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RATIONAL NUMBERS
CHAPTER - 1.

Rational numbers: Rational numbers are the numbers which can be written in the form p/q where $q \neq 0$
This means 2/3 is a rational number. But 2/0 is not a rational number.

Properties:

1. If we add , subtract or multiply rational numbers , we get rational number as answer.
2. Addition and multiplication of rational numbers is commutative and associative.

   Ex: commutative: $\frac{2}{3} + \frac{5}{7} = \frac{5}{7} + \frac{2}{3}$

   $\frac{2}{3} \times \frac{5}{7} = \frac{5}{7} \times \frac{2}{3}$

   Associative: $\left(\frac{2}{3}+\frac{5}{7}\right)+\frac{1}{2} = \frac{2}{3} + \left(\frac{5}{7}+\frac{1}{2}\right)$

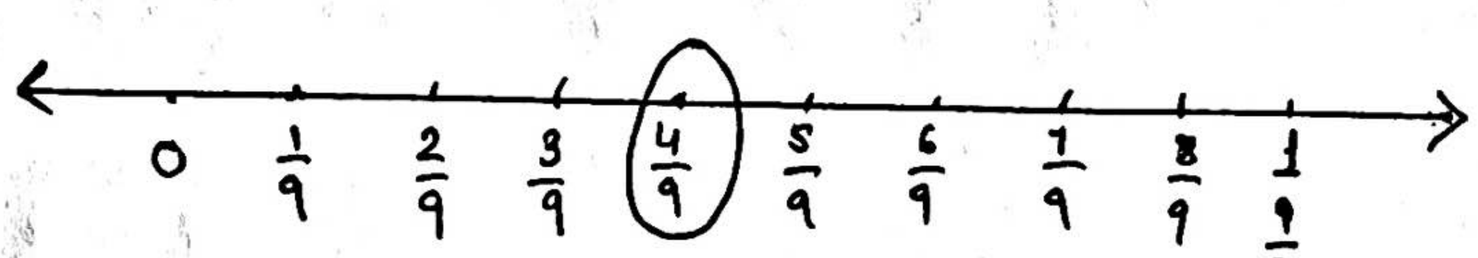
   $\left(\frac{2}{3}\times\frac{5}{7}\right)\times\frac{1}{2} = \frac{2}{3}\times\left(\frac{5}{7}\times\frac{1}{2}\right)$
3. Adding 0 to any rational number gives the same number. Ex: $\frac{3}{2} + 0 = \frac{3}{2}$
4. Multiplying by 1 any rational number gives the same number. Ex: $\frac{7}{8} \times 1 = \frac{7}{8}$
5. **Additive inverse**: change the sign of the numbers to find the additive inverse.

   Ex: Add. Inv. Of $\frac{7}{8} = -\frac{7}{8}$
6. **Multiplicative Inverse or Reciprocal**: To find the multiplicative inverse , write the number in p/q form and then interchange Dr. and Nr. Ex: Mult. Inv. Of 2: $2 = \frac{2}{1}$ M. I of 2 is $\frac{1}{2}$
7. **Distributive property**: $a(b+c) = ab + ac$

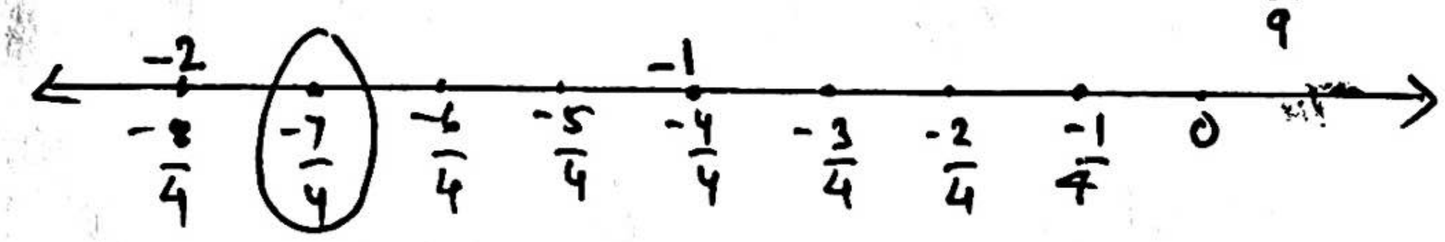
   $a(b-c) = ab - ac$

To represent the Rational number on number line: In a rational number , denominator tells the number equal parts into which the first unit has been divided. The numerator tells how many of these parts are nsidered. So, $\frac{4}{9}$ means 4 out of 9 equal parts on the right of 0 and for $-\frac{7}{4}$,we take 7 markings of distance each on the left of 0

$\frac{4}{9}$:-



$\frac{-7}{4}$:-



To find rational numbers between any 2 rational numbers:

Firstly , make the Dr. same in both the numbers by multiplication. Ex: $\frac{2}{3}$, $\frac{7}{4}$ LCM of 3 & 4 = 12

$\frac{2\times4}{3\times4}$, $\frac{7\times3}{4\times3}$

$\frac{8}{12}$, $\frac{21}{12}$

So $\frac{9}{12}, \frac{10}{12}, \frac{11}{12}, \frac{13}{12}$ ..... $\frac{20}{12}$ are the rational numbers between (any 2) rational numbers $\frac{2}{3}$ & $\frac{7}{4}$

See the distance between the numerators. If we are getting the required numbers within that distance, we write the numbers. Otherwise , multiply Nr. And Dr. of both the numbers by any number which makes the distance as required

Ex: 3 rational numbers between -2 and 0

$-\frac{2}{1}$, $\frac{0}{1}$

Distance between -2 and 0 is not sufficient. So multiply by 2. $\frac{-2\times2}{1\times2}$, $\frac{0\times2}{1\times2}$

$\frac{-4}{2}$, $\frac{0}{2}$

Distance between -4 and 0 is sufficient to get 3 numbers. So , $-\frac{3}{2}$, $\frac{-2}{2}$, $\frac{-1}{2}$

Ex: 5 rational numbers between $\frac{2}{3}$ *and* $\frac{4}{5}$

$\frac{2\times5}{3\times5}$, $\frac{4\times3}{5\times3}$

$\frac{10}{15}$, $\frac{12}{15}$ Distance between 10 and 12 is not sufficient , so multiply by 4 ,

$\frac{10\times4}{15\times4}$, $\frac{12\times4}{15\times4}$ *gives* $\frac{40}{60}$ *and* $\frac{48}{60}$

Therefore we have $\frac{41}{60}$, $\frac{42}{60}$, $\frac{43}{60}$, $\frac{44}{60}$, $\frac{45}{60}$

There are infinite rational numbers between any 2 given rational numbers

QUESTIONS

SHORT ANSWER QUESTIONS

1. Verify that -(- x) is the same as x for x = - 21 /31
2. a) Additive Inverse of -2 /19 =
   b) Is 2/3 the M.I. of 1 ½ ? Why or why not
   c) Reciprocal of – 5/9 =
   d) The product of 2 rational numbers is always a _____
3. What is the multiplicative inverse of – 2/8 × - 4/ 7
4. Represent -7/4 , 7/4 on a number line.
5. Subtract the sum of (-3/5 & 3/4) from -5/8
6. Simplify : -39 /3 × 19/5 ×-45/38
7. Find three rational numbers between -2 and 3
8. Verify x × y = y × x where x = -1/3 , y = -3/4

