation using concrete objects and pictures, till 20.
  - By chunking.
    Chunking is breaking down quantities to smaller groups.
  - By using referents.
  - Referents are smaller, easily countable numbers such as 2, 3 , 5, etc.
    Watch the video Estimating to practice estimation of small counts

- Students explore estimating quantities till 20 in their surroundings.
  Example: Estimating the number of petals of the flowers that are found around the school and then count to validate the closeness of the estimation.

D. Assessment

Performance Task 1

Estimate the quantity, till 20, using either chunking or referents.
Play the game 'Guess and check' (Refer Annexure for instruction).

Performance Task 2

Estimate the quantity, shown by the printed set and explain the strategy used.

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

- Reflective Questions
  i. How many chalks do you think are in the box?
  ii. Was it easy to guess the answer?
  iii. How many steps do you think will be there from ...... to ....?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Estimation - https://en.wikipedia.org/wiki/Estimation
  - Early Development of Estimation Skills- Early development of estimation skills
  - Estimating! | Mini Math Movies - Estimating

F. Game

Guess and Check game

Materials Required:

20 objects in a bag for each team

Instruction:

- Students will play this game in teams.
- Each team will be given about 20 items in a box.
- They will be numbered serially.
- First, player number one picks up some items from the box and displays them on the table.
- Then number two estimates the number of items on the table.
- Then player number three records the answer on the given record sheet against their number.
- Then player number counts the items and puts the items back in the bag.
- Again, player number three records the count stated by player number two.
- In the next round, player number two picks some items, player number three estimates the number of items displayed on the table and player number four records the stated answer.
- It goes on till all the members get to state their estimation and the actual count of items.
- The player who has the closest estimation to the actual count wins the game in each team.

- Record Sheet

Serial Number	Estimated Answer	Actual Counts
1		
2		
3		
4		

Topic: I-A6 Counting 2-Digit Numbers *[200 minutes]*

Introduction

In math, skip counting can be defined as the method of counting forward by numbers other than 1. To skip count, we keep adding the same number each time to the previous number.

Introduction to skip count -https://bit.ly/3328gdA

Utility and Scope

The ability to count in 2s, 5s and 10s makes it easier and quicker to count 2-Digit numbers. The skill enables students to better understand numbers and patterns. It helps to count things a lot faster. Therefore, improving their problem-solving skills and preparing them for more complex mathematical concepts.

A. Competency

- Apply the idea of counting on and backward by 2s, 5s, and 10s, and count large quantities effectively in real life situations.

B. Objectives

- Count by 2s, 5s, and 10s using various ways.
- Count on or backward from a given number (up to a range of 20).

C. Learning Experiences

- Students explore counting by 2s, 5s, and 10s with body parts.
  - Tell the whole class to count the eyes of those two students one by one.
  - After that, let those students raise their hands so that the class can count the number of fingers and ask if there are any other ways to count (Demonstrate counts by 2s,5s, and 10s).
  - The suggested videos:
  - https://youtu.be/bpr1RXYzHC0 (count by 2s)
  - https://youtu.be/E7XdL5SN0Fw (count by 5s)
  - https://www.youtube.com/watch?v=Ftati8iGQcs (count by 10s)

- Students count by 2s, 5s, and 10s using base ten blocks, currency, and then 100- charts.
  - Discuss the patterns that we find while doing the counts.
  - Doing such counts help students count quickly and also learn about multiplication indirectly.

- Display picture cards/write numbers on green board up to 20. Let students count on and backward from any number.
    - Continue the number pattern (28, 30, _, 34, 36, 38, _)
    - Continue the number pattern (20, 18, 16, 14, _, 10, 8, _)
    - Discuss how skip counting is used in our daily lives.

  Example: There are 5 pencils in a box. I have 3 boxes of pencils at home. How many do I have at home?

D. Assessment

Performance Task 1

Continue counting by 2s, 5s, and 10s on and backward from a given number.

Performance Task 2

Find the missing numbers while counting by 2s, 5s and 10s.

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

- Reflective Questions
  i. Why do you think counting by 2s, 5s, and 10s is helpful?
  ii. How many fingers does each of us have in total? How do we use our fingers to skip count?
  iii. Which number would you choose to skip count to find the number of students in your class?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- Self-Instructional Material, Key Stage I, Class I, Volume-II
- National School Curriculum, Mathematics for PP – XII
- Base ten blocks
- Currency notes
- 100 chart
- Online
    - Introduction to skip count -https://bit.ly/3328gdA
    - Skip counts by 2s video- https://youtu.be/bpr1RXYzHC0
    - Skip counts by 5s video-https://youtu.be/E7XdL5SN0Fw
    - Skip counts by 10s video - https://www.youtube.com/watch?v=Ftati8iGQcs

Topic: I-A7 Place Value (2-Digit numbers): Identifying the value of digit placement. Using base ten block models

I-B3 Place Value Patterns *[300 minutes]*

Introduction

In maths, every digit in a number has a place value. Place value can be defined as the value represented by a digit in a number based on its position in the number. Place Value is as simple as knowing that "every value has a place". The place tells us “What kind”, the value tells us “How many" of that kind is being shown.
Source: https://mathsaustralia.com.au/math-u-see/is-place-value-important/

Utility and Scope

Place value is the basis of our entire number system. This is the system in which the position of a digit in a number determines its value. The number 42 is different from 24 because the digits are in different positions. In the standard system, called the base ten number system (or decimal system), each place represents ten times the value of the place to its right. You can think of this as making groups of ten of the smaller units and combining them to make a new unit.

A. Competencies

- Demonstrate the ability to apply the concept of place value of 2-Digit numbers to identify and represent 2-Digit numbers accurately.
- Examine place value patterns and explain the connection between numbers and place value models.

B. Objectives

- Model whole numbers to 2 places by grouping tens and ones.
- Distinguish between the place value of Tens and Ones.
- Explain how digit placement denotes the value of each digit of a number.
- Demonstrate the understanding of placement by using group-able to pre-grouped models of base ten blocks to:
  - Identify a 2-Digit number given in a place value chart.
  - Represent a 2-Digit number in a place value chart by identifying tens and ones correctly.

- Connect numbers to place value models concretely (e.g. what happens to the numeral when 10 is consistently added or taken away?)

C. Learning Experiences

- Students explore representation of 2-Digit numbers using base ten blocks.
  - Identify tens block (rods) and ones block (units)
  - Discuss what each of the blocks represents.
  - Represent 2-Digit numbers using base ten blocks concretely and pictorially.
- Introduce place value charts.
  - Explain the value of each place (tens and ones) on a place value chart.

- Students explore placement of 2-Digit numbers on a place value chart.
  - Represent 2-Digit numbers on a place value chart using base ten blocks first.
    - First use group-able models (i.e. using a stack of 10 units/ ones block to model numbers in the tens place).
    - Then use pre-grouped models (i.e. rod/tens block to model tens and units/ones block to model ones.
    - Explain the relation between Tens and Ones.
    - Watch the video to https://www.youtube.com/watch?v=24ZVly-n6G8 to learn how to group numbers – (Trim the video till 3:36 min).

  - Identify 2-Digit numbers given on place value charts.
  - Write the numbers in standard form.
  - Represent a 2-Digit number on a place value chart by identifying tens and ones correctly.

- Students explore place value patterns to connect numbers to place value models.
  - Explain what happens to numerals when a 10 is added or taken away consistently.

    Examples:

    10 added to 1 makes 11 (The 1 on the right side stays in ones place and the 1 on the left moves to the Tens place).

    10 added to 11 makes 21.

    10 added to 21 makes 31.

    10 taken away from 31 makes 21, etc.

- Discuss the relation between the value of Tens and Ones place.
    - Discuss the increase in place value in relation to the value of the place on the right.
    - Interpret that 10 ones = 1 ten

D. Assessment

Performance Task 1

Represent 2-Digit numbers using base ten blocks for the numbers provided and explain the representations.

Performance Task 2

Interpret and write 2-Digit numbers represented by base-ten blocks.

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 know about the place value of a number?
    ii. Describe 32 as tens and ones.
    iii. How are 12 and 21 different?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
    - Place Value – How Important Is It Really - https://mathsaustralia.com.au/math-u-see/is-place-value-important/
    - Place Value Grouping Video for 1st and 2nd Grade - https://www.youtube.com/watch?v=24ZVly-n6G8

Topic: I-A8 Comparing 2-Digit Whole Numbers *[200 minutes]*

Introduction

In maths, to compare means to examine the difference between numbers, quantities, or values. By comparing we decide if the quantity or value of something is more than, fewer/less than, or the same as the other.

In mathematics, benchmarks can be defined as the standard or reference point against which something can be measured, compared, or assessed.

Benchmark numbers are numbers against which other numbers or quantities can be estimated and compared.

Source: https://bit.ly/353bHkC

Utility and Scope

Comparing numbers is an important part of building a student's number sense. Number sense is the ability for a student to recognize a number, its value (ability to determine more and fewer, greater than, less than, and putting a group of numbers in order), and its relationship with other numbers. The last component is important, as it is built by comparing numbers.

Source: https://www.mrsbalius.com/2020/08/comparing%20numbers.html

A. Competency

- Exhibit the skill of comparing 2-Digit numbers using benchmarks to recognize the value of a number and its relation to other numbers.

B. Objectives

- Compare numbers using benchmark numbers.
- Make use of 'more than', 'less than' or 'is the same as' to describe comparison.
- Differentiate 2-Digit whole numbers with:
  - different tens
  - an equal number of tens

C. Learning Experiences

- Students revisit recognizing and reading 2-Digit numbers.
  - Play 'Hooray!' Game. (Refer Annexure for the instruction).
- Students explore comparison of 2-Digit numbers.
  - Use 10-frames, base-ten blocks and number lines to compare numbers

- Watch the video https://youtu.be/m3zPc4hd-i8 to learn how to compare numbers using the number line and counting tens.
- Express comparison using symbols (**<**,**>**, **=**)
- Watch the video https://youtu.be/C7D8glOsoYg to learn the use of symbols for comparison of numbers.

- Introduce the use of benchmarks to compare numbers.
  - Demonstrate comparing numbers using the benchmark.
    Examples:
    - Comparing 18 and 23. If the benchmark is 20, 18 is less than 20, and 23 is more than 20. So, 18 is less than 23. (18 <23)
    - Comparing 37 and 32. If the benchmark is 40, it is greater than both the numbers. But 37 is closer to 40 than 32. So, 37 is greater than 32. (37 > 32)
  - Compare numbers using the terms 'more than', 'less than or 'is the same as' verbally as well as in writing.
  - Express comparison using appropriate symbols.

- Students Compare 2-Digit numbers by looking at tens and express which number has more /less tens or which pair of numbers have the equal number of tens using number cards.
  Example: 17 and 37)
  - Compare numbers having more/ less tens
    Example: While comparing 17 and 37. 17 has 1 ten and 37 has 3 tens. 37 has more tens. So, 37 is greater than 17. (17<37)
  - Compare numbers having the same tens.
    Example: While comparing 23 and 28. Both the numbers have the same tens, that is 2 tens. But 23 has only 3 ones and 28 has 8 ones. 8 ones is greater than 3 ones. So, 28 is greater than 23. (23<28)
  - Practice comparing numbers with the suggested worksheet.
    https://www.liveworksheets.com/hl191753oy

D. Assessment

Performance Task 1

Compare at least five pairs of 2-Digit numbers using benchmarks and record the comparisons using correct symbols.

Performance Task 2

Compare pairs of 2-Digit numbers having different tens as well as the same tens and explain the comparison.

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

- Reflective Questions
  - i. Why do you think we need to learn about the place value of numbers?
  - ii. How are 12 and 21 the same? How are they different?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Mat, Counters, Number Cards
- Online
  - Teaching the skill of comparing numbers - https://www.mrsbalius.com/2020/08/comparing%20numbers.html
  - Benchmark - Definition with Examples - https://bit.ly/353bHkC
  - Comparing and Ordering using Number Line and Counting Tens- https://youtu.be/m3zPc4hd-i8
  - Comparing Numbers-https://youtu.be/C7D8glOsoYg
  - Comparing Numbers Worksheet- https://www.liveworksheets.com/hl191753oy

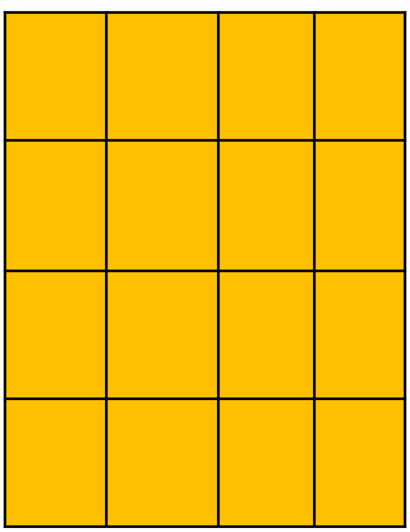
F. Game

Hooray Game

Materials Required:
Number Mat,
Number cards
Picture cards (With pictorial representations of numbers such as ten frames or base-ten blocks)

Instruction:

- Provide a mat and 16 number cards to each group.
- Place the mat at the centre of the table.
- The teacher shuffles the picture cards and number cards and takes a card from the deck. Show the card with the numeral or number name or representation.
- Students recognize and read aloud the number.
- Students check the number on their cards.
- If the number exists on their cards, they place the card on the number mat and shout out 'Hooray'!
- If the number does not exist, students in the group remain silent.
- The teacher repeats shuffling and taking out cards till all the cards in the teacher's deck finishes.
- The winner of the game is the group who finishes placing all their number cards on the mat first.
- Sample of Number Mat:



Variation: This game can be used to assess children's ability to recognize numbers from 1-100.

Note: Here educators have the freedom to modify, adapt or create their activities.

Topic: I-A9 Fractional Parts: Equal shares, Partitioning, one by one Exploring ‘Halves’ *[200 minutes]*

Introduction

Fractions are numbers that aren't whole; they are a part of a whole. A fraction (from Latin *fractus*, "broken") represents a part of a whole or, more generally, any number of equal parts. Fractions have two numbers, a numerator (the part-displayed above the line) and a denominator (the whole displayed below the line).
Source: https://en.wikipedia.org/wiki/Fraction

Utility and Scope

Fractions are important because they tell you what portion of a whole you need, have, or want. We use fractions every day. Some examples of fractions are: telling the time, dividing bills, setting aside budgets, and even splitting a share.

A. Competency

- Exhibit understanding of a whole and its part called fraction and apply the concept in real life situations to describe halves as parts.

B. Objectives

- Identify half as equal sets or equal parts.
- Represent halves using concrete objects in various ways.
- Discuss the use of fractions in real life experiences.

C. Learning Experiences

- Students explore ‘half’
  - Fold papers into two parts
  - Examine the parts of the folding to compare the parts
  - Analyse the comparison of parts.
  - Distinguish the folded parts as ‘equals’ and ‘not equal’
  - Identify equal parts as ‘halves’ and unequal parts as ‘not halves’.

- Explore half as one of two equal shares, part of a whole and part of a set using any 2-D shape cut-outs.

[Real life halves photos](#)

- Show how to represent halves using concrete objects and how it is written symbolically ($\frac{1}{2}$)
  - Discuss what the numerator and denominator means.
  - Watch the video : https://youtu.be/uUfLWCNkH6w

    Note: Teacher needs to show each shape one by one
- Express example of how fractions can be used in real life experiences
  - Money- half of Nu 10 is Nu 5 or dividing of cookies.
  - Sharing of fruits by cutting them into equal parts to show half (other examples: tree leaves, papers).
  - This activity allows teachers and students to discuss the values of sharing and how such actions are important in the human world.

D. Assessment

Performance Task 1

Identify halves and not halves. Write 'Yes' in the blank if the representation is a half and 'No' if not.

Suggested online worksheet: https://www.liveworksheets.com/js161367ia

Performance Task 2

Create half as a part of the set using concrete objects, manipulatives or shapes and explain the parts.

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

- Reflective Questions
  1. If I split a biscuit into two equal parts, are the parts halves or not halves? Why?
  2. How many halves are there in a whole?
  3. If 3 sweets make a half, how many sweets would make a whole?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-V
- National School Curriculum, Mathematics for PP – XII

- Concrete objects/Manipulatives
- Money
- Online
    - Introduction of Fractions - https://en.wikipedia.org/wiki/Fraction
    - Pictures showing Half - https://www.twinkl.com.au/resource/t-n-2920-real-life-halves-display-photos
    - Video on fractions -https://youtu.be/uUfLWCNkH6w
    - Identify halves and not halves online worksheet: https://www.liveworksheets.com/js161367ia

Topic: I-A10 Addition: Developing the meaning of addition. Recognizing the commutative property. Exploring strategies for finding sums till 20. Recording Addition *[300 minutes]*

Introduction

Addition is the process of adding two or more items together. In math, addition is the method of calculating the sum of two or more numbers. It is a primary arithmetic operation that is used commonly in our day-to-day life..
Source: https://www.cuemath.com/numbers/addition/

Utility and Scope

Addition is useful in everyday situations. Addition helps kids master the relationships between numbers and understand how quantities relate to one another. Some uses of addition are when we find the total number of people, or the total number of items or money we possess, when we calculate our grocery bills, or calculate the time, etc.
Source: https://www.skillsyouneed.com/num/addition.html

A. Competency

- Express the meaning of addition using models, diagrams, and symbols and effectively apply the concept to find the sum up to 20.

B. Objectives

- Explain the meaning of addition as putting together by using concrete materials.
- Draw inference that altering addends does not change the sum.
- Record additions using addition signs.
- Apply different strategies to add sums to 20.
- Use models, diagrams, and symbols to represent addition situations

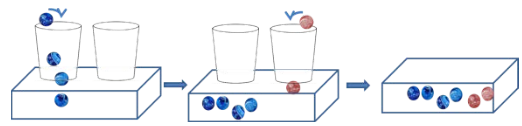
C. Learning Experiences

- Students discuss how quantities increase while combining objects till 10 (already learned in class PP)
- Students discuss addition as putting together.
  - Combine objects of two sets together and find the total.
  - Discuss how addition involves increase in quantity.

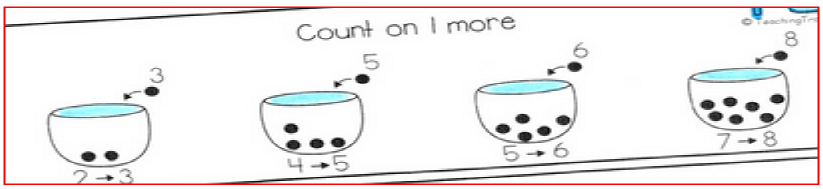
    - Introduce and discuss addition sign and the term ‘sum’
    - Practice writing addition sentences.

- Students explore the commutative property of addition
    - Realize that altering addends does not change the sum.
      Example: 4 + 2 = 6, 2 + 4 = 6).

- Students explore different strategies to add till the sums of 20.
    - Add by combining two sets.
      Adding objects to an existing set, then counting together or combining two existing sets and counting together.



    - Add using counting on.



    - Add using double facts for 10
      Watch the video https://youtu.be/At0quRa90rs to learn the fun song on double facts.
      Note: Trim the video till 1:06 – (10 + 10 = 20)
    - Add by making a 10.
      Watch the video https://youtu.be/q9h4skGoWJ8) to learn how to use ‘make a 10’ strategy for addition.
    - Adding relating to a known fact and counting on.
- Students explore representation of addition situations using models, diagrams, and symbols.
- Students could practice 'addition situations' through role-playing as a shopkeeper and the customer.

D. Assessment

Performance Task 1

Add the items in two sets and explain addition as putting together. Record the solutions, as addition sentences, using symbols correctly.

Performance Task 2

Solve addition problems using a strategy of their choice and explain the strategy used.
Play Dice Game
(Refer 'Understanding Mathematics, Teacher's Guide for class I' for instructions)

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

- Reflective Questions
  i. To add, do you need to count forward or backward?
  ii. Name one method to add and explain how to use it?
  iii. Which pairs of numbers will make the sum 12? _____ + ______ = 12

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Shopping items
- Self-created device to show addition (e.g., plastic cups and a box)
- Online
  - Addition - https://www.cuemath.com/numbers/addition/
  - Utility and scope: https://www.skillsyouneed.com/num/addition.html
  - Addition as double facts for 10 - https://youtu.be/At0quRa90rs
  - How to use 'make a 10' strategy for addition.https://youtu.be/q9h4skGoWJ8)

Topic: I-A11 Subtraction *[300 minutes]*

Introduction

Subtraction has been known to mathematicians for more than 6000 years. German Mathematicians first used the symbol of subtraction as markings on barrels. It was then used as an operational symbol in the 1500s. Later in 1557, it became common when Robert Recorded, a famous Physician and Mathematician, used it in the Whetstone of Witte.

Like addition, subtraction is also one of the oldest and the most basic arithmetic operations. The word subtraction is derived from the two words, 'sub' and 'tract,' which mean under or below and to pull or carry away, respectively. Subtraction is the term used to describe how we 'take away' one or more numbers from another. Subtraction is also used to find the difference between two numbers. Subtraction is the opposite of addition.

Utility and Scope

Real-life is full of opportunities for children to subtract, e.g., lending some toys to a friend and calculating how many toys will be left, or spending some money and working out how much money they should still have. Problems like this – about real things that children can see and touch – bring subtraction to life.

A. Competency

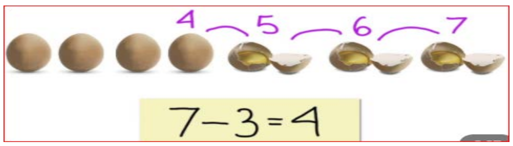
- Express the meaning of subtraction using models, charts, and symbols, and effectively apply the concept to find the differences between numbers.

B. Objectives

- Relate the meaning of subtraction as taking away or separating while exploring.
- Use concrete materials to take away objects physically to:
  - count the remainder
  - count backwards from the total
- Compare two sets to find how many more items need to be added to the smaller set to make it equal to the bigger set.
- Identify real life situations where subtraction is used.
- Record subtraction facts correctly.

C. Learning Experiences

- Students explore subtraction of 1-digit numbers from 1-digit numbers.
  - Subtract by taking away concrete objects from a given set and count the remainder.
  - Watch the video https://youtu.be/GyIOU2e_vHo to learn Subtraction For Numbers 1 to 9.
  - Watch the video Subtraction using fingers to learn how to subtract using fingers.
  - Subtract by counting backward from total using the number line.



  - Discuss how subtraction involves decrease in quantity.
  - Introduce subtraction sign (-) and the term 'difference'.
  - Record subtraction as subtraction facts using the subtraction sign and placing the minuend, subtrahend and difference correctly.
  - Watch the video https://www.youtube.com/watch?v=ShCq1BVVbQ0 to learn ways to subtract.
  - Practice subtraction by taking away objects with the online worksheet Printable worksheet
  - Practice counting back to subtract with the online worksheet. Subtraction worksheet
  - Play Card Game (instructions in the Annexure)

- Students explore subtraction by comparing items of two sets, concretely and pictorially.
  - Interpret how many more items need to be added to the smaller set to make it equal to the bigger set.

- Students discuss how subtraction is different from addition.
  - Subtraction involves decrease in quantity while addition involves increase in quantity.
  - Subtraction does not have the commutative property. The positions of the minuend and subtrahends cannot be altered to achieve the same difference.

- Students explore how subtrahend and difference can be exchanged using various representations.
  Example: 7-2 = 5 and 7-5 = 2

- Students explore subtraction of 1-digit numbers from 2-Digit numbers.
- Students discuss real life situations where subtraction is applied using simple sentences.
  This activity can be related to enhancing simple communication skills in English.

D. Assessment

Performance Task 1

Explain the meaning of subtraction as taking away by demonstrating subtraction concretely.

Performance Task 2

Solve a real life situation that involves subtraction of single digit numbers. Explain the strategy used to find the difference.

Example: Lhendup has Nu 10, he goes to a shop and buys a pencil worth Nu 5.

How much money will he get back from the shopkeeper?

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

- Reflective Questions
  i. Which strategy would you use to subtract? Why?
  ii. Where do you use subtraction in real life?
  iii. Which pairs of numbers will have a difference of 3? ____ - ____ = 3

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Concept of subtraction-https://youtu.be/GyIOU2e_vHo
  - subtract using fingers- https://www.youtube.com/watch?v=zeVdB9bzbkE

- different ways of subtraction- https://www.youtube.com/watch?v=ShCq1BVVbQ0
- Subtraction- http://cleverlearner.com/number-activities/printable-subtraction-worksheets-for-kindergarten.html
- Counting back to subtract with the online worksheet. https://www.kidsacademy.mobi/printables/grade-1/math/addition-subtraction/grade-1-count-back-to-subtract-substraction-worksheet.pdf

F. Game

Card Game

Material Required: A deck of cards with numbers 1 – 10.

Instruction:

- Students play in threes.
- While two players pick cards and find the difference, the third player judges their answers.
- Shuffle the cards.
- Two players take a card each from the deck and turn the card over.
- Take turns to turn over any two cards at a time.
- The players must then quickly subtract the lower number from the higher.
- The first person to answer the difference correctly takes the cards.
- If both players answer correctly at the same time, place the cards back on the table.
- The three players take turns to be the players and the judge.
- The game continues till all the cards in the deck have been taken.
- The winner of the game is the person with the maximum cards.

Variation: This game can be played in groups and can be used in addition too.

Topic: I-A12 Addition and Subtraction Facts: Exploring the relation between Addition and Subtraction. Representing Addition and Subtraction Facts

I-B2 Using patterns to solve Addition & Subtraction

[300 minutes]

Introduction

Addition and subtraction are intrinsically related. In any situation involving an addition, there is an equivalent subtraction situation and vice versa (inverse operations of each other). To put it simply, this means that they are the opposite. You can undo an addition through subtraction, and you can undo a subtraction through addition.

Patterns can be found everywhere in our daily lives and should be pointed out to small children. One can observe patterns in addition and subtraction facts. Additions involve increasing number patterns, while subtractions involve decreasing number patterns.

Utility and Scope

Being able to identify patterns in addition and subtraction enhances a student's ability to calculate sums and differences quickly and mentally. It also helps students understand the relation of numbers and the inverse relation of addition and subtraction.

A. Competencies

- Relate addition and subtraction facts using the model and apply the concept to solve real life problems involving addition and subtraction effectively.
- Apply identified patterns to solve addition and subtraction, then apply the pattern learnt in real-life situations.

B. Objectives

- Model situations to represent addition and subtraction facts.
- Infer that addition and subtraction "undo" each other.
- Use the concept of addition and subtraction facts in situations where:
    - the result is unknown.
    - the addend/subtrahend is unknown.

- Identify and use patterns in Addition or Subtraction facts.
- Explore and show the patterns found in the hundred charts.

C. Learning Experiences

- Students recall the concept of addition and subtraction by discussing
  - The meaning of addition and subtraction.
  - The representations of addition and subtraction.
  - Addition and subtraction facts.
  - Students explore the relation between addition and subtraction.
  - Represent addition and subtraction using the same set of concrete models or number lines.
  - Relate addition and subtraction.
  - Observe and discuss how they are inverse operations.

  Addition and subtraction undo each other
  Example: 3 + 4 = 7,   7 – 3 = 4 / 7 – 4 = 3

  - Watch the video: https://www.youtube.com/watch?v=bU-UcCnK-aM relationship Discuss stories or word problems to discuss the relation of addition and subtraction

- Students create addition and subtract fact families
  - Write addition and subtraction facts for concrete and pictorial representations.
  - Model addition and subtraction fact families using concrete objects or pictorial representations.
  - Watch the video https://youtu.be/aK3FKEZJKec to learn about addition and subtraction Fact Families.

Addition Facts	Subtraction Facts
3 + 2 = 5	5 – 2 = 3
2 + 3 = 5	5 – 3 = 2

- Students examine addition and subtraction facts.
  - Identify patterns in Addition or Subtraction facts.

  Example: **2 + 2 = 4, 2 + 3 = 5, 2 + 4 = 6**

- Discuss that if an addend is increased by 1 the sum also increases by 1 and if the subtrahend is decreased by 1, the difference also decreases by 1.
- Use the patterns to complete a given addition or subtraction fact.

- Students explore and discuss the patterns found in the hundred chart.

- Students apply the concept of relation of addition and subtraction to solve addition and subtraction problems.
  - When the result is unknown
  - When the addend/ subtrahend is unknown, etc.

    Example:
    - If 5 + 3 = 8 then 8 - 3 = ___,
    - If 9 – 2 =7, then 2 + ___= 9

- Students solve word problems by applying the concept of relation of addition and subtraction.
  Example: There are 10 students in a group and 6 of them are boys. How many of the students are girls?

D. Assessment

Performance Task 1

Create concrete or pictorial models of fact families and explain the relation between addition and subtraction.

Performance Task 2

Examine concrete models / pictorial representations and record addition and subtraction fact families.

Performance Task 3

Find the missing addend/subtrahend/sum/difference using a given addition or subtraction fact.

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

- Reflective Questions
  - i. Give one example of addition and subtraction fact families.
  - ii. How is addition different from subtraction?

iii. Which one do you like, addition or subtraction? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online

- Relationship between addition and subtraction video- https://www.youtube.com/watch?v=bU-UcCnK-aM
    - Addition and Subtraction Fact Families Videos- https://youtu.be/aK3FKEZJKec

Topic: I-A13 Mental Strategies: Sums & Differences to 10

[250 minutes]

Introduction

Mental math is a group of skills that allow people to do math "in their head" without using a pencil or a calculator. Mental math actually keeps our brains quick and sharp. The brain, like the muscles, gets stronger and more efficient with use. Mental math also greatly improves a person's number sense, the ability to understand the relationships between quantities.

Source: https://www.mathnasium.com/littleton-news-3-benefits-of-mental-math

Utility and Scope

Mental math helps children calculate quickly. Having a good mental math skill can be helpful in our daily lives in situations such as finding the total number of items, or the missing items or how many more is required. The skill is also effective while shopping, adding prices or calculating changes or while cooking, using proportional thinking to alter a recipe, etc.

A. Competency

- Apply various strategies to mentally calculate sums and differences till 10 and solve simple problems in real life effectively.

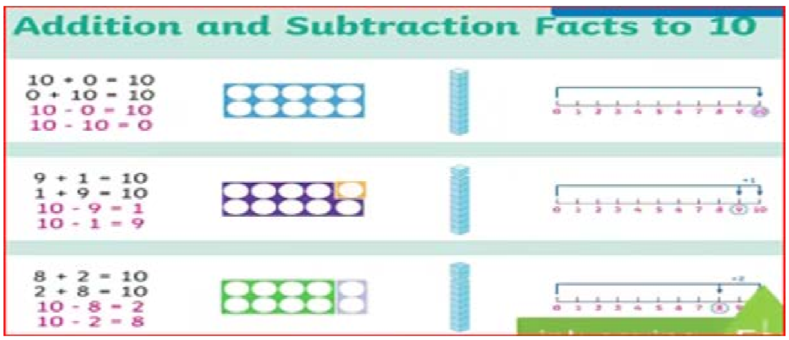
B. Objectives

- Apply various strategies to calculate sums and differences mentally.
- Choose an appropriate strategy to solve addition and subtraction problems mentally related to our real life situations.

C. Learning Experiences

- Students recall the understanding of a benchmark of 10, relating to a known fact, counting on, etc. (already learned in earlier topics).
- Students explore various strategies to add and subtract mentally.
  - Counting on
    Example: 9 – 5 = ?
    Simply count from 5 till 9. (6, 7, 8, 9, = 4 counts. So 9 – 5 is 4)
    Watch Video https://www.youtube.com/watch?v=u2MzqFdyzvc to learn mental subtraction using counting on and counting backward.

- o Use a benchmark of 10
  Example: To solve 8 + 4 =?
  Show how 8 can be made 10, by taking 2 from 4.
  Then show 8 + 4 can be written as 10 + 2 which makes it easier to find the sum mentally.
- o Relating to known facts
  Example: To solve 6 + 5 = ? , students could use any of the following known facts.
  5 + 5 is 10,6 is 5 and 1 more so 6 + 5 is 10 and 1 more, that is 11.
  6 + 6 is 12, 5 is one less than 6, so 6 + 5 is 1 less than 12, that is 11.
  6 + 4 is 10. 5 is 1 more than 4. So, 6 + 4 is 1 more than 10, that is 11.



- o Using Double facts
  Example: 2+ 2 = 4, 3 + 3 = 6, 6 – 3 = 3, 4 – 2 = 2

- Students explore word problems and solve them mentally.
  - o Discuss the information provided and the question asked.
  - o Solve the problem mentally.
  - o Explain the strategy used.
  - o Example questions:
  - o There are 2 cows and 7 sheep in a farm. How many animals are there in a farm?
  - o There are 8 apples in the basket. If you eat 3 apples, how many apples would there be left?
  - o Practice solving word problems using mental maths with the sample worksheet Sample worksheet

D. Assessment

Performance Task 1

Calculate sums and differences, till 10 using any two strategies.

Performance Task 2

Solve a relatable real life problem, involving sums or differences till 10, using mental calculation. Explain the strategy used.

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

- Reflective Questions
  i. Why do you think you would have to use mental calculations?
  ii. Tell all pairs of numbers which will make the sum 10.
  iii. Tell all pairs of numbers which will give the difference of 5.

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
  - 3 Benefits of Mental Math - https://www.mathnasium.com/littleton-news-3-benefits-of-mental-math
  - Subtracting numbers mentally by counting on and counting backward- https://www.youtube.com/watch?v=u2MzqFdyzvc
  - Word problems on Addition and Subtraction-https://www.pinterest.com/pin/115967759131807460/

Topic: I-B1 Copy, Extend, Create Patterns *[300 minutes]*

Introduction

Patterns can be found everywhere in our daily lives and should be pointed out to small children. When things are structured in a certain way that is predictable, it is a pattern. When some things repeat over and over again, there is a pattern. Patterns are seen everywhere in nature. For example: the pattern on *kira/gho*; patterns on plants; patterns in and around the classrooms; cycle of moon, etc.

Utility and Scope

Patterns help children make predictions because they begin to understand what comes next. They also help children learn how to make logical connections and use reasoning skills.

They play a key role in understanding mathematical ideas and relationships, and in understanding the order, logic, and concepts of mathematics.

Patterns can be used to create art, sing rhymes, follow norms, etc. Patterns will help children in understanding the working of the number system, including place value concepts, the number naming system, and the basic number operations.

A. Competency

- Identify repeating and growing patterns in the environment and apply the concept of patterns in real life situations.

B. Objectives

- Identify repeating and growing patterns focusing on attributes of shapes.
- Extend repeating and growing patterns.
- Represent repeating with numerals and growing patterns with numbers after counting the items.
- Create repeating and growing patterns in various ways.

C. Learning Experiences

- Students revisit repeating patterns (based on size, colour, and shape).
  - o Discuss repeating patterns observed in the environment
    Example: Paintings on the walls, doors, windows, clothes, pictures, etc.
  - o Identify and discuss cores of repeating patterns.
  - o Observe the core of a given repeating pattern and extend the pattern.
  - o Model repeating patterns concretely and pictorially.

