SECOND EDITION

MATHS WISE

7

Teaching Guide

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USING THIS TEACHING GUIDE

This teaching guide provides lesson plans for each unit. Each lesson starts with activities that can be completed within a specified time before the main lesson is taught. Working on starter activities help prepare the students for the more formal lessons and is an informal introduction to the topic at hand without straight away barraging them with new concepts.

While devising these activities, make sure that they can be done within a reasonable time span and that the resourses that are to be used are easily available.

Time required for completing each lesson is also given but can change depending upon the students' learning capabilities.

The guide refers to the textbook pages where necessary and exercise numbers when referring to individual work or practice session or homework.

This is not a very difficult guide to follow. Simple lesson plans have been devised with ideas for additional exercises and worksheets. Make sure that lessons from the textbook are taught well. Planning how to teach just makes it easier for the teacher to divide the course over the entire year.

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UNIT 1 SETS

Topic: Different form of sets
Time: 1 period

Objective

To enable students to express sets in different forms

Starter activity

What is a set?

The following sets will be written on the board and students will be asked to answer.

- {2, 3, 5, 7}
- {5, 10, 15, 20…}
- {1, 2, 3, 4, 6, 12}
- {juniper, oak, peepal, neem}
- {lion, tiger, cheetah, wolf}

1. In which form are sets 1, 2 and 3 written?
2. In which form are sets 4 and 5 written?

Main lesson

Explain to the students that a set can be represented in three forms.

1. Tabular form
2. Descriptive form
3. Set-builder notation form

In the last form, that is the set-builder notation, the members of a set are represented by a small letter for example, 'x', then a symbol '|' which stands for 'such that' is put and then a property is stated which clearly defines the members of the set.

Example 1

If A = {2, 3, 5, 7, 11…}

In the set-builder notation it is written as:

A = $\{x \mid x \in \text{P}\}$

The symbol '$\in$' indicates the element of a set, 'P' indicates the prime numbers and it is read as 'A is the set of all x such that x is a prime number:

Example 2

If B = {1, 2, 3, 6, 18}, the set of all factors of 18, then in the set-builder notation it is written as
B = $\{x \mid x$ is a factor of 18}

Example 3

If A = {1, 2, 3, 4 …15} then in the set-builder notation it is written as:

A = $\{x \mid x \in$ N, $0 < x < 15\}$

This set may also be written as:

A = $\{x \mid x \in$ N, $1 \leq x \leq 15\}$

and it is read as, 'A is the set of all x such that x is a natural number and x is either greater than or equal to 1 and either less or equal to 15.

Practice session

1. Give a worksheet to the students to write the following sets in a tabular form:
   a) Set of provinces of Pakistan
   b) Set of oceans of the world
   c) Set of continents
   d) Set of all prime numbers between 30 and 50
   e) Set of common divisors of 50 and 75

2. Write down the following sets in a descriptive form:
   a) {4, 6, 8, 10, 12, 14, 15, 16, 18, 20}
   b) {London, Lahore, Lancaster}
   c) {violet, indigo, blue, green, yellow, orange, red}
   d) {1, 3, 5, 7…}

3. Write down the following sets in the set-builder notation:
   a) C = {the set of all prime numbers}
   b) A = {all possible numbers formed by the digits 3, 7, 2}
   c) D = {all square numbers between 1 and 50

Individual work

Questions 1 and 2 of Exercise 1a will be given as classwork.

Homework

Question 3 of Exercise 1a will be given as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Types of sets
Time: 1 period

Objective

To enable students to express the types of sets

Starter activity

Write the following sets on the board to give the concept of types of sets:

A = {1, 2, 3, 4, 5, …50}
B = {1, 2, 3, 4, 5, …}
C = { } or set of students of class VII having horns
D = {1, 3, 5, 7, …} and E = {2, 4, 6, 8, …}
G = {1, 2, 3, 4, 6, 12} and H = {1, 2, 3, 6, 18}
J = {3, 4, 5} and K = {x, y, z}
M = {5, 6, 7} and N = {6, 7, 5}

Main lesson

After having written the sets on the board, ask the following questions:

1. How many members or elements are there in set A?

A: Set A contains 50 elements. We can count the elements of set A. A set containing a fixed number of elements is called a finite set.

2. How many elements are there in set B?

A: We cannot count. The sign ellipsis… indicates continuity to an unnamed number and so the elements are uncountable. It is an infinite set.

3. Are there any elements in set C? Would there be any girl or boy in class VII having horns?

A: No, set C does not contain any elements. Humans do not have horns. When there are no elements, the set is called an empty set or a null set and it is represented by an empty bracket or the symbol ∅.

4. Are the sets D and E the same?

A: No, set D is a set of odd numbers and set E is a set of even numbers. The members of Set E are exactly divisible by 2 while those of set D are not completely divisible by 2. Sets which have no common elements between them are called disjoint set.

5. Do you see any element common in set G and H?

A: Yes 1, 2, 3, and 6 are common; they are found in both the sets. G and H are called overlapping sets.

6. Are the elements of set J and K equal and the same?

A: The numbers of elements are same but they are different from each other. Such sets are called equivalent set and when the members and elements are the same they are called equal sets as shown by the sets M and N.

Individual work

Questions 5 and 6 of Exercise 1a will be done in class. The teacher should observe the students work and guide them.

Homework

Give some revision exercises and ask the students to prepare a chart showing types of sets with examples of their own.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Universal set, complements of a set, union, intersection and difference of two or more sets and related Venn diagrams
Time: 3 periods

Objectives

To enable students to:
- define universal set and complement of set, to find union, intersection and difference of sets.
- represent union or intersection of two sets through Venn diagrams.

Starter activities

Activity 1

Write the following sets on the board to give the concept of universal set and complement of a set:

A = {1, 2, 3, 4, 5 … 20}
B = {1, 3, 5, 7, 9, 11, 13, 17, 19}
C = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20}
D = {2, 3, 5, 7, 11, 13, 17, 19}

Ask the following questions to explain the universal set and complement of a set:

1. Which is the biggest set?

A: Set A

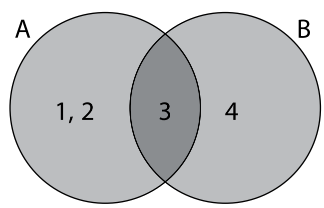
2. Are all the elements of set B, C and D the elements of set A?

A: Yes

Activity 2

The following diagrams will be drawn on the board:

A = {1, 2} and B = {3, 4}



1. What do you see in this figure?
2. Why the digit ‘3’ is in the centre?
3. Why are both the circles shaded?

Main lesson

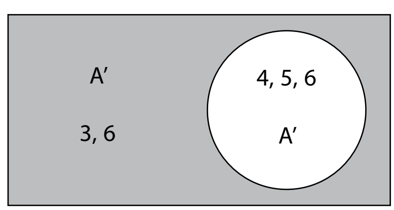
- A set consisting of all the elements occurring in a problem under consideration is called the universal set and it is denoted by $\cup$.
- In other words universal set is a super set of every set occurring together in problems. In the above four sets, A is the super set or universal set.
- Set B, C and D are called complements of a set being denoted by B', C', D'

  i.e. $B' = \cup \setminus B$ $\quad B' = \cup - B$
  $C' = \cup \setminus C$ $\quad C' = \cup - C$
  $D' = \cup \setminus D$ $\quad D' = \cup - D$

Example

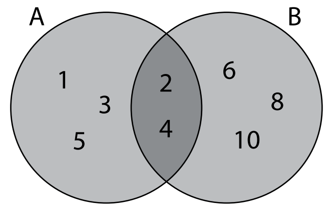
The Venn diagram on the right shows that:

If U = {3, 4, 5, 6, 7}
A = {4, 5, 7}
then A’ = {3, 6}
i.e. U – A = A’



represents A’ = {3, 6}

Explain union of two sets by giving the following examples:



- If $A = \{1, 2, 3, 4, 5\}$ and $B = \{2, 4, 6, 8, 10\}$

  then $A \cup B$ will be:

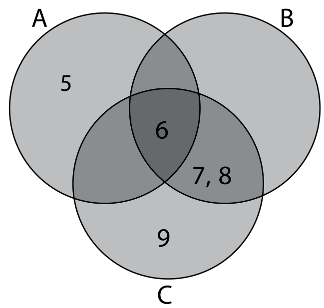
  $A \cup B = \{1, 2, 3, 4, 5\} \cup \{2, 4, 6, 8, 10\}$

  therefore $A \cup B$ or $B \cup A$ will be $\{1, 2, 3, 4, 5, 6, 8, 10\}$

  Note: Common elements are not written twice.
- A set containing all the elements of two sets is called the union of two sets.

  '$\cup$' is the symbol of union.

Union of three sets using Venn diagram can be shown as:



Example 1

- If $A = \{5, 6\}$
  $B = \{6, 7, 8\}$
  $C = \{6, 7, 8, 9\}$

  Proceeding as $(A \cup B) \cup C$

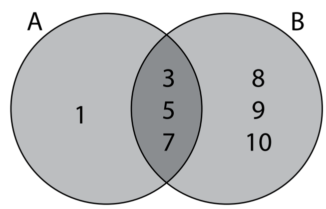
  $A \cup B = \{5, 6\} \cup \{6, 7, 8\} = \{5, 6, 7, 8\}$
  $(A \cup B) \cup C = \{5, 6, 7, 8\} \cup \{6, 7, 8, 9\}$
  $= \{5, 6, 7, 8, 9\}$
  Hence, operation of union of three sets is associative.

Explain to the students that in activity 2, the two sets, $A \cup B = \{1, 2, 3, 4\}$

- Shading of both the circles shows that $A \cup B = B \cup A$

  Hence union of two sets is commutative.
- $A \cup B = B \cup A$, this property is called commutative property of union.

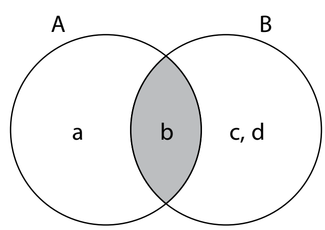
Explain intersection of two sets by the following example:



- If set $A = \{1, 3, 5, 7\}$ and $B = \{3, 5, 7, 8, 9, 10\}$ then
  $A \cap B = \{3, 5, 7\}$
- A set which contains all the common elements of two sets is called intersection of two sets. $\cap$ is the symbol of intersection.

Example 2

If $A = \{a, b\}$
$B = \{b, c, d\}$
then $A \cap B = \{b\}$
and also $B \cap A = \{b\}$



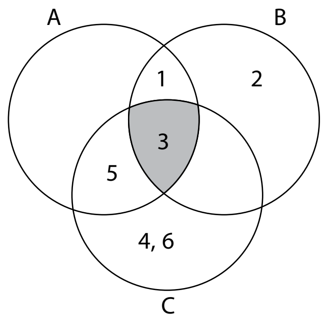
represents $A \cap B = \{b\}$
$A \cap B = B \cap A = \{b\}$

Hence the intersection of two sets is commutative.

Example 3

If A = {1, 3, 5}, B = {1, 2, 3} and C = {3, 4, 5, 6}
then A ∩ B = {1, 3, 5} U {1, 2, 3}
A ∩ B = {1, 3}
(A ∩ B) ∩ C = {1, 3} ∩ {3, 4, 5, 6} = {3}
B ∩ C = {1, 2, 3} ∩ {3, 4, 5, 6} = {3}
A ∩ (B ∩ C) = {1, 3, 5} ∩ = {3} = {3}

Hence the operation of intersection of 3 sets in also associative.



Explain the difference of two sets using the following example:

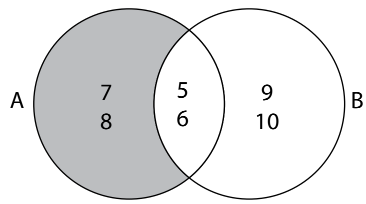
- If set A = {10, 11, 12} and B = {10, 11, 12, 13} then A – B or A\B = { } but B – A will be {10, 11, 12, 13} – {10, 11, 12} or B – A = {13}

  – or / denotes the difference of two sets.

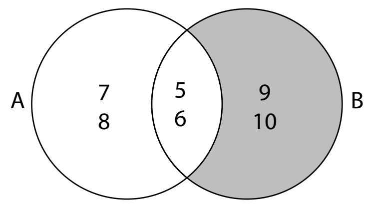
Example

The Venn diagram shows that:
If A = {5, 6, 7, 8} and B = {5, 6, 9, 10}
then,

A – B = {7, 8} all elements of set A which are not in B
B – A = {9, 10} all elements of B which are not in A



A – B = {7, 8}
shows A – B



B – A = {9, 10}
shows B – A

Practice session

1. If ∪ = {1, 2, 3, 4, 5, …15}
   A = {1, 3, 5, 7}
   B = {2, 4, 8, 10}
   C = {3, 6, 9, 12, 15}
   D = {1, 2, 3, 4, 6, 12}

   then find,

   a) A' b) A – B c) D' d) B ∩ C
   e) A ∪ D f) C – B

2. Show by Venn diagram the following:

   If A = {a, b, c, d} and B = {a, c, e, f} then show:

   a) A ∪ B b) A – B c) B ∩ A

   If ∪ = {1, 2, 3, 4, 5, 6}, X = {1, 3, 5}, Y = {2, 4, 5} then show:

   a) X’ b) Y’

3. Taking the example from the textbook p. 14, help the students solve it.

If $A = \{1, 2, 3\}$
$B = \{3, 4\}$
$\cup = \{1, 2, 3, 4, 5\}$

then show,

a) $A \cup B$
b) $A \cap B$
c) A'
d) $A - B$
e) Verify $A \cap B \neq A - B$
f) $A' \cap B'$
g) $A' - B'$

Individual work

Question 4 of Exercise 1a and Question 1 and 2 of Exercise 1b will be given as classwork

Homework

1. If $U = \{a, b, c, d, e, f, g, h\}$
$A = \{a, b, c, d\}$
$C = \{e, f\}$
$D = \{b, d, e, g\}$

then find,

a) C' b) $C - D$ c) $A \cup B$ d) $B \cap D$

2. Question 3 of Exercise 1b will be given as classwork.

Recapitulation

Any problems faced by the students will be discussed.

UNIT 2 RATIONAL NUMBERS AND DECIMAL NUMBERS

Topic: Rational numbers
Time: 3 periods

Objectives

To enable students to:

- define a rational number
- perform different operations on rational numbers
- find additive and multiplicative inverse of a rational number, reciprocal of a rational numbers
- verify associative, commutative, and distributives properties of rational numbers

Starter activity

Draw a number line on the board and ask the students the following questions:

1. How many sets of number are there on the number line?
2. Name the two sets of numbers on the number line.
3. {0, 1, 2, 3 …} Name the sets of the numbers.
4. Is 0 a negative or a positive number?
5. Are the negative numbers smaller than zero?
6. Is the sum of two natural numbers always natural?
7. Is the product of two natural numbers always natural?
8. When a natural number is subtracted from another natural number, is the result always a natural number?
9. When 2 is divided by 5 we get $\frac{2}{5}$. Is $\frac{2}{5}$ a natural number?
10. What is $\frac{2}{5}$ called? Does this number belong to any of the system of number just discussed?

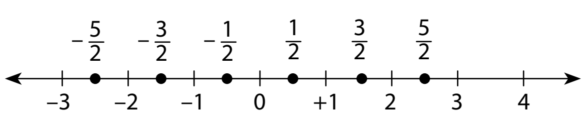
Main lesson

The number $\frac{2}{5}$ is called a rational number. Any number which can be expressed in the form of a fraction $\frac{a}{b}$ where 'a' and 'b' are integers and $b \neq 0$ is known as a rational number, and 'a' may be equal to zero.

Some examples are given to make this clearer.

$\frac{2}{3}, -\frac{1}{4}, \frac{5}{6}, -\frac{3}{5}$, 0, 6, –3 etc. are all rational numbers, and hence positive integers, negative integers, zero and common fractions are called rational numbers.

Dividing the number between each pair of consecutive integers in two equal parts, we get the representation of the numbers $-\frac{3}{2}, -\frac{1}{2}, \frac{1}{2}, \frac{3}{2}$ and so on.



Hence every rational number can be expressed on a number line.

The teacher will further explain irrational number with the help of following:

When $\frac{22}{7}$ is divided, we get:

$\frac{22}{7}$ = 3.14285714 (the value of π)

It is not completely divisible as the process of division goes on and on. It cannot be expressed as the quotient of two integers and hence is an unreasonable number. That is why they are called irrational numbers ($\sqrt{3}$, $\sqrt{5}$, π).

Practice session

1. Which of the following is/are rational number(s)?
   a) 3 b) $\frac{2}{0}$ c) $\frac{3}{1}$ d) $-\frac{3}{1}$ e) $\frac{0}{3}$ f) $\frac{0}{0}$
2. Write down the following rational numbers as integers:
   a) $\frac{8}{1}$ b) $-\frac{6}{1}$ c) $-\frac{5}{1}$ d) $\frac{-20}{-1}$ e) $\frac{-13}{-6}$
3. Write down the rational numbers whose numerator is (–5) 3 and whose denominator is 17–4.
4. Are $\sqrt{4}$, $\sqrt{9}$ irrational numbers? If not, give your reasons.

Individual work

Questions 1, 2, 3 of Exercise 2a will be given as classwork.

Homework

Questions 4 and 5 of Exercise 2a will be given as homework.

Topic: Laws of operations on rational numbers
Time: 1 period

Objectives

To enable students to:

- perform four basic operations on rational numbers
- verify commutative property of rational numbers.

Starter activity

Ask some questions similar to the ones given below to introduce the session.

1. What is the sum of 4 and 5?
2. Is the sum of 4 and 5 and 5 and 4 equal?
3. Is the sum of $\frac{3}{4}$ and $\frac{4}{3}$ equal to the sum of $\frac{4}{3}$ and $\frac{3}{4}$?
   $\frac{3}{4} + \frac{4}{3} = \frac{4}{3} + \frac{3}{4}$
4. Is subtracting 3 from 5 and subtracting 5 from 3 the same?
   $5 - 3 \neq 3 - 5$
5. Is adding 0 to 3 and adding 3 to 0 the same?
   $3 + 0 = 3$ and $0 + 3 = 0$
   (zero in called the additive identity)

Main lesson

Addition

$\frac{2}{5} + \frac{1}{5} + \frac{3}{5} = \left(\frac{2 + 1 + 3}{5}\right) = \frac{6}{5}$

When two or more rational numbers are added, the sum is also a rational number. Thus we can say that rational numbers are closed under addition and addition is commutative as shown in the above example: 3 + 4 = 4 + 3. Changing the order of numbers does not effect the result.