LONG ANSWER QUESTIONS

1. Arrange the following in ascending order 2/5, -1/2, -8/15, -3/-10
2. Find 4 rational numbers between -2/3 & 11/12
3. Divide the sum of 3/8 & -5/12 by the reciprocal of -15/8 × 16 /27
4. What is the perimeter of quadrilateral of quadrilateral whose 4 sides measure 3/7 cm , 4/5cm , 7/8 cm , 2/5 cm
5. Find 10 rational numbers between a) 3/5 and 4/5 b) -2/5 and 1/2

LINEAR EQUATIONS IN ONE VARIABLE

QUESTIONS

SHORT ANSWER QUESTIONS

1. When a certain number is added to the numerator & denominator of 9 /17 , the new fraction is 5/7. What is the number ?
2. The length of a rectangle is 7 times its width. If the perimeter of the rectangle is 208 cm , its length is :
3. The root of the equation $0.3x + 5 = 0.7x - 3$ is :
4. If $\frac{3b}{10} - \frac{2b}{15} = \frac{2}{3}$, then the value of b is :
5. Which of these is not a linear equation ?
   1) $2x+5 = 10$ 2) $3x^2 = 12$ 3) $3/x = 5$
6. Solve : $\frac{3x}{4} + \frac{x}{6} = 22$
7. One fourth of a number is 10 less than 2/3 of the number. Find the number .
8. Solve : $x = 4/5 (x + 20)$
9. The sum of two numbers is 45 & their ratio is 7 : 8. Find the numbers .
10. Two consecutive natural numbers whose sum is 85 are :

LONG ANSWER QUESTIONS

1. Solve for a : $\frac{1-9a}{19-3a} = \frac{5}{8}$
2. Ratio of two numbers is 3 : 5 . If 4 is subtracted from each number then the ratio becomes 5 : 9. Find the numbers.
3. Solve for z : $\frac{z}{z+15} + \frac{4}{9}$
4. The sum of 3 consecutive multiples of 8 is 888 . Find these multiples.
5. Solve : $\frac{9-x}{2} + \frac{3}{2} = \frac{7+x}{2}$
6. Solve : $9.3x + 3/5 = 2.7x + 13.8$
7. The length of a rectangle exceeds its breadth by 9 cm. If the length and the breadth are each increased by 3 cm. The area of the new rectangle will be 84 cm^2 more than of the given rectangle. Find the length & breadth of the given rectangle.
8. Solve : $\frac{7x-1}{4} - \frac{1}{3}\left(2x - \frac{1-x}{2} \right) = \frac{10}{3}$
9. Solve : $\frac{4+x}{2} - 5\left(\frac{x}{2.5} - 4 \right) = \frac{15}{4}$

UNDERSTANDING QUADRILATERAL.

1. Plane Curve : When a curve is drawn on a plane surface without lifting pencil, then it is called Plane Curve.
2. Simple Curve : A curve which does not cross itself
3. Closed curve : A curve which ends at the same point as the starting point.
4. Simple closed curve : A curve which is simple as well as closed
5. Polygon : A closed figure made up of 3 or more line segments
6. Regular Polygon : A Polygon having all sides equal.
   Eg : 3 sided - equilateral
   4 sided - square
7. Convex & Concave : If all diagonals of a Polygon be within the figure then it is convex otherwise concave.
8. ① Equilateral : is a polygon which has all the sides of the same length.
   ② Equiangular : is a polygon where all the angles have same measure.

Note : A square is equiangular as well as equilateral but rectangle is equiangular but not equilateral.

9. ① To find the angle sum of a convex Polygon with no. of sides as n $\therefore (n-2) \times 180$
   ② Each Interior angle $= \frac{n-2}{n} \times 180$
   ③ To find diagonal of a regular Polygon : $\frac{n(n-3)}{2}$
   Eg. Regular hexagon : 9
   Regular Octagon : 20.

10. Angle Sum Property :
    ① In a Δ, sum of all 3 angles is 180
    ② " " quadrilateral, sum of all 4 angles is 360
    [as quadrilateral is divided into 2 Δ's
    $\therefore$ Sum of 4 angles $= (n-2) \times 180 = 2 \times 180 = 360$

Note : Sum of angles of convex quadrilateral = 360
Sum of angles of concave quadrilateral = 360.

11. Sum of Exterior angles of a Polygon :
The sum of the measure of the external angles of any polygon is 360°.

*. In a regular polygon
all sides equal : all interior angles are equal
all exterior angles are equal.

So., No. of sides of regular polygon : $\frac{\text{Sum of exterior angles}}{\text{Measure of one exterior angle}}$

Types :

1 Trapezium : If only one pair off opposide sides are parallel then it is called trapezium.

2. Isosceles trapezium : If the non parallel sides of a trapezium are equal then it is called an isosceles trapezium.

3. Kite ① has 2 distinct consecutive sides pair of equal length.
② It gives 2 identical Δ about the vertical diagonal.

4. Parallelogram : If a quadrilateral has both pair of opposite sides parallel then it is called a parallelogram.

Elements :
① Opposite Sides : 2 sides having no common vertex.
② Adjacent sides : 2 sides having common vertex
③ Opposite angles : 2 angles having no common arm.
④ Adjacent angles : 2 angles having a common arm.

Properties of Parallelogram :
① The opposite sides of parallelogram are of equal length.
② The opposite angles of a parallelogram are of equal measure
③ The adjacent angles of a ∥gm are supplementary.

Rhombus :

It has all the properties of parallelogram and that of kite.
The diagonals of a rhombus are perpendicular bisector of each other.

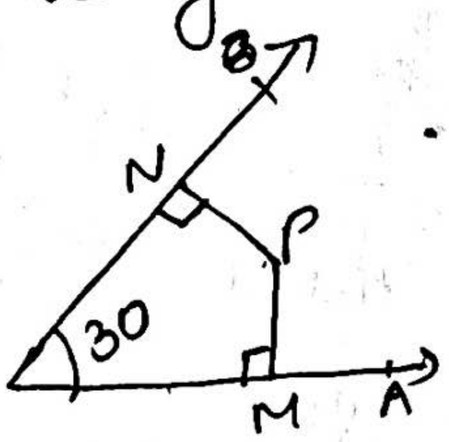
Rectangle : A ||gm having an angle of 90° is called a rectangle.

Square : A ||gm having a pair of adjacent sides equal and an ∠ of 90°.

Questions :

Short Answer question :

1. The sum of the angles of a quadrilateral is ——.
2. Any 2 adjacent angles of a parallelogram are ——.
3. The diagonal of a square makes an angle of —— with each of its side.
4. Two adjacent angles of a parallelogram are equal, its diagonal do not bisect, each other at right angles. It is ——
12. One angle of a parallelogram is 60°. Find its opposite angle and the adjacent angle.
13. The angles of a quadrilateral are in the ratio 1:2:3:4. Find each angle.
14. The sides of a rectangle are in the ratio 4:5. Find its sides if the perimeter is 90 cm.
15. The base angles A & B of a trapezium ABCD measures 110° & 120°. Find angles C & D.
16. If each interior angle of a regular polygon is 150°. how many sides does this polygon have?
17. In the given figure, ∠MON = 30°, PM ⊥ OA & PN ⊥ OB. Find the value of ∠MPN.