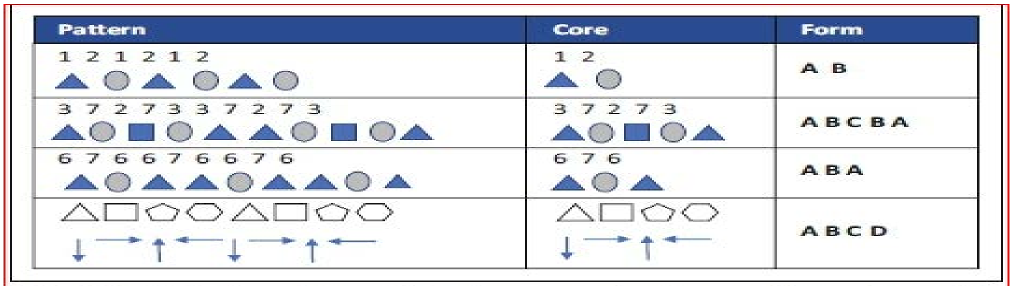


FIGURE 1: Illustration of the relational components of core and form of repeating patterns.

- Students explore growing patterns with concrete and pictorial representations.
  - o Examine growing patterns based on size and length.
  - o Explore growing patterns based on quantities.
    Realise that growing patterns can be represented with numbers.
    Count the number of objects in each set and write numbers below the set. Make students realise that 'growing' patterns can also be represented with numbers.
    Watch the video https://youtu.be/LvqFjQ29tFo to learn about repeating and growing patterns.
    This video is about different types of patterns. Show video till growing pattern only.
  - o Explore growing patterns in the environment.
  - o Observe given growing patterns and extend them.
    Explore growing patterns with fun worksheets.
    Sample worksheet: https://www.pinterest.com/pin/11470174036885473/
  - o Create one's own growing patterns.

- Students identify repeating and growing patterns.
  Practice identifying repeating and growing patterns with fun worksheets.
  Sample worksheet: https://www.pinterest.com/pin/3940718414231680/

- Students explore number patterns.
  - o Represent repeating patterns with numerals
  - o Represent growing patterns with numbers.
  - o Extend given repeating and growing number patterns.

- o Create new repeating and growing number patterns.

D. Assessment

Performance Task 1

Identify repeating and growing patterns and extend given patterns.

Performance Task 2

Create repeating and growing number patterns and explain the patterns created.

Performance Task 2

Identify patterns in the environment. Explain the pattern as repeating or growing patterns and model those patterns using manipulatives.

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

- Reflective Questions
  - i. How can you say if a given pattern is a repeating or a growing pattern?
  - ii. Where can you see patterns?
  - iii. You sleep every night and wake up every morning. What kind of pattern is this?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Material, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online
  - o Mathematics Key Stage 1 : Patterns https://youtu.be/LvqFjQ29tFo
  - o Growing pattern worksheet- https://www.pinterest.com/pin/11470174036885473/
  - o Growing and Repeating pattern worksheet- https://www.pinterest.com/pin/3940718414231680/

Topic: I-B2 Using patterns to solve Addition & Subtraction

Introduction

Patterns can be found everywhere in our daily lives and should be pointed out to small children. One can observe patterns in addition and subtraction facts. Additions involve increasing number patterns, while subtractions involve decreasing number patterns.

Utility and Scope

Being able to identify patterns in addition and subtraction enhances a student's ability to calculate sums and differences quickly and mentally. It also helps students understand the relation of numbers and the inverse relation of addition and subtraction.

A. Competency

- Apply identified patterns to solve addition and subtraction problems effectively.

B. Objectives

- Identify and use patterns in Addition or Subtraction facts.
- Explore and show the patterns found in the hundred charts.

C. Learning Experiences

Note: The Learning Experiences and Assessment for this topic has been included with I-A11.

Topic: I-B3 Place Value Patterns

Introduction

In math, every digit in a number has a place value. Place value can be defined as the value represented by a digit in a number based on its position in the number. Place Value is as simple as knowing that "every value has a place". The place tells us “What kind”, the value tells us “How many" of that kind is being shown.

Source: https://mathsaustralia.com.au/math-u-see/is-place-value-important/

Utility and Scope

Place value is the basis of our entire number system. This is the system in which the position of a digit in a number determines its value. The number 42 is different from 24 because the digits are in different positions. In the standard system, called the base ten number system (or decimal system), each place represents ten times the value of the place to its right. You can think of this as making groups of ten of the smaller units and combining them to make a new unit.

A. Competency

- Examine place value patterns and explain the connection between numbers and place value models.

B. Objective

- Connect numbers to place value models concretely (e.g. what happens to the numeral when 10 is consistently added or taken away?)

Note: The Learning Experiences and Assessment for this topic has been included with I-A6.

C. Resources

Online:

Introduction:https://mathsaustralia.com.au/math-u-see/is-place-value-important/

Topic: I-C1 Measurement: Concept and Principles

I-C2 Measuring Length using Non-Standard Units

[300 minutes]

Introduction

The term "length" refers to a measurement that determines the distance between two places. Comparing how much one feature of an object is compared to the identical feature of another thing is what measurement is all about. You'll measure lengths in non-standard units and compare them.

Ancient measurement of length was based on the human body, for example the length of foot, the length of a stride, the span of a hand, and the breadth of a thumb.
Source: Source link

Utility and Scope

We use length to talk about the distance between two points. Example: We use length to describe how long an object is; how tall our height is; how long a distance is.

It assists you in solving practical difficulties not only in the classroom but also in everyday life. It helps to know the exact value and quantity of something.

A. Competency

- Demonstrate the understanding of measurement through the application of different principles of measurement.
- Demonstrate the ability to measure length and distance using non-standard units to describe length in real life situations.

B. Objectives

- Explore measurement through hands-on experiences.
- Measure length using objects as non-standard units.
- Measure lengths using body parts as non-standard units.
- Justify the choice of a non-standard unit to measure length.
- Explain the importance of common starting points for measuring lengths using simple language
- Explain how the use of bigger units results in smaller counts and vice versa.

- Explain the need to repeatedly use a single unit to complete the measurement.

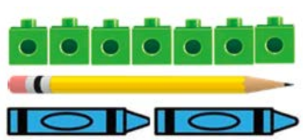
C. Learning Experiences

- Students revisit comparing length of objects directly (just by looking at the objects). And indirectly (using a third object)
- Introduce use of non-standard units for measuring length
  - Discuss the need for measuring length?
    When we want to check how long something is.
  - Demonstrate how to use smaller concrete objects to measure the length of objects.
  - Explain how to choose an appropriate unit for measuring certain lengths.

- Students explore measuring lengths using objects as non-standard units.
  - Choose appropriate non-standard units to measure length.
  - Measure the same length using different units and compare the measurements obtained.
  - Examine and explain the following while using non-standard units to measure length:
    - need to align the end points.
      The measurement is incorrect if an end point of an object and the starting

      point of the unit to be measured are not aligned.

    - Use of bigger units results in smaller counts and vice versa.



    - The need to repeatedly use a single unit to complete the measurement.

    - The need to arrange the objects (units) end to end.

- Students explore measuring lengths using their body parts.
  - Identify the lengths that can be measured using their body parts.
  - Use hand spans, arm spans and feet to measure lengths.
  - Compare their measurement to that of their friend's.
  - Discuss how body parts are not uniform units for measuring lengths.
  - Discuss the real life situations where such non-standard units are used for measuring lengths.
  - Watch the video https://www.youtube.com/watch?v=FrQqkwdAK2M to learn how to use non-standard units for measuring length.

D. Assessment

Performance Task 1

Measure the lengths of common objects using appropriate objects as non-standard units and justify the choice of the unit.

Performance Task 2

Measure the lengths using appropriate body parts as non-standard units and justify the choice of the unit.

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

- Reflective Questions
  i. Why is it important to have common starting points for measuring lengths?
  ii. What is the reason for obtaining different measurements while using your hand and the teacher's hand for measuring a length?
  iii. Which object would you choose to measure the length of your classroom? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete objects/ Manipulatives

- Online
  - Introduction https://www.google.com/search?q=ancient+measurement+of+length&oq=Ancient+measurement+of+length&aqs=chrome.0.0i512j0i22i30l9.1101j0j7&sourceid=chrome&ie=UTF-8
  - Length Uniform Non - Standard Units - https://www.youtube.com/watch?v=FrQqkwdAK2M

Topic: I-C3 Measuring Capacity Using Non-Standard Units

[200 minutes]

Introduction

The capacity of a container is the amount of something it can hold or contain. How much a container can hold depends on the space it has inside. A container which has more space inside has greater capacity than a container which has less space inside.

Early civilizations used standard measuring pottery to measure volume.

Using non-standard units for measurement is taught before standard units. This helps students to determine an estimation of how much a container can hold, without actually using standard measurement tools. It also helps students realize the importance of using standard units for measurement.

Utility and Scope

Understanding capacity is especially important when one is dealing with liquid measurement.

Being able to measure capacity using smaller containers helps students estimate how much a container can hold. They are also able to choose appropriate containers for assigned purposes.

A. Competencies

- Demonstrate the understanding of measurement through the application of different principles of measurement.
- Demonstrate the ability to use non-standard units of measurement to estimate and measure the capacity of common containers effectively.

B. Objectives

- Explore measurement through hands-on experiences.
- Estimate the capacity of a container in relation to smaller containers.
- Measure capacity of containers using non-standard units.
- Explain how the use of bigger units results in smaller counts and vice versa.
- Explain the need to repeatedly use a single unit to complete the measurement.
- Compare and order different containers based on their capacity.

C. Learning Experiences

- Students recall comparing the capacity of containers directly and indirectly.
  - Name some common containers.
  - Use phrases like 'holds more'/ 'holds less'/ 'holds the same' for comparing capacity.
  - Recall the purpose of using indirect comparison for comparing capacity of containers.
- Introduce measuring capacity using non-standard units.
  - Discuss the need to measure capacity.
  - Demonstrate how to use smaller containers to measure the capacity of a large container.
    Filling up a large container by pouring water into it using a smaller container filled with water.
  - Explain how to choose an appropriate container for measurement.

- Students explore using smaller containers as non-standard units for measuring capacity.
  - Choose appropriate non-standard units (smaller containers) to measure the capacity of a large container.
  - Estimate the capacity of the large container in terms of the smaller container.
    Example: How many glasses of water do you think the kettle can hold?
  - Measure the same container using different units and compare the measurements obtained.
  - Examine and explain the following while using non-standard units to measure capacity:
    - Use of bigger units results in smaller counts and vice versa.

    - The need to repeatedly use a single unit to complete the measurement.

    - The need to fill the unit with the same amount for each use.

- Compare the measurements obtained and order the containers based on their capacity.

- Students discuss the real life situation where the capacity of containers are measured using smaller units,
  Filling buckets with water using a jug.
  Filling a bottle with juice or water using a mug/glass.
  Measuring rice using a cup or *Phueta* .

  - Discuss how measuring capacity of containers using non-standard units is helpful in solving problems in real life situations.

D. Assessment

Performance Task 1

Estimate and measure the capacity of containers using a given non-standard unit.

Performance Task 2

Estimate and measure the capacity of containers using appropriate non-standard units. Explain the choice of unit.

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

- Reflective Questions
  i. Which one would hold more water, bucket or bottle? Why?
  ii. How will you compare the capacity of two containers?
  iii. Which object would you choose to measure the capacity of a bucket? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Containers of various sizes and with various capacities.

Topic: I-C4 Measuring Mass Using Non-Standard Units *[200 minutes]*

Introduction

The mass of an object is the amount of matter that the object contains. The mass of an object does not change whether it is on the Earth or on the Moon. Mass is a measurable attribute of objects.

The term 'mass' is derived from the Latin *massa* meaning a lump of dough or paste.

Using non-standard units for measurement is taught before standard units. This helps students to determine how heavy or light an object can be, without actually using standard measurement tools. It also helps students realize the importance of using standard units for measurement.

Utility and Scope

Mass is much more precise and can be used to measure very tiny things. Mass also serves as a universal unit of measurement. That means it can be used to communicate measurements to people all over the world. It can also be used to communicate with astronauts doing experiments in space.

Using non-standard units to measure mass is helpful in our daily life. For example, being able to use non-standard units to measure mass of an object helps students to make appropriate choices of objects that they would like to carry.

https://bit.ly/3Ap1bzW

A. Competency

- Demonstrate the ability to compare mass directly and indirectly to apply in day to day life using the concept and principles of measurement of mass.

B. Objectives

- Explore measurement through hands-on experiences.
- Estimate mass of an object in relation to the mass of smaller objects.
- Measure mass of objects using non-standard units.
- Explain how the use of bigger units results in smaller counts and vice versa.
- Explain the need to repeatedly use a single unit to complete the measurement.
- Compare and order different objects based on their mass.

C. Learning Experiences

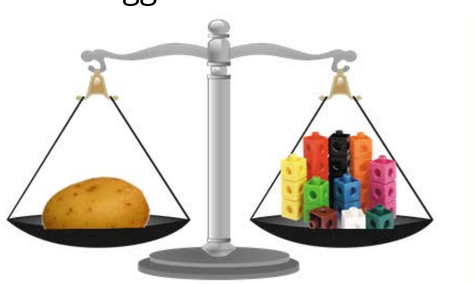
- Students recall comparing mass of objects directly and indirectly.
  - Name some common objects.
  - Use phrases like 'heavier'/ 'lighter' for comparing mass of objects.
  - Recall the purpose of using indirect comparison for comparing mass.

- Introduce measuring mass using non-standard units.
  - Discuss the need to measure mass
  - Demonstrate how to use smaller objects to measure the mass of a large object.

    Example: Use potatoes to measure the mass of a pumpkin.
  - Explain how to choose an appropriate object for measurement.

- Students explore using smaller objects as non-standard units for measuring capacity.
  - Choose appropriate non-standard units (smaller objects) to measure the mass of a larger object.
  - Estimate the mass of the larger object in relation to the smaller object.

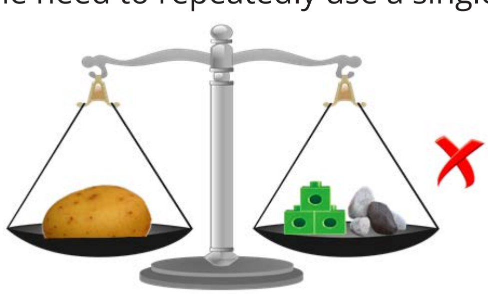
    Example: How many potatoes will weigh the same as the pumpkin?
  - Measure the same object using different units and compare the measurements obtained.
  - Examine and explain the following while using non-standard units to measure mass:
    - Use of bigger units results in smaller counts and vice versa.



The mass of the potato is about 25 linking cubes.

The mass of the potato is about 2 small bars of soap.

    - the need to repeatedly use a single unit to complete the measurement.



    - The need to use the same size and shape of units for measurement.

- Compare the measurements obtained and order the objects based on their capacity.

- Students discuss the real life situation where the mass of objects are measured using smaller units,
    - Discuss how measuring mass using non-standard units is helpful in solving problems in real life situations.

D. Assessment

Performance Task 1

Estimate and measure the mass of common objects using a given non-standard unit.

Performance Task 2

Estimate and measure the mass of objects using appropriate non-standard units. Explain the choice of unit.

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

- Reflective Questions
  i. How do you know the object you are comparing is heavy/light?
  ii. How would you compare the mass of two objects?
  iii. Why do we measure the mass of objects?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Pan balance
- Concrete objects
- Manipulatives
- Online
    - What is Mass? - Lesson for Kids – https://bit.ly/3Ap1bzW

Topic: I-C5 Area

[200 minutes]

Introduction

The area can be defined as the space occupied by a flat shape or the surface of an object. Area is the surface space covered. We measure the area of 2-D surfaces. The origin of the word area is from 'area' in Latin, meaning a vacant piece of level ground. The origin further led to an irregular derivation of area as 'a particular amount of space contained within a set boundaries'
Source: https://www.splashlearn.com/math-vocabulary/geometry/area

Utility and Scope

There are many real-life reasons where you would need to calculate the area of various shapes. For example, we need to know the area of our living room floor to cover it with a carpet; we need to know the area of a table to buy tablecloths for it, we need to know the area of a land if we need to build a house on it, etc.

A. Competency

- Exhibit the understanding of area as surface space to estimate the space required for objects in the real world.

B. Objectives

- Explain the meaning of area as 'surface space'/the amount of surface covered.
- Compare area directly (no units)
- Compare area indirectly (using a third surface)

C. Learning Experiences

- Students explore the meaning of area as the surface space or the amount of surface space covered by an object.
    - Trace the outline of objects on floor or other surfaces and describe that as the space used by a surface of the object.
      Example: Place a book on the table, outline its surface and describe the space within the outline as the surface covered by the book; the area of the surface of the book.
    - Cover a table by a piece of cloth and describe the amount of cloth used as area, the surface space of the table
    - Define area as a surface space or the amount of space covered, using simple language.

- Students explore the comparison of areas directly.
  Examples:
  Provide two cut-out of similar shapes with different sizes and let students predict which one has the bigger area.
  Provide two books, one small and the other large, and ask which book would take up more space on the table.
  - Compare the area of the two cut-outs/ books directly, just by looking at them.
  - Place one cut out/ book on top of the other to compare their area.
  - Describe comparison of area using appropriate terms.

- Students explore the comparison of areas indirectly.
  - Use the surface of a third object to compare the area of two surfaces.
  - Describe comparison of area using appropriate terms.

- Students discuss situations where they can apply the concept of comparing areas directly and indirectly.
  Examples:
  To check whether an object with a flat surface can fit in a box or not.
  To decide which tablecloth could be used on.
  To decide if we can safely place an object on a shelf.

D. Assessment

Performance Task 1

Compare area of surfaces directly using appropriate terms.

Performance Task 2

Compare the area of two surfaces, indirectly and justify the use of the third surface for comparison.

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

- Reflective Questions
  i. Why do you think we need to learn to compare areas?
  ii. Can we keep this box on the table safely? Why or why not?
  iii. Which object would you choose to measure the area of your table? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Concrete object
- Introduction Source:

https://www.splashlearn.com/math-vocabulary/geometry/area

Topic: I-C6 Time: Compare Time Duration. Reading Time by Hours

[200 minutes]

Introduction

Time is an on-going and nonstop arrangement of events that occur in sequence, from the past through the present to the future.

The invention of sundials in Ancient Egypt around 1500 B.C., marked the beginning of time measurement. The basic unit of time for Egyptians and for the next three millennia was the period of daylight. The Egyptians divided the time from dawn to sunset.

Utility and Scope

The concept of time refers to the length of time it takes for an event to occur. Acquire a sense of time as the length of time it takes for an event to occur. They will also figure out how to tell time to the hour.
Time is used to quantify, measure or compare the duration of events or the intervals between them, and even, sequence events.

A. Competency

- Apply the concept of time value in daily life by reading the time on analog and digital clocks in hours.

B. Objectives

- Compare time directly (no units) by comparing the duration for various tasks.
- Express time in 'hour' on analog and digital clocks.
- Create plans/schedules for daily activities using hours.

C. Learning Experiences

- Students compare time without using any unit.
  - Explore the durations taken for various simple activities.
  - Example: Collecting stones/leaves from the garden and bringing them back to the class.
  - Compare the durations.
    Example: Tashi took longer time than Deki. Sonam took the shortest time, etc.
    Through this activity, students can enhance their language and physical development. They can also discuss values such as punctuality, respect, and responsibility.

- Students explore reading time in hours on analog clocks.
  - Teacher demonstrates how to read time in hours on an analog clock.
  - Discuss what the face of the analog clock shows.

  The numbers from 1 to 12 show the time, hours.

  The long hand shows the minutes.

  The short hand shows the hours.
  - Explore analog clocks by moving the minute and hour hands.
  - Observe and discuss how a complete cycle of the movement of the minute hand moves the hour hand.
  - Realise that the minute hand points at 12 when we read the time in hours.
  - Read and express time in hours as __ o'clock using numerals as well as words.
  - Watch this video https://www.youtube.com/watch?v=8uzV1aTx6AM to read time based on an hour and minute hands on an analog clock.

- Students explore reading time in hours on digital clocks.
  - Teacher demonstrates how to read time in hours on a digital clock
  - Discuss what the numbers represent in the digital clocks.
  - Identify the colon as the separator for hours and minutes.
  - Observe and discuss how the hour changes after a complete cycle of the minutes from 01 -59.
  - Realise that the part shows 00 when we read the time in hours on a digital clock.
  - Read and express time in hours as __ o'clock, using numerals as well as words.
- Students use analog and digital clocks to represent time.
  - Watch this video https://www.youtube.com/watch?v=xdR7s8mwyp8 to tell the time.
  - Represent a given time (in hours) on analog as well as digital clock, pictorially.
  - Discuss the similarities and differences between digital clocks.
  - Recognize the time presented on an analog clock and represent it on a digital clock, and vice versa.

- Students discuss the use of time in their daily lives.
  - describe the time of the daily activities in hours,
  - Plan and create a schedule for their daily activities using hours.
  - Discuss the value of time.
  - Talk about the importance of time and how not to waste time in their daily lives.

D. Assessment

Performance Task 1
Identify time in hours on analog and digital clocks and write the time correctly.

Sample worksheet: Telling time worksheet

Performance Task 2
Model time said/given times on analog and digital clocks correctly.

Performance Task 3
Plan hourly activities for at least 3 hours after school and create a schedule.

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

- Reflective Questions
  i. When do you come to school? How long does it take to reach school?
  ii. The long hand on the clock is called________ hand.
  iii. What would happen to us if we don't have clocks or watches?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Hand-made analog wall clock
- Digital clock
- Online
  - Telling Time to the hour https://www.youtube.com/watch?v=8uzV1aTx6AM
  - Telling the Time for Kids: O' Clock Times https://www.youtube.com/watch?v=xdR7s8mwyp8
  - Sample worksheet for telling the time https://www.homeschoolmath.net/worksheets/grade1/telling_time_worksheets_gr1.php

Topic: I-D1- Spatial Sense: Visual Memory. Figure-Ground Perception

[200 minutes]

Introduction

Spatial sense is an intuitive feel for shape and space. It involves the concepts of traditional geometry.

Visual-spatial memory skills involve the ability to recall shapes and colours as well as their locations and movements.

Figure-ground perception is the ability to differentiate visually between an object and its background. It is a person's ability to separate an object from its surrounding visual field. The object that a person focuses on is called the figure; everything else is referred to as background, or simply ground.

Source: https://psychology.jrank.org/pages/246/Figure-Ground-Perception.html

Utility and Scope

Do you know why a child bumps, reads letters in reverse and has poor organisational skills? It shows the child must be having difficulty with visual-spatial relations.

Visual memory skills help children in letter/number recognition for reading, writing, mathematics calculations, fine motor tasks and movement-based activities. It develops their spatial sense by visualising, drawing, comparing, representing and transforming shapes and figures. It creates awareness of one's surroundings and objects in them. Can apply their spatial sense and knowledge of the properties of shapes and space to the real world, by remembering.

Figure-background perception is used when a child sees any object in the environment; recognizes printed words on white paper; differentiates one object from another for comparisons, etc.

A. Competency

- Exhibit development of visual memory by recalling objects or drawings and applying spatial sense of shapes and space to the real world.

B. Objectives

- Create visual memory by recalling objects or drawings which are no longer in view.
- Recognize figures against a complex background.

- Assemble parts to make a whole.

C. Learning Experiences

- Students develop visual memory.
  - Observe an object in the environment and close their eyes for 1 minute.
  Recall the image of the object and describe the object.
  Draw the image on the paper.

- Students develop figure-ground perception.
  - Identify figures in pictures.
  - Spot particular objects in the environment.
  - Play games that require finding objects or images in a complex background.
  - Watch this video https://youtu.be/fh-u9xdMcG8 to create awareness on spatial sense.

- Students assemble parts to create a whole.
  - Solve picture puzzles by assembling puzzle pieces to create the whole picture
  - Combine pattern blocks and create a new shape.

D. Assessment

Performance Task 1

Draw three images from the environment (field visit).

Performance Task 2

Combine various pattern blocks to create a new shape.

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

- Reflective Questions
  i. How can you differentiate an image from its background?
  ii. Will the size of a book change if you change the place? Why?
  iii. Will the colour of a shape change when you move it to a different place? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Different types of images
- Pattern blocks/ concrete objects
- Online
  - Figure-Ground Perception - https://psychology.jrank.org/pages/246/Figure-Ground-Perception.html
  - Spatial Awareness Game for children - https://youtu.be/fh-u9xdMcG8

Topic: I-D2 3-D & 2-D Shapes

[350 minutes]

Introduction

2-D shapes are flat and can be drawn on paper. 3-D shapes are solid shapes and occupy space. You can draw diagrams of 3-D shapes on paper, but these diagrams only show the view from one perspective.

Geometry began with a practical need to measure shapes. The word geometry means to "measure the earth" and is the science of shape and size of things. It is believed that geometry first became important when an Egyptian pharaoh wanted to tax farmers who raised crops along the Nile River. To compute the correct amount of tax the pharaoh's agents had to be able to measure the amount of land being cultivated.

Early Greeks (600 BC–400 AD) developed the principles of modern geometry beginning with Thales of Miletus (624–547 BC). Euclid was a great mathematician and was often called the father of geometry.
Source: http://www.thegeodes.com/templates/geometryhistory.asp

Utility and Scope

Learning shapes not only helps children identify and organise visual information, it helps them learn skills in other curriculum areas including reading, math, and science. Learning shapes also helps children understand other signs and symbols.

A. Competency

- Distinguish 2-D shapes from 3-D shapes and interpret constructions of various objects in the real world.

B. Objectives

- Identify and discuss the attributes of 3-D shapes
- Identify and describe the attributes of 2-D shapes
- Recognize and name shapes: rhombus, trapezoid, hexagon, cylinder, sphere, cone and cube
- Explain similarities and differences among shapes.

C. Learning Experiences

- Students sort 3-D shapes and 2-D shapes.
  - Examine the difference between 3-D and 2-D shapes.

  Example: Distribute a ball and a piece of paper to each team.
  Let them draw a circle on paper.
  Make them touch the ball.
  Let them throw, roll, dribble, kick or pass the ball. Ask if they can do the same with the circle drawn.
  Discuss if they would prefer a ball or a drawn circle. Why?
  - Discuss that 3-D shapes are solid objects while 2-D shapes are figures of flat surfaces.
  - Sort 3-D shapes and 2-D shapes.
  - Discuss the sorting rules used.

- Students explore 3-D (rectangular prism, triangular prism, rectangular pyramid, triangular pyramid, cube, cylinder, sphere and cone).
  - Discuss the attributes of the 3-D shapes (base, edges, corners/vertices, faces and apex)
  - Identify and name 3-D shapes.
  - Watch this video https://www.youtube.com/watch?v=ZnZYK83utu0 to learn and sing along to the song of 3-D shapes.

- Students explore 2-D (rectangle, triangle, circle, rhombus, trapezoid, hexagon)
  - Discuss the attributes of the 2-D shapes (sides and corners)
  - Identify 2-D shapes and name them.
  - Discuss the similarities or differences between 2-D shapes based on their attributes.

- Students explore prisms and pyramids
  - Examine and discuss the similarities and differences between the following shapes.
    - Rectangular prism and rectangular pyramid
    - Triangular prism and triangular pyramid.
  - Realise how shapes are named according to their base.

- Identify and name the shapes, 3-D and 2-D shapes.
  - Play 'Lift Me Up' game to practise identifying and naming shapes.

  (Refer Annexure for the instructions).

D. Assessment

Performance Task 1

Model 3-D shapes with dough/ mud and display them with their name on it. Describe the shapes using their attributes.

Performance Task 2

Build towers using 3-D provided shapes and explain the choice of placing a shape in a particular position.
Example: Why is a rectangular prism used as a base? Why is a cone used at the top?

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

- Reflective Questions
  i. Would you prefer a ball or a drawn circle to play? Why?
  ii. How would you differentiate between 3- D and 2-D shapes?
  iii. Which shapes do you find more around you?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Mud /clay/dough
- Online
  - Introduction: http://www.thegeodes.com/templates/geometryhistory.asp
  - 3-D Shapes Song For Kids | Spheres, Cylinders, Pyramids, Cubes, & Cones -https://www.youtube.com/watch?v=ZnZYK83utu0

F. Game

Game: Lift me up!

Materials Required:

- A cube with names of colours on its faces.
- A dummy body. (See the picture given below).
- Pictures of 2-D and 3-D shapes.
- Reward counters

Instruction:

- Divide the class into teams of 5 members each.
- Place the dummy body at the centre of the table.
- The first player rolls the colour cube and reads out the colour that appears on the top of the cube.
- The player earns a counter for naming the colour correctly.
- The player must identify and name the body part which is of the colour that has appeared on the cube.
- The player earns one more counter for naming the body part correctly.
- Then lift the body part and identify the shape underneath the part.
- Player earns 2 counters each for naming the shape correctly.
- The players take turns.
- If the player rolls a colour that had previously appeared, they must roll the cube again, till they get a different colour.
- If a player fails to name the shape correctly, the next player takes the chance and earns the 2 counters.
- The player with maximum counters wins the game.

Concepts and lessons related to many subjects can be taught through this simple game such as identification of colours and body parts in English, Dzongkha and science. We can inculcate the value of waste management, respect and fair play. This game helps students enhance their creativity, imagination and social skills

Topic: I-D3 2-D figures on 3-D Shapes

I-D4 2-D & 3-D Shapes in the Environment

[300 minutes]

Introduction

Whatever we see around us are all 3-D shapes including ourselves. Example: pencil, eraser, table etc. If we look outside, what do you see? All these are 3-D shapes. Faces of the 3-D shapes are the 2-D shapes. Example: surface of the table, surface of your book etc.

Utility and Scope

Without 3-D shapes, where will you live? How will you sleep? How will you eat, touch and study etc. 3-D shapes are an important part of our life.

When students are able to identify plane 2-D shapes in objects and structures around them they are able to consider why the given shape is suitable for its purpose. For example, wheels are circular so they roll freely, floors are usually rectangles because they are easier to build and things fit efficiently, etc.

Source: Plane Shapes

A. Competencies

- Demonstrate the ability to identify 2-D faces on 3-D shapes and recognize how three-dimensional objects are built from flat shapes.
- Identify 3-D and 2-D shapes in the environment and consider how a shape/structure is suitable for its purpose.

B. Objectives

- Identify similar faces in different solids.
- Distinguish 3-D shapes by 2-D faces.
- Identify 3-D and 2-D shapes in the environment of various sizes and proportions.
- Model the 3-D shapes spotted in the environment.
- Recognize how a shape is suitable for the purpose of its structure.

C. Learning Experiences

- Revisit names of 3-D and 2-D shapes learnt in the previous lesson.
- Students explore the faces of 3-D shapes.
  - o Trace the outlines of the surfaces of 3-D shapes on a paper or light a torch on the 3-D shape and identify the shadow as the 2-D shape.
  - o Identify the faces on 3-D shapes and 2-D shapes.
    The flat surfaces of 3-D shapes are called faces and are made up of 2-D shapes
  - o Identify similar faces on different solids.
    Example: Rectangular faces on rectangular prisms, rectangular pyramids, and circles on cone and cylinder.
  - o Distinguish 3-D shapes by 2-D faces.
    Example: Prisms have more rectangular faces, pyramids have more triangular faces, and cylinders and cones have circular faces.
- Students explore and identify 3-D and 2-D shapes in the environment.
  Take students for a field visit.
  - o Observe the objects or structures in the environment and identify the shapes. Draw and name the shapes in their notebook.
  - o Model the 3-D shapes spotted in the environment using mud/clay/dough.
  - o Watch this video https://youtu.be/7x95-tiFGTk to make connections with the real world.
- Students discuss how a structure is of a particular shape.
  - o Discuss how a shape is suitable for the purpose of its structure.
  - o Example: A ball is a sphere and it can roll in any direction from any side.

D. Assessment

Performance Task 1

Students to fill up the table as mentioned below to recognize faces of 2-D shapes in 3-D shapes

Sl. No.	3-D shapes image with name	Name of 2-D shapes found in that 3-D shapes
	Cylinder	Circle
	Rectangular prism	Rectangle, square

Performance Task 2

Colour 2-D faces on 3-D shapes and name them.
Example:

Performance Task 3

Create models of structures using 3-D and 2-D shapes.
(Refer Annexure for the instruction).

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

- Reflective Questions
  i. Why do you think a glass is in the shape of a cylinder?
  ii. What shapes can you see in the box? Why do you think these shapes have been used to make the box?
  iii. Will it be easy and enjoyable to play a cube shaped football? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Mud/clay/dough
- Online
  - Introduction: https://nzmaths.co.nz/ao/gm2-4-identify-and-describe-plane-shapes-found-objects

  - 3-D shapes in the environment https://youtu.be/7x95-tiFGTk

F. Annexure

i. **Instruction for creating models:**

Let students act as engineers and make models using 3-D and 2-D shapes in teams.

Example: Team 1 will make a model of house.

Team 2 will make a model of pole/ clock tower etc.

Provide the necessary materials such as coloured papers, dough, mud and concrete objects.

Display their model in different locations of the class.

Explain their model to the class. Explain the shapes they have used for their construction.

Topic: I-D5 2-D Shapes: Combining Shapes. Subdividing Shapes

[200 minutes]

Introduction

We can subdivide and combine two or more shapes to create another shape. We should be able to see shapes within shapes. Example: A rectangle can have two triangles. We also should be able to see the combination of different shapes.

Utility and Scope

Learning to see smaller shapes within a shape and to combine shapes to form a new shape will help students create new shapes. Such skill can be used in creative drawings, constructions and also to understand the structures around them.

A. Competency

- Combine and subdivide shapes to form new shapes and recognize how objects/structures are built or formed in the environment.

B. Objectives

- Combine shapes to compose new shapes with the provided shapes.
- Examine the resulting new shapes formed when shapes are subdivided.
- Recognize combinations of shapes in the environment.

C. Learning Experiences

- Students explore what other shapes can be formed when shapes are combined.
  - Combine traced outlines or cut-outs of 2-D shapes and explore new shapes formed.
  - Combine pattern blocks to form new shapes.

  Example: Two trapezoids when combined form a hexagon.
  - Watch this video Combination and subdividing to understand the combination and subdividing of 2-D shapes/ plane figures.

- Students explore subdividing shapes.
  - Subdivide 2-D shapes to see smaller shapes within a shape.
  - Example: A hexagon can be subdivided into two trapezoids; three rhombuses, a trapezoid, a rhombus and a triangle.
  - (Refer annexure for example)

○ Examine surfaces of 3-D shapes and spot the 2-D shapes on the surfaces of the 3-D shapes.

- Students explore the environment and examine combinations of shapes.
  - Identify a combination of 2-D shapes on the surface of a structure in the environment.
  - Draw the shapes which they see on the surface.
  - Model the structures examined and design the surfaces using a combination of smaller shapes, concretely.

D. Assessment

Performance Task 1

Create new shapes by joining traced outlines of the surfaces of objects and combining.

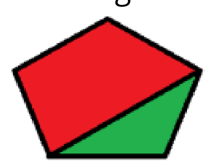
(Refer annexure for the instructions).

Performance Task 2

Design a painting for a surface of a structure of their choice using a combination of patterns. Present the design on an A4-sized paper.

Example: design a painting for the surface of a pillar or the surface of their bedroom wall, etc.

