

$$ax^2 + bx + c = 0$$

केन्द्रीय विद्यालय संगठन
Kendriya Vidyalaya Sangathan

**आंचलिक शिक्षा एवं प्रशिक्षण
संस्थान, भुवनेश्वर**

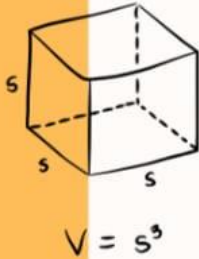
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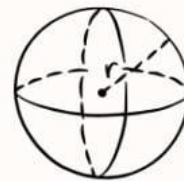
MATHEMATICS

STUDENT SUPPORT MATERIAL

for Class VIII



$$f(x)$$



SESSION: 2026 - 27

$$y = mx + b$$

“Mathematics is not about number, equations, computation or algorithm, it is about understanding.”



$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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अनुक्रमणिका / INDEX

S.No.	NAME OF THE CHAPTER	PAGE NO.
PART - I		
1	A SQUARE AND A CUBE	09– 19
2	POWER PLAY	20– 30
3	A STORY OF NUMBERS	31– 44
4	QUADRILATERALS	45– 58
5	NUMBER PLAY	59– 73
6	WE DISTRIBUTE, YET THINGS MULTIPLY	74– 85
7	PROPORTIONAL REASONING -1	86 – 105
PART - II		
1	FRACTIONS IN DISGUISE	107-118
2	THE BAUDHAYAN-PYTHAGORAS THEOREM	119-133
3	PROPORTIONAL REASONING-2	134-147
4	EXPLORING SOME GEOMETRIC THEMES	148-163
5	TALES BY DOTS AND LINES	164-181
6	ALGEBRA PLAY	182-206
7	AREA	207-222

PART -I

CHAPTER 1: A SQUARE AND A CUBE

SECTION – A (1 MARK)

Q. 1 A boy having 115 cubes of edge 1 unit. While stacking the cubes to form a bigger cube, he finds out that there is shortage of some cubes, how many more cubes are needed?
(a) 4 (b) 10 (c) 6 (d) 7

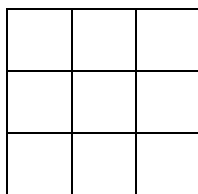
Q.2 In a highway, two milestones are marked 14^2 and 15^2 . How many milestones are there between these two?
(a) 29 (b) 28 (c) 30 (d) 32

Q.3 Arun wants to find out a number, which is closer to 250 and is also a perfect square, which of the following number will be chosen by him
(a) 225 (b) 28 (c) 256 (d) 248

Q.4 If $125^2 = 15625$, what is the value of 126^2 ?
(a) $15625 + 126$ (b) $15625 + 26^2$ (c) $15625 + 251$ (d) $15625 + 253$

Q.5 A farmer wants to plant banana plants in his field such that no. of plants in each row and each column is same, which of the following number of plants could he choose?
(a) 80 (b) 144 (c) 120 (d) 99

Q.6 Rohit saw a 3×3 square as shown in the fig below, how many squares are there in the given figure?



(a) 9 (b) 12 (c) 14 (d) 15

Q.7 If the sum of first n odd numbers is n^2 , What will be the sum of first n even numbers?
(a) n^2 (b) $n(n+1)$ (c) $2n^2$ (d) $4n^2$

Q.8 If $15^2 = 225$, what will be the value of $(1.5)^2$?
(a) 22.5 (b) 2.25 (c) 0.225 (d) 0.0225

Q.9 How can you determine if a number is perfect square by successively subtracting odd numbers?
(a) If the numbers subtracted are all prime
(b) If the final result is zero after subtracting consecutive odd numbers starting from 1
(c) If the final result is an odd number

(d) If the process never ends

Q.10 After squaring a prime number 'a', we get another number 'b'? How many factors are there of the number 'b'?

- (a) 1 (b) 2 (c) 3 (d) 4

ANSWERS:

- Q. 1 (b) Q. 2 (b) Q. 3 (c) Q. 4 (c) Q. 5 (b)
Q. 6 (c) Q. 7 (b) Q. 8 (b) Q. 9 (b) Q. 10 (c)

SECTION – B (2 MARKS)

Q. 1 A school is constructing a square-shaped parking lot where each car requires 4 m^2 of space. The side of parking lot is 14 m. How many cars can be parked?

Q. 2 A farmer has a square field of area 625 m^2 . He wants to divide it into 25 equal square plots for growing different vegetables. What will be the side of each smaller square plot?

Q. 3 Using the given pattern, find the missing numbers:

$$1^2 + 2^2 + 2^2 = 3^2$$

$$2^2 + 3^2 + 6^2 = 7^2$$

$$3^2 + 4^2 + 12^2 = 13^2$$

(i) $4^2 + 5^2 + (\text{ })^2 = 21^2$

(ii) $5^2 + (\text{ })^2 + 30^2 = 31^2$

Q. 4 Arjun wants to find a square number which is divisible by 4, 9, and 10. What will be the smallest such number?

Q. 5 Using prime factorization show that 3375 is a perfect cube?

Q. 6 Express 51^2 as the sum of square of two consecutive positive integers.

Q. 7 Find the smallest number by which the given number 605 must be multiplied so that the product becomes a perfect square. Hence find the square thus obtained.

Q. 8 What will be the unit digit of the square of the number 7898437?

Q. 9 How many non-perfect square natural numbers lie between the squares of the following numbers?

(i) 18 and 19

(ii) 78 and 79

Q. 10 Find the smallest number by which 400 must be multiplied to make it a perfect cube.

ANSWER:

Q. 1. The side of the parking lot = 14 m.

Area of square parking lot = 14×14

Area = 196 m^2

Space for 1 car = 4 m^2
No. of cars = $196 \div 4 = 49$ cars

Q. 2 Side of big square = $\sqrt{625} = 25 \text{ m}$
Total area = 625 m^2
Area of 1 smaller plot = $625 \div 25 = 25 \text{ m}^2$
Side of smaller square = $\sqrt{25} = 5 \text{ m}$
Each smaller plot has side **5 m**.

Q. 3 Given: $1^2 + 2^2 + 2^2 = 3^2$
 $\Rightarrow 1^2 + 2^2 + (1 \times 2)^2 = 3^2$
 $2^2 + 3^2 + 6^2 = 7^2$
 $\Rightarrow 2^2 + 3^2 + (2 \times 3)^2 = 7^2$
 $\Rightarrow 2^2 + 3^2 + 2^2 \times 3^2 = 7^2$
 $3^2 + 4^2 + 12^2 = 13^2$
 $\Rightarrow 3^2 + 4^2 + (3 \times 4)^2 = 13^2$
(i) Therefore $4^2 + 5^2 + (4 \times 5)^2$
 $= 4^2 + 5^2 + 20^2 = 21^2$
(ii) $\Rightarrow 5^2 + 6^2 + (5 \times 6)^2 = 31^2$
 $\Rightarrow 5^2 + 6^2 + 30^2 = 31^2$

Q. 4 LCM of 4, 9, 10 = 180.
Prime factorization: $180 = 2^2 \times 3^2 \times 5$.
To make it a perfect square, multiply by 5.
Smallest perfect square = $180 \times 5 = 900$.

Q. 5 Factor of 3375 = $3 \times 3 \times 3 \times 5 \times 5 \times 5$
 $= (3 \times 5)^3 = 15^3$.
Hence, 3375 is a perfect cube and cube root = 15.

Q. 6 Let the two positive consecutive integers be n and $n + 1$.
Then, $n + (n + 1) = 51^2$
 $\Rightarrow 2n + 1 = 2601$
 $\Rightarrow 2n = 2600$
 $\Rightarrow n = 1300$
Therefore, the numbers are 1300 and 1301
And $1300 + 1301 = 2601$

Q. 7 Factor of 605 = $5 \times 11 \times 11$
Since 5 is not in pairs so we multiply 605 by 5 to make it a perfect square.
Perfect square = $605 \times 5 = 3025$

Q. 8 The unit digit of the square of a number is the unit digit of the square of the unit digit of the given number.
Unit digit of 7898437 = 7
 $7 \times 7 = 49$
Unit digit of 49 is 9.
 $\therefore$ The unit digit of the square of 7898437 = 9.

Q. 9 There are $2n$ non-perfect square numbers between two consecutive square numbers n^2 and

$$(n + 1)^2$$

(i) For 18^2 and 19^2

$$n = 18$$

$$\therefore 2n = 36$$

$\therefore$ There are $2n = 36$ non-perfect square numbers between 18^2 and 19^2 .

(ii) For 78^2 and 79^2

$$n = 78$$

$$\therefore 2n = 2 \times 78 = 156.$$

$\therefore$ There are $2n = 156$ non-perfect square numbers between 78^2 and 79^2 .

Q. 10 Factor of $400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5 = 2^4 \times 5^2$.

For cube, powers must be multiple of 3.

Need $2^2 \times 5 \rightarrow 20$.

Smallest number = 20.

Section – C (3 MARKS)

Q. 1. Find the least number of persons among whom Rs. 33,275 must be distributed equally so that each person gets an amount which is a perfect square.

Q. 2. A school wants to build a square playground of area 1521 m^2 . If square shaped tiles of side 3 m are used then how many tiles are needed?

Q. 3. A cubical block of side 6 m is to be built using small cubes of side 2 m. Find the number of such small cubes.

Q. 4. Find the smallest number which when multiplied with 3600 will make the product a perfect cube. Find the cube root of the product.

Q. 5. A tailor has a square cloth of area 1600 cm^2 . He wants to cut square shaped handkerchiefs of side 8 cm. How many can he make?

Q. 6. A farmer has a square plot of land of area 8100 m^2 . He wants to build a square pond inside the plot such that the pond occupies exactly one-fourth of the total area. Around the pond, he wants to build a fence. Find the length of the fence required.

Q. 7. A square carpet has an area of 2025 m^2 . It is surrounded by a border of width 1 m which is decorated. Find the area of the decorated border.

Q. 8. Find the smallest square number that is divisible by each of the numbers 8, 15 and 20.

Q.9. A rectangular paper of length 45cm and breadth 5 cm is cut to form a square with the same area. What is the side of the square?

Q.10. Three numbers are in the ratio 1:2:3 and the sum of their cubes is 4500. Find the numbers.

ANSWER:

Sol.1. Factorize 33275 into prime factors: $33275 = 5^2 \times 11^2 \times 11$

For the quotient to have a perfect square, each prime factor's exponent must be a multiple of 2.

Divide by 11 to get a perfect square.

So, the required least number of persons = 11.

Sol. 2. Area of one tile = $3 \times 3 = 9 \text{ m}^2$.

Number of tiles = $1521 / 9 = 169$ tiles.

Sol. 3. Volume of large cube = $6^3 = 216 \text{ m}^3$.

Volume of small cube = $2^3 = 8 \text{ m}^3$.

Number of small cubes = $216 / 8 = 27$ cubes.

Sol. 4. Factorize 3600:

$$3600 = 2^4 \times 3^2 \times 5^2$$

For a perfect cube, need $2^3 \times 3^3 \times 5^3$

Multiply by $2^2 \times 3 \times 5 = 60$.

Cube root of product = $\sqrt[3]{(2^6 \times 3^3 \times 5^3)} = 2^2 \times 3 \times 5 = 60$.

Sol. 5. Side of cloth = $\sqrt{1600} = 40 \text{ cm}$.

Number of handkerchiefs along one side = $40 / 8 = 5$

Total handkerchiefs = $5 \times 5 = 25$

Sol 6. Area of pond = $8100 / 4 = 2025 \text{ m}^2$

Side of pond = $\sqrt{2025} = 45 \text{ m}$

Length of the fence required = $45 \times 4 = 180 \text{ m}$

Sol. 7. Area of carpet = 2025 m^2

Side of carpet = $\sqrt{2025} = 45 \text{ m}$

Side with border = $45 + 2 = 47 \text{ m}$

Area with border = $47^2 = 2209 \text{ m}^2$.

Area of border = $2209 - 2025 = 184 \text{ m}^2$.

Sol. 8. LCM of 8, 15, 20 = 120

Prime factorization of 120 = $2 \times 2 \times 2 \times 3 \times 5$.

Smallest square number divisible by 120 = $2 \times 2 \times 2 \times 3 \times 5 \times (2 \times 3 \times 5) = 3600$.

Sol. 9. Area of rectangle = $45 \times 5 = 225 \text{ cm}^2$.

Area of square = 225 cm^2 .

Side of square = $\sqrt{225} = 15 \text{ cm}$.

Sol. 10. Let the common factor be x

Then the numbers be x, 2x, 3x.

$$x^3 + (2x)^3 + (3x)^3 = 4500.$$

$$x^3 + 8x^3 + 27x^3 = 4500.$$

$$36x^3 = 4500.$$

$$x^3 = 4500/36 = 125$$

$$x = 5$$

So, the required numbers are 5, 10 and 15.

SECTION – D (4 MARKS)

Q. 1 Passage 1: The Tiling Project

Ramesh is a contractor hired to tile the floor of a large square hall. The hall has a side length of 12 meters. Ramesh has two types of square tiles available: one with a side length of 40 cm and another with a side length of 50 cm. He wants to use only one type of tile to avoid a mixed pattern.



(a) If Ramesh uses the 40 cm tiles, how many tiles will be needed? (2 marks)

(b) Which size of tile would be more cost-effective to use if the 40 cm tile costs ₹20 each and the 50 cm tile costs ₹30 each? Show your calculations. (2 marks)

Q. 2 Passage 2: The Cubical Box Puzzle

A carpenter is making a large cubical box to store toys. The box has a volume of 8 cubic meters. He decides to paint the outside of the box with a special anti-scratch paint. A small can of this paint can cover 4 square meters. Given that the volume of cube = l^3

(a) What is the length of one side of the cubical box? (2 marks)

(b) How many cans of paint will the carpenter need to buy to paint one side of the box? (2 marks)

Q. 3 Passage 3: The Garden and the Paving Stones

Mrs. Sharma has a square garden with a perimeter of 40 meters. She wants to create a square path around the garden using paving stones. The path will be 1 meter wide on all sides. She is curious about how many paving stones she will need. Each paving stone is a square with a side length of 50 cm.



- (a) What is the area of Mrs. Sharma's garden? (2 marks)
- (b) What is the area of the path, and how many paving stones will she need to cover it? (2 marks)

Q. 4 Passage 4: The School Block Challenge

A teacher gives a group of students 27 small wooden cubes, each with a side length of 3 cm. She challenges them to arrange all the small cubes to form a single, larger cube.

- (a) Is it possible for the students to form a single, larger cube using all 27 small cubes? If so, what would be the side length of the larger cube? (2 marks)
- (b) What is the difference between the total surface area of all 27 small cubes (when they are separate) and the surface area of the larger cube they form? (2 marks)

Q. 5 Passage 5: The Gift Box and the Ribbon

An event planner is decorating gift boxes for a party. Each gift box is a cube with a side length of 25 cm. For each box, she needs to tie a ribbon around all four sides of the top face, plus an extra 20 cm for a bow.