$\frac{5}{6} + \frac{3}{5} = \frac{3}{5} + \frac{5}{6}$

$\frac{25 + 18}{30} = \frac{18 + 25}{30} = \frac{43}{30}$

In general if a, b, c and d are integers and b and $d \neq 0$ then

$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$

This property of rational numbers is known as the commutative property of addition.

Subtraction

Subtract 5 from 8

$8 - 5 = 3$

Subtract 8 from 5 = $5 - 8 = -3$

This example shows that the difference of two rational numbers is also a rational number and therefore rational numbers are also closed under subtraction.

But $8 - 5 \neq 5 - 8$ or $\frac{5}{6} - \frac{1}{6} \neq \frac{1}{6} - \frac{5}{6}$

So, the commutative property does not hold for subtraction of rational numbers.

Multiplication

$3 \times 5 = 5 \times 3 = 15$

$\frac{4}{9} \times \frac{5}{6} = \frac{5}{6} \times \frac{4}{9} = \frac{20}{54}$

This implies that:

- Rational numbers is closed under multiplication.
- Multiplication is commutative for rational numbers.

Multiplicative identity

$\frac{3}{5} \times 1 = \frac{3}{5}$, $8 \times 1 = 8$

1 is called the multiplicative identity or the identity element for multiplication for rational numbers.

Division

Dividing a rational number by a non-zero rational number.

$8 \div 2$ or $\frac{8}{2} = 4 \rightarrow$ rational

$2 \div 8$ or $\frac{2}{8} = \frac{1}{4} \rightarrow$ rational

We can, therefore, say that rational numbers are closed with respect to division as the quotient is also a rational number but, $\frac{8}{2} \neq \frac{2}{8}$.

Example

$\frac{3}{4} \div \frac{5}{8}$

$= \frac{3}{4} \times \frac{8}{5} = \frac{6}{5}$ and $\frac{5}{8} \div \frac{3}{4}$

$= \frac{5}{_2\cancel{8}} \times \frac{\cancel{4}}{3} = \frac{5}{6}$

Division of two rational numbers is not commutative.

Absolute value of rational numbers

The absolute value of rational number is the number it self regardless of its value.

Example

$-\frac{3}{7} = \left|-\frac{3}{7}\right| = \frac{|-3|}{|-7|} = \frac{3}{7}$

Activity

Additive and multiplicative inverse will be explained to the students with the help of the following activity:

$\frac{a}{b} + \left(-\frac{a}{b}\right) = 0$

$-\frac{a}{b}$ is the additive inverse of $\frac{a}{b}$

- If −3 is an additive inverse of +3, then −2 is the additive inverse of __________.
- Additive inverse of $\frac{4}{5}$ is __________.

Multiplicative inverse in also called Reciprocal.

- Multiplicative inverse of a is $\frac{1}{a}$, what is the reciprocal of q?
- Multiplicative inverse of $\frac{2}{5}$ is __________.

Individual work

Questions 3, 4, and 5 of Exercise 2b will be given as classwork.

Homework

Find the value of:

a) $\frac{-6}{7} - \frac{-2}{7}$ b) $\frac{7}{24} - \frac{11}{36}$ c) $\frac{4}{15} \times \frac{3}{8}$

Topic: Associative and distributive properties of rational numbers
Time: 1 period

Objective

To enable students to verify associative and distributive property for rational numbers.

Main lesson

Example 1

Find the sum of $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$.

$\left(\frac{1}{2} + \frac{2}{3}\right) + \frac{3}{4}$

L.C.M of 2 and 3 = 6

$\left(\frac{3+4}{6}\right) + \frac{3}{4}$

$\frac{7}{6} + \frac{3}{4}$

LCM = 12

$\frac{14+9}{12} = \frac{17}{12}$

$\frac{1}{2} + \left(\frac{2}{3} + \frac{3}{4}\right)$

$\frac{1}{2} + \left(\frac{8+9}{12}\right)$

$\frac{1}{2} + \frac{17}{12}$

LCM = 12

$\frac{6+17}{12} = \frac{23}{12}$

By adding the numbers in any order, we get the same result. It can be shown for any three rational numbers.

This property is known as the associative property for rational numbers.

Example 2

$\left(\frac{3}{4} - \frac{1}{2}\right) - \frac{1}{3}$

$\left(\frac{3}{4} - \frac{2}{4}\right) - \frac{1}{3}$

$\left(\frac{3-2}{4}\right) - \frac{1}{3}$

$\frac{1}{4} - \frac{1}{3}$

$\frac{3-4}{12} = -\frac{1}{12}$

$\frac{3}{4} - \left(\frac{1}{2} - \frac{1}{3}\right)$

$\frac{3}{4} - \left(\frac{3}{6} - \frac{2}{6}\right)$

$\frac{3}{4} - \frac{1}{6}$

$\frac{9-2}{12} = \frac{7}{12}$

Subtraction is not associative for rational numbers.

Example 3

Multiplication is associative for rational numbers:

$\frac{3}{5} \times \left(\frac{\cancel{2}^{1}}{5} \times \frac{4}{\cancel{6}_{3}}\right)$

$\frac{\cancel{3}^{1}}{5} \times \frac{4}{\cancel{15}_{5}} = \frac{4}{25}$

$= \frac{\cancel{12}^{4}}{\cancel{75}_{25}}$ (dividing by 3)

$\left(\frac{3}{5} \times \frac{2}{5}\right) \times \frac{4}{6}$

$\frac{{}^{1}\cancel{6}}{25} \times \frac{4}{\cancel{6}_{1}} = \frac{4}{25}$

Note that division is not associative.

Example 4

Multiplication is distributive over addition and subtraction for rational numbers:

$$\frac{7}{9} \times \left\{\left(\frac{3}{10} + \left(-\frac{1}{5}\right)\right)\right\}$$

$$\frac{7}{9} \times \left(\frac{3-2}{10}\right)$$

$$\frac{7}{9} \times \frac{1}{10} = \frac{7}{90}$$

$$\frac{7}{9} \times \left(\frac{3}{10} + -\frac{1}{5}\right)$$

$$\frac{21}{90} + \frac{-7}{45}$$

$$\frac{21-14}{90} = \frac{7}{90}$$

Practice session

State the property followed in each of the following examples:

a) $-\frac{2}{3} \times \left(\frac{3}{7} \times \frac{-5}{7}\right) = \left(\frac{-2}{3} \times \frac{3}{7}\right) \times \frac{-5}{7}$

b) $\frac{-3}{5} \times \frac{4}{7} = \frac{4}{7} \times \frac{-3}{5}$

c) $\frac{4}{5} \times \left(\frac{2}{3} + \frac{-4}{9}\right) = \left(\frac{-4}{5} + \frac{2}{3}\right) + \left(\frac{-4}{5} \times \frac{-4}{9}\right)$

Individual work

Give a worksheet to students with questions similar to the ones given below.
Simplify:

a) $\frac{3}{7} + \frac{5}{9} - \frac{-2}{3}$

b) $\frac{-4}{11} + \frac{-2}{3} - \frac{-5}{9}$

c) $\left(-\frac{8}{5} \times \frac{3}{4}\right) + \left(\frac{7}{8} \times \frac{-16}{25}\right)$

d) $\left(\frac{7}{25} \times \frac{-15}{28}\right) - \left(-\frac{3}{5} \times \frac{4}{9}\right)$

Question 1 of Exercise 2b will be given as classwork.

Homework

Test whether each of the rational numbers are equivalent:

1. a) $\frac{5}{25}, \frac{25}{125}$ b) $\frac{23}{15}, \frac{12}{13}$ c) $\frac{15}{18}, \frac{26}{24}$
2. Saleem bought 8 blue and 7 red ribbons. What fraction of the total ribbons are red?
3. Arrange in an ascending order.
   $\frac{4}{5}$, 3, 2.28, $\frac{-8}{5}$, $1\frac{1}{4}$

Topic: Decimal numbers
Time: 2 periods

Objectives

To enable students to:

- convert decimals to rational numbers
- differentiate between terminating and non-terminating decimals

Starter activity

Ask questions like the ones given below to refresh students' memory:

- What are whole numbers?
- Which numbers are called rational numbers?
- What do you mean by a decimal fraction?
- Which of the numbers in group are terminating decimal numbers?
  $\frac{4}{8}$, 175, 2.602, $3\frac{8}{9}$, 9178.25, $\frac{56}{7}$ etc.
- How do we convert a decimal fraction into a rational number, for example, 0.35, 0.6, 2.173?
- How do we convert a rational number into a decimal fraction?
  Convert $\frac{5}{8}$ and $\frac{2}{7}$ into decimal fractions.
- Let the students come to the board and perform the division.

1.
```
     0.625
8) 5.0000
  –4 8
     20
    –16
      40
     –40
      xx
```

2.
```
    0.2857142
7) 2.0000
   1 4
    60
    56
     40
     35
      50
      49
       10
        7
       30
```

Ask the students what do they notice in the above two examples. Discuss examples from the textbook page 30.

Main lesson

Using textbook pages 30 and 31, explain and give the definitions of terminating decimals and non-terminating decimals. Give the rule and explain whether a given fraction is a terminating type of decimal or non-terminating.

Carry out some examples of converting fractions into decimals and vice versa using pages 31 and 32 of the textbook.

Practice Session

- Write some decimal fractions on the board and call the students at random to convert decimals into rational members, for example, 0.9, .027, 13.162 etc.
- Write some rational members on the board and ask the students to find which ones are terminating and which non-terminating decimals.
- Apply the rule to: $\frac{7}{8}$, $\frac{15}{4}$, $\frac{14}{15}$, $8\frac{9}{25}$, $\frac{23}{24}$, $\frac{15}{14}$ etc. (check the factors of the denominators in each case.)

Individual work

Give Exercise 3c from the textbook as classwork.

Homework

Students should be given some sums from sources other than the textbook.

Recapitulation

Revise the rules to find the terminating decimals; differentiate between terminating and non-terminating decimals.

Topic: Rounding off and estimation
Time: 1 period

Objective

To enable students to:

- estimate numbers and measures
- how to round off numbers to a specified degree of accuracy
- the concept of rounding off.

Starter activity

Show some pictures to the children and ask them to make a guess of the number of objects or articles in the picture. (Show charts of fruits, vegetables, flowers etc.)

Ask them to make an estimate of the weight of some objects like a boy, a car etc. Compare the answers.

Main lesson

Using textbook pages 33 and 34, explain approximate value of numbers, measures etc. and rounding off to one place, two places, or three places.

Practice session

Solve examples on the board with participation from the class (divide up to 2 places, 3 places etc.)

Write a few decimals and ask the students to give the answer rounded off to one decimal place, 2 decimal places etc.
For example, 0.275, 0.432, 16.892

Individual work

Questions 1 to 10 of Exercise 2d from the textbook to be done individually by each student. Help them solve it.

Homework

Questions 11 to 15 of Exercise 2d will be given as homework.

Recapitulation

Revise terminating and non-terminating decimals; convert rational numbers to decimals giving the answer to a specified number of places.

UNIT 3 SQUARE AND SQUARE ROOTS

Topic: Perfect square
Time: 1 Period

Objective

To enable students to:

- define a perfect square
- find out whether a given number is a perfect square
- apply the different properties of a perfect square

Starter activities

Activity 1

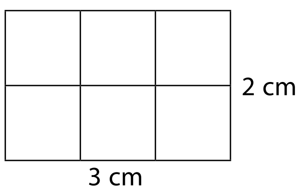


Fig. A

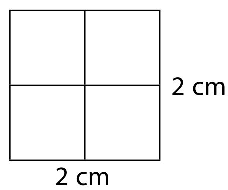


Fig. B

Name the figures drawn on the board. Figure A is a rectangle.

- What is the length and bread of the rectangle? Show that its length is 3 cm and breadth is 2 cm.
- What is its area? $l \times b = 3 \text{ cm} \times 2 \text{ cm} = 6 \text{ cm}^2$
- Is the length and breadth of figure B equal?

When the length and breadth of a figure is equal what is it called? It is called a square.

- What is the area of figure B?

  $l \times l$ or $s \times s = 2 \text{ cm} \times 2 \text{ cm} = 4 \text{ cm}^2$

  Figure B is a perfect square because its length and breadth are equal.

Activity 2

- What are the factors of the following numbers?

  9, 18, 25, 16, 20,

  $3 \times 3 = 9$, $4 \times 4 = 16$, $3 \times 6 = 18$, $4 \times 5 = 20$, $5 \times 5 = 25$
- Which of these numbers do you think are square numbers?

  9, 16 and 25 are square numbers, because both the factors are the same.

- Is 7 a square number? How can you make a square of it?

  No, 7 is a prime number. We can square it as follows:

  $7 \times 7 = 49$ or $7^2 = 49$

Activity 3

Ask the following questions:

1. What are the prime factors of:

   a) 8 b) 27

   The prime factors are:

   $8 = 2 \times 2 \times 2 = 2^3$ and $27 = 3 \times 3 \times 3 = 3^3$

2. What are the prime factors of 16?

   $2 \times 2 \times 2 \times 2 = 2^4$

3. What are the prime factors of 144?

   $144 = 16 \times 9$ or 12×12
   $16 \times 9 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$
   $= 2^4 \times 3^2$

Main lesson

When a number is multiplied by itself, the product is called the square of that number.

The square is called the Power of that number.

$8^2 = 64$ and $6^2 = 36$

because $8 \times 8 = 64$ and $6 \times 6 = 36$

8 is the square root of 64. What is the square root of 36?

The symbol used for square root is √ and it is called radical and the number whose square root is to be found is called radicand.

radical $\longleftarrow \sqrt{64} \longleftarrow$ radicand

We read it as the square root of 64.

Note the square of an odd number is always odd.

$3 \times 3 = 9$, $5 \times 5 = 25$, $7 \times 7 = 49$

The square of an even number is always even.

$4 \times 4 = 16$ or $8 \times 8 = 64$, $10 \times 10 = 100$

Explain to the students by giving the examples from the textbook page 40 that the prime factors of 8 and 27 do not have even powers i.e., $8 = 2^3$ and $27 = 3^3$.

But the prime factors of 16 and 144 have even powers.

$16 = 2 \times 2 \times 2 \times 2^4$
$144 = 2^4 \times 3^2$

Therefore, a number is a perfect square when all its prime factors have even indices (power is also called indices).

Properties of square number will be explained by giving the examples from the textbook page 41.

Property 1: Square of an even number is always even. Any even number can be written as 2n where 'n' is any integer:

$(2n^2) = 4n^2$ or $2 \times 2 \times n \times n$

$(20)^2 = 20 \times 20 = 400$

$(160)^2 = 160 \times 160 = 25600$

Property 2: Square of an odd number is always odd. Any odd number can be written as $(2n + 1)$ where 'n' is an integer: $(2n + 1)^2$

Example: If n = 3, then $(2 \times 3 + 1)^2 = (6 + 1)^2 = 7^2 = 49$

and if n = 5, then $(2n + 1)^2 = (2 \times 5 +1)^2 = (10 +1)^2 = 11^2 = 121$

Property 3: Square of a proper fraction is less than the fraction itself.

Example: $\left(\frac{1}{2}\right)^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}; \frac{1}{4} < \frac{1}{2}$

$\frac{2}{3} = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}; \frac{4}{9} < \frac{2}{3}$

Property 4: Square of a decimal fraction is less than 1.

Example: 0.4 is a decimal fraction and less than 1 and its square is also less than 1.

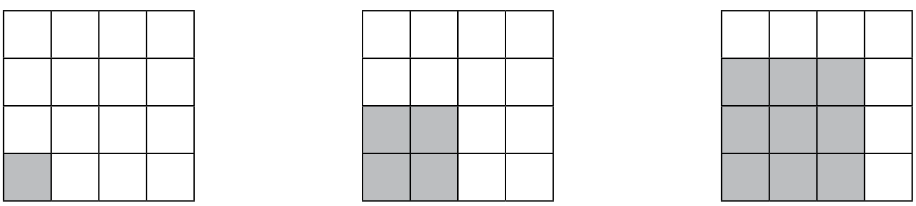
$(0.4)^2 = 0.4 \times 0.4 = 0.16$

or $0.4 = \frac{4}{10}$ and $\left(\frac{4}{10}\right)^2 = \frac{4}{10} \times \frac{4}{10} = \frac{16}{100} = 0.16$

Therefore, $0.4 > 0.16$ and $\frac{40}{100} > \frac{16}{100}$

Practice session

1. Draw the following squares and find the area of the shaded portion.



2. Complete the tables from the textbook page 40.

Table A

	Number	Squares
a)	13	
b)	14	
c)	15	
d)	16	

Table B

	Square Numbers	Square Root
a)	36	
b)	144	
c)	100	
d)	121	

3. Which of the following numbers is a perfect square? Explain with working:

a) 25 b) 39 c) 44 d) 81 e) 64

4. Which is greater?

a) $.1$ or $(.1)^2$ b) $\frac{2}{5}$ or $\left(\frac{2}{5}\right)^2$

Individual work

1. Pick out the square numbers from the following:

   23, 12, 110, 121, 56, 81, 72, 20, 99, 100
2. Find the square root of the following numbers:

   a) $\sqrt{169}$ b) $\sqrt{225}$ c) $\sqrt{400}$

Questions 1, 2, and 3 of Exercise 3a to be done in the class. Help the students with the exercises.

Homework

1. Find the area of a square with a length of 4.5 cm.
2. Complete the following:

   a) $9^2 =$ __________ b) $70^2 =$ __________ c) $1.1^2 =$ __________
3. Question 4 of Exercise 3a will be given as homework.

Recapitulation

To revise the lesson, ask these questions in the class:

1. Are the powers of prime factor of square even?
2. What is the sum of the squares of 5 and 3?
3. Is the sum of $(5)^{22}$and $(3)^{22}$ a perfect square?
4. What does the symbol √ stand for?
5. What is the square root of 25, 36, and 100?

Topic: Square root
Time: 2 periods

Objectives

To enable students to:

- find the square root by (i) factorisation method (ii) division method

Starter activity

Is 36 a perfect square? What are its prime factors?
Is 96 a perfect square? What are its prime factors?

Students should be able to answer these questions as the numbers are small.

Main lesson

Explain prime factorisation or square root by prime factorisation to the students with the help of the examples given on the textbook pages 44 to 46.

Example 1

Find the square root of 256 first by the factorisation method, and then by the division method.