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



- Reflective Questions
  i. What shapes were combined to form the above shape?
  ii. Which 2-D shapes do you find mostly around you?
  iii. How would a car move if it is fitted with rectangle-shaped tiers?

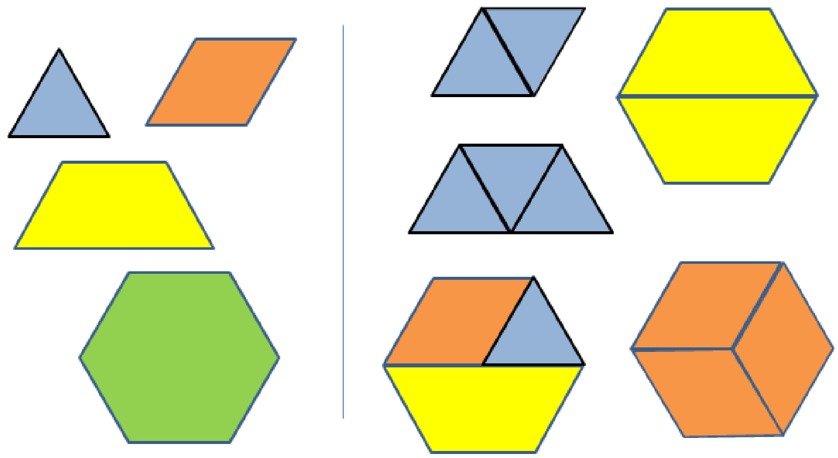
E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online

- Combining and Subdividing Plane Figures - https://www.youtube.com/watch?v=CrDnoRfI43s

F. Annexure

i. Examples of Combination and Subdivision of 2-D shapes.



ii. **Performance Task 1**
Instruction for

- Trace the outline of a surface of given concrete objects/ manipulatives.
- Trace another outline of a different shaped surface connecting with the first outline.
- Members take turns to trace outlines of different surfaces joining the previously drawn outline.
- Upon completion of the drawing, a member from each team presents their drawing to the class.

Topic: I-D6 2-D Reflective Symmetry

[200 minutes]

Introduction

A shape is symmetrical when it is the same on both sides. A shape has symmetry if a central dividing line (a mirror line) can be drawn on it, to show that both sides of the shape are exactly the same. This line is called the 'Line of symmetry'.
In the 19th century the French mathematician, Evariste Galois, discovered the concept of symmetry.

Utility and Scope

Symmetry is a fundamental part of geometry, nature and shapes. It is easily noticeable in various arts, buildings, and monuments. Identifying symmetry can help students understand the design of shapes and objects in our world. One can use the idea of symmetry to enhance their skill in creative arts.
Source: https://bit.ly/33nKhW4

A. Competency

- Demonstrate the ability to recognize symmetry and create different types of symmetrical shapes in relation to nature and the real life applications.

B. Objectives

- Recognize symmetrical shapes.
- Create symmetrical shapes.
- Identify the use of reflective symmetry in the real world.

C. Learning Experiences

- Students revisit learning about halves.
  Discuss some examples of halves and not halves.
- Students explore symmetrical and asymmetrical figures.
  - Use cut outs of regular and irregular shapes.
  - Predict if a shape can be folded into halves or not and explain why they think so.
  - Fold the shapes into exact equal halves, without overlapping.
  - Explain that figures that can be folded/divided into identical halves are called symmetrical.
  - For figures that cannot be folded into equal halves, explain that the images that cannot be divided into identical halves are asymmetrical.

- Recognize the crease formed while folding the symmetrical figures as the 'line of symmetry'.
    - A line of symmetry is a line that cuts/divides a shape exactly in half.
    - A line of symmetry can run horizontally, vertically or diagonally.
- Watch this video https://www.youtube.com/watch?v=L3g9B5Hzzo4 learn more about symmetrical and asymmetrical shapes.
- Discuss that reflective symmetry is when a shape or pattern is reflected in the exact same way.
- The half of a symmetrical figure is the reflected image of the other half.

* Students explore reflective symmetry used in the environment.
    - Discuss the symmetrical objects found inside the class or at home.
    - Examples: Books, chalkboard, some of our clothes, cupboards, windows, carpets, etc.
    - Examine some alphabets and numerals and discuss the application of reflective symmetry.
    - Example: Letters, A, B, C, D, E, H,I, K, M,O, T, U, V, W, X, Y and the numerals 0, 3, 8.
    - Identify symmetry on the surfaces of buildings or other constructions.
    - Go outside the classroom and explore reflective symmetry in nature.
      Discuss how they are symmetrical.
      Examples: reflection of trees in the water, butterfly's wings, on some flowers, etc.
      Discuss values such as appreciating nature and being responsible towards conservation of the beauty of nature.
    - Watch the video https://youtu.be/YFzktJNmnPU to learn more about examples of real life symmetrical and asymmetrical objects.

* Students create models using reflective symmetry.
    - Draw shapes or images having reflective symmetry.
    - Create structures having reflective symmetry on surfaces. Explain their structure and the use of reflective symmetry.

D. Assessment

Performance Task 1

Identify symmetrical images and colour them.

(Refer Annexure for sample worksheet)

Performance Task 2

Find at least 3 objects having reflective symmetry on their surfaces and explain how each is symmetrical. **(**Example: leaves, flowers, etc.)

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

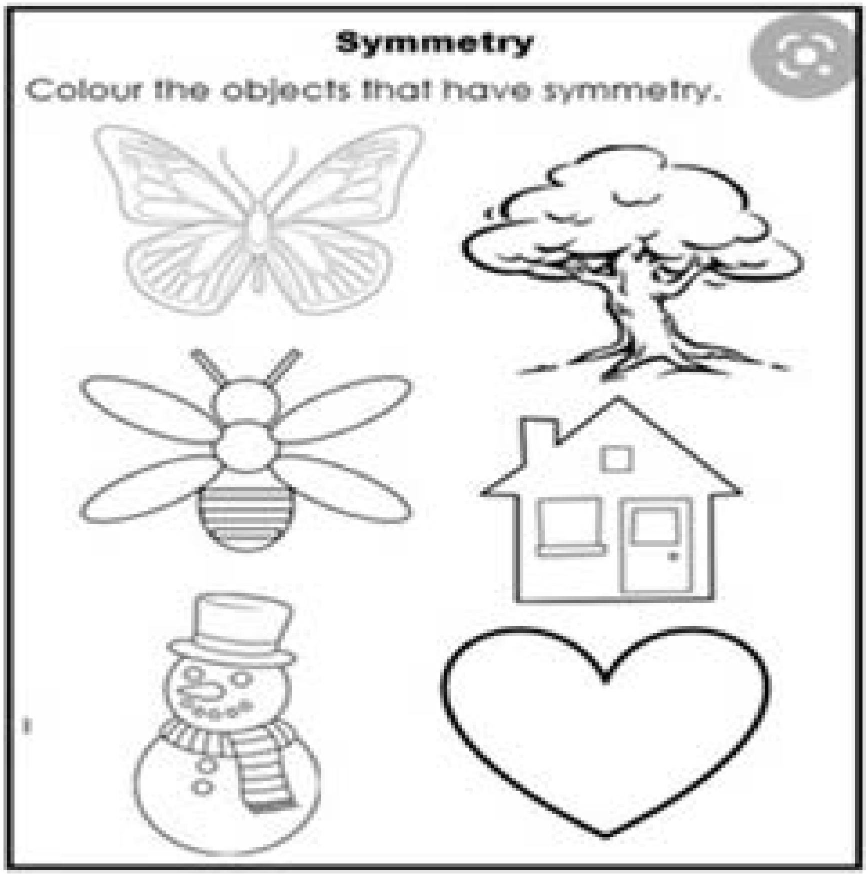
- Reflective Questions
  i. Where and how do you think you can use the idea of reflective symmetry in your life?
  ii. Where do we find the line of symmetry on a folded paper?
  iii. Does a line of symmetry divide a shape into two equal parts? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online
  - Utility and scope: https://bit.ly/33nKhW4
  - Symmetrical And Asymmetrical Shapes - https://www.youtube.com/watch?v=L3g9B5Hzzo4
  - Intro to Symmetry: All About Symmetry for Kids https://youtu.be/YFzktJNmnPU

F. Annexure

i. Sample worksheet for performance Task 1



Topic: I-E1 Collecting Data

[250 minutes]

Introduction

Data is a collection of facts or opinions. Data may be collected for a purpose through a planned design or may already be available. We use data to extract understanding and meaning out of it.

The first forms of early data were in the form of tally or tick marks. These were collected in order to keep track or record inventories such as food for ancient civilizations. Later the abacus was invented to help with the calculations of such records. Then, other data related to astrological studies and time-keeping resulted in scientific discoveries.

Utility and Scope

Collecting data can help:

- Measure a general state of affairs.
- Predict future events under similar situations.
- Store and analyse important information.
- Confirm certain assumptions and to help make decisions.
- Track and analyse in a credible way over time.
- Measure progress and success (or lack of it).

A. Competency

- Demonstrate the ability to collect data by designing simple questions and recording responses to collect information in real life.

B. Objectives

- Design simple questions requiring 'Yes' or 'No' responses (orally) to collect data.
- Record responses (collecting data) appropriately.
- Use tallies to organise and present the collected data.

C. Learning Experiences

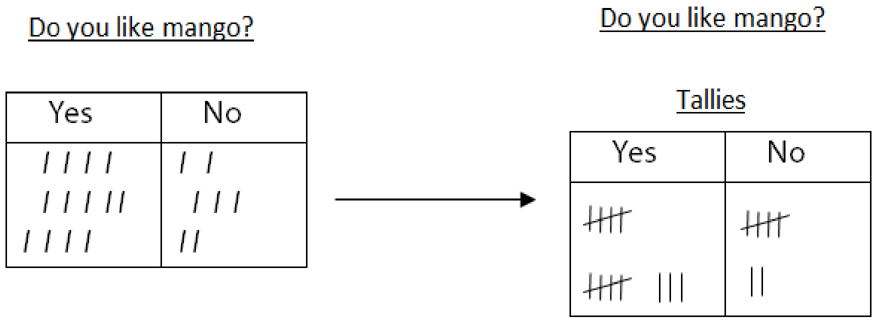
- Students revisit and collect data.
    - Present a simple question for students to respond with a 'Yes' or 'No' answer. Example: Do you like mango?
    - Demonstrate how to record responses.
    - Let students describe the collected data. Students can enhance their communication skills while using simple sentences, both in English and

Do you like mango?

Yes	No
/ / / /	/ /
/ / / / /	/ / /
/ / / /	/ /

Dzongkha. They can also learn the value of respect and good manners.

- Demonstrate how to use tallies to organise the collected data.



  - Watch the video https://youtu.be/XI8gcG-iL0U to learn how to draw tallies.
  - Let students describe the organised data.
  - Discuss how using tallies organise data helps a viewer to interpret the collected data.

- Students practise collecting data in teams.
  - Take students for a field visit.
  - Example: Provide charts to each team.
  - Let them observe the colour of the flowers.
  - Count and record their findings.
  - Let them record on the chart.
  - Watch this video: Reading tally charts to learn how to record using a tally chart.

  Through such activities students get connected with nature and develop appreciation for the things around them. They can also enhance team spirit and communication skills.

Colour	**Tallies**	**Number**
Blue		
Yellow		
Red		
Others		

- Students explore designing questions and collecting data.
  - Design a simple question that requires a yes or no answer.
  - Collect data for the question
  - Use tallies to organise data.
  - Describe the organised data.

D. Assessment

Performance Task 1

Design a simple and appropriate question and collect data.

Performance Task 2

Use tallies to organise and present the collected data. Describe the presented data.

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

- Reflective Questions
    i. Do you think your data will change if you ask this same question after next week?
    ii. How does tally make it easy for you to tell the number for each answer?
    iii. Why do we collect data?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instruction Material, Key Stage I, Class I, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online
    - How to Do Tally Marks- https://youtu.be/XI8gcG-iL0U
    - Reading and Adding Tally Marks - https://www.youtube.com/watch?v=qP6lADOtEF8

Topic: I-E2 Graphs: Creating Concrete Graphs. Interpreting Picture Graphs

[250 minutes]

Introduction

Graphs are powerful data displays since visual displays are easy to interpret very quickly. A Concrete graph is made using the actual objects or people on a graphing mat. A picture graph, or pictograph, is a graph used to display information that uses images or symbols to represent data.

Utility and Scope

Graphs and charts condense large amounts of information into easy-to-understand formats that clearly and effectively communicate important points. Graphs are powerful data displays since visual displays are easy to interpret very quickly.

A. Competency

- Demonstrate the ability to create concrete graphs and interpret pictographs to present and understand information in real life.

B. Objectives

- Create concrete graphs with representative objects while paying attention to:
  - Common base line.
  - One-to-one correspondence.
- Examine pictograph and Interpret information presented by a pictograph.

C. Learning Experiences

- Select a question that requires 'Yes' or 'No' answers and collect data.
- Students explore concrete graphs.
  Demonstrate how to construct a concrete graph on a graphing mat.
  - Decide on an appropriate topic for the graph. Then write it and place it on top of the graph.
  - Write the two labels and place it at the bottom of the graph.
  - Place the objects according to the data collected above the correct label.
    Ensure the following:
    - A common base line when starting to place the objects.
    - If the objects are arranged in one -to -one correspondence.
  - Describe the information presented by the concrete graph (the title, labels and the data for each label).
  - Discuss the result and interpret the graph.

Use one-to-one matching of the objects, in the two columns, to compare data and state which of the labels/categories have 'more' or 'fewer' objects.

- Students explore constructing concrete graphs with more than two categories of labels.
  Example: Favourite fruits, Colours of flowers, favourite sport, etc.
  Watch the video Concrete graph to learn how to construct a simple concrete graph using actual objects.
- Students create concrete graphs using representative objects instead of actual objects.
  Example: To create a concrete graph on favourite fruits, instead of actual fruits, students could use pattern blocks, counters or picture cut-outs of fruits.
  Watch the video https://www.youtube.com/watch?v=BnS1ZrURoOY to learn how to use representative manipulative to create concrete graphs.
- Students explore interpretation of pictographs.
  Explain that information of a concrete graph can also be presented using a pictograph.
  - Teacher presents a pictograph using the same data that was used to construct the concrete graphs.
    That way, students relate concrete graphs to pictographs.
  - Ensure the following:
    - Title and labels are placed appropriately.
    - The scale of the graph is 1 unit = 1 (i.e. 1 image= 1 count).
    - The same image is used to represent data for all the labels/categories
    - A common baseline to start drawing the images for all the labels.
    - One-to-one correspondence of images, for all the labels.
  - Students discuss the information presented by the pictograph (the title, labels and the data for each label).
  - Discuss the image used to represent the data.
  - Explain the need for one-to-one correspondence of the images.
    It not only helps with neater presentation of the data but also helps in interpreting the data.
  - Discuss the result and interpret the graph.
    Use one-to-one matching of the images among the labels to compare data.
    Answer questions related to the pictograph.
  - Watch the video Data Representation to learn how information is presented using pictographs. (Trim the video till 2:44 min).
  - Discuss the similarities and differences between a concrete graph and a pictograph.

D. Assessment

Performance Task 1

Create a concrete graph using representative objects (counters/ pattern blocks/ linking cubes) for a given data.

Performance Task 2

Interpret a given pictograph and answer questions related to the pictograph.
Sample worksheet: https://www.liveworksheets.com/dj67379li

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

- Reflective Questions
    i. What do we need to create a concrete graph?
    ii. Which one is easier for you to understand and use? A concrete graph or a pictograph? Why?
    iii. Have you seen graphs in and around our school? Where was it?

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- National School Curriculum, Mathematics for PP – XII
- Online
    - Making a Concrete Graph - https://www.youtube.com/watch?v=rg_JrM4BQD4
    - Kindergarten Math 12.4, Make a Concrete Graph - https://www.youtube.com/watch?v=BnS1ZrURoOY
    - Data Representation – Pictograph - https://www.youtube.com/watch?v=RQsHOeoz57s
    - Pictograph Practice **-** https://www.liveworksheets.com/dj67379li

Topic: I-E3 Probability of Everyday Events *[150 minutes]*

Introduction

Probability is the study of the chances of something happening. It is about predicting an event occurring in the future. Generally, we base most of our predictions on the pattern of what has already happened within the available data. Probability has its origin in the study of gambling and insurance in the 17th century.
Source: https://www.britannica.com/science/probability

Utility and Scope

Probability provides information about the likelihood that something will happen. Meteorologists use weather patterns to predict the probability of rain.
Source: https://www.iwh.on.ca/what-researchers-mean-by/probability

A. Competency

- Use probability language to describe the occurrence of simple future events appropriately and apply the concept of probability to make appropriate decisions.

B. Objectives

- Predict the occurrence of simple future events.
- Describe occurrence of future events using the terms 'impossible', 'possible', or 'certain'.
- Identify and describe different situations where we can use probability language.
- Make appropriate decisions according to predictions of future events.

C. Learning Experiences

- Students predict occurrences of simple future events by asking various questions.
  Examples:
  - Do you think you will sleep tonight?
  - Do you think the sun will not go behind the mountain today?
- Introduce use of probability language (impossible, certain, possible)
  - Explain what probability means.
  - Discuss the occurrence of simple and relatable future events.

- Use appropriate probability language to describe the occurrence of the future events.
- Watch this video https://www.youtube.com/watch?v=7XuNVVlD98g to learn how to use probability language to describe future events.

- Students explore different situations/future events to use probability language.
  - Describe the probability of future events using the terms 'Certain', 'Possible' and 'Impossible'.
  - Explain the choice of the word for describing the probability of the event.
  - Watch this video https://youtu.be/cjaE5RU_FC8 on predicting future events using probability languages (teacher explains possible, impossible and certain situations)
  - Discuss their decision towards a future event after learning the probability of that future event.

D. Assessment

Performance Task 1

Choose the correct word to describe the probability of stated future events, appropriately.

Example:

Read the following sentences. Describe the chances of each event happening, using the words Certainly, Possible and Impossible, correctly.

1. You will go to the shop later in the evening. ___________
2. You will eat metal for dinner tonight. _________
3. If today is Thursday, the next day will be Friday. _________

Performance Task 2

Describe three future events using the three different probability words.

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

- Reflective Questions
  - i. Do you think you will sleep tonight? Why?
  - ii. Tell us an event that will certainly happen.
  - iii. Tell us an event that will not happen at all.
  - iv. Tell us an event that will happen sometimes.

E. Resources

- Understanding Mathematics, Student Activity Book for class I
- Understanding Mathematics, Teacher's Guide for class I
- Self-Instructional Materials, Key Stage I, Class I, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Manipulative and/or concrete objects
- Online
    - Probability! | Mini Math Movies | Scratch Garden: https://www.youtube.com/watch?v=7XuNVVlD98g
    - Mathematics Key Stage 1: Probability Language: https://youtu.be/cjaE5RU_FC8
    - Introduction: https://www.britannica.com/science/probability
    - Utility and scope: https://www.iwh.on.ca/what-researchers-mean-by/probability

Instructional Guide

Class II

Mathematics

Topic: II-A1 Counting Beyond 100: Counting on and Backward

[300 minutes]

Introduction

In mathematics, the natural numbers are those numbers used for counting and ordering. In common mathematical terminology, words colloquially used for counting are 'Cardinal Numbers' and words used for ordering are "Ordinal Numbers".

An interesting and helpful method of continuing larger numbers can be by skip counting. In maths, skip counting can be defined as the method of counting forward by numbers other than 1. To skip count, we keep adding the same number to the previous number each time.

Source: https://en.wikipedia.org/wiki/Natural_number

Utility and Scope

Skip counting is a helpful skill in counting greater numbers of items. Counting by 2s, 5s, 10s, 25s, 50s and 100s makes it easier to count large numbers quickly. It enables students to enhance number sense and to see patterns in numbers. This skill will also be useful when students learn multiplication.

Practising skip counting using the number line provides the students with visual support that they are likely to need at this stage.

A. Competency

- Count numbers from 100 to 999 in various ways and apply the skill to count large quantities effectively.

B. Objectives

- Count numbers till 999 by counting in various ways.
- Count numbers till 999 backward in various ways.

C. Learning Experiences

- Students recall counting on numbers till 100 by 2s, 5s and 10s.
  - Play the 'Run up the Mountain' to practise skip counting.
  - Try counting numbers backwards.
  - Discuss some questions related to skip counting.

Examples:

- If you are counting by 2s, continue after 36, 38, …
- If you are counting by 10s, what will be the next number? 20, 30, …
- If you say the number 50, what could you have been counting by?

- Students explore counting on and backwards numbers from 100 till 999.
    - Use number lines and representatives to count by 2s, 5s and 10s.
    - Use number lines, base-ten blocks, representative pictures and dummy currency notes to count by 25s, 50s and 100s.
    - Count on from different starting points.
    - Say the numbers aloud while counting.
    - Try fun skip counting online activities https://mathsisfun.com/numbers/skip-counting.html
    - Discuss the difference of using smaller and greater numbers to skip count large numbers.

D. Assessment

Performance Task 1

Count numbers on from a given starting point by 10s, 50s and 100s number lines and dummy currency notes.

Performance Task 2

Skip count numbers backward from a given number (till 999), using a number of their choice.

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

- Reflective Questions
    i. If a number is more than 37, what other numbers must it be more than?
    ii. What number would you choose to count by, if you needed to count backward from 450?

Template to Record Student Achievement

Strand(s): Number and operations	**Topic(s):** II-A1 Counting Beyond 100: Counting on and Backward

Competency: • Count numbers from 100 till 999 in various ways and apply the skill to count large quantities effectively.					
Name of the student	**Level of achievement**				
	Beginning	**Approaching**	**Meeting**	**Advancing**	**Exceeding**

E. Resources

- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - III
- National School Curriculum, Mathematics for PP – XII
- Base-Ten Blocks
- Dummy Currency notes.
- Online
  - Skip Counting- https://mathsisfun.com/numbers/skip-counting.html
  - Source: https://en.wikipedia.org/wiki/Natural_number

F. Game

Game: Run Up the Mountain

Instruction:

Students stand in a circle.

Start running in a circle singing 'Run up the mountain, run, run, run'.

The teacher calls a number and students quickly form smaller groups of that number.

Discuss skip counting based on the groups formed.

Topic: II-A2 Relating Ordinal Numbers to Calendar *[300 minutes]*

Introduction

Although the dates are written as cardinal numbers it is read as ordinal numbers in English.
Ordinal numbers tell us the positions of an item in an arrangement. Since the counting process requires labelling of things with numbering when objects or things are placed in an order, ordinal numbers tell their exact position, or they help to put things in order in a collection.
The word “ordinal” comes from the Latin ‘ordo,’ meaning “row or series,” which also gave us the word “order.” Ordinals can be used as nouns, pronouns or adjectives, and can be written either as words (“third”) or as numerals with suffixes approximating the sound of the word (1st, 2nd, 3rd, 4th, etc.).
Source: video on cardinal number

Utility and Scope

A calendar provides a natural context for students to see and use the numbers from 1 to 31. They have an opportunity to read and represent numerals and to see the order of the first 31 numbers. The calendar is also a natural place for using ordinal numbers like first (1st), second (2nd), third (3rd), and so on, up to thirty first (31st).
Relating ordinal numbers to the calendar will help students to interpret the information provided by the calendar. This can then help students to plan their schedules and value time in real life. Reading dates appropriately as ordinal numbers helps students improve their communication skill in English.

A. Competency

- Interpret information delivered by calendar and read dates as ordinal numbers, appropriately.

B. Objectives

- Read and write ordinal numbers from 1st till 31st.
- Use ordinal numbers to read dates in the calendar.
- Interpret the days from the calendar.

C. Learning Experiences

- Recall reading and writing ordinal numbers till 20th.
- Students read and write ordinal numbers till 31st, using dates on a calendar.
  - Demonstrate on how to read ordinal numbers till 31st.
  - Demonstrate how to write ordinal numbers till 31st.
  - Demonstrate and explain how dates are read as ordinal numbers in English.
  - Practice reading dates as ordinal numbers forward as well as backward.
  - Discuss ordinal numbers in relation to months and weeks.

    Examples:

    How many months are there in a year?

    What month is it now?

    Which dates fall in the first week of the next month?
- Students discuss the important dates.
  - Discuss the important dates marked on the calendar.
  - Discuss the dates that are important in their lives.

    Example: dates for local festivals, birthdays, etc.

D. Assessment

Performance Task 1

Identify missing ordinal numbers in a given sequence (till 31st).

Performance Task 2

Read dates correctly to answer questions related to the calendar.
Example:
When is the Fifth King's birth Anniversary?
When did we start school this year?

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

- Reflective Questions

  i. What difference do you see in the way the dates are read and are written on a calendar?

  ii. Why do you think we need to learn to understand a calendar?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
    - Introduction to Ordinal Numbers - http://www.word-detective.com/2014/07/first-second-third/

Topic: II-A3 Estimating Numbers till 100 *[250 minutes]*

Introduction

Estimation is a part of our everyday experience. It is an important aspect of quantitative thinking and critical life skills in a world in which we often need to make decisions based on inexact or undefined information. When we estimate, we find an answer that is close to, but not exactly, the accurate answer for a problem. Students at every grade level, from kindergarten to high school, should learn estimation skills.
Source: https://en.wikipedia.org/wiki/Estimation

Utility and Scope

Estimating skill is useful to figure out quantities at a glance. It is useful when one is shopping in a grocery store or sharing money or objects, etc. Estimation also helps students determine the reasonableness of answers to mathematical calculations.

Learning how to estimate is important, not only because estimating is something we need to do all the time, but also because proficiency at estimation is substantially correlated with many aspects of numerical understanding. Estimation can be used to develop a sense of numbers.

Early on development of Estimation Skills

A. Competency

- Justify the estimate of counts till 100 and apply it to describe quantities in simple real life situations.

B. Objectives

- Estimate counts till 100 by applying estimation strategies such as chunking and using referents.
- Apply estimation to solve real life problems.

C. Learning Experiences

- Students revisit estimating counts till 20 using various strategies.

  Explain that estimating is not guessing, rather a rough calculation that gives us a value that is close to the actual value.
- Students explore estimating counts up to 100 using referents.

  Referents are smaller, easily countable numbers such as 5, 10, 20, etc.

- Students explore estimating counts up to 100 by chunking.

  Chunking refers to breaking the quantities into smaller groups.
  - Estimate quantities of concrete objects/manipulatives in sets.
  - Estimate quantities of items in sets in pictures.
  - Explore estimation of large quantities (up to 100 items) in the real environment.

    Example: Number of leaves on a plant. Number of cars at the parking. Number of students in the school, etc.
- Students discuss the real life applications of estimation
  - Discuss real life situations where estimation had been/could be used.
  - Discuss how use of estimation is helpful.

    Example: If we want to stack lots of books in a store, estimating the count of books can help choose the space to place the books.

    Such discussions help students express connection to life science and enhance their decision making skills.
- Students explore their own strategies for estimating counts.

D. Assessment

Performance Task 1

Estimate numbers of items in a few given sets (not more than 100 items) and explain the strategy they used.

Performance Task 2

Solve a given real life problem using estimation.
Example: How many biscuits could there be in a packet? How many packets would one need to have about 100 biscuits?

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

- Reflective Questions
  1. If there are 5 people in this group, how many people do you think are there in the class?

E. Resources

- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Concrete objects/Manipulatives.
- Pictures of sets containing items not more than 100.
- Introduction:
  https://en.wikipedia.org/wiki/Estimation
- Sense of numbers.
  Article on developing number sense

Topic: II-A4 Represent 3-Digit Whole Numbers: Using Base-Ten Blocks. Using Place Value Charts

II-B5 Place Value Patterns

[550 minutes]

Introduction

An important part of having a good number sense foundation is knowing that numbers can be represented in a variety of ways. As students learn to see numbers in different ways, it helps them to expand their understanding of the number and what it means.

The system of numbers we use is called the base-ten number system. It is a place-value number system in which 10 digits, 0 through 9, are used to represent a number. The position of a digit in a number determines its value. It is called place value. The value of each place is 10 times the value of the place to its right.

Source: video on place value

Utility and Scope

Counting numbers is very important to know so that we can understand that numbers have an order and also be able to count numbers easily. ... In our real life we can relate numbers to quantities.

Understanding the place value of digits in numbers helps in writing numbers in their expanded form. A place value chart can help us in finding and comparing the place value of the digits in numbers through millions.

Source: counting numbers

A. Competencies

- Read and represent 3-digit numbers concretely, pictorially and symbolically.
- Explain how place value increases in relation to the value of the place to its right.

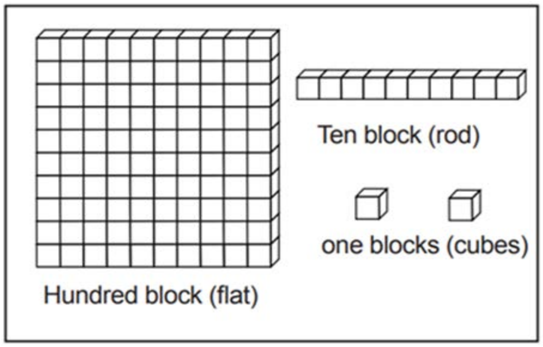
B. Objectives

- Model and interpret 3-digit numbers concretely (using base ten blocks), pictorially (using place value charts) and symbolically.
- Infer that each place value increases ten times the value of the place to its right
- Explain what happens to the number when the model is changed, adding or subtracting 10s and 100s concretely & symbolically.

C. Learning Experiences

- Conduct a brief revision of representing 2-digit numbers using base-ten blocks and place value charts.
- Introduce Hundreds block (flats) and relate it to Tens block (rods) and Ones block (units) to help students understand renaming numbers in different ways later.

  (An alternative to base ten blocks could be a bundle of sticks).



  - Introduce hundreds place, in a place value chart
  - Discuss how the value increases 10 times as a digit moves towards the left.
  - Discuss how a digit could be the same but its value depends on where it is in the number. (E.g. in 222 the three 2s have different values as per their placement).
- Students explore representing 3-digit numbers in various ways.
  - Model using base ten blocks (concretely and pictorially).
  - Express using a place value chart.
  - Model using dummy currency notes.
  - Write the number using symbols (numerals).
  - Discuss questions related to each of their representations.
  - Example: How are the models for 203 and 303 similar? How are they different?
- Students practise reading 3-digit numbers represented with base-ten blocks and place value charts, and written symbolically.
  - Discuss the value of digits in relation to how different currency notes denote different values.
  - Discuss relatable real life situations where 3-digit numbers are mostly used.
  - *Example:* Price of clothes or toys.

    Number of students in a school.

D. Assessment

Performance Task 1

Represent 3-digit numbers using base-ten blocks (concretely and pictorially) and place value chart

Performance Task 2

Explain the value of each digit for 3-digit numbers represented on a place value chart.

Performance Task 3

Read and write 3-digit numbers represented by base-ten blocks and on place value charts.

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

- Reflective Questions
  1. How many rods did you use to show 100? Why?
  2. How are the models for the numbers ____ and ____ alike? How are they different?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Introduction on Numbers - video on ways to represent numbers
  - Utility and scope, Counting Numbers - counting numbers upto 10

Topic: II-A5 Comparing 3-Digit Whole Numbers *[300 minutes]*

Introduction

In maths, to compare means to examine the differences between numbers, quantities or values to decide if it is greater than, smaller than or equal to another quantity. By comparing, we can also define or find by how much a number is greater or smaller.
Source: https://bit.ly/3zIbTkJ

Utility and Scope

Number lines and place value charts are useful models for representing and comparing numbers. It is easy for students to learn the "rule" that a number to the right on a number line is greater and a place value chart helps them see why it is greater.
The skill of comparing numbers is often applied in everyday situations. Example, when someone has made a choice based on quantities or price, describe quantity or value in comparison to another, interpret order of numbers, etc.

A. Competency

- Explain and use different methods to compare 3-digit whole numbers to express the value of numbers in comparison to other numbers.

B. Objectives

- Compare 3-digit whole numbers and explain the method used for comparing the numbers.
- State comparison of numbers orally and symbolically.

C. Learning Experiences

- Conduct a brief revision of comparing 2-digit numbers using a place value chart and representing 3-digit numbers on a place value chart.
- Students explore comparison of 3-digit whole numbers.
  - Compare 3-digit whole numbers using the number line.
  - Relate placement of 3-digit numbers on the number line to placement of 2-digit numbers learnt in class I.
  - Compare 3-digit whole numbers using a place value chart.

- Describe comparison of numbers using appropriate phrases such as 'greater than'/'less than'.
- Express comparison of numbers using appropriate symbols (>, <, =).
- Watch the video https://www.youtube.com/watch?v=hLsnpcP8hu0 to learn how to compare large numbers using appropriate phrases and symbols.

- Students explore ordering 3-digit numbers.
  - Order 3-digit numbers from least to greatest and vice versa.
  - Explain the strategy used.
- Discuss real life situations where comparison of numbers is used.

  Example: We compare prices while shopping.

D. Assessment

Performance Task 1

Using any method to compare pairs of 3-digit numbers and record the comparison using symbols (>, <, =).

Performance Task 2

Explain the method they used for comparing the 3-digit numbers

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

- Reflective Questions
  i. How do we know that 370 is more than 270?
  ii. Are 24 tens greater or less than 140? How do you know?

E. Resources

- Understanding Mathematics, Textbook for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
  - Introduction:
    https://bit.ly/3zIbTkJ
  - Comparing Large Numbers -
    https://www.youtube.com/watch?v=hLsnpcP8hu0

Topic: II-A6 Money *[250 minutes]*

Introduction

Money is an object that has a value placed on it, which allows for the trade of goods and services such as metal coins and papers. Children often see adults using money, exchanging currency notes when they buy things. As children grow and start to make choices, they learn that people, things, and money have value.

The Mesopotamian shekel – the first known form of currency – emerged nearly 5,000 years ago. In Bhutan, fine machine struck silver and copper coins were introduced in 1928, during the reign of the second King, *Druk Gyalpo Jigme Wangchuck.* The first series of banknotes issued by the Ministry of Finance and the Bank of Bhutan were all of the same size, which made it difficult to differentiate between the denominations. Then a new series was issued in 2006 with different size, colour and design. The currently used Ngultrum banknotes were issued to the public in 2013.

Source: https://intuit.me/3ouUZSf

https://www.rma.org.bt/history.jsp

Utility and Scope

The concepts and value of money forms the foundation for understanding the importance of spending, sharing, and saving. How to handle money and begin to make financial decisions are important life skills that can be taught as soon as children can count. Recognizing the value of each currency note helps children perform trading activities independently and effectively. It also helps children understand the difference between a "want" and a "need."

Source: article to gain concept of money

A. Competency

- Calculate change by investigating relations among currency notes (till Nu. 500) in our everyday life.

B. Objectives

- Examine and explain the relationship among currency notes (till Nu 500).
- Calculate change by carrying out trading activities.

C. Learning Experiences

- Discuss students' prior knowledge about money.
    - Show the dummy Ngultrum notes and let students share where they see those mostly.
    - Discuss their awareness of the value of the notes.
    - Discuss their experiences of using the Ngultrum notes.
    - Example: Using the notes while shopping and collecting change.
- Students explore the relation among various Bhutanese currency notes.
    - Identify the value of each of the notes. (Ngultrums 5, 10, 20, 50, 100 and 500).
    - Examine the relation among the notes by exchanging the notes of greater value with the notes of smaller value.
    - Explain the relationship in simple language.

