SECOND EDITION

MATHS WISE 8

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: Sets, subsets and power sets, operation on sets
Time: 3 periods

Objectives

To enable students to:

- recognise sets of
  - natural numbers (N), whole numbers (W)
  - rational numbers (Q), integers (Z)
  - even and odd numbers
  - prime and composite numbers
- differentiate between proper and improper subsets; find all possible subsets of a set; find and recognise power set of a set P(S)
- perform operations on sets (two or more) union of sets, intersection of sets, complement of a set, difference of two sets and represent them by Venn diagrams
- verify the commutative and property of Union and intersection of sets
- verify associative and distribute laws, representation and verification by Venn diagrams. (three or more sets)
- state and verify De Morgan's laws
  i) $(A \cup B)' = A' \cap B'$ ii) $(A \cap B)' = A' \cup B'$

Starter activity

Ask a few questions to refresh the students' memory. Following questions may be asked.

- What do you mean by the term 'set'?
- How do we define a set in technical terms?
- What does the symbol $\in$ stands for?
- What are the different ways of representing set?
- What does the symbol phi ($\varnothing$) means?
- What are finite and infinite sets?

Activity 1

Identify the following in the sets given below.

- pairs of overlapping sets
- pairs of disjoint sets
- pairs of equal sets
- pairs of subsets and super sets

When A = $\{a, b, c, \ldots z\}$, B = {1, 3, 5, 15},
C = {set of divisors of 15} D = $\{x : x \in n\}$
E = {set of positive even integers}
F = $\{x : x$ is a multiple of 5$\}$ W = {0, 1, 2, …}

Activity 2

Give the cardinal number (number of elements) of each set.
A={1, 0, 3, 4, 6}, B={0, 1, 2,…20}
C={x : x is a prime number and x < 30}

Activity 3
Given A={1, 2, 3}, B={1}, C={1, 2}, D=∅, E={2, 3, 1}, F={1, 3, 5}, write true or false.

i) B ⊆ A	ii) A ⊃ C	iii) F ⊆ A	iv) A = E
v) A ⊆ E	vi) A ⊃ E	vii) C ⊄ A	viii) B ⊂ C

Main lesson

Write on the board, the following: A={2, 4, 8}

Ask the students to form a set using the elements of set A. They can be called in turns to the board and asked to write their answers. Next, discuss the sets written. Ask a few questions like:
{2}, {4}, {8, 2}, (4, 2}, {4, 2}, {4, 8} etc.

- Is each of the set, a subset of set A?
- Is it possible to find more subsets from the elements of set A?
- Write all the possible subsets of set A in a certain order and ask how many subsets are there altogether?
  {2}, {4}, {8}, {2, 4}, {2, 8}, {4, 8}, {2, 4, 8}

  Another example may be given and students asked to form the subsets.

  B = {x, y, z}

  Answers will be noted. {x}, {y}, {z} and so on.
- How many subsets of set B can be formed?

Introduce the Power set

A set of all the possible subsets of a given set is called the Power Set and is denoted by the symbol P(S). (Refer to textbook pages 10 and 11)

Hence from the above examples

P (A) i.e. Power set of A = {∅, {2}, {4}, {8}, {2, 4}, {2, 8}, {4, 8}, {2, 4, 8}

and P(B) = {{x}, {y}, {z}…}

Every set is an improper subset of itself. Recall proper and improper subsets.

If C = {5, 7}, how many subsets can be formed?

P(C) = {∅, {5}, {7}, {5, 7}}

Null set is a subset of every set.

Number of elements of the power set will be explained.

We denote the cardinal number of number or elements of a set by n(s) so the number of elements of a power set will be denoted as n(P(s)).

Explain the difference between the elements of a set and elements of a power set.

From A={2, 4, 8}

2 ∈ A and {{2}} is an element of the P(A).

Give more examples:

x ∈ B, Y ∈ B etc. and {{x}} ∈ P(B) etc.

Formula for finding the number of elements of a power set i.e. n(P(s)) will be given.

From the examples A = {2, 4, 8}, B = {x, y, z}, C = {5, 7}, we see that n(P(A)) = 8,

n(P(B)) = 8 (each of the set A and B has three elements) and n(P(C)) = 4 (C has two elements).

If we take the number of elements as K in each set then $n(P(S)) = 2^K$

for $n(P(A)) = 2^K = 2^3 = 8$ (A has three elements, so K = 3)

Similarly, $n(P(B)) = 2^K = 2^3 = 8$. B also has three elements, so K = 3 C but has 2 elements so. $n(P(C)) = 2^K = 2^2 = 4$ subsets

How many subsets can be formed of a set with 4 elements, 5 elements, 1 element etc.

1. $n(P(S)) = 2^K = 2^4 = 16$ subsets (when the set has 4 elemets)
2. $n(P(S)) = 2^K = 2^5 = 32$ subsets
3. $n(P(S)) = 2^K = 2^1 = 2$ subsets

   If D = {b} then $n(P(D) = 2^K = 2^1 = 2$

Operation on sets

Explain the following:

- The properties of sets in the examples. Draw Venn diagrams to explain.
- Union and intersection of two or more sets will be explained with the help of examples from the textbook. (Refer to page 12)
- Difference of two sets and complement of a set with the help of examples. Complement of set A is denoted by A^c or A´. (Refer to page 13)
- Representation of the union, intersection, difference, and complements of sets by Venn diagram with the help of examples from the textbook.
- Commutative property of union and intersection of two sets
  $A \cup B = B \cup A$ and $A \cap B = B \cap A$
- Associative property of union and intersection of two sets
  i) $A \cup (B \cup C) = (A \cup B) \cup C$ and ii) $A \cap (B \cap C) = (A \cap B) \cap C$

  Work out examples on the board to verify the law.
- Union of a set and its complement. A={1, 2, 4, 8}, U={1, 2, 3, …10}, $A \cup A' = U$.
- Complement of a null set is a universal set and complement of a universal set is a null set.

Explain distributive law of union over intersection and intersection over union.

- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Verification of the properties with the help of examples will be done (Refer textbook page 17) on the board.

Verify De Morgan's laws giving examples.

U = {1, 2, 3…10}, A = {2, 3, 5, 7}, B = {1, 3, 5, 7, 9}

i) $(A \cup B)' = A' \cap B'$

ii) $A \cap B)' = A' \cup B'$

(Refer to textbook page 18)

Explain $(A \cup B)' = U - (A \cup B)$ and $A \cap B)' = U - (A \cap B)$

Work out examples on the board with student participation.

Practice session

Worksheets will be given with questions like the following.

1. Give sets:
   U = {months of the year}
   A = {January, June, July}
   B = {March, June, September, November}
   C = {months of the year, having 31 days}

   List the elements of:

   i) A' ii) $A \cap B$ iii) $B - A$ iv) $A \cup C$
   v) C' vi) $A' \cup B'$ vii) $A' \cap B'$

2. Find P(A) if A = {3, 5, 7}

3. Draw Venn diagrams to represent and verify the following.
   a) $A \cup Q = Q \cup P$ b) $Q - P \neq P - Q$
   c) $Q \cap P = P \cap Q$ d) $(P \cup Q)'$ (e) $(P \cap Q)'$
   P = {1, 2, 3……10}, Q = {0, 2, 6, 8, 10, 12}

Individual work

Give Exercise 1a, 1b, 1c, and 1d for class practice.

More sums will be given for verification of the properties of sets.

Homework

Given the sets U = {1, 2, 3…20} and A = {2, 3, 5, 7, 11, 13, 15, 17}

Verify that

i) $(A \cup B) \cup C = A \cup (B \cup C)$

ii) $(B \cap C) \cap A = B \cap (C \cap A)$

iii) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

iv) Verify De morgan's laws for the sets A and B,

v) Find P(A) when A = {a, b, c, d} and hence find n(P(A)). Check with the formula $n(P(A)) = 2^K$.

Recapitulation (10 minutes)

- Definitions of sets, types of sets will be revised. Also, discuss, power set of a set P(S) and n(P(S)). Revise operations of sets.
- Commutative property of union and intersection $A \cup B = B \cup A$ and $A \cap B = B \cap A$
- Associative property of union and intersection $(A \cup B) \cup C = A \cup (B \cup C)$ and,
- Distributive law of union over intersection and vice versa
  $A \cup (B \cap C = A \cup B) \cap (A \cup C)$.
- De Morgan's laws
- Complement of universal and null set.

Students will be asked to give examples. At the end of the chapter, a short test will be conducted (MCQs) and extended response questions, constructive response questions (ERQs and CRQs) will be given.

UNIT 2 REAL NUMBERS

Topic: Irrational numbers
Time: 1 period

Objectives

To enable students to:

- define irrational numbers (Q)
- identify rational and irrational numbers (Q′)
- define real numbers as R=Q∪Q′
- demonstrate non-terminating decimals/non-repetitive (non-periodic) decimals with examples

Starter activity

1. Write some sets of numbers on the board and ask the students to identify them.
   a) A = {1, 2, 3 ...} set of natural numbers
   b) B = {0, 1, 2, 3 ...} set of whole numbers
   c) C = {– 1, –2, –3, –4 ...} set of negative integers
   d) D = { –3, –2, –1, 0, 1, 2, ...} set of integers
   e) E = {2, 4, 6, 8 ---} set of even numbers.

2. Write some fractions and ask students to recognise them.
   a) $\frac{3}{5}, \frac{2}{7}, \frac{5}{8}, \frac{16}{11}$ a set of common fractions
   b) 0.2, 0.46, 0.135, 0.333, 0.2666 decimal fractions

3. Which of the following numbers are terminating / recurring or non-terminating?
   $\frac{1}{2} = 0.5, \frac{1}{8} = 0.125, \frac{2}{3} = 0.666$

4. What does a common fraction indicate? (ratio between numerator and denominator) and why is it called a rational number (rational is derived from the word ratio)

5. Which of these are recurring/non-recurring?
   a) 0.2, 0.36, 0.414141= 41, 0.666 or 0.6, 1.4142135623.......
   b) 0.2 (terminating), 0.36 (terminating), 0.4141 (recurring) and 1.414213

Main lesson

Rational numbers can be written in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$,

A set of rational numbers is denoted by the letter Q. Irrational numbers cannot be written in the form $\frac{p}{q}$. A set of irrational numbers is denoted by the letter Q'.

Explain that irrational numbers are numbers which are neither terminating nor recurring. Examples of terminating, non-terminating/recurring decimals will be worked out on the board.

Explain the difference of terminating/non-terminating and non-terminating/non-recurring decimals with examples, $\sqrt{5}$, $\sqrt{2}$ are irrational numbers. Value of π is taken as 3.14159265. More examples of rational and irrational numbers from the textbook (page 21) will be given. Worked examples will be discussed.

Introduce a real numbers set as the union of rational and irrational numbers. R denotes the set of real numbers.

i.e., $R = Q \cup Q'$

Every quantitative value can be represented by a numeral, it may be a terminating/recurring or non of these. So all the numbers are called real numbers.

Explain the number line and graphing the real, rational numbers.

(refer to page 29 of the textbook)

Practice session

1. Exercise 2a on page 24.

Give worksheets with questions like the following:

2. Convert the following rational numbers into decimal fractions and state whether they are terminating or recurring.

   $\frac{7}{9}, \frac{11}{12}, \frac{51}{70}, \frac{3}{8}, \frac{7}{25}$

3. Express the following as rational numbers

   i) 4.5 ii) 3.05 iii) 0.0007 iv) 0.666

Individual work

Give questions 1 and 2 from Exercise 2c as class work.

Homework

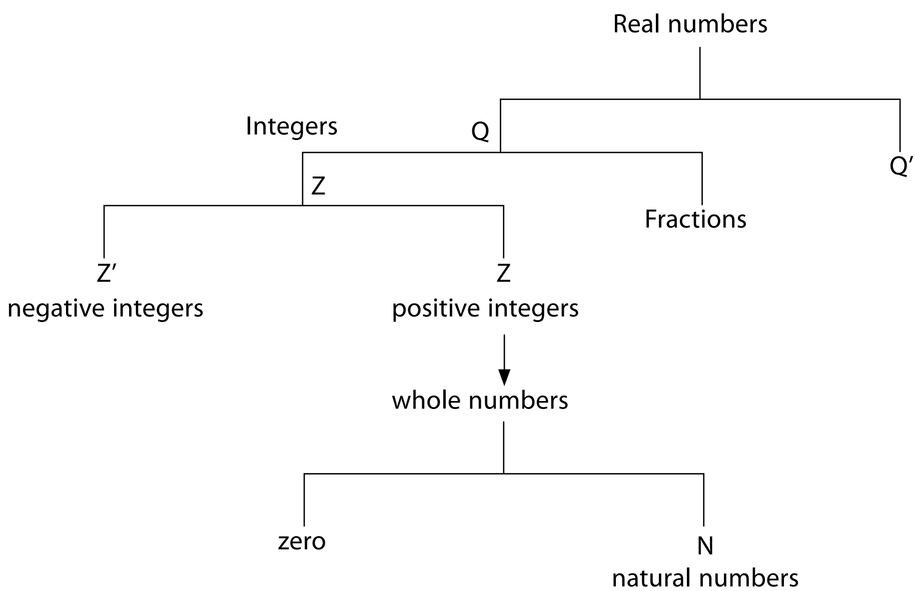
Ask the students to complete Exercise 2c, questions 3 and 4 as homework.

Recapitulation

- Difference between rational and irrational numbers will be discussed.
- Symbol or the letters used to denote rational and irrational numbers
- Set of real numbers is the union of rational and irrational numbers

  R = Q ∪ Q′

The Number Tree



Topic: Approximation
Time: 1 period

Objective

To enable students to:

- round off numbers up to 5 significant figures
- analyse approximation error when numbers are rounded off
- solve real-world word problems involving approximation

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 25 and 26, explain approximate value of numbers, measures etc. and rounding off numbers upto 5 significant figures.

Explain the rules to the students.

Rules for significant figures

1. All non-zero numbers are significant.
2. Zeros between two non-zero digits are significant.
3. Leading zeros are not significant.
4. Trailing zeros to the right of the decimal are significant.
5. Trailing zeros in a whole number may or may not be significant.

Approximation error

Approximation error can be found by subtracting the approximated value from original value or, by comparing one approximation with previous one.

Approximation error can be found by subtracting the approximated value from the exact value.

We can compute an approximate error by comparing one approximation with a previous one.

Example

Find out the possible maximum approximation error in calculating the area of a square with side length 12 cm, that is correct to the nearest centimetre.

We have length = 12 cm

Take length = 11.5 cm, 12 cm, and 12.5 cm

Area of square = l^2 = 11.5^2 = 132.25 cm^2

Area of square = l^2 = 12^2 = 144 cm^2

Area of square = l^2 = 12.5^2 = 156.25 cm^2

If length = 11.5 cm, then the error is

144 – 132.25 = 11.75 cm^2

If length = 12.5 cm, then the error is

156.25 – 144 = 12.25 cm^2

Therefore, the maximum possible approximation error is 12.25 cm^2.

Practice session

Solve examples on the board with participation from the class.

Write a few decimals and ask the students to give the answer rounded off to 1, 2, 3, 4, 5 significant figures etc. For example, 0.275, 0.432, 16.89201, 20.0000

Individual work

Give exercise 2b from the textbook to be done individually by each student. Help them solve it.

Homework

Give some sums for students to do at home.

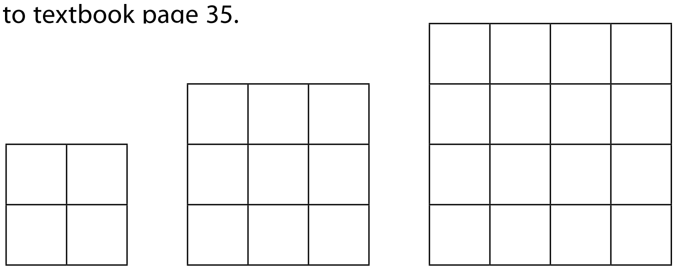
Topic: Squares and square root
Time: 3 periods

Objectives

- find the perfect square of a number and will be able to establish patterns for the squares of natural numbers
- find the square root of a natural number, common faction and decimal fraction by prime factorisation and division method.
- find the square root of numbers which are not perfect squares; determine the number of digits in the square root of a perfect square
- solve real-life problems involving square roots

Starter activity

Refer to textbook page 35.



2 units   3 units   4 units

Ask the following questions.

1. What is the area of the square with 2 units $2 \times 2 = 4$
2. What is the area of the square with 3 units $2 \times 3 = 9$

   4 is said to be the square of 2 and 9 is said to be the square of 3 and so on.

   Numbers like 1, 4, 9, 25, 36, ... are examples of square numbers.

Main lesson

A square number is obtained by multiplying a number with itself.

Workout the following on the board with student participation.

$1 \times 1 = 1^2 = 1$
$2 \times 2 = 2^2 = 4$
$3 \times 3 = 3^2 = 9$
$4 \times 4 = 4^2 = 16$
$5 \times 5 = 5^2 = 25$

$6 \times 6 = 6^2 = 36$
$7 \times 7 = 7^2 = 49$
$8 \times 8 = 8^2 = 64$
$9 \times 9 = 9^2 = 81$
$10 \times 10 = 10^2 = 100$

Numbers like 1, 4, 9, 14, 25, 36, 49, 81, 100 and so on are called perfect squares because they are obtained by multiplying a number by itself.

Which of the numbers can be a perfect square? Ask the students to observe the pattern developed by squaring numbers from 1 to 10. Each of the square number has either of 0, 1, 4, 5, 6 or 9 in the one's place.

So any number having these digits in their units place can be a perfect square. For example, 361, 729, 256, 784, etc.

But numbers having the digits 2, 3, 7, 8 in their one's place are not perfect squares.

Sum of first two, three four, etc. odd numbers is a perfect square.

$1 + 3 = 4$ and $4 = 2^2$
$1 + 3 + 5 = 9$ and $9 = 3^2$
$1 + 3 + 5 = 16$ and $16 = 4^2$

Similarly, other patterns for square numbers can be developed. (refer to textbook page 37)

Finding square roots of numbers will be explained with the help of examples (refer to textbook page 38)

Which number when squared, gives 4?

$2^2 = 4$, so 2 is called the square root of 4.

Similarly $3^2 = 9$, so 3 is the square root of 9.

Introduce the symbol $\sqrt{\ }$ (radical sign) for extracting the square root of a number. So $\sqrt{4} = 2$, $\sqrt{25} = 5$.

When a number is under the radical sign it means extract the square root.

There are two ways of finding the square root. First, find the square root by factorisation. To find the square root, find the factors (prime factors) of the given number.

What are the factors of 36?

Work on the board with students participation.
$36 = 2 \times 2 \times 3 \times 3$
Write the factors by pairing as squares
$36 = 2^2 \times 3^2$
$36 = 6^2$ (multiply 2 by 3)
$\therefore \sqrt{36} = 6$

2	36
2	18
3	9
3	3
	1

Similarly, workout the factors for square numbers. Students will be called in turns to perform prime factorisation on the board (refer to textbook page 39).

196
$196 = 2 \times 2 \times 7 \times 7$
$= 22 \times 72$
$= 14^2$
$\therefore \sqrt{196} = 14$

2	196
2	98
7	49
7	7
	1

Is 48 a perfect square?
$48 = \overline{2 \times 2} \times \overline{2 \times 2} \times 3$
$= 2^2 \times 2^2 \times 3$
The factor 3 is occurring only once.