- (a) What is the total length of ribbon needed for one gift box? (2 marks)
- (b) If the event planner has a 10-meter roll of ribbon, how many gift boxes can she decorate completely? (2 marks)

Solution:**Q. 1 Passage 1: The Tiling Project**

(a) Hall side = 12 m, 40 cm = 0.40 m

Area of hall = $12^2 = 144 \text{ m}^2$

Area of one 40 cm tile = $0.40 \times 0.40 = 0.16 \text{ m}^2$

Number of tiles = $144 \div 0.16 = 900$ tiles

Answer: 900 tiles

(b) 50 cm = 0.50 m $\rightarrow$ Area = 0.25 m^2

Number of tiles = $144 \div 0.25 = 576$ tiles

Cost: 40 cm $\rightarrow 900 \times 20 = ₹18000$

Cost: 50 cm $\rightarrow 576 \times 30 = ₹17280$

Answer: 50 cm tiles are cheaper (₹17280)

Q. 2 Passage 2: The Cubical Box Puzzle

(a) Volume = $8 \text{ m}^3 \rightarrow \text{side} = \sqrt[3]{8} = 2 \text{ m}$

Answer: 2 m

(b) area of each side = $2^2 = 4 \text{ m}^2$

1 can covers $4 \text{ m}^2 \rightarrow 4 \div 4 = 1$ can

Answer: 1 can

Q. 3 Passage 3: The Garden and the Paving Stones

(a) Perimeter = 40 m

$4 \times \text{side} = 40$

Side = $40 \div 4 = 10 \text{ m}$

Area = $10^2 = 100 \text{ m}^2$

Answer: 100 m^2

(b) Outer side = $10 + 2 = 12 \text{ m}$

Outer area = $12^2 = 144 \text{ m}^2$

Path area = $144 - 100 = 44 \text{ m}^2$

Stone area = $0.5 \times 0.5 = 0.25 \text{ m}^2$

Stones = $44 \div 0.25 = 176$ stones

Answer: 44 m^2 , 176 stones

Q. 4 Passage 4: The School Block Challenge

(a) Small cube volume = $3^3 = 27 \text{ cm}^3$

Total = $27 \times 27 = 729 \text{ cm}^3$

Side = $\sqrt[3]{729} = 9 \text{ cm}$

Answer: Yes, side = 9 cm

(b) One cube area = $6 \times 3^2 = 54 \text{ cm}^2$

Total area = $27 \times 54 = 1458 \text{ cm}^2$

Large cube area = $6 \times 9^2 = 486 \text{ cm}^2$

Difference = $1458 - 486 = 972 \text{ cm}^2$

Answer: 972 cm^2

Q. 5 Passage 5: The Gift Box and the Ribbon

(a) Perimeter of top = $4 \times 25 = 100$ cm

+ bow 20 cm $\rightarrow$ 120 cm

Answer: 120 cm

(b) 10 m = 1000 cm $\rightarrow 1000 \div 120 = 8.33 \rightarrow$ 8 boxes

Answer: 8 boxes

A SQUARE AND A CUBE

Class test

Section A (MCQ – 1 mark each × 4 = 4 marks)

1. A farmer fenced a square plot of land. Its area is 144 m^2 . Which of the following is the length of one side of the plot?
(a) 14 m (b) 13 m (c) 12 m (d) 11 m
2. A classroom has a square carpet of area 225 m^2 . What will be the length of each side of the carpet?
(a) 16 m (b) 15 m (c) 14 m (d) 13 m
3. Which of the following numbers is a perfect cube?
(a) 300 (b) 500 (c) 124 (d) 216
4. The unit digit of the square of 7898437 is:
(a) 1 (b) 9 (c) 3 (d) 7

Section B (2 marks each × 3 = 6 marks)

5. A farmer has a square field of area 625 m^2 . He wants to divide it into 25 square plots for growing different vegetables. What will be the side of each smaller plot?
6. Determine whether 3375 is a perfect cube by prime factorization.
7. Find the unit digit of the cube of 87523.

Section C (3 marks each × 2 = 6 marks)

8. Find the smallest square number that is divisible by each of the numbers 8, 15 and 20.
9. A tailor has a square cloth of area 1600 cm^2 . He wants to cut square handkerchiefs of side 8 cm. How many handkerchiefs can he make?

Section D – Case Based Question (4 marks = 4 sub-parts × 1 mark each)

10. The Cubical Box Puzzle

A carpenter is making a large cubical box to store toys. The box has a volume of 8 cubic meters. He decides to paint the outside of the box with a special anti-scratch paint. A small can of this paint can cover 4 square meters. Given that the volume of cube = l^3

- (a) What is the length of one side of the cubical box? (2 marks)
- (b) How many cans of paint will the carpenter need to buy to paint one side of the box? (2 marks)

SOLUTIONS:

1. (C) 12m
2. (b) 15 m
3. (d) 216
4. (b) 9

5. Area of the square field = 625 m^2
Square field into 25 square parts = $625/25 = 25 \text{ m}^2$
Area of one part = 25 m^2
Side of the square field = 5m

6. Prime factorization of 3375 = $3 \times 3 \times 3 \times 5 \times 5 \times 5 = 3^3 \times 5^3$

7. The number = 87523
Unit digit of number = 3
Square of unit digit = 9
Unit digit of the number = 9

8. LCM of 8, 15, and 20 = 120
Prime factorization of 120 = $2 \times 2 \times 2 \times 5 \times 3 = 2^3 \times 3 \times 5$
 $= 2 \times 2 \times (2 \times 5 \times 3)$
Smallest square number divisible = $2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 3 \times 3 = 3600$

9. Area of square cloth = 1600 cm^2
Side of each handkerchief = 8 cm
Area of each handkerchief = 16 cm^2
Total number of handkerchiefs = $1600/16 = 100$

10. Passage 2: The Cubical Box Puzzle
(a) Volume = $8 \text{ m}^3 \rightarrow \text{side} = \sqrt[3]{8} = 2 \text{ m}$
Answer: 2 m

(b) Surface area = $2^2 = 4 \text{ m}^2$
1 can covers $4 \text{ m}^2 \rightarrow 4 \div 4 = 1 \text{ can}$
Answer: 1 can

CHAPTER 2: POWER PLAY

SECTION A (1 mark questions)

Q 1 .A popular stationery company claims it sells one million pens every year. What is the scientific notation of the data?

- (A) 10^7 (B) 10^6 (C) 10^8 (D) 10^5

Q2 In a wildlife sanctuary, a cub is born weighing 4 kg. The sanctuary's scientist observes that the cub's weight doubles each year (power of 2 growth). What will be its weight after 5 years?

- (A) 126 (B) 40 (C) 120 (D) 128

Q3 Rohan organizes a juice party. He played a game with his friend. They pour 1 litre of juice into 3 glasses. Then, each glass is again poured equally into 3 smaller glasses. If this process continues for 5 rounds, how many glasses of juice will finally be on the table?

- (A) 3^3 (B) 3^5 (C) 5^3 (D) 5×3

Q4. Which of the following is equal to $2^5 \times 3^2$?

- (A) 96 (B) 144 (C) 288 (D) 192

Q5 A digital display in a smart calculator shows any non-zero number raised to the power zero. If Riya enters any non-zero number (say 7, 15, or 120) and presses the "power 0" key, what number will appear on her calculator screen?

- (A) 7 (B) 0 (C) 1 (D) 2

Q6. Ritta writes the number 6.7894×10^{-7} in normal(decimal) form as 67894000 but Sneha writes as 0.00000067894. Sohan writes as 0.0000067894 and Meena writes as 678940000000. Who is correct?

- (A) Ritta (B) Sneha (C) Sohan (D) Meena

Q7. A hundred crore =

- (A) an arab (B) a khrab (C) 2 million (D) 2 billion

Q8 Hundred koties are called.....

- (A) niyuta (B) kankara (C) ayuta (D) sarvajna

Q9. Use the power line of 4. Fill in the blank $1024 = 64 \times \dots$

- (A) 4^3 (B) 4^5 (C) 4^6 (D) 4^2

Q 10. In 8th class, the class teacher gives a question to solve $((3)^2)^4$. Ashuk said that it is solved with applying operation addition in powers and we get 3^6 as answer but Sonu said that "I think, here multiplication operation is applied on powers and then we get answer 3^8 ." Rohan gave the answer as 9^4 while Sneha gave the answer 81^2 . Who is not correct?

- (A) Ashuk (B) Sonu (C) Rohan (D) Sneha

SOLUTION

Solution 1: option B: $1000000=10^6$

Solution 2: Option D : Weighs of the baby after 5 years= $4 \times 2^5=4 \times 32=128\text{kg}$.

Solution3: Option B: Number of glasses: $=3^5=243$

Solution4: Option C: 288

Solution5: Option C: $a^0=1$

Solution 6: Option B: Decimal form is 0.00000067894. So, Sneha is right.

Solution 7: Option A: an arab

Solution 8: Option C: ayuta

Solution 9: option D: $1024=64 \times 16=64 \times 4^2$

Solution 10: option A: Ashuk is incorrect.

SECTION B (2 marks questions)

Q 1. The distance between earth and sun is 149600000000 m. Write this data into scientific form in metres and in kilometres?

Q.2. A student, Yash wants to make 4-character passwords using digits 0 to 9 and uppercase letters A to Z for his piggy bank. How many passwords can be formed by him, if repetition is allowed?

Q.3 A bacteria double every hour in the process of converting milk to curd. Milk takes 6 hours to convert into curd. If there are 2^4 bacteria initially, how many bacteria will there be after converting into curd?

Q.4 Raman has 3 dresses, 2 hats, and 4 pairs of shoes. How many different outfits can Raman create?

Q5. Write 47651 in expanded form and then express in powers of 10.

Q6. Express $4^{-3} \times 8^2 \times 2^3$ as a power with base 2.

Q 7. Express the number 32400 as a product of its prime factors and represent the prime factors in their exponential form.

Q8. Nestle Maggie is introducing a new flavour, and they want to package it in boxes that can hold $(3^2+2^4+2^8 \times 2^{-5})$ packets of Maggie. How many packets of Maggie can each box hold?

Q9 What is the value of $4^n/4^n$? Which property of power can you use here to find this value?

Q10 Sonu wants to make a password of 3 digits for his suitcase bag using digits 0–9.

(a) How many possible passwords are there if repetition is allowed?

(b) How many possible passwords are there if repetition is not allowed?

SOLUTION

Solution 1: Distance between earth and sun = 149600000000m = 149600000km
Scientific form: $1.496 \times 10^{11} \text{m} = 1.496 \times 10^8 \text{ km}$

Solution 2: Number of digits (0 to 9) is 10
And number of letters (A to Z) is 26
Total characters = $10 + 26 = 36$
Each of the 4 positions can be filled in 36 ways.
Therefore, Total passwords = 36^4

Solution 3: number of bacteria in starting = 2^4
Since bacteria doubles after every hour
so, the number of bacteria after 6 hours is $= 2^4 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^4 \times 2^6 = 2^{10} = 1024$

Solution 4: The total number of different outfits is calculated by multiplying the number of choices for each independent item, as expressed by the formula: Total Outfits = Number of Dresses $\times$ Number of Hats $\times$ Number of Shoes.
The values are substituted into the formula: Total Outfits = $3 \times 2 \times 4 = 24$

Solution 5 : expanded form $47561 = 4 \times 10000 + 7 \times 1000 + 5 \times 100 + 6 \times 10 + 1$
In power of 10 = $4 \times 10^4 + 7 \times 10^3 + 5 \times 10^2 + 6 \times 10^1 + 1 \times 10^0$

Solution 6 : $4^{-3} \times 8^2 \times 2^3 = (2^3)^2 \times 2^3 / (2^2)^3 = 2^{6+3} / 2^6 = 2^{9-6} = 2^3$

Solution 7 : $32400 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5$
Exponential form = $2^4 \times 3^4 \times 5^2$

Solution 8: No. Of packets of Maggie in each box =

$$= (3^2 + 2^4 + 2^8 \times 2^{-5}) = 9 + 16 + 2^3 = 25 + 8 = 33 \text{ packets}$$

Solution 9: $4^n / 4^n = 1$

Properties of power = $a^0 = 1$

Here $4^n / 4^n = 4^{n-n} = 4^0 = 1$

OR $a^n / b^n = (a/b)^n$

$(4/4)^n = 1^n = 1$

Solution 10 : (a) total possible password of 3 digits (using digits 0-9) = $10 \times 10 \times 10 = 10^3 = 1000$

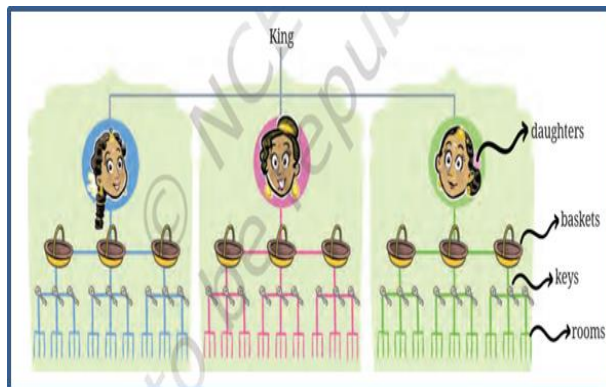
(b) when repetition is not allowed then total possible password of 3 digits (using digits 0-9) = $10 \times 9 \times 8 = 720$

SECTION C (3 marks questions)

Q1. Find the total thickness of 5 bundles of paper placed on each other. Each bundle contains 500 papers and the thickness of one paper is 0.0016 cm. Express the total thickness

in standard form also.

Q2-Three daughters with curious eyes. Each got three baskets — a kingly prize. Each basket had three silver keys. Each opens three big rooms with ease. Each room had tables — one, two, three. With three bright necklaces on each, you see. Each necklace had three diamonds so fine...



- How many necklaces are there in total?
- How many diamonds are there in total?
- find the sum of total necklaces and diamonds.

Q 3 A scientist is studying two types of bacteria growth in a competitive environment. Type A grows linearly by adding 5 bacteria every hour. Type B grows exponentially by doubling every hour. If both start with 10 bacteria, how many bacteria will each type have after 4 hours? Use exponents for Type B. Moreover, calculate the ratio of Type B bacteria to Type A bacteria after 4 hours.

Q4 The volume of water on Earth is approximately 1.386×10^{21} litres. If you drink 1 litre of water every hour, how long would it take to drink this volume in years? Express your answer using scientific notation.

Q5 Find the value of x: $(11/9)^3 \times (9/11)^6 = (11/9)^{2x-1}$

Q6. An electronics store uses scientific notation to represent numbers of small electrical resistance values. (For example if one resistor has 2 ohms and another has 3 ohms then in series their total resistance is $2+3=5$ ohms, where ohms is unit of resistance.)

You are having one resistor of resistance 4.7×10^{-5} ohms and another of 2.3×10^{-3} ohms.

- Express both resistances in “usual” (decimal) form.
- Which resistor has higher resistance?
- If you combine them in series, what’s the total resistance (give your answer in scientific notation)?

Q7. A scientist is studying three different types of viruses under a microscope. Their sizes are given as:

- Virus A: 2×10^{-7} m
- Virus B: 5×10^{-8} m
- Virus C: 9×10^{-9} m

According to you:

- A. Which virus is the smallest in size?
- B. Arrange the viruses in descending order of size.
- C. Why is expressing such small sizes using exponents helpful in real-life scientific studies?

Q8 Rohan read in 8th class. His teacher gave a problem to solve $3^4 \times 4^{-3} \times 3^2 / (3^{-5} \times 5^{-3} \times 4^5)$. But Rohan has some doubts. Help Rohan to solve his problem.

Q9 A doctor prescribes a medicine in the following doses:

- Morning dose: 2×10^{-2} L
- Afternoon dose: 5×10^{-3} L
- Night dose: 1×10^{-2} L

Answer the following:

1. What is the total medicine consumed in a day (in decimal form)?
2. Which dose is the smallest?
3. Convert all doses into decimal form.

Q10. A toy store sells blocks. Each block is made from combining smaller cubes. The total number of small cubes in one block is 648.

Answer the following question:

- (a). Find the prime factorization of 648, expressing it as a product of prime powers.
- (b). A bigger block is made by combining 5 such blocks. What is the prime factorisation of total small cubes in the big block.

SOLUTION

Solution 1:

Number of papers = 500

Thickness of one paper = 0.0016 cm

Total height = Number of papers $\times$ Thickness of one paper

= 500×0.0016 cm

= 0.8 cm

= 8×10^{-1} cm

Therefore, the height of the bundle of 500 papers is 8×10^{-1} cm.

Solution 2

a) total necklaces = $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6 = 729$

b) Total diamonds = $3^7 = 2187$

(c) $3^6 + 3^7 = 729 + 2187 = 2916$

Number of necklaces = $27 \times 3 = 3^3 \times 3 = 3^4 = 81$ necklaces.

So, Total diamonds = $81 \times 3^2 = 3^{4+2} = 3^6 = 729$ diamonds.

Solution 3

Type A (linear) = $10 + 5 \times 4 = 30$ bacteria

Type B (exponential) = $10 \times 2^4 = 10 \times 16 = 160$ bacteria

Ratio of Type B to Type A = $160/30 = 16/3 = 16:3$

Solution 4

Time in hours = 1.386×10^{21} hours

Time in years $\approx (1.386 \times 10^{21}) / (24 \times 365) \approx (1.386 \times 10^{21}) / 8760$

$\approx 1.58 \times 10^{17}$ years

Solution 5

$$(11/9)^3(9/11)^6 = (11/9)^{2x-1}$$

$$(11/9)^3(11/9)^{-6} = (11/9)^{2x-1}$$

$$(11/9)^{3-6} = (11/9)^{2x-1}$$

$$-3 = 2x - 1$$

$$-2 = 2x$$

$$x = -2/2 = -1$$

Solution 6 a) $4.7 \times 10^{-5} = 0.000047$ ohms (move decimal 5 places to left)

And $2.3 \times 10^{-3} = 0.0023$ ohms

b) Clearly, $0.0023 > 0.000047$, so the second resistor (2.3×10^{-3} ohms) has higher resistance.

c) Total resistance in series = sum = $0.0023 + 0.000047 = 0.002347$ ohms

Now convert into scientific notation: $0.002347 = 2.347 \times 10^{-3}$

Solution 7

A) Virus C is the smallest in size because 9×10^{-9} is the smallest number.