      Example: Five Ngultrum 100 notes make Ngultrum 500.

      Ten Ngultrum 50 notes make Ngultrum 500, etc.
- Students participate in fun trading activity to examine relations among the currency notes and calculate change.

  Note: Change here means the money you get back when you hand out more money than the cost of something that you buy.

  This activity allows students to apply addition and subtraction skills for calculating total amounts and changes to be returned.

D. Assessment

Performance Task 1

Explain the relation of each currency note to other currency notes of smaller value.

Performance Task 2

Calculate change correctly using appropriate currency while carrying out a trading activity.

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

- Reflective Questions
    i. If you bought a pencil worth Nu 5 from a shop but you gave Nu 20 note to the shopkeeper, how much money will you get back as the change? Which notes could you receive as a change?

ii. Why do we work?
iii. How much money would there be in a bundle of Nu 5, Nu 10, etc…?

E. Resources

- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Dummy Ngultrum Notes
- Common objects for trading activity.
- Online:
  - History of Money - https://intuit.me/3ouUZSf
  - Brief History of Currency of Bhutan - https://www.rma.org.bt/history.jsp
  - Let's Learn About Money! - an article on money

Topic: II-A7 Simple Fractions: Modelling Numerators and Denominators

[150 minutes]

Introduction

Around 500 CE we know the Hindu culture was using fractions very much like we do today. The number system they used developed into the one we use today, including a zero. Like the Chinese, the numerator was placed over the denominator and there was no line to separate them.

Fractions represent a part of a whole or a set. If a shape is divided into equal parts, each part is called a fraction. The name of the fraction depends upon the number of equal parts a whole is divided into. If a shape is divided into 2 equal parts, each part is one half; if it is divided into 3 equal parts, each part is one third; if it is divided into 4 equal parts, each part is one fourth, and so on.

Utility and Scope

Learning to model fractions helps students understand the concept of fractions and also to interpret fractional representations in the real world and their usage in real life.

A. Competency

- Interpret and model simple fractions in various ways and relate to real life representations of fractions.

B. Objectives

- Identify and read fractions (Halves, Thirds and Fourths) correctly.
- Model fractions, (Halves, Thirds and Fourths), concretely, pictorially, and symbolically, as part of a whole and part of a set.
- Explore and discuss representations of fractions in real life.

C. Learning Experiences

- Students apply the concept of halves and explore the concept of fractions.
    - fraction as part of a whole
    - fraction as part of a set
    - parts must be of equal size

- Students explore representation of simple fractions and identify the fractions Halves, Thirds and Fourths/Quarters.
  - Examine and discuss concrete representations of fractions (with pattern blocks or other objects).
  - Examine and discuss pictorial representation of fractions (partly shaded grids).
  - Read the fractions correctly.
- Students practise representing simple fractions as equal parts of a whole / set.
  - Model fractions concretely.
  - Represent fractions pictorially.
  - Write fractions in words.
  - Write fractions symbolically.
  - Identify the numerator and denominator of fractions.
  - Explain what the numerator and denominator mean for each fraction they represent.
  - Watch the video https://www.youtube.com/watch?v=MESbyiKFs1c to learn about halves, thirds and fourths.
- Students identify and discuss representations of fractions in their daily lives or their immediate environment.

D. Assessment

Performance Task 1

Identify, read and write fractions shown by concrete and pictorial representations

Performance Task 2

Model the fractions Halves, Thirds and Fourths, using pattern blocks and pictures of grids.

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

- Reflective Questions
  i. What fraction of this shape is coloured?
  ii. How many equal parts is this shape divided into?
  iii. What is the name for each part when we have two equal parts?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume – V

(Note: Use the activities to practice only till fourths/quarters)

- National School Curriculum, Mathematics for PP – XII
- Pattern Blocks
- Concrete objects and Manipulatives
- Online
  - What are Fractions? Halves, Quarters and Thirds Explained – https://www.youtube.com/watch?v=MESbyiKFs1c

Topic: II-A8 Properties of Addition: Commutative, Associative

[450 minutes]

Introduction

The addition is a process of adding or summing up 2 or more integers to get the final value. The addition is one of the highly important and common operations in the fields of mathematics and statistics. The numbers that are to be added are referred to as addends. The resulting value of this summation step is called the sum. The Plus (+) sign denotes the addition operation. The symbols of addition and subtraction were invented around the 16th century, but before that, the equations were written in words, making it really time-consuming to solve the problems.
Source: https://www.vedantu.com/maths/properties-of-addition

Utility and Scope

Understanding properties of addition will help us in defining the various conditions and norms to be followed while adding a set of numbers. Students should learn to think of and tell simple stories from addition and subtraction number sentences. This will deepen their understanding of addition concepts which will help them effectively solve word problems or simple real life problems which require addition.

A. Competency

- Explore addition properties to solve and record simple addition problems, concretely, pictorially and symbolically.

B. Objectives

- Solve simple addition problems by applying the properties of addition.
- Carry out addition concretely (using base ten blocks), pictorially and symbolically.
- Relate the use of addition and its properties to real life situations.

C. Learning Experiences

- Revisit addition of single digit numbers with sums up to 10.
    - Represent addition concretely, pictorially and symbolically.

- Students explore simple addition solutions and explain the properties of addition:
    - Commutative (2+3=5 and 3+2 = 5)

      Realise that altering addends does not change the sum.
    - Associative (1+(2+3) = 6 and (1+2) +3 = 6)

      Realise that altering the order of addends does not change the sum.
- Students practise addition of two and more single digit numbers by applying the properties of addition.
    - Use base ten-blocks or other concrete materials to represent addition and find the sum.
    - Draw simple pictures to represent.
    - Use digits and addition symbols correctly to express addition sentences.
- Discuss how the properties of addition are applied to solve additions effectively in real life situations.

D. Assessment

Performance Task 1

Explain commutative and associative properties while solving simple addition problems with single digit numbers.
(This assessment could be carried out while students are exploring addition problems)

Performance Task 2

How they solved the additions involving three single digit numbers using concrete objects, illustrations and then numbers and the addition symbols.

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

- Reflective Questions
    1. What are some different ways you could add 5 + 8 + 5?
    2. How do you know the sum of 4 + 4 + 8 will be more than 10?

E. Resources

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

- Base-ten Blocks
- Concrete Objects / Manipulatives
- Introduction: https://www.vedantu.com/maths/properties-of-addition

Topic: II-A9 Addition Strategies: Sums till 100

[300 minutes]

Introduction

The first official evidence of addition is that Egyptians and Babylonians used it in 2000 B.C. Addition is the first mathematical operation that students learn followed closely by subtraction. Addition helps kids master the relationships between numbers and understand how quantities relate to one another. Students begin studying these skills through the use of manipulatives, or physical tools that represent objects and continue building their skills, adding and subtracting ever larger numbers through elementary school. When the skills are initially introduced, students perform rudimentary calculations using single digits. Later in their study, they practice applying these skills through the completion of story problems.
Source: video on addition

Utility and Scope

Exploring various methods to add numbers develops number sense and enhances student's understanding of addition and relation among numbers. Developed addition skills would help students in learning multiplication.
Students can use their understanding and skill of addition to effectively solve real life situations involving addition. For example, while shopping, they find the total amount that needs to be paid; while playing games, they can total the scores correctly; provide appropriate estimates for a total of objects or number of people, etc.

A. Competency

- Estimate sums (till 100) to check the reasonableness of the answers to additional problems solved using various methods.

B. Objectives

- Estimate sums to 100.
- Apply strategies (such as counting on, double facts for 50, benchmark of 20, relating facts for 10 etc.) to find sums to 100.

C. Learning Experiences

- Conduct a quick revision of adding single digit numbers using various strategies.
    - Counting on,
    - Using number lines
    - Using double facts till 10
    - Using benchmark till 10
    - Using facts for 10

- Students explore addition of 2-digit numbers (sums till 100).
    - First estimate the sums.
    - Add 2-digit numbers using:
        - Double facts till 50
        - Explore double facts till 50.
        - Watch the video to revisit how to use doubles facts for addition [video on double facts]
        - Benchmarks till 20
        - Facts for 10
        - Place value chart
        - Watch the video https://www.youtube.com/watch?v=Q9sLfMrH8_w to learn how to add using digit placement.

    - Compare their estimations to the sums obtained to check the reasonableness of the answer.
      Discuss the importance of estimating first.
    - Record addition using correct addition sentences.
- Students practise solving word problems involving addition of 2-digit numbers using various methods.
    - Discuss how these different strategies affect the way they find sums.
- Students apply mental calculation to find sums of numbers till 20.

  While applying the mental calculations the students will be made to talk about the situation where we apply the mental calculation.

D. Assessment

Performance Task 1

Estimate first and add two-digit numbers using any one of the strategies. Justify their answers by relating them to their estimate.

Performance Task 2

Add 2-digit numbers using at least two different strategies. Explain the strategies used.

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

- Reflective Questions
  i. How much is 15 + 15? How does that help you figure out 15 + 17?
  ii. Suppose you are adding 13 + 5 + 8. Where would you start? Why would you start there?
  iii. What would be the sum for 38 and 10? How do you know that?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Using Doubles Facts to Add - https://www.youtube.com/watch?v=WDZoZytc94Q
  - Double-Digit Addition for Kids - https://www.youtube.com/watch?v=Q9sLfMrH8_w

Topic: II-A10 Subtraction Strategies: 1-Digit Numbers from 2-Digit Numbers. 2-Digit Numbers from 2-Digit Numbers *[250 minutes]*

Introduction

Like addition, subtraction is also one of the oldest and the most basic arithmetic operations. The word subtraction is derived from the two words, 'sub' and 'tract,' which mean under or below and to pull or carry away, respectively. Therefore, subtraction means to carry away the lower part.

Source: https://bit.ly/3gEcL0V

Utility and Scope

Subtraction is an important tool we use to help us find out what is left when taking one number away from another. Students can use their understanding and skill of subtraction to effectively solve real-life situations involving subtractions. For example, while shopping, they find the change that will be returned; while playing games they can estimate the additional score required for winning a game; providing appropriate estimates of remaining objects or number of people, etc.

Exploring various methods to subtract numbers enhances students' understanding of subtraction and would help students in learning division in the later stages.

A. Competency

- Apply various strategies to solve subtraction problems and use estimation to check the reasonableness of the answers obtained.

B. Objectives

- Estimate differences to check the reasonableness of answers acquired.
- Apply strategies (such as double facts for 50, the benchmark of 20, relating to a known fact, counting on and etc.) for subtracting:
  - 1-digit numbers from 2-digit numbers
  - 2-digit from 2-digit numbers
- Mentally subtract numbers till 20.

C. Learning Experiences

- Conduct a quick revision using various strategies to add 2-digit numbers.
- Discuss how subtraction is the inverse operation of addition.
- Discuss the strategies learnt to add 2-digit numbers using various strategies.
- Students explore subtraction using various strategies.
  - Subtract 1-digit numbers from 2-digit numbers.
  - Subtracting 2-digit numbers from 2-digit numbers.
  - First, estimate the differences
  - Apply various strategies to subtract.
    - double facts till 50

      Watch the video https://www.youtube.com/watch?v=70rruPQL6RQ to learn how to subtract using doubles.
    - Benchmarks till 20
    - Facts for 10
    - Watch the video https://www.youtube.com/watch?v=47zLTWrbzuk to learn how to use facts for 10 to subtract.
    - Review the facts for 10 and the related subtraction facts.
    - Extend this concept to solve a subtraction problem like 13 – 6, in which the strategy is to first think about the problem as 10 – 6 to get 4, and later add 4 to 3 to get 7.

    It will be beneficial for students to model these with 10-frames and counters
    - Subtracting as tens and ones
    - Watch the video subtraction using place value to learn how to use place value to subtract from 2-digit numbers.
    - Using the place value chart.
  - Compare their estimations to the differences obtained to check the reasonableness of the answers.
  - Record subtraction using the correct subtraction sentence.
- Students practise solving word problems involving subtraction of 1-digit and 2-digit numbers from 2-digit numbers using various methods.
- Students apply a mental calculation to find differences of numbers till 20.

  Discuss the application of mental calculation in real-life situations.

D. Assessment

Performance Task 1

Estimate and subtract 1-digit numbers from 2-digit numbers using at least two different strategies. Explain the strategies used.

Performance Task 2

Estimate and subtract 2-digit numbers from 2-Digit numbers using a strategy of their choice. Explain the strategy used.

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

- Reflective Questions
  i. What is the difference of 13 – 8? Why is 13 – 8 three more than 10 – 8?
  ii. A farmer has 15 cows and 8 horses. How many more cows than horses does the farmer have?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - I
- National School Curriculum, Mathematics for PP – XII
- Online
  - Introuction: https://bit.ly/3gEcL0V
  - 1-9 Use Doubles to Subtract: https://www.youtube.com/watch?v=70rruPQL6RQ
  - Make a 10 to subtract - https://www.youtube.com/watch?v=47zLTWrbzuk
  - Double-Digit Subtraction for Kids - double digits subtraction

Topic: II-A11 Addition and Subtraction Facts: Represent Addition and Subtraction Facts. Relation of Addition and Subtraction

II-B3 Finding Patterns Using Addition Table

II-B4 Open Sentences: Simple Patterns in Addition and Subtraction

[450 minutes]

Introduction

Addition and subtraction are the inverse operations of each other. Put simply, this means that they are the opposite. You can undo an addition through subtraction, and you can undo a subtraction through addition.

The symbols of addition and subtraction were invented around the 16th century, but before that, the equations were written in words, making it really time-consuming to solve the problems.

An additional table is a tool that can be used to find the sum of two chosen numbers in the table. It can help with teaching or learning addition. The addition table helps children add numbers by forming a specific pattern and where the numbers are arranged in rows and columns.

Source: https://www.math.net/addition-table
https://bit.ly/3qgSPXP

Utility and Scope

Generally, subtraction facts are harder for children to learn than addition facts. If a child knows that 6 + 9 = 15, and he or she sees the subtraction sentence 15 – 9 = __, the child can think, 9 and what are 15? If children learn the important inverse relationship between addition and subtraction, subtraction facts will become much easier.

Simply using the addition table to find various sums can help a child familiarise themselves with addition facts. The addition table helps children quickly get the result of the summation of two numbers without actually adding them. It also enhances their understanding of the commutative property of addition.

Examining and identifying patterns in addition and subtraction enhances students' ability to calculate sums and differences quickly and mentally. It also helps students

understand the relation of numbers and the inverse relation of addition and subtraction.
Source: https://bit.ly/3f26yes
Source: addition and subtraction reverse and facts

A. Competencies

- Relate addition and subtraction to calculate mentally (till 20) and use it in real life situations.
- Identify patterns in the addition table and apply them to calculate sums and differences effectively.
- Respond to open sentence problems by exploring patterns in addition and subtraction.

B. Objectives

- Model situations to represent addition and subtraction facts
- Examine the relationship between addition and subtraction facts (Addition and Subtraction undo each other) then apply the concept while performing addition or subtraction.
- Identify and explain patterns in an additional table.
- Discover missing addends/subtrahends or the missing sums/differences by exploring simple patterns in addition and subtraction.

C. Learning Experiences

- Students discuss addition and subtraction facts.
    - Discuss the commutative of addition.
      Example: 10 + 5 = 15 and 5 + 10 = 15
    - Discuss how the subtrahend and the difference are interchangeable.
      Example: 12 – 7 = 5, 12 – 5 = 7
- Students explore and discuss the inverse relation of addition and subtraction.
    - Model addition and subtraction facts using the same set of numbers, concretely and pictorially.
    - Discuss how addition and subtraction undo each other.
    - Discuss the commutative property of addition.

- ○ Express understanding of the relation of addition and subtraction symbolically.
  Example: If 6 + 9 = 15 then 15 – 6 =9
- ○ Use concrete and pictorial representations to create and discuss addition and subtraction fact families.
- ○ Record the fact families symbolically.
- ○ Discuss how knowing an addition fact helps them solve subtraction.
- ○ Explore the video https://www.youtube.com/watch?v=aK3FKEZJKec to learn about the relation of addition and subtraction.
- ○ Practice calculating sums and differences mentally (till 20).

- Students explore the addition table.
  - ○ Explain and demonstrate how to fill the addition table.

+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

  - ○ Students examine the pattern in the addition table and discuss the increasing number pattern during addition and decreasing pattern during subtraction.
    Example: The numbers increase by one as it moves to the right (8 + 5 is one more than 8 + 4).
    The rows are the same as the columns, so the order of adding does not matter.
  - ○ Use the observed patterns to predict the sums or differences for given addition and subtraction facts (mental calculation).
- Students solve open sentence problems by applying the understanding of the relation of addition and subtraction and also using patterns observed on the addition table.
  - ○ Use known/given addition facts to find missing differences or subtrahends.
  - ○ Use known/given subtraction facts to find missing sums or addends.

- Discuss how realising the relation of addition and subtraction enhances their ability to calculate mentally.
- Discuss some problems in real-life situations, which could be solved effectively using the concept of the fact family.

D. Assessment

Performance Task 1

Create addition and subtraction fact families using sets of three numbers.
Sample online worksheet: https://www.liveworksheets.com/se1272406mv

Performance Task 2

Describe a few observed patterns in the addition table. Use the patterns to predict the sum or difference of a given addition or subtraction problem.

Performance Task 3

Solve open sentence problems and justify their solutions.

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

- Reflective Questions
    i. What strategies can you use to figure out the missing number in 13 - --- = 9?
    ii. Why can you subtract 7 from 12 to solve 12 – = 7?
    iii. Karma has 15 pebbles. He has 8 more than Dorji. How many pebbles does Dorji have?
    iv. How can addition facts be helpful with solving 16 - --- = 8?

E. Resources

- Understanding Mathematics, Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume -
- National School Curriculum, Mathematics for PP – XII
- Online
    - Relation between Addition and Subtraction - https://bit.ly/3qgSPXP
    - Introduction: https://www.math.net/addition-table

- Utility and scope - https://bit.ly/3f26yes Addition Explanation and Examples
- Utility and scope - addition and subtraction reverse and facts - Inverse Relationship between Addition and Subtraction
- Addition and subtraction fact families - https://www.youtube.com/watch?v=aK3FKEZJKec
- Two-Digit Fact Family https://www.liveworksheets.com/se1272406mv

Topic: II-B1 Even and Odd Numbers

[200 minutes]

Introduction

An even number is a number that can be divided into two equal groups. Even numbers end in 2, 4, 6, 8, and 0 regardless of how many digits they have.

An odd number is a number that cannot be divided into two equal groups.

Pythagoras was the first man to come up with the idea of odd and even numbers. To him, the odd numbers were male; the evens were female.

Source: video on even and odd

Utility and Scope

Identifying even and odd numbers is an important skill that children need to help them understand our number system and aid in their preparation to group whole number operations. It will also help prepare them to learn multiplication, division, prime numbers, and even square roots in the later stages.

Source: https://bit.ly/3LCS43Z

A. Competency

- Identify even numbers as doubles of a number and apply the concept to deal with numbers in various mathematical situations.

B. Objectives

- Recognize the pattern in even and odd numbers. (Even numbers doubles)
- Model the pattern in even numbers by folding rectangles.

C. Learning Experiences

- Students revisit counting numbers by 2s.
- Students explore even and odd numbers.
  - Mark numbers counted in 2s on a Hundred chart.
  - Examine and discuss the pattern observed on the Hundred chart.
  - Identify the doubles.
- Introduce even and odd numbers.
  - Discuss odd and even numbers using a hundred chart.
  - Explain even numbers as doubles.

- Explain the definition of even and odd numbers.
  An even number is the double of a number.
  An odd number are those numbers which cannot be divided into two equal parts.
  (Instead of the word 'divided' teacher could use the word 'shared')
- Students explore modelling even numbers.
  - Fold rectangle papers.
    Count the folded parts and relate it to the even number.
  - Represent concretely
    Divide a set into two equal parts.
  - Watch the video https://www.youtube.com/watch?v=tLWFt_vW33E to learn about even and odd numbers.
  - Practice identifying even and odd numbers.
    Sample online worksheet: https://www.liveworksheets.com/ua163050ov

D. Assessment

Performance Task 1

Identify the numbers as even or odd numbers.

Performance Task 2

Justify how a number is an even or odd number by explaining the definition of even and odd numbers in simple language.

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

- Reflective Questions
  i. Do you see a pattern with the doubles?
  ii. What kind of a pattern is it?
  iii. What numbers do you not see in the doubles?

E. Resources

- Understanding Mathematics, Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII

- Rectangular paper cut-outs.
- Online
    - Introduction- What are Odd and Even Numbers? video on even and odd
    - Utility and scope- Even Odd numbers: https://bit.ly/3LCS43Z
    - Even and Odd Numbers: https://www.youtube.com/watch?v=tLWFt_vW33E
    - Worksheet 18 ODD and EVEN NUMBERS: https://www.liveworksheets.com/ua163050ov

Topic: II-B2 Compare Number Patterns *[450 minutes]*

Introduction

A Number Pattern refers to a sequence of numbers that follow a certain order in mathematics. Patterns typically describe the inverse relationship between numbers. The sequences of numbers can also be called patterns. It is first necessary to understand the rule being followed by the pattern in order to solve the problems involving the Number Pattern. A pattern has a group of units that follow a rule while repeating or changing. Some patterns grow and some reduce. A growing pattern is the one which increases and a shrinking pattern is the one which decreases by a constant unit. You can find a growing pattern with pictures, shapes, objects, numbers, etc.
Source: https://www.vedantu.com/maths/number-patterns
https://www.math-only-math.com/growing-patterns.html

Utility and Scope

Number pattern awareness allows one to use patterns and models to analyse the change in both real and abstract contexts. Numerical patterns are just the beginning of the acknowledgment of the importance of mathematics in one's everyday life.
Learning number patterns helps students build a strong foundation in mathematics and will help in working with numbers. Children will be able to learn the relationships that exist between numbers. They will learn to observe sequences and will be able to predict what comes next. These patterns will make it easier for students to understand multiplication and division in the later stages.
Source: https://kidskonnect.com/math/number-pattern-worksheets/

A. Competency

- Recognise repeating, growing, and shrinking patterns of numbers and apply the concept to interpret and describe the sequence.

B. Objectives

- Describe repeating, growing, and shrinking number patterns.
- Compare simple number patterns.

- Create Growing and shrinking number patterns.

C. Learning Experiences

- Students revisit repeating patterns:
  - With objects collected from the environment. (e.g. leaves, stones, or flowers) Discuss the importance of leaves or flowers.
  - With numbers.
  - Create growing number patterns, and share them to other students.
- Students revisit growing patterns with numbers:
  - Skip count by 2s, 3s, and 5s.
  - Use number lines to represent skip count.
  - Examine what happens when we skip count numbers.
    Discuss the increase in numbers.
  - Relate the growing number pattern to the skip counts (forward).
  - Describe growing patterns.
  - Create growing number patterns, and share them to other students.
- Students explore shrinking patterns.
  - Examine shrinking patterns represented with concrete objects (based on size and count).
  - Examine and discuss shrinking patterns represented with pictures (based on size and count).
  - Skip count by 2s, 3s, and 5s backward.
  - Use a number line to skip count backward
    Relate to subtracting a number repeatedly.
  - Examine the pattern and discuss the decrease in numbers.
  - Relate the shrinking number pattern to the skip counting backward.
  - Extend given shrinking patterns.
    Example: 12, 10, 8 ...
  - Describe shrinking patterns.
  - Create shrinking number patterns, share them to other students.
- Students examine the comparison among the three types of number patterns.
  - Describe ‘repeating’, ‘growing’, and ‘shrinking’ patterns in simple language.
  - Discuss the similarities and differences among the three types of patterns.

- Students practise extending and creating number patterns through activities in Self-Instructional Material, Key Stage I, Class II, Volume – IV.
    - Practice extending repeating, growing, and shrinking patterns while watching the video https://youtu.be/BNIt8LedXn8?si=m5mUV36Sa8tSLmz6 .

D. Assessment

Performance Task 1

Identify repeating, growing, and shrinking patterns. Extend the patterns.

Performance Task 2

Create repeating, growing, and shrinking) and describe them.

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

- Reflective Questions
    i. Can you extend this pattern (30, 25, 20 ...)?
    ii. What kind of a pattern is this?

E. Resources

- Understanding Mathematics, Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - IV
- National School Curriculum, Mathematics for PP – XII
- Concrete Objects
- Online
    - Introduction-Number Patterns: https://www.vedantu.com/maths/number-patterns
    - Introduction- Growing Patterns https://www.math-only-math.com/growing-patterns.html
    - Utility and scope: https://kidskonnect.com/math/number-pattern-worksheets/
    - Number Patterns https://www.youtube.com/watch?v=wCtc75zDZkc

Topic: II-B3 Finding Patterns in Addition Table

Introduction

An additional table is a tool that can be used to find the sum of two chosen numbers in the table. It can help with teaching or learning addition. The addition table helps children add numbers by forming a specific pattern and where the numbers are arranged in rows and columns.

Source: https://www.math.net/addition-table

Utility and Scope

Simply using an addition table to find various sums can help a child familiarise themselves with addition facts. The addition table helps children quickly get the result of the summation of two numbers without actually adding them. It also enhances their understanding of the commutative property of addition.

A. Competency

- Identify patterns in addition table and apply it to calculate sums and differences effectively.

B. Objective

- Identify and explain patterns in an additional table.

C. Learning Experiences

Note: The Learning Experiences and Assessment for this topic has been included with II-A11.

Topic: II-B4 Open Sentences:

Simple Patterns in Addition and Subtraction

Introduction

Addition and subtraction are the inverse operations of each other. Put simply, this means that they are the opposite. You can undo an addition through subtraction, and you can undo a subtraction through addition.

The symbols of addition and subtraction were invented around the 16th century, but before that, the equations were written in words, making it really time-consuming to solve the problems.

Source: https://bit.ly/3qgSPXP

Utility and Scope

Generally, subtraction facts are harder for children to learn than addition facts. If a child knows that 6 + 9 = 15, and he or she sees the subtraction sentence 15 – 9 = __, the child can think, 9 and what are 15? If children learn the important inverse relationship between addition and subtraction, subtraction facts will become much easier.

Examining and identifying patterns in addition and subtraction enhances student's ability to calculate sums and differences quickly and mentally. It also helps students understand the relation of numbers and the inverse relation of addition and subtraction.

Source: https://bit.ly/3f26yes

reverse between addition and subtraction.

A. Competency

- Respond to open sentence problems by exploring patterns in addition and subtraction.

B. Objective

- Discover missing addends/subtrahends or the missing sums/differences while exploring simple patterns in addition and subtraction.

C. Learning Experiences

Note: The Learning Experiences and Assessment for this topic has been included with II-A11.

D. Resources

Online:

Introduction: https://bit.ly/3qgSPXP

Utility and scope: https://bit.ly/3f26yes

reverse between addition and subtraction.

Topic: II-B5 Place Value Patterns

Introduction

The system of numbers we use is called the base-ten number system. It is a place-value number system in which 10 digits, 0 through 9, are used to represent a number. The position of a digit in a number determines its value. It is called place value. The value of each place is 10 times the value of the place to its right.

Utility and Scope

Understanding the place value of digits in numbers helps in writing numbers in their expanded form. A place value chart can help us in finding and comparing the place value of the digits in numbers.

A. Competency

- Explain how place value increases in relation to the value of the place to its right.

B. Objectives

- Infer that each place value increases ten times the value of the place to its right.
- Explain what happens to the number when the model is changed, adding or subtracting 10s and 100s concretely & symbolically.

C. Learning Experiences

Note: The Learning Experiences and Assessment for this topic has been included with II-A4.

Topic: II-C1 Measuring Length Using Metre and Centimetre. Measuring Perimeter using cm *[450 minutes]*

Introduction

The term "length" refers to a measurement that determines the distance between two places/points. Measurement has been important ever since human settlement started. Length is one of the most common measurements that is used every day. This can tell you how far away the nearest town is, the width of a fridge, or your height. Ancient measurement of length was based on the human body, for example, the length of a foot, the length of a stride, the span of a hand, and the breadth of a thumb. There were unbelievably many different measurement systems developed in early times, most of them only being used in a small locality. As trade between different places increased, the need for standard units of length increased.

Standard units of measurement were applied to one single community or small region. In order to make it uniform and have standard systems throughout, measurement was introduced.

Non-standard units do not prove a fixed measurement. They vary from person to person and from object to object. Standard units are predefined and do not change person to person or object to object. The base unit for length in the SI is the metre, abbreviated with a lowercase “m”. An upper case “M” has a very different meaning; it is the prefix for a million times larger, so care needs to be taken with this!

A centimetre (SI symbol cm) is a unit of length in the metric system, equal to one-hundredth of a metre

Source: length measurement
https://bit.ly/3GEa7Tu
https://bit.ly/31DNjoq

Utility and Scope

To know the exact value and exact quantity of something in our everyday life we have to use measurement.

The use of standard units for measurement makes it easier to calculate and describe measurements. Standard units provide better accuracy of what is being measured. The use of metre and centimetre to measure length helps students understand the need for a standard unit of measurement of length. It also helps students provide an appropriate estimation of the length of objects around them.

A. Competency

- Demonstrate the ability to measure length and perimeter using appropriate standard units (m and cm) and justify the use of standard units in real life.

B. Objectives

- Justify the use of standard units by examining various situations.
- Justify how long a centimetre and a metre are.
- Estimate and measure length in cm and m.
- Estimate and measure perimeter in cm.
- Examine and recognize the relation between metre and centimetre (1 metre is 100 cm long).

C. Learning Experiences

- Students briefly revisit the use of non-standard units to measure length.
    - Measure the length of an object using different non-standard units.
    - Compare the measurements obtained, discuss how the use of non-standard units can provide varied measurements,
      Discuss how the non-standard units could change from place to place or person to person.
    - Discuss the need for a standard unit for reliable, uniform and accurate measurement of length.
- Introduce centimetre for measuring length.
    - Show how long a centimetre is using a ruler.
    - Demonstrate how to measure length using centimetre.
    - Explain the centimetre is a standard unit used for measuring shorter length.
    - Explain how centimetre is written as 'cm' in short.
    - Watch the video on measuring length to learn where and how to use centimetre for measuring length.
- Students explore measuring the length of various small objects in centimetre using a ruler.
    - Estimate the lengths of short objects / lines in cm.
    - Measure and record short lengths using cm.

- Discuss the comparison of their estimation and the actual measurement obtained.
- Draw lines of short lengths in cm
- Provide an estimate of how long a centimetre is.
- Watch the video on using cm to measure a length to learn how to use centimetre to measure short lengths.

- Students explore measuring perimeter using cm.
  - Measure the length around objects.
    Use strings or paper strips to wrap around the border of objects and measure their length when stretched.
  - Measure the lengths of all the sides of drawn 2-D shapes and add the lengths of all the sides.
  - Discuss the meaning of perimeter as the total length around a shape.
- Introduce metre for measuring length.
  - Discuss the possibilities of measuring the length of the school football ground /basketball court using their short ruler.
  - Show how long a metre is using a metre ruler.
  - Demonstrate how to measure length using metre.
  - Demonstrate and explain the metre is a standard unit used for measuring longer length.
  - Explain how metre is written as ‘m’ in short.
  - Watch the videos to learn where and how to use metre for measuring length:
    https://www.youtube.com/watch?v=yFh5lO1SQlw
    https://www.youtube.com/watch?v=HT_c0AQu1I8
- Students explore measuring length of various lengths / distances and heights in metre.
  - Estimate the lengths/distances/heights in m.
  - Measure and record lengths using m.
  - Discuss the comparison of their estimation and the actual measurement obtained.
  - Provide an estimate of how long a metre is.
- Students discuss the use of appropriate units to measure different length/height of different objects/structures.
- Students examine metre and centimetre rulers and recognize that 1 metre = 100 centimetre.

D. Assessment

Performance Task 1

Choose the appropriate length, ,cm and m, to describe different lengths. Justify the choice of the unit.

Performance Task 2

Estimate and measure various lengths using centimetre and metre rulers. Record the measurements using appropriate units.

Performance Task 3

Explain the relation between the units, m and cm, by converting the units to one another.

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

- Reflective Questions
  - i. How long do you think the table is along this edge in terms of your palm width?
  - ii. Suppose each one of us measured the length of the table with our hand span would we get the same measurement? Why, or why not?
  - iii. How many centimetres long do you think this pencil is? What makes you think so?
  - iv. Which unit would you use to measure the length of the flower garden? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume – IV
- Self-Instructional Material, Key Stage I, Class II, Volume – V
- National School Curriculum, Mathematics for PP – XII
- Common Objects in the Classroom

- Metre and Centimetre Rulers
- Online
  - Introduction- Measurement of Length - length measurement
  - Introduction- Week 1: Measurement of Length - https://bit.ly/3GEa7Tu
  - Introduction- The history of Measurement - https://bit.ly/31DNjoq
  - Units of Length-Centimetre - https://www.youtube.com/watch?v=jshiAs9HGOE
  - Units of Length–Metre - https://www.youtube.com/watch?v=yFh5lO1SQlw
  - Measuring Length in Metres - https://www.youtube.com/watch?v=HT_c0AQu1I8

Topic: II-C2 Estimate and Measure Capacity Using Litre *[300 minutes]*

Introduction

Capacity is a measure of how much something can hold, before it becomes full. How was capacity measured in ancient times?
Early civilizations used standard measuring pottery to measure volume. For instance, in the city of Heraclea Pontica, special amphorae for measuring grains and liquids were found. The amphorae were used as units of volume in all Greek territories. They came in various forms and sizes, from 2 to 26 litres.
The standard metric unit of capacity is the 'litre'. From the litre, we get the rest of the metric units using the standard metric prefixes.
Source: article on history of measurement

Utility and Scope

Use of standard units for measurement makes it easier to calculate and describe measurements. Standard units provide better accuracy of what is being measured. Use of the standard unit 'Litre' to measure capacity helps students provide an appropriate estimation of the capacity of a common container by describing in comparison to a litre. It helps students understand the need for a standard unit of measurement of capacity.

A. Competency

- Demonstrate the ability to measure capacity of containers in Litre and make appropriate estimation of the capacity of common containers.

B. Objectives

- Identify various containers which have the capacity of 1 Litre.
- Examine various capacities in relation to a litre (how much it takes to make a litre)
- Compare and order different containers based on their capacity.

C. Learning Experiences

- Students briefly revisit the use of non-standard units to measure capacity.
    - Name some drinks or liquids they are familiar with.

- Discuss the containers used for storing liquids.
- Measure the capacity of a container using different non-standard units.
- Compare the measurements obtained and discuss how the use of non-standard units can provide varied measurements.
- Discuss the need for a standard unit for reliable, uniform and accurate measurement of capacity.

- Introduce 'Litre' as a standard unit for measuring capacity of containers.
  - Show a container to which the students can associate the capacity of a litre with.
  - Demonstrate measurement of capacity using containers that have the capacity of a litre.

    For further exposure let students explore various containers that have the capacity of a litre.