18. One angle of a quadrilateral is 180°. and the remaining three angles are equal. Find the 3 equal angles.

Long Answer Questions / HOTS :-

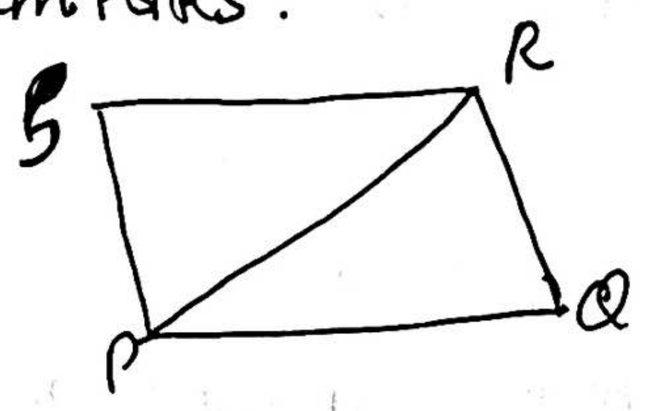
① PQRS is a rectangle and PR is a diagonal in it. Show that $\Delta PQR \cong \Delta RSP$.

② Find the perimeter of a rhombus in which diagonals have lengths 24 dm & 10 dm resp.

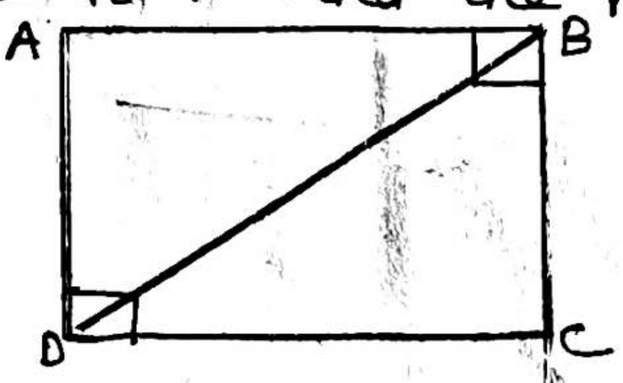
③ The perimeter of a rhombus is 60 cm & one diagonal measures 18 cm. Find the length of the other diagonal.

④ PR is a diagonal of parallelogram PQRS :

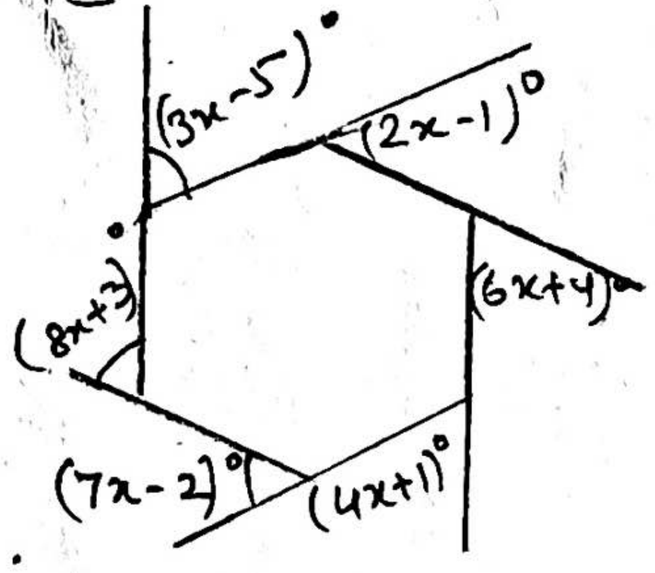
i) Is PS = RQ ? Why ?
ii) Is SR = PQ ? Why ?
iii) Is PR = RP ? Why ?
iv) Is $\Delta PSR \cong \Delta RQP$ Why ?



⑤ ABCD is a quadrilateral in which $\angle ABC = \angle ADC = 90^\circ$, $\angle DBC = 60^\circ$ & $\angle BDA = 40^\circ$. Find the measures of $\angle BAD$ & $\angle BCD$.



⑥ Find the value of x.



⑦ ABCD is a square. Determine $\angle DCA$ where AC is its diagonal.

⑧ One of the diagonals of a rhombus is congruent to one of its sides. Find the angles of the rhombus.

⑨ The exterior angle of a regular polygon is one third of its interior angle. How many sides has the Polygon.

PRACTICAL GEOMETRY.

1. Construct a quadrilateral in which AB = 3·5 cm, BC = 4·2 cm, CD = 5·1 cm, DA = 5·5 cm & AC = 6·8 cm.

2. Construct a quadrilateral ABCD in which AB = 4·4 cm, BC = 5·2 cm, DA = 6·3 cm, AC = 6·8 cm & BD = 7·2 cm

3. Construct a parallelogram ABCD in which AB = 4 cm, BC = 3·2 cm, $\angle A = 45^\circ$

4. Construct a parallelogram ABCD in which BC = 4·8 cm, CD = 6 cm, $\angle C = 50^\circ$

5. Construct a parallelogram PQRS in which PR = 5 cm, $\angle ROQ = 40^\circ$ & QS = 6·2 cm.

6. Construct a rectangle ABCD in which AB = 9 cm, AC = 15 cm.

7. Construct a rectangle ABCD in which DC = 4·8 cm & CA = 6·2 cm

8. Construct a square PQRS in which PQ = 6 cm.

9. Construct a rhombus ABCD in which AB = 4·8 cm & $\angle B = 120^\circ$.

10. Construct a quadrilateral ABCD in which AB = 4·2 cm, BC = 5·4 cm, $\angle A = 120^\circ$, $\angle B = 120^\circ$, $\angle D = 60^\circ$

DATA HANDLING

1. Raw Data : The first hand information collected is called raw data.
2. . Steps : Raw data –Arranging data – Analyses/ Interpretation of data
3. Tools of representing data
   1) Bar graph
   2) Grouped / Ungrouped Table
   3) Pie Chart
   4) Histogram
4. Grouped frequency table : when data has a wide range , then data is presented in groups and their frequency is calculated accordingly. These are called frequency table

   Terms : 1) Class interval : The groups used are called class interval / class

   2)Lower limit /upper limit : eg : Class : 10 – 20 ,

   10 is called lower limit

   20 is called upper limit.
5. · Class size : the difference of upper & lower class.
6. Histogram : The graphical representation of grouped frequency table is known as histogram , it has heading , 2 axis x & y , scale for both the axis, Bars having no gap between them.

   Note : Lower limit of the class interval is included in present class interval . Upper limit is not . eg : 20 is included in 20-30 and not n 10-20
7. Pie Chart : Another way to represent a data is called pie chart / circle graph . It shows a data as a part of whole.

PROBABILITY :

Range of probability is 0 -1.