So 48 is not a perfect square number.
Now $48 \times 3 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{3 \times 3}$
$= 2^2 \times 2^2 \times 3^2$
$= 12^2$

$144 = 12^2$

$\therefore \sqrt{144} = 12$ (refer to textbook page 40)

2	48
2	24
7	12
7	6
3	3
	1

Similarly, if we divide 48 by 3 we get

$48 \div 3 = \frac{2 \times 2 \times 2 \times 2 \times \cancel{3}}{\cancel{3}}$

$16 = \overline{2 \times 2} \times \overline{2 \times 2}$

$16 = 2^2 \times 2^2$

$16 = 4^2$

So 16 is a perfect square number.

A perfect square number can be obtained by multiplying or dividing any given number with its factor/s not appearing in pairs.

Square roots of common fractions can also be extracted by prime factorisation.

Example

$\frac{36}{49}$

Students will be asked to find the square root of the above fraction on the board.

$36 = 6^2$

$49 = 7^2$

$\therefore \sqrt{\frac{36}{49}} = \frac{6}{7}$

Square root of decimal fractions will be worked out on the board (refer to textbook pages 41 and 42) with student participation.

Decimal fractions with denominators 10,1000 or 100 000 cannot be perfect squares. Explain with the help of examples (refer to textbook page 42).

Method of finding square root by the division method will be explained with the help of examples (refer to textbook page 43).

To find the square root of 357604, proceed as:

$\overline{35}\ \overline{76}\ \overline{04}$

	598
5	35 76 04
+5	−25
109	1076
+9	−981
1188	9504
8	−9504
	xxxx

$\therefore \sqrt{357604} = 598$

Mark off the digits in pairs from right to left.
Taking the first pair which is 35, we know that,
$1^2 = 1$, $2^2 = 4$, $3^2 = 9$, $4^2 = 16$, $5^2 = 25$
and $6^2 = 36$. So 6^2 is greater than 35. We take $5^2 = 25$. Write 5 as the divisor and 5 as the quotient.
Subtract $5^2 = 25$ from 35.
The remainder is 10. Bring down the next pair which is 76.
Add 5 in the divisor which gives the new divisor. By trial, we find a digit for the one's place of the divisor.

$$\begin{array}{r} 101 \\ \times\ 1 \\ \hline 101 \end{array} \qquad \begin{array}{r} 102 \\ \times\ 2 \\ \hline 204 \end{array} \qquad \begin{array}{r} 103 \\ \times\ 3 \\ \hline 309 \end{array}$$

$$\begin{array}{r} 104 \\ \times\ 4 \\ \hline 416 \end{array} \qquad \begin{array}{r} 105 \\ \times\ 5 \\ \hline 525 \end{array} \qquad \begin{array}{r} 106 \\ \times\ 6 \\ \hline 636 \end{array}$$

$$\begin{array}{r} 107 \\ \times\ 7 \\ \hline 749 \end{array} \qquad \begin{array}{r} 108 \\ \times\ 8 \\ \hline 864 \end{array} \qquad \begin{array}{r} 109 \\ \times\ 9 \\ \hline 981 \end{array}$$

Put 9 in the divisors column and also in the quotient.

Add 9 for the next divisor and bring down the next pair with the remainder.

Next, we find the digit for the one's place of the new divisor.

1181×1,	118 ② × ②,	118 ③ × ③,	118 ④ × ④
1181	(2364)	3549	4736
118 ⑤ × ⑤,	118 ⑥ × ⑥,	118 ⑦ × ⑦,	118 ⑧ × ⑧
5925	7116	8309	9504

We see that 118 8 × 8 gives us 9504 which is our last dividend. Similarly workout the example with odd number of digits in the given number with student participation for finding the new divisor.

Example

$\hat{2}\overline{72}\ \overline{25}$

	165
1	$\hat{2}$72 25
+1	−1
26	172
+ 6	−156
325	1625
5	−1625
	xxxx

$\therefore \sqrt{27225} = 165$

2 is the first digit, so find a number whose square is – 2.
$(1 \times 1 = 1^2 = 1)^1$
Put 1 in the divisor column and 1 in the quotient.
Subtract $1^2 = 1$ from 2.
Now the remainder is 1, bring down the next pair which is 72 and add 1 for the new divisor in divisor's column. Again by trial, find a digit for the one's place in the divisor's column.
Now see that 27 × 7 = > 172, so take
26 × 6 = 156 < 172 and subtract it from 172. Put 6 in the divisor's column and 6 in the quotient. Now the remainder is 16. Bring down the next pair, (25), as the new dividend. Again by trial, find the digit for the one's place with 32. We find that 325 × 5 = 1625, so, put 5 in the divisor's column next to 32 and 5 in the quotent next to 16.

2① × ① = 21

2② × ② = 44

2③ × ③ = 69

2④ × ④ = 96

2⑤ × ⑤ = 125

2⑥ × ⑥ = 156

2⑦ × ⑦ = 189

321 × 1 = 321

322 × 2 = 644

323 × 3 = 969

324 × 4 = 1296

325 × 5 = 1625

Finding the square root of common fractions and decimal fractions will be explained with the help of examples (refer to textbook pages 45 and 46)

Finding the square roots of numbers which are not perfect squares will be explained with the help of examples worked out on the board. (refer to textbook page 47)

Explain that square root of numbers which are not perfect squares can be extracted to a certain number of places of decimal (one place, two places, three places etc.).

Examples will be solved on the board with student participation.

Method of finding the number of digits in the square root of a number will be explained (refer to textbook page 47).

Number of digits in the square root of a number

If the number of digits in a number is even then the number of digit is in the square root will be $\frac{n}{2}$, where n is the number of digits. For example 16 is a 2-digit number, n=2 (even) $\frac{2}{2} = 1$, the square root in a one digit number. Another example of a 16 digit number the square root will have $\frac{16}{2} = 8$ digits.

If the number of digits of a number is odd, the square root will have n + $\frac{1}{2}$ digits.

Example

196 ⟶ 3 digits (odd)

$\therefore \frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$ digits

$\sqrt{196} = 14$(14 is a 2 digit number)

Estimating the square root of a number will be explained with the help of examples (refer to textbook page 49).

Explain adding or subtracting the smallest number to a given number to make a perfect square number, with the help of examples (refer to textbook page 50)

Practice session

Worksheets will be given.

Find the square root of the numbers by factorisation and by the division method.

Find the number of digits in the square root of the given numbers.

Estimate the square root of the given numbers mentally.

Individual work

Give selected questions from Exercise 2f for individual practice. Similary, give some of the word problems.

Homework

Complete Exercise 2f for homework.

Recapitulation

Any problem faced by the students will be discussed.

UNIT 3 PROPORTIONS

Topic: Compound proportion
Time: 1 period

Objective

To enable students to
- calculate compound proportion
- solve real-world word problems related to compound proportions

Starter activity

Asking a few simple questions at the start of the lesson will make the students ready to learn it in detail.

If 14 men do a job in 8 days working 4 hrs daily, how many hours a day must 35 men work to do it?

1. How many units you see in this question?
   Three units: men, days, and hours
2. What do you have to find out?
   Hours
3. Are the units, days and hrs, in inverse or direct proportion?
   More days worked, lesser hours are needed and vice versa. So it is an inverse proportion.
4. What about men and days? Are they direct or inverse?
   They are also in inverse proportion, that is, if more men work, lesser days would be needed.

Main lesson

Explain to the students that when more than two ratios are involved in a problem it is called a compound proportion. Next, take example 9 on page 69 of the textbook as an example to explain this.

Proportion Method

worker	depth (ft)	hour
↑ 40	20 ↓	3 ↓
25	35	x

Method 1

Worker and hour (inverse), dig 35 feet (work) for x hours (direct proportion, more work more time.)

$$\left.\begin{array}{l}25 : 40\\ 20 : 35\end{array}\right\} 3 : x$$

$25 \times 20 \times x = 40 \times 35 \times 3$

$$\frac{25 \times 20 \times x}{25 \times 20} = \frac{{}^{2}\cancel{40} \times \cancel{35}^{7} \times 3}{{}_{5}\cancel{25} \times \cancel{20}_{1}} = \frac{42}{5} = 8.4 \text{ hrs}$$

Method 2

40 workers dig a 25 feet deep hole in 3 days

1 worker would dig: $40 \times 3 = 120$ hrs

25 workers will dig in $\dfrac{^{24}\cancel{120}}{\cancel{25}_5}$

Therefore, 25 workers dig a 1 foot hole in: $\dfrac{^{6}\cancel{24}}{5} \times \dfrac{1}{\cancel{20}_5} = \dfrac{6}{25}$

25 workers will dig a 35 feet hole in $\dfrac{6}{\cancel{25}_5} \times {}^{7}\cancel{35} = \dfrac{42}{5} = 8.4$ hours

More examples from page 59 will be explained.

Practice session

1. If 30 men drink 12 gallons of water in 4 days. Find how many gallons 50 men will drink in 30 days?

Individual activity

Give exercise 3a, questions 6 and 8 as classwork.

Homework

Give exercise 3a questions 9 and 10 as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Direct and inverse proportion
Time: 3 periods

Objectives

To enable students to:

- calculate direct and inverse proportions
- solve real-world word problems related to direct and inverse proportions

Starter activity

Make students recall the concept of direct and inverse proportion by discussing the real-life scenarios given on page 57.

Main lesson

Students already know how to calculate direct and inverse proportions using unitary method. Explain the students that these proportions can be represented using graphs. Explain equations and graphs for both the proportions.

Solve examples 5 and 7 on board to explain how to make table of values and equations and draw the graphs.

Example 1

It is given that y is directly proportional to x.

a) Find the value of constant k, if $x = 3$ and $y = 15$

$k = \frac{y}{x}$

$= \frac{15}{3} = 5$

b) Write down the equation expressing y in terms of x.

$y = kx$

$y = 5x$

c) Find value of y when $x = 5$ using above equation.

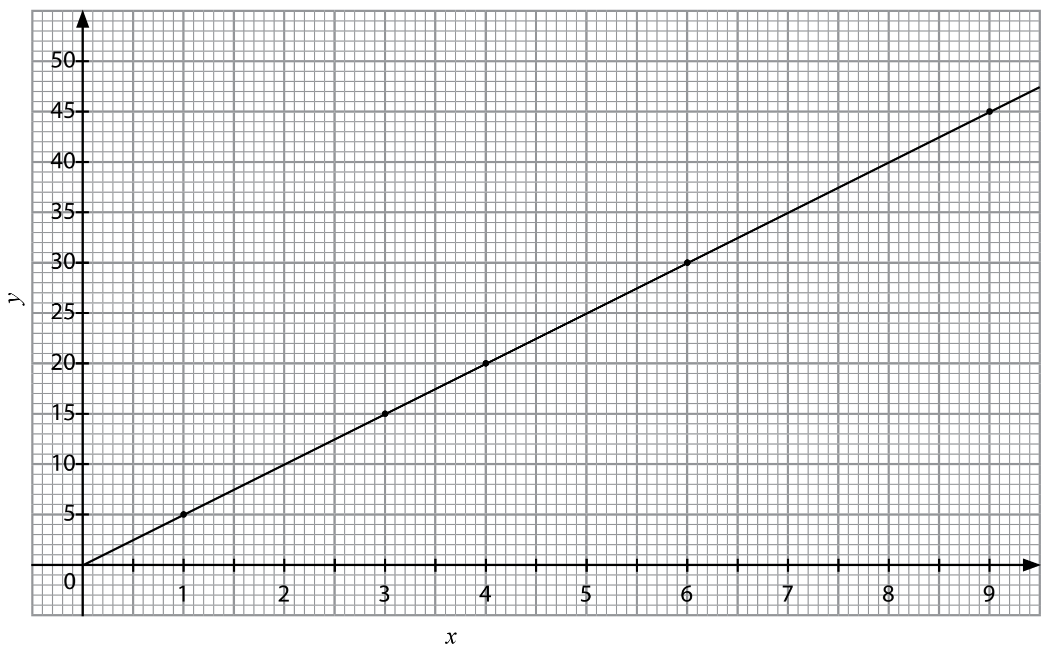
$y = 5(5)$

$y = 25$

d) Complete the following table.

x	1	3	4	6	7	9
y	5	15	20	30	35	45

e) Draw the graph of y against x.



Example 2

It is given that y is inversely proportional to x.

a) Find the value of constant k, if $x = 2$ and $y = 18$

$k = xy$

$= 2(18) = 36$

b) Write down the equation expressing y in terms of x.

$y = \frac{k}{x}$

$y = \frac{36}{x}$

c) Find value of y when $x = 3$ using above equation.

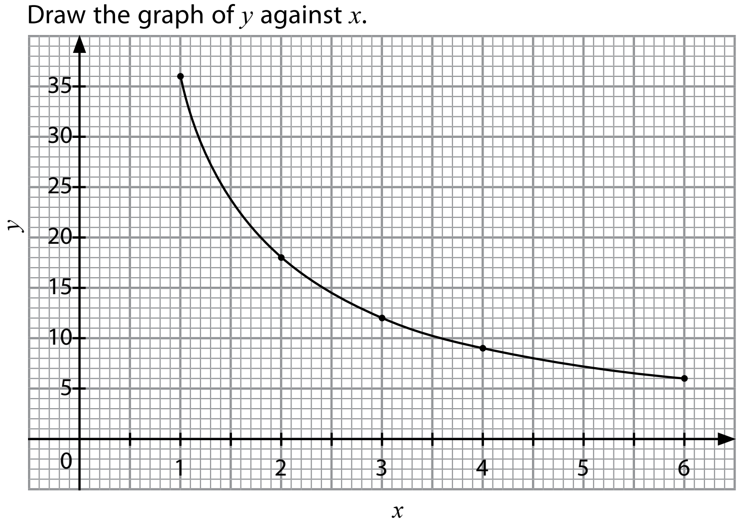
$y = \frac{36}{3}$

$y = 12$

d) Complete the following table.

x	1	2	3	4	6
y	36	18	12	9	6

e) Draw the graph of y against x.



Individual activity

Give examples 6 and 8 to students to solve and explain the methods.

Homework

Give questions 12 and 13 of exercise 3a for homework.

Recapitulation

Any problem faced by the students will be discussed.

UNIT 4

FINANCIAL ARITHMETIC

Topic: Currency conversion and profit/markup
Time: 1 period

Objectives

To enable students to define and understand:
- conversion of currencies
- calculate profit / markup
- principal amount, markup rate and period
- solve everyday problems related to profit/markup

Starter activity

Put up a slide show or show some pictures of the work that goes on in a bank. Next ask some questions.
- How did people save their money in the ancient times?
- How and where do they save it now?
- Why do you need to exchange currency?
- What will you do if you want to start a business?

Main lesson

Explain the concepts of conversion of currencies and profit/markup.

Currencies of different countries will be displayed (for example, Pakistani Rupee, $, £, Yen, Euro, etc).

Explain the conversion of currencies from foreign currency to local (Pakistani) and vice versa. Discuss the need and importance of conversion / exchange of currencies and the rate of exchange and its application. As an activity, ask the students to look up the newspaper for currency rates.

Explain the need of borrowing and depositing money.

Practice session

Display a 1000 rupee note and ask the students to look for an equivalent amount in US Dollars and British Pounds (refer to pages 71 from the textbook). Solve with student participation.

Introduce and explain terms like profit, markup, principal amount, period (time).

- Markup amount = Principal amount × markup rate × time period
- Profit amount = Principal amount + Markup amount
- Markup rate = $\frac{\text{Markup Amount}}{\text{Principal amount} \times \text{time}}$

For calculating period, refer to page 73 from the textbook.

Practice session

Examples on page 73 (about markup amounts, profit amounts, markup rate principal amount etc.) will be explained on the board.

Individual work

Give selected questions from Exercise 4a and 4b to be done as class work.

Homework

Give the rest of questions from Exercise 4a and 4b as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Percentage, profit and loss
Time: 2 periods

Objectives:

To enable students to:
- understand and identify percentage, profit and loss
- solve real-life problems related to percentage profit and loss

Starter activities

Activity 1

Two days before teaching the topic, ask the students to do some shopping with their parents. When they come to the school for the lesson, they should bring with them the following:
- a simple cash memo
- bring a few discount leaflets from the super store

Ask the students to point out the (vocabulary building) terms used in the cash memo, promotional leaflets e.g. total rate, price, cost etc. Write down these terms on the board and give a quick review as they are to be used in the following lesson.

Activity 2

Students will be given activity sheets to recall their knowledge of percentage, profit, loss, selling price, cost price etc.

a) C.P. = Rs 500, S.P. = Rs 600 then Profit = Rs ?
b) I bought a book for Rs 50 and gained 50% by selling it. What is my selling price?
c) C.P. of an article is Rs 400 and S.P. = Rs 350. Find the loss%.

Discuss the answers the students give.

Main lesson

Solve examples from the textbook page 77 and 78 on the board with student participation.

Practice session

Give Exercise 4c, questions1 and 2 for practice. The students will be called in turns to the board to solve.

Individual work

Give selected questions from Exercise 4c, questions 3 to 5 for students to do individually.

Homework

Give the rest of the questions from Exercise 4c to be done as homework.

Recapitulation

Revise the terms used, cost price, selling price, profit, loss, percentage, etc.

C.P. = S.P – Profit

C.P. = S.P + loss

Profit = S.P – C.P

Loss = C.P – S.P

Profit% s $= \frac{\text{Profit}}{\text{C.P.}} \times 100$

Loss% $= \frac{\text{Loss}}{\text{C.P.}} \times 100$

Topic: Discount
Time: 1 period

Objectives

To enable students to:

- understand and identify discount
- solve real-life problems related to discount

Starter activity

Make some flash cards of discount offers as advertised in some newspapers or magazines and show to the class. Ask questions about the offers and what the students can understand about the offers.

Main lesson

Define and explain the meaning of discount. Discount means a reduction in price at sales on special occasions for Eid, new year festival or clearance sale etc.

Formula

Net price = marked price – discount

Discount% $= \frac{\text{discount}}{\text{marked price}} \times 100$

Refer to textbook pages 79 and 80. Examples 12, 13, and 14 from page 79 and 80 will be solved on the board.

Practice session

Give question 1 of Exercise 4d to be done on board with student participation.

Individual work

Give Exercise 4d questions 2 to 5 as class work.

Homework

Give the rest of the questions from Exercise 4d as homework.

Recapitulation

Revise the terms, discount, net price, marked price, discount % etc.

Topic: Insurance
Time: 1 period

Objectives

To enable students to:
- define and understand insurance
- solve real life problems related to life and vehicle insurance

Starter activity

Two short stories or incidents can be told to explain why insurance is important.

1. A family suffering from day-to-day financial problems due to sudden death of their bread winner
2. Another family not suffering from daily financial problems because the head of the family had taken a life insurance policy

Ask relevant questions based on life insurance and discuss the answers.

Main lesson

Explain the importance and need of different insurance policies (life insurance, vehicle insurance etc.) For more explanation, refer to pages 82 to 84 of the textbook.

Practice session

Solve the following questions with student participation.

1. Ali purchases a life insurance policy for Rs 200 000. How much does he have to pay annually when the rate of premium is 2% of net amount?
2. Arif pays Rs 16000/- as annual premium for his car. What is the total amount of the car insurance policy?

Individual work

Questions 1 to 3 from Exercise 4e as class work.

Homework

Questions 4 and 5 from Exercise 4e as homework.

Recapitulation

Revise the terms life insurance policy, vehicle insurance, premium, rate of premium etc.

Topic: Inheritance and Partnership
Time: 1 period

Objectives

To enable students to:
- define and understand inheritance and partnerships
- solve real-life problems involving inheritance and partnerships

Starter activity

Any story related to inheritance can be shared to explain the importance of Islamic laws of inheritence. A real-life example can be shared to explain the convept of partnership.

Main lesson

Define and explain the term inheritence. Explain how the property and money is distributed according to islamic laws.