B) Descending order: Virus A > Virus B > Virus C

C) Expressing very small values using exponents makes it easier to read, write, and compare measurements in scientific studies, where such tiny values are common.

Solution 8 $3^4 \times 4^{-3} \times 3^2 / 3^{-5} \times 5^{-3} \times 4^5$

$$= 3^4 \times 3^2 \times 3^5 \times 5^3 / 4^3 \times 4^5$$

$$= 3^{4+2+5} \times 5^3 / 4^{3+5}$$

$$= 3^{11} \times 5^3 / 4^8$$

Solution 9

1. Total dose = $2 \times 10^{-2} + 5 \times 10^{-3} + 1 \times 10^{-2} = 0.02 + 0.005 + 0.01 = 0.035$ L

2. Afternoon dose (5×10^{-3}) is the smallest.

3. Decimal forms:

- Morning: 0.02
- Afternoon: 0.005
- Night: 0.01

Solution 10: (a) The prime factorization of 648 is $2^3 \times 3^4$.

(b) A bigger block is made by combining 5 such blocks.

The total number of small cubes is 648×5

So the prime factorization of the total small cubes in the big block: $2^3 \times 3^4 \times 5^1$.

SECTION D (CASE STUDY BASED) (4 MARKS)

Q 1. ISRO is testing a new satellite system. During the tests, engineers are analyzing signal speeds and component sizes using **scientific notation** to manage very large and very small numbers efficiently.

Here are some values from their report:

- The signal travels at a speed of **300,000,000 m/s**.
- The thickness of the signal wire is **0.0000045 meters**.
- The satellite sends **15,000,000 signals per hour**.

a) Help scientists to convert these data into their standard form.

b) According to you, why is scientific notation useful in space engineering?

Q2. If a pond doubles its lotus flowers every day and is fully covered on the 30th day.



(i) On which day was it half-covered?

(ii) Express the number of lotuses on 30th day using exponents, if there was 1 lotus on 1st day

Q3 Scientists often use very large numbers while studying astronomy, computers, and the universe. A famous very large number is called a **Googol**.

Give answer of following questions:

- (a) Which number is called Googol?
- (b) How many zeroes are in a Googol?
- (c) If Earth has about 10^{20} grains of sand, compare this number with a googol. Which is larger and by how many powers of 10?

Q4. Maths teacher gives following challenge to students:

- "You have a number 117649, you are asked to multiply it by the reciprocal of 343. But instead of doing direct multiplication you must do solve it using concept of powers of 7"
- There is a power line of 7.

7^7	823543
7^6	117649
7^5	16807
7^4	2401
7^3	343
7^2	49
7^1	7
7^0	1
7^{-1}	$\frac{1}{7}$
7^{-2}	$\frac{1}{49}$
7^{-3}	$\frac{1}{343}$
7^{-4}	$\frac{1}{2401}$

Using the power line of 7, Answer the following questions:

- solve the above challenge.
- Observe the pattern of power of 7. Write the relationship between 7^{-n} and 7^n ?
- How many times larger than 7^{-2} is 7^2 ?

Q5. You buy a tiny LED bulb whose brightness halves every year due to wear. Its initial brightness is 100 units.

- Write an expression for brightness after n years.
- What is the brightness after 4 years?
- After how many years will the brightness drop below 10 units?

SOLUTION

Solution 1: Conversions :

- Speed of signal:
 $300,000,000 = 3 \times 10^8$ m/s
- Thickness of wire:
 $0.0000045 = 4.5 \times 10^{-6}$ meters
- Signals per hour:
 $15,000,000 = 1.5 \times 10^7$

(b) Scientific notation helps engineers work with very large or very small numbers easily and reduces calculation errors, especially in fields like space research where precision matters.

Solution 2 : Pond fully covered on the 30th day.

We know double of half is 1. So, the pond was half covered just before 1 day of fully covered.

Therefore it half covered on 29th day

(ii) Number of lotus on 1 day $= 1 = 2^0$

On 2nd day $= 1 \times 2 = 2 = 2^1$

On 3rd day $= 2 \times 2 = 4 = 2^2$

On 4th day $= 4 \times 2 = 8 = 2^3$

On 30th day $= 2^{29}$

Solution 3:

(a) A googol is 10^{100} .

(b) Number of zeroes in Googol $= 100$

(c) The number of grains of sand on Earth is estimated to be around 10^{20} .

Finding the Difference in Powers of 10:

To compare them, divide the larger number by the smaller number: $10^{100} / 10^{20}$.

Using the rule of exponents ($a^m / a^n = a^{(m-n)}$), this becomes $10^{100-20} = 10^{80}$.

This means a googol is larger than the number of grains of sand on Earth by a factor of 10^{80} .

Solution 4: (a) $117649 \times 1/343 = 7^7 \times 7^{-3} = 7^4 = 2401$

(b) $7^{-n} = 1/7^n$

They are reciprocals of each other.

(c) There are 4 steps from 7^{-2} to 7^2

So, 7^2 is 7^4 times larger than 7^{-2} .

Solution 5 :a) Each year brightness becomes half: factor = $1/2$

Starting brightness = 100.

After n years: $100 \times (1/2)^n$

b) For $n=4$

$100 \times (1/2)^4 = 100 \times 1/16 = 6.25$

c) we want $100 \times (1/2)^n < 10$

$(1/2)^n < 0.1$

Compute:

$(1/2)^1 = 0.5$

$(1/2)^2 = 0.25$

$(1/2)^3 = 0.125$

$(1/2)^4 = 0.0625$

Here, at $n=4$, brightness = $100 \times (1/2)^4 \approx 6.25$ which is < 10 . So after **4 years** brightness drops below 10.

CLASS TEST

Section A(1x4=4)

Q.1 Sonika says $(\frac{1}{3})^{-3} = 1/(-27)$, but Mohan says $(\frac{1}{3})^{-3} = 27$. Reena says $(\frac{1}{3})^{-3} = -27$ and Seema says $(\frac{1}{3})^{-3} = 27^{-1}$. Who is correct?

- (A) Sonika (B) Mohan (C) Reena (D) Seema

Q.2 Reema has a number 5^2 and Amit has a number 5^3 . Seema gives them a challenge to multiply both numbers. Solve this challenge and write your answer.

- (A) 5^1 (B) 5^6 (C) 5^5 (D) 25^6

Q.3 Niyuta =.....

- (A) 10^{10} (B) 10^{11} (C) 10^{12} (D) 10^{13}

Q.4 what is value of $3^5/3^9$

- (A) 3^{-4} (B) 3^6 (C) 3^{-3} (D) 3^4

Section B(2x3=6)

Q.5 A pond gets fully covered in 30 days by lotuses that double every day. On which day was the pond half full?

Q.6 How many unique 5-digit passwords are possible if each digit can be anything from 0–9?

Q.7 If an individual weighs 60 kg and a 1-rupee coin weighs 5 g, estimate how many 1-rupee coins equal that person's weight

Section C(3x2=6)

Q.8 Express the height of a bundle of 500 papers placed on each other if the thickness of one paper is 0.0016 cm, in standard form.

Q.9 A researcher is studying radioactive decay. A sample has 1000 atoms. The decay reduces the number of atoms by a factor of $1/3$ every hour.

- a) Write a formula for the number of atoms after "t" hours.
b) After 3 hours, how many atoms remain (approx., round to nearest integer)?
c) After how many hours will less than 100 atoms remain?

Section D CBA (4 marks)

Q. 10 A scientist is working in a laboratory and discovers a special kind of bacteria that doubles in number every hour. She starts with just 1 bacterium at 8 AM in the morning.

- a) Write an expression using exponents to show how many bacteria will be present after 10 hours.
b) Calculate the exact number of bacteria present at 6 PM.
c) The scientist's jar can only hold 2^{12} bacteria, at what time will the jar first get full?
d) At what time does a scientist's jar fill half with bacteria?

Answer key

Ans1. option B: Mohan is correct. $(\frac{1}{3})^{-3}=27$

Ans2. Option C: 5^5

Ans3. Option B

Ans4. Option A

Ans5. Day 29

Ans 6. 100,000

Ans7. 12000 coins

Ans 8: 8×10^{-1} cm.

Ans 9(a): $N(t)=1000 \times (1/3)^t$

9(b) ≈ 37.037 . Rounded ≈ 37 atoms remain.

9(c) at $t = 3$ hours

Ans 10(a): 2^{10}

10(b): 2^{10}

10(c): 8PM

10(d): 7PM

CHAPTER 3: A STORY OF NUMBERS

SECTION A (1 MARK)

1. In ancient Rome, a historian was calculating the total distance of his journey. If he travelled LXXX miles each for XXV days, what was the total distance he travelled? Express in Roman numerals?

- a) MM b) MMC c) MMCC d) MMXXX

2. A teacher is introducing the base 5 number system to her class. She explained that landmark numbers are the powers of the base. To make it more engaging, she asked the students to identify third landmark number of base 5.

- (a) 5 (b) 10 (c) 100 (d) 25

3. A teacher is introducing the base 5 number system to her class. She explained that landmark numbers are the powers of the base. What is the largest landmark number smaller than 143 in the base-5 system?

- (a)  (b)   (c)  (d) 

4. Fill in the blanks (multiplication using base-5 system using symbols) where

$$\begin{array}{|c|} \hline 25 \\ \hline \end{array} \begin{array}{|c|} \hline 25 \\ \hline \end{array} \times \dots\dots\dots = \begin{array}{|c|} \hline 125 \\ \hline \end{array} \begin{array}{|c|} \hline 125 \\ \hline \end{array}$$

- a)  (b)  (c)  (d) 

5. In a classroom discussion on the history of numbers, the teacher explained that many ancient numeral systems such as Roman and Mayan are no longer used in daily life, but some number systems are still in use in modern times. Name two number systems which are still in use.

- (a) Roman and Mayan b) Babylonian and Egyptian
c) Roman and Mesopotamian d) Hindu and Binary

6. A group of indigenous people in Australia called Gumulgals counts a group of animals as "ukasar-urapon". Then they found another group with same number of animals that is counted as "ukasar-urapon." What is the total count of the animals of both groups?

- a) ukasar-ukasar-urapon b) ukasar-ukasar
c) ukasar-ukasar-ukasar d) ukasar-urapon

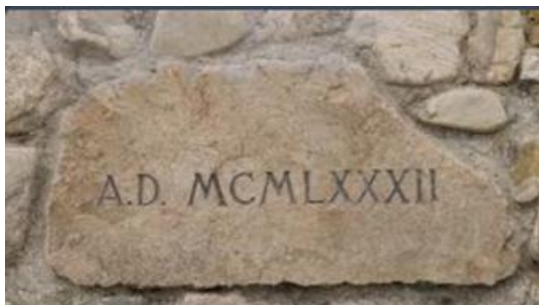
7. The Mesopotamian Sexagesimal system, a base-60 system, has influenced modern time measurements. Which of the following statements best explains this influence?

- a) This system was the first to use a base-60 structure for measuring time, which was adopted by subsequent civilizations and still in use.
- b) The use of 60 minutes in an hour and 60 seconds in a minute is a modern invention that coincidentally aligns with the Mesopotamian system.
- c) The Mesopotamian people were the first to accurately calculate the number of seconds in a day, which they determined to be a multiple of 60.
- d) The system's use of 60 was limited to astronomical calculations and has no historical link to our modern time units.

8. What is the base of the Egyptian number system?

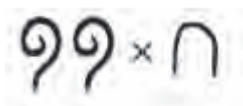
- (a) 10
- (b) 20
- (c) 60
- (d) 50

9. A Roman number inscribed on the stone that is found on roman tombstone that describes about the year (**MCMLXXXII**). What is the number in Hindu numerals?



- a) 1982
- b) 1972
- c) 1882
- d) 1872

10. Find the product of the numbers in the Egyptian system



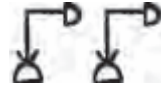
- (a)
- (b)
- (c)
- (d)

ANSWERS

- 1. (a)
- 2. (d) 25
- 3. (c) 125
- 4. (b)
- 5. (d) Hindu and Binary
- 6. ukasar-ukasar-ukasar

7. (a) This system was the first to use a base-60 structure for measuring time, which was adopted by subsequent civilizations and preserved in our current units

8. (a) 10 9. (a) 1982 10. (b) 2000



SECTION B (2 marks QUESTIONS)

1. A monument was built in the year MDCCXLIV in Rome.

(a) Write your answer in Hindu-Arabic numerals.

(b) How old is the monument today (as on date)? Write your answer in Roman numerals.

2. An old coin has **MCMXLVII** inscribed on it.

(i) Convert it into Hindu-Arabic numeral.

(ii) Is the year an important event in Indian history. Find the event connected to it.

3. In ancient Rome, the years of an emperor's reign were often recorded using roman numerals. For example, Augustus ruled from **XXIV** BCE to **XIV** CE. Suppose you are a historian trying to analyse the timeline of these emperors. You are given information in Roman numerals, and your task is to interpret, compare, and calculate the durations of the rule using both Roman and Hindu-Arabic numerals.

(i) Find the total duration of his reign in years and express it in Roman numerals.

(ii) Express the period of his reign in Hindu numerals.

4. The year of birth of Aryabhata is **CDLXXVI**.

(i) Convert it into Hindu-Arabic numerals.

(ii) If Aryabhata lived for **LXXV** years, in which year did he die? Write the year both in Hindu-Arabic and Roman numerals.

5. The cost of an antique written in Mesopotamian system as:

(a) Write it in Hindu-Arabic numerals.

(b) If you give Rs. 4000, how much money the shopkeeper will return. Write your answer in Mesopotamian system.



6. The landmark number in Egyptian Number system is 10 times the previous one. The following are the symbols that are used in Egyptian number system.

1	10	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷
							

Represent the following number in Egyptian System: -

- (a) 10458 (b) 1023

7. Convert the following rod numeral representations into Hindu-Arabic numerals:

- (a) 2 (Heng), 6 (Zong), 3 (Heng), 4 (Zong)
(b) 4 (Heng), 1 (Zong), 8 (Heng), 2(Zong)

8. While studying ancient civilizations, Arjun read that the Mayans used wedge-shaped marks on clay tablets. When he noticed the different ways of grouping numbers. Compare Mayan and Mesopotamian numeral systems with respect to base.

9. The Mayans used dots for 1 and bars for 5. How many symbols used to represent the number 13?

10. A merchant records the price of silk using rod numerals as: 8 (Zong), 5 (Heng) and 3 (Zong)

- (i) Convert it into Hindu-Arabic numbers.
(ii) If he sells 3 such bundles, what is the total cost?

ANSWERS:

1. (a) Ans:- MDCCXLIV = **1744**

(b) Ans:- CCLXXXI years (**281 years .**)

2. (i) **1947**

(ii) **Yes, India got its independence.**

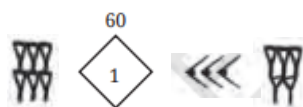
3. Reign: 38 years , in roman numerals XXXVIII

4. Birth: CDLXXVI = **476**

Lifespan: LXXV = **75 years** → Death year = **551 = DLI**

5. (a) **Rs 3605.**

(b) **Write answer in Mesopotamian system:**



6. Ans: -

10458 → 
1023 → 

7. (a) 2634

(b) 4182

8. Both used place value, both used zero as placeholder, but Mesopotamian was base-60 and Mayan was near base-20.

9. Ans: use 2 bars (10) + 3 dots = 13.

10. (a) 853

(b) 2559 [2 (Heng), 5 (Zong), 3 (Heng), 9 (Zong)]

SECTION C (3 MARKS QUESTION)

Question 1. A student is trying to add numbers written in Roman numerals. He places LXXXVII and LXXVIII side by side and feels confused about how to add them directly. His friend suggests converting into Hindu numerals first, add, and then convert back to Roman. Help the student by showing the process step-by-step and give the final sum in both systems.