Factorisation method

Short division by prime numbers only.

$$\begin{array}{r|r}
2 & 256 \\ \hline
2 & 128 \\ \hline
2 & 64 \\ \hline
2 & 32 \\ \hline
2 & 16 \\ \hline
2 & 8 \\ \hline
2 & 4 \\ \hline
2 & 2 \\ \hline
 & 1
\end{array}$$

$\sqrt{256} = \sqrt{\overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2}}$
$= 2^8$

It is easy to make four pairs of 2s to get the product or divide the power '8' by 2 = 4

$2 \times 2 \times 2 \times 2 = 16$
$\sqrt{256} = 16$
i.e. $256 = 16^2$

Division method

$$\begin{array}{lr|r}
 & & 16 \\ \hline
 & 1 & \widehat{2}\overline{56} \\
\text{add the same} & +\ 1 & 1 \downarrow \\ \hline
 & 26 & 156 \\
 & 6 & -\ 156 \\ \hline
 & & \text{x}
\end{array}$$

$\sqrt{256} = 16$

Mark off the digits from right to left.
2 is single, divide it by a square number whose square is less or equal to 2.

1. Write 1 as a divisor and quotient.
2. Subtract 1 from 2; the remainder is 1.
3. Bring down the next pair i.e., 56. Now the dividend is 156.
4. In 156, the first digit is 6 so try with 4 or 6. $4 \times 4 = 16$ and $6 \times 6 = 36$

$$\begin{array}{r} 24 \\ \times 4 \\ \hline 96 \end{array} \qquad \begin{array}{r} 26 \\ \times 6 \\ \hline 56 \end{array}$$

The square root of a 3-digit number will always be a 2-digit number.

Example 2

Find the square root of 6084 by division.

6084 is a 4-digit number so it has 2 pairs.

$$\begin{array}{r|r}
 & 78 \\ \hline
7 & 60\underbrace{84} \\
+\ 7 & -\ 49 \downarrow \\ \hline
148 & 1184 \\
+\ 8 & 1184 \\ \hline
156 & \text{xx}
\end{array}$$

Perfect square which is less than 60 is 49.

$7 \times 7 = 49$

The first digit of 1184 is 4.

To get 4, we will check by putting 2 or 8 with 14.

$$\begin{array}{r} 142 \\ \times\ 2 \\ \hline 284 \\ \hline \end{array} \qquad \begin{array}{r} 148 \\ \times\ 8\ \checkmark \\ \hline 1184\ \checkmark \\ \hline \end{array}$$

$\sqrt{6084} = 78$
$6084 = 78^2$
$6084 = 78 \times 78$

8 is the right number

Example 3

Find the square root of 10.3041

	3.21
3	10.3041
+ 3	− 9
62	130
+ 2	124
641	641
+ 1	− 641
642	x

- First pair is 10.
  $3^{23}$is less than 10
- The next pair is 30.
  Bring it down with 1=130
- $62 \times 2 = 124$;
  124 is < then 130
- Bring down the next pair i.e., 41
  now the dividend is 641
  The first digit is 1
  $1 \times 1 = 1$ and $9 \times 9 = 81$
  $641 \times 1 = 641$

$\sqrt{10.3041} = 3.21$
Because $3.21 \times 3.21 = 10.3041$

Practice session

Find the square root by division method and factorisation method.

a) 289 b) 196 c) 324 d) 1.69 e) 2.56

Individual work

As class practice, give Exercise 3b, questions 1and 2. Guide the students.

Homework

Give Wxercise 3b question 3 as homework.

Recapitulation

1. How many pairs you can make with a 6 digit number?
2. The first digit of the square root of 256 is ______________.
3. The first digit of the square root of 400 is ______________.

Topic: Problems involving square root
Time: 2 periods

Objective

To enable students to solve real-life problems involving square root

Starter activity

Start the session by asking questions like:

1. There are 36 students in a class.
   a) Can you arrange them in a square?
   b) How many rows will you form?
   c) How many students will there be in each row?

   Hence: number of rows = number of students in each row.

   $x = x$
   $x \times x = 36$
   $x^2 = 36$
   $x = 6$

   Number of rows = 6
   Number of students in each = 6

2. There are 70 students in a class. The teacher wants the students to sit in a square frame. Can 70 students form a square?

   No, 70 is not a perfect square. What is the solution?

   Take away 6 students and send them to another classroom.

   $70 - 6 = 64$

3. Is 64 a perfect square number? Yes.
   How many rows can you make of it? 8 rows because $8 \times 8 = 64$

4. How many students will be there in each row? There will be 8 students.

Main lesson

Real-life problems involving square root will be explained to the students with the help of the example given on the textbook page 47.

Example

Let the number of students = x
Each child gives x number of two rupee coin = Rs $2x$
Total contribution = $x \times 2x = 2x^2$
$2x^2 = 1250$

$x^2 = \frac{\overset{625}{\cancel{1250}}}{\cancel{2}}$

$x^2 = 625$

$x = \sqrt{625}$

$x = 25$

Therefore, the number of students is 25 and each contributed 25 two rupee coins.

Example 2

Find the greatest and smallest 5-digit numbers which are a perfect square.

Solution

Greatest 5-digit number is 99 999
Smallest 5-digit number is 10 000
The smallest 5-digit number is a perfect square itself because,

$100 \times 100 = 10\ 000$
$100^2 = 10\ 000$

But 99 999 is not a perfect square. We will find this by the division method and the remainder will be subtracted from 99 999.

$$\begin{array}{r|l} & 316 \\ \hline 3 & \hat{9}9999 \\ +3 & -9 \\ \hline 61 & \times 99 \\ +1 & 61 \\ \hline 626 & 3899 \\ 6 & 3756 \\ \hline 632 & \quad 143 \text{ Remainder} \end{array}$$

$99\ 999 - 143 = 99856$
99 856 is a perfect 5-digit square
$\sqrt{99\ 856} = 316$

Individual work

Questions 4 to 7 of Exercise 3b will be given as classwork.

Homework

Questions 8 to 10 of Exercise 3b will be given as homework.

Recapitulation

To revise the lessons, give questions like these:

1. How many rows with equal number of plants in each row can you make with 121 plants?
2. Is the smallest 4-digit number a perfect square?

UNIT 4 RATE, RATIO, AND PROPORTION

Topic: Rate
Time: 1 period

Objective

To enable students to understand rate and average rate of quantities

Starter activities

The students will be asked the following questions.

1. If one pack of juice box costs Rs 25, what will be the cost of 10 juice packs?
2. If a dozen bananas cost Rs 120, what will be the cost of one banana?

Main lesson

The teacher should discuss and explain the following concepts of rate and average rate with examples.

Rate is defined as the ratio of two quantities with different units. For example, tomatoes cost Rs 80 per kg so rate of tomatoes is 80 Rs/kg and speed of a car can be rated as 60 km/h.

The rate of change is the amount of change in one item divided by the corresponding amount of change in another. The average rate of change describes the average rate at which one quantity is changing with respect to another.

Provide them some examples as given below:

- If a car travels 50 km / hour for three hours and 75 km / hour for five hours, what is the average speed of the car?
- The average cost of 3 kg apples and 4 kg of pears is Rs 125 /Kg.

  Refer to page 49.

Practice session

Aliya types 36000 words in 30 minutes. How many words can she type in a minute?
Company A charges Rs 2.95 per 30 seconds whereas the company charges Rs 3.25 per minute for a phone call. Which network company charges more per minute?

Individual work

Questions 1 and 2 of Ex 4b on page 58 will be given as classwork.

Topic: Ratio
Time: 1 period

Objectives

To enable students to:

- express ratio with ratio notation
- use ratio to describe the relationship between two quantities
- express ratio as a fraction of one quantity to other
- increasing and decreasing ratios

Starter activity

Ratios are used all the time to represent all sorts of things in real world situations.

Discuss the topic involving real-life examples.

Show them some dessert recipe which might instruct that for every 2 cups of flour, we need 1 cup of sugar. This means that the ratio of flour to sugar is 2 to 1.

To make one glass of lemonade drink one lemons is added in one glass of water, so the ratio of lemon to water is 1 to 1.

Main lesson

- Ratio is a comparison between two quantities. It is expressed in ratio notation as $a : b$, where a and b are two quantities. Mathematically, it is expressed in ratio notation as $a : b = \frac{a}{b}$

Give different real-life examples to help students better understand the topic.

Explain increasing and decreasing ratios to the students.

- If the ratio of a new quantity to an old quantity can be expressed as an improper fraction, then the new quantity is greater than the old quantity. Applying this ratio to the old quantity is known as increasing the old quantity in each ratio.
- If the ratio of a new quantity to an old quantity can be expressed as a proper fraction, then the new quantity is less than the old quantity. Applying this ratio to the old quantity is known as decreasing the old quantity in each ratio.

  Refer to page 50

Practice session

Sarah and Ahmed collected money to buy a birthday present for their mother. The amount of money Sarah was twice what Ahmed collected. What will be the ratio of amount paid by Ahmed if they collect Rs 3000?

Individual work

Question of Ex 4a and Exercise 4b on page 54 and 58 will be given as classwork.

Homework

Selected questions of Ex 4b on page 70 will be given as homework.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Direct and inverse proportion
Time: 1 period

Objective

To enable students to solve problems related to direct and inverse proportion

Starter activity

Ask a few questions to discuss with students.

1. Nadia works 8 hours a day while Amir works 10 hrs a day. Who gets paid more?

A: Amir's income will be more. More the time he works, more the amount he gets.

2. What happens when there is strike in the city?

A: Everything is shut down. It means more strikes lesser production.

3. If you are late for office, how will you drive the car, fast or slow?

A: The less the time, faster the speed.

Main lesson

With the help of the starter activity, explain to the students that, a change in one variable brings a change in the other. Things depend on each other if two quantities are related so that a change in one causes a change in the other.

We have seen from example in the starter activity that there are two types of variations: Direct and inverse

Example 1

Proportion method

If the cost of 12 toy cars is Rs 1500, find the cost of (a) 8 cars (b) 3 cars.
Let the required cost be x.

	No. of cars	Cost in (Rs)
Start	↓ 12	1500 ↓
	8	x
	less the no. of cars	less the cost

The direction of both the arrows is the same. The problem involves direct variation.

$$12 : 8 : : 1500 : x$$

$$12 \times x = 8 \times 1500$$

$$\frac{12x}{12} = \frac{\overset{2}{\cancel{8}} \times \overset{500}{\cancel{2500}}}{\cancel{3}\ \cancel{12}} = 1000$$

$x = 1000$

Ans: Cost of 8 cars is Rs 1000

Unitary method

Cost of 12 cars = Rs 1500

Cost of 1 car = $\frac{1500}{12} = 125$

Cost of 1 car = Rs 125

Cost of 8 cars = $125 \times 8 = 1000$

Cost of 8 cars = Rs 1000

Example 3 from textbook page 52 will be explained on the board.

Proportion method

No. of people	days
↑ 6	9 ↓
10	x
More the people	less the time

The arrows are showing opposite directions.

$\therefore$ It is an inverse variation.

$10 : 6 : : 9 : x$

$10 \times x = 6 \times 9$

$\frac{10x}{10} = \frac{{}^{3}\cancel{6} \times 9}{\cancel{10}_{5}} = \frac{27}{5}$

10 men take $5\frac{2}{5}$ days.

Unitary method

6 people can paint a wall in 9 days.

1 will paint in $6 \times 9 = 54$ days.

If the number of men decreases, the time increases.

10 men require:

$\frac{{}^{3}\cancel{6} \times 9}{\cancel{10}_{5}} = 27\frac{2}{5}$

10 men take less time i.e. $5\frac{2}{5}$ days

Practice session

a) The cost of 3 chairs is Rs 900. What will be the cost of 7 chairs?
b) A top can fill a tank in 10 hours. If two tops are open at the same time to fill it, how long it will take to fill the tank?

Individual work

Exercise 4a will be given as classwork.

Homework

1. The cost of a dozen bananas is Rs 60. Find the cost of 8 bananas.
2. 8 men can complete a work in 15 days. How much time will 5 men take to complete the same work?

Recapitulation

For a quick revision, ask some mental questions.

1. How many types of variations are there?
2. Give some examples of an inverse variation from real-life.
3. If the speed of a train is fast, will it take less or more time to reach its destination.

Topic: Time and distance
Time: 1 period

Objective

To enable students to solve real-life problems involving time and distance.

Starter activity

1. Rafi goes to school by car. The distance from his home to school is 15 km. The time he takes without stopping is 25 minutes. What do you think is the speed of the car?
2. What is speed?
3. If a car travels 18 km in 15 minutes its speed is ________ km/hr.
4. A train running at a speed of 42.5 km/hr travels ________ km in 10 minutes.

Main lesson

Distance, time and speed will be explained by giving the examples.
What type of variation are these?

Distance	Time
More the distance	More the time (Direct)
Slower the speed	More the time
Faster the speed	Lesser the time

Example 7 will be explained from the textbook page 56.

A man is walking 7 km/hr. How long will he take to cover a distance of 42 km?

Method 1 (Unitary method)

The man covers 7 km is 1 hour

1 km in $\frac{1}{7}$ hours

42 km in $\frac{1}{\cancel{7}} \times \cancel{42}^{6} = 6$ hours

Method 2 (Forumla)

Using the formula,

$$\text{Time} = \frac{\text{Distance}}{\text{Speed/n}}$$

$$= \frac{\cancel{42}^{6}}{\cancel{7}} = 6 \text{ hours}$$

Method 3 (Proportion method)

Let the time taken be x hour

speed distance (km)	time
7	1
42	x

$7x = 42$

$x = \frac{\cancel{42}^{6}}{\cancel{7}}$

$x = 6$ hours

Example 8 page 57 from the textbook will be explained by all the methods.

Individual work

Give Exercise 4b questions 1, 2, and 3 to be done in the class.

Homework

Questions 4 and 5 of Exercise 4b will be given as homework.

Recapitulation

Ask questions similar to the ones give below, so that the concepts are recalled.

1. What type of variation is distance and time?
2. If a boy wants to reach his school in 10 minutes by car from his usual time, what should the speed be?
3. If your speed is slow you need more time or less time.

UNIT 5 FINANCIAL ARITHMETIC

Topic: Profit and loss
Time: 2 periods

Objective

To enable students to define terms like selling price, cost price, profit, loss and discount.

Starter activity

Fun fare activity may be conducted in the class. A group of 5 students could be asked to buy a few articles from the market (pencils, erasers, story books etc.) and set up a shop in the classroom.

Other students could be asked to buy them.

Ali sold a book to Anis.

Teacher: Ali for how much did you buy this book?
Ali: Rs 25

Teacher: For how much did you sell this book to Anis?
Ali: Rs 30

Teacher: Tariq, what is the cost of your pen?
Tariq: 50 rupees

Teacher: Whom did you sell the pen to and for how much?
Tariq: I sold it to Suman for Rs 45.

What is this transaction called?

What do shopkeepers or businessman do?

- They buy things and sell them.
- Do they sell the things for the same amount for which they buy it at?
- Why do they do this?
- Do the shopkeepers always make a profit in sales?

Students' answers to these questions will be noted and discussed.

Main lesson

Explain the term transaction.

Explain the terms, cost price and selling price by giving examples and write the abbreviated form for cost price (C.P), and for selling price (S.P). The cost price is the price which a person pays to buy an article.

The selling price is the price or amount that a person gets by selling an article to another person. Explain the terms profit or gain and loss. When the S.P is more than the C.P. we get a profit.

i.e. S.P – C.P. = profit

When the S.P is less than the C.P., we suffer a loss.

C.P – S.P = loss

Explain the percentage gain or loss. Gain or loss is always calculated as a percentage of the C.P

Profit percentage will be explained with the help of following examples.

Example 1

Atif bought a television for Rs 12000 and sold it for Rs 14000. Find the actual profit and the profit percentage.

Solution

C.P. = Rs 12000
S.P. = Rs 14000
Profit = S.P – C.P
14000 – 12000 = 2000
The actual profit is Rs 2000

Profit % = $\frac{\text{Profit}}{\text{C.P.}} \times 100$ (profit or loss is always calculated on C.P.)

$\frac{\cancel{2000}^{1}}{\cancel{12000}_{\cancel{6}\,3}} \times \cancel{100}^{50} = \frac{50}{3}$

Profit % = $16\frac{2}{3}$%

Example 2

Sarah bought a watch for Rs 1000 and she sold it for a loss of 5%. Calculate the selling price and the loss.

Method 1

5% = $\frac{5}{100}$ If the C.P. is Rs 100 then the loss is 5.

C.P. – loss = S.P.
100 – 5 = 95

But the actual C.P. of the watch is Rs 1000

C.P – S.P
100 – 95
1000 – x?

S.P = $\frac{10\cancel{00} \times 95}{1\cancel{00}} = 950$

S.P = Rs 950
Actual loss = 1000 – 950 = 50
The loss is Rs 50

Method 2

5% of 1000

$\frac{5}{100} \times 1000 = 50$ loss

C.P. – loss = S.P.
1000 – 50 = Rs 950
S.P. = Rs 950

Practice session

Conduct an activity in classroom.

Ahmad bought a chair for Rs 800 and sold it for Rs 960. Find his profit.

1. What is the cost price of the chair? Rs 800
2. What is the selling price of the chair? Rs 960
3. Did Ahmed gain or lose on selling the chair? He gained because the selling price is greater than the cost price.
4. What profit did he gain?

Students will be divided into groups and given worksheets to solve.

1. Wasif bought a book for Rs 70 and sold it for Rs 80. Find his profit percentage.
2. Raza bought a CD at Rs 120 and sold it at a gain of 8%. Calculate the selling price.
3. Rehan sold a book for Rs 160 at a gain of 10%. Find the C.P. of the book.

Individual work

Students will be asked to solve the table on page 65 of the textbook.

Homework

1. Ali bought a ball for Rs 60 and sold it for Rs 85. What did he gain?
2. Rehan bought a table for Rs 850 and sold it for Rs 700. Find his loss percentage.
3. Amna bought a pack of chocolates for Rs 360 and sold it for Rs 400. Find the profit %.
4. The selling price of a car is Rs 375 000 and the loss on it is Rs 28 850. Find C.P. of the car.
5. By selling a doll for Rs 480, a toy shop gains a profit of 8%. Find the C.P. of the doll.

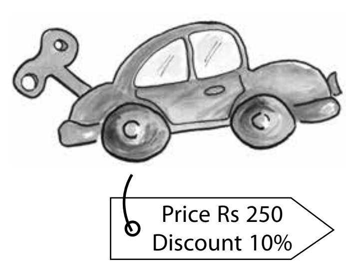
Topic: Marked price, discount %, and real-life problems involving profit and loss
Time: 2 periods

Objective

To enable students to solve problems involving discount, profit and loss, marked price, C.P. and S.P.