Define the term partnership and explain the two cases given on page 86 of textbook.

Individual work

Give related questions of Exercise 4e to be done as practice exercises.

Homework

Give the rest of the questions from Exercise 4e as homework.

Recapitulation

Revise the terms inheritence, partnership, share, and heir.

UNIT 5 POLYNOMIALS AND LAWS OF INDICES/EXPONENTS

Topic: Number sequence and pattern
Time: 2 periods

Objectives

To enable students to:
- differentiate between an arithmetic sequence and a geometric sequence
- find terms of an arithmetic sequence
- construct the formula for the general term of an arithmetic sequence
- solve real-life problems involving number sequence and patterns

Starter activity

Give the following number sequences to the students and ask them to write their next terms and the rules for sequence.

a) 5, 8, 11, 14, ...

b) –20, –23, –26, –29, ...

c) –105, –100, –95, –90, ...

d) 333, 322, 311, 300, ...

Main lesson

Explain the difference between arithmetic and geometric sequences with the help of examples.

Take example 1 from the book to explain how to find term rule. Construction of the formula for general term of arithmetic sequences can be explained using following example.

Example 1

Find the n^{th} term formula for the following sequences and then find their 22^{nd} term.

a) 3, 7, 11, 15, ...

$T_1 = 3$

$d = 7 - 3 = 4$

$$
\begin{aligned}
T_n &= T_1 + (n-1)d \\
&= 3 + (n-1)4 \\
&= 3 + 4n - 4 \\
&= 4n - 1 \\
T_{22} &= 4(22) - 1 \\
&= 88 - 1 \\
&= 87
\end{aligned}
$$

b) 50, 45, 40, 35, ...

$T_1 = 50$

$d = 45 - 50 = -5$

$T_n = T_1 + (n - 1)d$

$= 50 + (n - 1)(-5)$

$= 50 - 5n + 5$

$= 55 - 5n$

$T_{22} = 55 - 5(22)$

$= 55 - 110$

$= -55$

Example 2

Find the n^{th} term formula for the following sequences and then find their 22^{nd} term.

a) 3, 7, 11, 15, ...

$T_1 = 3$

$d = 7 - 3 = 4$

$T_n = T_1 + (n - 1)d$

$= 3 + (n - 1)4$

$= 3 + 4n - 4$

$= 4n - 1$

$T_{22} = 4(22) - 1$

$= 88 - 1$

$= 87$

b) 50, 45, 40, 35, ...

$T_1 = 50$

$d = 45 - 50 = -5$

$T_n = T_1 + (n - 1)d$

$= 50 + (n - 1)(-5)$

$= 50 - 5n + 5$

$= 55 - 5n$

$T_{22} = 55 - 5(22)$

$= 55 - 110$

$= -55$

Explain various examples from real-life scenarios where the concept of number sequences can be applied.

Individual work

Example 3, Questions 2, 5, 9, and 12 will be done in the class.

Homework

The rest of the exercise questions will be given as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Laws of exponents
Time: 2 periods

Objectives

To enable students to:

- write a number in index notation
- identify base and exponent
- evaluate expressions given in the index form
- deduce laws of exponents using rational numbers
- recognise zero exponent and negative exponent.

Starter activity

Write some numbers in index form and ask questions as given below.

10^5, 4^6, 3^4 $(18)^3$ etc.

a) What do you mean by 10^5?

b) What is 3^4 equal to?

c) How do we read 4^6?

d) What is the method of writing numbers in the form 10^5, 3^4, 4^6 called? (exponential or index form)

e) What is the base in 10^5, 3^4 and 4^6?

f) What is the power of 10, 3 and 4?

g) What is the other term used to express power of a number?

h) What do you mean by a^6?

i) What is a? What is the exponent?

j) How do we write $a \times a \times a \times a \times a$ and $(-a) \times (-a) \times (-a) \times (-a) \times (-a) = ?$

Main lesson

Using textbook pages 94 to 98, explain the terms base, exponent and when the base is negative with examples from the textbook.

1. $(-3)^4$

$(-3)^4 = (-3) \times (-3) \times (-3) \times (-3)$

$= (-1) \times 3 \times (-1) \times (-1) \times 3 \times (-1) \times 3$

$= \quad - \times - \qquad - \times -$

$\quad + \qquad +$

$\qquad +$

$(-3)^4 = 3^4$

If we multiply two negative integers, the result is positive.

2. $(-3)^5 = (-3) \times (-3) \times (-3) \times (-3) \times (-3)$

$(-1) \times 3 \times (-1)(3) \times (-1) \times 3 \times (-1) \times 3 \times (-1) \times 3$

$- \times - \qquad - \times - \qquad - \times -$

$(+) \quad \times \quad (+) \qquad (-)$

$(+) \quad \times \quad (-)$

$-$

The product of a positive and a negative integer is negative.

We can generalise with the following notations:

$(-a)^4 = a^n$ when 'n' is an even number

$(-a)^n = -a^n$ when n is an odd number

Give more examples and write the product with student participation.

$(-4)^2 = 4^2$ 2 is an even number

$(-4)^3 = 4^3$ 3 is an odd number

$(-5)^6 = 5^6$ the power or exponent is even

$(-5)^7 = -5^7$ the power or exponent is odd

$(6)^5 = 6^5$ and $(-6)^4 = 6^4$

$(-6)^5 = -6^5$

Consider $3^4 \times 3^2$. We can write it as:

$= (3 \times 3 \times 3 \times 3) \times (3 \times 3)$ or

$= 3^{4+2}$

$= 3^6$

Product law

Now take $a^4 \times a^3$. We can write it as:

$= (a \times a \times a \times a \times a) \times (a \times a \times a)$

$= a^{4+3} = a^7$

We can generalise this by using:

$a^m \times a^n = a^{m+n}$

We call it the law of product of powers.

Now let us consider: $2^3 \times 5^3$

Here the base is different but the exponent is the same. We can write it as:

$(2 \times 5)^3$ or $a^m \times b^m = (a \times b)^m$

This law is called the law of power of product.

Quotient law

What is meant by quotient? When a number is divided by another number the result is called the quotient.

$125 \div 25 = \frac{125}{25} = 5; \frac{125}{5} = 25$ or 5^2

Now divide 5^3 by 5^2

$= \frac{5^3}{5^2}$

$\frac{5^4}{5^2} = \frac{5 \times 5 \times 5 \times 5}{5 \times 5} = 5 \times 5 = 5^2$

or

$5^{4-2} = 5^2 = 25$

This rule can also be generalised by taking it as:

$a^m \div a^n = a^{m-n}$

When the base is different and the power is the same.

Example

$8^3 \div 2^3 = \frac{8^3}{2^3} = \left(\frac{8}{2}\right)^3 = (4)^3 = 6^4$

In general we can write it as:

$a^m \div b^m = \left(\frac{a}{b}\right)^m$

Power law

When a number in an exponential form is raised to another power, we simply multiply the exponent with the power. For example,

$(4^3)^2 = 4^{3 \times 2} = 4^6$

To generalise $(a^m)^n = a^{mn}$

From the above examples, we get the laws of indices which are:

1. $a^m \times a^n = a^{m+n}$
2. $\frac{a^m}{a^n} = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $a^m \times b^m = (a \times b)^m$
5. $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

$(-a)^m = a^m$ (when m is an even number)

$(-a)^n = -a^n$ (when n is an odd integer)

Zero exponent

When 5 is divided by 5, what is the result?

$\frac{5}{5} = 1$ if we apply the laws of indices here:

$\frac{5^1}{5^1} = 5^{1-1} = 5^{\circ} = 1$

Let us take another example:

$\frac{5^2}{5^2} = \frac{25}{25} = 1$ or by the laws of indices

$\frac{5^2}{5^2} = 5^{2-2} = 5^{\circ} = 1$

Hence any number raised to power zero is always equal to 1.

This can be written as:

$\frac{a^3}{a^3} = a^{3-3} = a^{\circ} = 1$

so $x^{\circ} = 1$, $y^{\circ} = 1$ or any integer raised to the power zero is 1.

Negative exponent

By definition, $\frac{1}{8} = \frac{1}{2^3} = 2^{-3}$ (we read it as 2 raised to the power minus 3)

We generalise this as: $a^{-3} = \frac{1}{a^3}$

Let us take an example.

$5^6 \times 5^{-3}$

$5^6 \times \frac{1}{5^3}$ (since $5^{-3} = \frac{1}{5^3}$ by definition)

$= \frac{5^6}{5^3} = 5^{6-3} = 5^3$

Practice session

Worksheets will be given for practice. Help the students as they solve these problems.

1. Indicate the base and the exponent.

a) 5^3 b) $(28)^2$ c) $2x$ d) 10^6 e) a^{15}

2. Apply laws of indices and write in the form of a^n.

a) $4^3 \times 4^5$ b) $12^3 \times 3^3$ c) $\frac{14^5}{14^2}$ d) $\frac{25^4}{5^4}$

e) $(6^2)^4$ f) $a^5 \times a^{-5}$ g) $9^7 \times 9^{-5}$

3. Rewrite as positive indices:

a) x^{-4} b) 11^{-6} c) $a^{-2} \times a^{-3}$ d) $7^{-4} \times 7^{-2}$

4. Write in an index form:

a) $3 \times 3 \times 3 \times 3 \times 3$ b) $2 \times 2 \times 5 \times 5 \times 5$

c) $\frac{7 \times 7 \times 7}{5 \times 5 \times 5}$ d) $\left(\frac{4 \times 4}{4 \times 4 \times 4}\right)^3$

Individual work

Give Exercise 5b as class work.

Homework

Give some questions based on laws of indices.

Simplify using laws of indices. Verify the laws of indices for integers.

1. $(am)^n = a^{mn}$. Verify if this is true for $a = 5$, $m = 3$, $n = 2$
2. $a^m \times b^m = (ab)^m$ when $a = 5$, $b = 7$, $m = -2$
3. $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$ when $a = 4$, $m = 3$
4. $\frac{x^2}{x^{-1}} = x^3$
5. $y^{10} \times y^{-10}$

Recapitulation

Laws of indices will be revised. Identify the laws applied.

Topic: Polynomials
Time: 1 period

Objectives

To enable students to:

- define a polynomial, kinds of polynomial
- recognise the degree of a polynomial
- recognise polynomial in one, two or more variable with various degrees.

Starter activity

Write an algebraic expression on the board and ask the following questions.

$a^3 - 5x + 7$

1. What is the degree of 'a'?
2. What is the degree or power of 'x'?
3. What is the coefficient of x?
4. What is the coefficient of a?

Main lesson

After getting the answers to the starter activity questions, define a polynomial.

A polynomial is an algebraic expression where coefficients are real numbers and exponents are non-negative integers.

For example: $a^3 - 5x + 7$ is a polynomial as its coefficients 1, –5, and 7 are real numbers and exponents (also called powers or degree) are non-negative integers.

Explain the degree of a polynomial by the following examples.

Polynomial in one variable:

$9a + 8$	degree = 1
$4x^2 - 3x + 1$	degree = 2
$5a^6 - 3b^2 + 1$	degree = 6

The greatest power of the variable = degree of the polynomial.

Polynomials in two or more variables will be explained by giving the following examples.

$4a + 2b^2 + ab$	degree = 2 in a and b
$x^2y^2 - 4xy + 3xy^2$	degree = 4 in x and y
$4p^3q^4 + 3pq^2 + 4q^6$	degree = 7 in p and q

The degree of any term is the sum of powers of all variables in that term.

Example 1

$14x^6y^4 = 6 + 4 = 10$

Explain with the help of an example that the degree of the polynomial is the greatest sum of the powers.

Example 2

$2x^5y^4 - 4x^3y^3 + y^8\,x^2$ the degree = 10

(5+4) (3+3) (2+2)

Explain that a linear polynomial has a degree equal to 1.

Example 3

$8a + x$, $9x + 10$

A polynomial with a degree of 2 is termed a quadratic polynomial.

A polynomial with a degree of 3 is termed a cubic polynomial.

Individual activity

Exercise 5c questions 1, 2, 3, and 4 will be done in the class. Help the students solve these.

Homework

Students will be asked to revise the work done in the class.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Operations on polynomial, addition and subtraction
Time: 2 periods

Objective:

To be enable students to: add and subtract polynomials.

Starter activity

A few questions will be written on the board and each students will be called to solve. Rest of the students with be observing the work being done. This will help students to find mistakes and give solution or help the other students.

Example

Find the sum of $3x$ and $4y$

A worksheet will be given to each student to solve.

Find the sum of the following.

a) $3a$ and $4b$

b) $2a^2$, $3a^3$ and $4a$

c) $7a - 2ab$

d) $6x, -2xy, -11x + xy$

e) $9abc$, $2cba$, and bca

f) $8x, 2y^2, 7x^2, -5y^2, -2x$

Collect the worksheet and point out the mistakes of the students.

Main lesson

After pointing out the mistakes if any, in the worksheet, start explaining the topic.

Example 1

The sum of $3x$ and $4y$ will be $3x + 4y$ because they have a different base.

We can only add or subtract the polynomial when they have the same or a common base.

$3xy - 8xy$ (xy are common)

$3xy + (-8xy)$ or $(-8 + 3)xy = -5xy$

Explain and highlight the following.

When subtracting a polynomial from the other, always change the signs of the expression which is to be subtracted.

For example subtract $3a$ from $4b$

$4b - (3a)$

$= 4b - 3a$ (base are different)

Example 2

Subtract $3a - 4b + c$ from $8a - 9b + 4c$

$(8a - 9b + 4c) - (3a - 4b + c)$

Step 1: Change the sign inside the bracket.

$8a - 9b + 4c - 3a + 4b - c$

Step 2: Collect the like terms.

$8a - 3a - 9b + 4b + 4c - c$

$= 5a - 5b + 3c$

Example 3

Find the difference between:

$3a^2b^2$ and $5a^2b^2$

difference has no sign

Therefore,

$3a^2b^2 - 5a^2b^2 = -2a^2b^2$ or $5a^2b^2 - 3a^2b^2 = 2a^2b^2$

Practice session

Write some sums on the board. Call the students turn by turn to solve the given questions on the board. Ask the rest of the class to carefully observe the solutions.

Individual activity

Give Exercise 5c questions 5 to 10 to be done in the class.

Homework

Add: $4pq - 7qr + 3rp$, $8qr - qr + 8\,ps - 8$, $-6qr + 11rp - 2\,pq$

Subtract: $6xy - 2yz + 12$ from $7x^2y^2 - 8yz$

Recapitulation

Any problem faced by the students will be discussed.

Topic: Multiplication and division of polynomials
Time: 2 periods

Objective:

To be able to multiply and divide a polynomial

Starter activities

Activity 1

As the students have learnt these topics in the previous class, a worksheet maybe given to test their knowledge.

1. Cost of a book is Rs $4b - 8x$ find the cost of 3 books.
2. Write down the product of a^2 and a.
3. Write down the continued product of $b^2 \times b^2 \times b^2$.
4. Solve these.
   a) $3a^2 \times a^2 =$
   b) $7a \times 5b \times 3c =$
   c) $8a^3 \div 2a^2 =$
   d) $5a^2 \times 3a^2 \times 2a^7 =$
   e) $7a \times 2x \times 3xy =$
   f) $18x^3y^2 \div 3xy =$

Write the correct answers on the board and ask the students to interchange their worksheets and check the answers of their peers and point out the mistakes.

Activity 2

Students have already done division on polynomials in the previous class. Solve these sums with student participation on the board.

1. Divide $9a^2$ by $3a$
2. Divide $48a^2b^2$ by $12ab$
3. 72 a^3b^2c by $6ab^2c$
4. $9a^5 - 12a^2$ by $3a^2$
5. $18x^3y^2 - 27x^5y^3$ by $3x^2y^2$

Main lesson

With the help of examples, explain multiplication and division.

Example 1

Multiply $6a^2 - 4b^3$ by $7ab$

- Multiply the numeral coefficients.
- Multiply the literal coefficients.
- Add the powers.

$7ab(6a^2 - 4b^3)$

$= 6 \times 7 \times a.a^2.b - 7 \times 4 \times a.b.b^3$ (dot represents the sign of multiplication)

$= 42\ a^{1+2}b - 28\ ab^{3+1}$

$= 42a^3b - 28ab^4$

For multiplication:
$- \times - = +$
$+ \times + = +$
$- \times + = -$

Example 2

$(y - 2z)(y^2 + 4yz - z^2)$

$y\ (y^2 + 4yz - z^2) \qquad = y^3 + 4y^2z - yz^2$

$-2z\ (y^2 + 4\ yz - z^2) \qquad = -2y^2z - 8yz^2 + 2z^3$

$= ye + 2y^2z - 9yz^2 + 2z^3$

Simplify the like terms and write the sign of the greater value.

Note: do not add the powers while adding or subtracting.

Explain the method of division of polynomials with the help of the examples on the board.

Example 1

Divide $-11x + 2x^2 + 12$ by $x - 4$

Method

Arrange the terms in a descending order. (from greater to smaller powers of their variables leaving spaces for the missing terms)

$-11x + 2x^2 + 12$

As it not arranged in descending order, first rearrange the expression.

$2x^2 - 11x + 12$

This expression cannot be solved by the short division method.

$2x - 3$

$x-4 \overline{\smash{)}\, 2x^2 - 11x + 12}$

$2x^2 - 8x$

$- \quad +$

$-3x + 12$

$-3x + 12$

$+ \quad -$

Subtract, change the sign

Divide the first term of dividend by the first term of the divisor.

$\frac{2x^{2-1}}{x} = 2x$

quotient = $2x$

Multiply $x - 4$ by $2x$ — $2x(x-4) = 2x^2 - 8x$

divide $-3x$ by $x - 3$ — $\frac{-3x}{x} = -3q$

Multiply $x - 4$ by $- 3$ — $-3(x - 4) = -3x + 12$

Example 2

Divide $x^2 + 8$ by $x + 2$

$x^2 - 2x + 4$

$x+2 \overline{\smash{)}\, x^3 + 00 + 00 + 8}$

$x^3 + 2x^2$

$- \quad -$

$-2x^2 + 00$

$-2x^2 - 4x$

$+ \quad +$

$+4x + 8$

$4x + 8$

$- \quad -$

Quotient = $x^2 - 2x + 4$

(00 for missing terms)

$\frac{x^3}{x} = x^2$

$x^2 (x + 2) = x^3 + 2x^2$

$\frac{-2x^{2-1}}{x} = -2x$

$-2x(x + 2) = -2x^2 - 4x$

$\frac{4x}{x} = 4$

$4(x + 2) = 4x + 8$

Individual activity

Exercise 5c questions 11, 12, and 13 will be done in the class. Help the students with the questions.

Homework

Give Exercise 5c, questions 14, 15, and 16 as homework.

Recapitulation

Review the unit and explain again where students are unclear on any concept.

UNIT 6 ALGEBRAIC IDENTITIES

Topic: Algebraic formula
Time: 3 periods

Objective:

To enable students to solve $(a + b)^2$ and $(a - b)^2$ through formula.

Starter activity

The students have already learnt to find the square of an algebraic expression through formulae previously. Call a few to the board to solve the following.

Find the squares of the following.

a) $(a + b)^2$ b) $(a - b)^2$ c) $(3x - 4y)^2$

d) $(5m + 6n)^2$ e) $(204)^2$ f) $(98)^2$

Help the students in recalling the steps to solve these.

Main lesson

Explain to find the perfect square of a given expression with the help of the formula (without actual multiplication).