Question 2. During an activity, students were asked to represent 77 using Mayan numerals.

One student grouped the number into twenties, another used dots and bars. The teacher said both are fine if positional rules are followed.

Represent 77 in Mayan numerals and explain the grouping clearly.

Question 3. In the Egyptian system every landmark number is a power of 10. A student wants to write 324 using Egyptian symbols and explains it as $300 + 20 + 4$. His friend reminds him to use repeated symbols for each landmark. Show how 324 is written in the Egyptian numerals and explain why it is far more efficient than tally marks.

Question 4. A teacher asks her class to convert 25 into base-8 and base-5 using repeated division (record remainders).

Perform both conversions and explain briefly how the representations differ from base-10.

Question 5. The Gumulgal tribe counted in 2s: e.g., $3 = 2+1$ and $4 = 2+2$. A student is asked to express 5 and 6 in their notation. Where they called 2 as ukasar and 1 as urapon. Write those representations and comment briefly on efficiency vs tally marks.

Question 6. While visiting a museum, Riya noticed ancient Egyptian writing carved on a stone tablet. The guide explained that these carvings were numbers used thousands of years ago. Riya was surprised to see that Egyptians had separate symbols for 1, 10, 100,

1000, and so on, and they would repeat these symbols to form larger numbers. Later in her class Riya shared her experience.

- (i) What was the base of the Egyptian number system.
- (ii) If Egyptian wanted to write the number 243, which symbols and how many of each would they use?

Question 7. A student is asked to write 200 using the Mesopotamian (Sexagesimal) system. He divides by 60 and writes the quotient and remainder.
Show the division and explain how 200 is represented in Mesopotamian notation.

Question 8. A student reading Mesopotamian tablets confused 60 with 3600 because spacing between groups was unclear. The teacher said the problem was solved later by introducing a special symbol.
Identify that symbol and explain with an example why it was important.

Question 9. Two students argue: “Base-10 is natural because of fingers” vs “Base-5 works too (counting in groups of five).”
Compare the landmark numbers (place values) of base-10 and base-5 and explain which system gives more compact representations – give an example.

Question 10. Aryabhata and Brahmagupta both influenced the idea of zero but in different ways. A student asks you to summarize each of their contributions.
Write a short, precise explanation of how Aryabhata and Brahmagupta advanced the idea of zero.

ANSWERS

Question 1. Convert each Roman numeral to decimal:

- LXXXVII = 87

- LXXVIII = 78

Add: $87 + 78 = 165$

Convert back: $165 = \text{CLXV}$ in Roman.

Final: HINDU = 165; Roman = CLXV.

Question 2. Step 1: Understand the Mayan Numeral System

The Mayan numeral system is Vigesimal (base-20), using a combination of dots (representing 1) and bars (representing 5). The system also has a positional notation, where the rightmost position represents units (1-19), the next position to the left represents 20s, and the next represents 400s (20^2), and so on.

Step 2: Convert 77 to Mayan Numerals

To represent 77 in Mayan numerals, we first divide 77 by 20 to find out how many 20s and units we have.

$$77 \div 20 = 3 \text{ remainder } 17.$$

This means $77 = 3 * 20 + 17$.

Step 3: Represent $3 * 20$ in Mayan Numerals

For the 20s place, we have 3 twenties. In Mayan numerals, 3 would be represented by 3 dots.

Step 4: Represent 17 in Mayan Numerals

For the units place, we have 17. In Mayan numerals, 17 would be represented by 3 bars ($3_5 = 15$) and 2 dots ($2_1 = 2$), because $15 + 2 = 17$.

Step 5: Combine the Representations

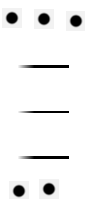
The Mayan numeral representation of 77 would have 3 dots in the 20s place and 3 bars and 2 dots in the unit place.

$$77 \div 20 = 3 \text{ remainder } 17 \rightarrow 77 = (3 \times 20) + 17.$$

- 20s place: 3 $\rightarrow$ three dots.

- 1s place: 17 $\rightarrow$ three bars (15) + two dots (2).

Final Mayan representation: top – 3 dots; bottom – three bars + two dots.



Question 3. $324 = 3 \times 100 + 2 \times 10 + 4 \times 1$.

- Write three 100-symbols, two 10-symbols, four 1-symbols.



Compared to 324 tally marks, Egyptian numerals need only 9 symbols, making them efficient and easy to compute with.

Question 4. Step 1: Convert 25 to Base-8

To convert 25 to base-8, we perform repeated division by 8 and record the remainders.

$$25 \div 8 = 3 \text{ remainder } 1$$

$$3 \div 8 = 0 \text{ remainder } 3$$

So, 25 in base-8 is 31.

Step 2: Convert 25 to Base-5

To convert 25 to base-5, we perform repeated division by 5 and record the remainders.

$$25 \div 5 = 5 \text{ remainder } 0$$

$$5 \div 5 = 1 \text{ remainder } 0$$

$$1 \div 5 = 0 \text{ remainder } 1$$

So, 25 in base-5 is 100.

Step 3: Compare Representations

In base-10, 25 is represented as 25. In base-8, it's 31, and in base-5, it's 100. The representations differ because each base has a different set of digits and place values. Base-8 uses digits 0-7, while base-5 uses digits 0-4. The place values also change accordingly (e.g., 8^1 in base-8 and 5^1 in base-5).

The final answer is:

Base-8: $25 \div 8 = 3$ remainder 1 $\rightarrow 31_8$.

Base-5: $25 \div 5 = 5$ r0, $5 \div 5 = 1$ r0 $\rightarrow 100_5$.

Base-10 uses powers of 10, but here digits represent powers of 8 or 5.

Question 5. Ans: 5 = ukasar-ukasar-urapon (2+2+1).

6 = ukasar-ukasar-ukasar (2+2+2).

This grouping is more efficient than tally marks but still less compact than positional systems.

Question 6. – (i) the Egyptian number system was built on 10(decimal system). However, unlike our system, it was additive and non-positional.

(ii) Egyptians would write it using

- $2 \times (100 \text{ symbol})$
- $4 \times (10 \text{ symbol})$
- $3 \times (1 \text{ symbol})$

Question 7. $200 \div 60 = 3$ remainder 20.

So $200 = 3 \times 60 + 20$.

Written with 3 symbols in the 60s place and 20 in the 1s place. Much shorter than 200 tally marks.



Question 8. The special symbol was zero as a placeholder.

Without it, a symbol '1' could mean 1, 60 or 3600. Zero marked empty positions and removed ambiguity. Example: 101 vs 11 – zero fixes meaning.

Question 9. Base-10: 1, 10, 100,

Base-5: 1, 5, 25,

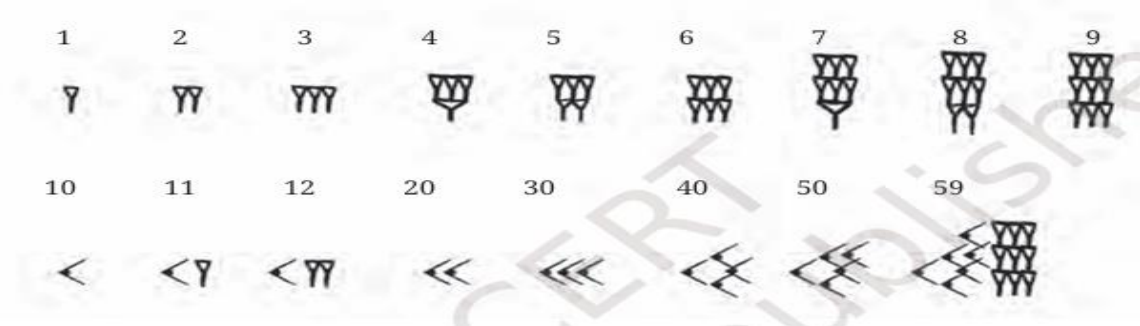
Higher bases give more compact representations. Example: 125 $\rightarrow$ '125' in base-10, but '1000₅' in base-5 (four digits). So base-10 is more compact.

Question 10. - Aryabhata: used zero as placeholder in place value; showed its power in calculations.

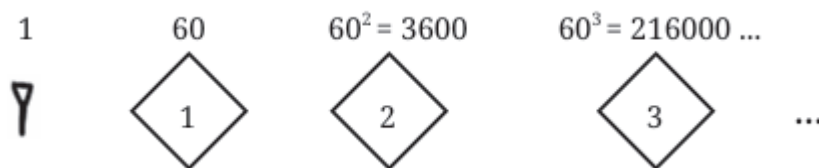
- Brahmagupta: treated zero as a number; defined rules like $0+a=a$, $0 \times a=0$.
Thus Aryabhata focused on notation; Brahmagupta on arithmetic laws.

SECTION D (4 MARKS QUESTIONS)

Question 1. Long ago, people in Mesopotamia used a number system based on 60. This is why we still measure time in 60 seconds make a minute and 60 minutes make an hour. The Babylonians could write big numbers using combinations of wedges and lines. This system used the following symbols to represent the number. Their number system influenced later civilizations.



They also use the following symbols to represent their landmark numbers:-

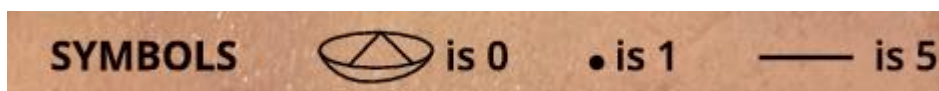


Now answer the following questions based on above information.

- (i) Which base was used in the Mesopotamian number system?
- (ii) How many seconds make an hour in our modern system?
- (iii) Name one-way Mesopotamian numbers are still influencing us today.
- (iii) Represent 36002 in this system.

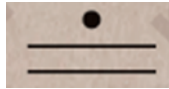
Question 2. The Mayans developed a number system with almost a base 20 system. They used dots and bars to represent numbers. A single dot stood for 1, while a bar represented 5. Unlike others, they used 360 instead of 400 for the third-place value, as their calendar was based on 360 days in a year. In this system symbols are placed vertically to represent a number.

Following landmark numbers are in this system.



Now answer the following questions: -

- (i) Which base was used in the Mayan number system?
- (ii) A number in the Mayan system is represented by the given symbol
- . What number it represent?



- (iii) Represent 100 and 361 in the Mayan system.

Question 3. The Romans did not use place value but symbols like I, V, X, L, C, D, and M. For example, the number 9 was written as IX (10 – 1). Although Roman numerals were useful in their time, they were not very convenient for calculations. That is why Roman numerals are now used only in special cases like clocks, book chapters, and names of kings or queens.

Answer the following questions based on this system.

- (i) Which symbol represents 1000 in Roman numerals?
- (ii) Rohan Writes 400 as CCCC. Is it correct? If Not, then correct it.
- (iii) How many seconds are in one hour? Write it in Roman Numerals?
- (iv) If you buy a shirt in Rs 425 and a paint in Rs 950. How much amount you pay the shopkeeper. Write all details in Roman Numerals.

Question 4. The Indian number system brought two revolutionary ideas to mathematics — zero and place value. These concepts made it possible to write and calculate with very large numbers in a simple way. Before this, number systems were complicated and less efficient. With zero and place value, addition, subtraction, multiplication, and division became much easier. Today, the Hindu–Arabic number system, which is used worldwide, is based on the Indian number system.

Now answer the following questions: _

- (i) What new idea did the Indian number system introduce?
- (ii) Why are zero and place value regarded as turning points in the history of mathematics?
- (iii) Write the following numbers in word (In Indian number system)
- (a) 36,90,45,548 (b) 90,00,00,009

Question 5. Trade Across Civilizations (Math + History + Economics)

A Roman merchant bought a necklace in Rome for **XLV (Roman coins)**. He sailed to

Mesopotamia and sold it there for   (in the Mesopotamian place-value notation), in base-60. During a cross-border transaction an extra tax of **VIII (8 Roman coins)** was levied. The merchant then converted all accounts to the Hindu-Arabic system for final record-keeping.

Table: Given representations (use this for solving).

System	Representation	Value (Hindu-Arabic)
Roman (purchase)	XLV	
Mesopotamian (sale)		
Roman (tax)	VIII	

Questions:

- Convert all given values into Hindu-Arabic numerals.
- Find the final cost of the necklace after adding the tax (express in Hindu-Arabic numerals).

Question 6. A group of indigenous people in Australia called the Gumulgal had the following words for their numbers.

Gumulgal (Australia)

- urapon
- ukasar
- ukasar-urapon
- ukasar-ukasar
- ukasar-ukasar-urapon
- ukasar-ukasar-ukasar

Consider the extension of the Gumulgal number system beyond 6 in the same way of counting by 2s. Come up with ways of performing the different arithmetic operations (+, −, ×, ÷) for numbers occurring in this system, without using Hindu numerals.

Use this to evaluate the following:

- (ukasar-ukasar-ukasar-ukasar-urapon) + (ukasar-ukasar ukasar-urapon)
- (ukasar-ukasar-ukasar-ukasar-urapon) − (ukasar-ukasar ukasar)
- (ukasar-ukasar-ukasar-ukasar-urapon) × (ukasar-ukasar)
- (ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar) ÷ (ukasar-ukasar)

ANSWERS

Ans 1:-

- base 60 (sexagesimal system)
- 3600
- Time measurement (60 seconds = 1 minute, 60 minutes = 1 hour).
-



Ans 2(i) 20

(ii) 11

$100 = 5 \times 20 + 0$ 	$361 = 1 \times 360 + 0 + 1$ 
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Ans 3:-

(i) M

(ii) No, correct form = CD (400 = 500-100)

(iii) 3600 = MMMDC

(iv) Shirt = CDXXV, Pant = CML, Total = MCCCCLXXV

Ans4:-

(i) The ideas of **zero** and **place value**.

(ii) Because they made it possible to write very large numbers easily,

Perform arithmetic operations (addition, subtraction, multiplication, division) more quickly,

Distinguish numbers clearly (e.g., 15 and 105).

(iii) (a) Thirty-six crore ninety lakh forty-five thousand five hundred forty-eight.

(b) Ninety crore nine.

Answer 5— (Trade Across Civilizations)

i. Conversions to Hindu-Arabic numerals (stepwise):

- Roman: XLV = XL + V = (50 - 10) + 5 = 40 + 5 = 45.
- Mesopotamian: 1,2 means $1 \times 60 + 2 \times 1 = 60 + 2 = 62$ (sexagesimal decomposition).
- Roman tax: VIII = V + I + I + I = 5 + 1 + 1 + 1 = 8.

ii. Final cost after adding the tax (interpretation: sale price + tax):

- Sale price (in Hindu) = 62
- Tax (in Hindu) = 8
- Final cost (sale + tax) = 62 + 8 = 70 (Hindu-Arabic numerals).

Answer 6:-

- (i) ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar (ukasar comes 8 times)
- (ii) ukasar-urapon
- (iii) ukasar-ukasar-ukasar-... (ukasar repeated eighteen times).
- (iv) ukasar-ukasar

CLASS TEST (20 Marks)

Chapter: A Story of Numbers

Section A – 1 Mark Questions (MCQs) ($4 \times 1 = 4$ Marks)

Q1. A Roman clock in a museum shows the time as “VIII”. A child asks what this means in Hindu-Arabic numerals.

- a) 6 b) 7 c) 8 d) 9

Q2. A farmer keeps records of his harvest using the Gumulgal system. He writes “ukasar-urapon” for one group of fruits and then doubles it. What number of fruits does he finally record?

- a) 4 b) 5 c) 6 d) 7

Q3. A digital watch displays “60 minutes = 1 hour.” A guide explains to students that this idea came from an ancient numeral system. Which system is being referred to?

- a) Roman b) Hindu–Arabic c) Mesopotamian (Sexagesimal) d) Mayan

Q4. A book has the year “MCM” printed on its cover. Convert the year in to Hindu-Arabic numerals?

- a) 1800 b) 1900 c) 2000 d) 2100

Section B – 2 Mark Questions ($3 \times 2 = 6$ Marks)

Q5. A student visits a science museum and sees the number “143” written in base-5. His teacher asks him to convert it into base-10 to check how many exhibits were counted.

Q6. A king’s reign was carved on a stone in Roman numerals as “XIV years”. If another king ruled for “XXV years”, how many more years did the second king rule than the first? Write your answer in both Hindu-Arabic and Roman numerals.