Starter activity

Mrs Zafar went to buy some items from a shop and she finds that there is a discount given on each item.



1. What is the price printed on the tag of each item.
2. What is the printed price on the tag called? It is called marked price.
3. What is the discount given on the frock? It is 5%.

Main lesson

Discount means reduction on the marked price. When a person buys any item on sale he/she has to pay less than the marked price.

After explaining the terms discount, marked price, and overheads and explain how to solve real-life problems.

Explain the examples given on pages 63 and 64 of the textbook.

Method 1

Zainab bought a dress marked at Rs 1800 after a discount of 10%. How much did Zainab pay for the dress?

Marked price = Rs 1800
Discount = 10%

If the marked price (M.P.) is Rs 100, the discount is Rs 10.
If the marked price is Rs 1800 the discount will be

$\frac{10}{1\cancel{00}} \times 18\cancel{00} = 180$ discount

MP – Discount
Zainab pays 1800 – 180 = 1620

Method 2

MP – Discount = selling price

100 – 10 = 90

If the M.P. is Rs 100, the selling price is Rs 90.

If the M.P. is Rs 1800, S.P. will be:

MP	SP
100	90
1800	x

$100x = 1800 \times 90$

$x = \frac{18\cancel{00} \times 90}{1\cancel{00}} = 1620$

Explain all the examples given in the textbook of Unit 5 on pages 63 to 70.

Individual work

Questions 1 to 6 of Exercise 5a will be given as classroom.

Homework

Questions 7 to 11 of Exercise 5a will be given as homework.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Taxes
Time: 2 periods

Objective

To enable students to solve real-life problem involving taxes i.e. property tax, sale tax, value added tax, and general tax.

Starter activity

Arrange a few items on a table, for example, a pack of biscuits, a jam bottle and a masala packet.

Select any of the items and ask a student to read out to the class, its price and tax as written on its label. Repeat with other items and other students. Ask, and then explain why taxes must be paid.

Main lesson

Explain each type of taxes to the students and their importance. Refer to pages 71 to 74 of the textbook.

Example 1

Property tax

Mr Aslam rented out his house for Rs 30 000 and 2 shops at Rs 8000 per shop per month. Calculate the amount of property tax at the rate of 5% premium.

Property tax is given yearly.

House rent = 30 000
Rent of two shops = $2 \times 8000 = 16000$
Total income = $30\,000 + 16000 = 46000$
Rate of tax = 5%
Yearly income = $46000 \times 12 = 552000$

5% mean if the income is Rs 100 the tax is Rs 5
5% of 552000

$\frac{5}{\cancel{100}} \times 5522000 = 27600$

He has to pay Rs 27600 as property tax.

Example 2

General sale tax

What amount would Mr Faraz have to pay as tax if he sold a refrigerator for Rs 56 800 at the rate of 20%?

Cost of the refrigerator = 56800
Rate of percentage = 20%

% $= \frac{20}{100}$

20% of 56800 $= \frac{20}{100} \times 56800 = 11360$

Mr Faraz will have to pay Rs 11360.

Example 3

Income Tax

Mr Saad has an annual income of Rs 2 500 000. If all his income is taxable, how much tax does he pay? Assume the income tax rate is 7%.

Annual income = Rs 2 500 000

Taxable income = Rs 2 500 000

Income tax rate = 7%

Income tax = 7% of 2 500 000

$= \frac{7}{100} \times 2\,500\,000$

$= 175\,000$

Example 4

Value added tax

Calculate the price of 6 boxes of biscuits at Rs 1500 each plus 13% VAT.

Price of 6 boxes = 6×1500

= Rs 9000

VAT paid = 13% of 9000

$= \frac{13}{100} \times 9000$

= Rs 1170

Individual work

Exercise 5b will be given as classwork.

Homework

1. Razia paid Rs 2500 as property tax at the rate of 2%. Find the amount of property.
2. Find the commission of an agent at a rate of 10% if he sold a house for Rs 37 5000.
3. Goods worth Rs 8000 were sold in a shop. What amount will the shopkeeper have to pay when the GST is 15%?

Topic: Zakat and Ushr
Time: 2 periods

Objective

To enable students to understand the terms Zakat and Ushr and solve related problems.

Starter activity

Explain the importance of Zakat and Ushr. The rate of Zakat and Ushr is always constant.

Main lesson

Example 1

The yearly income of a man is Rs 280 000. He spends Rs 220 000 every year. What amount of Zakat he has to pay?

Zakat is always given on saving (yearly)
Income – Expenditure = saving
280 000 – 220 000 = 60 000

Rate of Zakat = $2\frac{1}{2}\% = \frac{1}{40}$

$\frac{5}{2}\%$ of 60 000

$\frac{5}{\cancel{2}} \times \frac{1}{1\cancel{00}} \times \overset{300}{\cancel{60000}} = 1500 \qquad = 1500$

He will have to pay Rs 1500 as Zakat.

Example 2

Yearly saving of Amna is Rs 40 500 and she owns some gold jewellery costing Rs 250 000. Find the amount of Zakat she has to pay.

Total saving = 40 500 + 250 000 = 290 500

$2\frac{1}{2}\%$ of 290 500

$\frac{5}{2} \times \frac{1}{1\cancel{00}} \times 2905\cancel{00} = \frac{14525}{2} = 7262.5$

Amount of Zakat = Rs 7262.50

Example 3

Ahmad earns Rs 40 000 from his farm produce. What amount will he have to pay as Ushr?

Amount earned Rs 40000

Rate of Ushr = $\frac{1}{10}$ or one tenth

Total Ushr due $\frac{1}{10}$ of 40000

$\frac{1}{1\cancel{0}} \times 4000\cancel{0} = 4000$

He has to pay Rs 4000 as Ushr.

Individual work

Exercise 5c will be given as classwork.

Homework

Give a worksheet comprising of problems similar to the examples given above to be done as homework.

Recapitulation

Ask questions similar to the ones given below to help students revise the lesson.

1. What is the rate of Zakat?
2. What is saving?
3. When do we have to pay Zakat?
4. What is Ushr?

UNIT 6 ALGEBRAIC POLYNOMIALS

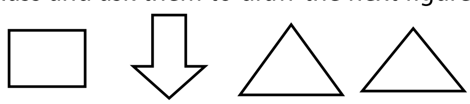
Topic: Number Pattern
Time: 1 period

Objectives

To enable students to:
- find term to term rule in each number sequence
- find position to term rule in each number sequency

Starter activity

Distribute the given pattern in the class and ask them to draw the next figure.



Tell them that in a pattern, the shape is repeated in a certain manner. Numbers can also be arranged in a certain manner and make a pattern.

Show them few examples of number patterns given below and ask the students to find the next number in each number sequence.
1, 2, 3, 4, 5, ...
2, 4, 6, 8, 10, ...
3, 7, 11, 15, ...

Main lesson

Ask the students to find the common difference between the two consecutive terms in each sequence given above. In 1, 2, 3, 4, 5, ... The difference between two consecutive term is 1. Tell them that 1 is added to each term to get next term and the numbers are getting bigger, so, this is an ascending sequence.

Similarly, ask the to find the common difference in the sequence 3, 7, 11, 15, ... is this an ascending or descending sequence? Now, each new term is obtained by adding common difference to the last term. This property can be used as a rule to find the unknown terms of the sequence.

Term to term rule

Write a sequence on the board and the common difference between the terms as follows.

$$\underbrace{2 \quad 5}_{+3} \; \underbrace{\quad 8}_{+3} \; \underbrace{\quad 11}_{+3} \; \underbrace{\quad 14}_{+3} \; \underbrace{\quad 17...}_{+3} \; \underbrace{\quad 20}_{+3}$$

The rule to continue this term is add 3 to each term. This is known as term-to-term rule.

Refer to page 81.

Position to term rule

Each term in a sequence has a position. The first term is in position 1, the second term is in position 2 and so on.

Position to terms rule works out what number is in a sequence if the position in the sequence is known. This is also called the nth term, which is a position to term rule that works out a term at position n, where n means any position in the sequence.

Work out the position to term rule for the following sequence: 5, 6, 7, 8, 9, ...

Position	1	2	3	4	5	6
Term	5	6	7	8	9	

To go from position to term, we add 4 to each position. If the position is n, then term is n + 4.

The nth term of a sequence is the position to term rule using n to represent the position number. If rule for nth position is known, then we can find the respective term.

For example: What would be the term at 23rd position of the sequence, where nth term is given as $3n + 2$.

Here, $n = 23$ and nth term is $3n + 2$, so the term on 23rd position is $3 \times 23 + 2 = 71$

Refer to page 81 and 82.

Practice session

Ask the students to solve the selected questions on page 80, 81, and 88.

Individual work

The remaining Question of Exercise 6a will be given as classwork.

Homework

A worksheet based on term-to-term rule and position to term rule will be given as homework.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Algebraic Expressions
Time: 2 periods

Objectives

To enable students to:

- define and identify algebraic expressions (terms, constants, variable)
- differentiate between constant and variable
- identify types of polynomials with respect to terms (monomial, binomial, trinomial)
- perform mathematical operations in algebra (addition, subtraction, multiplication)

Starter activity

Test previous knowledge by asking questions about algebraic expressions written on the board:

What is a constant? Give examples.
What is a variable? Give examples.
What is an expression? Give examples.

Main lesson

Using textbook pages 83 to 84, recall like and unlike teams giving examples.

Like terms

$2x$, $-3x$, $4x$ or $2a^2$, $4a^2$, $-7a^2$ are like terms (terms in which the base and the exponents are the same).

Unlike Terms

Although the base is the same but the exponents are different.

$2a^2$, a^3, $5a$; $2a^3$, $3b^3$, $-4c^3$; x, xy, $2x^2y$ are examples of unlike terms.

Introduce the terms, polynomial, bionomial, monomial, and trinomial in class

Explain addition and subtraction of algebraic expressions giving examples.

- Like terms can be added to and subtracted from one another. To add like terms, simply add the coefficients of the terms. Thus to add $4x$, $3x$, $-2x$ simply add the coefficients 4, 3 and -2 i.e.

  $4 + 3 - 2 = 7 - 2 = 5$

  Hence $4x + 3x - 2x = 5x$

Give more examples $3x^2 + 2x + 5$, $4x^2 + 8x + 3$ etc.

Explain the vertical and horizontal methods of addition and subtraction as given on the textbook page 85.

Give and explain rules of signs for addition with examples (apply the same rules for integers)

- The sum of two positive terms is also a positive term:

  $(+3x) + (+5x) = +8x$ (give some more examples)

- The sum of two negative terms is also a negative term:

  $(-3x) + (-5x) = -8x$ (give more examples)

- The sum of a positive and a negative term is equal to the difference of their coefficients and will be given the sign of the greater coefficient.

  $(-3x) + (+5x) = +2x$

  $(-8x) + (+6x) = -2x$ (give more examples)

Subtraction of algebraic expressions

To subtract a polynomial expression from another polynomial expression, change the sign of the expression that has to be subtracted and follow the rules of signs for addition.

1. Subtract $3x$ from $5x$
   $5b - (+3b) = 5x - 3x = 2x$

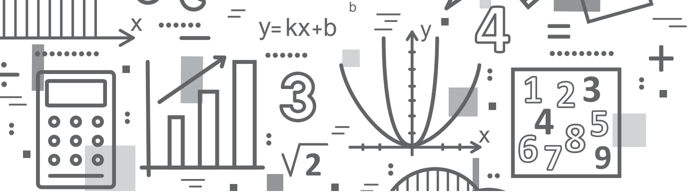
2. Subtract $-2x$ from $6x$
   $6x - (-2x) = 6x + 2x = 8x$ or vertically as:

$$\begin{array}{rr} & 6x \\ (-) & \mp\, 2x \\ \hline & +\, 8x \end{array} \qquad (-2x \text{ is changed to } +2x)$$

3. Subtract $4x$ from $-7x$
   $-7x - (+4x) = -7x - 4x = -11x$

4. Subtract $-7x$ from $-4x$
   $-7x - (-4x) = -7x + 4x + -3x$

Work out more examples on the board using both methods (horizontal and vertical) using page 85.



Multiplication of polynomials

Explain with the help of examples the multiplication of polynomials and give the rules of signs.

To multiply a polynomial by another polynomial, multiply the coefficients and add the powers of variables with the same base.

$(3x^2) \times (2x) = (3 \times 2)(x)^{2+1} = 6x^3$
$(-3x^2) \times (-2x) = (-3 \times -2)(x)^{2+1} = 6x^3$
$(-3x^2) \times (2x) = (-3 \times 2)(x)^{24}\times = -6x^3$
$(3x^2) \times (-2x) = (3 \times -2)(x)^{2+1} = -6x^3$

Rules of signs

By the above examples we get the rules of signs.

- The product of two positive terms is also a positive term $(+) \times (+) = +$
- The product of two negative terms is a positive term $(-) \times (-) = +$
- The product of a positive and a negative term is always a negative term $(+) \times (-) = -$

Multiplication of a binomial by a monomial expression

Multiply each term of the binomial with the given monomial.

1. $(4x + 2y^2) \times 3x$
   $(4x \times 3x) + (2x^2 \times 3x)$
   $= (4 \times 3)(x)^{1+1} + (2 \times 3)(x)^{2+1}$
   $= 12x^2 + 6x^3$

2. $(3a^2 + 7b) \times -5a$
   $= (3a^2 \times 5a) + (7b \times 5a)$
   $= (3 \times -5)(a)^{2+1} + (7 \times -5)(b \times a)$
   $= -15a^3 - 35ab$

Give some more examples.
Multiplication of a trinomial expression by a monomial expression.

$(4x^2 - 2x + 5) \times (2x)$
$(4x^2 \times 2x) + (-2x \times 2x) + (5 \times 2x)$
$= (4 \times 2)(x^{2+1}) + (-2 \times 2)(x^{1+1}) + (5 \times 2)(x)$
$= 8x^3 + (-4x^2) + (10x)$
$= -8x^3 - 4x^2 + 10x$

Hence to multiply a trinomial by a monomial, multiply each term of the trinomial with the given monomial.

To multiply a binomial with a binomial/trinomial, multiply each term of one binomial expression by each term of the other binomial/trinomial expression and add the like terms.

Explain the example from the textbook.

$(a + 2)\,(a^2 - 3a + 4)$
$= a(a^2 - 3a + 4) + 2(a^2 - 3a + 4)$
$= a^3 - 3a^2 + 4a + 2a^2 - 6a + 8$
$= a^3 - 3a^2 + 2a^2 + 4a - 6a + 8$ (arrange the like terms)
$= a^3 - a^2 - 2a + 8$ (simplify the like terms)

Like addition and subtraction, multiplication can be done horizontally (as above) or vertically as follows:

$$\begin{array}{rl}
a^2 - 3a + 4 & \\
a + 2 & \\
\hline
a^3 - 3a^2 + 4a \phantom{{}+8} & \text{(multiply by } a\text{)} \\
+ 2a^2 - 6a + 8 & \text{(multiply by 2 and place the like terms under the like terms)} \\
\hline
a^3 - a^2 - 2a + 8 & \text{(like terms added)} \\
\hline
\end{array}$$

Practice session

More examples of each type will be worked out on the board by the students.

Give worksheets for the practice of rules of signs.

1. $(-3a) \times (-5a^2)$
2. $(7a) \times (-6b)$
3. $(4x^2) \times (7x)$
4. $(2a + 3b) \times (-6a)$
5. $(-5p^4) \times (2p^2)$
6. $(-8c + 3d) \times (-5cd)$

Individual work

Exercise 6a from the textbook will be given as classwork. Word problems from daily life situations based on addition, subtraction multiplication will be given.

Homework

Give at least 3 sums of each (addition, subtraction and multiplication will be given) including word problems for homework.

Recapitulation

Reuse horizontal and vertical methods (addition, subtraction and multiplication) and discuss areas of difficulty. Revise rules of signs of addition and multiplication.

Topic: Algebraic identities
Time: 2 periods

Objectives

To enable students to:

- define and differentiate algebraic equations and algebraic identities
- recognise and apply algebraic identities in expanding binomial expressions
- establish and apply algebraic identities in solving problems (evaluation)

Starter activity

Give activity sheets to refresh the previous knowledge.

Activity sheet

- Separate the polynomial expressions and equations.

  $2x + 3$, $4x$, $a + 5 = 11$, $x^2 - 4xy + 5y^2$,
  $2^x - 15 = 5$, $9a^2 - 25b^2$, $a^2 + 2ab + b^2$, $(a - b)^2 = 9$
  8, $ax - by - 1$

- Find the product:

  $3 \times a$ = ______________
  $2x \times -4$ = ______________
  $2(x + 3)$ = ______________
  $(x - 1)(2x + 3)$ = ______________
  $(a - b)(a + b)$ = ______________

- Find the product of (expand) using multiplication.
  1. $(x - 1)\ (x + 1)$
  2. $(x - 5)\ (x + 5)$
  3. $(a + b)^2$

Main lesson

We can find the product of binomial expression or trinomial expression applying algebraic identities. Let us see what an algebraic identity means.

If $3(x + 4) = 10$, then what is the value of x?

Here $x = 2$. If we put $x = 3$ or any other number, the statement or the equation will not be true.

Explain by putting different values of x.

Now take $(x - 1)(x + 1) = x^2 - 1$

By actual multiplication $(x - 1)(x + 1)$
$= (x)^2 + x(6) - (x)(1) + (1)^2$
$= x^2 - 1$

or $(a - 2)(a + 2) = (a)^2 - (2)^2$
$= a^2 - 4$

By actual multiplication, $(a - 2)(a + 2) = (a)(a) + 2(a) - 2(a) + (-2)(2)$
$= a^2 + 2a - 2a - 2a - 4$
$= a^2 - 4$

that is, if we multiply two binomial expressions.

The product of the sum and difference of two binomial expressions is always equal to the difference of their squares.

Such an equation becomes an identity and provides us a rule for expanding expression without actually going through the process of multiplication. Give the definitions of algebraic equations and identities and introduce the four basic algebraic identities using textbook pages 90 and 95.

Identity 1

$(x + a)(x + b) = x^2 + x(a + b) + ab$
$= x^2 + ax + bx + ab$

Rule: product of two binomial expressions having the first terms alike = square of the 1st term + (1st term) (sum of the constants) + (product of the constants)

Work out some more examples with student participation.