Establishing the formula:

$$(a + b)^2 = (a + b)(a + b)$$
$$= a(a + b) + b(a + b)$$
$$= a^2 + \underbrace{ab + ab} + b^2$$
$$= a^2 + 2ab + b^2$$

square of 1st term

square of 2nd term

two times the product of the 1st and 2nd terms

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

$a(a - b) -b(a - b)$

$a^2 - \underbrace{ab - ab} +2$

$a^2 - 2ab + b^2$

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

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

It is clear that the formula on R.H.S is the sum of three terms.

Explain the above in words as, "square of the sum of two terms is always equal to the square of the first term plus twice the product of first and second terms plus the square of the second term."

Example 1

Find the square of $2a - 3b$

$(2a - 3b)^2 \quad = (2a - 3b)(2a - 3b)$

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

$= (2a)^2 - 2(2a)(3b) + (3b)^2$

$= 4a^2 - 12ab + 9b^2$

Example 2

$(5x^2 + 6y^2)^2 \quad = (5x^2 + 6y^2)\ (5x^2 + 6y^2)$

$= (5x^2)^2 + 2(5x^2)\ (6y^2) + 6y^2)^2$

$= 25x^4 + 60x^2y^2 + 36y^4$

From the above examples, we can see that it is easy to find the product of expressions by using formulae.

Example 3

Find the value of $(204)^2$

$(204)^2 \quad = (200 + 4)^2$ (split the number into two parts)

$a^2 + 2ab + b^2$

$= (200)^2 + 2(200)(4) + (4)^2$

$= 40000 + 1600 + 16$

$= 41616$

Example 4

Find the value of $(198)^2$

198 is nearest to 200 (split in two terms)

$(200 - 2)^2 \quad = (198)^2$

$(200 - 2)^2 \quad = (200)^2 - 2(200)(2) + (2)^2$

$= 40000 - 800 + 4$

$= 39204$

Example 5

Find the square of 19.9

$(19.9)^2 \quad = (20 - 9.1)^2$

$= (20)^2 - 2(20)(0.1) + (.1)^2$

$= 400 - 4.0 + .01$

$= 396.01$

Explain in detail, the formula on the board.

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

$x(x + y) - y\ (x + y)$

$= x^2 + \cancel{xy} - \cancel{xy} - y^2$

$= x^2 - y^2$

(product of sum and difference of two terms)

Example 2

$(3x + 4y)(3x - 4y)$

$(3x)^2 - (4y)^2$

$9x^2 - 16y^2$

Hence, the product of sum and difference of any two numbers is equal to the difference of their squares.

Example 3

Find the product of 43 and 37 with the help of the formula.

$43 = 40 + 3$ Split into two terms, the first and second

$37 = 40 - 3$ terms of both the numbers should be the same.

$= 43 \times 37$

$= (40 + 3)(40 - 3)$

$= (40)^2 - (3)^2$

$= 1600 - 9$

$= 159.1$

Deduction will be explained to the students by the following examples.

Example 1

$(x + \frac{1}{x})^2 = (x - \frac{1}{x})^2 + 4$

$(x - \frac{1}{x})^2 = (x + \frac{1}{x})^2 - 4$

Explanation

$(x - \frac{1}{x})^2 = x^2 - 2 + \frac{1}{x^2}$

$= x^2 + \frac{1}{x^2} - 2$

$(x + \frac{1}{x})^2 = x^2 + 2 + \frac{1}{x^2}$ or $x^2 + \frac{1}{x^2} + 2$

$(x^2 + \frac{1}{x^2} + 2) -2 -2$

$= (x + \frac{1}{2})^2 = -4$

If $x + \frac{1}{x} = 4$, find $x - \frac{1}{x}$

$(x - \frac{1}{x})^2 = (x + \frac{1}{x})^2 -4$

$= (4)^2 - 4$

$(x - \frac{1}{x})^2 = 16 - 4$

$(x - \frac{1}{x})^2 = 12$

$(x - \frac{1}{x}) = \sqrt{12}$

Example 2

If $x + \frac{1}{x} = 4$ find $x^2 + \frac{1}{x^2}$

$= x^2 + \frac{1}{x^2} = (x^2 + \frac{1}{x^2} + 2)-2$

$= (x + \frac{1}{x})^2 -2$

$= (4)^2 -2$

$= 16 - 2$

$= 14$

Example 3

Find $x^2 - \frac{1}{x^2}$ when $x + \frac{1}{x} = 4$

$x^2 - \frac{1}{x^2} = (x + \frac{1}{x})(x - \frac{1}{x})$

$= 4\sqrt{12}$

Individual activity

Exercise 6a will be given to be solved in the class.

Homework

1. Evaluate:

   a) $(301)^2$ b) $194)^2$ c) $(997)^2$ d) $(502)^2$

2. Expand each of the following by using algebraic formulae.

   a) $(2p^2 - 3q^2)\ (2p^2 + 3q^2)$

   b) $(a^2b^2 + c^2d^2)(a^2b^2 - c^2d^2)$

   c) (25)(15)

   d) (32)(28)

Recapitulation

1. What is the formula for finding the square of a number?
2. Split 56 into two terms.
3. Split 999 into the two terms.

Topic: Factorisation
Time: 2 periods

Objectives

To enable students to factorise different types of algebraic expressions and apply them to solve different problems.

Starter activity

A worksheet will be given to the students to find the factors.

Worksheet

What are the common factors of the following numbers and expressions.

1. $a - 5a$
2. $3a - 42b + 6c$
3. 72 and 60
4. $4xy + 6x - 20y$
5. $ab - ac + ad$
6. $7a - 9b + 6c$
7. $48abc - 40bc$
8. $ax + xy - xz$
9. $x - 4x + 3x$
10. $32pq - 4pq + 8$

Write the correct answers on the board so that students can check their solutions.

Main lesson

Explain that factorisation is the process in which we write an algebraic expression as a product of two or more factor.

Example 1

$ac + ad - ae$ (There are three terms in this expression and first and the last terms are not squares.)

What is common in all?

'a' is a common factor.

Divide all terms by 'a'.

$ac/a + ad/a - ae/a$

$= a(c + d - e)$

Example 2

$a^5 + a^3 + a^2$ (Find the lowest power.)

It means a^2 is common factor.

Divide all the terms by a^2

$\frac{a^{5-2}}{a^2} + \frac{a^{3-2}}{a^2} + \frac{a^{2-2}}{a^2}$ (when we divide we subtract powers)

$= a^2(a^3 + a + 1)$

a^2 is the common factor

Example 3

Factorise $ab + ac + yb + yc$

There are 4 terms given in this expression.

Is there any common factor, no.

Divide them into two groups

$(ab + ac) + (yb + yc)$

a is common: y is common

$a(b + c) + y(b + c)$

$(b + c)$ is common

$(a + y)(b + c)$

Therefore, $(a + y)$ and $(b + c)$ are the factor of the product $ab + ac + yb + yc$

Example 4

Factorise $a^2 + 6a + 9$

$a^2 + 6a + 9$

In this expression, the first and the last terms are perfect squares. This expression is a perfect square.

$\sqrt{a^2} = a$ and $\sqrt{9} = d$

Applying the formula $a^2 + 2ab + b^2$

$(a)^2 + 2(a)(3) + (3)^2$

$= (a + 3)^2$

$(a + 3)(a + 3)$ gives $a^2 + 6a + 9$

Example 5

$c^2 - 8c + 16$ (First and last terms are perfect squares.)

Apply formula $a^2 - 2ab + b^2$	$\sqrt{c^2} = c$
$= (c)^2 - 2(c)(4) + (4)^2$	$\sqrt{16} = 4$
$= (c - 4)^2$	

Example 6

Factorise $a^2 - 9$ (Here both the terms are perfect squares.)

Apply formula $(a + b)(a - b)$	$\sqrt{a^2} = a$
$= (a)^2 - (3)^2$	$\sqrt{9} = 3$
$= (a + 3)(a - 3)$	$-9 = -3 \times +3$

Individual activity

Ask the students to do Exercise 6b in their exercise books. They can work in pairs to help each other.

Homework

Factorise the following:

1. $6a^2 - 2ab + 3ac$	2. $16a^2 - 16ab + 4b^2$	3. $25a^2b^2 - 10ab + 1$
4. $25y^2 - 81z^2$	5. $ac + ad + bc + bd$	6. $49y^4 - 121z^4$

Recapitulation

Any problem faced by the students will be discussed.

Topic: Expansion of cubes in binomials
Time: 2 periods

Objectives

To enable students to:

- recognise formula such as $(a + b)^3$ and $(a - b)^3$
- apply them to solve different problems

Starter activity

Following questions will be asked.

1. What is the square of $5a$
2. What is the sum of the squares of $3a$ and $5b$?
3. What is the product of a^2 and a?
4. What is the continued product of a.a.a?
5. What do you read a^3 as?
6. Write down the cubes of 2, 3, 4, 5.

Main lesson

Find the product or expand $(a + b)^3$.

$(a + b)^3 = \{(a + b)(a + b)\}(a + b)$

$= (a + b)^2$

$= \{a^2 + 2ab + b^2\}\ (a + b)$

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

$= a^3 = 2a^2b = ab^2 + a^2b + 2ab^2 + b^3$

$= a^3 + 2a^2b + a^2b + ab^2 + 2ab^2 + b^3$

$= a^3 + 3a^2b + 3ab^2 + b^3$

Therefore, $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

i.e. cube of the sum of the binomial.

We have derived the formula $(a + b)^3$ by actual multiplication. We can now apply it to find the cube of any algebraic expression.

For $(a - b)^3$, through the actual multiplication we get:

$(a - b)^3 = \{(a - b)\ (a - b)\}\ (a - b)$

$= a^3 - 3a^2b + 3ab^2 - b^3$

Example 1

Expand $(2x + 3y)^2$

$(2x + 3y)^3 = (2x + 3y)\ (2x + 3y)\ (2x + 3y)$

Formula for $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$= (2x)^3 + 3(2x)^2\ (3y) + 3(2x)(3y)^2 + (3y)^3$

$= 8x^3 + 36x^2y + 54xy^2 + 27y^3$

Example 2

Expand $(2m - 4n)^3 = (2m - 4n)\ (2m - 4n)\ (2m - 4n)$

$= (2m)^3 - 3(3m)^2\ (4n) + 3(2m)\ (4n)^2 - (4n)^3$

$= 8m^3 - 48m^2n + 96mn^2 - 64n^3$

Example 3

Expand $(\frac{2}{a} + \frac{y}{2})^3$

$= (\frac{2}{a})^3 + 3(\frac{2}{a})^2\ (\frac{y}{a}) + 3\ (\frac{2}{a})\ (\frac{y}{a})^2 + (\frac{y}{2})^3$

$= \frac{8}{a^3} + 3(\frac{4}{a^2})\ (\frac{y}{f}) + 3(\frac{2}{a})\ (\frac{y^2}{4}) + \frac{y^3}{8}$

$= \frac{8}{a^3} + \frac{4y}{a^2} + \frac{3y^2}{2a} + \frac{y^3}{8}$

We can write this as $= \frac{8}{a^3} + \frac{y}{8} + \frac{3y}{a}\ (\frac{2}{a} + \frac{y}{2})$ as $\frac{3y}{a}$ is a common factor of $\frac{6y}{a^2}$ and $\frac{3y^2}{2a}$

Individual activity

Exercise 6c will be done in the class. Students can work in pairs to help each other.

Homework

Expand the following:

a) $(6a - 8)^3$ b) $(7a - 5b)^3$ c) $(2x + 7y)^3$

Recapitulation

Any problem faced by the students will be discussed.

UNIT 7

SIMULTANEOUS LINEAR EQUATIONS

Topic: Graph of Linear Equation
Time: 3 Periods

Objectives

To enable students to:

- recognise the gradient of a straight line
- interpret the gradient of straight line
- plot the graph of linear equations in two variables; $y = mx + c$

Starter activity

Students have already learnt about the equations of horizontal and vertical lines in Grade 7. A worksheet of graphs of vertical and horizontal lines will be given to the students to write the equations for each. Feedback will be taken to discuss the differences between horizontal and vertical lines.

Main lesson

Explain that to plot the graph of a linear equation, first we need to make a table of values for x and y of the equation.

Use examples, given on page

Use examples, given on page 119 of the textbook to explain the terms 'y-intercept' and 'gradient' of a line.

y-intercept is the value of y coordinate where the line intersects y-axis.

Gradient of a line is calculated using the formula

$$m = \frac{\text{rise}}{\text{run}}$$

or

$$m = \frac{\text{vertical change}}{\text{horizontal change}}$$

Explain example 1 on page 121.

Individual activity

Questions 2(a) and 3(a) of exercise 7a will be done in the class.

Homework

Question 2(b) and 3(b) will be assigned for homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Simultaneous equations
Time: 4 periods

Objectives

To enable students to:
- find the value of two unknowns in a problem
- recognise simultaneous linear equations in one and two variables
- use different methods to solve simultaneous linear equations.

Starter activity

Students of class VIII have some knowledge of linear equations in one variable. Write a few questions on the board and let students solve these one by one. The rest of the class will observe the solutions and point out the mistakes if any.

Some sample linear equations are given below:

1. $3x + 2 = 15$
2. $8x = 40$
3. $\frac{2x}{3} + 8 = 24$
4. $7x - 5 = 4x - 10$
5. $\frac{5x}{8} - 3 = \frac{2}{8x} + 12$

Main lesson

Explain to the students that if in an equation of two variables, the greatest degree of the variables is one, then the equation is called a linear equation in two variable

Example 1

$8x + y = 40$ is a linear equation in two variables, x and y.

Ordered pairs

Explain that if a value for x in an equation is given, a corresponding value of y can be found out.

Example 1

If $x = 2$ then the corresponding value of y would be:
$2x + y = 10$
$2 \times 2 + y = 10$
$4 + y = 10$
$y = 10 - 4$
$y = 6$

Thus, $(x, y) = (2, 6)$ is an ordered pair that satisfies the equation.

Two equations necessary for two unknowns

A set of two equal or more equations is known as simultaneous equation.

Example 2

The following are simultaneous equations.

$2x + y = 10$

$3x - 2y = 15$

There are three methods of solving these equations.
1. Substitution method
2. Elimination method
3. Graphical method

Substitution Method

Example

Solve $x + y = 4$ (i)

$x - y = 2$ (ii)

Solution

From (i) $x = 4 - y$..... (iii)

Substituting the value of x in (ii)

$x - y = 2$

$(4 - y) - y = 2$

$= \quad 4 - y - y = 2$

$= \quad y - 2y = 2$

$= \quad -2y = 2 - 4$

$= \quad -2y = -2$

$= \quad y = -\frac{2}{2}$

$y = 1$

By substituting the value of y in equation (iii)

$x = 4 - y$

$= x = 4 - 1$

$x = 3$

Therefore, {3, 1} is the solution set.

Verification

$x + y = 4 = 3 + 1 = 4$

$x - 2 = 2 = 3 - 1 = 2$

Elimination Method

In this method, the coefficient of one of the variables should be the same so that it can be eliminated.

Example

$$\begin{array}{lcll} 2x + \cancel{3y} & = & 14 & \text{(i)} \\ 2x - \cancel{3y} & = & 2 & \text{(ii)} \\ \hline 4x & = & 16 & \end{array}$$

'y' has the same coefficient with + and – sign, y can be liminated

$4x = 16$

$x = \frac{\cancel{16}^{\,4}}{\cancel{4}} = 4$

$x = 4$

Putting the value of x in equation 1 we have

$2x + 3y = 14$

$2(4) + 3y = 14$

$8 + 3y = 14$

$3y = 14 - 8$

$3y = 6$

$y = \frac{6}{3}$

$y = 2$

Hence the solution set is {4, 2}

Verification

$2x + 3y = 14 = 2 \times 4 + 3 \times 2 = 14$ (i)

$2x - 3y = 2$ $\quad$ $8 + 6 = 14$

$(2 \times 4) - (3 \times 2) = 2$

$8 - 6 = 2$

Graphical Method

In this method, graphs of both the equations are drawn on the same coordinate plane/axes. The point of intersection of the two lines is their solution. If the lines are parallel, there is no solution. However, if the equations represent the same line, the two equations have infinite solutions.

Solve and explain example 7, 8, and 9 to identify the differences.

Practice session

Students will be called turn by turn to do the given questions on the board.

a) $x - y = 5$, $x + y = 7$ $\quad$ b) $3x + y = -4$, $2x - 7y = 5$ $\quad$ c) $x + y = 13$, $3x - 5y = 7$

All parts of Exercise 7b, question 1 will be done on the board by students.

Individual work

Ex 7b, question 2 will be done individually by the students.

Homework

Solve by any method.

a) $x - 6y = 33$, $7x + 4y = 1$ $\quad$ b) $3a + b = 7$, $2a - b = 3$ $\quad$ c) $4x + 3y = 41$, $3x - 4y = 12$

Recapitulation

Any problem faced by the students will be discussed.

Topic: Real-life problems involving simultaneous equations
Time: 2 periods

Objective

To enable students to solve real-life problems.

Example

The sum of two numbers is 84. If their difference is 12, find the numbers.

Solution

Let one number be x and the other be y.

Since their sum is 84 ($x + y = 84$), the difference is 12 ($x - y = 12$)

$$\begin{array}{r} x + \cancel{y} = 84 \\ x - \cancel{y} = 12 \\ \hline 2x \quad = 96 \end{array}$$

$x = \frac{\cancel{96}^{48}}{\cancel{2}}$

$x = 48$

$x + y = 84$

$48 + y = 84$

$y = 84 - 48$

$y = 36$

The two numbers are 48 and 36.

Verification

$48 + 36 = 84$

$48 - 36 = 12$

Example 1 of sub-section 7.5 from the textbook will also be explained to the students.

Individual work

Exercise 7b, question 4 to 6 will be done in the class. Help the students in solving the problems.

Homework

Following questions will be given as homework.

1. Four times the sum of two numbers is 72 and their difference is 8. Find the numbers.
2. The length of a rectangle is 7 cm more than its breadth. If the perimeter is 74 cm, find the length and breadth of the rectangle.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Linear Inequatlities
Time: 1 period

Objectives

To enable students to:
- solve linear inequalities
- represent the solution of linear inequality on the number line.

Starter activity

Students already know how to solve linear equations in one variable. Give linear equations to the students to solve them.

Take feedback from them to discuss how they solved the equations.

Main lesson

Take any one equation from the equation you gave for starter activity and replace the '=' sign with '<' sign. Now explain the difference between equation and inequalities.

Give example from the book and explain the propertites of linear inequalities.

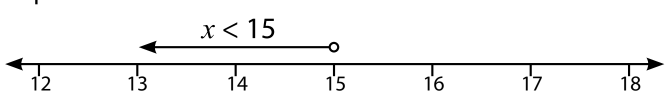
Example 1

Solve $x + 5 < 20$

Subtract 5 from both the sides.

$x < 15$

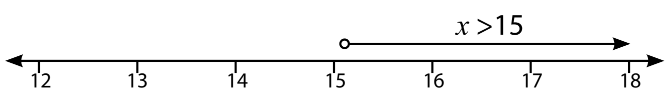
Represent this solution on number line as follows.



Example 2

Solve $x + 5 > 20$

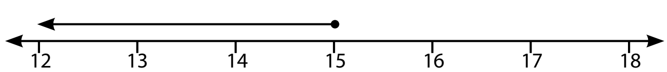
$x > 15$



Example 3

Represent

$x \leq 15$ on a number line.



Use a closed/solid circle for ≤ and ≥.

Example 4

Solve

$2x < 8$

divide both the sides by 2

$x < 4$

Example 5

Solve

$-2x < 8$

divide both the sides by -2

$x > 8$

Explain to the students that if both sides are multiplying and dividng by a negative number the inequality sign will be flipped. $<$ becomes $>$, $>$ becomes $<$, $\leq$ becomes $\geq$, and $\geq$ becomes $\leq$.