Event : The experiment undertaken is called an event.

$$P(E) = \frac{Number\ of\ favourable\ outcomes}{Total\ Possible\ outcomes}$$

1) When a coin is tossed :

Sample Space = { H , T } = 2

Probabilty (getting head) :

Sample Space = { H} = 1

$$P(H) = \frac{Possible\ outcomes}{Total\ outcomes} = ½$$

Probabilty (getting tail) :

Sample Space = { T } = 1

$$P(T) = \frac{Possible\ outcomes}{Total\ outcomes} = ½$$

2) When 2 coins are tossed :

Sample Space = { HH , TT, HT,TH} = 4

Probabilty (getting 2 head) :

Sample Space = { H H } = 1

$$P(H) = \frac{Possible\ outcomes}{Total\ outcomes} = 1/4$$

Probabilty (getting 2 tails) :

Sample.Space = { TT } = 1

$$P(T) = \frac{Possible\ outcomes}{Total\ outcomes} = 1/4$$

Q. When 1 dice is tossed:

S.S : {1, 2, 3, 4, 5, 6} = 6

$P(2) = \frac{1}{6}$, $P(5) = \frac{1}{6}$, $P(3) = \frac{1}{6}$

$P(\text{even number}) = \frac{3}{6} = \frac{1}{2}$

When 2 dices are tossed:

S.S. $\left\{\begin{matrix} (1,1)\ (1,2)\ (1,3)\ (1,4)\ (1,5)\ (1,6) \\ (2,1)\ (2,2)\ (2,3)\ (2,4)\ (2,5)\ (2,6) \\ (3,1)\ (3,2)\ (3,3)\ (3,4)\ (3,5)\ (3,6) \\ (4,1)\ (4,2)\ (4,3)\ (4,4)\ (4,5)\ (4,6) \\ (5,1)\ (5,2)\ (5,3)\ (5,4)\ (5,5)\ (5,6) \\ (6,1)\ (6,2)\ (6,3)\ (6,4)\ (6,5)\ (6,6) \end{matrix}\right\}$

(same number).

Possible Outcome : {(1 1) (2,2) (3,3) (4,4) (5,5) (6,6)}

Total Outcome : 36

$= \frac{6}{36} = \frac{1}{6}$.

uestions:

Short Answer questions:

- The probability that it will rain tomorrow is 0.85. What is the probability that it will not rain tomorrow?

A man's monthly salary is Rs 2400 & his monthly expenses on travel are Rs 250

Suppose we toss a coin 100 times and get a head 58 times. at random). What is the probability of getting a head?

Write a formula for finding the central angle for a component using a pie chart.

A bag contains 3 Red & 2 blue marbles. A marble is drawn at random. What is the probability of drawing a blue marble

(6) A dice is thrown. Find the probability of getting

(1) a prime number

(2) 2 or 4

(3) a multiple of 2 or 3.

(7)

Class Interval	Frequency
10-20	4
20-30	5
30-40	15
40-50	10
50-60	6

(1) What is the lower of 20-30?

(2) What is class size?

(3) Write the class marks of the classes 20-30 & 40-50.

Long Answer Questions /HOTS

(1) The pie chart represents the no. of valid votes obtained who contested for school captain. The total no. of valid votes polled was 720.

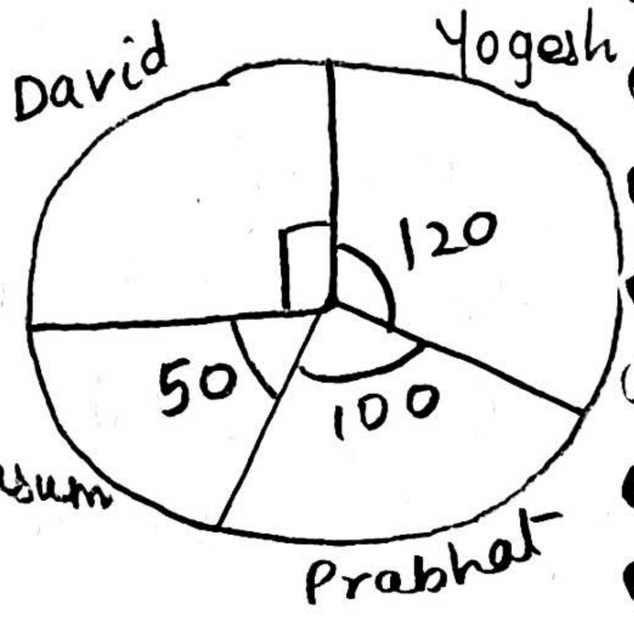
(1) Who has won the election? How many votes did he get?

(2) By what margin, the winner defeated the nearest contestant?

(3) Who got minimum no. of votes?

(4) What is the no. of votes obtained by a candidate?

(5) How many votes are obtained by David?



(2) The weights of 30 students in a class are given. Make a frequency table using tally method.

43, 44, 40, 44, 42
41, 44, 43, 42, 45
41, 40, 45, 44, 40
43, 40, 42, 45, 41
45, 43, 41, 44, 40

(3) The height of 11 players in a football team is as : height given in cm.

148, 154, 152, 146, 160, 162, 148, 165, 141, 166, 161.

Find the mean height of the players.

(4) The enrolment of a secondary school is as below.

classes	VI	VII	VIII	IX	X
Enrolement	1000	900	800	400	500

(5) A dice is thrown. what is the probability of getting

a) an even number
b) a multiple of 3
c) an even number & a multiple of 3
d) a number 3 or 4
e) an odd number
f) an even number or a multiple of 3.

(6) The water tax bills (in rupees) of 30 houses in a locality are given below.
Construct a grouped frequency distribution with class size of 10.

30, 32, 45, 54, 74, 78, 108, 112, 66, 76, 88, 40,
14, 20, 15, 35, 44, 66, 45, 84, 95, 96, 102, 110,
88, 74, 112, 14, 34, 44

(7) Given is the frequency distribution of the heights of 50 students of a class.

Class Interval :	140-145	145-150	150-155	155-160	160-165
frequency :	8	12	18	10	5

Draw a histogram representing the above data.

SQUARE & SQUARE ROOTS.

Square: Multiplying a number by itself is called square of a no. $x \times x = x^2$

Perfect Number/Square numbers: The numbers that can be expressed as the product of the number within itself are called square numbers.

Eg: 1, 4, 9, 16, 25, - - - - - and so on.

52 is not a square number as $7 \times 7 = 49$ & $8 \times 8 = 64$ are the 2 consecutive square number having no other square number between them.

Number	Square
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100

Properties:

① The numbers ending in 2, 3, 7, 8 cannot be a square number as the square in above Table have 0, 1, 4, 5, 6, 9 in unit place.

② The numbers ending in odd numbers of zeroes cannot be square numbers.

③ If a no. is ending in 1 or 9, the square ends in 1
" " " " " " 2 or 8, then " " " 4
" " " " " " 3 or 7, then " " " 9
" " " " " " 4 or 6, " " " " " 6
" " " " " " 5, " " " " " 5
" " " " " " 0, " " " " " 0.

Adding odd Numbers:- Eg: $25 = 1+3+5+7+9$

If a natural number cannot be expressed as a sum of successive odd natural numbers starting from 1, then it is not a perfect square.