Q7. A historian is comparing the Egyptian system with tally marks. She shows that 243 can be written with fewer symbols in Egyptian numerals. Explain briefly how Egyptians symbols would represent 243.

Section C – 3 Mark Questions ($2 \times 3 = 6$ Marks)

Q8. During an activity, a teacher asked students to compare base-10 and base-5 systems. One student wrote “25 in base-10 = 100 in base-5.” Another wrote “25 in base-10 = 31 in base-8.” Explain how both are correct, show steps.

Q9. In a cultural exchange, a Roman merchant calculated the total cost of two goods: XLV coins for a necklace and LXX coins for a ring. Find the total in Hindu-Arabic numerals. Then, convert the result back into Roman numerals.

Section D – 4 Mark Question ($1 \times 4 = 4$ Marks)

Q10. The Mayan numeral system was based on 20 but used 360 for their calendar place value. A student wants to represent the year “361.”

- (i) Identify the base used in the Mayan system.
- (ii) Explain why 360 was used instead of 400.
- (iii) Show how 361 is written in Mayan numerals.
- (iv) Compare briefly how this differs from our Hindu-Arabic system.

Answer Key

Section A – 1 Mark (MCQs):

Q1. (c) 8

Q2. (b) 5

Q3. (c) Mesopotamian (Sexagesimal)

Q4. (b) 1900

Section B – 2 Marks:

Q5. $143_5 = 1 \times 5^2 + 4 \times 5^1 + 3 \times 5^0 = 25 + 20 + 3 = 48$ (base 10 system). (Place value $5^0 = 1$, $5^1 = 5$, $5^2 = 25$)

Q6. XIV = 14, XXV = 25 → Difference = 25 – 14 = 11 years → XI years in Roman.

Q7. $243 = 2 \times 100 + 4 \times 10 + 3 \times 1$ → Egyptians used 2 hundred symbols, 4 ten symbols, and 3 one symbols (9 total).



Section C – 3 Marks:

Q8. Base-5:

$25 \div 5 = 5$ remainder 0,

$5 \div 5 = 1$ remainder 0

$1 \div 5 = 0$ remainder 1 → 100_5 . (remainders from the bottom 1,0,0)

Base-8: $25 \div 8 = 3$ remainder 1,

$3 \div 8 = 0$ remainder 3 → 31_8 . (remainders from the bottom 3,1)

Both are correct representations of 25 in different bases.

Q9. XLV = 45, LXX = 70 → Total = 115 → In Roman = CXV.

Section D – 4 Marks:

(i) Base = 20. (ii) 360 used for calendar (360 days in a lunar year).

(iii) $361 = 1 \times 360 + 1$ = top dot (360) + bottom dot (1).

(iv) Unlike Hindu-Arabic (positional base-10), Mayan used vertical symbols with 360-adjustment.

CHAPTER 4: QUADRILATERALS

SECTION A (1 MARK QUESTIONS)

1. A window glass is in the shape of a regular quadrilateral. The window must be in the shape of
a) Rhombus b) Rectangle c) Trapezium d) Square
2. A park is made in the shape of a trapezium with exactly one pair of parallel sides. The sum of its interior angles is always:
a) 90° b) 180° c) 270° d) 360°
3. A carpenter makes a frame whose opposite sides are equal and parallel, but no angle is 90° . The frame is a:
a) Rectangle b) Parallelogram c) Square d) Trapezium
4. A notice board is in the shape of a rhombus. Its diagonals are always:
a) Equal and not perpendicular b) Unequal but perpendicular
c) Equal but perpendicular d) Unequal and not perpendicular
5. The top of a garden bench is in the shape of a quadrilateral with opposite sides are equal and all angles are right angles. The bench top is a:
a) Rectangle b) Rhombus c) Trapezium d) Kite
6. A building plot is in the shape of a parallelogram. Which of the following is *always true*?
a) All sides equal b) Opposite sides equal and parallel
c) Diagonals are equal d) All angles are 90°
7. A wall clock is designed in the shape of a square. Which statement about its diagonals is correct?
a) They are equal but not perpendicular b) They bisect each other at right angles
c) They are unequal and perpendicular d) They do not bisect each other
8. The diagonals of a playground in the shape of quadrilateral bisect each other at right angles. The playground must be
a) Trapezium b) Rectangle c) Parallelogram d) Rhombus
9. An artist cuts a paper in the shape of quadrilateral where all sides are equal but angles are not right angles. The shape is a:
a) Square b) Rhombus c) Rectangle d) Trapezium
10. The board is in the form of a trapezium. The non-parallel sides are equal in length. This trapezium is called:

a) Right trapezium
trapezium

b) Parallelogram

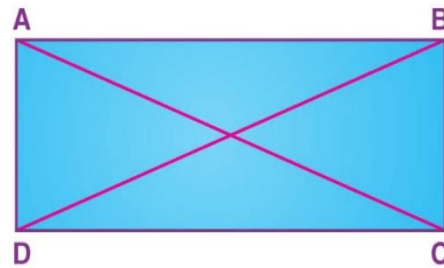
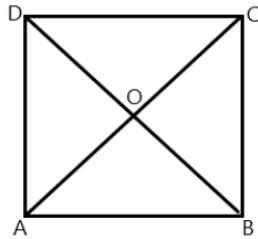
c) Scalene trapezium d) Isosceles

Solutions:

1 (d) 2(d) 3 (b) 4 (b) 5 (a) 6 (b) 7 (b) 8 (d) 9 (b) 10 (d)

SECTION B (2 MARKS QUESTIONS)

1. State two special property of a square that differentiates it from a rectangle.



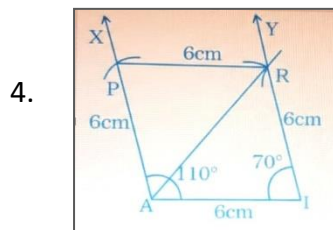
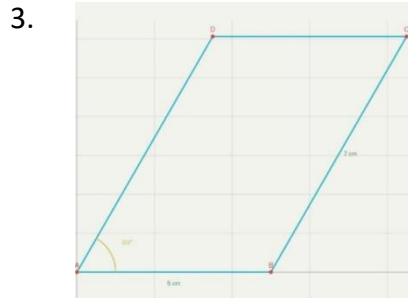
2. A park is surrounded by four street lights at its corners. The street light are positioned such that they do not form 90° at each corner. If each pair of opposite sides of the park are equal, what type of quadrilateral is the park? Justify your answer.
3. Construct a parallelogram with adjacent sides of 5cm and 7 cm and an angle of 60° between them.
4. Construct a rhombus PAIR, given that PA = 6 cm and angle $\angle A = 110^\circ$.
5. Explain why every square is also a rhombus or a rectangle.
6. The two adjacent angles of a parallelogram are the same. Find the measure of each angle.
7. A farmer fenced his land in the shape of a quadrilateral where opposite sides are parallel and equal, but the angles are not 90° . Identify the shape of his land and state one property of its opposite angles.
8. Meena drew a quadrilateral where only one pair of opposite sides is parallel. What kind of quadrilateral it is? Write any one property of it.
9. A photo frame is made in the form of a quadrilateral with both diagonals are equal and bisecting each other at 90° . Name the quadrilateral and justify.
10. The three angles of a quadrilateral are 100° , 50° , and 40° . Find the fourth angle.

SOLUTIONS

- (a) A square is having all four sides are equal, whereas a rectangle only requires opposite sides to be equal.

(b) Diagonals of a square bisect at 90 degrees, while diagonals of a rectangle bisect at different angles.

- It is a parallelogram because both pairs of opposite sides are parallel and equal.



5. Square has all sides equal and diagonal bisect at 90° as rhombus. Similarly, Square has opposite sides equal and all angles 90° as rectangle.

- In a parallelogram, adjacent angles are supplementary and $\angle A = \angle B$

$$\angle A + \angle B = 180^\circ$$

$$\angle A + \angle A = 180^\circ$$

$$2\angle A = 180^\circ$$

$$\angle A = 90^\circ$$

- The land is a parallelogram. In a parallelogram, opposite angles are equal.

8. In a trapezium, the sum of the angles on the same side of a transversal is 180° and opposite angle are not equal.

- It is a square because diagonals are equal and bisect each other at 90° .

10. Sum of all the angles of quadrilaterals = 360°

$$\Rightarrow 100^\circ + 50^\circ + 40^\circ + x = 360^\circ$$

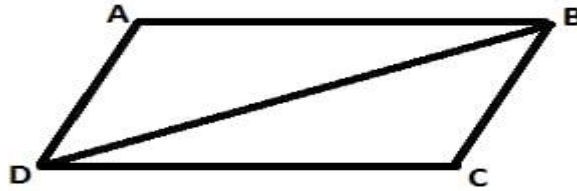
$$\Rightarrow 190^\circ + x = 360^\circ$$

$$\Rightarrow x = 360^\circ - 190^\circ$$

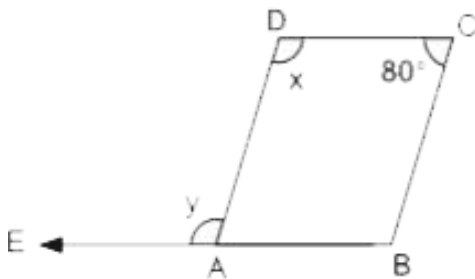
$$\Rightarrow x = 170^\circ$$

SECTION C (3 MARKS QUESTIONS)

Q1) In the given figure, a diagonal is dividing a parallelogram into two triangles. Find any three equal corresponding parts of two triangles formed. Can we say $\triangle ABD \cong \triangle CDB$?



Q2. In the given parallelogram, find the values of x and y .



Q 3) Represent the relation among a square, a rectangle and a parallelogram using a Venn diagram. Answer the following questions:

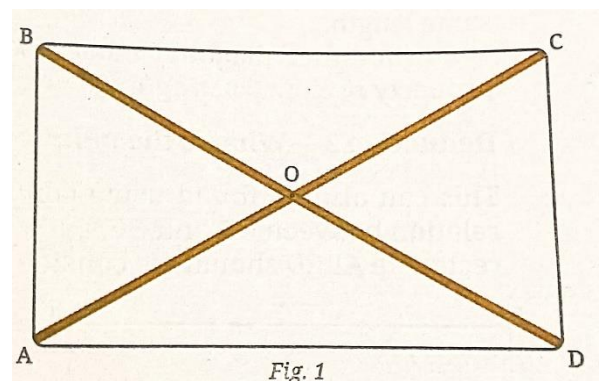
- a) Is a square a rectangle? b) Is a rectangle a parallelogram?

Q 4) Raju has a field whose sides measure 70m, 50m, 70m and 50m. Identify the name of the possible shapes of his field. Write any two common properties of the possible shapes.

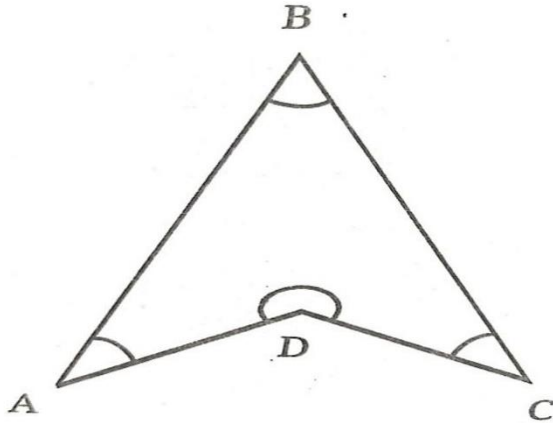
Q 5) Find the measure of all the angles of the quadrilateral obtained by joining two equilateral triangles with sides 5cm. Name the quadrilateral formed and write a property that make it different from square.

Q6) A carpenter needs to put together two thin strips of wood diagonally, as shown in the fig.1, so that when a thread is passed through their endpoints, it forms a rectangle. She already has one 8cm long strip.

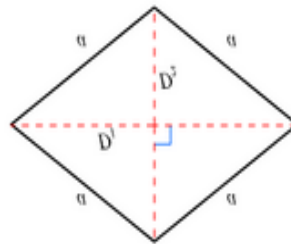
- a) What should be the length of the other strip?
b) Name the point of intersection of the two diagonals.
c) Find the length of OD and OB.



Q 7) What is the sum of all interior angles of a quadrilateral? If $\angle A = 58^\circ$, $\angle B = 42^\circ$ and $\angle C = 40^\circ$, then find the value of reflex $\angle ADC$ and $\angle ADC$.



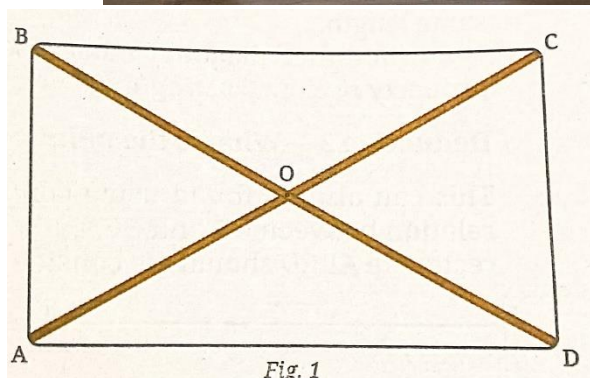
Q 8) A Math teacher gave a project to his student Aayush, to cut a paper in the shape of a rhombus with diagonals 24cm and 10cm. He wants to paste four different color's laces on each part of the diagonals divided after intersection to decorate it. Find the length of the 4 laces he has to buy for decoration. Also each side of rhombus is 13cm and he wants to decorate border too. Find the total length of the lace to be pasted .



Q 9) Rohit has a task to fence a park of quadrilateral shape with diagonals 8m and 6m bisecting each other perpendicularly but the angles at the corners are not a right angle. Can you identify the shape of the park? Draw a sample park and tell the length of its one side.



Q 10) A carpenter wants to make a rectangular display board with sides 12m and 5m. He wants to give extra support by putting two more strips joining its two opposite vertices as shown in the figure. Can you say $\triangle ABD \cong \triangle CDB$. Justify.



SOLUTIONS:

- 1) Here ABCD is a parallelogram and BD is a diagonal.
 In $\triangle ABD$ and $\triangle CDB$, we have
 $AD = BC$ [Opposite sides of a parallelogram]
 $DC = AB$ [Opposite sides of a parallelogram]
 $BD = DB$ [Common side]
 Yes, now we can say that $\triangle ABD \cong \triangle CDB$ by SSS Criteria.

2) In the figure, we have

ABCD is a parallelogram.

$\angle DAB = 180^\circ - y$ [linear pair]

$\Rightarrow \angle DAB + \angle CDA = 180^\circ$ [sum of adjacent angles of a parallelogram is 180°]

$\Rightarrow 180^\circ - y + x = 180^\circ$ (1)

Also, $\angle DAB = \angle DCB = 80^\circ$ (opposite angles of a parallelogram are equal)

Then, $180^\circ - y = 80^\circ$

Therefore, $y = 100^\circ$ (2)

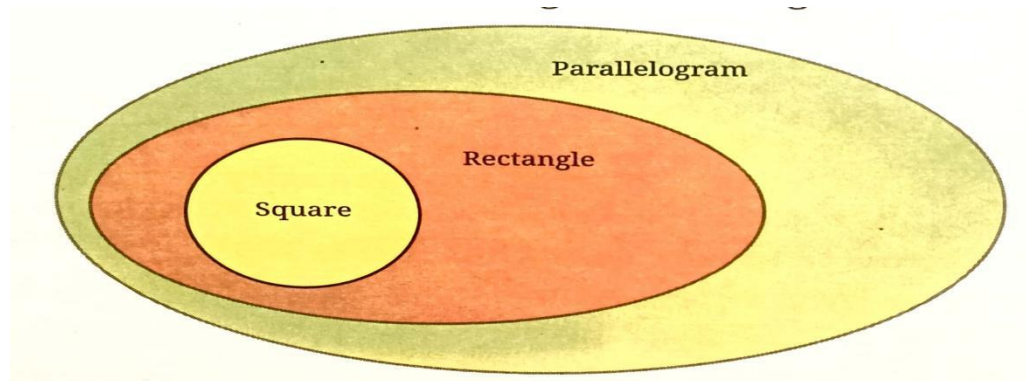
Using eq.2 in eq.1

$\Rightarrow 180^\circ - y + x = 180^\circ$

$\Rightarrow 180^\circ - 100^\circ + x = 180^\circ$

Then $x = 100^\circ$

3)



Yes, a square is a rectangle.