    Explain that the shape of the size of a container doesn't determine the capacity of a container.

    Some containers that look big might hold less than a litre.
  - Explain how litre is written as 'L' in short.
- Students explore measuring capacity of various containers in litre.
  - Estimate and describe the capacity of containers in comparison to a litre (holds more/less than a litre).
  - Estimate capacity of containers using litre.
  - Measure and record capacity of larger containers using L.
  - Discuss the comparison of their estimation and the actual measurement obtained.
  - Provide an estimate of how much a container holds if its capacity is 1 L.
  - Examine and discuss the capacity of 1 litre in relation to the capacity of smaller containers.

    Example, how many glasses of water does it take to make a litre?
- Students explore measuring capacity of larger containers using litres.
  - Measure, compare and order containers based on their capacity.
  - Describe the capacity of various containers in relation to a Litre.

    Name common containers which have the capacity of 1 L.

    Name common containers which have more/less capacity than 1 L.

    Name containers which have a capacity of about 2 L, 5 L, 10 L, etc.

- Practice using litre to describe capacity through the activities in Self-Instructional Material, Key Stage I, Class II, Volume - IV

D. Assessment

Performance Task 1

Identify containers which have the capacity of 1 L from a given set of containers.

Performance Task 2

Describe the capacity of 1 L using the capacity of common containers.

Performance Task 3

Estimate first and measure the capacity of a few containers using litre. Order the containers based on their capacity.

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

- Reflective Questions
  i. For which of the containers can we use litre to describe their capacity, a cup or a water bottle? Why?
  ii. How would you like to describe the capacity of a large bottle of juice, as 2 L or as 8 glasses? Why?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - IV
- National School Curriculum, Mathematics for PP – XII
- Common Containers of Different Capacities
- Online
  - Introduction of Capacity [article history of measurement]

Topic: II-C3 Estimating and Measuring Mass using Kilogram

[300 minutes]

Introduction

The mass of an object is the amount of matter in it. Weight is the amount of gravitational pull or force that is exerted on an object. The weight of an object is directly proportional to its mass.

In ancient Egypt and Greece, pieces of grain were used as one of the earliest units of measurement. 200 grains of barley corn equaled one *Beqa*. Other items could be measured on a scale balance with the grain on the other side.

Mass is commonly measured by how much something weighs.

Source: https://bit.ly/3fic7Wf

Utility and Scope

The basic SI unit for mass is the kilogram (kg), but smaller masses may be measured in grams (g). To measure mass, you would use a balance.

When an object is sitting still, it resists moving, and the more mass it has the more it resists.

Use of standard unit kg for measurement of mass helps students relate to measuring mass in the real world. This is because 'kg' is the most common unit they hear elders around them use while describing the measurement of mass.

Using the standard unit 'kilogram' to measure mass helps students provide an appropriate estimation of the mass of common objects by describing their mass in comparison to a kilogram. Students recognize the need for the standard unit to measure mass.

A. Competency

- Use the standard unit, kg, to estimate and measure the mass of the objects.

B. Objectives

- Estimate & measure mass using Kilogram, using a pan balance.
- Express how heavy a kilogram feels in relation to the mass of other objects (lighter than/ heavier than).

C. Learning Experiences

- Revise the use of non-standard units to measure mass.
  - Discuss how the use of non-standard units can provide varied measurements.
  - Different sizes and mass of objects result in different measurements.
  - Discuss the need for a standard unit for reliable, uniform, and accurate measurement of mass.
- Introduce 'Kilogram' as a standard unit for measuring the mass of objects.
  - Let students name some objects they buy from the shop.
  - Use one of those objects and demonstrate how to measure mass using a 1 kg unit stone and pan balance.
  - Explain how a kilogram is written as 'kg' in short.
  - Discuss the situations where students have heard their elders using kg.
- Students explore measuring mass using kilogram (kg).
  - Estimate the mass of objects using kg.
  - Use pan balance and a 1 kg unit stone to measure the mass of objects in kg.
  - Record mass of objects using kg.
  - Compare their estimation of the obtained measurement.
  - Feel the mass of the unit stone and the objects measured as 1 kg.
    Associate the mass of a kilogram and use it for measuring mass in case of the absence of an actual unit stone.
  - Provide an estimate of how heavy the mass of 1 kg feels like.
  - Name objects which have a mass of about 1 kg.
- Students describe the mass of 1 kg in comparison to the mass of other objects.

  Example: 1 kg feels heavier than the mass of my book.
  1 kg feels lighter than the mass of the chair, etc.
- Students practise describing the mass of objects using kilogram through the activities in Self-Instructional Material, Key Stage I, Class II, Volume – IV.

D. Assessment

Performance Task 1

Estimate first and measure the mass of a few familiar objects using kilograms.

Performance Task 2

Describe how heavy the mass of 1 kg feels in relation to mass of other objects.

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

- Reflective Questions
  i. How many _____ do you think it will take to make 1 kg?
  ii. How many kilograms is this stone? How can you say that?
  iii. Does 1 kg feel heavy?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - IV
- National School Curriculum, Mathematics for PP – XII
- Simple Pan Balance
- 1 kg weight
- Common Objects
- Online
  - The History of Measuring Mass - https://bit.ly/3fic7Wf

Topic: II-C4 Estimate and Measure Area Using Non-Standard Units

[200 minutes]

Introduction

Area is defined as space which is occupied by any of the flat shapes or by any of the surface of an object. The word 'area' originated from the Latin word 'area'. It means a vacant piece of ground level. Afterwards the origin of these words fled further to an irregular derivation of an area as a specific measure of the room contained inside a set of boundaries'.
Source: https://askanydifference.com/what-is-area/

Utility and Scope

Children's early spatial thinking predicts their mathematical achievement and understanding. A focus on shape and space may provide a more accessible route to mathematics for some children, rather than focusing mainly on numbers. There are many real life situations where one would need to calculate the area of various shapes. For example, we need to know the area of our living room floor to cover it with a carpet; we need to know the area of a table to buy tablecloths for it, we need to know the area of a land if we need to build a house on it, etc.

A. Competency

- Use non-standard units to estimate and measure the area of flat surfaces to relate it with our everyday life.

B. Objectives

- Estimate area of a surface using concrete objects.
- Measure area of surfaces using concrete objects (non-standard units)
- Explain that the use of bigger units results in smaller counts and vice versa.

C. Learning Experiences

- Revisit the meaning of area and compare area directly and indirectly.
- Demonstrate how to measure the area of flat surfaces using non-standard units.
    - Use objects, manipulatives and pattern blocks of various shapes and sizes as the unit of measurement.
    - Explain how to select an appropriate unit.

- Explain the need to use the same size and shape of the unit to complete a measurement.
- Discuss that the use of bigger units results in smaller counts and vice versa.
- Explain the end-to-end arrangement of the units to achieve more accurate measurement.

- Students explore measuring areas of flat surfaces using non-standard units.
  - Choose an appropriate unit to measure a given surface.
  - Estimate the number of units required to cover up the flat surface.
  - Measure the surface using the selected unit.
  - Compare their estimation to the actual measurement obtained.
  - Compare and order shapes according to the area of their surface.

- Students practise describing measurement using non-standard units through the activities in Self-Instructional Material, Key Stage I, Class II, Volume – V.
- Discuss real life situations where we need to use non-standard units.

D. Assessment

Performance Task 1

Choose appropriate non-standard units to measure the area given flat surfaces. Explain the choice of the unit.

Performance Task 2

Estimate and measure the area of a flat surface using two different sized non-standard units. Explain how the size of the units affects the measurement obtained.

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

- Reflective Questions
  1. Can we use different units at the same time to measure the area of a surface? Why or why not?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - V
- National School Curriculum, Mathematics for PP – XII
- Common objects with flat surfaces
- Cut-outs of 2-D shapes
- Online
  - What is Area? | Definition and Origin - https://askanydifference.com/what-is-area/

Topic: II-C5 Measuring Time: Reading Time in Half Hours and Quarter Hours. Exploring Calendar

[300 minutes]

Introduction

In maths, time can be defined as the on-going and continuous sequence of events that occur in succession, from the past through the present to the future. Time is used to quantify, measure or compare the duration of events or the intervals between them, and even, sequence events.

Utility and Scope

Time is used to quantify, measure or compare the duration of events or the intervals between them, and even, sequence events. Enhancing the ability to read and measure time helps children to value the use of time and punctuality. It helps children plan events effectively.

A. Competency

- Read time as hours, days, weeks, months, seasons and relate to our everyday life.

B. Objectives

- Read time to the nearest half hour and quarter hour on both analog and digital clocks.
- Relate the number of days the week, months of the year and seasons (in context).

C. Learning Experiences

- Revisit reading time in hours on analog and digital clocks.
- Demonstrate with a few examples on how to read time to the nearest half and quarter hour in analog clocks and digital clocks.
  - Explain how the position where the minute hand points to show half and quarter hours,
  - Demonstrate how to read time using phrases such as 'half past', 'quarter past' and 'quarter to'.
  - Examples: 'It is half past __ o'clock', '
    'It is quarter past __ o'clock'
    'It is quarter to __ o'clock).
  - Explain half and quarter hours on analog clocks by relating it to half and quarter fractions of a circle.

  - Explain how to read the minutes on a digital clock for half and quarter hours.
  - Explain that the number after the colon shows the minutes past after the hour and the number before the colon shows the hour.
  - Practice reading and writing time to the nearest half and quarter hours through the activities on Self-Instructional Material, Key Stage I, Class II, Volume – V.
- Students examine calendars to explore various measurements of time and discuss the following:

  Realise that measurement of time doesn't only include minutes and hours.
  - Number of days in a week.
  - Number of days in a month
  - Number of days in a year
  - Number of months in a year.
  - Name the twelve months of a year.
  - Number of seasons in a year.
  - Name and describe the four seasons.
- Discuss information derived from calendars related to dates of the festivals, religious occasions, students' birthdays and other important dates related to students' local society or their lives.
- Discuss the duration of time to or past those events in their life.

  Example: There are three days until the celebration of our local festival.

  This activity caters to enhancement of communication skills and promotes social and cultural values as students talk about their local festivals as well as the days considered important in their locality or even their friend's birthdays.

D. Assessment

Performance Task 1

Read and write time to the nearest half and quarter hours expressed on analog and digital clocks using appropriate phrases.

Performance Task 2

Students share information about an important event in relation to calendar (Teacher can talk about the month of February and ask questions related to it)

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

- Reflective Questions
  1. What could you do in an hour?

ii. How long will it take till the winter vacation starts? (in terms of weeks, months or seasons)

iii. How many months are there in a year?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - V
- National School Curriculum, Mathematics for PP – XII
- Analog and Digital Clocks
- Calendar

Topic: II-D1 Spatial sense: Perceptual Constancy. Visual Discrimination

[250 minutes]

Introduction

What is spatial sense? Why is it important in the primary mathematics classroom?
It also allows you to visualise and manipulate objects and shapes in your head. Not only is spatial thinking very important for everyday tasks, new research shows that it is essential for mathematics learning. Children and teenagers who are good at spatial tasks are also good at mathematics questions

Perceptual constancy, also called object constancy, is the tendency to see familiar objects as having standard shape, size, colour, or location regardless of changes in the angle of perspective, distance, or lighting. The impression tends to conform to the object as it is or is assumed to be, rather than to the actual stimulus. Perceptual constancy is reduced by limited experience with the object and by decreasing the number of environmental cues that aid in identification of the object.

Visual discrimination is the ability to recognize similarities and differences between shapes, size, colours, objects and patterns. Children need adequate visual discrimination skills to function properly in school and at home.

Source: https://www.britannica.com/science/perceptual-constancy

Utility and Scope

Spatial sense is an intuitive feel for shape and space. It involves the concepts of traditional geometry, including an ability to recognize, visualise, represent, and transform geometric shapes. Students of geometry can apply their spatial sense and knowledge of the properties of shapes and space to the real world.

Perceptual constancy is responsible for the ability to identify objects under various conditions, which seem to be “taken into account” during a process of mental reconstitution of the known image. The ability to determine differences and similarities between objects helps us to understand and interpret the environment around us. Visual discrimination is especially important to learn how to read and write.

Source: source of information on spatial sense

A. Competency

- Identify and recognize similarities and differences between objects in space when viewed from different distances and angles.

B. Objectives

- Recognize figures or objects in space regardless of size, position, or orientation (shapes viewed from a different distance or different viewpoint)
- Recognize that a shape or size is stable even if it appears to be different to the observer.
- Identify the similarities and differences between or among objects.

C. Learning Experiences

- Students observe objects when placed from different distances and different angles, and then identify those objects correctly to help student gain the following perceptual constancy:
  - Shape constancy (Even if objects look different when viewed from different angles/viewpoints, the objects remains unchanged)
  - Size constancy (Objects may look bigger when viewed from shorter distance and smaller when viewed from longer distance, but they remain unchanged)
  - Identify objects placed under different conditions.
- Students practise visual discrimination by comparing objects and classifying them.
  - Tell the difference between concrete objects that may look similar but are not the same.
  - Observe pictures and identify similarities and differences.
  - Practise visual discrimination by playing games like treasure hunts, matching puzzles, finding the difference, etc.

D. Assessment

Performance Task 1

Identify objects viewed from different angles and different distances, correctly.

Performance Task 2

Describe the similarities and differences between objects or pictures of objects.

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

- Reflective Questions
    i. Will the shape of the bottle change if I look at it from a different direction?
    ii. Are the shapes of the window and the shape of the water bottle the same? Why?

E. Resources

- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Common Objects
- Printed images of common objects
- Online
    - Introduction- Perceptual Constancy - https://www.britannica.com/science/perceptual-constancy
    - Utility and scope - source of information on spatial sense

Topic: II-D2 3-D and 2-D Shapes

[450 minutes]

Introduction

2-D shapes are flat and can be drawn on paper. 3-D shapes are solid shapes and occupy space. You can draw diagrams of 3-D shapes on paper, but these diagrams only show the view from one perspective.

Geometry began with a practical need to measure shapes. The word geometry means to "measure the earth" and is the science of shape and size of things. It is believed that geometry first became important when an Egyptian pharaoh wanted to tax farmers who raised crops along the Nile River. To compute the correct amount of tax the pharaoh's agents had to be able to measure the amount of land being cultivated.

Early Greeks (600 BC–400 AD) that developed the principles of modern geometry beginning with Thales of Miletus (624–547 BC). Euclid was a great mathematician and often called the father of geometry.

Source: http://www.thegeodes.com/templates/geometryhistory.asp

Utility and Scope

Learning shapes not only helps children identify and organise visual information; it helps them learn skills in other curriculum areas including reading, maths, and science. Learning shapes also helps children understand other signs and symbols.

A. Competency

- Distinguish 3-D shapes from 2-D shapes by identifying and describing the attributes of shapes.

B. Objectives

- Examine the attributes of 3-D and 2-D shapes through sorting, building structures, using manipulative like pattern blocks, linking cubes, coloured counters etc.
- Identify, name, describe prisms & pyramids
- Distinguish prisms and pyramids by investigating their attributes.

C. Learning Experiences

- Students examine the attributes of 3-D shapes.
  - Identify and describe the number of edges, corners/vertices, rectangular faces and triangular faces of 3-D shapes.
  - Sort 3-D shapes as prisms and pyramids.
  - Discuss how 3-D shapes are named according to their base.
  - Discuss the similarities and differences between prisms and pyramids.
  - Discuss the similarities and differences between cube and rectangular prism. Watch the video https://cutt.ly/OkWzxlt to learn more about 3-D shapes.
  - Practice identifying 2-D shapes through the online activity worksheet on geometry
- Students examine the attributes of 2-D shapes.
  - Describe the attributes of 2-D shapes, number of sides and corners, using pattern blocks or drawings of 2-D shapes.
  - Examine the attributes and distinguish squares from a rectangle.
  - Compare and contrast 2-D shapes based on the attributes. Watch the video https://cutt.ly/GkWzbSr to learn more about 2-D shapes.
  - Practice identifying 2-D shapes through the online activity worksheet on 2-D shape
- Students observe the construction of 3-D shapes with 2-D faces, then name and describe 3-D shapes correctly.
- Practice identifying and discussing 3-D and 2-D shapes through the activities on Self-Instructional Material, Key Stage I, Class II, Volume – IV.
- Students connect 3-D and 2-D shapes with the real world.
  - Identify objects in the environment as 3-D shapes and name the shapes.
  - Identify surfaces as 2-D shapes and name the shape.

D. Assessment

Performance Task 1

Identify, name and describe 2-D shapes based on their attributes.

Performance Task 2

Identify, name and describe 3-D shapes based on their attributes.

Performance Task 3

Classify 3-D shapes as prisms and pyramids and explain the difference.

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

- Reflective Questions
  i. How is square a rectangle?
  ii. Why is the shape Triangular Prism named that way?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- Self-Instructional Material, Key Stage I, Class II, Volume - IV
- National School Curriculum, Mathematics for PP – XII
- 3-D manipulatives
- Concrete objects
- 2-D shapes drawn on chart papers.
- Online
  - Introduction: http://www.thegeodes.com/templates/geometryhistory.asp
  - Mathematics Key Stage 1: Exploring 3-D shapes
  - https://cutt.ly/OkWzxlt
  - Solid Shape: https://www.iknowit.com/lessons/a-geometry-solid-shapes-3-D.html
  - Mathematics Key Stage 1 : 2-D shapes & Polygons: https://cutt.ly/GkWzbSr
  - Flat Shapes: https://www.iknowit.com/lessons/a-geometry-flat-shapes-2-D.html

Topic: II-D3 Parallel Lines *[250 minutes]*

Introduction

Parallel lines are lines that are always the same distance apart. Because they are always the same distance from one another, parallel lines will never intersect.

Few examples of parallel lines observed in the real world are:

- Road ways and tracks: the opposite tracks and roads will share the same direction, but they will never meet at one point.
- Lines on a writing pad: all lines are found on the same plane, but they will never meet.
- Pedestrian crossings: all painted lines lie along the same direction and road, but these lines will never meet.

Source: https://bit.ly/3LtClyj

Utility and Scope

Understanding what parallel lines can help us find missing angles, solve for unknown values, and even learn what they represent in coordinate geometry. Since parallel lines are used in different branches of maths, we need to master them as early as now.

The parallel lines help us understand where the objects and sides of different shapes are going. For example, we can observe the opposite sides of a square, rectangle, and parallelogram as they are equal and parallel to each other.

Source: https://bit.ly/3LtClyj

A. Competency

- Recognize the features of parallel lines and identify parallel lines in our surroundings.

B. Objectives

- Represent and discuss the meaning of parallel lines
- Generate one's own definition of parallelogram upon investigating parallel lines.

C. Learning Experiences

- Students draw different pairs of lines.
    - Compare their lines with their friends and discuss the similarities and the differences.
- Introduce parallel lines.

- Show examples of parallel lines
- Discuss the meaning and definition of parallel lines.
- Discuss the features of parallel lines.
- Let students compare their drawings to discuss if their drawn lines were parallel.
- Discuss some non-examples of parallel.
- Students explore drawing of examples of parallel lines as well as non-examples of parallel lines to understand the meaning of parallel lines.

- Students explore examples of parallel lines
  - Examine drawing of 2-D shapes and identify parallel lines as the opposite sides of 2-D shapes.
  - Identify and discuss examples of parallel lines in the real world.
  - Practice identifying parallel lines through the online worksheet. https://www.liveworksheets.com/ib1184554ud

D. Assessment

Performance Task 1

Draw parallel lines.

Performance Task 2

Examine a parallelogram and define it in simple language.

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

- Reflective Questions
  i. How could you say that these lines are parallel?
  ii. What makes this pair of lines different from this pair of lines (showing up a pair of parallel line against a pair of non-parallel lines)?
  iii. Why do you think the sides of the rod are parallel?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
  - Parallel Lines – Definition, Properties, and Examples – https://bit.ly/3LtCIyj
  - Parallel lines - https://www.liveworksheets.com/ib1184554ud

Topic: II-D4 Reflective Symmetry *[200 minutes]*

Introduction

Reflective symmetry is a type of symmetry where one-half of the objects reflect 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 on both sides, the left and right sides.

Some important points to remember about reflective symmetry are:

- All regular polygons are symmetrical in shape.
- An object and its image are symmetrical with respect to its mirror line.
- Reflection symmetry can also be observed in inkblot paper.
- A figure can have one or more lines of reflection symmetry depending on its shape and structure.

Source: https://www.cuemath.com/geometry/reflection-symmetry/

Utility and Scope

Understanding reflective symmetry helps students with a better understanding of geometrical shapes and their properties.

For example, A square has 4 lines of symmetry, which are lines through the midpoints of opposite sides, and lines through opposite vertices make up the four lines of symmetry.

A rectangle has two lines of symmetry, which are lines through the midpoints of opposite sides.

One can utilise their understanding of symmetry to interpret and design arts. Children develop a better understanding of the images they see in the real-world environment.

The reflection of trees in clear water; the reflection of mountains in a lake are amongst the commonly seen examples of reflection symmetry around us.

A. Competency

- Describe reflective symmetry by investigating symmetry in the environment.

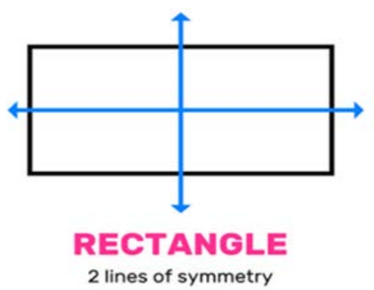
B. Objectives

- Identify that half of the shape is the mirror image of the other half.
- Identify more than one line of symmetry in shapes.
- Describe symmetry in a real-world environment.

C. Learning Experiences

- Students explore symmetry in 2-D shapes.
  - Folding paper cutouts of regular and irregular 2-D shapes into halves.
  - Examine each side of the fold.
  - Identify the side of the fold which looks exactly the same as the other side as the reflective image.
  - Explain the meaning of symmetry by comparing the image of the halves that students folded.
  - Identify the crease formed as the line of symmetry.
  - Describe a line of symmetry in a simple sentence.
  - Explore more than one way of folding shapes into halves.

    Example:



- Students explore symmetrical structures or objects in the environment.
  - Examine the two halves of the symmetrical as well as non-symmetrical shapes.
  - Identify that for a shape to be symmetrical the half of the shape must be the mirror image of the other half.
  - Practice identifying symmetrical images through the online worksheet [worksheet on symmetry]

    Towards the end, ask: How many of your shapes are symmetrical?
    How many of your shapes are not symmetrical?
    How many shapes are there altogether?

D. Assessment

Performance Task 1

Draw lines of symmetry for different 2-D shapes.

Performance Task 2

Explain what symmetry is in simple language with the examples from the environment.

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

- Reflective Questions
    i. Which kind of shapes are symmetrical?
    ii. How do you know that this shape is symmetrical?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
    - Introduction- Reflective Symmetry – worksheet on reflective symmetry
    - Practising Symmetry - worksheet on symmetry

Topic: II-E1 Collect and Organise Data *[300 minutes]*

Introduction

Data collection is the organised process of getting information to evaluate outcomes. The main goal of collecting data is to collect information to ensure accuracy and make data easier to study.

The first forms of early data were in the form of tally or tick marks. These were collected 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.

Source: https://www.questionpro.com/blog/data-collection-methods/

Utility and Scope

Collecting data is an important life skill. Students need to develop their ability to think out how data is best collected and then organised. They should develop questions with only a few possible responses so that they can handle the data they collect. If they try out a question and many unexpected answers arise, they should think about how to modify their questions, so that the question defines the options of the responses.

A. Competency

- Collect and record data using tallies to gather information for an appropriate purpose.

B. Objectives

- Identify a problem/situation to conduct a survey.
- Conduct simple surveys based on verbal or written questions.
- Collect and record information using tallies.
- Make and modify predictions based on data collected or presented.

C. Learning Experiences

- Revisit collecting data using simple yes/no questions.
  - Discuss the use of tallies to organise collected data.

- Students examine and discuss problems and design a simple question for a survey.

  Example: The sample shows how we can collect data with simple questions.

How many sisters do you have?

0 sisters	||||	4
1 sister	~~||||~~ ||	7
2 sisters	~~||||~~	5
More than 2 sisters	||	2

- Design appropriate questions to collect data.
- Conduct simple surveys using simple questions verbally.
- Record and organise data using tallies.
- Describe the collected data.
- Discuss information presented by collected data

  Example: Ask questions to student like,

  What have you thought about asking your friends?

  What was your question?

  Which answer was most popular in your group?
- Predict results based on the information presented by the collected data.

D. Assessment

Performance Task 1

Conduct simple surveys and record information using tallies.

Performance Task 2

State a prediction of the survey result by observing the tallies.

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

- Reflective Questions
  - i. Why do you think we collect data?
  - ii. How does organising data help you describe the collected data?

E. Resources

- Understanding Mathematics, Student activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
  - History of Data - https://www.questionpro.com/blog/data-collection-methods/

Topic: II- E2 Pictographs: Interpret and Create Pictographs

[250 minutes]

Introduction

A pictograph is the representation of data using images. Pictographs represent the frequency of data while using symbols or images that are relevant to the data. This is one of the simplest ways to represent statistical data.

Graphs are powerful data displays since visual displays are easy to interpret very quickly. A Concrete graph is made using the actual objects or people on a graphing mat. A picture graph, or pictograph, is a graph used to display information that uses images or symbols to represent data.

Source: https://thirdspacelearning.com/gcse-maths/statistics/pictograph/

Utility and Scope

Pictographs are taught as a simple and engaging introduction to graphs. Pictographs are a great way to show data. Instead of using numbers, lines, and bars, which could seem complicated for kids, one can show quantities using pictures. A pictograph is a great way to show quantified data in pictures and children easily connect to pictures.

Graphs and charts condense large amounts of information into easy-to-understand formats that clearly and effectively communicate important points. Graphs are powerful data displays since visual displays are easy to interpret very quickly.

A. Competency

- Interpret and create pictographs, having 1 symbol/picture representing 1 unit.

B. Objectives

- Recognize, interpret and create pictographs.
- Use 1 symbol/picture to represent 1 unit.
- Use both vertical and horizontal orientations to create and interpret pictographs.

C. Learning Experiences

- Collect data by asking a simple question to students.
- Present a pictograph using the data collected.
    - Present both horizontal and vertical orientations of the pictograph.
    - Ensure the following:

        - Title and labels are placed appropriately.
        - The scale of the graph is 1 unit = 1 (i.e., 1 image= 1 count).
        - The same image is used to represent data for all the labels/categories
        - A common baseline to start drawing the images for all the labels.
        - One-to-one correspondence of images, for all the labels.
- Students explore the interpretation of pictographs.
    - Discuss the information presented by the pictograph (the title, labels, and the data for each label).
    - Discuss the image used to represent the data.
      While interpreting a pictograph, students must notice the scale of the graph (1 symbol/picture represents 1 unit)
    - Explain the need for one-to-one correspondence of the images.
      It not only helps with the neater presentation of the data but also helps in interpreting the data.
    - Discuss the result and interpret the graph.
      Use one-to-one matching of the images among the labels to compare data.
      Answer questions related to the pictograph.
    - Watch the video https://www.youtube.com/watch?v=RQsHOeoz57s to learn how information is presented using pictographs. (Trim the video till 2:44 min).
- Students create their own pictographs.
    - Use the data they had collected from their survey earlier and create a pictograph (where 1 symbol/picture represents 1 unit, of both horizontal and vertical orientation.
    - Explain the picture used to represent data.
    - Create horizontal as well as vertical orientations of pictographs.
    - Discuss how the two orientations look different but present the same information.
    - Discuss why we have created pictographs from the data collected.
- Discuss the similarities and differences between a concrete graph and a pictograph.

D. Assessment

Performance Task 1

Interpret a pictograph and describe the information presented by the graph.

Performance Task 2

Create a pictograph using the data they had collected using a scale of 1 (1 symbol/picture = 1 unit)

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

- Reflective Questions
  - i. What questions are you going to ask?
  - ii. Why did you choose the particular image to represent the data for your pictograph?
  - iii. How would you like to present a pictograph? Vertically or horizontally? Why?
  - iv. Why did you choose the particular title of the pictograph?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
  - What is Graph Theory and Why Should You Care - https://thirdspacelearning.com/gcse-maths/statistics/pictograph/
  - Data representation-Pictograph - https://www.youtube.com/watch?v=RQsHOeoz57s

Topic: II-E3 Bar Graphs: Interpret Bar Graphs. Create Bar Graphs

[300 minutes]

Introduction

Graphs are powerful data displayed since visual displays are easy to interpret very quickly. Pictographs and bar graphs are used to compare frequency within categories.

The basic idea of graphs was first introduced in the 18th century by the Swiss mathematician Leonhard Euler, one of the most eminent mathematicians of the 18th century.

A bar graph can be defined as a chart or a graphical representation of data, quantities, or numbers using bars or strips.

Bar graphs are used to compare and contrast numbers, frequencies, or other measures of distinct categories of data.

Source: https://www.cuemath.com/data/bar-graphs/

Utility and Scope

Bar graphs are used to provide an easy to interpret visual display that can be used to compare the numbers in different categories of information.

Graphs are a common method to visually show relationships in the data. The purpose of a graph is to present data that are too much or difficult to be described effectively in the text and in less space.

When data is presented in the form of a graph, it becomes attractive, easy to read and interpret. Example, most of the data are presented in the form of graphs in many of the institutions and documents. Learning to construct and interpret bar graphs will help them build foundations for research work in later part of their life.

A. Competency

- Interpret and create bar graphs, having 1 square representing 1 unit.

B. Objectives

- Recognize, interpret and create bar graphs.
- Use 1 symbol/picture to represent 1 unit.
- Use both vertical and horizontal orientations to create and interpret bar graphs.

C. Learning Experiences

- Revise the previous lesson on pictographs by asking questions.
  Discuss how collected data is represented using graphs.
- Introducing bar graphs.
  - Present vertical as well as horizontal bar graphs.
  - Let students describe the information displayed by the bar graph.
  - Let students interpret the information presented by the bar graphs.
  - While interpreting the bar graph, students discuss the scale of the graph (1 square represents 1 unit), what each square represents, the title and labels of the graph.
  - Compare the bar graph to a pictograph.
- Demonstrate how to create a bar graph on a square grid using the collected data that was also used for creating pictographs.
- Students use the data they had collected from their survey earlier and create vertical as well as horizontal bar graphs with a scale of 1, on a square grid.
  - Mention the title and labels of the graph.
  - Describe the graph.
  - Watch the video https://youtu.be/iWzy0k38CPk to learn to create bar graphs.
  - Discuss question like:
    - What is the difference between these two bar graphs?
    - Why does it make sense to call these bar graphs?
    - Why is it useful to separate the bars?

D. Assessment

Performance Task 1

Interpret a bar graph and describe the information presented by the graph.

Performance Task 2

Create a bar graph using the data they had collected using a scale of 1 (1 square= 1 unit)

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

- Reflective Questions
  i. What is the difference between these two bar graphs?
  ii. Why does it make sense to call these bar graphs?
  iii. Why is it useful to separate the bars?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
    - What is Graph Theory and Why Should You Care - https://www.britannica.com/topic/graph-theory
    - Mathematics Key Stage 1: Data Collection - https://youtu.be/iWzy0k38CPk

Topic: II-E4 Probability Language: Likely and Unlikely Events Conducting Experiments

[300 minutes]

Introduction

Probability is the study of random events to understand the chance. Students can use it in analysing and applying to everyday events.

The definition of probability has been given by a French mathematician named "Laplace". According to him, the probability is the ratio of the number of favourable cases among the number of equally likely cases. It has got its origin from games, tossing coins, throwing dice, and drawing a card from a pack.

Source: https://byjus.com/maths/probability/

Utility and Scope

We use probability language to describe the prediction of the occurrence of future events. Learning to use appropriate probability language improves communication skills.

A. Competency

- Investigate mathematical and real-life events to describe the probability of future events as likely and unlikely events.

B. Objectives

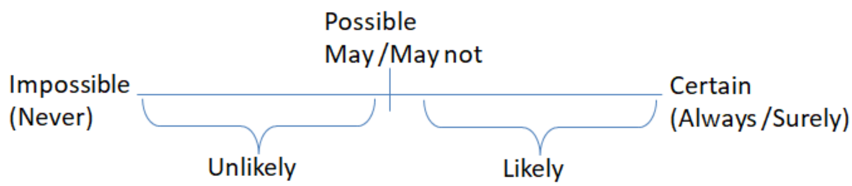
- Predict and describe probability outcomes of various events using the terms 'likely' or 'unlikely'.
- Conduct experiments on the probability of various mathematical and real-life events.

C. Learning Experiences

- Take students through a brief revision of describing the probability of events using the terms 'possible', 'impossible', and 'certain'.

  Ask the students a few questions such as:
  - Do you think you will become shorter in height by next week?
  - Do you think you will sleep tonight?
  - Do you think you will slip and fall down while walking back home today?
- Introduce and explain how to use terms 'likely' and 'unlikely' to describe the probability of real-life events.

- We can further describe possible future events using terms 'likely' and 'unlikely'



Likely: When the occurrence of the future event is and the chance of occurrence is higher.
Unlikely: When the occurrence of the future event is possible but there is less chance of occurrence.

- Watch the video on probability words to learn how to describe the occurrence of a future event using appropriate probability language.

• Students predict and then conduct experiments on various mathematical and real-life events to describe future events as likely and unlikely events and evaluate their predictions.

D. Assessment

Performance Task 1

Describe the occurrence of future events stated by the teacher as likely or unlikely events.

Performance Task 2

State some examples of likely or unlikely future events.

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

- Reflective Questions

i. What is it called when we talk about the chances of something happening in the future?
ii. How many words can we now use to describe a prediction? What are these words?
iii. Can you tell an example of something that is possible, but unlikely?

E. Resources

- Understanding Mathematics, Student Activity Book for class II
- Understanding Mathematics, Teacher's Guide for class II
- National School Curriculum, Mathematics for PP – XII
- Online
    - Mathematics Key Stage 1: Probability language - on probability words
    - Introduction: https://byjus.com/maths/probability/

Instructional Guide

Class III

Mathematics

Topic: III-A1 Numbers to 4-digits

III-A4 Money

III-B4 Place Value Pattern Base-Ten System to Thousands

[500 minutes]

Introduction

Number is the concept of an amount, quantity, or how many items there are in a collection, while Numeral is the written symbol that represents a number. Numbers play an important part in our lives. We use numbers in school, at the workplace, and in our daily life.

The system of numbers we use is called the base-ten number system. It is a place-value number system in which 10 digits, 0 through 9, are used to represent a number. The position of a digit in a number determines its value. It is called place value. The value of each place is 10 times the value of the place to its right.
To represent large numbers, Stern (1948) developed devices that represent the structure of the ten-base system. Stern and Stern used it for teaching place values. Although they did not use the terms for naming base-ten-blocks such as bars or cubes, the blocks have been sold under the name base-ten-blocks,
Source: Concept on Numbers
History on Base Ten Blocks

Utility and Scope

Understanding the place value of digits in numbers helps in writing numbers in their expanded form. A place value chart can help us in finding and comparing the place value of the digits in numbers through millions.

Use of concrete materials helps in enhancing number sense. Learning to represent 4-digit numbers will help conduct operations with large numbers. This in turn will help students solve problems in real life involving large numbers.