Product of 2 consecutive odd/even natural numbers:

① $11 \times 13 = 143 = (12-1) \times (12+1) = 12^2 - 1$ $\because a^2 - 1 = (a-1)(a+1)$
(15) (8)

2. 13×15

$(14-1) \times (14+1) = 14^2 - 1$

3. 29×31

$(30-1) \times (30+1) = 30^2 - 1$

Questions :

Short Answer Questions :

(1) Find $\sqrt{212 + \sqrt{154 + \sqrt{225}}}$

(2) $\sqrt{1 + \frac{x}{144}} = \frac{13}{2}$, then x is ?

(3) Write a Pythagorean triplet whose smaller member is 6

(4) Show that (16, 63, 65) is a pythagorean triplet.

(5) Without adding find the sum $(1+3+5+7+9+11)$

(6) Expres 64 as sum of eight odd numbers.

(7) What would be added to 7912 to make the sum a perfect square ?

long Answer questions/HOTS.

(1) Find the perimeter of a square whose area is $6889\ m^2$.

(2) Find the smallest number by which 28812 must be divided so that the quotient becomes a perfect square.

(3) A society collected Rs 8836, each member contributing as many rupees as there were members. Find the number of members of the society.

(4) Find the square root of 1734489 by long division method.

(5) Find the greatest 5 digit number which is a perfect square.

(6) Find the smallest number by which 252 must be multiplied to get a perfect square.

(7) Find the least 6 digit number which is a perfect square

CUBES & CUBE ROOTS

Numbers obtained when a number is multiplied by itself 3 times are known as cube numbers.

$$(x)(x)(x) = x^3$$

Perfect Cube numbers :- The numbers that are cubes of natural numbers are called perfect cubes. Eg. 8, 27, 64, 125.

First 10 natural numbers.	Cube
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1000

Observe that cube of numbers ending in 1, 4, 5, 6, 9, 0 always end with that number itself.

Observe that cube of numbers ending in 2 ends in 8, 3 ends in 7, 7 ends in 3 and 8 ends in 2.

Cube Root : If cube of a is b, then we say that cube root of b is a. ie $\sqrt[3]{b} = a$ (where $a^3 = b$)

for eg : ① $2^3 = 8 \Rightarrow \sqrt[3]{8} = 2$

② $\sqrt[3]{1000} = 10$

To find cube Root : By prime factorisation.
By estimation.

Questions :

Short Answers

① The cube root of an odd number is always an :

② The volume of a cubical box is $3.824\ m^3$. Find the length of each side of the box.

3. Find $(0.8)^3$

4. Write the cubes of first five natural numbers.

5. Find the cube root of ① (-1000) ② $\frac{27}{64}$

6. Identify the perfect cubes in the following :
   27, 64, 125, 98, 100, -8000, -9000

7. By what least number should 4000 be divided so as to obtain a number which is a perfect cube ?

8. By what least number should 675 be multiplied so as to obtain a number which is a perfect cube ?

9. Find the cube root of $\frac{27}{64}$, 9.261

Long Answer Questions :

1. Divide 259875 by the smallest number so that the quotient is a perfect cube. Also find the cube root of the quotient

2. Find the cube root of 10077696 by prime factorization method.

3. Three numbers are in the ratio 1:3:4. The sum of their cubes is 31556. Find the numbers.

4. Show that 0.042875 is the cube of a rational number.

5. Find the volume of a cube whose edge is 3.5 cm?

6. What is the edge of a cube whose volume is $91125\ cm^3$.

7. By what smallest number should 18252 be multiplied so that the product becomes a perfect cube ? Also find the cube root of the product.

8. The volume of a cubical box is $13.824\ m^3$. Find the length of each side of the box.

9. Show that $\frac{\sqrt[3]{-512}}{\sqrt[3]{343}} = \sqrt[3]{\frac{-512}{343}}$.

COMPARING QUANTITIES

- Increase and Decrease Percentage :-

$$\text{Increase \%} = \frac{\text{Increase}}{\text{Original Value}} \times 100\%$$

$$\text{Decrease \%} = \frac{\text{Decrease}}{\text{Original value}} \times 100\%$$

- Discount : It is the reduction given on the marked price (MP) of the article.

Discount = Marked Price - Sale Price.

$$\text{Discount} = \frac{\text{Discount \%}}{100} \times \text{Marked Price}.$$

$$\text{Discount \%} = \frac{\text{Discount}}{\text{M.P}} \times 100$$

When SP > CP, we get Profit, Profit = SP - CP

When CP > SP, we get Loss, Loss = CP - SP

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100$$

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

- Overhead Expenses : Additional expenses made on the purchase of goods.

∴ CP = Buying Price + OH Expenses.

- Sales Tax is charged on the sale of an item by the Government and is added to the bill amount.

Sales Tax = Tax % of the bill amount.

- Value Added Tax (VAT) = Prices that include the tax.

- Compound Interest :

Interest : The extra money paid / charged on the money charged / borrowed / deposited is called Interest.

1. Simple Interest : $\frac{\text{Principal (P)} \times \text{Rate (R)} \times \text{Time (T)}}{100}$

2. Compound Interest (C.I.) when the interest is calculated on the amount of the previous year, then it is called C.I.

a) Amount $(A) = P\left(1 + \frac{R}{100}\right)^n$, where n = time in years

R = Rate compounded annually

P = Principal.

b) $C.I = A - P$

$= P\left[1 + \frac{R}{100}\right]^n - P$

$= P\left[\left(1 + \frac{R}{100}\right)^n - 1\right]$

Note: If interest is compounded half yearly (semi annually)

then n = no. of half years

$= 2 \times$ no. of years.

R = Rate per half year

$= (\text{Rate p.p.a}) \div 2$

So we double the time & rate is halfed to calculate compound interest if interest is to be calculated semi annually.

- Population Increase [By C.I method].

R = Rate of Interest in population

then population at the end of said time

$A = P\left(1 + \frac{R}{100}\right)^n$

Increase in population $= A - P$.

- DEPRECIATION: The value of article reduces every year at given rate.

1. New Value: $A = P\left(1 - \frac{R}{100}\right)^n$

2. Depreciation: $P - A$ = Original value - Reduced value

Questions:

Short Answer questions:

1. 50% of a length is 30 cm. What is the whole length?
2. Find the amount and compound Interest on Rs 2000 for 2 years at 10% interest being payable yearly?
3. What sum will become Rs 4913 in $1\frac{1}{2}$ years if rate of interest is $12\frac{1}{2}$% compounded half yearly?
4. If a person sells an article for Rs 400 gaining $\frac{1}{4}$ of its C.P., Find the gain %.
5. If the population of a town decreases 6.25% annually and the present population is 2048000. Find the population after 3 years
6. Compute the Amount & CI : (1) P = Rs 12800, R = $7\frac{1}{2}$%, T = 3 yrs (2) P = Rs 3000, R = 18%, T = 2 yrs.

Long Answer questions / HOTS:

(1) A dealer offers 20% discount on a saree with a marked price of the Khadi silk saree of Rs 450. How much should a buyer pay for it?

(2) By selling a scooter to a customer for Rs 11200, an auto dealer makes a profit of 12% on the Cost Price. Find the Cost Price.