Practice session

Students will be called turn by turn to solve the following question on board.

a) $x - 7 \geq 23$ b) $3x < 24$ c) $5 - 4x$ d) $\frac{6}{5}x \geq 6$

Individual activity

Question 1a and b of Exercise 7c will be done in the class. Question 2 for question 1 (a,b) will also be done.

Homework

Give the rest of the questions of Exercise 7c for homework.

Recapitulation

Any problem faced by the students will be discussed.

UNIT 8 MENSURATION

Topic: Area and volume; Pythagoras theorem
Time: 3 periods

Objectives

To enable students to:
- state the Pythagoras theorem
- find the sides of right-angled triangle or any triangle by applying the formula

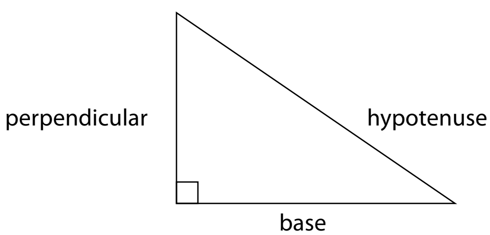
Starter activities

Activity 1

1. What is the area of the square if the sides are given as:
   a) 5 cm b) 3.4 cm c) 7 cm
2. What is the measure of the sides of a square if the area is:
   a) 49 cm^2 b) 2.5 cm^2 c) 81 cm^2
3. What is the perimeter of a square with a side of 2.5 cm?
4. Is the diagonal of a square equal to its sides?
5. How many right-angled triangles can be formed in a square when a diagonal is drawn?

Activity 2

Draw a right-angled triangle on the board and ask the students to label its elements.

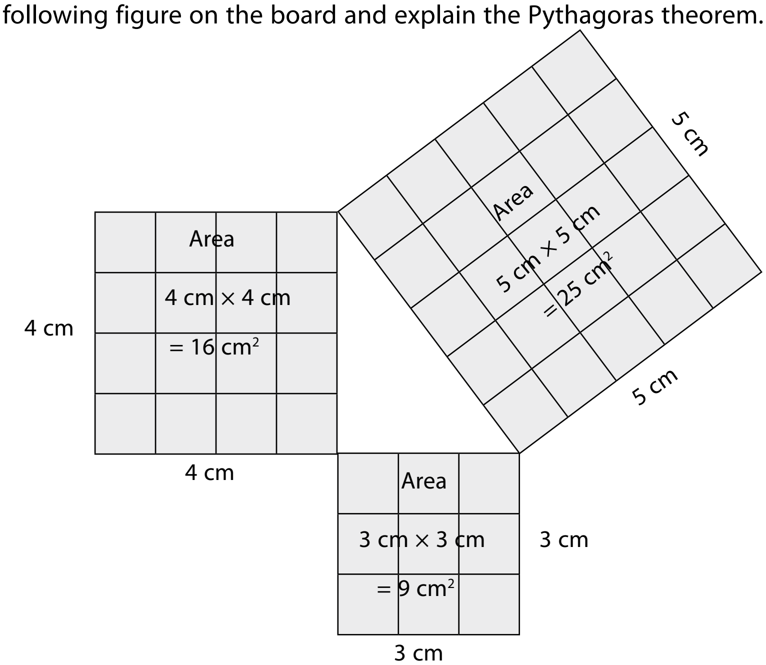


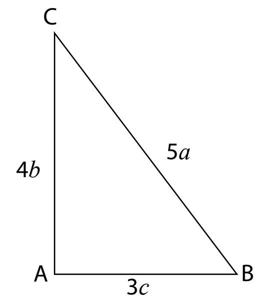
Answer the following questions.

1. Are all the sides of a right-angled triangle equal?
2. What is the longest side called?
3. Is the sum of other two sides equal to the measure of the hypotenuse?

Main lesson

Draw the following figure on the board and explain the Pythagoras theorem.





1. A right-angled triangle ABC in which mAB = 3 cm, AC 4 cm and BC = 5 cm will be constructed on the board.
2. On each side of the triangle, a square will be drawn. On side AB, a square of side 3 cm, on AC, a square of side 4 cm and, on BC, a square of side 5 cm.
3. Area of each square will be found out.
   $3\text{ cm} \times 3\text{ cm} = 9\text{ cm}^2$, $4\text{ cm} \times 4\text{ cm} = 16\text{ cm}^2$, $5\text{ cm} \times 5\text{ cm} = 25\text{ cm}^2$
   Explain that the square formed at the hypotenuse is no greater than the squares at the other two sides.

Example 1

In a right-angled triangle ABC, find the third side if the hypotenuse c = 15 cm and side b = 9 cm.

We have to find side a.

$\therefore c^2 - b^2 = a^2$

(hyp) (perp) (base)

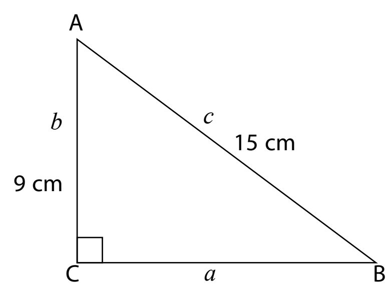
$(15)^2 - (9)^2 = (\text{base})^2$

$225 - 81$

$144 = a^2$

or $a = \sqrt{144}$

$\therefore a = 12$ cm



Example 2

Find c when a = 9 cm, b = 12 cm (right angle at c)

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

$(c)^2 = (9)^2 + (12)^2$

$(c)^2 = 81^2 + 144^2$

$(c)^2 = 255$

$c = \sqrt{225}$

$c = 15$ cm

Now add the area of the squares of the other two sides.

$9\text{ cm}^2 + 16\text{ cm}^2 = 25\text{ cm}^2$

From this activity we find that the area of the squares of the other two sides is equal to the area of the square at the hypotenuse which is 25 cm^2.

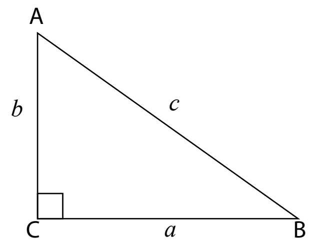
$9\text{ cm}^2 + 16\text{ cm}^2 = 25\text{ cm}^2$ or

$(\text{hypotenuse})^2 = (\text{perpendicular})^2 + (\text{base})^2$

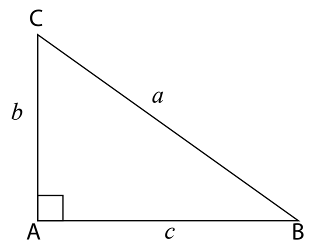
Pythagoras theorem states that 'in any right-angled triangle, the area of the square of the hypotenuse is equal to the sum of the squares of the other two sides.'

Explain that in the right-angle triangle ABC, if we denote the opposite sides of the vertices ABC by a, b and c respectively then according to this proposition,

$c^2 = a^2 + b^2$
$a^2 = c^2 - b^2$
$b^2 = c^2 - a^2$



and if the right angle is at 'A' then,
$(a)^2 = (b)^2 + (c)^2$
$(c)^2 = (a)^2 - (b)^2$
$(b)^2 = (a)^2 - (c)^2$



Explain the solved examples on page 138 of the textbook.

Individual activity

Give Exercise 8a to be done individually by each student. Help them solve it.

Students can be called turn by turn to solve these on the board with the rest of the class observing.

Homework

In the right-angled triangle ABC, right-angled at c, find the third side when the other two are given.

1. If $b = 16$ cm and $c = 20$ cm find a.
2. If $a = 15$ cm and $b = 5\sqrt{3}$ find c.

Give questions 9 and 10 of Exercise 8a as homework.

Recapitulation

Any problem faced by the students will be discussed.

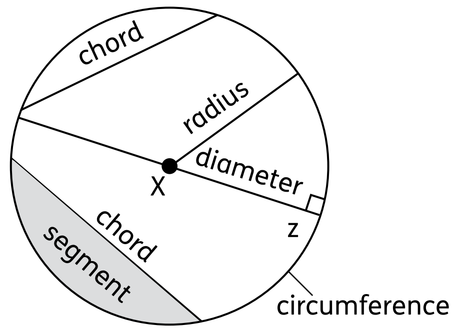
Topic: Circle
Time: 1 period

Objective:

to enable students to describe terms such as sector, secant, chord of a circle, cyclic points, tangent to a circle and concentric circles

Starter activity

Students have learnt about the circle previously. Ask them to draw a circle of radius 4 cm and show its diameter, radius, chord, radial segment, and circumference.



Fill in the blanks:

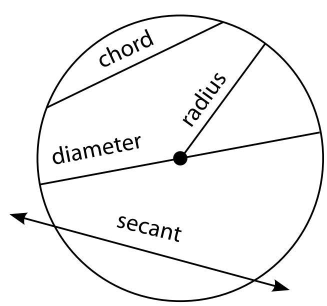
1. A ___________ divides the circle into parts.
2. ___________ the circle is called semicircle.
3. Outline of the circle is called ___________.
4. Part of a circumference is called ___________.
5. ___________ is a line segment joining the two points of a circle.
6. Half the diameter is called ___________.
7. The value of π (pi) = ___________

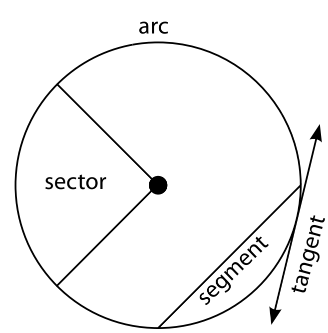
Main lesson

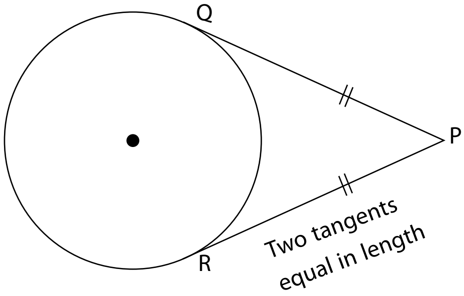
Explain to the students that apart from the parts they have labeled, there are other parts which are as important.

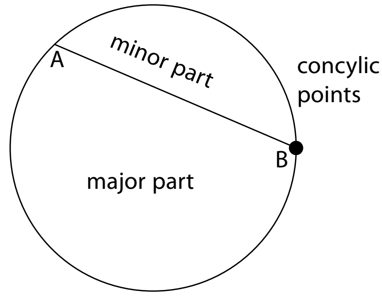
Draw a circle on the board to explain the following parts:

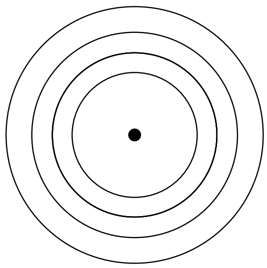
arc, sector, secant, tangent, concyclic points, and concentric circles



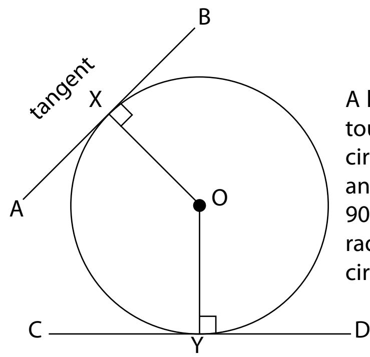








Circles with the same centre but different radii are called concentric circles.



A line that touches a circle makes an angle of 90° with the radius of the circle.

Individual activity

1. Students will be asked to copy the diagrams from the board and label them neatly and define the following:
   a. secant b. diameter c. tangent
   d. concyclic points e. concentric circle
2. Give some examples of concentric circles from real-life.

Homework

Revise the properties of a circle.

Recapitulation

Ask questions to reinforce the concepts.

1. What is a circle?
2. Which is the longest chord of a circle?
3. How many lines can be drawn from a point of circumference of a circle?

Topic: Arc length and area of a sector
Time: 1 Period

Objectives

To enable students to calculate the arc length and the area of sector of a circle.

Starter activity

Make groups of 4 students.

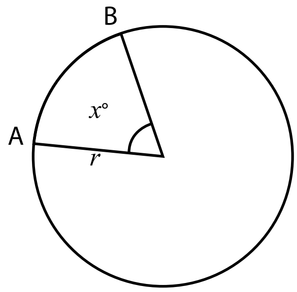
Have students discuss different parts of a circle in their groups. Ask them to explain one to the whole class.

Main lesson

Explain to the students the formulae to find out the arc length and area of a sector.

arc length = $\frac{x^\circ}{360^\circ} = 2\pi r$

sector area = $\frac{x^\circ}{360^\circ} = \pi r^2$



Explain the important terms such as, central angle, sectors, major and minor arc, etc.

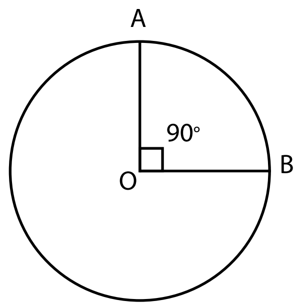
Example 1

Find the arc length of a circle with central angle 60° and radius 6cm.

$$\begin{aligned}\text{arc length} &= \frac{x^\circ}{360^\circ} = 2\pi r \\ &= \frac{60^\circ}{360^\circ} = 2 \times 3.14 \times 6 \\ &= 6.28 \text{ cm}\end{aligned}$$

Example 2

Find the area of sector AOB.



$$\begin{aligned}\text{sector area} &= \frac{x^\circ}{360^\circ} = \pi r^2 \\ &= \frac{90^\circ}{360^\circ} \times 3.14 \times 9^2 \\ &= 63.585^2\end{aligned}$$

Topic: Volume of Surface Area of Pyramid
Time: 2 Periods

Objectives

To enable students to calculate the volume nd surface area of pyramid

Starter Activity

Ask students to share what they know about the Egyptian Pyramids. Discuss the shape of a pyramid by drawing its labelled figure on the board.

Main lesson

Explain the method of calculating volume and surface area of pyramids using the following formulae.

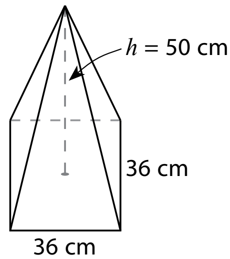
Volume of a pyramid = $\frac{1}{3}$ × base area × height

where base area depends on the shape of the base of the pyramid.

Total surface area of a pyramid = Sum of areas of all its surfaces

Example 1

Find the volume of the given pyramid.



Volume of a pyramid $= \frac{1}{3} \times \text{base area} \times \text{height}$

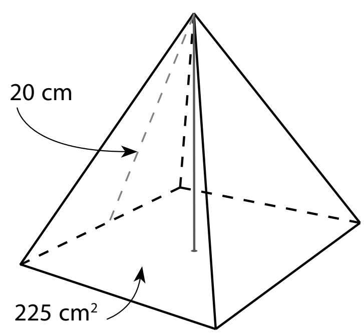
$= \frac{1}{3} \times (36 \times 36) \times 50$

$= \frac{1}{\cancel{3}} \times \overset{12}{\cancel{36}} \times 36 \times 50$

$= 21\,600 \text{ cm}^3$

Example 2

Find the surface area of a square pyramid with a base area of 225 cm^2 and a slant height of 20 cm.



Base area = 225 cm^2

One side of the base $= \sqrt{225} = 15$ cm

Area of the triangular face $= \frac{1}{2} \times 15 \times 20$

$= 150 \text{ cm}^2$

Total area of 4 triangular faces $= 150 \times 4$

$= 600 \text{ cm}^2$

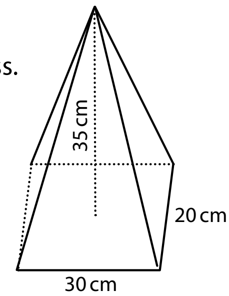
Total area of the pyramid $= 600 + 225$

$= 825 \text{ cm}^2$

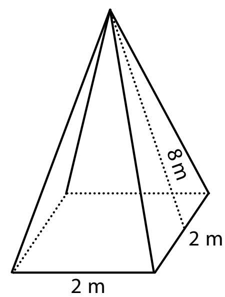
Individual activity

The following questions will be done in the class.

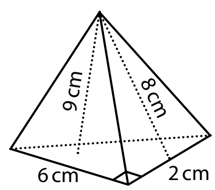
1. Find the volume of the given pyramid.



2. The volume of a square based pyramid is 100 m^3. The length of its square base is 5 m. Find its height.
3. Draw the net of the given pyramid and find out its total surface area.



4. Find volume and surface area of the given pyramid

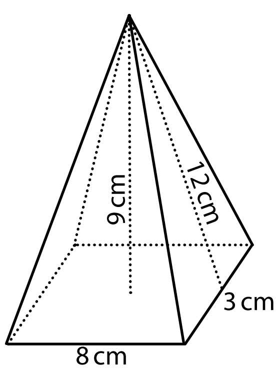


Homework

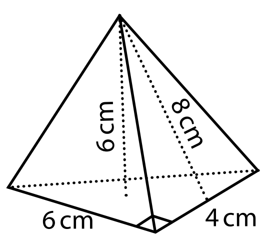
The following question will be given for homework.

1. Find the total surface area of a pyramid with square base of length 14 cm. Its slant height is 17 cm.
2. Draw the nets and calculate volume and surface area of the following pyramids.

a)



b)



Recapitulation

Any problem faced by the students will be discussed.

Topic: Surface area and volume of a Cone and a Sphere
Time: 2 periods

Objective:

to enable students to find the surface area and volume of sphere and cone.

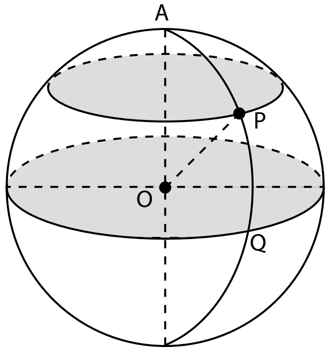
Starter activity

1. Give some examples of spheres and cones that are found in real-life.

   A cricket ball, football, world globe, soccer ball, and a golf ball are some examples of a sphere.
2. Is a Rs 5 coin a sphere?
3. How many faces do a sphere has?
4. Does it have a flat surface?

Main lesson

Explain to the students with the help of a football that a sphere is a solid figure generated by the complete rotation of a semi-circle around a fixed diameter.



The radius of the semicircle is the radius of the sphere.

OP = OA = OB

The surface area of the sphere is the surface that can be touched.

The surface area of a sphere is given by:

Surface area $= 4 \pi r^2$

$= 4 \times \frac{22}{\cancel{7}} \times \overset{3}{\cancel{21}} \times 21$

$= 5544 \text{ cm}^2$

Volume $= \frac{4}{3} \pi r^3$

$\frac{4}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$

$= 38808 \text{ cm}^3$

$\pi = \frac{22}{7}$ or

Example

Find the surface area and volume of a sphere whose radius is 21 cm.

Surface are $= 4 \pi r^2$

$= 4 \times \frac{22}{7} \times 21 \times 21$

$= 5544 \text{ cm}^2$

Volume $= \frac{4}{3} \pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$

$= 38808 \text{ cm}^3$

Explain all the examples given in the textbook by drawing figures on the board.

Individual activity

Exercise 8c Questions 1(a-f),2, 3, 5, 7, 8, 9, 10, 11 as classwork.

Homework

Complete Exercise 8c for homework.

Recapitulation

Any problem faced by the students will be discussed.

UNIT 9 GEOMETRY

Topic: Construction of Triangles
Time: 2 periods

Objectives

To enable students to construct triangles when:
- three sides are given (SSS)
- two sides and the included angles are given (SAS)
- two angles and side are given (ASA)
- the hypotenuse and one side is given of a right triangle.