Yes, a rectangle is a parallelogram.

4) Here, the shape has four sides, hence it is a quadrilateral and its opposite sides are equal. Hence the quadrilateral is a parallelogram. If it's all angles are equal then we can say that it is a rectangle.

The two common properties are:

- I. Opposite sides are equal
- II. Opposite sides are parallel

5) Two equilateral triangles having each side 5cm will form a rhombus when joined together of each side 5cm.

All sides measure 5 cm

Since each angle of an equilateral triangle is 60° .

$\angle ACD = 60^\circ + 60^\circ = 120^\circ$

$\angle D = 60^\circ$

$\angle B = 60^\circ + 60^\circ = 120^\circ$

$\angle A = 60^\circ$

Since all the angles formed in this figure are not 90° , that's why it is not a square.

- 6) (a) We know that diagonals of a rectangle are equal in length, hence other strip also measures 8cm.
 (b) The point of intersection is the midpoint of both the diagonals.
 (c) Diagonals of a rectangle bisect each other. Therefore, OD and OB both measure 4cm each.

- 7) In the figure,
 if $\angle A = 58^\circ$, $\angle B = 42^\circ$ and $\angle C = 40^\circ$
 we know that sum of all angles of a quadrilateral is 360° .
 i.e., $\text{reflex } \angle ADC + \angle A + \angle B + \angle C = 360^\circ$
 then, $\text{reflex } \angle ADC = 360^\circ - (\angle A + \angle B + \angle C)$

$$= 360^\circ - (58^\circ + 42^\circ + 40^\circ)$$

$$= 360^\circ - 140^\circ$$

$$= 220^\circ$$

 Now, $\angle ADC = 360^\circ - 220^\circ$

$$= 140^\circ$$

- 8) Given,
 $D_1 = 24\text{cm}$ and $D_2 = 10\text{cm}$.
 We know that, diagonals of a rhombus bisect each other. Hence their halves are 12cm and 5cm.
 $\text{Perimeter} = 4 \times 13$

$$= 52\text{cm}$$

 Hence, he will buy two laces of 12cm, two laces of 5cm and one of 52cm.

- 9) Yes, the shape of the park is Rhombus.
 Since the diagonal are bisecting perpendicularly, it means it is a rhombus.
 We can find its side by using Pythagoras theorem.

$$H^2 = P^2 + b^2$$

 Where, $P = 8/2 = 4\text{m}$

$$B = 6/2 = 3\text{m}$$

 Then, $\text{side} = \sqrt{4^2 + 3^2}$

$$= 5\text{m}$$

- 10) Yes, $\triangle ABD \cong \triangle CDB$
 We have,
 $AB = CD$ [Opposite sides of a rectangle]
 $\angle A = \angle C = 90^\circ$
 $AD = CB$ [Opposite sides of a rectangle]
 By SAS Criteria, $\triangle ABD \cong \triangle CDB$

SECTION D (4 MARKS)

Q.1 A carpenter uses two wooden strips as diagonals to form a rectangle. One strip is 8 cm long, and the other must be adjusted so that the figure becomes a rectangle.



(a) What should be the length of the second diagonal so that the figure forms a rectangle? (1)

(b) Where should the diagonals intersect? (1)

(c) $\triangle AOB \cong \triangle COD$. why ? (2)

Q.2 A farmer in Assam uses bamboo sticks to form the base of a hut . The diagonals are equal, bisect each other but no right angle is found at the point of intersection.

(a) What type of quadrilateral is formed? (1)

(b) If the diagonals intersect at 90° , what type of quadrilateral will be formed? (1)

(c) Write the sum of adjacent angles in both cases. (2)



Q.3 In a school park, a gardener is designing a flower bed in the shape of a quadrilateral. The shape has two opposite sides placed parallel to each other, while the other two sides are slanting but not parallel. To make the design look neat, he also marks one corner angle as 110° .



(a) Name the quadrilateral if two of its adjacent angles are 110° and 70° , also find the sum of remaining two angles.

(b) If one of the remaining angles is 75° , find the measure of the fourth angle.

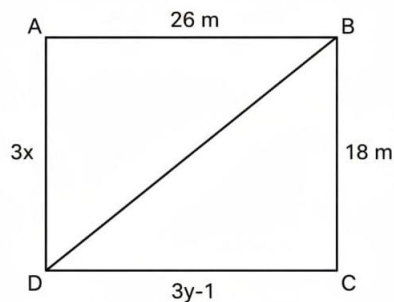
Q.4 In a park, children are playing on a square-shaped swing frame. When observed closely, the metallic frame of the swing is not exactly a square but slightly tilted, forming a slanted diamond-like shape. This frame has all its sides of the same length. Inside the frame, two rods are fixed from corner to corner (as diagonals), and they cross each other at the middle of the frame. Interestingly, these rods meet at a right angle, forming four equal parts.



(a) If all four sides of the metallic frame are of the same length and the opposite sides run parallel to each other, what will be shape of the frame?

(b) If one of the angles of the frame is 80° . Find the measure of the adjacent angle and its opposite angle.

Q.5 A farmer wants to build a parallelogram-shaped plot of land for fencing purposes. He places four wooden poles at the corners to form the shape. The length of one pair of opposite sides of the plot is 26 meters and $(3y-1)$ meters and the length of another pair of opposite sides are $3x$ meters and 18 meters.



(a) By using the property of parallelogram, find x and y . (2)

(b) If one of the angles at a corner is 110° , what is the measure of remaining three angles? (2)

SOLUTIONS

Q.1 (a) Since diagonals of a rectangle are equal, the second diagonal should also be 8 cm.

(b) The diagonals of a rectangle bisect each other. Hence, they must intersect at their midpoints.

(c) Triangles are congruent because $AO=CO$, $BO=DO$

Because diagonals of a rectangle bisect each other.

$AB=DC$ Because opposite sides of a rectangle are equal.

Q.2 (a) : It is a rectangle, because diagonals of equal length that bisect each other always form a rectangle, regardless of the angle between them.

(b) It will be a square, because in addition to rectangle properties, the diagonals also bisect each other at right angles.

(c) In first case quadrilateral is rectangle hence sum of adjacent angles is 180°

In second case quadrilateral is a square hence sum of adjacent angles is 180°

Q.3 (a) We know that the sum of all interior angles of any quadrilateral = 360° .

Given two angles = 110° and 70° .

Their sum = $110^\circ + 70^\circ = 180^\circ$.

Remaining sum of other two angles = $360^\circ - 180^\circ = 180^\circ$.

(b) The sum of the remaining two angles = 180° .

If one angle = 75° , then the other angle = $180^\circ - 75^\circ = 105^\circ$.

Q.4 (a) Since all four sides are equal in length and opposite sides are parallel, the frame is a rhombus. This property makes the swing frame stable and balanced because the equal side lengths distribute the tension and weight evenly.

(b) In rhombus sum of adjacent angles is 180° .

So adjacent angle is $180^\circ - 80^\circ = 100^\circ$

As we know opposite angles of a rhombus are equal so opposite angle will be 80° .

Q.5 (a) $3x = 18$ m (opposite sides of parallelogram are equal)

$$x = \frac{18}{3} = 6 \text{ m}$$

$$3y - 1 = 26$$

$$3y = 26 + 1$$

$$3y = 27$$

$$y = \frac{27}{3} = 9 \text{ m}$$

(b) . In such a plot, adjacent angles add up to 180° .

So, adjacent angle = $180^\circ - 110^\circ = 70^\circ$.

Opposite angles are always equal.

So, the opposite angle = 110° .

Thus, the angles of the plot are: 110° , 70° , 110° , and 70° .

CLASS TEST
QUADRILATERALS

1 MARK QUESTIONS

1. The football ground is shaped like a parallelogram. The diagonals intersect at point O. Which of these is true about point O?
a) O is equidistant from all four vertices
b) O is the midpoint of each diagonal
c) O lies on only one diagonal
d) O divides one diagonal in 2:1 ratio
2. A square clock is hung in such a way that one diagonal is vertical. What is the angle between its diagonals?
a) 45° b) 60° c) 90° d) 120°
3. The support structure of a flyover is in the shape of a quadrilateral with one pair of opposite sides parallel. The structure is a:
a) Kite b) Trapezium c) Rhombus d) Rectangle
4. When a rectangular sheet is folded along its diagonal, two triangles are formed. These triangles are:
a) Scalene b) Isosceles c) Right-angled d) Equilateral

2 MARKS QUESTIONS

1. Draw a rhombus NUTS such that one side is 4cm and $m\angle N = 75^\circ$
2. The four angles of a quadrilateral are in the ration 3:5:7:9. Find the angles.
3. ABCD is a parallelogram in which $\angle A = 110$. Find the measures of the angles B,C, D respectively.

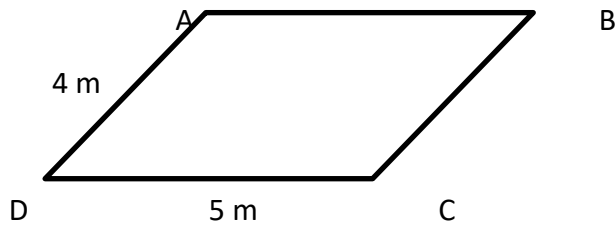
3 MARKS QUESTIONS

1. Find the measure of all the angles of the quadrilateral obtained by joining two equilateral triangles with sides 5cm. Name the quadrilateral formed and write a property that make it different from square.

Q2. Is it possible to construct a quadrilateral with three angles equal to 90° and the fourth angle not equal to 90° ? Justify your answer why and why not?

CASE BASED QUESTIONS (4 MARKS)

Q.1 A land surveyor marks a plot in the form of a parallelogram (ABCD). The adjacent sides measure 5 m and 4 m, and the angle between them is 30° .



(a) Find the measures of all the angles of the parallelogram.

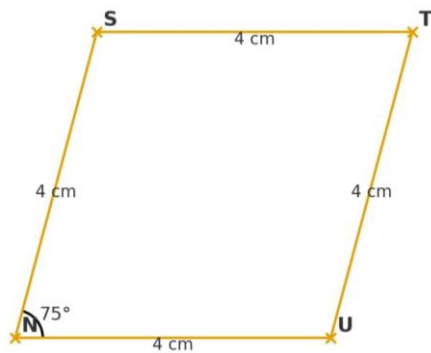
(b) Write the length of the sides AB and BC with justification.

SOLUTIONS

1 MARK QUESTIONS

1 (b) 2 (c) 3(c) 4 (c)

2 MARK QUESTIONS



(1)

(2) $45^\circ, 75^\circ, 105^\circ, 135^\circ$ (3) $70^\circ, 90^\circ, 90^\circ$

3 MARKS QUESTIONS

(1) $\angle ACD = 120^\circ$, $\angle D = 60^\circ$, $\angle B = 120^\circ$, $\angle A = 60^\circ$

(2) No, because sum of all angles of a quadrilateral is 360° .

4 MARKS QUESTIONS

Q.1 (a) $\angle A = 30^\circ$, $\angle B = 150^\circ$, $\angle C = 30^\circ$, $\angle D = 150^\circ$, since opposite angles are equal and adjacent angles are supplementary.

(b) Opposite sides of a parallelogram are equal

Hence $AB = DC = 5\text{m}$

$AD = BC = 4\text{m}$

CHAPTER 5: NUMBER PLAY

SECTION A (1 MARK QUESTIONS)

Q1. What can be said about the expressions formed by placing + and - signs between four consecutive numbers?

- A. The resulting expressions always have even parity.
- B. The resulting expressions always have odd parity.
- C. The parity of the resulting expressions varies.
- D. The resulting expressions are always divisible by 4.

Q2. How can you prove that all expressions of the form $a \pm b \pm c \pm d$ have the same parity?

- A. By showing that switching a sign changes the value by an odd number.
- B. By showing that switching a sign changes the value by an even number.
- C. By showing that the sum of the numbers is always even.
- D. By showing that the product of the numbers is always even.

Q3. Which of the following algebraic expressions will *always* evaluate to an even number for any integer values of the variables?

- A. $3g+5h$ B. $x^2 + 2$ C. $2u-4v$ D. $6m-3n$

Q4. What is the divisibility rule for 9?

- A. A number is divisible by 9 if its units digit is 9 or 0.
- B. A number is divisible by 9 if the sum of its digits is divisible by 9.
- C. A number is divisible by 9 if it is an even number.
- D. A number is divisible by 9 if its last two digits are divisible by 9.

Q5. When will the sum of two even numbers be a multiple of 4?

- A. When both numbers are multiples of 4.
- B. When both numbers are not multiples of 4.
- C. When one number is a multiple of 4 and the other is not.
- D. Both A and B are correct.

Q6. Which of the following statements is **always true**?

- A. If a number is divisible by 8, then 8 also divides any two numbers that add up to it.
- B. If a number is divisible by 7, then it is also divisible by any multiple of 7.
- C. If a number is divisible by 12, then it is also divisible by all the factors of 12.
- D. When you add an odd number to an even number you get a multiple of 6.

Q7. How can a number that leaves a remainder of 3 when divided by 5 be expressed algebraically?

- A. $3k+5$ B. $5k+3$ C. $5k-3$ D. $3k-5$

Q8. What is the remainder when the number 7309 is divided by 9?

- A. 0 B. 1 C. 7 D. 9

Q9. What is the general rule for determining divisibility by 11 using place values?

- A. The sum of the digits at all places must be divisible by 11.
- B. The difference between the sum of digits at even places and the sum of digits at odd places must be divisible by 11.
- C. The difference between the sum of digits at place values that are 'one more than a multiple of 11' and the sum of digits at place values that are 'one less than a multiple of 11' must be a multiple of 11.
- D. The last digit must be 1.

Q10. What can be said about the statement: "The sum of a multiple of 6 and a multiple of 3 is a multiple of 9"?

- A. Always true. B. Sometimes true. C. Never true. D. Insufficient Data

ANSWER KEY

ANS 1. Correct Answer: A. The resulting expressions always have even parity.

Explanation: When four consecutive numbers are chosen, regardless of how + and - signs are placed between them, the resulting expressions always have an even parity.

ANS 2. Correct Answer: B. By showing that switching a sign changes the value by an even number.

Explanation: One of the explanations provided in the text is that when a sign is switched in an expression like $a+b-c-d$, the value changes by an even number (e.g., changing $+b$ to $-b$ results in a change of $2b$). This means the parity of the expression remains the same, leading to the conclusion that all such expressions have the same parity.

ANS 3. Correct Answer: C. $2u-4v$

Explanation: The expression $2u-4v$ can be factored as $2(u-2v)$, which shows that 2 is always a factor of the expression, making the result an even number for any integer values of u and v .

ANS 4. Correct Answer: B. A number is divisible by 9 if the sum of its digits is divisible by 9.

Explanation: "A number is divisible by 9 if and only if the sum of its digits is divisible by 9".

ANS 5. Correct Answer: D. Both A and B are correct.

Explanation: There are two cases:-

1. Adding two even numbers that are multiples of 4 (e.g.,

$4p+4q$) will always result in a multiple of 4, as the sum can be written as $4(p+q)$.

2. Adding two even numbers that are

not multiples of 4 (e.g., $(4p+2)+(4q+2)$) will also always result in a multiple of 4, because their remainders of 2 add up to 4, and the sum can be written as $4(p+q+1)$.

ANS 6. **Correct Answer:** C. If a number is divisible by 12, then it is also divisible by all the factors of 12.

Explanation: This statement is "always true," and in general, if A is divisible by k, then A is divisible by all the factors of k.

ANS 7. **Correct Answer:** B. $5k+3$

Explanation: Numbers which leave a remainder of 3 when divided by 5 are "3 more than multiples of 5". Since multiples of 5 can be represented as

$5k$, the expression is $5k+3$.

ANS 8. **Correct Answer:** B. 1

Explanation: To find the remainder when a number is divided by 9, you can add its digits repeatedly until a single digit is obtained. For 7309, the sum of the digits is $7+3+0+9=19$. The digits of 19 can be added as well: $1+9=10$. Repeating the step for 10, we get $1+0=1$. Therefore, the remainder is 1.

ANS 9. **Correct Answer:** B. The difference between the sum of digits at even places and the sum of digits at odd places must be divisible by 11.