(3) At what time will Rs 64000 amount to Rs 68921 at 5% p.a. interest being compounded semi-annually.

(4) The difference between the simple & compound interest for a certain sum of money for 3 years

(5) A shopkeeper buys 60 dozen eggs at Rs 8.40 per dozen. If 5 dozen eggs are broken and unsaleable, at what price per dozen must he sell the remaining eggs to make a profit of 10%.

(6) Rita bought an air cooler for Rs 3300 including a tax of 10%. Find the price of the air cooler before VAT was added.

(7) Find the amount of Rs 256 in one year at 12½% p.a. when the interest is compounded annually.

(8) A shopkeeper purchased 200 bulbs for Rs10 each. However 5 bulbs were fused and had to be thrown away. The remaining were sold at Rs 12 each. Find the gain or loss %.

(9) Find the compound interest on Rs 1000 at the rate of 10% p.a. for 18 months when interest is compounded half-yearly?

(10) Find the compount interest on Rs 24000 at 15% p.a. for $2\frac{1}{3}$ years?

ALGEBRAIC EXPRESSION & IDENTITIES

The variables, numbers/constants along with operators $+, -, \times, \div$ form algebraic expression.

Types of expressions: On the basis of number of terms:
having 1 term : Monomial
having 2 term : Binomial
having 3 term : Trinomial
3 or more terms : Polynomial

Coefficient of Terms: The factors other than a variable in a term is called the coefficient of the variable.
Eg:- coefficient of $x^3 = 1$

$3x^2 + 2x = 3, 2$

$4x + 5x = 9x = 9$

coefficient of x^2 in $4x^2y^2z = 4y^2z$

Like/Unlike Terms: Terms of an expression are said to be like if they have same variable factors otherwise they are unlike.

Standard Identities:

① $(a+b)^2 = a^2 + 2ab + b^2$ $\left[(a+b)(a+b) = a(a+b) + b(a+b) = a^2 + 2ab + b^2\right]$

② $(a-b)^2 = a^2 - 2ab + b^2$ $\left[(a-b)(a-b) = a(a-b) - b(a-b) = a^2 - 2ab + b^2\right]$

③ $(a+b)(a-b) = a^2 - b^2$ $\left[a(a-b) + b(a-b) = a^2 - ab + ba - b^2 = a^2 - b^2\right]$

④ $(x+a)(x+b) = x^2 + (a+b)x + ab$ $\left[x(x+b) + a(x+b) = x^2 + xb + xa + ab = x^2 + x(b+a) + ab\right]$

Questions.

Short Answer Questions :

① Expand : a) $\left(3x+\frac{2}{5}\right)^2$

b) $\left[\sqrt{2}\left\{\frac{p^2}{2}+\frac{2}{q^2}\right\}\right]^2$

② Find the value of $(1003)^2$

③ Find the value of $(501)^2-(499)^2$ using suitable Identity

④ Simplify : $42a^2-8a(a-1)-7a(1+5a)+a(a-1)$

⑤ What must be taken away from $3x^2+4x+1$ to get $2x^2-4x+3$?

⑥ The adjacent sides of a rectangle are $3x^2-5y^2$ and $7x^2-xy$. Find its Perimeter.

⑦ If $x+\frac{1}{x}=5$, Find the value of $x^2+\frac{1}{x^2}$

⑧ Solve:- $\left(x-\frac{1}{x}\right)\left(x+\frac{1}{x}\right)\left(x^2+\frac{1}{x^2}\right)\left(x^4+\frac{1}{x^4}\right)$

Long Answer questions / HOTS.

① Find the product of $(3x-2y)(x^2-2xy+2y^2)$

② Find the square of $[(2a+3b)+1]$

③ If $x-\frac{1}{x}=5$, find the value of $x^2-\frac{1}{x^2}$

④ Find the value of x when

$4x = 50\times50 - 48\times48$

⑤ Find the value of

$49x^2-56xy+16y^2$ when $x=\frac{1}{7}$, $y=\frac{1}{2}$

⑥ If $a-2b=15$ and $ab=11$, find the value of a^2+4b^2

⑦ Evaluate $(99.5)^2$ using identity

⑧ Simplify $a^2b(a-b^2)+ab^2(4ab-2a^2)-a^3b(1-2b)$

⑨ The perimeter of a Triangle is $7p^2-8p+9$ and 2 sides are $2p^2-p+1$ and $11p^2-3p+5$. Find the third side of the Δ

(24)

VISUALISING SOLID SHAPES

In a 3D shape :-

Vertex : The common point between 3 faces of 3D shapes.
Eg : Cuboid has 8 vertices.

Face : The flat surface of a 3D shape is called a face.

Edge : As we have side in 2D, we have edges in 3D is where 2 faces of a 3D shape meet.

Polyhedron : 3D shape which are obtained / defined by straight edges.
Eg : Cube, cuboid, prism are polyhedron.
Cone, Cylinder, sphere are not polyhedron.

Convex Polyhedron : Polyhedron generated by a convex polygon.

Regular Polyhedron : A polyhedron is said to be regular.
a) Its faces are made up of regular polygon.
b) Same number of faces meet at each vertex : eg : cube.

Questions :

1. A solid shape bounded by polygon is called :
2. A solid shape whose side faces are parallelograms & whose ends (bases) are congruent parallel figures is called :
3. When a prism has ends which are triangles it is called :
4. No. of edges of a cube are :
5. No. of edges of a tetrahedron are :
6. If the no. of faces and vertices in a solid are 7 & 10 resp., the no. of edges are :
7. A cuboid is also called a :

8. The solid with 6 vertices, 12 edges & 8 triangular faces is:

9. Is a square prism same as a cube. Why?

10. What is the least number of planes that can enclose a solid. What is the name of the solid?

11. Write number of faces of ① cuboid
② triangular prism
③ a square pyramid.

12. A solid figure which has only one vertex is called:

13. An ice almirah looks like a:

14. If the line segment joining any 2 points on the surface of a polyhedron entirely lies inside or on the polyhedron, then it is called:

CH- MENSURATION

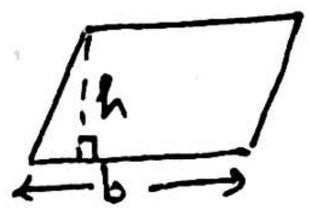
RECTANGLE: Perimeter = 2(l+b) , Length of diagonal = $\sqrt{l^2 + b^2}$

Area = l x b

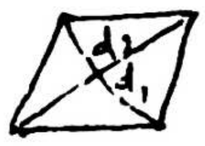
SQUARE : Perimeter = 4 x side length of diagonal = $\sqrt{2}$ x side

Area = side xside

PARALLELOGRAM : Area = base x height



RHOMBUS: Area = ½ x product of diagonals

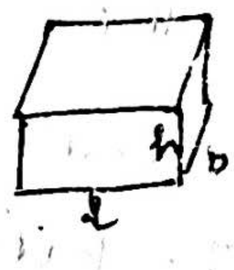


TRAPEZIUM : Area = ½ (sum of parallel sides) x height

CUBOID : Volume = l x b x h , total surface area = 2(lb +bh +hl)

Lateral surface area = 2x h(l + b)
= Perimeter (base) x h.

length of diagonal = $\sqrt{l^2 + b^2 + h^2}$



CONVERSION : $1 m^2 = (100 cm)^2 = 10000 cm^2$

$1 km^2 = (1000 m)^2 = 1000000 m^2$

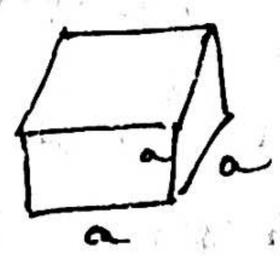
1 hectare = 100 are = $10000 m^2$.