Identity 2

$(x + a)(x - a) = x^2 - a^2$

Rule: product of the sum and difference of two terms = square of the 1st term – square of the 2nd term

Identity 3

$(a + b)^2 = a^2 + 2ab + b^2$
$(a + b)(a + b) = a^2 + 2ab + b^2$

Rule: product of the square of the sum of two terms = (square of the 1st team) + (twice the product of 1st + 2nd term) + (square of the 2nd term)

Identity 4

$(a - b)^2 = a^2 - 2ab + b^2$
$(a - b)(a - b) = a^2 - 2ab + b^2$

Rule: product of the square of the difference of two terms = (square of the 1st term) – (twice the product of 1st + 2nd term) + (square of the 2nd term)

Work out some more examples of each identity on the board with student participation.

These identities can be proved geometrically. Explain the geometrical proofs of the identities using textbook pages 91 and 92. Activity sheets will be given to the students for group work.

Practice session

Worksheet will be given.

1. Match the following identities:

a)	$(a - b)^2$	$x^2 + 2xy + y^2$
b)	$(4a + 3b)(4a - 3b)$	$x^2 + 4xy + 4y^2$
c)	$(x + 2y)^2$	$a^2 - 2ab + b^2$
d)	$(p - q)(p + q)$	$m^2 - 3m - 10$
e)	$(m + 2)(m - 5)$	$p^2 - q^2$
f)	$(x + y)^2$	$16^2 - 9b^2$

2. Complete the following:

a) $(x - 4)(x - 7) = x^2 + x$ (_______) + _______
b) $(p - q)^2 =$ _______ $- pq + q^2$
c) $(a + b)^2 = a^2 +$ _______ $+ b^2$
d) (   )(   ) $= x^2 - 16$
e) $71 \times 69 = (70 + 1)($ $)$
f) $(405)^2 = (400 +$ _______$)^2$

Individual work

Give Exercise 6b from the textbook page 95, (select sums for each identity) to be done in the class.

Homework

Give Exercise 6b to be completed at home.

Recapitulation

Discuss algebraic identities and their application. Tests may be conducted to check students' understanding. Explain areas of difficulties again.

Topic: Factorisation
Time: 2 periods

Objectives

To enable students to:

- understand and explain the meaning of factorisation; compare and recognise various types of expressions and factorise
- apply suitable techniques to factorise the expressions using algebraic identities; factorise by making groups

Starter activity

Write some expressions and ask questions:

- $2 \times 3 =$ ________ what is the product of 2 and 3
- $5 \times 7 =$ ________ what is the product of 5 and 3
- $4 \times$ ________ $= 28$, with what number should 4 multiplied to get 28?
- In $6 \times 7 = 42$, which number is the product and which numbers are the factors?

Write some algebraic expressions and ask questions.

What are the factors of:

ab, x^2, $2x$, $a^2 - 4$, $a^2 + 2ab + b^2$ etc.

Main lesson

Refer to textbook pages 95 to 97 and explain the terms product and factors and the meaning and techniques of factorisation.

Factorisation: Reverse process of expansion

To factorise an expression means to find the factors of which it is the product.

Write a few more expressions and ask the students to give their factors.

$a^2 - 2ab + b^2$, $x^2 - 25$

(give a hint to apply the identities they have learnt)

Identities

Identities are very useful in finding the factors of expressions which are perfect squares or difference of two squares. Explain the steps to factorise by refering to page 96 and 97.

Besides the identities, there is another way of factorising algebraic expression which is by making groups.

- Write the expression $x^2 + 4x$ (extract the common factor) $= x(x + 4)$
- $3a^3 - 6ab$ (common factors) $3a(a^2 - 2b)$
- $ac + bc + ad + bd$

All the terms in the expression does not contain any common factor.

Divide the expression in two groups.

$ac + bc + ad + bd$

The lines under the terms show their grouping.

Take away the common factor from each group.

$c(a + b) + d(a + b)$

c is common in the first group while d is common in the second group.

Now $(a + b)$ is the common factor in both the groups. Taking it away, only c and d are left.

Hence

$$\begin{aligned} & ac + bc + ad + bd \\ = & c(a + b) + d(a + b) \\ = & (a + b)(c + d) \end{aligned}$$

Write the expression $(x + 3)(x + 4) = x^2 + 7x + 12$

Recall the process or techniques of expanding expressions having their first terms alike.

Now to factorise expressions like $x^2 + 7x + 12$, find the sets of factors of the constant 12

$12 = 12 \times 1, 6 \times 2, 4 \times 3$

The middle term is $7x$. Which set of factors of 12 gives the sum 12?

$12 + 1 + 13 \neq 7$, $6 + 2 = 8 \neq 7$, $4 + 3 = 7$

Now $4 + 3 = 7$, so we can write

$$
\begin{aligned}
x^2 + 7x + 12 &= \underline{x^2 + 3x} + \underline{4x + 12} \text{ since } (7x = 3x + 4x) \\
& x(x + 4) + 3(x + 4) \\
&= (x + 4)\,(x + 3)
\end{aligned}
$$

Similarly, work out few more examples on the board with student participation.

$x^2 - 5x + 6$, $x^2 + 5x + 6$,
factor of $+ 6 = (2 \times 3)$, (-2×-3)

$x^2 - x - 6$, $x^{22} + x - 6$
factor of $-6 = (-2x + 3)$ or $(-3x + 2)$

Practice session

Worksheets can be given that could include matching the product with the factors.

1. Product / Factor

Product	Factor
$2ab$	$(4m + d)^2$
$x^2 + ax + 20$	$(p - 7)\,(p + 10)$
$4x^2 - 9y^2$	$2 \times a \times b$
$4x^3y - 8x^2y$	$(x + 4)\,(x + 5)$
$4a^2 - 20ab + 25b^2$	$(2x - 3y)\,(2x + 3y)$
$16m^2 + 24m^2 + 9$	$4x^2y(x - 2)$
$p^2 - 17p + 70$	$(2a - 5b)^2$

2. Apply identities and factorise:

   $x^2 + 2xy + y^2$, $p^2 - 5pq - 14q^2$, $x^2 - y^2$, $m^2 - 2mn + n^2$, $m^4 - n^4$

Individual work

Questions 1 and 2 of Exercise 6c will be given as classwork.

Homework

Question 3 of Exercise 6c will be given as homework.

Recapitulation

Factorisation of algebraic expressions can be done by:

- applying algebraic identities

  $(a + b)^2 = a^2 + 2ab + b^2$
  $(a - b)^2 = a^2 - 2ab + b^2$
  $\mathrm{a}^2 - b^2 = (\mathrm{a} - b)\,(\mathrm{a} + b)$
  $(x + a)(x + b) = x^2 + x(a + b) + ab$

- by extracting common factors from all the terms

  $ab + ac + ad$
  $= a(b + c + d)$

- by grouping terms

  $ax + bx + ay + by$
  $x(a + b) + y(a + b)$
  $= (a + b)(x + y)$

- by breaking up the middle term and grouping

  $x^{22} + 3x - 10$
  $x^2 + 5x - 2x - 10$
  $x(x + 5) - 2(x + 5)$
  $(x + 5)(x - 2)$

UNIT 7 LINEAR EQUATIONS

Topic: Linear equation
Time: 1 period

Objectives

To enable students to:

- recognise and form algebraic equations
- define a linear equation

Starter activities

Activity 1

As a starter, give this example and then ask questions as given.

Asif bought a pencil box for Rs 75 and has Rs 20 left with him. How much money did he have originally? Form an expression.

1. How many rupees does Asif have in total?
A: It is not given, therefore let the amount he has be Rs x.
2. How many rupees did he spend?
A: Rs 75
3. Write an expression to show the amount he has spent.
A: $(x - 75)$
4. How many rupees are actually left with him? Rs 20.
A: The expression therefore becomes:
$x - 75 = 20$

It is called an equation because here the two expressions $(x - 75)$ and 20 are equal.

An equation is like a balance where both the sides are equal.

Activity 2

Form equations for the following:

1. When 8 in added to a number the result is 32.
A: Let the number be x
$x + 8 = 32$
2. Salma is 3 years younger than her brother. Form an expression.
A: Let her brother's age be x years.
Since she is 3 years younger, she is $(x - 3)$
3. The sum of a, b and c is Rs 50. Form an equation.
A: $a + b + c^3 = 50$

4. Name the variables used in question 3.

A: a, b and c^3

5. What powers do they have?

A: The powers of a and b is 1 while the power of c is 3.

6. Find the sum of $2a$, $2a$ and $5c$

A: $2a + 2a + 5c = 4a + 5c$

What powers do a, b, and c have? The powers of a, b, and c is one. When in an equation, all the variables have their powers as one then it is said to be a linear equation.

Practice session

Which of the following equations are linear?

1. $a + b + c = 60$
2. $8a - 3b = 2c^3$
3. $x^3y^3z^3 = 45$
4. $2p - 3q = 3$
5. $7a - 8 = 10$

Individual work

Exercise 7a will be given as classwork.

Homework

Write down the following statements in an equation form.

1. When a is divided by 5, the quotient is 10.
2. If 20 is subtracted from a number, the result is 7.
3. If 8 is multiplied by c and 5 is added to the product, the result is 12.
4. Sarah has Rs 10 more than her brother. Write an expression.

Recapitulation

1. Is $x - y = 35$, an expression?
2. $2a + 5c + 8y$
   a) What is the coefficient of c?
   b) What are a, c and y called?
3. $3x^2 - 4y$
   a) What power does x have?
   b) What is the power of y?

Topic: Linear equation (solving equation)
Time: 2 periods

Objectives

To enable students to:

- solve simple linear equations
- use additive and multiplication inverse to find the solution set

Starter activity

Draw a diagram of a balance on the board and ask the following questions to give the concept of equation to find the value of x, y or any other variable by using additive and multiplicative inverse.

Example 1

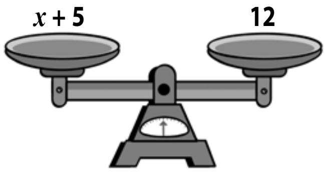


Figure 1

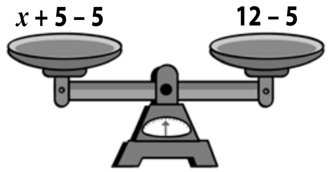


Figure 2

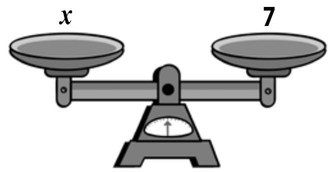


Figure 3

In figure 1, both the pans have equal weight.

In figure 2, –5 is added to both pans.

In figure 3, both pans become equal as the variable equates to the number.

This can be numerically done as follows:

$x + 5 = 12$
$x + 5 - 5 = 12 - 5$
$x = 7$

Verification
$x + 5 = 12$
$7 + 5 = 12$
$12 = 12$

Example 2

$3x - 4 = 17$

$= 3x - 4 + 4 = 17 + 4$ (Inverse of –4 is + 4)
We add 4 to both sides.

$= 3x = 21$

$\frac{3x}{3} = \frac{21}{3}$ (Both sides divided by 3)
(multiplicative inverse)

$x = 7$

Verification
$3x - 4 = 17$
$3(7) - 4 = 17$
$21 - 4 = 17$
$17 = 17$

Example 3

$\frac{y}{12} = 3$

$\frac{y}{12} \times 12 = 3 \times 12$ (multiplying both sides by 12)

$y = 36$

Example 4

$5(a + b) = 70$
$5a + 30 = 70$
$5a + 30 - 30 = 70 - 30$ (subtracting 30 from both sides)
$5a = 40$
$\frac{5a}{5} = \frac{40}{50}$ (dividing both sides by 5)
$a = 8$

Practice session

Call students to the board one by one to solve some equations.

Individual work

Questions 1 to 10 of Exercise 7b from the textbook will be given as classwork.

Homework

Questions 11 to 16 of Exercise 7b will be given as homework.

Recapitulation

1. What is a linear equation?
2. Is $3x^2 + 4y$ a linear equation?
3. What is the value of y in equation $3y = 12$?
4. What is the additive inverse of 8, + 5, and 1?

Topic: Equations containing unknown quantities on both the sides
Time: 2 periods

Objectives

To enable students to:

- solve equation containing unknown quantities on both sides
- solve real-life problems.

Main lesson

Explain the example given on page 104 on the board and ask questions related to it.

Example 1

Mum's age is 17 more than 3 times the age of her child, Atif. Dad is the same age as Mum but his age is 3 less than eight times Atif's age. What is Atif's and the ages of Mum and Dad?

Since Mum is 17 more than 3 times age of Atif, we first suppose Atif's age to be x years.

Step 1 Suppose Atif is x years old, 3 times Atif's age is $3x$
Step 2 Mum is 17 more than $3x$, so Mum is $(3x + 17)$
Step 3 Since Dad is 3 less than 8 times Atif's age, so the Dad's age $(8x - 3)$
Step 4 $3x + 17 = 8x - 3$ (bring the like terms together)
$3x - 8x = -3 - 17$
$-5x = -20$
$x = \frac{20}{5} = 4$
$x = 4$
Atif is 4 years old.
Mum's age $= 3x + 17 = 3(4) + 17 = 29$
Dad's age $= 8x - 3 = 8(4) - 3 = 29$

Example 2

Asma is twice as old as her daughter Meera. 15 years ago, she was 5 times as old as her daughter. Find their present ages.

Let the daughter's age be x years.

Since mother is twice the age of daughter, the mother is $2x$ years.

15 years ago:

Daughter's age was $(x - 15)$
Mother's age was $(2x - 15)$
Mother was 5 times the age of the daughter
$2x - 15 = 5\,(x - 15)$
$2x - 15 = 5x - 75$
$2x - 5x = -75 + 15$
$-3x = -60$
$x = \frac{\cancel{60}^{\,2}}{3}$
$x = 20$
Daughter's present age is 20 years.
Mother's age $2x = 2(20) = 40$ years.
Explain all the examples given on pages 104 to 106 of the textbook to clarify the concept.

Practice session

a) $8a + 4 = 5a + 16$
b) $2(x - 6) = 5 - 3x$
c) $2x - 25 = -3x$
d) $4(y + 7) = 12y - 4$

Individual work

Give Exercise 7c to be done in the class.

Homework

Solve the following equations:

1. $9x + 4 = 3x - 9$
2. $2(5 - 2x) = 4(2 - 3x)$
3. Susan is 10 years older than her brother. In three years times she will be twice as old as her brother. What are their present ages?

Topic: Fractional linear equation
Time: 2 periods

Objective

To enable students to solve fractional equations.

Main lesson

Fractional equations will be explained to the students with the help of the examples given on the textbook page 106.

Example 1

$$\frac{2b+5}{7} - \frac{4}{5} = \frac{2b-3}{3}$$

Step 1 Find out the LCM of 7, 5 and 3. LCM: 105

Step 2 Multiply each fraction by 105.

$$\overset{15}{\cancel{105}}\left(\frac{2b+5}{\cancel{7}}\right) - \frac{4}{\cancel{5}}\,(\overset{21}{\cancel{105}}) = \frac{2b-3}{\cancel{3}}(\overset{35}{\cancel{105}})$$

$$30b + 75 - 84 = 70b - 105$$

Step 3 Bring the like terms together.

$$30b - 70b = -105 + 9$$

$$-40b = -96$$

$$b = \frac{\overset{12}{\cancel{\overset{24}{\cancel{96}}}}}{\underset{5}{\cancel{\underset{10}{\cancel{40}}}}} = \frac{12}{5}$$

$$b = \frac{12}{5}$$

Practice session

Students will be divided into groups of four and they will be given a worksheet to solve by sharing their knowledge.

Call students in turns to the board to solve the equations given. Make sure that the rest of the class observes the steps carefully so they can note them or even pin point if any mistake is committed.

Worksheet

Solve:

1. $\frac{5a}{3} + 6 = \frac{2a}{3}$
2. $\frac{3a}{4} + 9 = \frac{5a}{3}$
3. $\frac{6y+8}{5} = \frac{3y-10}{8}$

Individual work

Questions 1 to 7 of Exercise 7d to be done in the class.

Homework

Questions 8 to 10 of Exercise 7d will be given as homework.

Topic: Real-life problems leading to simple equation
Time: 2 periods

Objective

To enable students to solve real-life problems involving simple equations

Starter activity

Give the following puzzle to the students and ask them to solve it.

I think of a number and add 8 to it and the answer is 40. Find the number.'

Let the number be 'x'

I add 8 to it, i.e. $x + 8$

Since the sum of $x + 8 = 40$

The equation is also, $x + 8 = 40$

$x + 8 - 8 = 40 - 8$ (by adding -8 to both sides)
$x = 32$

The number is 32.

Main lesson

Use the following example to explain real-life problems to the students.

The sum of 3 times a number and 6 is equal to the sum of the number and 18. Find the number.

Let the number be 'x'

3 times the number = $3x$

When 6 is added to $3x$ the sum is 18.

$= 3x + 6 = 18$
$3x + 6 - 6 = 18 - 6$
$3x = 12$
$x = \frac{\cancel{12}^{4}}{3}$
$x = 4$
The number is 4.

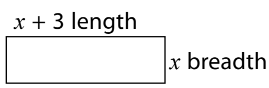
All the examples given in the textbook will be explained to the students.

Example 1

The length of a rectangle is 3 cm more than its breadth. If the perimeter of the rectangle is 12 cm, find the area of the rectangle.

Draw a rectangle.

Let the breadth be x cm



Length = $x + 3$

Perimeter = 12 cm

Perimeter of rectangle = $2(l + b)$

$2(x + 3 + x) = 12$
$2(2x + 3) = 12$
$4x + 6 = 12$
$4x + 6 - 6 = 12 - 6$
$x = \frac{6^{3}}{\cancel{4}_{2}}$
$x = \frac{3}{2} = 1.5$ cm
Breadth = 1.5 cm
Length = $x + 3 = 1.5 + 3 = 4.5$ cm
$2(1.5 + 4.5) = 12$
$2(6) = 12$
Perimeter = 12, hence proved.

Practice session

a) The sum of two numbers is 120. If one of the numbers is four times the other, find the smaller number.
b) Five times an equal number is equal to 60. Find the number.
c) A number subtracted from 10 is equal to 4 times the number. Find the number.

Individual work

Question 1 to 5 of Exercise 7f will be given as classwork.

Homework

Questions 7 to 12 of Exercise 7f will be given as homework.

Recapitlation

Give a small quiz to revise the important concepts and terms. Discuss any concept that the students may have not understood.