Explanation: The difference between the sum of digits at even places and the sum of digits at odd places must be divisible by 11.

ANS 10. **Correct Answer:** B. Sometimes true.

Explanation: The sum of a multiple of 6 (which is a multiple of 3) and a multiple of 3 is always a multiple of 3. However, it is not always a multiple of 9. For example,

$6+3=9$ (a multiple of 9), but $12+6=18$ (a multiple of 9), while $6+6=12$ (not a multiple of 9). Therefore, the statement is only sometimes true.

2-MARK QUESTIONS

Q1. Find the value of A and B:

$$\begin{array}{r} AB \\ \times A7 \\ \hline 211B \\ \hline \end{array}$$

Q.2 If $31y5$ is a multiple of 3, where y is a single digit, what could be the value of y?

Q.3 "I take a number that leaves a remainder of 8 when divided by 12. I take another number, which is 4 short of a multiple of 12. Their sum will always be a multiple of 8", claims Sonal, is she right?

Q.4 Prove that the sum of a 2- digit number and the number obtained by reversing their digits is always divisible by 11.

Q.5 Prove that the difference of a 2- digit number and the number obtained by reversing their digits is divisible by 9.

Q.6 If a, b, and c are three digits of a three-digit number, find the largest prime number, by which $abc + cab + bca$ is divisible ?

Q.7 Mr. Faheem announced the 3 prizes (1st, 2nd and 3rd) for the mathematics quiz organized under STEM week, he told that the students of class 8, having consecutive roll number are the winners and the sum of their roll number is 24. Also the first prize won by the student whose roll number comes in the middle of these three roll number. Which roll number is the winner?

Q.8 The students from all India schools participated in a Programme. A tent house provided 6000 chairs which were arranged in such a way that there are 9 chairs in each row, but it was found that a few students left without chairs, due to incomplete last row. How many least chairs need to be arranged to complete last row, and how many rows are there.

Q.9 Suppose 'M' is the greatest of 4 consecutive numbers. Describe the other three numbers in terms of 'M'.

Q.10 Rahul has written several numbers that leave a remainder of 2 when divided by 6. He claims, "If you add any three such numbers, the sum will always be a multiple of 6." Is Rahul's claim true?

ANSWER KEY (2 MARKS)

ANS 1. EXPLANATION:- Step 1: Here, we have $B \times 7 = B$; this is only possible when either $B = 0$ or $B = 5$.

Step 2: If $A = 1$ and $B = 0$, then $10 \times 17 = 170 \neq 2110$,
and if $A = 1$ and $B = 5$, then $15 \times 17 = 255 \neq 2115$.

Step 3: If $A = 2$ and $B = 0$, then $20 \times 27 = 540 \neq 2110$,
and if $A = 2$ and $B = 5$, then $25 \times 27 = 675 \neq 2115$.

Step 4: If $A = 3$ and $B = 0$, then $30 \times 37 = 1110 \neq 2110$,
and if $A = 3$ and $B = 5$, then $35 \times 37 = 1295 \neq 2115$.

Step 5: If $A = 4$ and $B = 0$, then $40 \times 47 = 1880 \neq 2110$,
and if $A = 4$ and $B = 5$, then $45 \times 47 = 2115$.

Thus, $A = 4$ and $B = 5$.

ANS 2. EXPLANATION:- The sum of the digits of a number $31y5 = 3 + 1 + y + 5 = 9 + y$

The number is divisible by 3 if the sum of its digits, i.e., $(9 + y)$ is divisible by 3.

This is possible only when $y = 0, 3, 6$, or 9 .

Thus, y could have either value of $0, 3, 6$, or 9 .

ANS 3. EXPLANATION: - A number that leaves a remainder of 8.

when divided by 12: $12k + 8$, where $k \geq 1$.

Also, another number 4 short of a multiple of 12: $12k - 4$

Their sum will be $(12k+8) + (12k-4) = 24k+4 = 4(6k+1)$

The number will always be a multiple of 4, but it will not be a multiple of 8 always.

ANS 4. EXPLANATION: - Given number = $ab = 10a + b$

Number obtained by reversing the digits = $10b + a$

Sum = $(10a + b) + (10b + a)$

= $10a + b + 10b + a$

= $11a + 11b$

= $11(a + b) \div 11$

= $a + b$

Hence proved.

ANS 5. EXPLANATION: - Given number = $xy = 10x + y$

Number obtained by reversing the digits = $10y + x$

Difference = $(10x + y) - (10y + x)$

= $10x + y - 10y - x$

= $9x - 9y$

= $9(x - y) \div 9$

= $x - y$

Hence proved.

ANS 6. EXPLANATION: - We have $abc + cab + bca$

$abc = 100a + 10b + c$

$cab = 100c + 10a + b$

$bca = 100b + 10c + a$

Adding $abc + cab + bca = 111a + 111b + 111c$

= $111(a + b + c)$

= $37 \times 3(a + b + c)$, which is a multiple of 37.

That prime number is 37.

ANS 7. EXPLANATION: - Let the roll numbers be x , $x + 1$, and $x + 2$.

$\Rightarrow x + (x + 1) + (x + 2) = 24$

$\Rightarrow 3x + 3 = 24$

$\Rightarrow 3x = 24 - 3 = 21$

$\Rightarrow 3x = 21$

$\Rightarrow x = 7$

$\therefore x + 1 = 7 + 1 = 8$

$\therefore x + 2 = 7 + 2 = 9$

Thus, the roll numbers are 7, 8, and 9, where roll number 8 comes in the middle, so 'roll number 8 student' won the first prize.

ANS 8. EXPLANATION: - For this we need to find the multiple of 9, nearest to 6000.

Given, 6000

Sum of the digits = $6 + 0 + 0 + 0 = 6$

we know that, if the number is divisible by 9, then the sum of the digits is divisible by 9.

If we add 3 to the number 6000.

$6000 + 3 = 6003$, it is divisible by 3.

Thus, the multiple of 9 that is closest to the number 6000 is 6003.

So at least 3 more chairs need to be arranged, to complete last row.

Also total rows are $6003/9 = 667$ rows.

ANS 9. EXPLANATION: - The other three numbers in term of M are, M-1, M-2, M-3

Where M-1 is the second largest number

M-2 is the third largest number.

M-3 is the smallest number.

$M > (M-1) > (M-2) > (M-3)$

ANS 10. EXPLANATION: - The expression has been written by Rahul = $6k + 2$

where, $k = 1, 2, 3, 4, 5, 6, \dots$

$$6 \times 1 + 2 = 8$$

$$6 \times 2 + 2 = 14$$

$$6 \times 3 + 2 = 20$$

$$6 \times 4 + 2 = 26$$

The sum of three numbers

$$8 + 14 + 20 = 42, \text{ it is a multiple of 6.}$$

$$14 + 20 + 26 = 60, \text{ it is a multiple of 6.}$$

Also if we add $6k+2$, 3 times. $(6k+2) + (6k+2) + (6k+2) = 18k + 6 = 6(3k+1)$

So it will always be the multiple of 6

Yes, Rahul's claim is true.

3- MARKS QUESTIONS

Q1. A student picks four consecutive numbers 7, 8, 9, and 10. She places '+' and '-' signs in between them to form expressions.

Verify that whatever combination of signs she chooses, the result is always even.

Q2. Two even numbers 'm' and 'n' are added.

Will their sum always be a multiple of 4? Justify.

- Q3. A number 12345 is checked for divisibility by 5.
Use algebraic reasoning (place values) to explain why the test for divisibility by 5 works.
- Q4. The digital root of number 489710 is calculated.
Find the digital root and explain its connection with divisibility by 9.
- Q5. A farmer has 47 pebbles. He groups them in 5s.
What remainder does he get? Which general algebraic form represents such numbers?
- Q6. Sita says, "If a number is divisible by 12, then it must also be divisible by all the factors of 12."
Check whether her claim is always true.
- Q7. Find the remainder when 427 is divided by 9 without actual division.
- Q8. A 6-digit number $48a23b$ is divisible by 18. Find possible pairs of (a, b) .
- Q9. Ravi claims: "The product of two consecutive integers is always a multiple of 2 but not always a multiple of 6."
Examine the correctness of his statement.
- Q10. Draw a Venn diagram which captures the relationship between the multiples of 4, 8, and 32?

ANSWER KEY (3-MARKS)

ANS 1. General form of 4 consecutive numbers: $a, (a+1), (a+2), (a+3)$.

- Any expression looks like $\pm a, \pm(a+1), \pm(a+2), \pm(a+3)$.
- Changing a sign changes result by an even number (e.g., switching $+b$ to $-b$ changes by $2b$).
- Thus, all results have the same parity.
- Example with given numbers:
 - $7 + 8 + 9 + 10 = 34$ (even)
 - $7 + 8 - 9 - 10 = -4$ (even)
 - $7 - 8 - 9 + 10 = 0$ (even)

Hence, **all results are even.**

Marks: (1 for general rule + 1 for example + 1 for conclusion).

ANS 2.

Step 1: General form of even numbers

Any even number can be written as $2k$, where k is an integer.

So, $m = 2a, n = 2b$, where a, b are integers.

Step 2: Their sum

$$m + n = 2a + 2b = 2(a + b)$$

So, the sum is always a **multiple of 2** (i.e., always even).

Step 3: Check divisibility by 4

Now, whether it is always divisible by 4 depends on the values of $a + b$.

- If $a + b$ is even $\rightarrow 2(a + b)$ is a multiple of 4.
- If $a + b$ is odd $\rightarrow 2(a + b)$ is **not** a multiple of 4.

Step 4: Example check

- Example 1: $m = 6, n = 10 \Rightarrow m + n = 16$ (multiple of 4).
- Example 2: $m = 2, n = 6 \Rightarrow m + n = 8$ (multiple of 4).
- Example 3: $m = 2, n = 4 \Rightarrow m + n = 6$ (not multiple of 4).

The sum of two even numbers is **always even**, but it is **not always a multiple of 4**.

ANS 3. General form: $\dots + 1000d + 100c + 10b + a$.

- Every term except unit's place is multiple of 10.
- Only the last digit matters for divisibility by 5.
- If unit digit $a = 0$ or 5, the number is divisible by 5.
- Here, last digit = 5, so divisible.

Marks: (1 for algebra explanation + 1 for reasoning + 1 for conclusion).

ANS 4. Add digits: $4 + 8 + 9 + 7 + 1 + 0 = 29 \rightarrow 2 + 9 = 11 \rightarrow 1 + 1 = 2$.

- Digital root = 2.
- Since it is not 9, the number is not divisible by 9.
- Rule: A number is divisible by 9 iff its digital root is 9.

Marks: (1 for working + 1 for digital root + 1 for divisibility conclusion).

ANS 5. Divide 47 by 5 $\rightarrow 47 = 5 \times 9 + 2 \rightarrow$ remainder = 2.

- General form of numbers leaving remainder 2 on division by 5 = $5k + 2$.
- Here, $k = 9$ gives 47.

Marks: (1 for division + 1 for remainder + 1 for general form).

ANS 6. Factors of 12 = 1, 2, 3, 4, 6, 12.

- Example: 36 is divisible by 12.
- $36 \div 2 = 18, 36 \div 3 = 12, 36 \div 4 = 9, 36 \div 6 = 6, 36 \div 12 = 3$. All exact.

- By definition, if a number is divisible by n , then divisible by all factors of n .
Hence, claim is **Always True**.

Marks: (1 for factors + 1 for example + 1 for conclusion).

ANS 7.

- Add digits: $4 + 2 + 7 = 13$.
- Add again: $1 + 3 = 4$.
- Hence remainder = 4.

Marks: (1 for digit sum + 1 for reducing + 1 for final remainder).

ANS 8.

- Divisible by 18 $\Rightarrow$ divisible by 2 and 9.
- For divisibility by 2 $\rightarrow b$ must be even (0, 2, 4, 6, 8).
- Sum of digits = $4 + 8 + a + 2 + 3 + b = 17 + a + b$ must be multiple of 9.
- Case $b = 0 \rightarrow 17 + a$ must be multiple of 9 $\rightarrow a = 1$ (since 18).
- Case $b = 2 \rightarrow 19 + a$ must be multiple of 9 $\rightarrow a = 8$ (27).
- Case $b = 4 \rightarrow 21 + a$ multiple of 9 $\rightarrow a = 6$ (27).
- Case $b = 6 \rightarrow 23 + a$ multiple of 9 $\rightarrow a = 4$ (27).
- Case $b = 8 \rightarrow 25 + a$ multiple of 9 $\rightarrow a = 2$ (27).

Thus, pairs: (1,0), (8,2), (6,4), (4,6), (2,8).

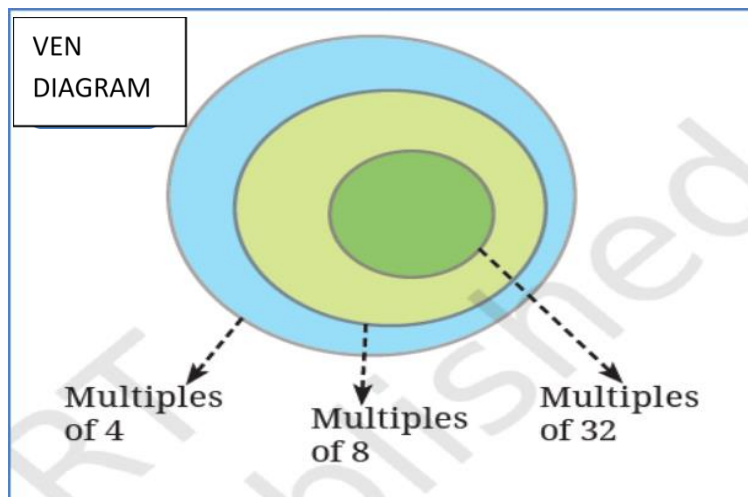
Marks: (1 for rule + 1 for stepwise check + 1 for pairs).

ANS 9.

- Two consecutive integers: n and $n+1$.
- One of them must be even $\rightarrow$ product always multiple of 2.
- For multiple of 6 $\rightarrow$ need factor 2 and 3.
Example: $2 \times 3 = 6$ (multiple of 6).
Example: $4 \times 5 = 20$ (not multiple of 6).
- Hence, statement is **correct**.

Marks: (1 for factor 2 proof + 1 for multiple of 6 check + 1 for conclusion).

ANS 10.



4- MARK QUESTIONS

SECTION D (4 marks questions)

Q1. The school has 5 buses A, B, C, D, E numbered 132, 225, 450, 720 and 835 respectively.

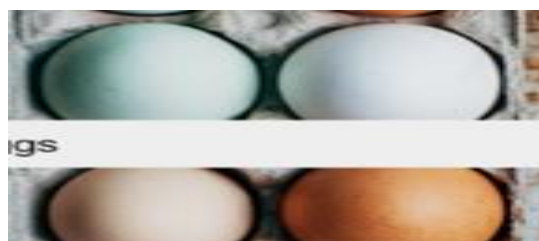


The head master says the bus having the number divisible by 3 have red stickers; buses having number divisible by 5 have green stickers.

- (i) Which buses get red stickers?
- (ii) Which buses get green stickers?
- (iii) Can any bus get both stickers, if possible then identify those buses?

Q2. A farmer keeps eggs in crates of 4 each. He has the following number of eggs on different days.

DAY	NO. OF EGGS
Monday	236
Tuesday	412
Wednesday	768
Thursday	995



On which days the eggs can be placed in crates of 4 eggs each (with no eggs left over)?

Q3. Aman is designing a number puzzle. He asks players to find a **3-digit number** such that:

- The number is divisible by **9**.
- The digits of the number are in **ascending order**.
- The sum of the digits is **18**.

a) What rule helps us check if a number is divisible by 9?

b) Find the possible 3-digit even number that satisfies all the conditions.

Q4. A fruit seller has 21 oranges. He wants to arrange them either in two baskets or in three baskets, such that each type of arrangement has consecutive natural numbers of oranges. Find both the possible ways.



Q5. Mary has some number cards. She asked John to choose such numbers from number cards that have remainder 3 when divided by 5.



i) Write two such numbers.

ii) Which algebraic expressions capture all such numbers?

- a) $3k+5$ b) $3k-5$ c) $\frac{3k}{5}$ d) $5k+3$

iii) Write another algebraic expression for the numbers divided by 5 leaves remainder 3.

ANSWER KEY (4 MARKS)

ANS 1.