A. Competencies

- Express 4-digit numbers in various ways and apply the skill to effectively express large quantities and value of money in real life.
- Examine relations among the currency notes, till Nu 1000 and use the knowledge to trade effectively in real life situations.

- Interpret the place value pattern and describe thousands in terms of hundreds and tens.

B. Objectives

- Read 4-digit numbers correctly.
- Identify the value of currency notes till 1000.
- Represent 4-digit numbers correctly in different ways, using:
    - Place Value Charts.
    - Base-Ten Blocks
    - Dummy Ngultrum notes
- Explain the increase in place value in relation to the value of the place to its right.
- Represent and describe numbers till 1000 as groups of Tens and Hundreds, correctly.
- Compare and order 4-digit numbers using various methods, correctly.

C. Learning Experiences

- Learners revisit reading and representation of 3-digit numbers in various ways.

- Learners explore representation of 1000 on place value charts and using base ten block models to infer one thousand as 10 hundreds.

- Learners explore place value charts to discuss the increase in place value in relation to the value of the place to its right.
    - Identify that hundreds are recorded to the left of tens, and thousands are recorded to the left of hundreds.
    - Use base ten block models to interpret that 10 of any unit = 1 of the unit to the left.
    - Explain the increase in place value in relation to the value of the place to its right.

- Learners read 4-digit numbers in different ways by representing the numbers using:
    - Place Value chart
    - Base-Ten blocks (concretely and pictorially)

Watch the video [Representing 4-Digit Numbers] to learn how to represent 4-digit numbers with base-ten blocks.

- ○ Dummy Ngultrum notes.

  Example: 1542 is read as 'One Thousand Five Hundred Forty- Two' or as 'Fifteen Hundred Forty-Two'.

  Explore reading 4-digit numbers correctly in Dzongkha as well.

- Learners explore representations of 4-digit numbers in various ways
  - ○ Express numbers in expanded form.
  - ○ Interpret the numbers expressed in expanded form.
  - ○ Write the numbers in their standard correctly.

    Write the numbers using Dzongkha numerals as well.
  - ○ Use the online worksheet [Liveworksheet] to practise representing 4-digit numbers in different ways.
  - ○ Play 'Hoop the Match' game to relate various pictorial and symbolic representations of a 4-digit number.

    (Refer Annexure for the instruction)

- Learners describe numbers till 1000 as groups of Tens and Hundreds

  Example: 1000 = 10 Hundreds or 1000 = 100 Tens.
  - ○ Using base-ten blocks
  - ○ Using dummy Ngultrum notes

    Note: Use of dummy Ngultrum notes helps make real world connections. It helps learners identify the value of currency notes, calculate note exchanges and changes. It also enhances their understanding of regrouping of numbers.

- Learners practise rounding numbers to the nearest Ten, Hundred or Thousand.
- Learners explore comparison of different pairs of 4-digit numbers
  - ○ Use appropriate symbols for comparison
  - ○ Order different sets of 4-digit numbers from least to greatest and vice-versa.
  - ○ Explain the method used for comparing the numbers
  - ○ Watch the video [Comparing 4-Digit Numbers] to learn how to compare and order 4-digit numbers.

D. Assessment

Performance Task 1

Represent 4-digit numbers in three ways (on Place Value chart, drawing sketches of Base-Ten blocks and using dummy Ngultrum notes) , appropriately.

Performance Task 2

Read and write 4-digit numbers, in standard form, which has been expressed in expanded form, correctly.

Performance Task 3

Order at least three sets of 4-digit numbers from least to greatest and vice-versa, and explain the method used.

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

- Reflective Questions
  i. How are the numbers 3250 and 3205 similar/different?
  ii. Why is the numeral 2 of more value than 9 in 2900?
  iii. In what situation can you think of using 4-digit numbers?

Template to record assessment

<table>
<tr><td colspan="2">Strand(s): Number and operations</td><td colspan="4">Topic(s): III-A1 Numbers to 4-digits</td></tr>
<tr><td colspan="6">Competency:
Express 4-digit numbers in value ways, apply the skill to effectively express large quantities and value money in real life.</td></tr>
<tr><td>Name of the students</td><td colspan="5">Level of achievement</td></tr>
<tr><td></td><td>Beginning</td><td>Approaching</td><td>Meeting</td><td>Advancing</td><td>Exceeding</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Base-Ten Blocks
- Dummy Ngultrum notes
- Online
  - Recognize representations for four-digit numbers (with base 10 blocks) | Place Value | Year 4 - Representing 4-Digit Numbers
  - Compare and order four-digit numbers- Compare & order numbers
  - Four Digit Partner Practice - Liveworksheets
  - Introduction:

    Number Concept Explained

    History of Base Ten Blocks

Game

Game: Hoop the Match.

Materials Required: Small hoops.

Cards with various representations of 4-Digit numbers:

- With Sketches of base ten blocks
- With Sketch of dummy ngultrum notes
- As expanded form
- Renamed as hundreds and tens
- Written in words in English
- Written in words in Dzongkha
- Written using Dzongkha numerals

Instruction:

Place cards on the ground

Each team gets a number, written in the standard form.

They must find different representations of the number on the ground and through a hoop on the cards.

All the team members must stand behind a line drawn.

Each player gets two chances to throw the hoop.

If the hoop falls on the card, they can fetch the card.

They can keep the cards if it is the correct representation of the number they have.

If not, they must place it back on the ground.

The team that finds all the representations first wins the race.

Topic: III-A2 Fractions up to Tenths *[300 minutes]*

Introduction

Fraction represents part of a whole. Fractions are numbers that aren't whole; they are a part of something bigger. Fractions have two numbers, a numerator (the part-displayed above the line) and a denominator (the whole-displayed below the line).

The 'Fraction' word is derived from Latin 'fractus', which means "broken". It represents a part of a whole or, more generally, a number of equal parts.

Source: Fraction Defined

Utility and Scope

We use fractions in almost all walks of life. We divide our time in terms of weeks, months and days and use fractions in it. We use fractions when we say time, e.g. 'It is a quarter (1/4) past seven'. We use fractions to describe measurements and chances, etc.

A. Competency

- Demonstrate the ability to interpret fractions and use fractions to describe parts in real-life situations.

B. Objectives

- Interpret and read modelled fractions (till tenths) as a part of a whole and set, in various ways.
- Model fractions, till tenths, concretely, pictorially, and symbolically, as part a whole and part of a set.
- Discuss representations of fractions in real life to solve simple problems using the concept of fractions.

C. Learning Experiences

- Learners recall and briefly discuss half, thirds, and fourths, as fractions, as part of a whole and part of a set.
- Learners explore fractions till tenths, as parts of a whole, by dividing concrete objects and fraction strips into equal parts (till 10).

- Learners explore fractions till tenths, as parts of a set (till ten objects in a set).
  - Read fractions correctly.
  - Observe and discuss the basic principles of fractions:
    - The parts must be of equal size and shape in the case of whole (a single shape or object)
    - The parts can be of varied size and shape in case of a set or group.
    - A fraction always has a complementary fraction. These two fractions, together, make up the whole.

      Refer Annexure for examples.

- Learners identify and practise symbolic representation of fractions till tenths.
  - Play the game 'Finding My Fraction Mates' for identification and interpretation of symbolic representation of fractions.

    (Refer Annexure for the instruction)
  - Design worksheets for learners to practise expressing fractions as symbols

    Watch the video Fraction Explained Symbolically to see how fractions are expressed symbolically.

    Discuss what the numerators and denominators mean for each fraction.
  - Try the online activity Liveworksheets to relate fractions names to fraction symbols and to differentiate numerators from denominators.

- Learners identify and discuss representations of fractions in their daily lives or their immediate environment.

  Example: Explore the representation of fractions in measurements of length, mass, and capacity.
  - The boy's height is about one-third of the tree
  - Length of a leaf is about one-fifth of the length of the stem.
  - The mass of the potato is about one-tenth of the pumpkin.

- Learners apply the understanding of fractions to solve simple everyday problems.

  Example:
  - You are given a small round cake. You need to share the cake equally among 8 people. How would you divide the cake? How much of the cake would one of them get?
  - If 3 girls make up three-tenths of a group, how many boys should there be in the group?

D. Assessment

Performance Task 1

Interpret at least four representations of fractions and read them as fractions and complementary fractions correctly.

Performance Task 2

Express at least four pictorial representations of fractions in words and in symbols.

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

- Reflective Questions
  i. What fraction would you use to describe the number of boys/girls in your family?
  ii. If two glasses of water fill the sixths of a bottle, how many more glasses of water need to be added to fill the whole bottle? Why do you think so?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Printed shapes/pictures and their outlines
- Worksheets
- Online
  - Introduction -Fraction - Fraction Defined
  - Let's Learn Fractions - Understanding Maths for Kids - Fraction Explained Symbolically
  - Fraction Shapes - Liveworksheet

F. Annexure

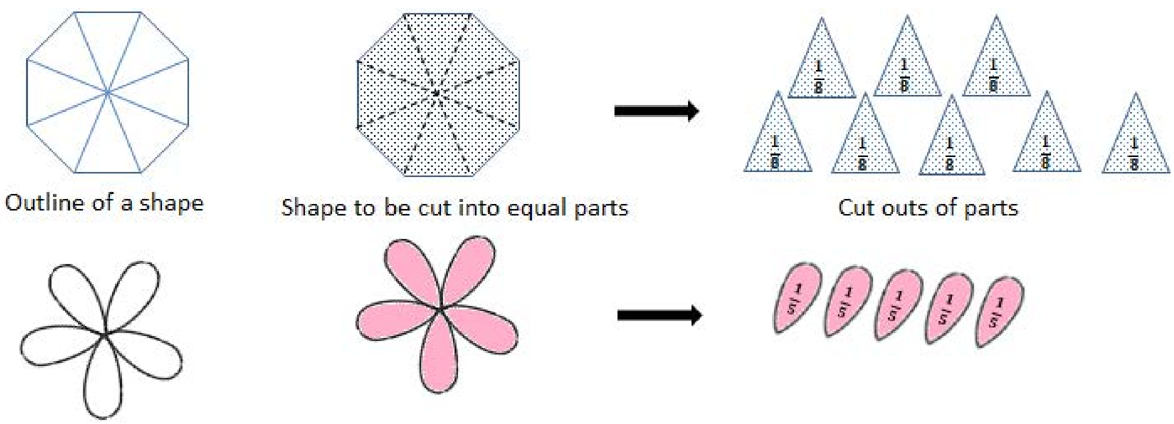
i. Example of fraction as a part of a whole
ii. Example of fraction as a part of a set

iii. Game: Finding My Fraction Mates.
Materials required:

- Shapes or pictures cut into a certain number of equal parts (max. ten parts)
- Outlines for the shapes/pictures of equal size

Instructions:

- Learners play in teams but the team members would be unknown in the beginning of the game.
- Each learner picks a random cut part, while being blindfolded.
- Learners then move around to find mates with similar cut out having the same symbol. While doing so, learners must figure out how many teammates they have to search for, by looking at the denominator of the fraction written on the piece they are holding.
- Once all the mates have gathered, they race together to collect the outline of the whole shape/picture that can be filled with the parts they are holding.
- In teams, learners paste the parts on the outline sheet and race towards the finish line.
- Whichever team completes the task first wins the game.



Topic: III-A3 Decimal Tenths *[300 minutes]*

Introduction

A decimal is a fraction written in a special form.

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.

The decimal point refers to the period that separates the one's place from the tenth's place in decimal numbers.

Source: [Decimal Defined]

Utility and Scope

Decimals are used every day in situations where more precision is required than the whole numbers can provide. For example, when we check our weight on the weighing machine, we do not always find the weight equal to a whole number on the scale.

Likewise, we use decimals to express measurements of length and capacity. We also use decimals while dealing with money.

A. Competency

- Demonstrate the ability to use the concept of the decimal tenth to interpret decimal representations in the real -world situation.

B. Objectives

- Explain the concept of tenths in a place value system using a place value chart, in simple language.
- Explain tenths as part of a whole divided into 10 equal parts.
- Model decimal tenths using concrete objects or by drawing pictures.
- Express the relation of the decimal tenth and a tenth fraction.

C. Learning Experiences

- Learners explore the concept of Tenths place in the number system.
    - Discuss what a tenth fraction tells us. (out of ten, less than a whole/1)
    - Introduce and explain the term 'Decimal Tenth Fraction'

Decimal fractions are those fractions which have 10 or powers of 10 as the denominator.

E.g. $\frac{2}{10}$, $\frac{8}{100}$, etc.

- ○ Introduce Tenths place on a place value chart and discuss students' interpretations about the Tenths place.

- Learners relate tenth fractions to decimal tenths.
  - ○ Represent both concretely and pictorially.
  - ○ Discuss briefly about the concrete objects used.

    Example: If learners use twigs or parts of plants, learners could discuss the values of taking care of plants, etc.
  - ○ Watch the video Decimal Tenth to learn how tenths are represented as fractions and decimal tenths.

- Learners read and interpret decimal tenths correctly.
  - ○ Read decimal in English (e.g., 0.2 is read as 'three-tenths' and 'zero point two)
  - ○ Read decimals in Dzongkha (This could be related to appropriate use of Dzongkha phrases)

- Learners express decimal tenth fractions as decimal tenths symbolically.
  - ○ Try the online activity Liveworksheet to relate pictorial representation of tenths to tenth fractions and decimal tenths.

    (Or design a worksheet for learners to practise the above mentioned).

- Learners discuss real-life application of decimals.

Example:

- ○ Score on test papers,
- ○ timer on stopwatch,
- ○ expression of mass on digital scales,
- ○ expression of length and capacities,
- ○ nutritional values on food packets (This could be related to healthy food lesson in science),
- ○ Price tags. (This could be related to understanding the economic value of commodities).

D. Assessment

Performance Task 1

Interpret at least four representations of tenths and read and write as decimal tenths (as words and symbols), correctly.

Performance Task 2

Model at least 4 different decimal tenths, appropriately and explain their model.

Performance Task 3

Interpret at least 3 different real-life applications of decimal tenths.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. How are decimal tenths similar to tenth fractions?
  ii. How are they different?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete Materials/Manipulatives
- worksheets
- Online
  - Introduction on Decimal - https://www.vocabulary.com/dictionary/decimal
  - Decimal Models: Tenths - https://www.youtube.com/watch?v=asOD7H6C8ig
  - Decimal Tenth - https://www.liveworksheets.com/gf1225002lx

Topic: III-A5 Add 3-digit Whole numbers *[400 minutes]*

Introduction

Addition is one of the oldest and the most basic arithmetic operations. It has been known to mathematicians for more than 6000 years. The 'counting' was considered as an early form of addition.

The first official evidence of addition is that Egyptians and Babylonians used it in 2000 B.C. The symbols of addition and subtraction were invented around the 16th century, but before that, the equations were written in words, making it really time-consuming to solve the problems.

Source: Addition Explained

Utility and Scope

Addition helps kids master the relationships between numbers and understand how quantities relate to one another. Addition is useful in everyday situations such as to find the total number of people or items in large groups, while travelling, one can add the distance to estimate the time required or even pay bills for groceries after shopping, etc.

A. Competency

- Add three-digit numbers in various ways and use estimation to check the reasonableness of the sum obtained.

B. Objectives

- Estimate sums of 3-Digit whole numbers to determine the reasonableness of the answer obtained.
- Add 3-Digit whole numbers (without regrouping), concretely, pictorially, and symbolically.
- Add 3-digit whole numbers with regrouping, concretely, pictorially, and symbolically.
- Use and explain the alternative paper-and-pencil algorithm to solve problems related to addition, appropriately.
- Solve word problems involving the addition of 3-digit whole numbers, using pencil-paper algorithm, correctly.
- Create word problems involving the addition of 3-digit whole numbers and assess the solution to the problems, appropriately.

C. Learning Experiences

- Learners recall the addition of 2-digit numbers.
  Discuss different ways of carrying out addition, for about two examples of addition of 2-digit numbers.

- Learners explore addition of 3-digit numbers, using place value chart (First without regrouping, then with regrouping)
  - Estimate the sum for each pair, and explain their estimate.
  - Add 3-digit numbers and explain the addition method used.
  - Analyse the comparison of their estimate and the sum obtained.
  - Watch the video Adding 3-Digit Numbers learn how to add three-digit numbers by regrouping.
  - Play 'Shopping game' to explore addition of 3-digit numbers using dummy Ngultrum notes. (Refer annexure for instructions)
    Discuss the expenditure their parents have to bear, and thereafter value their parents' efforts.

- Learners solve addition problems using a pencil-paper algorithm and explain the steps.
  Addition Algorithm is a step-by-step way of adding numbers. (Refer Annexure)
  - Practice addition of 3-digit numbers (without regrouping) with the online activity Liveworksheets
  - Add 3-digit numbers (with regrouping) using pencil-paper algorithm.

- Learners explore word problems involving the addition of 3-digit numbers.
  - Solve problems using an algorithm.
  - Create their own word problems that require the addition of 3-digit numbers, for their peers to solve.
  - Check the answers and provide appropriate feedback. (This activity can be related to the use of simple and appropriate language for simple communication).

D. Assessment

Performance Task 1

Estimate first and solve at least two addition problems involving 3-digit numbers (without regrouping) using place value charts.

Performance Task 2

Estimate first and solve at least two addition problems involving 3-digit numbers (With regrouping) using pencil-paper algorithm.

Performance Task 3

Estimate first and solve at least two word problems involving addition of 3-digit numbers.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Which method of addition do you prefer? Why?
  ii. If you were to find the total number of students of two schools, quickly, which method would you choose? Why?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Dummy Ngultrum notes
- Worksheet
- Online
  - Introduction on Addition - Addition Explained
  - 3-digit addition: regroup ones and tens - Adding 3-Digit Numbers
  - 3-digit numbers addition - Liveworksheets

F. Annexure

i. Game: Shopping

Materials Required:

- Objects such as toys brought in by students.
- Dummy Ngultrum notes, till Nu 1000.

Instructions:

- Place objects brought by students (e.g. toys, shirts, storybooks, bags, pencil cases, etc.) and put a price tag on each (of 3-digit numbers).
- Teacher plays the role of the shopkeeper and students play the role of buyers.
- Each learner would be given dummy notes that total up to Nu.1000.
- They can buy items within the limited budget of Nu. 1000.

- o (This probes students to estimate sums)
- o After choosing their products, they must add the prices of the goods and pay the teacher.
- o After shopping they put their items together, as a team.
- o The team with the maximum number of goods bought would be the winner.

ii. Addition Algorithm (without regrouping)

Note: For standard algorithm, we start adding from right to left. We add the ones first and then move towards the left.

Expanded Algorithm (Addition)

$\begin{array}{rl} & 127 \\ + & 341 \\ \hline & 400 \text{ (Add the Hundreds)} \\ + & 60 \text{ (Add the Tens)} \\ + & 8 \text{ (Add the Ones)} \\ \hline = & 468 \end{array}$	$\begin{array}{rrrr} & 100 & + 20 & + 7 \\ + & 300 & + 40 & + 1 \\ \hline = & 400 & + 60 & + 8 \\ \hline = & 468 & & \end{array}$

Standard Algorithm (Addition)

$$\begin{array}{rr} & 127 \\ + & 341 \\ \hline = & 468 \end{array}$$

iii. Addition Algorithm (with regrouping)

Expanded Algorithm (Addition)

$\begin{array}{rl} & 237 \\ + & 186 \\ \hline & 300 \text{ (Add the Hundreds)} \\ + & 110 \text{ (Add the Tens)} \\ + & 13 \text{ (Add the Ones)} \\ \hline = & 423 \end{array}$	$\begin{array}{rrrr} & 200 & + 30 & + 7 \\ + & 100 & + 80 & + 6 \\ \hline = & 300 & + 110 & + 13 \\ \hline = & 423 & & \end{array}$

Standard Algorithm (Addition)

$$\begin{array}{rr} & 1\,1 \\ & 237 \\ + & 186 \\ \hline = & 423 \end{array}$$

(7 + 6 = 13) (1 + 3+ 8 = 12)

Topic: III-A6 Subtract 3-Digit Whole Numbers *[400 minutes]*

Introduction

Like addition, subtraction is also one of the oldest and the most basic arithmetic operations. The word subtraction is derived from the two words, 'sub' and 'tract,' which mean under or below and to pull or carry away, respectively. Therefore, subtraction means to carry away the lower part.

Subtraction has been known to mathematicians for more than 6000 years.

Utility and Scope

We come across subtraction a lot in real-life. For example, lending or spending some money and working out how much money one should still have, or counting the days left for certain events, etc. Problems like this – about real things that children can relate to, bring subtraction to life.

It's not numbers and signs on a page that children most need to deal with in life, but real events. The more children are encouraged to tackle real-life situations, the better and easier they find to solve problems at home and at school.

Source: https://bit.ly3qEcL0V

A. Competency

- Estimate difference of 3-digit numbers to determine the reasonableness of the answer obtained after subtracting in various ways.

B. Objectives

- Estimate difference of 3-digit whole numbers to determine the reasonableness of the answer obtained.
- Subtract 3-digit whole numbers (without regrouping) concretely, pictorially and symbolically.
- Subtract 3-digit whole numbers by regrouping concretely, pictorially and symbolically.
- Use and explain the alternative paper-and-pencil algorithm to solve problems related to subtraction.
- Solve word problems involving subtraction of 3-digit whole numbers, using pencil-paper algorithm.

- Create word problems involving subtraction of 3-digit whole numbers and assess the solution to the problems.

C. Learning Experiences

- Learners recall subtraction of 2-digit numbers.
  - Discuss different ways of carrying out subtraction, from 2-digit numbers.

- Learners explore subtraction of pairs of 3-digit numbers (first without regrouping, then with regrouping)
  - First estimate the difference of each pair, and explain their estimate.
  - Use place value chart and base-ten block to subtract
  - Explain the subtraction method used.
  - Analyse the comparison of their estimate and the difference obtained.
  - Watch the videos to learn how to subtract using base-ten blocks and place value charts.
    Subtracting without regrouping (without regrouping)
    Subtracting with regrouping (with regrouping)
  - Play a shopping game to explore subtraction of 3-digit numbers using dummy Ngultrum notes.

  Calculate the remaining change/balance after paying.
  Discuss the importance of saving money.

- Learners calculate the difference of 3-digit numbers using pencil-paper algorithm and explain the steps

  Subtraction Algorithm is a step by step way of subtracting numbers.
  - Subtract 3-digit numbers without regrouping. (Refer Annexure)
  - Subtract 3-digit numbers with regrouping. (Refer Annexure)
  - Try the online activity Liveworksheet to practise subtracting 3-digit numbers with regrouping.
  - Solve word problems with subtraction of 3-digit numbers using algorithms.
  - Create their own word problems with subtraction of 3 digit numbers, for their peers to solve.
  - Check the answers and provide feedback. (This activity can be related to the use of simple and appropriate language for simple communication).

D. Assessment

Performance Task 1

Estimate first and solve at least two subtractions of 3-digit numbers (without regrouping) using place value charts.

Performance Task 2

Estimate first and solve at least two subtractions of 3-digit numbers (with regrouping) using pencil-paper algorithm.

Performance Task 3

Estimate first and solve at least two word problems involving subtraction of 3-digit numbers.

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

- Reflective Questions
  1. Does estimation help you in finding the answers to subtraction problems? How?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-I
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Dummy Ngultrum notes
- Worksheet
- Online
  - Subtraction – Explanation and Example - https://bit.ly3qEcL0V
  - 3 Digit Subtraction without Regrouping - https://www.youtube.com/watch?v=98e4Y2VGUcM
  - Digit Subtraction with Regrouping - https://www.youtube.com/watch?v=w-7XAFnx_uo
  - 3-Digit Subtraction 100 to10 or 10 to1 regrouping - Liveworksheets

F. Annexure

i. Subtraction Algorithm (without regrouping)

Note: For standard algorithms, we start subtracting from right to left. We subtract the ones first and then move towards the left.

Expanded Algorithm (Subtraction)

$$\begin{array}{rrl} & 8\,5\,3 & \\ - & 6\,1\,2 & \\ \hline & 2\,0\,0 & \text{(Subtract the Hundreds)} \\ + & 4\,0 & \text{(Subtract the Tens)} \\ + & 1 & \text{(Subtract the Ones)} \\ \hline = & 2\,4\,1 & \end{array}$$

$$\begin{array}{rl} & 800 + 50 + 3 \\ - & 600 + 10 + 2 \\ \hline = & 200 + 40 + 1 \\ \hline = & 241 \end{array}$$

Standard Algorithm (Subtraction)

$$\begin{array}{rr} & 8\,5\,3 \\ - & 6\,1\,2 \\ \hline = & 2\,4\,1 \end{array}$$

ii. Subtraction Algorithm (with regrouping)

Expanded Algorithm (Subtraction)

$$\begin{array}{rr} & 3\,7\,4 \\ - & 1\,3\,6 \\ \hline = & \end{array} \rightarrow \begin{array}{rl} & 300 + \overset{60}{\cancel{70}} + \overset{10+4}{\cancel{4}} \\ - & 100 + 30 + 6 \\ \hline = & 200 + 30 + 8 \\ \hline = & 238 \end{array}$$

(We cannot subtract 6 ones from 4 ones. So we borrow 10 (1 tens) from 70 and place it with 4 ones. Now we have 14 ones and we can subtract 6 ones.)

Standard Algorithm (Subtraction)

$$\begin{array}{rccc} & 3 & \overset{6}{\cancel{7}} & \overset{14\ (10+4)}{\cancel{4}} \\ - & 1 & 3 & 6 \\ \hline = & 2 & 3 & 8 \end{array}$$

iii. Refer Annexure of III-A1 for the template to record student achievement.

Topic: III-A7 Add and Subtract 3-digit Numbers Mentally

[300 minutes]

Introduction

Mental maths refers to doing maths calculations "in their head" without using pencil and paper or a calculator. Skills include rounding numbers, estimating calculations, decomposing numbers or using known facts or friendly numbers.
Addition and subtraction are the inverse operations of each other. Put simply, this means that they are the opposite. You can undo an addition through subtraction, and you can undo a subtraction through addition
Source: Mental Math explained

Utility and Scope

Mental maths helps us function in our daily lives in situations such as:
Shopping, adding prices or calculating changes; Cooking, using proportional thinking to alter a recipe; Converting from one type of unit into another like kilogram to gram; Using; Figuring out a score or a grade; Comparing values of products, etc.

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.
Fact families are really useful for mathematical calculations. If children are comfortable with how addition and subtraction are related, and how sets of three numbers are related by addition and subtraction, they can complete problems much quicker. They can recognise which numbers go together without counting out the sum, and subtraction feels a lot less scary when we understand it as the reverse of addition.

Source: Benefits of Mental Math

Relation between Addition & Subtraction

A. Competency

- Perform mental addition and subtraction using various strategies and solve real life problems effectively, using appropriate strategies.

B. Objectives

- Use different strategies to calculate sums and differences mentally.
- Explain the strategies used for calculating sums and differences mentally.
- Choose an appropriate strategy to solve a given problem, mentally.

C. Learning Experiences

- Learners try solving simple addition and subtraction mentally.
  - Add or subtract single digit numbers mentally.
  - Explain the strategy used.

- Learners explore the following strategies to solve addition and subtraction mentally:
  - Counting on

    Example: To solve 37 – 29, just count from 29 to 37 to find out how many more needs to be added to 29, to get to 37.
  - Relating to a known fact

    Example: To solve 30 – 18, learners use the known fact that 18 is 2 less than 20. So 30 – 20 is 10. Add on the extra 2 that was subtracted.
    So 30-18= 12.
  - Using double facts

    Example: 22 + 20 = ?
    20 + 20 = 40. 22 is 2 more than20. So add the 2 to 40.
    That makes 22 + 20 = 40,
    Watch the video Doubles & 10 Facts for Mental Math to learn using 'doubles' and '10s fact' for mental calculation.
  - Compensation Strategies' (Refer Annexure)
    - Make a 10 (rounding to the nearest ten)
    - Benchmarks' (benchmark of 5, 10, 25, 50 or even 100)
    - 'Friendly Numbers' (Can be any number that a child finds easy)
  - Break it' / Decompose/Expanded Strategy (Refer Annexure)
  - Left-right addition and subtraction (Refer Annexure)

(Using this strategy enhances learners' conceptual understanding of Place value and regrouping)

Watch the videos:

Left-right addition (left-right addition)

Alternate Strategy to subtract (left-right subtraction).

- Learners explore addition and subtraction fact family
  - Discuss the relation of addition and subtraction.
  - Apply the concept of fact family to solve addition and subtraction problems mentally.

- Learners explore real-life situations and apply mental calculations:
  - First discuss the information provided and then problem/question.
  - Choose a strategy to solve the problem mentally and explain the strategy used.

  Example:

  A boy goes to the shop with Nu 70. He picks a notebook that costs Nu 35. He also picks a packet of crayons that costs Nu 15. How much does he have to pay for the two items? How much money is left after buying the two items?

D. Assessment

Performance Task 1

Choose an appropriate strategy to mentally solve a given problem and explain the strategy.

Performance Task 2

Use mental addition/subtraction to solve at least two real-life situations.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  - i. Do you think learning mental addition and subtraction is helpful? How?
  - ii. State a real life situation where you could use the mental calculation skill.

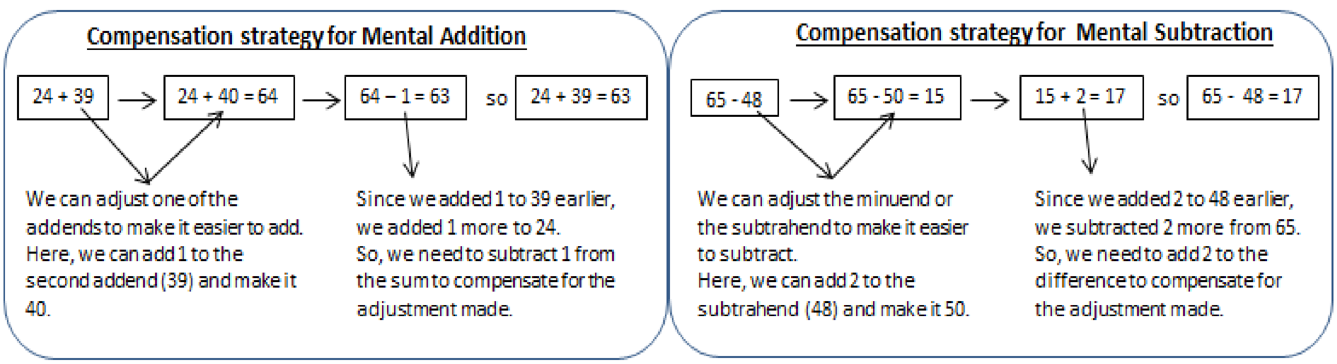
E. Resources

- Understanding Mathematics, Textbook for class III
- National School Curriculum, Mathematics for PP – XII

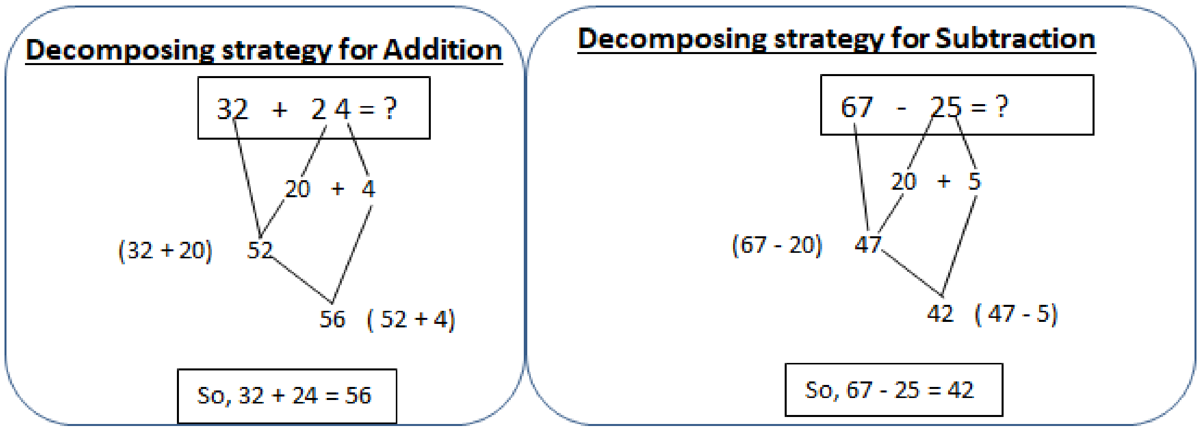
- Concrete materials/Manipulatives
- Base-ten Blocks
- Worksheet
- Online
  - Introduction:[Mental Math Explained]
  - Utility and scope-3 Benefits of Mental Maths - https://bit.ly/3Idy0Cy
  - Utility and scope -Relationship Between Addition and Subtraction - https://bit.ly/3GHkg2r
  - Jedi maths tricks: mental maths strategies - https://www.youtube.com/watch?v=G3hZ9Yddba8
  - Left to Right Addition with 2 digit numbers - https://www.youtube.com/watch?v=hCuf6OEsJds
  - Left to Right Subtraction - An alternate way to Subtract - https://www.youtube.com/watch?v=mAh3BYRYIp4

Annexure

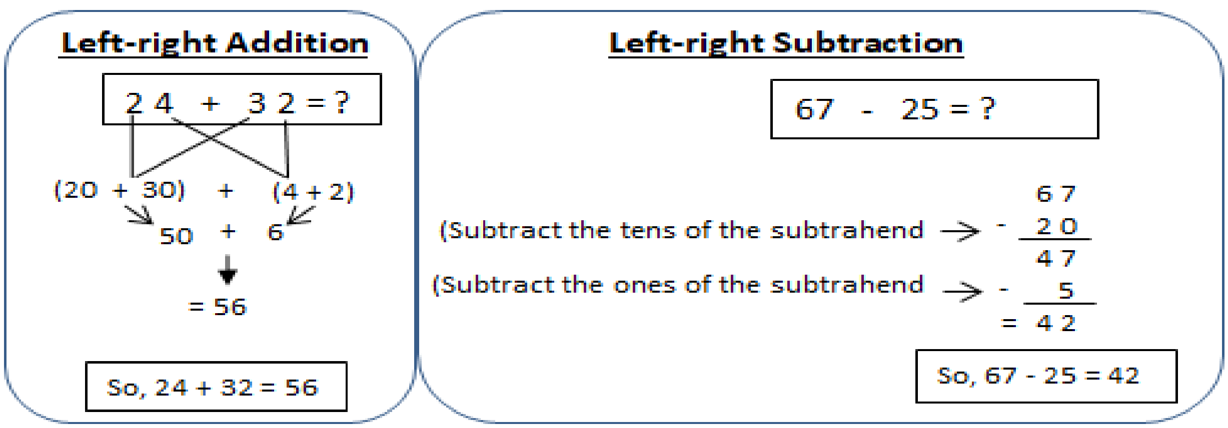
i. Compensation Strategy for Mental Addition and Subtraction



ii. Decomposing Strategy for Mental Addition and Subtraction



iii. Left to Right Strategy for Mental Addition and Subtraction



Topic: III-A8 Multiplication – Meaning

III-A9 Multiplication Properties

III-B1 Multiplication as Repeated Addition

III-B2 Multiplication Table Pattern

[550 minutes]

Introduction

Multiplication is a mathematical operation performed to calculate the result of repeated additions of two numbers. An example of multiplication is 4 times 2 equals 8, that is 2 when repeatedly added 4 times is 8. In multiplication, the numbers being multiplied are called factors; the result of the multiplication is called the product.