Topic: Cartesian coordinate system
Time: 1 period

Objective

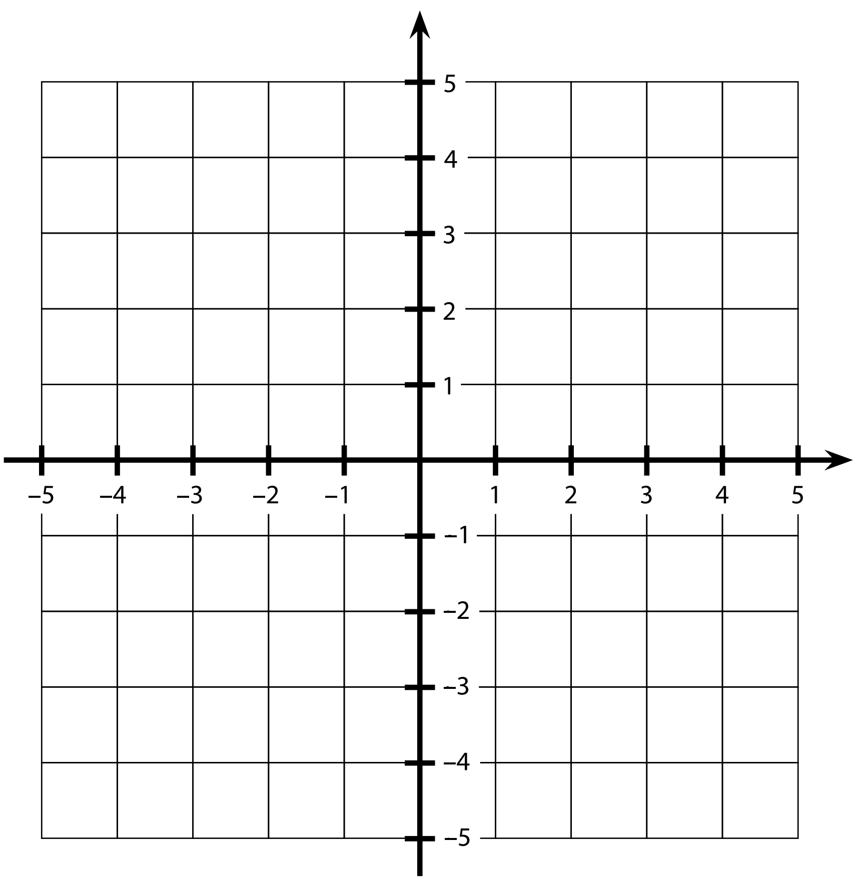
To enable students to plot the graphs of linear equation $ax + by + c = 0$ on a Cartesian plane.

Starter activity

Distribute a grid paper in the class and ask them to draw a star, counting 5 squares to the right and 7 squares upward.

Main lesson

A coordinate plane is a 2D plane which is formed by the intersection of two perpendicular lines known as the x-axis and y-axis. This plane is used to locate the position of an object or find the coordinates (x, y) of a point on the plane.



Refer to page 112 – 114

A linear equation in one variable is given as $y = mx + b$. Equations for vertical and horizontal lines have one variable.

$y = b$ represents a horizontal line and $x = a$ represents a vertical line on a cartesian plane.

Refer to page 115

To find the values of x and y coordinates of a point P on a line, we read the corresponding position of x and y on the graph.

Refer to page 116

To plot the graph of a linear equation in two variables we plot the coordinates on the cartesian plane and join them in a straight line.

Refer to page 116, 117

Practice session

Selected questions from Exercise 7g.

Individual work

Draw the graph of the linear equation $y = 2x - 3$

Homework

Selected question from Exercise 7g.

Recapitulation

Any problem faced by the students will be discussed. They will be asked to solve worksheet and discuss in class.

UNIT 8 LINES, ANGLES, AND POLYGONS

Topic: Properties of angles
Time: 2 periods

Objectives

To enable students to:

- identity and define adjacent angles, complementary angles, supplementary angles, vertically opposite angles
- calculate the measures of the angles applying properties of angles
- solve real-life problems related to properties of angles

Starter activities

Activity 1

Display charts with angles formed by objects and instruments from daily life and ask questions.

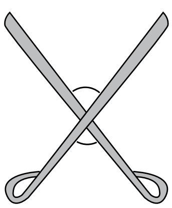


Figure 1

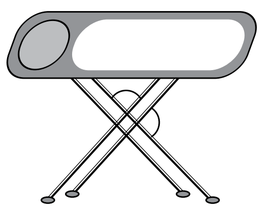


Figure 2

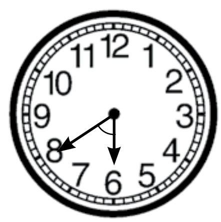


Figure 3

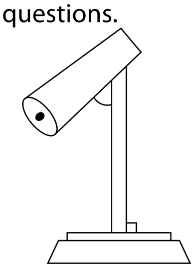


Figure 4

- Name the type of angle formed in each of the above figures. (right, acute, obtuse, reflex)
- Name the instrument used to measure an angle.
- What is the unit of measuring an angle?
- How do we define acute angle, obtuse angle or right angle etc?

Give the students activity sheets and let them work in groups to measure and find the sum. They should answer other questions.

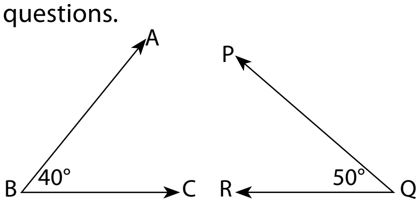


Figure 1

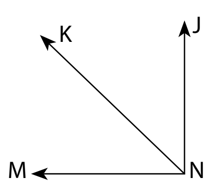


Figure 2

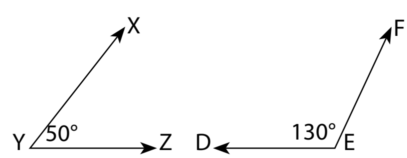


Figure 3

- What is the sum of angles in figure 1?
- What is the measure of ∠MNK and ∠JNK. Write their sum.
  ∠MNK + ∠JNK ________ + ________ = ________
- Measure the angles in figure 3 and write their sum. ________ + ________ =
- Which of the figures represent pair of complementing/supplementary angle?

Activity 2

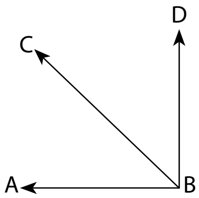


Figure 1

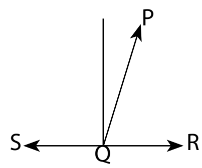


Figure 2

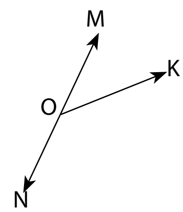


Figure 3

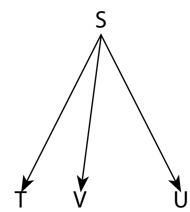


Figure 4

Name the angles in each of the figures given above.

Figure 1 ∠ABC, ∠CBD
Figure 2 ∠PQS, ∠PQR
Figure 3 ∠MOK, ∠NOK
Figure 4 ∠TSV, ∠VSU

Name the vertex of angles in figure 1.

Name the arms of each of the angle in the figure 1.

arms of ∠ABC, $\overleftrightarrow{BA}$ + $\overleftrightarrow{BC}$
arms of ∠CBD, $\overleftrightarrow{BC}$ + $\overleftrightarrow{BD}$
Which is the common arm?

What do we call the angles with a common vertex and a common arm?

Main lesson

Give the conditions of complementary angles and explain with the help of a figure drawn or the board.
In figure 1, the ∠ABD and ∠CBD share a common vertex (B) and a common arm ($\overleftrightarrow{BC}$). The uncommon arms $\overleftrightarrow{BA}$ + $\overleftrightarrow{BD}$ lie on the opposite sides of the common arm.

Such a pair of angles is called adjacent angles.

Also discuss the vertex and common and uncommon arms of the other figures.

Measure the angles in figures 2 and 3.

∠PQS + ∠PQR = 180° (sum of the angles is 180°, they are supplementary angles)

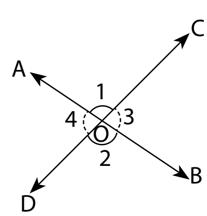
∠MOK + ∠NOK = 180°

∠PQS + ∠PQR are adjacent angles, and their sum is 180°, so they are called adjacent supplementary angles.

- Are the angles ABC and CBD supplementary?
- What do you say about fig 4?

Draw two intersecting lines on the board and ask questions.

- How many angles are there?
- Name all the angles four angles.
- Name the pairs of adjacent angles, are they supplementary?



What types of angles are:
1. ∠AOC + ∠BOD
2. ∠AOD + ∠BOC

They are not adjacent. They share only a common vertex and pairs of arms form (opposite rays) straight lines. We call them vertically opposite angles or vertical angles.

Measure each of the vertical angle. Are they equal in measure? (Call some students to the board to measure the angles.) Give the definition and properties of vertical angles.

Practice session

Worksheet will be given.

1. Identify the following pairs of angles.

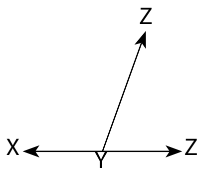


Figure 1

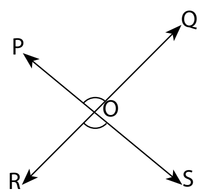


Figure 2

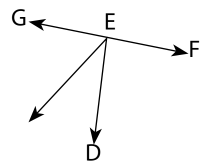


Figure 3

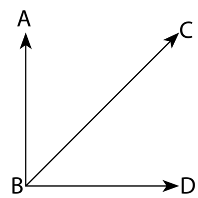
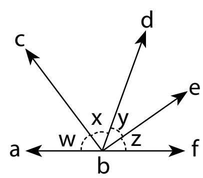


Figure 4

2. Draw any two triangles, ΔABC and ΔPQR. Measure each angle and find the sum of all the angles. Is it 180° in each case?
3. Measure each angle in the figure given below and find the sum. Is the sum = 180°?



4. What conclusion do you draw from figures 3 and 4?

Individual work

Questions 1 and 2 of Exercise 8a will be given as classwork.

Homework

Questions 3 of Exercise 8a will be given as homework.

Recapitulation

Revise the definitions and properties of angle. Summarise properties of angles.

Topic: Unknown angles in a triangle
Time: 1 period

Objective

To enable students to calculate unknown angles in a triangle.

Starter activity

Ask each student to draw a triangle randomly and then measure the angles at each vertex. Ask them to find the sum of the angles, that would be 180°.

Main lesson

Explain the property of a triangle that all the three angles of a triangle sum up to 180°.

Refer to page 126.

Using the property, guide them to calculate the unknown angle in a triangle through different examples.

Refer to page 127.

Practice session

Q 1 (a, b) from Exercise 8b.

Individual work

Q 2 and 3 from Exercise 8 b

Homework

Q1 (c, d) from Exercise 8 b.

Recapitulation

Any problem faced by the students will be discussed. They will be asked to solve worksheet and discuss in class.

Topic: Polygons
Time: 2 periods

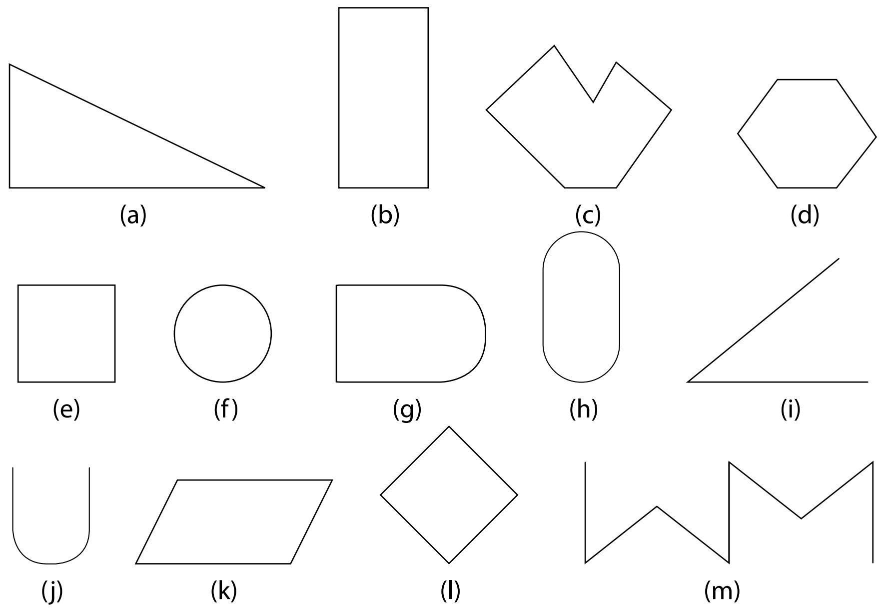
Objectives

To enables students to:

- define types of polygons
- differentiate between convex and concave polygons
- understand and calculate the exterior and interior angles of polygons

Starter activity

Draw some figures on the board and ask the students to name them.



After naming them, ask the students to write the number of line segments each of the above figure has.

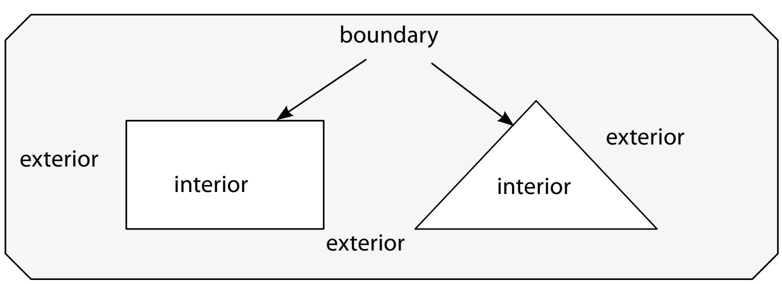
1. Are all the figures made up of line segments?
2. How many vertices are there in figures c and d?
3. Does figure 'g' have 4 vertices?
4. How many vertices does a circle have?

What is a polygon?

Let the students observe the figures drawn on the board. Some of them are bounded by three or more line segments while some are not.

Main lesson

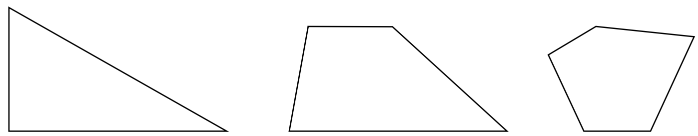
- A simple closed figure formed by three or more line segments is known as a polygon. In a closed figure, the beginning and ending points are the same and there are no intersection points.
- A simple closed figure divides the plane into two regions, the interior and exterior. The border of the shape is the boundary between these regions.



Explain that polygons are classified according to the number of sides they have.

Number of sides	Name of the Polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon
8	octagon
9	nonagon
10	decagon

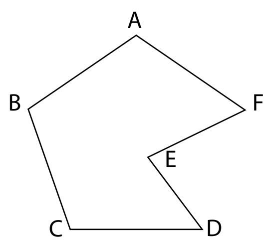
- A polygon has sides, vertices, adjacent sides and diagonals. The angular points of a polygon are called its vertices.
- The number of sides of a polygon is equal to the number of its vertices.
- A line which joins any two non-adjacent vertices is called a diagonal.
- A polygon is said to be convex when all its interior angles are less than two right angles.



1 2 3

Figures 1, 2, 3 are convex polygons.

- If a polygon has one or more of its interior angles greater than two right angles then it is said to be a concave polygon for example.

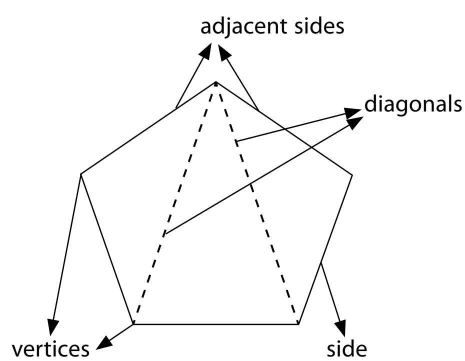


The measure of interior angle DEF is greater than 180°.

Regular polygon

- If all the sides of a polygon and its angles are equal then it is called a regular polygon.
- Examples are rectangle, square, equilateral triangle, pentagon, hexagon etc.
- Rectangle is an equiangular (having equal angles) polygon. Square is an equiangular as well as an equilateral polygon

Draw a pentagon, a hexagon and an octagon on the board and ask the students to join its diagonals to the opposite vertices and count the number of triangles formed in each.

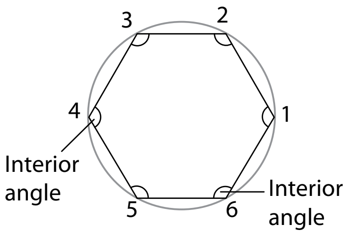


The two diagonals form 3 triangles.
Sum of each triangle = 80, $3\Delta = 180 \times 3 = 540^{\circ}$
Interior angles add upto 540°
Each angle of the pentagon $= \frac{540}{5} = 108^{\circ}$

- All 5 sides and 5 interior angles of a pentagon are equal.

Mention that interior angle of a polygon is calculated by: Sum of interior angle ÷ number of sides whereas the exterior angles of a polygon are calculated by: 360 ÷ number of sides

- Hexagon (six-sided polygon)



Three diagonals divide the hexagon into four triangles.

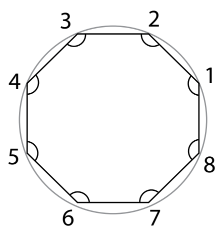
$\therefore$ the interior angles will be equal to
$180 \times 4 = 720^\circ$

Each angle of a regular hexagon will be
$\frac{\cancel{720}^{120}}{\cancel{6}_{1}} = 120^\circ$

Number of sides = 6

$\therefore$ the exterior angles will be equal to $360 \div 6$
$= 60^\circ$

- Octagon (eight-sided polygon)

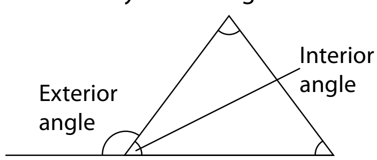


All eight sides and eight interior angles are equal.
Here the interior angles add up to 6 triangles.
$\therefore = 180 \times 6 = 1080$
$\therefore$ Each angle $= \frac{\cancel{1080}^{135}}{\cancel{8}_{1}} = 135^\circ$

Each regular polygon can fit into a circle i.e., a circle can be drawn passing through each vertex of a polygon.

Number of sides = 8
$\therefore$ the exterior angles will be equal to $360 \div 8 = 45^\circ$.

- For triangles, the exterior angles are obtained by extending one side of the triangle.



- The sum of interior angles of a triangle is equal to 180°.

  Refer to the examples on page 131 to explain the students.

Ask the students to draw a pentagon, hexagon and octagon on different coloured papers and then cut and paste in their exercise books and write the properties of each.

Individual work

Questions 1 to 8 of Exercise 8b will be given as classwork.

Homework

Question 9 of Exercise 8b will be given as homework.