1 arc = $100 m^2$

CUBE : Volume = a^3 , a is the side of a cube , Total surface area = 6 a^2

Lateral surface area = 4 a^2 ,

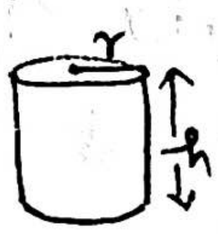
length of diagonal = $\sqrt{3}$ a



CYLINDER : Volume = $\pi r^2 h$

Total surface area = $2\pi rh + \pi r^2 + \pi r^2$

$= 2\pi r(h + r)$



Curved surface area = $2\pi rh$

= Perimeter of base x h

Conversion :

$1 m^2 = (100 cm)^2 = 10000 cm^2$

$1 km^2 = (1000 m)^2 = 1000000 m^2$

1 hectare = 100 are = $10000 m^2$

1 are = $100 m^2$

Questions :

Short answers questions :

(1) A cube has volume $27000 cm^3$. Its edge measure.

(2) The area of a trapezium is $385 cm^2$. Its parallel sides are in the ratio 3:4 & the perpendicular distance between them is 11 cm. Its longer side is.

(3) The edge of a cube is $\sqrt{9}$ m. Find its surface area.

(4) The breadth of a room is twice its height & half its length. The volume of the room is $512 cm^3$. Find the length of the room.

(5) If the diameter of a cylinder is 28 cm & its height is 20 cm. Find the total surface area.

(6) Find the volume of a cuboid measuring 3m by 60cm by 38 cm. Give the answer in m^3.

(7) Curved surface area of a right circular cylinder is $6.6 m^2$. If the radius of the base of the cylinder is 1.4 m. Find its height.

Long Answer questions / HOTS :-

(1) The total surface area of a cube is $96 m^2$. Find its volume.

(2) A metal cube of edge 12m is melted to form three smaller cubes. If the edge of 2 smaller cubes are 6m & 8m. Find the surface area of the third smaller cube.

EXPONENTS & POWERS.

Exponential / Power Notation : When a number is multiplied by itself 'n' number of times, then it is represented using exponents / power.

1) Base : The number which is being multiplied.
2) Power : The no. of times it is multiplied.

Laws of Exponent.

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $a^m \times b^m = (ab)^m$
5. $a^m \div b^m = \left(\frac{a}{b}\right)^m$
6. $a^0 = 1$
7. $a^{-m} = \frac{1}{a^m}$

Note : $(-1)^{\text{even number}} = 1$

$(-1)^{\text{odd number}} = -1$

Question:

Short Answer questions:

(1) The value of $\left(\frac{1}{3}\right)^{-1} + \left(\frac{1}{5}\right)^{-1} - \left(\frac{1}{6}\right)^{-1}$ equals :

(2) The reciprocal of $\left(\frac{2}{5}\right)^{-3}$ is :

(3) Simplify : $(5^3 - 4^2) \times \left(-\frac{1}{3}\right)^2$

(4) Express 62×10^{-5} in usual form.

(5) $(5^0 + 4^0) \times 2^{-1}$ equals :

(6) 4^{-3} expressed as a power with base 2 is :

(7) Evaluate : $\left[\left(-\frac{1}{2}\right)^2 \times \left(\frac{-1}{2}\right)^{-3} \times \left(\frac{-1}{2}\right)^4\right]$

(8) Mass of the earth is 5.97×10^{24} kg and the mass of the moon is 7.35×10^{22} kgs. What is the total mass?

Long Answer / HOTS :

(1) If $5^{2x+1} \div 25 = 125$, find the value of x.

(2) If $\frac{p}{q} = \left(\frac{3}{2}\right)^2 \times \left(\frac{2}{3}\right)^{-4}$, find the value of $\left(\frac{p}{q}\right)^{-2}$

(3) If x is a rational number and a, b, c are any integers, then prove :

$$\frac{x^a}{x^b} \times \frac{x^b}{x^c} \times \frac{x^c}{x^a} = 1$$

(4) Evaluate $\left(6^{-1} - 8^{-1}\right)^{-1} + \left(2^{-1} - 3^{-1}\right)^{-1}$

(5) By what number should $\left(\frac{5}{4}\right)^{-3}$ be divided so that the quotient may be $\left(\frac{15}{16}\right)^{-2}$?

(6) Simplify : $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^b}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a}$

(7) Evaluate : $\left[\left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right] \div \left[\frac{1}{4}\right]^{-3}$

(8) Express the product 3.2×10^6 & 4.1×10^{-2} in the standard form.

(9) (1) For any 2 non-zero rational nos a & b, $a^4 \div b^4$ is equal to:

(2) " " " , rational nos a & b $a^5 \times b^5$ is equal:

(3) For a non-zero rational no a, $(a^3)^{-2}$ is equal :

(4) For a non-zero rational no. a, $a^7 \div a^{12}$ is equal :

DIRECT AND INVERSE PROPORTION

Direct : 2 quantities are said to be in a direct Proportion if an increase and decrease in the first quantity results in the increase and decrease in the second quantity as well.

$$\frac{x_1}{x_2} = \frac{y_1}{y_2}.$$

Inverse : 2 quantities are said to be in inverse proportion to each other if an increase in first quantity results in decrease in 2nd quantity.

In inverse variation

$x \times y = K$ where K is a constant.

$$\therefore \frac{x_1}{x_2} = \frac{y_2}{y_1} \qquad \therefore x_1 y_1 = y_2 x_2$$

Questions

Short Answer:

① A car travels at the speed of 36 km/hr. How many meters will it travel in 1 second?

② 40 persons take 30 days to complete a work. How long will it take to complete the work, if 20 more persons join them?

③ Complete the Table determining first whether x & y vary directly or inversely.

x	3	6	?	27	?
y	11	22	33	?	880

④ u varies inversely as V. Complete.

u	30	?	?	0.2
V	5	25	0.5	?

⑤ Reema types 540 words during half an hour. How many words would she type in 6 minutes?

long answer /HOTS :

(1) $\frac{5}{9}$ of a piece of metal weighs 7 kg. What would be the weight of $\frac{2}{7}$ of the metal?

(2) A car travels at a speed of 72 km/hr. Express this speed in m/sec.

(3) Sony & Rani together can do a piece of work in 20 days. Sony alone can finish the work in 30 days. If Rani would be doing it alone, how long will she take?

(4) Arun drives his car at 60 km/hr. How much distance will he cover in 2hrs 15 seconds.

(5) Working 5 hours daily, Shaheed can embroider 3 saree in 21 days. How many days will it take for him to embroider 6 Sarees working 7 hours daily.