Multiplication has existed ever since time began. The systems of multiplication began in Babylon 4000 years ago. They used multiplication in the way that we do. In Babylon, they were using a number by doubling, tripling, and 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.

There are many patterns that exist in the timetable that can help students not only develop a better sense of multiplication but also master the multiplication facts much more easily than they might otherwise

Source: Multiplication Tables

Learning to Think Mathematically in Multiplication

Utility and Scope

There are a number of ways in which we can use multiplication in everyday life. There are situations such as cooking, doubling or tripling a recipe, gardening, setting the table or preparing snacks for a group of people, calculating savings, etc.

Instead of just rote memorization of multiplication, it is important for students to understand the concepts. As a child becomes faster at recalling multiplications, they will be able to solve more complex mathematical problems in much less time..

If students are given the opportunity to investigate the timetable and to discover the many interesting patterns that exist within it, there is a much greater chance that they will be able to develop intuitive strategies that will help them master the multiplication facts.

[Importance of Multiplication table]

A. Competencies

- Relate repeated addition with multiplication and solve real-world problems involving multiplication, effectively.
- Demonstrate the ability to use properties of multiplication to multiply single digit numbers accurately.
- Demonstrate the ability to recognize repeated addition patterns in representations of multiplication to interpret and solve multiplication problems.
- Examine patterns observed in multiplication and work with new multiplication facts effectively.

B. Objectives

- Explain multiplication as repeated addition with concrete, pictorial representations.
- Identify the pattern in repeated addition and record as multiplication fact.
- Identify properties of multiplication and perform single digit multiplication.
- Apply strategies for multiplications up to 9 x 9.
- Apply multiplication facts such as double facts (e.g., 2 x 7 = 14, so 4 x 7 = 2 x (2 x 7) = 2 x 14 = 28) to solve problems.
- Explain patterns observed in multiplication tables.
- Use the patterns in the multiplication table to find the products of a given multiplication problem.

C. Learning Experiences

- Learners recall repeating patterns with numbers and single-digit additions.

- Learners explore concrete, pictorial and symbolic representations of repeated addition.

- Introduce multiplication as a way of representing repeated addition.

  Use appropriate terms to read a multiplication fact. ('factors', 'product' and 'multiplication' sign)

  Example: *2 + 2 + 2, we add 2 three times, so we can write this addition as 3 x 2, three times 2.*

- Learners explore multiplication of single digit numbers (till 9 x 9) by:
  - Creating small, equal-sized sets and adding total items.
  - Using arrays (concretely and pictorially)
  - Using number lines for repeated addition and skip counting.
  - Double facts

  Note: recognize and discuss repeated addition in all the ways mentioned above.

  Watch the video Multiplication Strategies learn various strategies to multiply.

  Try the online worksheet to practise writing multiplication facts correctly.

  liveworksheets

  Liveworksheets

- Learners examine multiplication of single digit numbers to recognize properties of multiplying:
  - Commutative property

    Change in the order of factors, doesn't change the product. (e.g., 2 x 3 = 3 x 2)
  - Identity property of multiplication

    If any number is multiplied by 1, the product is always the number itself. (***e.g***., 5 x **1** = 5)
  - Zero property

    Any number multiplied by 0, the product is always 0 (2 x **0** = 0)

- Learners examine patterns in the multiplication table.
  - Describe the observed patterns.
  - Use the patterns to predict the next product.
  - Play 'Times Table-Basketball' game to enhance the ability to multiply.

- Learners explore multiplication of single digit numbers outside the classroom

  Example: Create arrays/ small, equal-sized groups of objects and add total items. Find the number of windows in a school block/building.

- Learners discuss real-life situations where multiplication is used.

  Example: Doubling or tripling ingredients for a recipe (Relatable to life science)

D. Assessment

Performance Task 1

Use multiplication facts to describe various representations of repeated addition:

- Array
- Equal sets
- Number line
- Symbolic representation of repeated addition (2 + 2 + 2 + 2)

Performance Task 2

Solve at least three single-digit multiplication problems using each:

- Array
- Equal sets
- Number line
- Symbolic representation of repeated addition

Performance Task 3

Use properties of multiplication to determine products. Explain the property in simple language.

Example: If 3 x 4 = 12, 4 x 3 = ?

7 x 1 = ?

0 x 9 = ?

Performance Task 4

Identify at least three real-life situations and solve them using multiplication of single digit numbers.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. Where can we use multiplication in a real life situation? How is knowing multiplication helpful in our daily lives?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet

- Online
  - Introduction on Multiplication - Introduction on Multiplication
  - Learning to Think Mathematically About Multiplication - Think Mathematically about multiplication
  - Use and Importance of Multiplication in Everyday Life - Use of Multiplication Table in Daily Lives
  - Multiplication Strategies: Equal Groups, Repeated Addition, Number Line, and Array - Multiplication Strategies
  - Multiplication sentence and array - Liveworksheets
  - Arrays and Equal Groups - Liveworksheets

F. Game

Game: Times Table-Basketball

Material required:

a ball

a bucket

number cards (0 – 9)

Instructions:

Take the learners outside

Write numbers with chalk on the ground (0 -81)

Split the class into teams.

Each learner picks two number cards randomly.

Learners multiply the two numbers and find the product on the ground.

Then stand on the product number and shoot the ball into the bucket.

Learners get 2 points for the correct product and two points if the ball goes into the bucket.

Learners add the scores of their team members.

The team with the highest score wins.

Topic: III-A10 Multiplying 2-digit by 1-digit numbers *[300 minutes]*

Introduction

Multiplication, one of the four basic operations of arithmetic, gives the result of combining groups of equal sizes. ... In other words, multiplication is repeated addition.

It is important for students to understand that there are several ways to multiply. No one method is better than another, as long as the method of choice is both reliable for the student, and is understood well enough such that the student has an idea when the result of a given computation is reasonable.

Source: Think Mathematically on Multiplication

Utility and Scope

The standard algorithm is a useful tool when multiplying numbers of any size. It can be used to multiply any two numbers no matter how small or how large and especially when numbers are too large to mentally calculate quickly or accurately.

Students can use algorithm to solve multiplication problems in their daily lives, involving 2-digit numbers such as while buying packets of food items containing items more than 9; or when

Multiply 2-Digit numbers

Importance Algorithm

A. Competency

- Use appropriate strategies to solve multiplication of 2-digit numbers by single-digit numbers encountered in real-world experiences.

B. Objectives

- Estimate products of multiplication of a 2-digit number by 1-digit numbers, reasonably.
- Multiply 2-digit numbers by 1-digit numbers using concrete, pictorial and symbolic representations, accurately.
- Use and explain the algorithm of multiplying 2-digit numbers by 1-digit numbers, appropriately.
- Solve relatable problems involving multiplication of 2-digit numbers by 1-digit numbers efficiently.

- Create word problems that can be solved by multiplying 2-digit numbers by 1-digit numbers.

C. Learning Experiences

- Learners recall strategies used for multiplying single digit numbers and the properties of multiplication.
    - Introduce multiplication by exploring learners to situations where one of the factors for multiplication is a 2-digit number.
      Example: If a teacher wants to give two candies to each learner in the class, how many candies should she bring? (There may be more than 9 learners in the class).

- Learners explore multiplying 2-digit numbers by single digit numbers by using:
    - concrete objects and pictorial representations
    - double facts (if 6 x 3 = 18, then 12 x 3 is the double of 18, i.e. 36)
    - Multiplication algorithm.
      Discuss the distributive property of multiplication.
      Example: for 12 x 3, 3 is multiplied to 2 ones as well as 1 tens
      $12 \times 3 = (10 + 2) \times 3 = (10 \times 3) + (2 \times 3) = 36$
    - Watch the videos to learn how to multiply 2-digit number by a single digit number, using algorithm:
      Multiplying without regrouping (without regrouping)
      Multiplying with regrouping (with regrouping)

- Learners explore word problems (real-world situations) and solve by multiplying 2-digit numbers by single digit numbers.
    - Solve word problems
    - Create word problems for peers to solve.
    - Assess the ability of the peers to solve the problem using one or variety of methods.

D. Assessment

Performance Task 1

Estimate first and then multiply 2-digit numbers to single-digit numbers. Explain the strategy used.

Performance Task 2

Solve at least two multiplication problems using an algorithm (with and without regrouping) and explain the algorithm.

Performance Task 3

Create word problems involving multiplication of 2-digit numbers by single-digit numbers for their peers to solve. Assess the solution presented by the peer and provide appropriate feedback

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions

  i. Karma found 15 marbles. Dawa has 2 times as many marbles as Karma. How many marbles does Dawa have? Who has more marbles?
  (This question allows students to think of multiplication as a means of comparison and not just finding the total).

  ii. What strategy did you use to solve the above problem? Why did you choose the particular strategy?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
  - Introduction- Think Mathematically About Multiplication -
  - Think Mathematically About Multiplication
  - The Importance of Learning to Multiply Two-Digit Numbers- https://bit.ly/3qAVBXW

- Algorithms are useful. Understanding them is even better! - https://files.eric.ed.gov/fulltext/EJ1231316.pdf
- 2-Digit by 1-Digit Multiplication with No Regrouping - https://www.youtube.com/watch?v=XOnE_3GgeIw
- Multiply with Regrouping - Multiply with regrouping

Topic: III-A11 Division Meaning *[300 minutes]*

Introduction

Division is one of the four basic mathematical operations, the other three being addition, subtraction and multiplication. In simple words, division can be defined as the splitting of a large group into equal smaller groups. Division can also be equal sharing and repeated subtraction. Division is also the inverse of multiplication.
Source: Division Defined

Utility and Scope

Children come across division in their daily lives. For example, while sharing things among their friends or siblings, while making small groups to play games, etc.

Understanding the concept of division at this stage would enhance children's number sense, the relation among numbers, and the concept of fractions and decimals.

A. Competency

- Interpret a division problem in a real-life situation and solve it effectively using appropriate strategies.

B. Objectives

- Identify division as equal groups/sets, as equal shares and as repeated subtraction, according to given situations.
- Model division (2-Digit by 1-Digit number) concretely, pictorially and symbolically to solve division problems effectively.
- Justify the method chosen to solve a given division problem.

C. Learning Experiences

- Learners explore division as:
  - equal sharing (Concretely and pictorially)
  - equal group (Concretely and pictorially)
  - repeated subtraction
  - Learners go outside the classroom to explore concrete representations.

  Watch the following videos:

Division as Equal Sharing (Division as equal sharing)
Division as Equal Grouping (Division as equal grouping)
Division as Repeated Subtraction (Division as repeated subtraction)

- Use appropriate terms to describe a division fact. ('dividend', 'divisor', 'quotient' and 'division sign')

- Learners learn division through reading aloud stories.
  Watch the video, a read-aloud story of 'The Doorbell Rang by Pat Hutchins.' The story is about sharing 12 yummy cookies.
  Learning Division through Stories
  This activity can be related to English lessons reading aloud and comprehending stories.

- Learners explore simple relatable situations where they can apply division.
  Examples:
  - They have Nu 15 which needs to be shared among 3 friends. So how many would each get?
  - There are 30 learners in a class. We need to form groups. There should be 6 learners in each group. How many groups can we form?
  - There are 12 apples in a basket. You eat 3 apples every day. In how many days will you finish eating the apples?

- Learners discuss how division is different from multiplication.

D. Assessment

Performance Task 1

Interpret concrete and pictorial representations of the following and record them using division facts, correctly.

- Equal sharing
- Equal grouping
- Repeated subtraction

Performance Task 2

Model at least two division problems (concretely and pictorially) in each way, appropriately.

- As equal sharing
- As equal grouping

- As repeated subtraction

Performance Task 3

Solve at least two relatable problems and explain the method used.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. How is division different from multiplication?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume- V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
    - Utility and scope on Division - Division Defined
    - Division as Equal Sharing - Division as Equal Sharing
    - Division as Grouping - Division as Equal Grouping
    - Class 3: Division as Repeated Subtraction - Division as Repeated Subtraction
    - The Doorbell Rang | Division Children's Books Read Aloud - Story

Topic: III-A12 Multiplication and Division

III-B3 Open Sentences

[300 minutes]

Introduction

Multiplication and Division are often taught separately, with multiplication preceding division. However, division and multiplication are inverse operations. Every multiplication calculation can be replaced by equivalent division calculations and vice versa. Therefore, it is important to combine multiplication and division soon after multiplication has been introduced in order to help children see how they are related.

An open sentence in Mathematics is neither true nor false until the variables have been substituted by specific values. The method of finding the values of variables that result in a true sentence is known as solving the open sentence. The replacement value is known as the solution of the open sentence.

For example, 1x n = 8 is an open sentence because the value of 'n' is unknown and as a result, we can state if it is true or false.

Open sentences can use a picture symbol (for example a box or a circle) or a variable (a letter denoting any number)

Source: Mental Math Strategies

Open Sentences in Math

Utility and Scope

As children handle money, share items between friends and cut food into portions. They are beginning to build their division and multiplication skills as part of their everyday life. Children being introduced to these ideas at an early age will allow them to gain confidence in the subject and will be able to utilise these skills in the wider world.

Learning Basic Multiplication & Division

A. Competencies

- Interpret the relation of multiplication and division, then apply it to solve problems effectively.
- Explore the patterns in multiplication and division through open sentence problems to enhance problem-solving skills in real life.

B. Objectives

- Interpret models and explain the relationship between multiplication and division.
- Write multiplication and division of the fact family, (2-Digit by 1-Digit Numbers).
- Identify and explain the meaning of each factor.
- Discover missing factors or the missing products/quotient.
- Explain the strategy used to solve an open sentence problem.

C. Learning Experiences

- Learners recall and discuss some of the strategies learnt for multiplication and division.
- Learners explore concrete and pictorial representations to interpret the relationship between multiplication and division, such as arrays, equal groups, etc.
    - Watch video Multiplication & Division Fact Families about multiplication and division fact families
    - Write multiplication and division fact families.
    - Explain the meaning of each factor.
- Learners apply fact family concepts to find missing factors, products, or quotients.
    - Solve open sentence problems (e.g. 3 x n = 12)
    - Try the online worksheet Liveworksheet to practise finding the missing factor.

D. Assessment

Performance Task 1

Explain the relation of multiplication and division by modelling fact families concretely, pictorially and then by writing fact families correctly.

Performance Task 2

Solve at least six open sentence problems (Finding the missing digit)

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. How does understanding the relation between multiplication and division help solve number or word problems quicker and more efficiently?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
    - Practical Approaches to Developing Mental Maths Strategies for Multiplication and Division
      Mental Math Strategies
    - Introduction: Open Sentences in Math
    - The Importance of learning Multiplication and Division from a Young Age - Importance of Learning Multiplication & Division
    - Multiplication and Division Fact Families - https://www.youtube.com/watch?v=wBPkUId8hRA
    - Multiplication number bonds - https://www.liveworksheets.com/gy1287135gm

Topic: III-B1 Multiplication as Repeated Addition

Introduction

Multiplication is a mathematical operation performed to calculate the result of repeated additions of two numbers. An example of multiplication is 4 times 2 equals 8, that is 2 when repeatedly added 4 times is 8.
Source: Multiplication Defined

Utility and Scope

There are a number of ways in which we can use multiplication in everyday life. There are situations such as cooking, doubling or tripling a recipe, gardening, setting the table or preparing snacks for a group of people, calculating savings, etc.

A. Competency

- Demonstrate the ability to recognize repeated addition patterns in representations of multiplication to interpret and solve multiplication problems.

B. Objectives

- Explain multiplication as repeated addition with concrete, pictorial representations.
- Identify the pattern in repeated addition and record as multiplication fact.

C. C. Resources

- Online
  Introduction: Multiplication Defined

Note: The Learning Experiences and Assessment for this topic has been included with III-A8 and III-A9

Topic: III-B2 Multiplication Table Pattern

Introduction

There are many patterns that exist in the times table that can help students not only develop a better sense of multiplication, but also master the multiplication facts much more easily than they might think otherwise.
Source: Think Mathematically about Multiplication

Utility and Scope

If students are given the opportunity to investigate the times table and to discover the many interesting patterns that exist within it, there is a much greater chance that they will be able to develop intuitive strategies that will help them master the multiplication facts.

A. Competency

- Examine patterns observed in multiplication tables and work with new multiplication facts effectively.

B. Objectives

- Explain patterns observed in multiplication tables.
- Use the patterns in the multiplication table to find the products of a given multiplication problem.

C. Resources

- Online
  Introduction: Think Mathematically about Multiplication

Note: The Learning Experiences and Assessment for this topic has been included with III-A8 and III-A9

Topic: III-B3 Open Sentences

Introduction

Multiplication and Division are often taught separately, with multiplication preceding division. However division and multiplication are inverse operations. Every multiplication calculation can be replaced by equivalent division calculations and vice versa.

An open sentence in Mathematics is neither true nor false until the variables have been substituted by specific values. The method of finding the values of variables that result in a true sentence is known as solving the open sentence. The replacement value is known as the solution of the open sentence.

For example, 1x n = 8 is an open sentence because the value of 'n' is unknown and as a result, we can state if it is true or false.

Open sentences can use a picture symbol (for example a box or a circle) or a variable (a letter denoting any number)

Source: Mental Math Strategies

Open Sentences in Math

Utility and Scope

Solving open sentences not only enhances a student's understanding of relations between numbers, it also helps them in understanding the operations. This leads to building student's confidence in problem solving skills.

A. Competency

- Explore the patterns in multiplication and division through open sentence problems to enhance problem solving skills in real life.

B. Objectives

- Discover missing factors or the missing products/quotient of a given problem.
- Explain the strategy used to solve an open sentence problem.

C. Resources

- Online:
  - Introduction:
    Mental Math Strategies
  - Introduction: Open Sentences in Math

Note: The Learning Experiences and Assessment for this topic has been included with III-A12

Topic: III B4 Place Value Pattern. Base-Ten System to Thousands

Introduction

The system of numbers we use is called the base-ten number system. It is a place-value number system in which 10 digits, 0 through 9, are used to represent a number. The position of a digit in a number determines its value. It is called place value. The value of each place is 10 times the value of the place to its right.

Utility and Scope

Understanding the place value of digits in numbers helps in writing numbers in their expanded form. A place value chart can help us in finding and comparing the place value of the digits in numbers through millions.

A. Competency

- Interpret the place value pattern and describe thousands in terms of hundreds and tens.

B. Objectives

- Represent 4-digit numbers correctly in different ways, using:
    - Place Value Charts.
    - Base-Ten Blocks
    - Dummy Ngultrum notes
- Explain the increase in place value in relation to the value of the place to its right.

Note: The Learning Experiences and Assessment for this topic has been included with III-A1.

Topic: III-C1 Angles *[150 minutes]*

Introduction

Angles are seen all around us. For example, on doors, tables, corners of the walls and on our body.
The word angle comes from the Latin word angulus, meaning "corner"; Greek (ankylos), meaning "crooked, curved," and the English word "ankle". These words are connected with the Proto-Indo-European root *ank-, meaning "to bend" or "bow".
Source: Angle Defined

Utility and Scope

Engineers and architects use angles for designs, constructing roads, buildings and sporting facilities. Athletes use angles to enhance their performances. Carpenters use angles to make furniture. Artists use their knowledge of angles to sketch portraits and paintings.

A. Competency

- Identify angles in the real world environment and describe them in comparison to right angle.

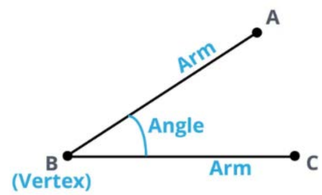
B. Objectives

- Compare angles directly to the right angle.
- Describe angles as less or more than a right angle.
- Identify angles in the environment which are right angles, more/less than right angles.

C. Learning Experiences

- Introduce angles, physically and pictorially, and discuss the definition of angle with reference to right angle.

  Note: The names of angles such as *acute* or *obtuse* are not used at this stage.
  - Learners study the diagram below and discuss the angles using the terms- ‘arms’, ‘vertex’ and ‘angle’.



- ○ Let learners go out and throw stones from different angles. Measure the distance covered in each case.
- ○ Draw the angles formed in each case.
- ○ Discuss the different angles formed.

- Learners explore right angles in the environment.
  - ○ Describe it in relation to a quarter turn guided by the teacher.
  - ○ Locate angles in the surroundings.
    Example: Roof of the house, corners of the book and wall.
  - ○ *Reflect on the question: Which angle do you think will be easiest to find? Why?*

- Learners compare angles in relation to right angle
  - ○ Compare angles directly (just by observing)
  - ○ Describe angles as greater/smaller than right angle.
  - ○ Represent right angles in their surroundings. E.g., Corners of tables, books, walls, etc.

- Learners draw angles in comparison to right angles. (Angles greater than or smaller than right angles).
  - ○ Draw angles to match the description.
    Refer textbook Class III Mathematics.
  - ○ Watch the video Types of Angles to learn more about angles.

D. Assessment

Performance Task 1

Describe angles with diagrams in comparison to right angles.

Performance Task 2

Identify two examples of angles greater and smaller than right angles in their environment. Record the name of the items and draw the angles seen.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. Where do you see angles?
    ii. How would our life be without angles?
    iii. Which angle is more in our surroundings? Why do you think so?

E. Resources

- Understanding Mathematics, Textbook for class III
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
    - Introduction on Angle – Angles Defined
    - Angles - Types and definition-: Types of Angles

Topic: III-C2 Length: Relationship among different units

[400 minutes]

Introduction

Measurement has been important ever since human settlement started. Some examples are building materials, occupying land and trading with neighbours. As trade between different places increased, the need for standard units of measurement increased. Standard units of measurement were applied to one single community or small region. In order to make it uniform and have standard systems throughout, measurement was introduced.

The term "length" refers to a measurement that determines the distance between two places/points. Comparing how much one feature of an object is compared to the identical feature of another thing is what measurement is all about. You will measure lengths in standard units and compare them.

Source: Length Defined

Utility and Scope

Learning about measuring units helps children in solving practical difficulties not only in the classroom but also in everyday life. To know the exact value and quantity of something in our everyday life, we have to use measurement.

We choose units depending on the distance or the length. For example, we use kilometres to measure the distance from our home to school. Metre is used to measure the length of the table; the height of the door and room sizes, playgrounds size etc. The millimetre is used to measure shorter lengths.

A. Competency

- Express the relationship among the four units of measuring length (km, m, cm, and mm) and describe real-life usage of the units.

B. Objectives

- Estimate and measure length using centimetre (cm), millimetre (mm), metre (m) including perimeter context.
- Examine the relation between cm and mm, cm and m, m and km.
- Choose the appropriate unit (km, m, cm, and mm) to measure length/distance.
- Measure the distance around regular objects using different units.

C. Learning Experiences

- Learners recall the use of the units cm and m to measure length.

- Learners examine rulers to explore units of measuring length.
  - Introduce mm using a ruler.
  - Explain that the shorter lengths which make up a cm are called mm.
    Example: Measure length of tiny objects using mm and realise that mm is a very small unit of measuring length.
  - Introduce kilometre using example of distance and explain the relation of metre and kilometre (1 km = 1000 m)
    Take the class for a walk from your school along the road for 1 km. This will give them a good sense of how long 1 km is.
  - Watch the video Units for Length or measurement in mm, cm, or m to get a clear concept of the units of measurement.

- Learners explore the relationships among the units of measuring length by examining rules and distances.
  - Compare measurement of cm and mm and identify the relation between the two units (1 cm = 10 mm)
  - Examine a metre ruler to compare the measurement of centimetre and metre and identify the relation between the two units (1 m = 100 cm)
  - Explore ways to convert kilometres to metre and vice versa.

- Learners explore the length of various objects to combine units for measuring length.
  - Demonstrate how to measure length using a combination of units.
    Example: The height of the door is 2 m 20 cm.
    The length of the pencil is 6 cm 5 mm
  - Estimate lengths of objects, using a combination of units, then measure their lengths and evaluate their estimation.

- Learners explore measurement of perimeter using the four units.
  - Watch the suggested video to learn how to calculate perimeter. Measuring Area & Perimeter
  - Demonstrate and explain how to calculate the perimeter for regular shapes.

- ○ Demonstrate and explain how to measure the perimeter of irregular shapes.
  Example: if the outside of a shape is curved, you could place a thread all along its boundary. Cut the thread and compare it with the ruler to see how long it is.

- Learners discuss estimation of lengths and choose appropriate units to measure the length. (Refer Textbook Class III Mathematics)

  Example: it would be difficult to measure the distance from your home to school using the unit cm. We measure to determine the distance between two points.

  If we know the distance between two places, we will be able to prepare ourselves accordingly.
- Learners practise the use of the four units of measurement with the online activity Liveworksheets

  (Teacher could design a similar worksheet).

D. Assessment

Performance Task 1

Choose an appropriate unit to measure length and explain their choice of unit.

Performance Task 2

Measure length using combination of units (km, m, cm, and mm)

Performance Task 3

Convert units to one another (km to m, m to cm, cm to mm, and vice versa)

Performance Task 4

Measure perimeter using an appropriate unit and explain the choice of unit.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  - i. Which unit do we use the most? Why?
  - ii. How would the measuring system in the world be without the standard units?
  - iii. Why do you think the tables in your classroom are of the same length?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
  - Introduction on Length - Length Defined
  - Key Stage 1 - Area and Perimeter Measuring Area & Perimeter
  - Understanding mm, cm, m, and km - Units of Length
  - Measuring Length - Liveworksheets

Topic: III-C3 Capacity: Measuring Capacity in Litre. Measuring capacity in Millilitre

[400 minutes]

Introduction

The capacity of a container is the amount of something it can hold or contain. How much a container can hold depends on the space it has inside. A container which has more space inside has greater capacity than a container which has less space inside.

Utility and Scope

Understanding capacity has the advantage of knowing how much a container/object can hold. Learning to estimate and evaluate the capacity of containers will help children in their real-life situations. For example, we store essential items in different containers of various sizes. Salt, milk powder, and tea leaves are stored in small containers. Water and rice are stored in bigger containers. We use different cups for drinking tea, water and juice or any fluids.

A. Competency

- Demonstrate the ability to use the unit Litre and Millilitre to describe the estimation and measurement of capacity of containers used every day.

B. Objectives

- Estimate and measure capacity using litre and millilitre
- Examine the relation of litre and millilitre (1 L = 1000 mL) to realise that millilitre is an extremely small unit.
- Choose appropriate unit (L/mL) to measure capacity

C. Learning Experiences

- Conduct a brief revision of using litre to measure capacity.
- Introduce millilitre (mL) using a measuring cylinder.

  Example: Pour water in the measuring cylinder which exactly measures 1 mL and let learners observe.

  Make them state their understanding of the measurement of the water.

  Then, explain that the capacity of water is 1 mL, which is a very small amount.

  Watch the video to introduce millilitre: Units for Capacity

Note: Teacher needs to be cautious of use of some terms in the video.
Example: (**x**) is times but not into.

- Explore the relation of litre (L) and millilitre (mL) using a measuring cylinder
  - Compare the two units of capacities.
  - Identify ml as an extremely small unit.

- Discuss and examine the containers whose capacity is measured in L and mL
Example: bottle caps, small juice packets, water bottles, buckets, etc.).
  - Estimate their capacities.
  - Measure their capacities.
  - Evaluate their estimation
    Example: You decide to pour a glass of milk. If you try to pour more, the milk will overflow. You will now know the limit to how much a glass can hold.

Read the capacities of containers such as these.

Beakers

- Learners explore measuring capacity of containers
  - Estimate the capacity of containers, then measure and record their capacity, using a combination of the two units.

- Learners explore converting Litre (L) to millilitre (mL) and vice-versa.
  - Practice conversion of units using the worksheet Worksheets on Capacity

- Learners choose appropriate units (L/mL) to measure capacity of containers.
Explain the choice of unit.

D. Assessment

Performance Task 1

Choose an appropriate unit to measure capacity and explain the choice of the unit.

Performance Task 2

State capacity of containers by combining the units L and mL (e.g. 2 L 500 mL)
Sample worksheet: Liveworksheets

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. How many 200 mL of bottles can fill up a 1 L jug?
    ii. Does capacity measure only liquids?
    iii. Which unit would you use to measure how much water to add to a recipe?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Containers of different sizes
- Measuring Cylinder
- Worksheet
- Online
    - Litres and Millilitres | Mathematics Grade 3 | - Units for Capacity
    - Metric units of capacity: litres and millilitres- Worksheets on Capacity
    - Mathematics - 3B - Capacity and Volume H - Liveworksheets

Topic: III-C4 Mass: Measuring Mass in Kilogram. Measuring Mass in Gram

[300 minutes]

Introduction

Mass is the amount of matter or substance that makes up an object. It is measured in units called kilograms, which can be abbreviated as kg. It's important to remember that mass is different from weight. Mass always stays the same, while weight changes with changes in gravity.

The term ‘mass’ is derived from the Latin ‘massa’, meaning, a lump of dough or paste. Newton used the term ‘pondus’ which translates to 'weight' to refer to a measure of matter.

Source: Mass Explained

Concept of Mass & Weight

Utility and Scope

Initially using estimation to measure allows children to focus on the language associated with measuring, for example heavier, lighter, heaviest and so on. This will help them when comparing the mass of objects. Children will move to formal units of measurement. The standard unit of measuring mass is kilogram. Using a range of scales will help children in measuring with formal units.

A. Competency

- Relate the units kilogram and gram to estimate and measure mass of objects in everyday life.

B. Objectives

- Estimate and measure mass in kilogram and gram.
- Describe the correlation of litre and millilitre (1kg = 1000 g) to infer that gram is used to measure very light objects.
- Choose the appropriate unit (kg/g) to measure mass.

C. Learning Experiences

- Conduct a brief revision on using kilogram (kg) to measure mass.
- Introduce gram (g) using small objects (mass) and pan balance.
- Learners explore measuring mass in grams.

- Measure the mass of small objects which would have a mass of 1g. (e.g. paper clips, pen cap, paper)
- Describe the comparison of kilogram (kg) and gram (g) using pan balance and infer that gram is used for measuring mass of smaller and fewer objects.
- Watch the video Units for Mass to learn about units of measuring mass in grams.

- Learners examine the objects whose mass can be measured using gram and kilogram.
  - Estimate first and measure their mass to validate their estimation, using appropriate units.
  - Watch the video- Grams & Kilograms them to learn about grams and kilograms.
  - Learning to use appropriate units can be related in their real life situations. They will be able to predict the mass of any kind of object accordingly.
  - Play the game 'Guess and Check' to check their ability to estimate. (Refer annexure for instructions.)

- Learners explore combining the two units (kg and g) to measure mass.
  - Estimate mass of objects, using a combination of units.
  - Measure and record their mass using a combination of the two units, appropriately.

- Explore converting kilogram (kg) to gram (g) and vice-versa.
  - Perform the tasks related to conversion of units through the provided worksheet.
    Sample online worksheet: liveworksheets

D. Assessment

Performance Task 1

Choose an appropriate unit to measure mass of certain objects. Explain the choice of unit.

Performance Task 2

Express mass of objects in kg, g and combination of the units.
Sample online worksheet: liveworksheets

(This online worksheet provides students practise to convert kg to g and vice-versa and to combine kg and g)

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

- Reflective Questions
  i. Which unit do you use to measure your body mass?
  ii. Which unit will you use to estimate the mass of a cake? Justify.

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Objects of different sizes and masses
- Pan Balance
- Weighing stones (1g, 2g, 5g, 10g, 50g,1kg, 2kg)
- Worksheet
- Online
  - Measuring Mass in Gram - Measuring Mass in Grams (youtube.com)
  - Metric units of mass: Kilograms and grams - Worksheets on Mass
  - Grams and Kilograms | Mathematics Grade 3 | Periwinkle -Grams & Kilograms
  - Convert units of mass - Liveworksheets
  - Introduction: Mass Explained
  - History on mass and weight Concept on Mass & Weight

F. Game

Game: Guess and Check

Partners will guess an item's mass and then actually measure it to see how accurate they were.

Materials required:

- Various items to measure mass

- Textbooks, packs of crayons, fruits or vegetables, stones, etc.
- Balances
- Weights in grams, depending on the type of balance.
- Pencils
- Recording sheet

Item	Estimated Mass	Actual Mass	Difference
Apple	75 grams	95 grams	15 grams

Procedure

- Learner will work with a partner. Partners will decide who goes first. (Birthdays, rock-paper-scissors, etc.)
- The first partner selects an item and gives an estimate of its mass.
- He/she records the estimate on the chart.
- Then, he/she actually measures the item's mass using the pan balance and records the measurement on the chart.
- Finally, he/she subtracts the difference to check for accuracy.
- Learners continue to take turns until they've guessed and checked all items.
- When finished, partners compare and share their findings with other pairs.
- The learner with the lowest difference wins!

As a class, discuss the accuracy of estimation.

Were learners becoming better at estimating an item's mass toward the end of the activity? Why or why not?

The goal is to help learners get an idea of how to estimate using grams. Also, learners get to enhance their skills using a balance to find the real measurement.

Topic: III-C5 Area

[300 minutes]

Introduction

Area is defined as the space occupied by a flat shape or the surface of an object. The origin of the word is from 'area' in Latin, which translates to a vacant piece of level ground. The first recorded use of areas was in ancient Babylon, where they used it to measure the amount of land that was owned by different populations for taxation purposes.

Later, the great mathematician Archimedes from Greece discovered the area and the perimeter of the circle and the relationship between spheres. Archimedes, no doubt, wasn't the first to realise the fact. However, he was, as far as we know, the first to prove it formally.

Source: Area Defined

Utility and Scope

Use of area has many practical applications. To determine the size of the carpet to be bought, we often find the area of the room floor. To cover the floor with planks or tiles, to paint walls or ceiling or cover with wallpaper, to make a flower garden are other examples, where the area is calculated.

A. Competency

- Relate centimetre square grid to the standard unit (square centimetre) to measure area and record the measurement using standard units.

B. Objectives

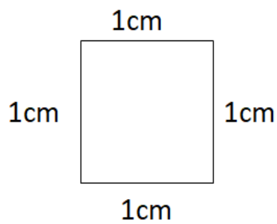
- Estimate and measure the amount of surface space of common objects using non-standard units and square centimetre.
- Use centimetre square grids to measure the area of regular and irregular shapes.
- Explain the standard unit of measuring area, square centimetre (sq. cm) in relation to the use of square centimetre grid.

C. Learning Experiences

- Conduct a brief revision of the measuring area using non-standard units.
- Learners measure the area of flat surfaces using appropriate non-standard units.

  Watch the video Finding Area Explained to measure area using non-standard units.

- Demonstrate measurement of area of regular and irregular shapes.
  - Demonstrate how to measure the area of regular shapes on square grids.
  - Introduce the standard unit of measuring area in square centimetre (sq.cm) by relating it to centimetre square grid.