Starter activities

A triangle will be drawn on the board and the students will be asked to answer the questions.
- How many sides does a triangle have?
- How many angles does a triangle have?
- What is the sum of all the angles of a triangle?
- What are the elements of a triangle?
- What is the hypotenuse?

Main lesson

Construction of a triangle, when sides, side angle side (SAS), and two angles and a side (ASA) are given, will be explained on the board.

They will be shown how to draw a plan or rough diagram before constructing a triangle.

Practise session

The students will be asked to construct an equilateral triangle and an isosceles triangle using their own measurements.

Individual work

Exercise 9a will be given to solve in class.

Recapitulation

Any problems faced by the students will be discussed.

Topic: Construction of quadrilaterals
(square, rectangle, parallelogram, rhombus and kite
Time: 2 periods

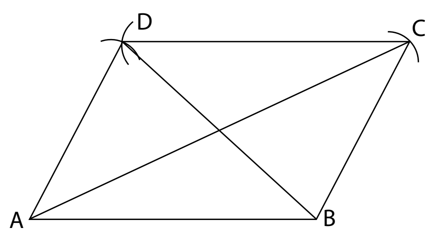
Objective

To enable students to construct and write the steps of constructing quadrilaterals.

Starter activity

Draw a quadrilateral on the board and ask the students to define the following:
i) adjacent angles ii) adjacent sides iii) diagonals.

Main lesson



Explain with the help of the figure.

A simple closed two-dimensional figure bounded by four line segments is called a quadrilateral.

If A, B, C, and D are four coplanar points such that no three of them are collinear, the union of segments $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{AD}$ is called a quadrilateral. It is denoted by □ ABCD or Quad ABCD.

Vertices:

The common end points of the line segments are called its vertices. A, B, C and D are the four vertices.

Angles:

∠A, ∠B, ∠C, and ∠D, are the four angles of □ ABCD.

Opposite angles:

∠A, and ∠C, ∠B, and ∠D, are pairs of opposite angles.

Diagonals:

The line segments joining the opposite vertices of a quadrilateral are called its diagonals. $\overline{AC}$ and $\overline{BD}$ are the diagonals of □ ABCD.

Sides:

The line segments, $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{AD}$ are called its sides.

Opposite sides:

$\overline{AD}$ and $\overline{BC}$, $\overline{AB}$ and $\overline{CD}$ are the pairs of opposite sides.

Adjacent sides:

Two sides of a quadrilateral are called adjacent if they have a common end point. It the above figure, $\overline{AB}$ and $\overline{BC}$ are adjacent sides.

Adjacent angles or (Consecutive angles):

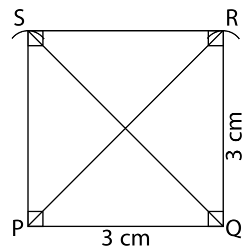
Two angles of a quadrilateral are adjacent if they have a common arm. ∠A and ∠B, ∠B and ∠C, ∠C and ∠D, ∠D and ∠A are the pairs of adjacent angles.

Sum of all the angles of a Quadrilateral is equal to 360°.

The following are the types of quadrilaterals.
1. parallelogram
2. rectangle
3. square
4. rhombus
5. trapezium

Explain the construction of a square with the help of its properties.

Example



Construct a square PQRS when mPQ = 3 cm.

Properties of a square

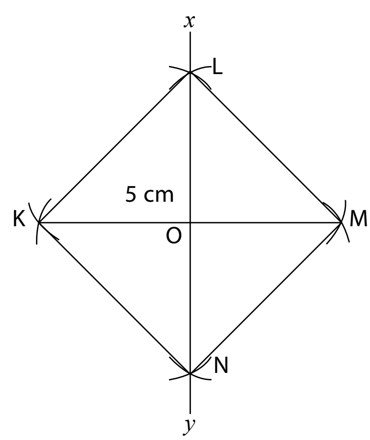
1. All sides are equal.
2. All angles are right angles.
3. The diagonals are equal and bisect each other.

Steps of construction

1. Draw a line segment PQ of 3 cm.
2. At P and Q, construct a right angle (90°).
3. With P and Q as the centre with radius 3 cm, draw arcs to cut PY at S and QX at R. Join R and S.

PQRS is the required square.

Construction of a square when its diagonal is given.



Construct a square KLMN when mKM = 5 cm.

First draw a plan or a rough figure.

Given KM = 5cm

KM = LN

Steps of construction

1. Draw a line segment KM of 5 cm.
2. Bisect KM with the help of a compass.
3. Join the arcs X and Y to get the midpoint O.
4. With O as the centre and the radius half of 5 cm i.e. 2.5 cm,
5. draw 2 arcs to cut OX at L and OY at N.
6. Join K to L, L to M, M to N and N to K. Measure the sides, they are equal.

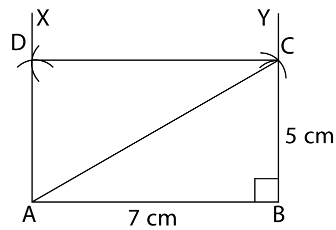
KLMN is the required square.

Construction of a rectangle

Explain with the help of a compass and a ruler on the board.

Case 1: Construction of a rectangle when 2 sides are given

Construct a rectangle ABCB where AB = 7 cm, mBC = 5 cm.

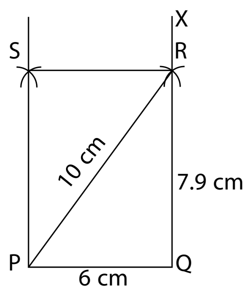


Steps of construction

1. Draw $\overline{AB}$ = 7 cm
2. Construct ABY = 90°
3. With radius 5 cm and with B as the centre draw an arc cutting $\overline{BY}$ at C.
4. With C as the centre and radius = 7 cm draw an arc.
5. With A as the centre and radius = 7 cm, draw another arc cutting the previous arc at D. Join BC, CD, and AD. ABCD is the required rectangle.

Case 2: Construction of a rectangle when the diagonal and one side is given

Construct a rectangle PQRS when m$\overline{PR}$ =10 cm and m$\overline{PQ}$ = 6 cm and given that:



opposite sides are equal and parallel diagonals are equal and bisect each other and they do not bisect the interior angles

Steps of construction

1. Draw PQ = 6 cm
2. Construct ∠PQX =90°
3. With P as the centre and a radius 10 cm draw an arc to cut $\overleftrightarrow{QX}$ at R.
4. With R as the centre and radius = 6 cm (opposite sides equal) draw an arc.
5. With P as the centre and radius equal to $\overleftrightarrow{QR}$, draw another arc to cut the previous arc at S. Join RS and SP, PQRS is the required rectangle.

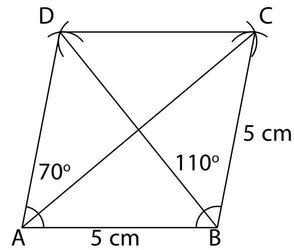
Construction of a rhombus

Case 1: When one side and angle is given

Construct a rhombus ABCD when AB = 5 cm and ∠B = 110°

All sides are equal.

Steps of construction



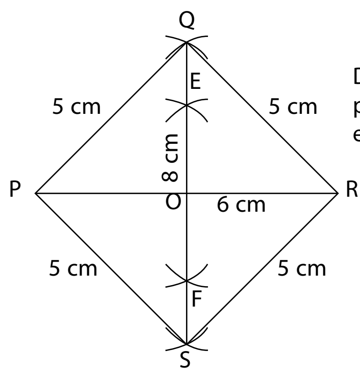
1. Draw $\overline{AB}$ = 5 cm
2. Draw angle ABx = 110°
3. With B as the centre and a radius of 5 cm, draw an arc to cut Bx at C.
4. With C as the centre and a radius of 5 cm, draw an arc.
5. With A as the centre and with the same radius, draw another arc to cut the previous arc at D. Join C to D and D to A.

   ABCD is the required rhombus.

Case 2: When the measure of two diagonals is given

Diagonals are perpendicular to each other.

Construct a rhombus PQRS,
when mPR = 6 cm mQS = 8 cm



Diagonals are perpendicular to each other.

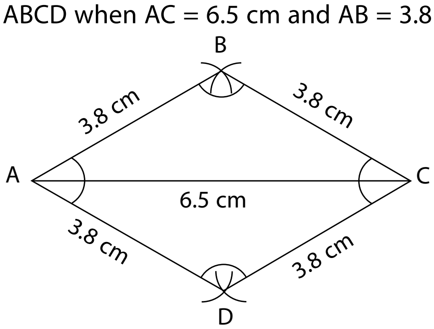
Steps of construction

1. Draw $\overline{PR}$ = 6 cm
2. Draw $\overleftrightarrow{EF}$ right bisectors of $\overline{PR}$.
3. With O as the centre and radius half of the other diagonal i.e., 4 cm, draw two arcs to cut $\overrightarrow{OE}$ at Q and $\overrightarrow{OS}$ at S.
4. Now join P to Q, Q to R, R to S, and S to P.

   PQRS is the required rhombus.

Case 3: When one side and diagonal are given

Construct a rhombus ABCD when $\overline{AC}$ = 6.5 cm and $\overline{AB}$ = 3.8 cm



All sides of a rhombus are equal. Diagonals bisect its interior angles.

Steps of construction

1. Draw $\overline{AC}$ = 6.5 cm.
2. With A as the centre and radius 3.8 cm, draw an arc on either side of $\overline{AC}$.
3. With C as the centre and radius 3.8 cm, draw an arc on either side of $\overline{AC}$ to cut the previous arc at B and D.
4. Join A to B, B to C, C to D, and D to A.

   ABCD is the required rhombus.

Practice session

Construct squares with diagonals as given below. Measure its sides.

a) 10 cm b) 8.4 cm

Individual activity

1. Construct a square where the diagonals measure 6 cm. Find its side by the Pythagoras theorem and verify it by measuring the constructed square.
2. Construct a rhombus PQRS when mPQ = 5 cm, m $\angle$P = 70°
3. Construct a rhombus ABCD when mAC = 6 cm, BD = 4 cm
   Measure the sides for each case.
4. Construct and write the steps of construction of rectangles with the following measures.
   a) 6 cm and 4.5 cm b) 5 cm and 3.5 cm
5. Construct and write the steps of construction.
   a) Rectangle PQRS when $\overline{QS}$ = 8 cm and $\overline{PQ}$ = 5 cm.
   b) Rectangle ABCD when $\overline{AC}$ = 10 cm, $\overline{BD}$ = 7 cm.

Homework

Selected questions from Exercise 9b will be given as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Construction of a parallelogram

Time: 1 period

Objectives

To enable students to construct a parallelogram when:

- its two diagonals and the angle between them are given
- two adjacent sides and the angle between them are given and
- to enable them to understand the properties of a parallelogram.

Main lesson

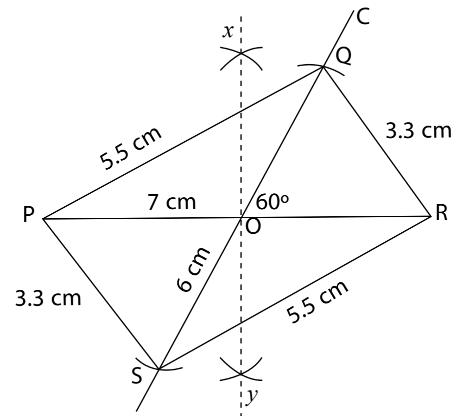
Explain with an example on the board.

Case 1: Construct a parallelogram PQRS where $\overline{PR}$ = 7 cm and $\overline{QS}$ = 6 cm and the included angle is 60°. Measure its sides.

The students should first know the properties of a parallelogram as then it becomes easier to follow the construction.

- Opposite sides are equal and parallel.
- Opposite angles are equal.
- Each diagonal bisects the parallelogram.

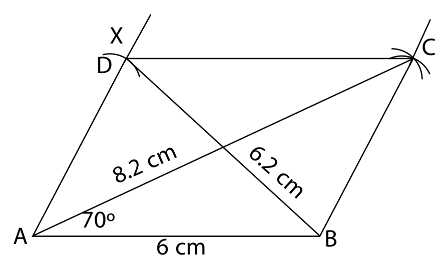
Steps of construction



1. Draw PQ = 7 cm and draw its perpendicular bisector XY to get the midpoint O.
2. At O, make an angle COR = 60° and produce it both ways.
3. With O as the centre and a radius half of the other diagonal i.e. 3 cm, draw arcs cutting $\overrightarrow{OC}$ and $\overrightarrow{OD}$ at Q and S respectively.
4. Join QR, RS and S
5. PQRS is the required parallelogram.

Case 2: Construction of a parallelogram when two adjacent sides and the angle between them are given

Construct a parallelogram ABCD where AB = 6 cm, BC = 45 cm and ∠A = 70°. Measure the diagonals and write the steps of construction.



Steps of construction

1. Draw $\overleftrightarrow{AB}$ = 6 cm.
2. Draw ∠XAB = 70°
3. With A as the centre and a radius = 4.5 cm, draw an arc cutting the arm AX at D.
4. With D as the centre and a radius = 6 cm, draw an arc.
5. With B as the centre and a radius = 4.5 cm, draw another arc cutting the previous arc at C.
6. Join AB, BC, CD, and DA.

   ABCD is the required parallelogram.

Individual activity

Construct the following parallelograms and write the steps of construction.

1. ABCD, when $\overline{AB}$ = 5 cm, $\overline{BC}$ = 6 cm –B = 110°
2. KLMN, when $\overline{KL}$ = 7 cm, $\overline{KN}$ = 5.5 cm and ∠K = 65°
3. ABCD, when $\overline{AC}$ = 8 cm, $\overline{BD}$ = 6.4 cm and the included angle = 75°

Homework

Draw the following parallelograms.

1. PQRS, $\overline{PR}$ = 6 cm, $\overline{QS}$ = 8 cm and the included angle = 70°
2. EFGH when $\overline{EF}$ = 6 cm, ∠F = 115°, $\overline{FG}$ = 4 cm

Give questions from Exercise 9b as homework.

Recapitulation

Any problem faced by the students will be discussed.

Topic: Construction of a kite
Time: 1 period

Objectives

To enable students to:
- construct a kite
- differentiate between a kite and other quadrilaterals.

Starter activity

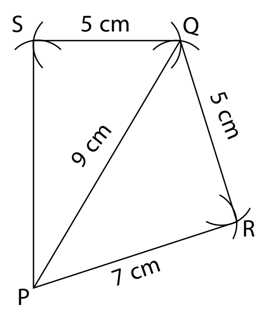
Show a kite and discuss its properties.

Main lesson

Explain the construction of a kite on the board with the help of a compass and a ruler.

Construct a kite when the two unequal sides are 5 cm and 7 cm each and one of the diagonal is 9 cm.

Sides = SQ = QR = 5 cm
Side = SP = PR = 7 cm
Diagonal PQ = 9 cm



Steps of construction

1. Draw PQ = 9 cm.
2. With P as the centre and a radius = 7 cm, draw arcs on either sides of PQ.
3. With Q as the centre and a radius 5 cm draw arcs to cut the previous arcs at R and S.
4. Join PR, RQ and QS and SP.

PRQS is the required kite.

Individual activity

Construct the kites with the following measurements and write the steps of construction.

1. diagonal 8 cm, sides = 4 cm, 7 cm
2. diagonal 9 cm, 4.5 cm, 6 cm

Topic: Congruent and similar shapes
Time: 2 periods

Objectives

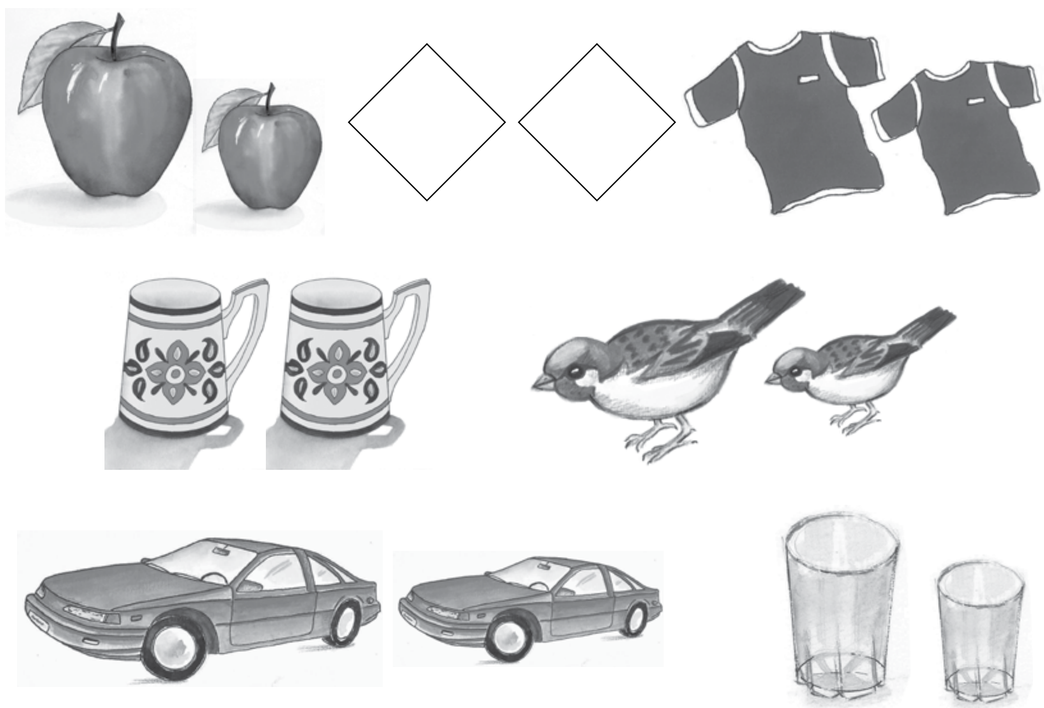
To enable students to:

- identify congruent figures
- identify similar figures
- apply properties of congruency to prove the congruency of two triangles
- similarity of two figures under given conditions
- solve problems involving congruency and similarity in daily life situations

Starter activity

Activity 1

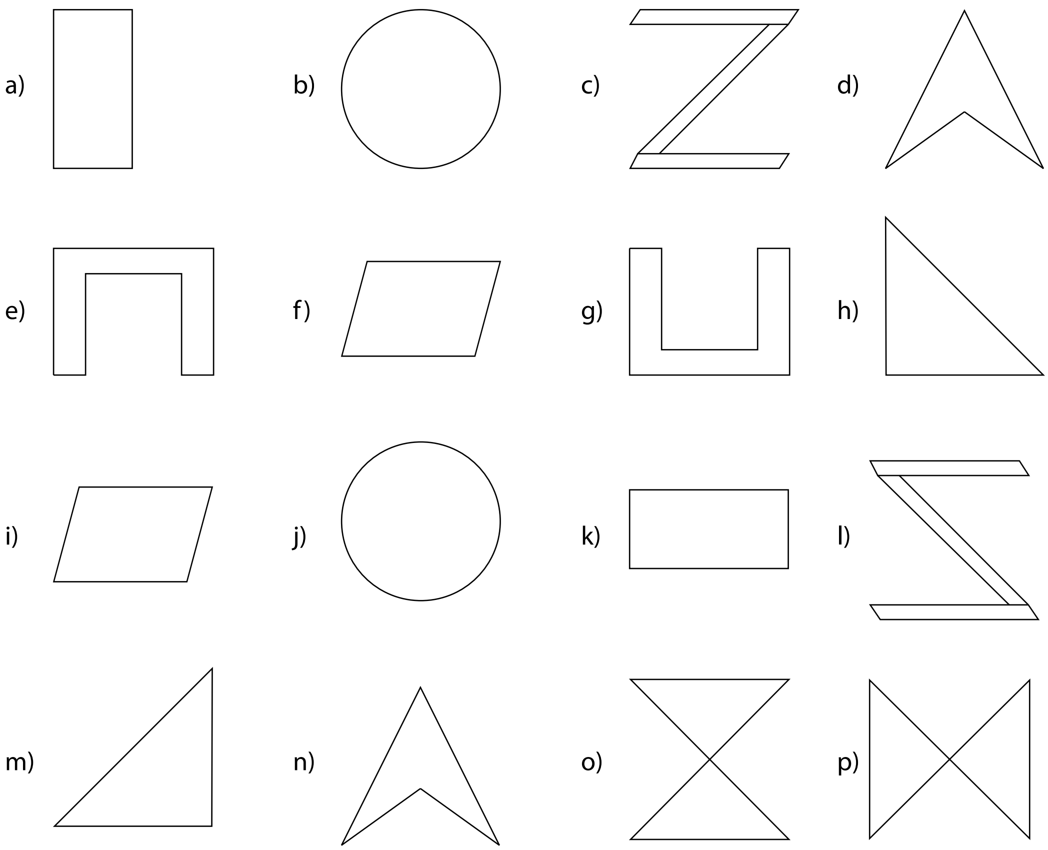
Display charts with pictures of congruent and similar objects and ask questions.