UNIT 9

PRACTICAL GEOMETRY

Topic: Triangles
Time: 1 period

Objectives

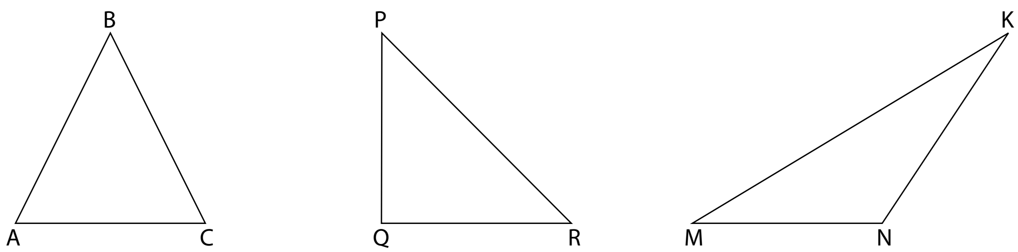
To enable students to:

- define the types and classification of triangles
- construct a scalene triangle
- construct an equilateral triangle when base is given
- construct an equilateral triangle when the attitude is given
- construct an isosceles triangle when the base and a base angle is given.
- construct an isosceles triangle when the vertical angle and altitude is given.
- construct an isosceles triangle when altitude and a base is given

Starter activity

Ask the following questions to recall:

- How many elements does a triangle have?
- Name the different types of triangles with respect to angles, with respect to sides.
- Give activity sheets with some triangles drawn on them and ask students to measure the angles and sides of each triangle.



- Measure the lengths of each side of the triangles.
- What is the perimeter of ΔABC, ΔPQR, and ΔMNK?
- Measure the angles of ΔABC, ∠A =__________, ∠B = __________, ∠C= __________
- What is the sum of ∠A+ ∠B + ∠C? Similarly, find ∠P + ∠Q + ∠R and ∠M + ∠N + ∠K.

Main lesson

Using textbook pages 136 to 142, explain the steps of construction of the triangles under given conditions Case I, Case II, Case III, Case IV, Case V and Case VI.

Practice session

Assist the students to work on the examples from the textbook.

Individual work

Questions 1, 2, 4, 5, and 7 of Exercise 9a will be given as classwork.

Homework

Give remaining questions from Exercise 9a as homework.

Recapitulation

Ask questions that will help recall the lesson.

What is a triangle? What are the different types of triangles?
What is perimeter?
What are base angles? What is a vertical angle?
What is the altitude of a triangle?

Topic: Quadrilaterals
Sub Topic: Parallelogram
Time: 1 period

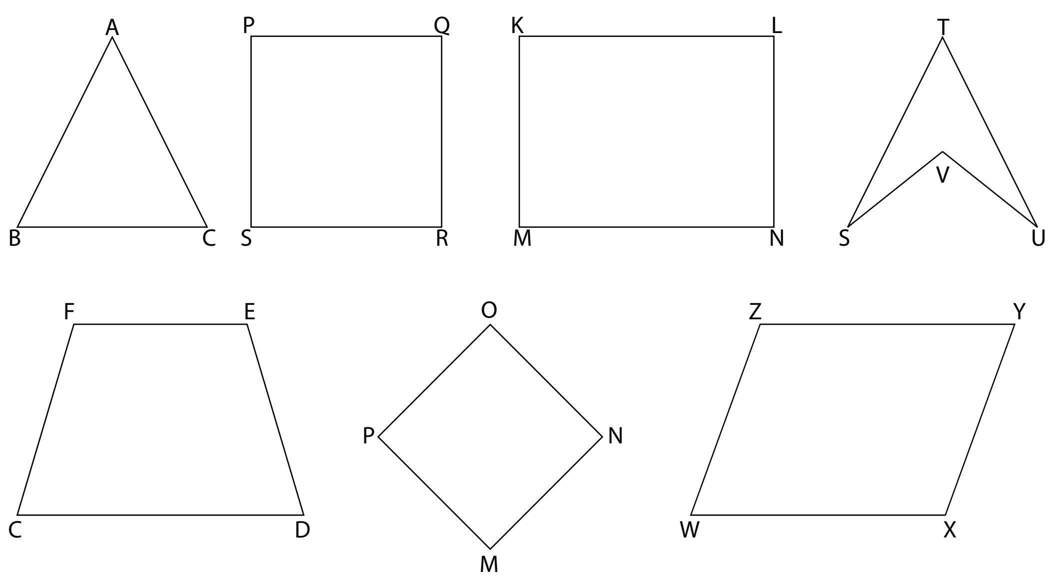
Objectives

To enable students to:

- define a quadrilateral
- define a differentiate types of quadrilaterals
- construct parallelogram under given conditions

Starter activity

Display charts with types of polygons and then ask questions like:



- What is a polygon? What is a quadrilateral?
- What is a three-sided figure called?
- Which of the figures is a rectangle?
- What are the properties of a square?
- What measurements are required to construct a square, a rectangle?
- What is a parallelogram, how do we define it?

Main lesson

Using textbook pages 143 to144, explain and give the definitions of types of quadrilaterals specifically parallelogram.

- Give the components of a parallelogram
- Properties of a parallelogram

Explain to students on how to calculate or find an unknown angle of a quadrilateral.

- Four angles in a quadrilateral sum up to 360°.
- All known interior angles are added first and then their sum is subtracted from 360°.
- The result will be the value of the unknown angle.

Practice session

Give worksheets to:

- identify the quadrilaterals and name them
- calculate the unknown angles of each figure

Individual work

Question 1(a-d) of Exercise 9b will be done in class.

Homework

Question 1(e-f) of Exercise 9b will be given as homework.

Recapitulation

Discuss and define properties of kinds of quadrilateral.

Topic: Rotational Symmetry
Time: 1 period

Objective

To enable students to draw lines of rotational symmetry in 2D shapes.

Starter activity

On a grid paper attach a square shape such that it can be rotated about its centre. Rotate it at 90°. The shape on the grid appears the same. Then, rotate it again to 90° until it comes to its original position after 4 turns. On every turn the shape and its orientation does not change. So, the rotational symmetry of a square shape is 4.

Main lesson

For rotational symmetry of square, rectangle and other polygons refer to page 145, 146, and 147.

Practice session

Q 2 Exercise 9b

Individual work

Find the rotational symmetry of an equilateral triangle.

Homework

Find the rotational symmetry of a regular pentagon.

Recapitulation

Any problem faced by the students will be discussed. They will be asked to solve worksheet and discuss in class.

Topic: Translation
Time: 1 period

Objective

To enable students to translate an object with precise description of transformation.

Starter activity

Draw a square grid on the floor. Number the horizontal and vertical squares. Call a student and make them stand on an intersecting point. Help them to locate the position on the grid by counting horizontal and vertical squares. Suppose it is (5, 4). Now ask the student to move 3 squares vertically upward and 4 squares horizontally to the right. Now, the new location point (9, 7) is the translation of the student with 4 squares right and 3 squares up.

Main lesson

A translation moves a shape left, right, up, or down but does not turn. The translated shapes (or the image) appear to be the same size as the original shape, indicating that they are same in size and orientation. They've simply shifted in one or more directions.

Refer to page 147 and 148

Practice session

On grid paper, give them different shapes and ask to translate the shapes according to a given transformation.

Individual work

Q 3 (a, b, c) Exercise 9b

Homework

Q 3 (d)

Recapitulation

Any problem faced by the students will be discussed. They will be asked to solve worksheet and discuss in class.

UNIT 10 CIRCLES

Topic: Elements of a circle
Time: 2 periods

Objectives

To enable students to:

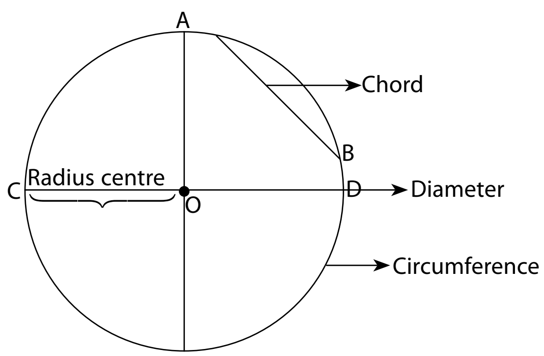
- explain the different terms associated with circle
- express pi (π) as the ratio between the circumference and the diameter of a circle
- explain properties of circle

Starter activity

Draw a circle on the board and ask the students to label the diagram. Ask the following questions:

Main lesson

Once the circle is drawn and students are asked to label it, ask them the following questions and discuss the answers in class.



1. Define a circle.
2. What is a radius?
3. Which line divides the circle into two equal parts?
4. Which is the shortest line of a circle joining the two points of a circle?
5. Can you draw a number of chords in any circle?
6. What is the outline of the circle called?
7. Does a circle have many radii?
8. Does a circle have many diameters?
9. We can draw an infinite number of diameters and radii, what are they called?
10. What is an arc?

Ratio between the circumference and the diameter of a circle will be explained to the students by giving activities.

Step 1: Ask the students to draw circles with different radii, and to draw diameters as well.

Step 2: Ask them to measure the outline of the circle (circumference) with the help of a thread and note down its measurement.

Step 3: Ask them to measure the diameter with the same thread, and note down the measure.

Step 4: Divide the circumference by the diameter $\frac{c}{d}$ $\frac{\text{circumference}}{\text{diameter}} = \pi$.

Call some students to write their answers on the board. They will note that their answers are approximately the same even though they have taken different radii. It will be explained to the students that the circumference of the circles with different radii will be different but the ratio $\frac{c}{d}$ in each case will be the same and this ratio is denoted by π and the approximate value is $\frac{22}{7}$ or 3.141.

Hence we have,

$\frac{c}{d} = \pi$

since $d = 2r$

Therefore, $c = \pi d$ or $\pi 2r$

$\Rightarrow c = 2\pi r$

Example 1

Find the circumference of the circle whose radius is 3.5 cm.

$c = 2\pi r$

$c = 2 \times \frac{22}{\cancel{7}} \times \cancel{3.5}^{.5} = 22.0$

$c = 22$ cm

Example 2

Find the radius of a circle whose circumference is 22 cm.

$c = 2\pi r$

$22 = 2 \times \frac{22}{7} \times r$

$22 = \frac{44r}{7}$

$r = \frac{7}{\cancel{44}_2} \times \cancel{22}^1 = \frac{7}{2}$

$r = 3.5$ cm

Topic: Chord properties of a circle

Time: 2 periods

Objective

To enable students to understand the Properties of chord in a Circle.

Starter activity

Paste a big cutout of circle and label the elements of the circle by taking feedback from the students.

Main lesson

Using the same circle draw two equal chords on the circle. find the mid-points of the chords and join them to the centre. Measure both the distance and show them that they are equal. This is property 1 of a circle.

Refer to pages 156 - 158 to explain other chord properties of a circle.

Practice session

Divide the class in four groups and handover a circle cutout to each group.

Refer to pages 156 - 158.

Assign one property to each group,

Guide them to refer to Maths Wise 7 page number 156 - 158 and perform the activity as done on the board.

Individual work

Exercise 10c Question 3, 4, 5, and 6 will be given as classwork.

Recapitulation

Any problem faced by the students will be discussed.

Individual work

Students will be asked to draw different circles and measure their diameter and radius.
Exercise 10a will be given as classwork.

Homework

Exercise 10a will be completed.

UNIT 11 TIME, AREA, AND PERIMETER

Topic: Perimeter and Area

Time: 2 period

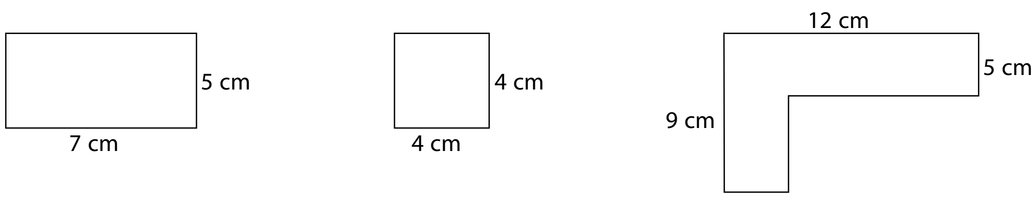
Objectives

To enable students to:

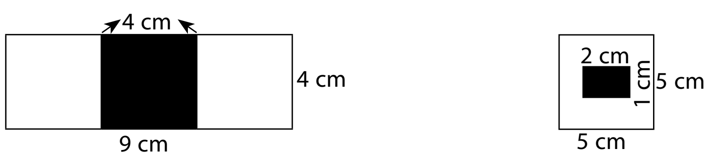
- recall the formulae for area and perimeter used in the previous grade
- calculate the area of a circle with different radii

Starter activity

1. Draw the following figures on the board and ask the students to find the area.



2. Find the area of the un-shaded part.

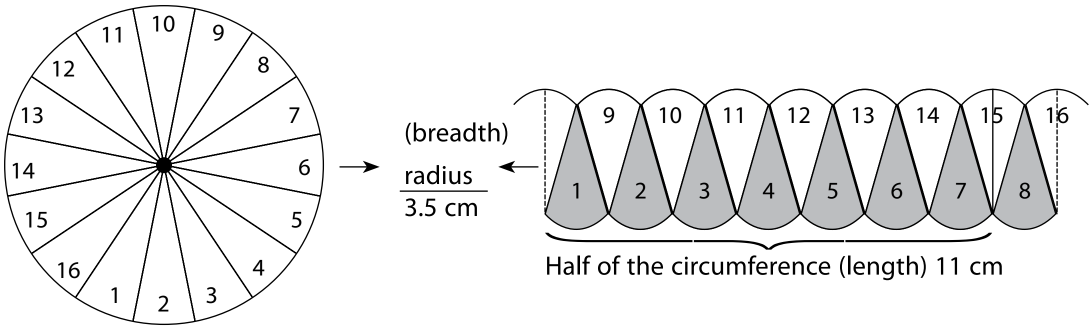


Main lesson

Using starter activity, recall the formulae for area and perimeter of geometrical figures such as square, rectangle, parallelogram, triangle, trapezium, and rhombus.

Recall the parts of a circle that the students must have learnt in the previous chapter.

The following activity will help the students to find the area of a circle.



Step 1: A large circle will be drawn on the board to explain how to find out the length and breadth of a circle (as it has curved outline) to find the area of a circle.
Step 2: Area of circular region will be divided into 16 triangular regions.
Step 3: Alternate regions or parts will be shaded by one colour and will mark them as 1, 2, 3, 4, 5, 6, 7, 8 and the unshaded will be marked or as 9, 10, 11, 12, 13, 14, 15, 16.
Step 4: Triangular regions i.e. 16 triangles will be cut along the boundaries.
Step 5: The entire shaded region will be kept in a row.
Step 6: The entire unshaded region will be kept between shaded regions.
Step 7: The remaining once piece, will be divided into two equal parts and will be pasted or kept on either side.

This arrangement gives almost a rectangular region with length equal to half the circumference and breadth equal to the radius of the circle.

Area $= \text{Length} \times \text{Breadth}$
$= \frac{1}{2}(2\pi r) \times r$

$\therefore$ Area of a circle $= \pi r^2$

This gives the formula for area of a circular region of radius r. Area of a circular region is πr^2.

Area of rectangle $= l \times b$
$3.5 \times 11 = 38.5 \text{ cm}^2$

Area of a circle $= \pi r^2$
$= \frac{22}{\cancel{7}} \times \overset{.5}{\cancel{3.5}} \times 3.5 = 38.5 \text{ cm}^2$

Hence proved that the area of the circle is approximately the same when its triangular pieces are arranged in a rectangular shape is $l \times b = \pi r^2$.

Practice session

Divide the students into groups of four. Each group will be asked to do the same activity with different radii by taking two coloured papers. Ask them to show the different steps as explained to find out the area of the circle.

The students may complete the table on page 169.

Individual work

Exercise 11b will be given as classwork.

Homework

Give a worksheet to each student to solve.

Worksheet

1. Find the area of a circular plate with a radius of:
   a) 7 cm   b) 5.6 cm
2. Find the diameter of a circular plate with an area of 616 sq cm.
3. What is the area of a circular disc with a diameter of 6.3 cm?.
4. If the radius of a circle is 2.1 cm, what will be its:
   a) circumference   b) area
5. What is the value of pi?
6. If the diameter of a circle is 3.5 cm what will be its:
   a) radius   b) circumference   c) area

Recapitulation

Any problems faced by the students will be discussed.

UNIT 12 SURFACE AREA AND VOLUME

Topic: Surface area and volume of prisms and cylinders
Time: 2 periods

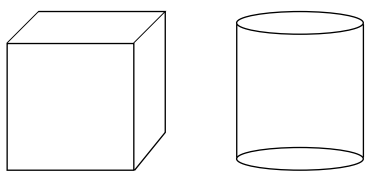
Objectives

To enable students to:

- calculate surface area and volume of simple 3D shapes like cube and cuboid
- define a cylinder
- calculate the surface area and volume of prisms
- calculate the surface area and volume of a cylinder; solve real-life problems related to surface area

Starter activity

Display charts (or models) of some solid objects. Ask some questions to start the lesson.



(a) (b)

1. How do we calculate the area of a rectangle?
2. Give the formula for the area of a triangle.
3. How do we calculate the circumference of a circle?
4. What is the unit of measuring area of a flat shape?
5. How many faces does a cuboid have?
6. What is the shape of each face?
7. How can we calculate the surface area of a cuboid?

Main lesson

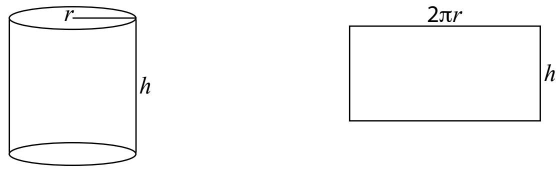
Explain the surface area and volume of a cuboid and a triangular prism. Refer to pages 175 to 177.

Using textbook pages 178 to 180, explain what a cylinder is.

Using textbook pages 175-177, explain the total surface area of solids (cuboids, cylinders). Explain the volume of cuboid.

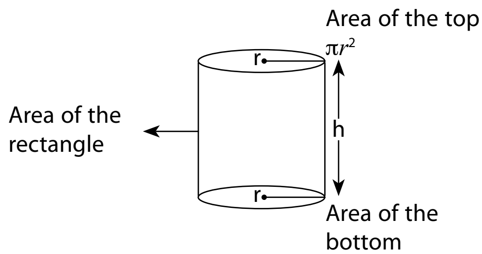
A cylinder is a solid with a circle as its uniform cross section (a stack of coins will give a good concept)

To calculate the surface area of a cylinder performs this activity.



Take a rectangular paper sheet and wrap it around a cylinder and then open it. What do you notice?

Area of the curved surface of the cylinder = Area of the rectangular paper covering it.