A square with all its 4 sides having the length of 1 cm is called a square centimetre. The area of that square is 1 square centimetre.
When we measure a surface space with that square, the area of the surface space is then measured in square centimetre.
The short from of square centimetre is sq. cm

  - Demonstrate how to measure the area of irregular shapes using square grids and relating it to the area of a square in the grid.

    Example: To measure the area of a leaf, first place the leaf on a centimetre square grid and trace its shape on it.
    Then put a tick mark on each of the squares that is either totally or more than half within the shape.
    Count all the tick marks.
    The area of the shape is about 9 square cm.

- Learners explore measurement of regular and irregular shapes on their own, using centimetre square grids.
  - Estimate first and measure the area of different shapes by tracing them on square grids.
  - Record the area using the standard unit (sq. cm).
  - Explain measurement recorded in standard units.

- Learners practise measuring area using the square units

  Sample worksheet: Workssheets on finding area

D. Assessment

Performance Task 1

Choose an appropriate non-standard unit to measure area and explain their choice of unit.

Performance Task 2

Measure the area of at least two regular and irregular 2-D shapes in sq. cm.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. How will you find the area of irregular shapes?
  ii. Why do we need to learn about the area?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Centimetre Square grids
- Cut-out of shapes
- Worksheet
- Online
  - History of Area - Area Defined
  - Mathematics Key Stage 1: Area and Perimeter- Finding Area Explained
  - Area: Counting unit squares - Worksheet on finding area

Topic: III-C6 Measuring Time. Reading Time on Analog and Digital clocks. Relation among Different Units of Time

[300 minutes]

Introduction

We live in a world where time is all important. We are continuously reminded of "the time" of being early or late, of having missed an appointment or arriving "before time". In today's world, time now governs our life.

The Ancient Egyptians used simple sundials (Instrument used when sun shines) and divided days into smaller parts, and it has been suggested that as early as 1,500BC, they divided the interval between sunrise and sunset into 12 parts. Timekeeping originated from the Babylonians and the Jews (the seven-day week in Genesis). The Ancient Romans, during the republic, went with eight days – including a shopping day where people would buy and sell things. When the Roman emperor Constantine made Christianity the state religion early in the 4th century AD, the seven days a week was officially adopted.

Source: History of telling time

Utility and Scope

Learning about time gives children the opportunity to practise basic fractions and counting in 5s. It will also help to improve their ability to recognize numerals, to count up to 60 and to recall the 5 times table. The visual clock face presents the opportunity to advance comprehension of addition and subtraction. The time format encourages children to practise and remember number bonds to 60, which will help children with other number bonds and mental arithmetic.

A. Competency

- Express correct measurement of time in relation to different units of time and apply the concept to manage time effectively in real-life situations.

B. Objectives

- Relate time on both digital and analog clocks.
- Read and write time in different ways on analog and digital clocks.
- Examine the relation among different units of time such as minute, hour, days of the week and months of the year.

C. Learning Experiences

- Conduct a brief revision of reading time in hours, half hours and quarter hours in analog as well as digital clocks.
  - Play the suggestive game "Giraffe Pull Time" to revise.
    (Refer Annexure for instructions)

- Introduce reading of minutes and the relation of hour and minute using both analog and digital clocks.

  - Use the analog clock. Let the learners figure out how many minutes make 1 hour, half hour and quarter hour.
  - Explain that when the minute hand moves from one number to the next, it takes five minutes.
  - When the minute hand moves from 12 and back to 12, it is 60 minutes.

- Learners explore reading time in both digital and analog clocks (including minute) in two different ways.

  Example: Six-Fifteen on analog clock can be read as 15 minutes past 6 o'clock/ Quarter past 6 o'clock or 45 minutes to 5 o'clock)
  - Record time in digital format. (6:15)
  - Watch the video: Reading Time Explained that explains reading time. Learning to read the time will help in real-life situations. They will be guided in whatever they do and wherever they go.

- Learners perform certain activities, then calculate durations and record it using hours and minutes.

- Learners refer clocks and calendar to examine the relation among different units of time:
  - 1 hour = 60 minutes
  - 1 day = 24 hours,
  - 1 week = 7 days,
  - 1 month = 4 weeks,
  - 1 year = 12 months, etc.

    This activity can be related to the lesson in learning days of the week and names of the months in English and Dzongkha.

- Learners explore activities related to measurement of time in Self-Instructional Materials, Key Stage I, Class III, Volume-V.

D. Assessment

Performance Task 1

Read time shown in analog and digital clocks in two ways.

Performance Task 2

Express units of time in different ways.
Example: (2 hours =___minutes, 2 weeks =___days, etc.)

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Why do you think we have timetables in our school?
  ii. Why do bus services have particular timing?
  iii. At what time do you go to bed? Why?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-V
- National School Curriculum, Mathematics for PP – XII
- Analog and Digital Clocks
- Worksheet
- Online
  - A Brief History of Telling Time - History of Telling Time
  - Mathematics Key Stage 1: Reading Time: Reading Time Explained

F. Game

i. Game: Giraffe Pull Time

Materials needed: Pictures of giraffe

Instruction:

Learners play in pairs

Each pair is provided with a picture of a giraffe.

Mark a centre point and keep the giraffe at the endpoint.

Five questions are asked by showing the clocks (Analog and digital)

Three options are provided for a particular question.

As soon as the options are shown, the learners take turns to answer first.

If learners are able to answer it correctly, they pull the partner's giraffe towards themselves.

The pair who gets their giraffe past the centre point first wins.

Sample questions:

10:15 = 1. Quarter past 10

2. Half past 10

3. Quarter to 11

Topics: III-D1 Polygons

III-D2 Squares & Rectangles

III-D3 Parallelograms

[550 minutes]

Introduction

A polygon is a 2-dimensional shape with sides made of straight line segments which are connected to each other end to end. An example of a polygon is a triangle with three straight sides. A circle is also a plane figure but it is not considered a polygon, because it is a curved shape and does not have sides or angles. Therefore, we can say, all the polygons are 2-D shapes but not all 2-dimensional figures are polygons.
Word polygon comes from the Greeks, like most terms in geometry, which they invented. It simply means many (poly) angles (gon). The concept of polygons was generalised in 1952 by Geoffrey Colin. A polygon can't have any curves or any gaps or openings in its shape. If you want to describe something as angular and closed, like, say, the Pentagon, or a stop sign, you could call it "polygonal".
Source: Polygons Explained

Utility and Scope

Polygons are all around us. Most of the common shapes that you see or study every day are polygons. You see a wall, which is rectangular in shape, is a polygon. A front view of a dice, which has a square shape, is a polygon. A pizza slice is triangular in shape, hence, is a polygon. A rectangular football ground or playground is an example of a polygon.

A. Competencies

- Classify shapes as regular polygons and quadrilaterals and identify these shapes in their environment.
- Examine the attributes of squares and rectangles and distinguish square as a special rectangle.
- Demonstrate the understanding of the concept of parallelogram by describing parallelogram in one's own words.

B. Objectives

- Classify and describe shapes as regular shapes of quadrilaterals, after examining the attributes of each shape.
- Examine the attributes of squares and rectangles to identify squares as a special rectangle.
- Generate one's own definition of parallelogram upon investigating the attributes of a parallelogram.

C. Learning Experiences

- Learners recall the names and properties of 2-D shapes they learnt till class II. Show the polygons and let learners name them.
- Learners explore polygons and their features.
  - Discuss the properties of polygon (e.g. A polygon should be a closed shape).
  - Identify the parts of polygons (side and vertex).
  - Explain what a polygon is.

    Suggestive reflective questions: What is the smallest number of sides any polygon can have?

- Introduce the names of the polygons according to the number of sides (e.g. triangles, quadrilaterals etc.).
  - Watch the suggestive video Learning about Polygons to introduce polygons.
  - Find the polygons in the classroom.
  - Play game to identify different polygons by using the link
  - Game on understanding the concept of Polygon

- Learners explore the types of polygons.

  Classify polygons as concave, convex, regular, or irregular.
  - Regular polygon: All the sides are equal and all the angles are equal.
  - Irregular polygon: All the sides and angles are not equal.

    Watch the video: Polygons on regular and irregular polygons.
  - Concave polygon: Has bent inward/outward side(s)
  - Convex polygon: Does not have any bent in the side(s).
  - Explain the differences between regular and irregular polygons.

- Learners explore quadrilaterals.
  - Discuss the properties of quadrilaterals.

Example: A quadrilateral should be a closed shape. It should be made up of 4 straight lines.

- Watch video on properties of quadrilaterals
  Properties of Quadrilaterals

- Introduce different types of quadrilaterals and discuss their properties.
  Explain why the square is a special rectangle.
  All four sides are congruent squares.
  All squares are rectangles, but not all rectangles are squares.
- Find examples of different quadrilaterals and squares around the school campus.
  Example: You may see square and rectangle signs, windows, doors and buildings.

- Learners discuss the properties of parallelogram
  - Identify the attributes of a parallelogram
  - Compare the attributes of parallelogram with other quadrilaterals.
  - Create their own definition of parallelogram.
  - Sample worksheet on Parallelogram- Worksheet on Polygons

D. Assessment

Performance Task 1

Write the names for different polygons and quadrilaterals.

Performance Task 2

Sort different polygons according to their sides.
(e.g., polygons having 3 sides together; polygons having 4 sides together etc.).

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Which polygons are mostly seen around us?
  ii. What do you know about squares? Explain.
  iii. What is the minimum number of sides a polygon can have?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Cut out quadrilaterals/polygons
- Worksheet
- Online
  - Introduction on Polygons - Polygons Defined
  - Math Antics – Polygons - https://bit.ly/3jxiFl7
  - Identifying polygons - Game on Understanding Polygons
  - Regular & Irregular Polygons - https://bit.ly/2YX5j8v
  - Quadrilaterals (by Math Antics)- Quadrilaterals
  - Parallelogram- https://bit.ly/3JWt9re

Topic: III-D4 Prisms & Pyramids

[300 minutes]

Introduction

Pyramids have been of interest from ancient times, particularly because the ancient Egyptians constructed funeral monuments in the shape of square-based pyramids several thousand years ago.

Utility and Scope

People often come across pyramids and prism-shaped things but they get confused about what shape it is. The properties and characteristics of these shapes are not known in day to day life. They are often confused with one another. A prism is a polyhedron made up of parallel top and bottom bases and rectangular side faces. Pyramids have one base and triangular side faces, which meet at a central vertex point. A die or cube is an example of a prism. A traditional tent with flat faces that meet at one vertex and one base is an example of a triangular pyramid.

Source: Cones, Pyramids & Spheres

A. Competency

- Distinguish prisms and pyramids by exploring the attributes of 3-D shapes and make connections with the figures and solid shapes around them.

B. Objectives

- Recognize, name, and describe prisms and pyramids.
- Discover that the shape of the base determines the name of the shape.
- Examine patterns in the attributes of prisms & pyramids (e.g. the number of vertices for all prisms is two times the number associated with its name – a triangular prism has 6 vertices).
- Locate prisms and pyramids around themselves, in the environment.

C. Learning Experiences

- Learners recall names and properties of 3-D shapes they learnt till class II. Show 3-D shapes and let learners name them.

- Learners examine the base of prisms and pyramids.

- Discover that the shape of the base determines the name of the shape. ***Example:*** If the pyramid has a triangle base, the name of the shape is a triangular pyramid.

- Learners explore prisms and pyramids.
  - Learners discuss the attributes of 3-d shapes.
    Count the number of sides, faces, and vertices of each 3-D shape. Examine patterns in the attributes of prisms & pyramids
    Example: The number of vertices for all prisms is two times the number associated with its name – a triangular prism has 6 vertices, similarly, the number of sides of a pyramid is two times the number associated with its name-rectangular pyramid has 8 sides.
  - Learners sort the shapes as prisms and pyramids.
  - Learners describe prisms and pyramids.

  A prism is a 3-D shape with two congruent and parallel polygonal bases which are joined by rectangular faces.
  A pyramid is a 3-D shape with one base that is a polygon and triangular faces which join at a point called the apex.
  - Watch a video to help learners learn about prisms and pyramids:
  - Prisms & Pyramids

- Learners look for objects that resemble prisms and pyramids in the school.

D. Assessment

Performance Task 1

Describe how many edges, faces, and vertices each prism and pyramid has.

Performance Task 2

Compare and describe prisms and pyramids with some examples.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Which 3-D shapes are seen mostly around us? Why do you think so?
  ii. Which base do you think will be stable when you build? Prism or Pyramid?
  iii. How are prisms and pyramids named?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete objects/Manipulatives
- Worksheet
- Online
  - Cones, pyramids, and spheres - Cones, Pyramids & Spheres
  - 3D Figures - Prisms and Pyramids - Prisms & Pyramids

Topic: III-D5 Combining two or more Shapes

III-D7 Similar and Congruent Shapes

[300 minutes]

Introduction

A combined figure is a geometrical shape that is the combination of many simple geometrical shapes. Any shape can be a combination of two or more shapes. Example, a rectangle can be a combination of two or more rectangles. A rhombus can be a combination of two equilateral triangles or a trapezoid can be a combination of three equilateral triangles.

Utility and Scope

Shape exercises can assist students in creating critical thinking abilities. When a child recognizes the attributes of a square, he can coordinate it with the square gap on the toy. Knowing shape can help when assembling puzzles.

When students combine two or more shapes, they will be able to tell how shapes can be combined to create another beautiful shape. This will help them to think creatively and critically and appreciate the shapes around them. This will also help them build foundations for learning more about composite shapes in higher classes.

A. Competencies

- Combine, create new shapes, name them and identify similar shapes in the environment.
- Explain the difference between similar and congruent shapes and identify such shapes around them.

B. Objectives

- Predict results for combining triangles & quadrilaterals by visualising.
- Construct various polygons using combinations of triangles and quadrilaterals to validate their predictions.
- Identify the difference between similar and congruent shapes.

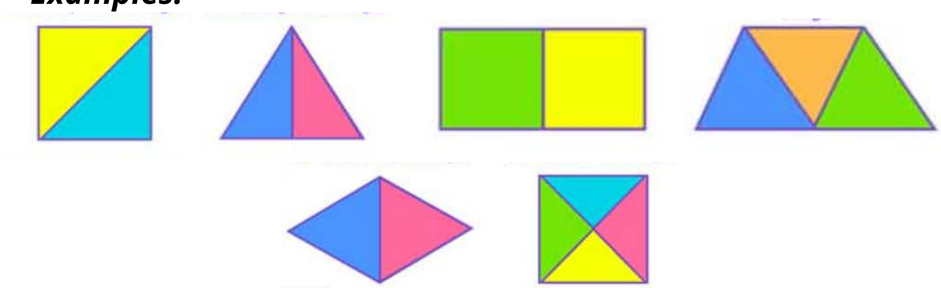
C. Learning Experiences

- Learners explore combining shapes to form a new shape

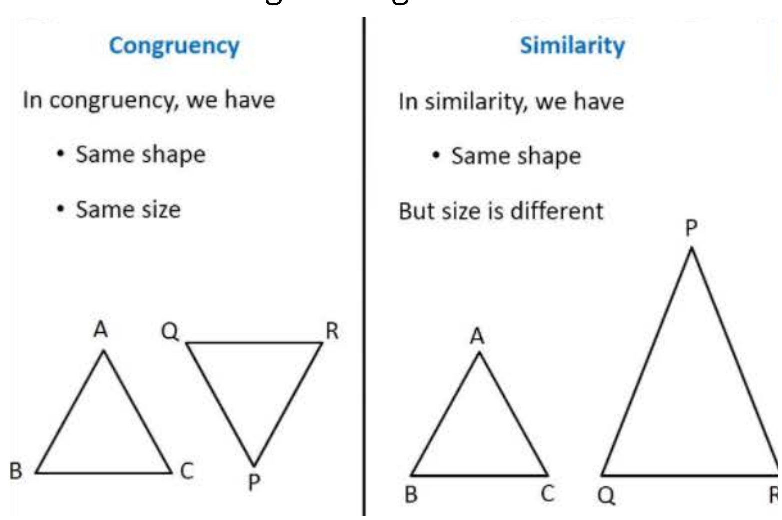
- Visualise and predict what shape they will get if they combine
    - Two triangles
    - A triangle and a rectangle
    - A triangle and a parallelogram
- Validate their prediction by combining shapes using pattern blocks, cut-out of shapes or tangrams.

  Example: Learners glue together two or more shapes onto a blank piece of paper to form other shapes.
- Explain how and why the polygon they make changes when they manipulate.
- Watch the video on how shapes are combined.
  [CombiningShapes]

  Examples:



- Learners explore similar and congruent shapes.
    - Identify whether the given shapes are similar or congruent.
    - Explain the differences between similar and congruent shapes with examples.
    - Watch the video [Similar & Congruent Figures] to learn the difference between similar and congruent figures.



D. Assessment

Performance Task 1

Create various outlines of 2-D shapes using any 3 polygons of their choice.

Performance Task 2

Distinguish similar and congruent shapes from a given set of shapes.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  1. How many equilateral triangles will make one regular hexagon?
  2. If half of a shape is a trapezoid, which could be its full shape?
  3. Which shape do you think will you get if you combine two congruent rectangles? Justify.

E. Resources

- Understanding Mathematics, Textbook for class III
- National School Curriculum, Mathematics for PP – XII
- Pattern blocks
- Shape cut-outs
- Tangram
- Worksheet
- Online
  - Combining shapes - Combining Shapes
  - Difference between similar and congruent figures - Similar & Congruent Shapes

Topic: III-D6 Turns, Slides and Flip of 2-D Shapes *[300 minutes]*

Introduction

A transformation is where 2-D shapes are repeated using flips, slides, and turns. When a shape is transformed, the size remains the same but the direction/orientation changes. The first systematic effort to use transformations as the foundation of geometry was made by Felix Klei. Transformations can be found everywhere. 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!

Source: Transformation Explained

Utility and Scope

Learning transformations enable children to develop their ability to identify the properties of shapes and objects and how they can be combined. Transformation is used to create and design patterns which can be used in so many different areas, including buildings, clothes, models, flooring, gaming, furniture and Interior designs.

A. Competencies

- Examine results of transforming 2-D shapes (Turn, slide and flip) and describe images in relation to the original shapes.
- Explore symmetry in relation to flips and construct personal definitions of lines of symmetry.

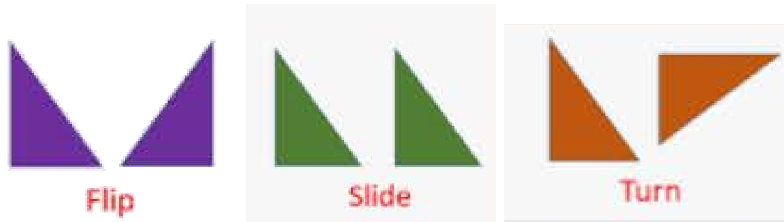
B. Objectives

- Perform transformation of 2-D shapes by sliding, flipping and turning.
- Examine various lines of reflection in polygons.
- Define lines of symmetry and reflective symmetry in simple words.

C. Learning Experiences

- Learners explore moving shapes in different ways, by sliding, flipping and turning.
    - Demonstrate various flips, slides and turns.
    - Explain the movements.

- Discuss the change in the position or direction of the shapes as the resulting image of the transformation, but not in the shape itself.



- Play ‘matching cards”. Match with the shape that is being transformed after flipping, sliding and turning. (Refer annexure for instructions)
- Identify what transformation is used when the few transformed shapes are displayed.
- Watch the suggested video [flips-turns-slides explained] to learn about flips, turns and slides.

- Learners explore lines of symmetry and reflective symmetry.
  - Learners discuss the lines of symmetry in a shape.
  - Learners identify reflective symmetry while flipping shapes.
  - Learners explain lines of symmetry and reflective symmetry in their own words.

    A line of symmetry is a line that divides the shape into two equal halves that can be matched exactly when folded.

    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.

- Learners explore things around them or outside the classroom, which has a line of symmetry.

  Example: Explore the lines of symmetry on leaves and petals of flowers.
  The lesson can be related to the value of sharing.

D. Assessment

Performance Task 1

Transform shapes by turning, flipping and sliding. Explain the transformation applied.

Performance Task 2

Identify transformation that has already been applied to a shape.
Suggested worksheet: [Worksheets on turns, flips & slides]

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Which shape will face the same way when flipped?
  ii. In which transformation will a shape face the way?
  iii. In which Bhutanese paintings do we see the transformation of shapes?

E. Resources

- Understanding Mathematics, Textbook for class III
- National School Curriculum, Mathematics for PP – XII
- Cut-outs of shapes
- Pattern blocks
- Worksheet
- Online
  - Transformation - transformation
  - Shapes: Flips, Slides and Turns - Flips-Slides-Turns Explained
  - Worksheet for Third Grade Math on flip, turn and slide - Worksheet on Flips-Slides-Turns

F. Game

Game: Matching cards
Materials required:
Two sets of cards.
(Pictures of original form of shape and shape after turning, sliding and flipping).
One card each for all the students in the class)
Instruction:
Each student gets a card.
Upon signal children look for a card that matches their shapes after turning, sliding and flipping.
After finding a match, the partners take their place and sit.
The game will end till the last two students match their card.
The winner will be the pair who matches first.

Topic: III-E1 Data Collection *[300 minutes]*

Introduction

When children collect and analyse data, they're integrating several mathematical skills to answer questions and solve real-world problems. For example, to answer the question, "What is the most preferred colour in our classroom?," children need to ask their classmates what their favourite colour is (collect data), sort and organise their findings (classification), and count how many are in each category (counting and cardinality). Children can then represent their findings in simple charts or graphs for all to see and discuss! It is important for young children to have lots of opportunities to think systematically about questions and answers that are relevant to their lives and interests. These early experiences provide a foundation for later data learning using technology, models, and simulations. Check out our sorting games and suggested readings to engage children in playful experiences with sorting, counting, and describing data!

Source: Data Collection explained

Utility and Scope

Data collection is to capture quality evidence that seeks to answer all the questions that have been posed. Through data collection, we can gather quality information that is a must for making informed decisions. To improve the quality of information, it is useful that data is collected so that you can draw conclusions and make informed decisions on what is considered real.

A. Competency

- Select appropriate strategies for collecting and organising data to help present an appropriate description of the collected data and later create their own learning goals and track them.

B. Objectives

- Select appropriate strategies for collecting and displaying data.
- Inspect considerations when collecting data such as:
  - Where is a good source?
  - Where should I conduct the survey?
  - Does it matter when the survey is conducted?

- How should the questions be phrased?
- Describe and interpret the collected data.

C. Learning Experiences

- The teacher and learners collect data on any topic (***e.g.***, ages of the learners).
  - Choose appropriate questions for collecting data.

    Example: Data collected on age of students.

  - Discuss the information presented by the collected data in the class.

  Example:

  - What is the youngest age in the class?
  - What is the oldest age?
  - How many students are 7 years old?
  - Which age is the most common?
  - How many students are in the class?

- Teacher assigns learners with an activity where they collect data on some topics like;
  - Favourite fruits
  - Favourite colour
  - Pet animals at home etc
- The learners discuss the information presented by the collected data.

Example:

  - What is the favourite colour of students in the class.?
  - Which colour is liked the least?
  - How many chose the colour pink?
  - How many students are in the class?

- Learners discuss what data collection is and why it is done.

  Explain that data is a collection of information.

  Data collection is done for many purposes, such as to understand particular situations, to predict future events, to confirm certain assumptions, and to help make decisions.

- Learners discuss the purpose of organising data.

If the data is not organised it could be difficult to understand. And, if the data is organised, it helps you understand better.
One way to organise data is to make a tally chart as shown below.

Ages of students in the class

Age	Tally	Frequency
7		2
8		13
9		6

- Watch the suggested video on collecting and organising data Data Collection
- Learners discuss and describe the data presented after organising it.

Example:

- The data shows the age of the students in the class.
- There are 21 students in the class.
- There are 13 students whose age is 8.

D. Assessment

Performance Task 1

Collect data on any appropriate topic and then organise the collected data properly.

Performance Task 2

Describe and interpret the collected data appropriately.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. Why do we collect data?
    ii. If you want to know the favourite fruits of class III students, what will you do?
    iii. Why is it important to organise data?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-
- National School Curriculum, Mathematics for PP – XII
- Online
  - History of Data - Data Collection Explained
  - Collecting and organising data-Data Collection

Topic: III-E2 Pictograph

III-E3 Bar Graph

[450 minutes]

Introduction

A graph can be defined as a pictorial representation or a diagram that represents data or values in an organised manner. The basic idea of graphs was first introduced in the 18th century by the Swiss mathematician Leonhard Euler. We can represent the data using a bar graph. The representation of the information or data through pictures is called pictograph.

Source: Graph Explained
The idea of graph explained

Utility and Scope

Graphs are a common method to visually show relationships in the data. The purpose of a graph is to present data that are too many or difficult to be described effectively in the text and in less space.

When data is presented in the form of a picture or graph, it becomes attractive, easy to read and interpret. Example, most of the data are presented in the form of graphs in many of the institutions and documents. Learning to construct and interpret graphs will help them build foundations for research work in later part of their life.

A. Competency

- Interpret and create pictographs and bar graphs that have one symbol/picture representing more than 1 unit to enhance data interpretation skills.

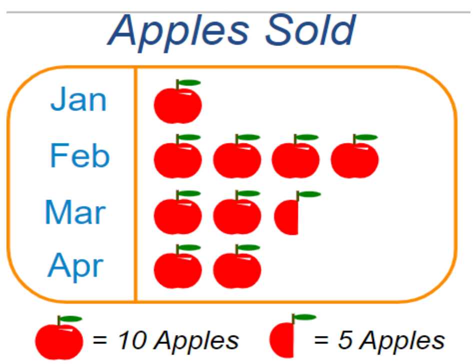
B. Objectives

- Construct pictographs where each symbol represents more than one item.
- Interpret pictographs.
- Create and interpret bar graphs for which each section represents a value greater than one using simple scales for larger numbers.
- Construct both horizontal and vertical graphs.

C. Learning Experiences

- Briefly recall the steps of collecting and organising data.
- Model how to construct a pictograph using any data.
    - Explain that the data collected is represented in the form of pictures/symbols.
    - Explain all the labels of the pictograph (a title, labels, a symbol, and a scale).
    - Explain about choosing a convenient scale depending upon the numbers in the data.

    Example: The pictograph shows the apples sold at a local shop for over a month.



- Learners explore vertical and horizontal pictographs.
- Learners interpret pictographs appropriately.

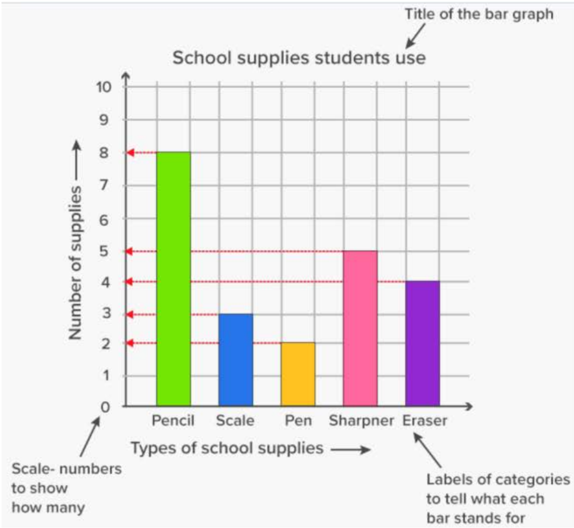
Watch the suggested video to learn how to create and interpret pictographs.

Pictograph and its interpretations

While interpreting pictographs, learners develop their communication and interaction skills.

- Model and explain how to construct a bar graph using any data.
    - Explain all the labels of the bar graph (a title, labels, and a scale).

The bar graph below shows the different types and number of school



supplies used by students.

- Watch the video to learn how to construct a bar graph. [Bar Graph]
- Explain about choosing a convenient scale depending upon the numbers in the data.
- Explore vertical and horizontal bar graphs.

- Learners interpret the bar graphs appropriately.
- Learners explore creating pictographs and bar graphs on collected data.

D. Assessment

Performance Task 1

Create pictograph and bar graph from a set of data including the title and labels.

Performance Task 2

Interpret pictographs and bar graphs and draw conclusions to find solutions to a given problem.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
    i. Where have you seen pictographs and bar graphs? What was it about?
    ii. Why do we represent data using pictographs and bar graphs?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Concrete materials/Manipulatives
- Worksheet
- Online
  - What is Graph Theory - Graph - Explained
  - Data Representation – Pictograph Pictograph & Its interpretations
  - Create your own Bar Graph-Bar Graph

Topic: III-E4 Probability Language

III-E5 Conducting Probability Experiments

[300 minutes]

Introduction

Probability is the study of random events to understand the chance. Students can use it in analysing and applying in everyday events.

The definition of probability has been given by a French mathematician named "Laplace". According to him, the probability is the ratio of the number of favourable cases among the number of equally likely cases. It has got its origin from games, tossing coins, rolling dice, and drawing a card from a deck of cards.

Source: Probability Concept

Utility and Scope

In our day-to-day life the "probability" or "chance" is a commonly used term. Sometimes, we use to say "Probably, it may rain tomorrow", "Probably, Sonam might come for his class today" and "Probably, you are right". All these terms, possibility and probability convey the same meaning. The probability is zero for an impossible event and one for an event which is certain to occur. Example, The probability that the sky will fall is 0. The sun will rise in the east is at 1.

A. Competencies

- Predict and describe probability outcomes of various mathematical and real-life events using probability language.
- Conduct experiments on probability of various mathematical and real-life events and apply the findings to make appropriate decisions in real life.

B. Objectives

- Predict and describe the probability of outcomes of various events using terms 'more likely' or 'less likely'
- Let learners conduct experiments on probability of various mathematical and real-life events and record outcomes.
- Investigate every day & fictional events to realise that theoretical predictions may not prove true given a set of tries.

- Describe probability of events in terms of simple fractions (E.g. '2 out of 5').

C. Learning Experiences

- Learners explore the probability of relevant events. Describe probability of each event using appropriate probability language; certain, likely, unlikely, impossible
    - A tree will talk to me tomorrow.
    - Tomorrow will be a sunny day.
    - When you drop a nail in the water, it will sink.

- Learners explore the theoretical probability of events.
    - Describe the chances of outcomes in terms of fractions.
    - Describe the chances of outcomes using appropriate language.

      Example:

      There are 5 pieces of blocks in a box – 2 blue, 1 red, and 2 yellow. If you reach into the box without looking and take one block, what is the probability of you getting a blue block?
    - Probability of getting a blue block = $\frac{2}{5}$, which is less than half so, it is unlikely to get a blue block.
    - Watch the video Probability Explained related to learning probability.

- Learners conduct experiments on various mathematical and real-life events to describe future events as likely and unlikely events.
    - First predict the chances of outcome using theoretical probability.
    - Conduct experiments and record the outcomes.
    - Describe the outcomes in terms of simple fractions.
    - Describe the outcomes using appropriate terms.
    - Compare their prediction to the experimental findings and realise that theoretical predictions may not prove true given a set of tries.

      Example:

      There is 1 out of 6 chances of getting a 2 when a die is rolled, so the probability is unlikely but when given 6 tries, there are chances of actually getting 2 more than once, even 6 out of 6 times maybe).
    - Discuss if one should choose to conduct the event or not based on the results of the experiment.

- Learners explore the activities on probability in Self-Instructional Materials, Key Stage I, Class III, Volume-IV
- Watch a video on Probability. Basic Probability explained
  Probability Concept for Kids

D. Assessment

Performance Task 1

Describe the probability of at least five real-life events using appropriate language.

Performance Task 2

Conduct experiments using a die and describe outcomes using fractions and appropriate terms.

Performance Task 3

Make theoretical predictions and then conduct experiments on the outcomes of a relevant event. Explain the decision to carry out the event after finding the outcomes.

(*Design appropriate assessment tools and record the learner's learning based on the template given in the annexure*)

- Reflective Questions
  i. Which event do you think will always happen? Why?
  ii. Which event do you think will never happen in your locality? Why?
  iii. How will we use the idea of probability in our life?

E. Resources

- Understanding Mathematics, Textbook for class III
- Self-Instructional Material, Key Stage I, Class III, Volume-IV
- National School Curriculum, Mathematics for PP – XII
- Die
- Coin
- Spinner
- cubes
- Worksheet
- Online
  - Probability, Meaning, Concept and Importance - Probability Meaning
  - Probability - Probability Explained
  - Probability game- Probability Explained

Appendix A

Assessment Structures for each Strand

Assessment Structures for KS- I (Classes PP - III)

<table>
<tr><th rowspan="3">Key Stage</th><th colspan="6">Assessment</th></tr>
<tr><th colspan="3">Term I</th><th colspan="3">Term II</th></tr>
<tr><th>CA</th><th>Mid Term Examination</th><th>Total</th><th>CA</th><th>Annual Examination</th><th>Total</th></tr>
<tr><td>1</td><td colspan="6">CFA</td></tr>
<tr><td colspan="7">For both Term I and Term II, assess each competency through appropriate performance tasks and assessment tools.
Performance Tasks: Worksheets, quiz, question and answer, presentation, making models, small projects, etc.
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.</td></tr>
</table>

Weightage for Key Stage I (Classes PP-III)

Strand	Time Allocation (Mins.)				Weightage(%)			
	PP	I	II	III	PP	I	II	III
Strand A: Numbers and Operations	3000	3500	3600	3750	42	48	43	45
Strand B: Patterns and Algebra	650	400	700		10	6	8	
Strand C: Measurement	1500	1200	1600	1950	21	17	19	23
Strand D: Geometry	1200	1350	1250	1550	17	18	15	18
Strand E: Data and Probability	850	750	1250	1150	12	11	15	14

Class work Assessment Rubrics

Criteria	Exceeding	Advancing	Meeting	Approaching	Beginning
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 appplieS 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-organised and neatly presented. -All text is highly legible, and there are	-Overall organisation is good, with a clear presentation-Most text is legible, and there are	-Organization is acceptable but may lack some neatness. -Legibility varies, and there may be	-Organization is somewhat lacking, and there is some difficulty in following the work.	-Poor organisation makes it challenging to follow the homework. -Legibility is compromised,

	no smudges or unintended marks. -Clear headings, labels, and steps enhance the overall organisation	minimal smudges or unintended marks. -Headings, labels, and steps contribute to effective organisation.	occasional smudges or unintended marks. -Clear headings and labels help maintain a basic level of organisation	-Legibility issues are noticeable, and there are frequent smudges or unintended marks. -Headings and labels are consistently not clear.	and there are 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.

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 organisation	-Homework is exceptionally well-organised and neatly presented. -All text is highly legible, and there are	-Overall organisation is good, with a clear presentation-Most text is legible, and there are	-Organization is acceptable but may lack some neatness. -Legibility varies, and there may be	-Organization is somewhat lacking, and there is some difficulty in following the work.	-Poor organisation makes it challenging to follow the homework. -Legibility is compromised,

	no smudges or unintended marks. -Clear headings, labels, and steps enhance the overall organisation	minimal smudges or unintended marks. -Headings, labels, and steps contribute to effective organisation.	occasional smudges or unintended marks. -Clear headings and labels help maintain a basic level of organisation	-Legibility issues are noticeable, and there are frequent smudges or unintended marks. -Headings and labels are consistently not clear.	and there are 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.