1. Which pairs of the figures have the same size?
2. Which pairs of pictures look alike?
3. If two shapes have the same size, what do we call them?
4. What do we call two objects which look alike?

Activity 2

Give a worksheet with pictures of similar and congruent shapes and ask the students to separate them and draw them in their respective columns.



Main lesson

Using textbook pages 114 and 115, give the definitions of congruent and similar shapes (in particular triangles), the elements of a triangle, (3 sides + 3 angles) and properties of congruent triangles.

Congruency cases will be explained with examples.

Case 1: side/side/side property (SSS)

Case 2: angle/angle/side property (AAS)

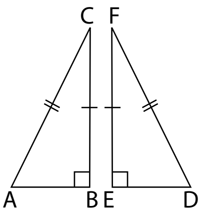
Case 3: side/angle/side property (SAS)

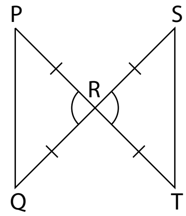
Case 4: right/angle/hypotenuse and side (RHS)

Symbols used to denote congruency and similarity properties of congruency will be verified by making the students construct the triangles practically.

Practice session

By using the properties of the SSS, SAS, AAS and RHS, state whether a congruency property is present in each pair. Study the figure and find the values of x and y.

a)


b)


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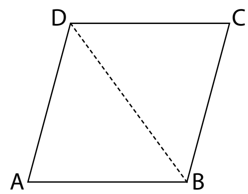

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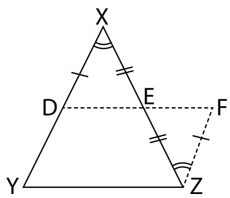

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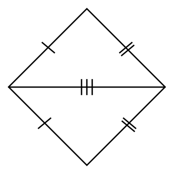

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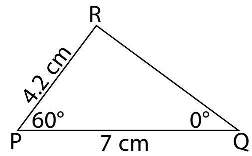

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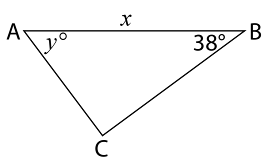

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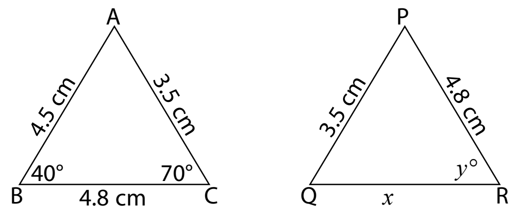


Individual work

Give Exercise 10b from the textbook to be done in the class.

Verify the properties by constructing the triangles and superimposing them.

Verification of the other geometrical properties of triangles as given in examples on pages 116 and 118 of the textbook will be worked out.

Homework

Give exercise 10b, questions 7 to 14 as homework.

Recapitulation

- What is a triangle?
- How many elements does it have?
- What is the sum of the angles of a triangle?
- What are the conditions necessary for two triangles to be congruent?
- State two cases proving that two triangles are congruent.
- Discuss the areas of difficulty of the students.
- A short test should be conducted to check the understanding of the students.

Topic: Transformation
Time: 3 period

Objectives

To enable students to
- rotate an object and find the centre of rotation by construction
- enlarge a figure and find the centre and scale of factor of enlargement

Starter activity

Divide the class into groups of 4 students. Ask groups to discuss congruence and similarity of various 2D shapes and write down the important points.

Take feedback from each group to recall the properties.

Main lesson

Link the discussion with enlargement and rotation of 2D shapes.

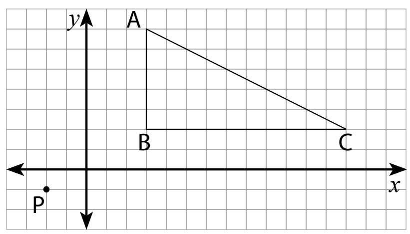
Draw a square on the board. Write down its dimensions as well. Make a dot at its centre and explain the steps to draw its enlargement with scale factor 3.

Explain example 1 from the book.

Draw a triangle and explain how this triangle can be rotated about a centre and how to find the centre of rotation by construction.

Example

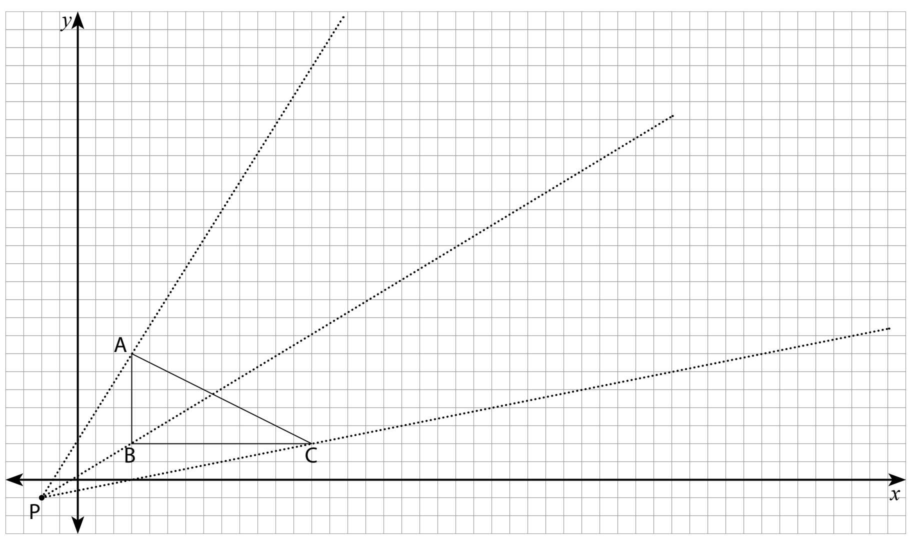
Enlarge triangle ABC from centre of enlargement P, with scale factor 3.



Draw guidelines from the centre of enlargement to each vertex of the triangle and produce it further.

Measure the lengths from P to each vertex A, B, and C.

$\overline{PA} = 30$ mm, $\overline{PB} = 15$ mm, and $\overline{PC} = 45$ mm



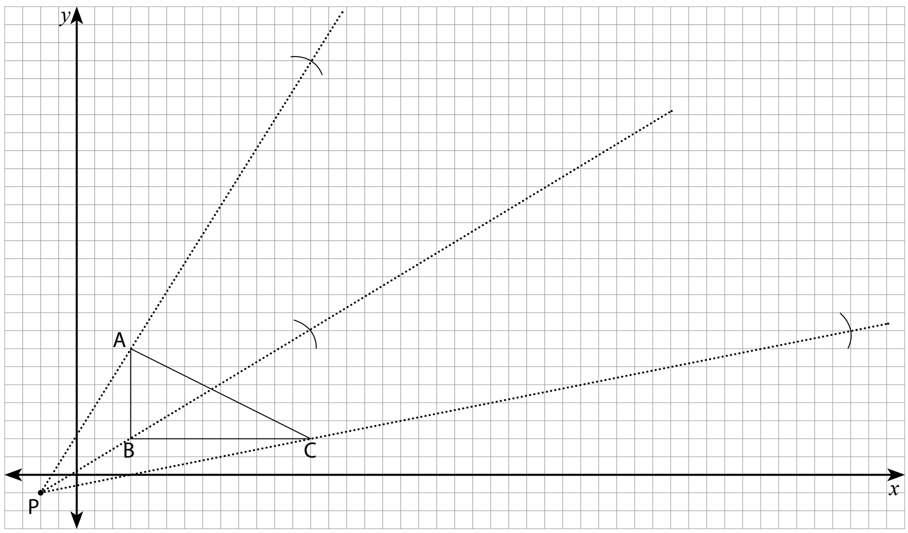
Apply scale factor to each measurement and get the measurements of new enlarged image.

$\overline{PA'} = 30 \times 3 = 90$ mm

$\overline{PB'} = 15 \times 3 = 45$ mm

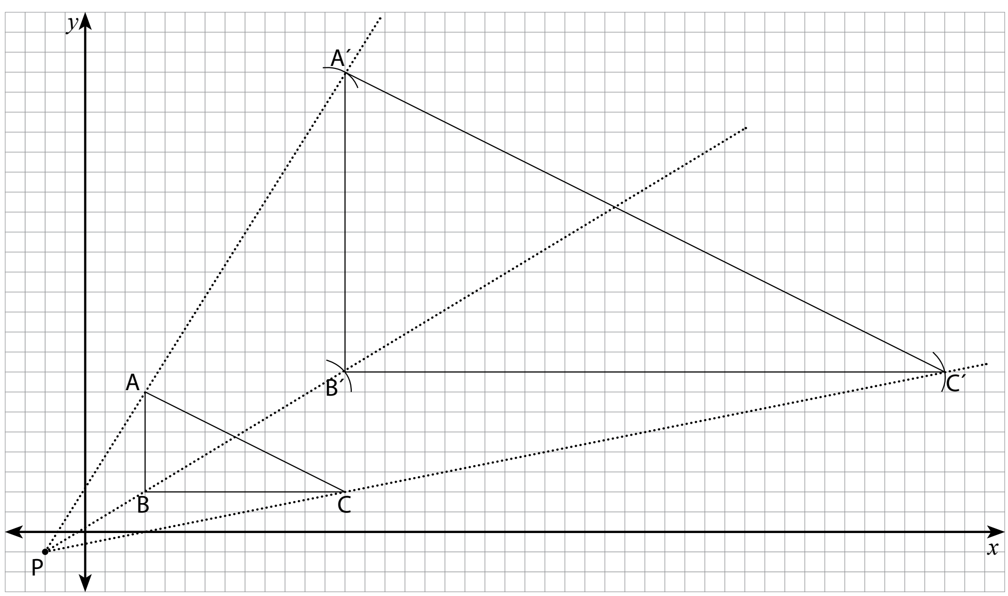
$\overline{PC'} = 45 \times 3 = 135$ mm

Use your compass to mark the points A′, B′, and C′ with the above calculated lengths.



Join A′ to B′, B′ to C′, and C′ to D′, to make the enlarged image.

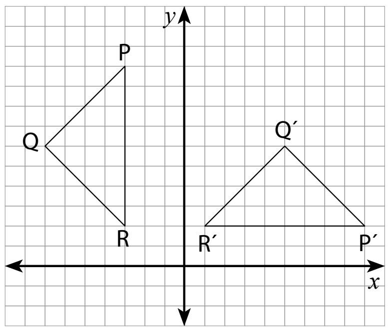
Triangle A′B′C′ is the enlarged image.



Rotation

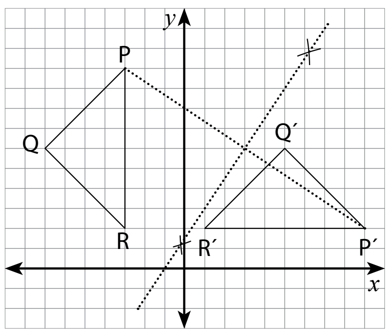
A shape can be rotated around a fixed point. That point is called the centre of rotation.

Consider the following two triangles. Triangle PQR is the original image and triangle P′Q′R′ is its rotated image.



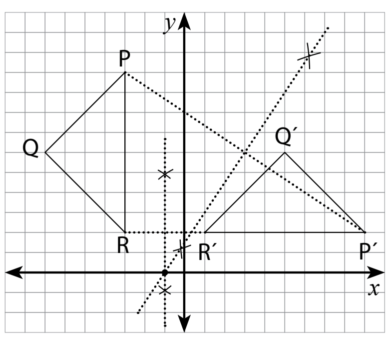
Follow the given steps to find their centre of rotation.

Join P to P′ and construct the line bisector.



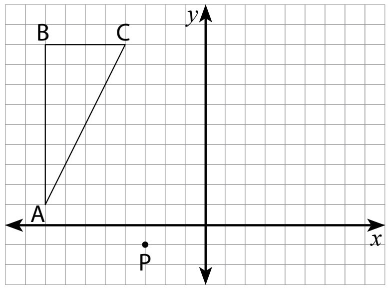
Join Q to Q′ or R to R′ and construct line bisector.

The point where these two bisectors intersect each other is the centre of rotation.



Rotate an image

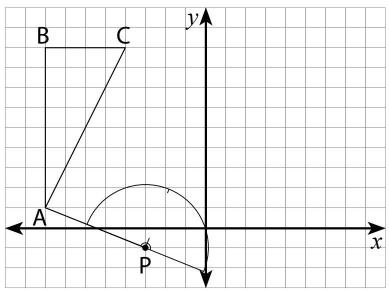
Rotate triangle ABC 90º clockwise about the given centre of rotation p.



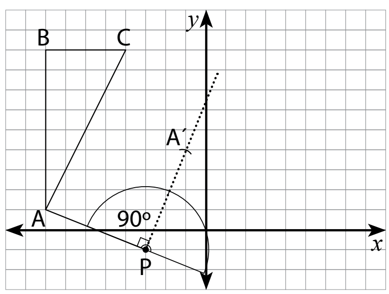
Steps:

Join A to P with a straight line.

Make an angle of 90º at P.

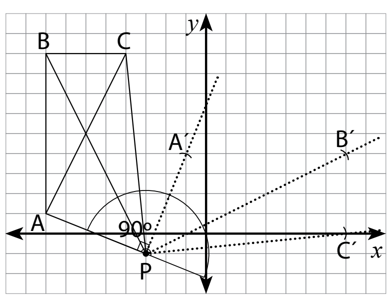


Mark an arc at the same distance as from P to A , on the line. This new point is A´.

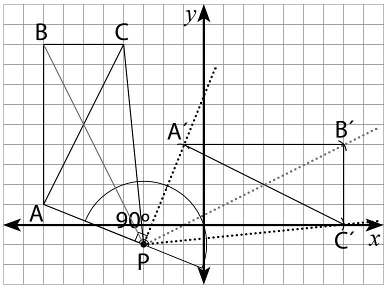


Join P to B and repeat above steps to get new point B´.

Join P to C and follow the similar steps to get point C´.



Join A′ to B′, B′ to C′, and C′ to A′.



Individual activity

Examples 2, 3, and questions 1(a), 3(a), and 4(a) of Exercise 9d will be done in the class.

Homework

Give remaining questions of Exercise 9d for homework.

Recapitulation

Any problem faced by the students will be discussed.

UNIT 10 DATA HANDLING

Topic: Data handling
Time: 1 period

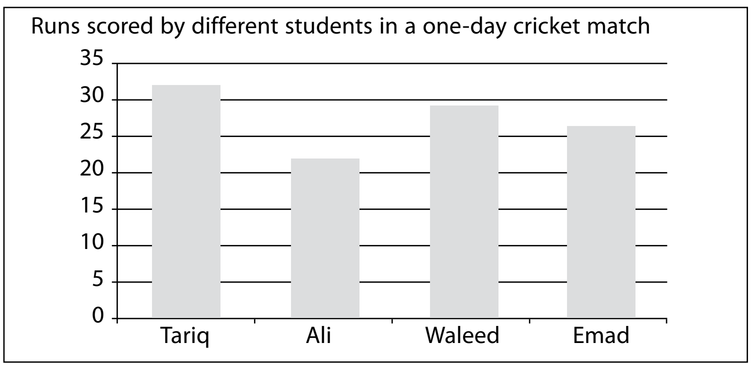
Objectives

To enable students to:
- define frequency distribution
- construct frequency tables for grouped and ungrouped data
- define and construct a histogram and frequency polygon
- define and calculate the measures of central tendency (mean, median and mode) for grouped and ungrouped data

Starter activities

Activity 1

Display pie charts and standard bar graphs.



Ask the following questions:
- Which student has the highest score in the match?
- Which student has the lowest score in the match?
- How many runs did Waleed score in the match?

Ask the following questions:

- Which class has the highest strength?
- Which class has the lowest strength?
- What is the total number of students?

Activity 2

Give a worksheet with the following information:

25 students appeared in a test and obtained the following marks out of 100.

21 35 65 25 13 45 72 50 69 20 49 39 58 29 74

70 69 12 80 75 10 90 100 95 88

Ask the following questions to get information from the data given.

- How many students scored 50 marks?
- What was the highest score?
- How many scored 90 marks?
- How many students scored marks between 60 and 70?
- How many students scored less than 50 marks?

Compare and discuss the answers the students give.

Main lesson

Display an organised list of the above mentioned data and explain to the students the importance of organising the data and its effective use.

Introduce frequency distribution referring to page 187 of the textbook. Solve the examples on the board. Define and explain a Histogram.

Explain how to make a histogram on the board with the help of the example on page 188 of the textbook.

Frequency distribution of ungrouped and grouped data will be explained.

- Ungrouped data: arranging the data in ascending or descending order.
- Grouped data: the data is divided into different classes or groups with a uniform class interval. The terms range, class interval, lower limit, upper limit, frequency of class interval, size of class interval will be explained with the help of examples given on page 189 of the textbook.

Practice session

1. Form a frequency distribution table from the following information.

   Note: The ungrouped data on page 196, Exercise 12a.3 of the textbook will be used.

2. Form a group frequency distribution table for the following data.

   Note: The data given on page 196, Exercise 12a.1 of the textbook will be used.

3. Draw a histogram for the following data.

   Note: Any data can be used.

4. Draw a frequency polygon on the histogram drawn for point 3.

Steps to make a frequency polygon:

- Creation of a histogram.
- Finding the midpoints for each bar that exists on the histogram. Using formula

  $= \frac{[\text{upper class limit} + \text{lower class limit}]}{2}$
- Placing a point on the origin of the histogram and its end.
- Connection of the points.

Topic: Measurement of Central Tendency
Time: 2 periods

Explain the term, Central Tendency. Discuss its importance, methods of calculation and application in everyday life.

Mean: It is defined as the single representative value of the entire data. It is commonly known as the Average. It is calculated by adding up all the data and dividing by the total number of observations. It is denoted by $\bar{x}$.

Formula

Mean or $X = \Sigma\frac{x}{n}$

Where Σ = sum of

x = observation or value

n = no. of observations

$\overline{X} = \frac{x^2 + x^2 + x^3...}{n}$

Explain the term weighted mean as given in the textbook.

Median of ungrouped data: It is the central value of a data set, after the data has been arranged in ascending or descending order. If the number of observations is an even number, then there are two middle terms. In this case, the average of these two terms is the median.

If the number of observations is an odd number, then there will only be one middle term and it will be the median. Explain with the help of examples given in the textbook.

Mode of ungrouped data: It is the value which occurs most frequently in a data set.