(6) Find the height of the pole which casts a shadow 20 m long at a time & place where the shadow of a stick 1m long is 55 cm.

(7) Rita walked to her school at a speed of 45 km/hr and takes 45 minutes to reach the school in time. One day she reached the school 10 minutes late. At what speed did she walk that day, assuming that she did not start late from home?

FACTORISATION

Short Answer Questions :

(1) Simplify using standard identities : $\frac{58^2 - 42^2}{16}$

(2) Factorize $x^2 - xz + xy - yz$

(3) Fill in the missing term, making a square : $x^2 + \_\_\_ + 49$.

(4) Factorize $p^2q - pr - pq + r^2$

(5) Factorize $-5x^2 - x + 4$

(6) Factorize $\frac{3b - 3a}{7a - 7b}$.

(7) Factorize : $16x^2 - 24yz - 9y^2 - 16z^2$

Long Answer Questions/HOTS :

(1) Find out the error in :

a) $(x-7)^2 = x^2 - 72$

b) $(x-4)(x-2) = x^2 + 8$

(2) Factorise

a) $25 - p^2 - q^2 - 2pq$

b) $x^4 - y^4$

c) $49a^2b^4 - 4a^2b^6$

d) $m^2 + 3m + \frac{9}{4}$

e) $14m^5n^4p^2 - 42m^7n^3p^7 - 70m^6n^4p^3$

f) $100 - a^2 - b^2 - 2ab$.

e) $16a^2 - \frac{25}{4a^2}$

f) $100(x+y)^2 - 81(a+b)^2$

g) $a^{12}x^4 - a^4x^{12}$.

h) $4y^2 - 8y + 3$.

INTRODUCTION TO GRAPHS.

Questions:

short answer

(1) The point where the x-axis & y-axis intersect is called the :

(2) The point (2,7) lies in the ___ quadrant.

(3) The ordinate of a point is its distance from the :

(4) The equation representing y-axis is :

(5) The coordinates of any point on the x-axis are of the form :

(6) Plot the points on a graph paper :
A(3,4) , B(-8,4) , C(-5,+4) D(6,+4)

(7) Plot the points (0,0) (1,1) (2,2) & (4,4) on the graph Do they lie on a line ?

long Answer / HOTS

(1) The following table shows the marks obtained by students in various class tests.

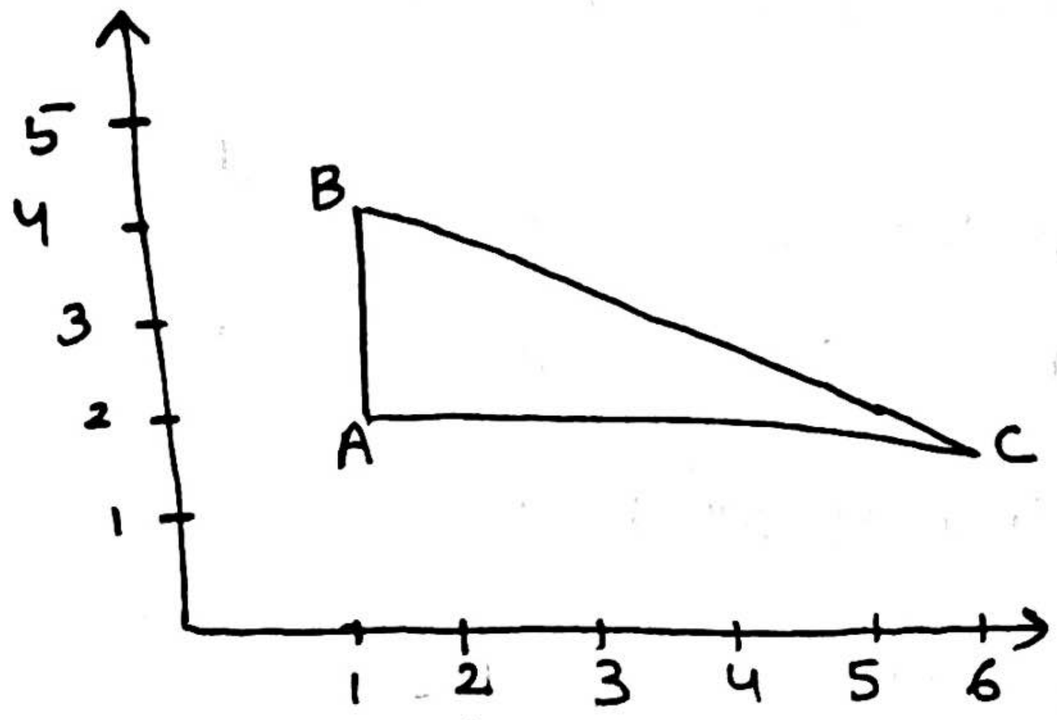
Unit Test	1	2	3	4
Marks	30	42	60	80

(2) Iron is heated and its temperature is noted at different intervals of time as given in the following table.

Time (in seconds)	0	2	6	12	14
Temperature in °C	20	22	27	32	39

③ Which of the following points lie on x-axis :
(0,7) (7,2) (5,0) (0,3) (1,0) (8,0)

④ Look at the figure & fill in the blanks :



(1) Co-ordinates of origin are :
(2) Co-ordinates of M are :
(3) x axis is
(4) y axis is
(5) Coordinates of ____ are (2,0)

⑤ (1) What is vertical line through the origin called ?
(2) Where does the point having co-ordinates as (1,0) line.

⑥ Plot a graph using the table and find the cost of 8 litres of milk.

Litres of milk bought	10	15	20	25
Cost of milk (in Rs)	240	360	480	600

⑦ The following table shows multiples of 2.

x	1	3	4	5	7
z	2	6	8	10	14

Do all the points lie on a straight line.

PLAYING WITH NUMBERS

QUESTIONS :

1. Solve :

①
$$\begin{array}{r} BA \\ \times\ B3 \\ \hline 57A \end{array}$$

②
$$\begin{array}{r} 8A5 \\ 94A \\ \hline 1A33 \end{array}$$

2. Replace each alphabet by a digit from 1 to 9, so that the following sum is correct.

①
$$\begin{array}{r} AB \\ BA \\ \hline BCB \end{array}$$

②
$$\begin{array}{r} PQ \\ \times\ QP \\ \hline RQPR \end{array}$$

3. Give an example of a number which is (a) divisible by 2 but not by 4 (b) divisible by 3 but not by 6.

4. If x is a digit of the number $66784x$ such that it is divisible by 9. Find possible values of x.

5. Which of the following numbers are divisible by each of these numbers 2, 3, 5, 9 or 10.
37635, 31530, 57525, 741780

6. Replace each alphabet by a digit from 1 to 0.

$$\begin{array}{r} SEND \\ MORE \\ \hline MONEY \end{array}$$

②
$$\begin{array}{r} ABC \\ -\ CCB \\ \hline \end{array}$$

Find a, b, c, d to make the sum correct.

$$\begin{array}{r} 3a07 \\ 1b2 \\ \hline 3c7c \end{array}$$

②
$$\begin{array}{r} 37a \\ \times\ b7 \\ \hline cbc5 \\ +\ 1a000 \\ \hline 17625 \end{array}$$