Area of a rectangle = $l \times b$, what is the length of the rectangle?

Length of the rectangle = circumference of the circle. (Cross-section of the cylinder)

Hence, the length of the rectangle = $2\pi r$

Area of the curved surface of the cylinder = $2\pi rh$ (area of the rectangle = $l \times b$; here $l = 2\pi r$ and $b = h$)

The total surface area of a closed cylinder will be:

(Area of the top circle + area of the bottom circle) + Area of the curved surface

$$= 2\pi r^2 + 2\pi rh \text{ or } 2\pi r\,(r + h)$$

Give the unit of measuring surface area of solids.
Now, volume of a prism is product of base area and height.
Volume of cylinder = $\pi r^2 \times h$

Practice session

Divide the students into groups and give cylindrical objects (wooden cylinders) and shoe boxes (cuboids) and have them try out the examples given in the textbook.

To find the total surface area and volume of the cylinders, and simple 3D shapes, solve a few problems with student participation.

Individual work

Exercise 12a will be done as classwork.

Homework

Collect 5 cylindrical objects (cans, tins etc.) and find the surface area of each.

Recapitulation

To recall the lesson, give worksheets with questions like:

- How do we calculate the area of solids?
- Write the formula to calculate the surface area and volume of a cylinder?

UNIT 13

DATA HANDLING

Topic: Frequency distribution and pie charts
Time: 2 periods

Objectives

To enable students to:

- explain the terms grouped and ungrouped data
- differentiate between grouped data and ungrouped data
- collect and classify data in a manageable way
- explain steps involved in classification of data
- define terms used in data handling: frequency, distribution table (ungrouped and grouped) discrete and continuous data, class intervals (continuous and discontinuous intervals), tally marks, frequency
- illustrate data through pie charts, bar graphs, line graphs, and histogram
- analyse, interpret, and obtain information
- differentiate between a histogram and bar graph

Starter activity

Display a chart showing marks obtained by a group of students in a mathematics test and ask the questions like the following:

22, 17, 7, 13, 10, 11, 15, 17, 18, 9
11, 10, 12, 19, 18, 12, 16, 15, 17, 19
15, 17, 20, 16, 10, 17, 20, 10, 13, 15

- What is the highest score of the class?
- What is the lowest score?
- How many students are there in the class?
- How many students scored 17 marks etc.

Display the same information in the form of a table.

Marks scored	No. of students
7	1
9	1
10	4
11	2
12	2
13	2
15	4
16	2
17	5
18	2
19	2
20	2
22	1

Main lesson

Explain the importance of data presentation and the methods of collecting data (questionnaire, interviews, observations etc.)

Activity 1

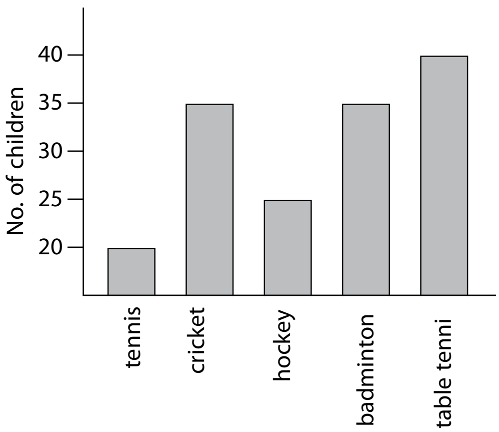
Ask from each student the month of the year in which they were born and note it on the board.

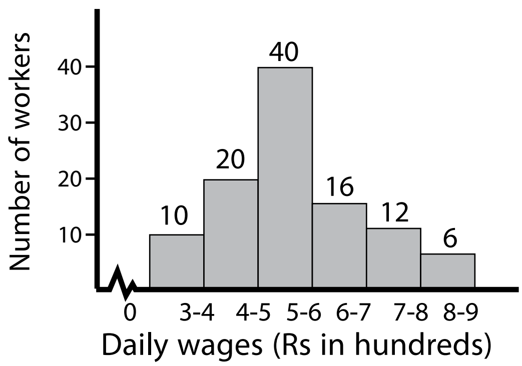
Dec	Feb	April	June	June	March	Dec
Aug	Dec	Jan	Aug	Oct	Dec	May
Sept	Dec	July	July	May	Nov	Sept
Dec	Jan	April	May	Nov	March	Sept
Feb	Nov	Sept	Aug	July	May	Sept

- Explain the purpose of collecting and organising data.
- Explain the steps on the board and prepare the table. Also, explain tally marks, frequency and discrete frequency table.

Activity 2

Distribute activity sheets, with bar graphs, or pie charts, and histograms showing some information and ask questions like these:





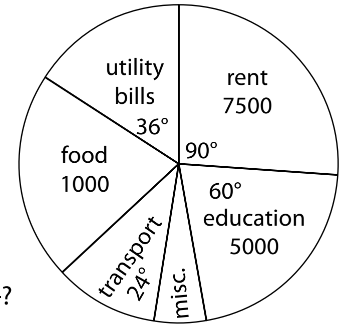
- Which is the most popular disk?
- How many students like mango juice?
- Which in the favourite sports of the students?
- How many like to play football?
- Which is most unpopular game?

For showing students on how to prepare graphs, refer to pages 192-197 of the textbook and explain the steps.

In bar graphs, explain the x-axis (date) and y-axis (frequency); width and length of the bars. In pie graphs or pie charts as they are also called, explain the method of calculating angle of sector. Explain the steps involved in making the pie graph, title, key etc. In histograms, data is presented with rectangular bars, without any space in between them.

Practice session

1. Give worksheets with graphs drawn and let the students study them and answer questions.
   The pie chart on the right shows information of a family's expenditure for a month.



- How much do they spent on food?
- What portion of their income is spent on education?
- What is the degree of sector for miscellaneous expenses?
- Calculate the degree of sector of food.
- How much is left for miscellaneous expenses if the income per month is Rs 30 000/-?

2. Give 5 examples of each of: discrete data and continuous data.

Individual work

Give Exercise 14a questions 1 to 3 to be done in the class.

Homework

Give some relevant data and ask the students to draw both a bar graph and a pie-chart.

Main lesson

Calculating the mean, median, and mode of ungrouped data and mean for grouped data.

Activity

Explain the concept of mean, median, and mode.
Refer to page 198-200.

Practice session

Exercise 13b Questions 3 and 4.

Individual work

Exercise 13b Questions 5 and 7.

Homework

Exercise 13b 7 and 8

Recapitulation

Any problems faced by the students will be discussed in class.

Topic: Measures of central tendency
Time: 2 period

Objectives

To enable students to:
- calculate the mean, median, and mode for ungrouped data and the mean for grouped data
- compare, choose, and justify the appropriate measures of central tendency for a given set of data

Starter activity

Bring different sized apples in the class and measure them over weighing scale. Ask the students to weigh the apples and find the average mass of one apple.

Main lesson

Refer to page 198 to 202.

Using examples, explain each measure of central tendency, that is mean, mode and median.

Calculation of mean, weighed mean, median, and mode.

Practice session

Find the mean of the following data:
12, 54, 13, 45, 32, 22, 60

Find the median of the following data:
2, 5, 4, 7, 8, 6, 9

Find the mode of the following data:
51, 55, 53, 56, 57, 59, 65, 62, 55, 60

Individual work

Selected questions from Exercise 13b will be given as classwork.

Homework

Completion of Exercise 13b will be given as homework

Recapitulation

Any problems faced by the students will be discussed in class.

Topic: Probability

Objective

Explain and compute the probability of certain events, impossible events, and complement of an event

Starter Activity

Flip a coin and ask them whether it will be heads or tails. Tell them that tossing a coin can result in either heads or tails only. There are equal chances of getting heads or tails in a single throw.

Main lesson

Students have already been introduced to the concept of probability in previous grades. Explain them certain events, impossible events, and complementary events.

Certain events

Certain event is an event which is sure to happen.

The Pakistan Day will be celebrated on the 14th of August each year. This is a certain event. It is Monday today and will be Tuesday tomorrow. This is a certain event. The probability of certain event is always 1.

Impossible events

An event which cannot happen is called an impossible event. For example, getting both head and tail simultaneously when tossing a coin.

Complementary events

Complementary events happen when there are only two outcomes, like going to the party or not going to the party. In other words, the complement of an event happening is the exactly opposite the probability of it not happening.

Refer to page 204 and 205 of the textbook.

Practice session

Page 206 Exercise 13

Individual work

Give them a bag containing red, black and blue marbles. Ask the following questions.

Which one of the following is an impossible outcome?

a) Picking a red marble

b) picking a white marble

c) picking a blue marble

Which one of the following is a certain outcome?

a) getting a present everyday

b) mango on an apple tree

c) sun on the sky on a sunny day

Which one of the following is a complementary event?

a) it rains or it does not rain

b) the dish is sweet and salty

c) you won and lost

Homework

Complete Exercise 13 on page 206 as homework.

Recapitulation

Any problems faced by the students will be discussed in class.

Model Examination Paper
Mathematics

Class VII

Name: ____________ **Section:** ____________ **Date:** ____________

Time: 2 Hours **Maximum Marks:** 100

Read these instructions first:

- Write your name, section, and date clearly in the space provided.
- Answer all questions in Section A, Section B, and Section C.
- Show all your working along with the answer in the space provided.
- Omission of essential working will result in loss of marks.
- At the end of the examination, recheck your work before handing it over.
- The number of marks is given in brackets [ ] at the end of each question.
- This document consists of 10 printed pages.

For Examiner's Use Only

Section	**A**	**B**						**C**					**Total**
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	
Max. Marks	**20**	**5**	**5**	**5**	**5**	**5**	**5**	**10**	**10**	**10**	**10**	**10**	**100**
Marks Obtained													
												Percentage	

Invigilated by: ____________ **Marked by:** ____________ **Checked by:** ____________

Section A

Attempt **all** questions [20 Marks]

Q1. Each question has four options. Encircle the correct answer.

I. What are the like terms in $5a\,(5 - 3b)$ and $4\,(ab + a^2)$?

A. $25a$ and $4a^2$
B. $-15ab$ and $4ab$
C. $25a$ and $4ab$
D. $-15ab$ and $4a^2$

II. What is the sum of measures of two complementary angles?

A. 90°
B. 180°
C. 36
D. 270°

III. Which term is used for the difference between the greatest and smallest data value?

A. Upper limit
B. Lower limit
C. Range
D. Frequency

IV. Which option is correct for the union of two sets?

A. It consists of only common members of the two sets
B. It has all the members of both the sets
C. It has only the members of A
D. It has only the members of B

V. If a number has finite numbers of decimal digits, what is it called?

A. Terminating decimal
B. Non-terminating decimal
C. Recurring decimal
D. Non-recurring decimal

VI. Which property is represented in $a \times b = b \times a$?

A. Associative property of multiplication
B. Distributive property of multiplication
C. Commutative property of multiplication
D. Multiplicative identity

VII. What are the factors of $ab - ca$?

A. $a\,(b + c)$
B. $(a - c)\,(b - a)$
C. $(a + b)\,c$
D. $a\,(b - c)$

VIII. Order of rotaional symmetry of a rectangle is

A. 0
B. 1
C. 2
D. 4

IX. If surface area of a cube is 294 cm^2, what is the area of one side?

A. 14 cm^2
B. 7 cm^2
C. 28 cm^2
D. 49 cm^2

X. When more time is alloted, the number of days required to finish a task becomes

A. less
B. more
C. double
D. same as before

XI. Which is the greatest rational number in $\frac{7}{14}$, $\frac{3}{9}$, $\frac{12}{16}$, and $\frac{10}{13}$?

A. $\frac{7}{14}$
B. $\frac{10}{13}$
C. $\frac{3}{9}$
D. $\frac{12}{16}$

XII. What would 7.2 4 9 5 become when rounded off to the encircled digit?

A. 7.24
B. 7.25
C. 7.3
D. 7.2595

XIII. If $a = 8$, and $b = 3$, what will be the value of $a^2 - b^2$?

A. 5

B. 73

C. –55

D. 55

XIV. What will be the factors of $pq^3 - pq^2$?

A. $pq^2(q - 1)$

B. $pq^3(1 - pq^2)$

C. $pq(q^2 - q)$

D. $q^2(pq - p)$

XV. Sum of interior angles of a pentagon is

A. 180°

B. 360°

C. 540°

D. 900°

XVI. Which of the following statement is true for concentric circles?

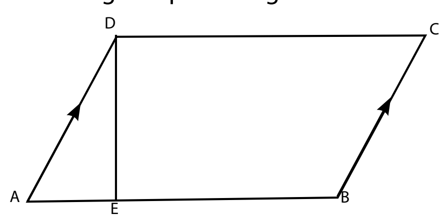
A. They have same centre

B. They have no common centre

C. They have equal diameters

D. They have same radius

XVII. What is $\overline{DE}$ in the given parallelogram?



A. Base

B. Altitude

C. Diagonal

D. Side

XVIII. What are the length, breadth, and height of a cube called?

A. Area

B. Volume

C. Dimensions

D. Surface area

XIX. $\frac{21}{8}$ is same as

A. 2

B. 26.25

C. 0.2625

D. 2.625

XX. $144x^2 + 72x + 9 =$

A. $(12x - 3)^2$

B. $(12x + 3)^2$

C. $(144x + 9)^2$

D. $(12x + 3)(12x - 3)$

[Total: **/20]**

Section B

Attempt **all** questions **[30 Marks]**

Q2.

a) Ahad bought a square cardboard sheet to make a doll house for his sister. The area of the sheet is 324 m^2. What will be the length of one side of the sheet? **[/3]**

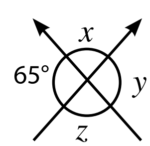
b) Adil sold out his old bed set according to the price given below. Did he earn a profit or incured a loss? Fill in the appropriate boxes. **[/2]**

Items	Cost price	Selling price	Profit	Profit %	Loss	Loss %
Bed Set	Rs 45500	Rs 30500				

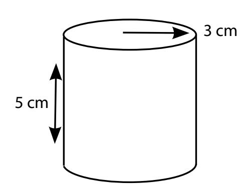
[Total: /5]

Q3.

a) Find the value of angles x, y, and z in the given diagram. **[/3]**



b) What is the volume of the given cylinder? **[/2]**



[Total: /5]

Q4.

a) Simplify and find the multiplicative identity of $\frac{4}{8} \times \frac{3}{5} \div \frac{12}{25}$ **[/2]**

b) Calculate the value of expression for given values of x. **[/3]**

x	$10x - 3$
10	
− 5	
− 12	

[Total: /5]

==

Q5.

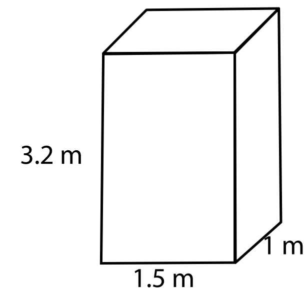
a) Abid saved Rs 10700 to purchase a bicycle. The marked price of the bicycle is Rs 15250. The shopkeeper offered a 20% discount on the marked price. Does Abid have enough money to buy the bicycle? If not, how much more money does he need? **[/3]**

b) Simplify: $\sqrt{49} \times \sqrt{100} \div \sqrt{25} + \sqrt{64}$ **[/2]**

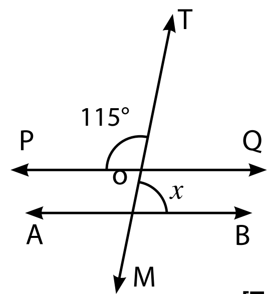
[Total: /5]

Q6.

a) Find the surface area of the given cuboid. **[/2]**



b) Find the value of x if AB 11 PQ. **[/3]**



[Total: /5]

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Q7.

a) Find the value of $(898)^2$ using an algebraic identity. **[/3]**

b) Expand $(\frac{2}{3}x + 1)^2$ using an algebraic identity. **[/2]**

[Total: /5]

Section C

Attempt **all** questions **[50 Marks]**

Q8

a) Construct a triangle PQR using ruler and compass, where $\overline{PQ} = 7$ cm, $m\angle QPR = 30^\circ$, and $m\angle PQR = 60^\circ$. Calculate $m\angle PRQ$.

OR

Construct a parallelogram whose diagonals are 5.4 cm and 6.2 cm, and the angle between them is 70°. **[/4]**

b) Sum of interior angles of a regular polygon is 1080°.

Find:

i) each interior angle, **[/1]**

ii) each exterior angle **[/2]**

c) Find the sum of interior angles of an octagon. **[/3]**

[Total: /10]

Q9.

a) 30 mangoes picked at random from a consignment weigh:

93,	111,	92,	86,	68,	84,	99,	82,	74,	140,
104,	110,	118,	81,	84,	104,	75,	78,	98,	112,
125,	130,	142,	85,	78,	102,	108,	124,	130,	115

Find:

i) Mean **[/3]**

ii) Median **[/2]**

iii) Mode **[/1]**

b) Ahmed owns a plot and some gold jewellery. Calculate the property tax on the plot and zakat on the jewellery. The details are given below. **[/4]**

Items	Worth	Property Tax 20%	Zakat 2.5%
Plot	Rs 22500000		
Gold	Rs 1255000		

[Total: /10]

==

Q10.

a) $\mathbb{U}$= {1, 2, 3, … 10}, A = {3, 5, 8, 9}, and B = {2, 3, 4, 5, 9}.

(i) Draw a Venn diagram to show the elements of $\mathbb{U}$, A, and B. **[/2]**

(ii) $A \cup B$ **[/1]**

(iii) $A \cap B$ **[/1]**

b) Factorise the given expression using identity. **[/3]**

$(a^2 + 8ab + 16b^2) - 81$

c) Rafay's mother gave him Rs $8xy^2$ and his father gave him Rs $3(xy^2 + 4)$. Out of the total he spent Rs $(12 - 8xy^2)$ to buy his favourite books. How much money is left with him? [/3]

[Total: /10]

==

Q11.

a) If $p^2 + \frac{l}{p^2} = 7$, find the value of $p + \frac{l}{p}$. [/4]

b) Expand $(2x - 1)^2$ using an identity. [/3]

c) A spinner has 8 equal sectors. Find the probability of: [/3]

i) spinning a 5

ii) not spinning a 3

iii) spinning an even number

[Total: /10]

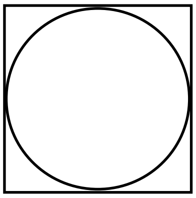
==

Q12.

a) Express 15m in cm³. **[/1]**

b) Calculate the volume and total surface area of a cube whose side is 3.4 cm. **[/5]**

c) Find the perimeter and area of a circle inscribed in a square of side 15 cm. **[/4]**



[Total: /10]