Standard deviation and Variance

Standard deviation is the square root of the arithmetic mean of the squares of deviations of observations from their mean value.

Variance $= \frac{\Sigma x^2}{n} - \text{Mean}^2$

Standard deviation $= \sqrt{\text{Variance}}$

$= \sqrt{\frac{\Sigma x^2}{n} - \text{Mean}^2}$

Practice session

Give worksheets comprising of questions similar to these.

1. Find the mean, variance, and standard deviation.
   100, 120, 125, 105, 109, 112, 120, 126, 105, 111, 113
2. Find the weighted mean of the following ages of students.
   a. 12, 13, 14, 14, 13, 12, 17, 13, 15, 14, 16, 11, 14, 10
   b. 9, 11, 10, 8, 18, 19
3. Find the median.
   a. 41, 46, 38, 37, 49, 35, 30
   b. 50, 48, 32, 55, 48, 52, 56, 60, 62, 64
4. Find the mode.
   a. 102, 135, 138, 250, 135, 102, 102, 192, 200, 240, 138
   b. 61, 68, 63, 65, 60, 61, 61, 60, 60, 48, 59, 59

Individual work

Give selected questions from Exercise 10a for class practice.

Homework

Give the rest of the questions from Exercise 10a to be done as homework.

Recapitulation

Revise the formation of frequency distribution tables, the construction of histograms, frequency polygons, and the methods of calculating the mean, median, mode, variance, and standard deviation.

Topic: Probability

Time: 2 periods

Objectives

To enable students to

- compute the probability of mutually exclusive, independent, simple combined, and equally likely events.
- perform probability experiments
- compare experimental and theoretical probabilty in simple events.

Starter activity

Make students recall the following terms by writing down each term on the board and taking feedback from them.

Review

- Probability: The chance of an event out of all possibilities occurring. For example, the probability of obtaining an even number from a roll of a dice is $\frac{3}{6}$ or $\frac{1}{2}$.
- Experiment: The process of obtaining a possible result. For example, tossing a coin is an experiment, the process through which you can obtain either heads or tails.
- Sample Space: All the possibilities together form the sample space. If choosing a single digit number, all the numbers from 0-9 together form the sample space for this experiment.
- Event: A particular result or set of results amongst the possibilities in the sample space: For example, obtaining 3 from a dice or obtaining a sum of 14 with a pair of dice.
- Equally likely events: Events that have the same probability (for likelihood) of occurring. For example, when a coin is tossed, the chances of 'Heads' or 'Tails' both have the same probability of occurrence.

Main activity

Write the formula for the probability of single event on board.

$$\text{Probability of an Event, P(E)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of positive outcomes}}$$

Write combined events and how to write their sample space.

Elaborate the difference between mutually exclusive and independent events with examples. Explain the methods to solve mutually exclusive and independent event.

Example 1

A dice is rolled. Find the probability of getting 3 or 4.

P(3) $= \frac{1}{6}$

P(4) $= \frac{1}{6}$

P(3 or 4) = P(3) + P(4)

$= \frac{1}{6} + \frac{1}{6}$

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

Example 2

Two dice are rolled simultaneously. Find the probability of getting 3 and 4 both.

P(3) $= \frac{1}{6}$

P(4) $= \frac{1}{6}$

P(3 and 4) = P(3) × P(4)

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

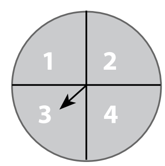
$= \frac{1}{36}$

Explain the difference between exprimental and theoretical probability. Give formula for the experimental probability.

$$P(E) = \frac{\text{Number of times an event occurs}}{\text{Total number of trials}}$$

Example 3

Farah spun the given spinner 20 times and landed on 3 eight times.
What is the experimental probability of getting 3?



Experimental Probability of an event $P(E) = \frac{\text{Number of times landed on 3}}{\text{Total number of trials}}$

$P(3) = \frac{8}{20} = \frac{2}{5}$.

Individual activity

Questions 1 to 6 of Exercise 10b will be done in the class. Feedback will be taken form the students.

Homework

Questions 8, 12, 13, 16, 18, and 19 of Exercise 10b will be given for homework.

Recapitulation

Any problem faced by the students will be discussed.

Model Examination Paper
Mathematics

Class VIII

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.

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Section	A	B					C					Total
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	
Max. Marks	20	6	6	6	6	6	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. If A is a set of first 5 odd numbers and B is a set of first five prime numbers, then which one of the following shows $A \cap B$?

A. {1, 2, 3, 4, 5}
B. {1, 3, 5}
C. {3, 5, 7}
D. {1, 5, 7, 9, 11}

II. Which one of the following is an irrational number?

A. 35π
B. Square root of 196
C. 0.4343434343…
D. 0

III. Which one is the scientific notation of 0.0004351?

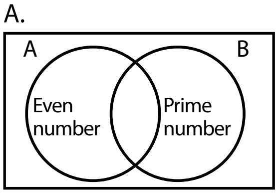
A. 4351×10^{-7}
B. 4.35×10^{4}
C. 4.35×10^{-4}
D. 4.35×10^{-3}

IV. Mahmood is 5 years older than his sister Faiza and their total age is 27. Which equation satisfies the given condition?

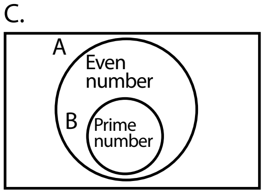
A. $5x + 2 = 27$
B. $x + 2 + 5 = 27$
C. $2x + 5 = 27$
D. $2x - 5 = 27$

V. If A is a set of all even numbers and B is a set of all prime numbers then which Venn diagram is true?

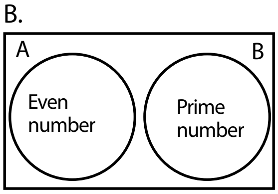
A.



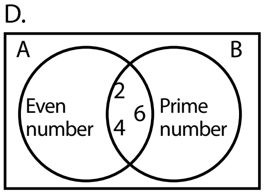
C.



B.



D.



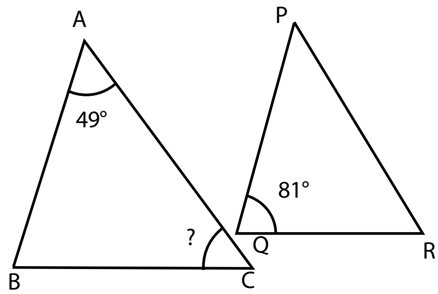
VI. What is the value of $\frac{\sqrt{4}}{2^0}$?

A. 2
B. $\frac{\sqrt[2]{4}}{4}$
C. 4
D. 1

VII. The volume of a cube is $216\ cm^3$. What is the length of its side?

A. 4 cm
B. 6 cm
C. 4 m
D. $6\ cm^3$

VIII. If the following two triangle ABC and PQR are similar, then what is the measurement of angle C?



A. 50°
B. 70°
C. 60°
D. 83°

IX. Following is the data Mohid has recorded for his class tests marks. He has forgotten the marks of one of his class tests.

6	9	8	5	8	9	6	5	7	8	?

If 8 is the mode value of the marks, which of the following is the missing value?

A. 5
B. 6
C. 7
D. 9

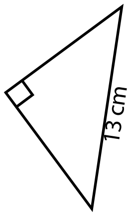
X. $x + y = 6$ and $3x + 2y = 13$ are two simultaneous linear equations. What are the values of x and y ?

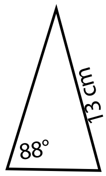
A. $x = 3, y = 3$
B. $x = 4, y = 2$
C. $x = 5, y = 1$
D. $x = 1, y = 5$

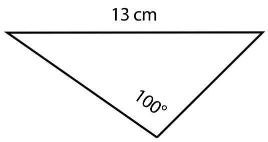
XI. Rabia buys a football to play during her summer vacations. The ball has a radius of 5 cm. What is the surface area of the ball?

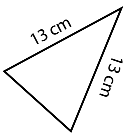
A. $100\pi\ cm^2$
B. $20\pi\ cm^2$
C. $\frac{100}{3}\pi\ cm^2$
D. $500\pi\ cm^2$

XII. Which triangle has the hypotenuse = 13 cm?

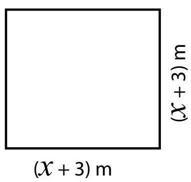
A.


B.


C.


D.


XIII. Jamil wants to measure the area of his room's floor that is square in shape. If the side length of the floor is $(x + 3)$ m, what is the area?



A. $2(x + 3)$ m²

B. $(x^2 - 6x + 9)$ m²

C. $(x^2 + 6x + 9)$ m²

D. $(x + 3)(x - 3)$ m²

XIV. What is the first term of the quotient in $(3x^3 + 2x^2 - x - 1) \div (x + 2)$?

A. $3x$

B. x

C. $3x^2$

D. $3x^3$

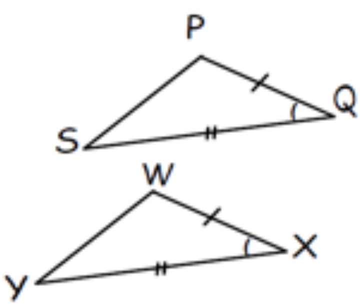
XV. Which of the following postulates satisfy the congruence between the given triangles?

A. Side-Side-Side (SSS)

B. Angle-Side-Angle (ASA)

C. Side-Angle-Side (SAS)

D. Pythagoras' Theorem



XVI. What is the value of $(x + y)^2$, if $x^2 + y^2 = 19$ and $2xy = 6$?

A. 22

B. 25

C. 5

D. $\sqrt{5}$

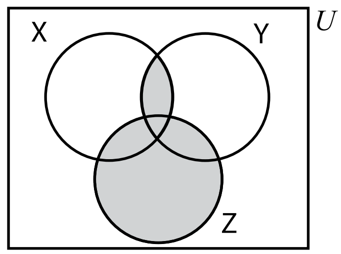
XVII. Which of the following represents the shaded region in the given Venn diagram?

A. $(X \cap Z) \cup Y$

B. $(X \cap Y) \cup Z$

C. $(X \cup Z) \cap Y$

D. $(Y \cap Z) \cup X$



XVIII. Javeria wants to buy a cubical tank of volume $(x^3 - 3x^2y + 3xy^2 - y^3)$ m³. What should be the length of each side?

A. $(x - y)^3$ m

B. $(x - y)$ m

C. $(x + y)^3$ m

D. $(x + y)$ m

XIX. What is the area of a, $(2x + y)$ m by $(2x - y)$ m rectangular field?

A. $4x^2 - y^2$

B. $4x^2 + 8xy + y^2$

C. $4x^2 + y^2$

D. $4x^2 + 8xy + y^2$

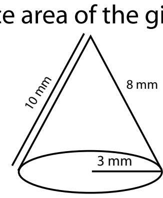
XX. What is the curved surface area of the given cone?

A. 96π mm²

B. 24π mm²

C. 30π mm²

D. 120π mm²



Section B

Attempt **all** questions **[30 Marks]**

Q3. Evaluate

a) $(\sqrt[5]{2})^{-3} \times 2^{-\frac{4}{8}}$ **[/2]**

b) $\left(\frac{4}{5}\right)^{-9} \div \left(\frac{4}{5}\right)^{-9}$ **[/2]**

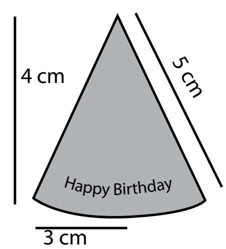
c) $\sqrt{70}$ (up to 1 decimal place) **[/2]**

Q3. Kainat buys a painting for Rs 25000 and sells it for Rs 28000.

a) Does she sell the painting at profit or at loss? Calculate loss or profit. **[/2]**

b) Calculate the profit or loss percentage? **[/2]**

c) Sophia wants to wrap conical birthday caps with different colour sheets. What is the surface area of the given cap? Give your answer in terms of π. **[/2]**



Q4.

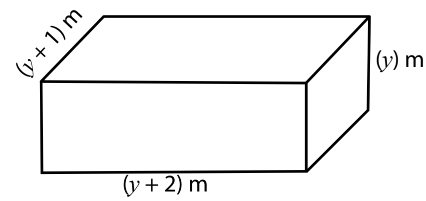
a) Marium's family is planning to visit USA during summer vacations. Marium saved Rs 11250 from her pocket money. She gives this amount to a money exchange company to get the equivalent US dollars. If the company offers the rate as given in the following table, how many dollars would she get? [/2]

Currency	Symbol	Rate (Rs)
US Dollars	USD	125
Euro	EUR	135
British Pound	GBP	140
Saudi Riyal	SAR	55

b) Five pipes take 90 minutes to fill a water tank. How many pipes are required to fill the same tank in 30 minutes? [/3]

c) Ahsan buys a calculator that costs $20. If the exchange rate for rupee is 115, how much money does he pay in rupees? [/1]

Q5. A rectangular swimming pool measures (y) m by (y +1) m by (y + 2) m.



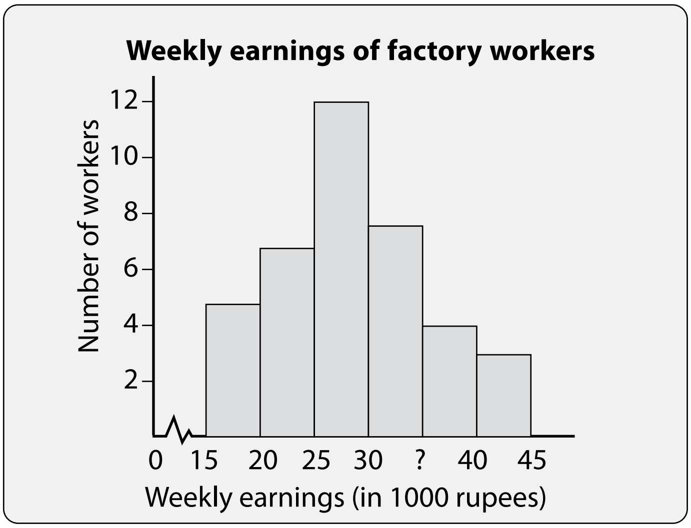
a) Express the volume of swimming pool in terms of y. **[/1]**

b) Simplify the expression. **[/3]**

c) If $y = 20$, calculate the volume of the swimming pool. **[/2]**

Q6. Following histogram and frequency table shows the weekly earnings of factory workers.
Few values are missing in histogram and table both.

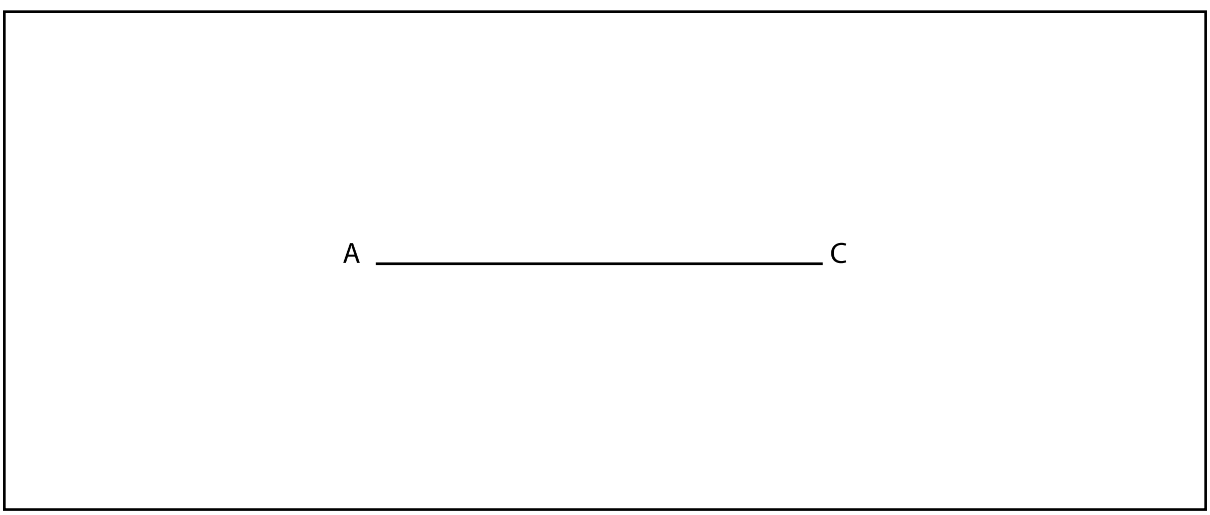
a) Find out the missing value in histogram. **[/1]**



b) Complete the following table. **[/2]**

Weekly earnings (in rupees)	No. of workers
15000 – 20000	5
20000 – 25000	?
?	12
30000 – 35000	8
35000 – 40000	3

c). Construct a kite with two sides measuring 4 cm and 8 cm respectively. The diagonal has already been drawn for you. **[3]**



Section C

Attempt **all** questions **[50 Marks]**

Q7.

a) Shiza sold 1000 tickets. She charged Rs 85 for adults and Rs 45 for children, and earned Rs 7300 in total.

i) Form two simultaneous equations. **[/1]**

ii) How many tickets of each kind were sold? **[/5]**

b) Qasim wants to decorate his room's front wall with marble tiles. If the area of the wall and a tiles are $(a^4 - 6a - 4)$ m^2 and $(a-2)$ m^2 respectively, find how many such tiles are required for the wall decoration? **[/4]**

Q8. Aleen plays with her play dough and makes a sphere. The surface area of the sphere is 144π cm^2 .

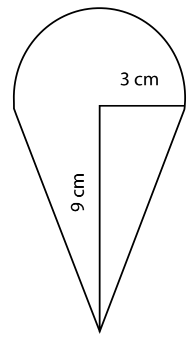
a) What is the radius of the sphere? **[/3]**

b) Find out the volume of the sphere? (Give your answer in terms of π.) **[/3]**

c) How many smaller spheres of radius 3 cm each can be made out of it? **[/4]**

Q9.

a) Iman buys a cone full of ice-cream with a hemisphere of ice-cream on top. The radius of a hemisphere is 3 cm and its base coincides with the cone's top. The height of the cone is 9 cm. When she pours the ice-cream in a jar, it is filled completely. Find out the volume of the jar. **[/3]**



b) Maheen draws a triangle with sides 5 cm, 12 cm, and 13 cm. Prove that Maheen draws a right angled triangle. **[/3]**

c) The following table shows the marks scored by the students in Maths test.
Complete the following table and find out the mean marks. **[/4]**

Marks (x)	8	9	12	13	14	
No. of Students (f)	3	4	6	4	2	$\sum f =$
fx						$\sum fx =$

Q10.

a) In a small town, various families are surveyed about their favourite pet animals. It is found that Khan family likes parrots, pigeons, and cats and Sheikh Family likes cats, dogs, rabbits, and pigeons. Prove De Morgan's law $(A \cap B)' = A' \cup B'$, if Universal set is defined as
U = {sparrows, pigeons, parrots, cats, cows, dogs, goats, hens, rabbits},
A is a set of pet animals liked by Khan family, and B is a set of animals liked by Sheikh family. **[/5]**

b) 25 men can build a 60 m wall in 8 days. How many men are required to build a 300 m wall in 20 days? **[/3]**

c) Find the smallest value of n, if 200n is a perfect cube? **[/2]**

Q11. a) Factorise $4(m + n)^2 - 12(m + n)(a + b) + 9(a + b)^2$ [/4]

b) If $x + y = -\frac{1}{3}$, prove that $x^3 + y^3 - xy = -\frac{1}{27}$ [/4]

c) In a city, the following observations were made in a study of the daily wages of 40 workers. Draw histogram of the given data. [/2]

Wages in rupees	Number of workers
150 – 200	4
200 – 250	12
250 – 300	18
300 – 350	4
350 – 400	2