- Divisibility by 3 $\rightarrow$ sum of digits divisible by 3.
132 $\rightarrow 1+3+2 = 6$ divisible
225 $\rightarrow 2+2+5 = 9$ divisible

$450 \rightarrow 4+5+0 = 9$ divisible
 $720 \rightarrow 7+2+0 = 9$ divisible
 $835 \rightarrow 8+3+5 = 16$ not divisible
So, **Red stickers: 132, 225, 450, 720**

- Divisibility by 5 $\rightarrow$ last digit 0 or 5.

132 $\rightarrow$ ends with 2

225 $\rightarrow$ ends with 5

450 $\rightarrow$ ends with 0

720 $\rightarrow$ ends with 0

835 $\rightarrow$ ends with 5

So, **Green stickers: 225, 450, 720, 835**

- Both stickers $\rightarrow$ buses divisible by 3 **and** 5 $\rightarrow$ divisible by 15.
225, 450, 720 satisfy both.

Final Answer:

Red: 132, 225, 450, 720

Green: 225, 450, 720, 835

Both: 225, 450, 720

ANS 2. **Numbers given:** 236, 412, 768, 995

Check divisibility by 4 (last two digits divisible by 4).

- $236 \rightarrow 36 \div 4 = 9$ divisible
- $412 \rightarrow 12 \div 4 = 3$ divisible
- $768 \rightarrow 68 \div 4 = 17$ divisible
- $995 \rightarrow 95 \div 4 =$ not divisible

Final Answer: 236, 412, 768 can be exactly divided into crates.

ANS 3. **Conditions:**

- Divisible by 9 $\rightarrow$ sum of digits divisible by 9.
- Digits in ascending order.
- Sum = 18.

Step 1: Rule

Divisibility by 9 $\rightarrow$ sum of digits divisible by 9.

Step 2: Find number

Digits must be increasing $\rightarrow$ possible triplets summing 18:

(4, 6, 8) $\rightarrow$ number 468 ✓ divisible by 9 ($4+6+8=18$).

Final Answer: 468

SOLUTION 4. We need consecutive natural numbers whose sum = 21.

- Case 1: $10 + 11 = 21$

- Case 2: $6 + 7 + 8 = 21$

Final Answer: Two ways $\rightarrow (10, 11)$ and $(6, 7, 8)$.

SOLUTION 5. i) 48, 78 ii) d) $5k+3$

iii) $5k-2$.

SELF ASSESSMENT (M.M. 20)**(MCQ- 1 MARK EACH)**

Q1. Without computing them, find out which of the following arithmetic expressions are even.

- (i) $567 + 262$ (ii) $19405 - 2130$ (iii) $37503 + 28307$ (iv) $69312 - 28323$

Q2. A number $39x52$ is divisible by 3, where 'x' is a single digit. What is the maximum value of 'x'?

- (i) 9 (ii) 8 (iii) 0 (iv) 7

Q3. A number $48xy7$ is divisible by 9. What is the difference of maximum value of 'x' and minimum value of 'y'?

- (i) 8 (ii) 9 (iii) 1 (iv) 3

Q4. Anuradha uses a 6-digit pin for her suitcase, which is 987342; its digital root is-

- (i) 3 (ii) 33 (iii) 9 (iv) 6

Q5. The sum of 5 consecutive natural numbers is 35. What is the largest number?

- (i) 6 (ii) 10 (iii) 11 (iv) 9

(VERY SHORT ANSWER- 2 MARKS EACH)

Q.6 A shopkeeper gives lucky draw coupons numbered 234, 345 and 456 to three customers.

By using divisibility rules, check which of these numbers is divisible by 9. (Show working)

Q.7 The sum of 4 consecutive numbers is 30, what are these numbers.

(SHORT ANSWER TYPE- 3 MARKS EACH)

Q.8 Find three consecutive numbers such that the first number is a multiple of 2, the second number is a multiple of 3, and the third number is a multiple of 4.

Are there more such numbers? How often do they occur?

Q.9 A railway ticket number is 5483.

The checker uses digital roots to quickly check divisibility.

i.	Find the digital root of 5483.
ii.	Using the digital root, check whether 5483 is divisible by 9.

(LONG ANSWER TYPE)

Q.10 Mr. Suryakanta received electricity bills for four months, May, June, July and August. The bill amount is: 5832, 5745, 6180, and 5233, respectively.

- (a) Find the digital root of each bill number.
(2)
- (b) Using the pattern, tell which bills are divisible by 9.
(1)
- (c) Give one reason why digital roots are useful in checking arithmetic calculations.
(2)

SOLUTIONS

ANSWER 1. (iii) $37503 + 28307$

ANSWER 2. (ii) 8

ANSWER 3. (i). 8

ANSWER 4. (iv). 6

ANSWER 5. (iv) 9

ANSWER 6: 234

ANSWER 7: 6, 7, 8 AND 9.

ANSWER 8: there are infinitely many such numbers. They occur after every **12 numbers**.
The sets are: (2,3,4), (14,15,16), (26,27,28), (38,39,40), ...

ANSWER .9:

i.	The digital root of 5483 is 2.
ii	5483 is not divisible by 9.
.	

ANSWER 10:

- (a) The digital root of each bill number is 9, 3, 6 and 4 respectively. (2)
- (b) 5832 is divisible by 9. (1)
- (c) Digital roots are useful because they help in **quickly verifying the correctness of arithmetic calculations** without redoing the entire work. (2)

CHAPTER 6: WE DISTRIBUTE, YET THINGS MULTIPLY

Section A(1 mark questions)

1. Riya buys 6 boxes containing 4 pencils and 2 erasers each. How many items does she have in total?

- (a) 30 (b) 36 (c) 24 (d) 18

2. A farmer divides his field into x equal plots, each plot grows a kg wheat and b kg rice. What is the total produce for all plots?

- (a) $x(a+b)$ kg (b) $a(x+b)$ kg (c) $b(a+x)$ kg (d) $x + a + b$ kg

3. What comes next to complete the pattern. $1 \times 3, 2 \times 4, 3 \times 5, 4 \times 6, \dots$

- (a) 5×7 (b) 6×8 (c) 4×9 (d) 5×6

4. Given that $35 \times 75 = 2625$: if 75 is increased by 1, the product will increase by

- (a) 45 (b) 75 (c) 35 (d) 85

5. What will be the n th term of the pattern $2^2 - 1, 3^2 - 1, 4^2 - 1, 5^2 - 1, \dots$

- (a) $n^2 - 1$ (b) $(n+2)^2 - 1$ (c) $(n+1)^2 - 1$ (d) $6^2 - 1$

6. Find the odd one out?

- (a) $k^2 + 2k$ (b) $(k+1)^2 - 1$ (c) $k(k+1)$ (d) $k(k+1) + k$

7. Maya wants to buy 9 bags. Each bag costs ₹120 and she also buys 4 purses together at ₹80 each. What is the total sum spent by Maya?

- (a) ₹1,400 (b) ₹1,280 (c) ₹1,360 (d) ₹1,080

8. Which identity is suitable to find the product 397×403 :

- (a) $(a+b)^2 = a^2 + 2ab + b^2$ (b) $(a-b)^2 = a^2 - 2ab + b^2$
(c) $a^2 - b^2 = (a+b)(a-b)$ (d) none of the above

9. A square garden has its side equal to the sum of the width of two smaller paths of p and q metre respectively. What is its area ?

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

10. **Assertion** : $225(175+375) = 225 \times 175 + 225 \times 375$

Reason : Addition is distributive over multiplication

- (a) Both Assertion & Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion & Reason are true and Reason is not the correct explanation of Assertion.

- (c) Assertion is true and Reason is false.
 (d) Assertion is false and Reason is true.

Solution of Section A

1. Option:-b

$$\text{Total items per box} = 4 + 2 = 6$$

$$\text{Total items} = 6 \text{ boxes} \times 6 \text{ items} = 36$$

2. Option:-a $x(a+b)$ Kg

3. Option:- a Pattern is $k(k+2)$

4. Option:- c $35X(75+1) = 35X75+35$

5. Option:- c The pattern is $(n+1)^2 - 1$

6. Option:- c $k(k+1)$

other options are $k^2 + 2k$ when simplified the algebraic expression.

7. Option:- a

$$\text{Price for bags} = 9 \times 120 = ₹1,080$$

$$\text{- Price for purses} = 4 \times 80 = ₹320$$

$$\text{- Total} = ₹1,080 + ₹320 = ₹1,400$$

8. Option:- c $a^2 - b^2$

$$(400+3)(400-3) = 400^2 - 3^2$$

9. Option:- c $(p+q)^2$

$$\text{Side of square} = p + q, \text{ hence area of square} = \text{side}^2 = (p+q)^2$$

10. Option:- c

Assertion is true and Reason is false (Multiplication is distributive over addition)

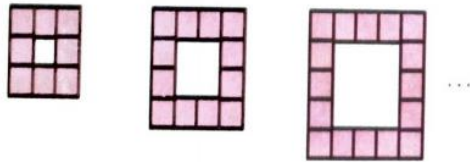
Section- B(2 MARK QUESTIONS)

11. Find the product of 318×1002 using distributive property.

12. A shopkeeper sells $15x$ boxes of biscuits, and in each box there are $6p$ chocolate biscuits and $4q$ vanilla biscuits. Find the total biscuits.

13. A sports coach buys 24 kits. Each kit has 2 pairs of shoes and 3 T-shirts. Each boy is given a pair of shoes and a T – shirt. In that afternoon the coach has distributed shoes & T -shirt to 20 boys. How much T – shirts are left ?

14. Draw the next two figures to continue the pattern.

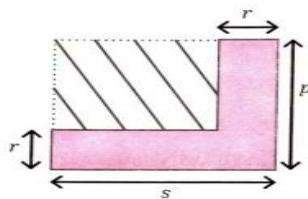


_____.

15. Find the square of the followings using a suitable identity.

(a) 1005 (b) 98

16. Write an expression for the area of dashed region in the given figure.



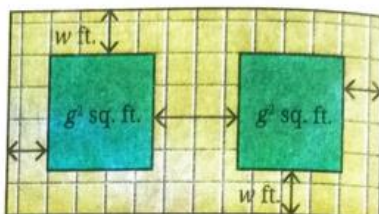
17. We know that the difference of the product of dates lying along each diagonal of any 2×2 square is 7. For example $11 \times 5 - 12 \times 4 = 55 - 48 = 7$. Explain why it is always 7.

February						
Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

18. A number leaves a remainder of 2 when divided by 9 and another number leaves a remainder of 5 when divided by 9. What is the remainder when their sum and their difference are divided by 9?

19. Express 36 as the difference of two squares.

20. A tiny park is coming up in Dhauri. The plan is shown in the figure. The two plots, each of area g^2 sq.ft. will have a green cover. All the remaining area is a walking path w ft. wide that needs to be tiled. Write an expression for the area that needs to be tiled.



Solution of Section B

11. $318 \times 1002 = 318 (1000+2) = 318 \times 1000 + 318 \times 2 = 318000 + 636 = 318636$

12. Total biscuits per box = $6p + 4q$

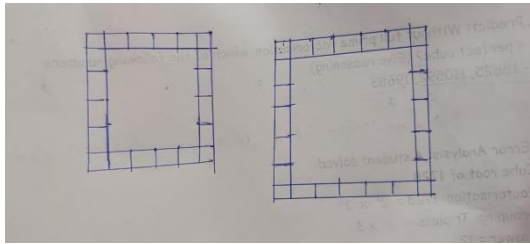
Total biscuits = $15 \times (6p+4q) = 90 \times p + 60 \times q$

13. Total T-shirts in kit = $24 \times 3 = 72$

T-shirts distributed = $20 \times 1 = 20$

T-shirts left = $72 - 20 = 52$

14.



15. (a) $1005^2 = (1000 + 5)^2 = 1000^2 + 2 \times 1000 \times 5 + 5^2$ $[(a+b)^2 = a^2 + 2ab + b^2]$
 $= 1000000 + 10000 + 25 = 1010025$

(b) $98^2 = (100 - 2)^2 = 100^2 - 2 \times 100 \times 2 + 2^2$ $[(a-b)^2 = a^2 - 2ab + b^2]$
 $= 10000 - 400 + 4 = 9604$

16. Length of rectangle = $s - r$

Breadth of rectangle = $p - r$

Area of rectangle = $(s-r)(p-r) = sp - sr - pr + r^2$

17. Let first date is x , Other dates are $x+1$, $x+7$ and $x+8$

When we multiply diagonally $(x+1)(x+7) = x^2 + 8x + 7$

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

Difference = $\{x^2 + 8x + 7\} - \{x^2 + 8x\} = 7$

18. First number = $9x + 2$

Second number = $9y + 5$

Sum = $9x + 2 + 9y + 5 = 9(x+y) + 7$

So remainder will be 7

Difference = $(9y + 5) - (9x + 2) = 9(y-x) + 3$

So remainder will be 3

19. 36 is the square of 6. It is to express as the difference of two squares. So we have to find a Pythagorean triplet.

$$2n, n^2+1 \text{ and } n^2-1$$

$$\text{As } 2n = 6, n = 3$$

$$\text{Hence } n^2+1 = 3^2+1=10 \text{ and } n^2-1 = 3^2-1=8 \quad \text{So.. } 36 = 10^2 - 8^2$$

20. Length of rectangle = $2(g+2w) = 2g + 4w$

$$\text{Breadth of rectangle} = g + 2w$$

$$\text{Required area} = (2g + 4w)(g+2w) - 2g^2 = 8wg + 8w^2$$

SECTION-C (3 MARK QUESTIONS)

21. A farmer has a rectangular field. He wants to divide the field into smaller plots such that the length and breadth of each plot are in the ratio 3:2. If the total field area is 3600 m², find the dimensions of each smaller plot when he divides it into 6 equal plots.

22. A container is divided into 4 equal parts. Each part is filled with water that is twice the volume of the previous part. If the smallest part has 2 liters, find the total amount of water in the container.

23. Two numbers p and q are multiplied. The product is pq. If p is increased by 3 and q is decreased by 2, what is the product? Find also the difference of two products.

24. A businessman advertises his product in layers where each layer's sales are 3 times the previous layer's sales. If the first layer sells 50 units and overall sales are 6050 units, find how many layers are there.

25. Find three examples where the product of two numbers remain unchanged when one of them is increased by 6 and other number is decreased by 2 .

26. Let us take a 4-digit number *dcba*.

$$dcba \times 101 = dcba \times (100 + 1) = dcba \times 100 + dcba.$$

This becomes

$$\begin{array}{rcccccc} & d & c & & b & a & o & o \\ + & & & & d & c & b & a \\ \hline d & c & (b+d) & (a+c) & b & a & & \end{array}$$

Use the above process to find 3874×101 in one line.

27. A company produces 100 gadgets first month, and production doubles every month. After x months 6400 gadgets will be produced. Find the value of x?

28. To pack candies, boxes are arranged such that each subsequent box contains thrice the candies of the previous one. If the first box has b candies , if total candies in 7 boxes are 13116. Find the candies in first box?

29. A number leaves a remainder of 3 when divided by 7, and another number leaves a

remainder of 5 when divided by 7. What is the remainder when their sum, difference, and product are divided by 7?

30. Find the square of the followings using suitable identity.

a) $3q + r$

b) $2a - 3b$

c) 605

Solution of Section C

21. Total area of the rectangular field = 3600 m^2

Number of smaller plots = 6

Area of each smaller plot = Total area / 6 = $3600 / 6 = 600 \text{ m}^2$

Let length = $3x$, breadth = $2x$

So area = $3x \times 2x = 6x^2$

$$6x^2 = 600$$

$$x^2 = 100$$

$$x = 10$$

$$3x = 30\text{m and } 2x = 20\text{m}$$

22. 1st part = $a = 2$ liters,

2nd part = $2a = 2 \times 2 = 4$ liters,

3rd part = $2 \times 2a = 2 \times 4 = 8$ liters,

4th part = $2 \times 8 = 16$ liters.

The total amount of water in the container is the sum:

$$2 + 4 + 8 + 16 = 30 \text{ liters.}$$

So, the total amount of water in the container is 30 liters.

23. new product = $(p + 3)(q - 2) = pq + 3q - 2p - 6$

$$\text{Difference} = (pq + 3q - 2p - 6) - pq = 3q - 2p - 6$$

24. Total no. of sales =

$$1^{\text{st}} \text{ sales} = 50$$

$$2^{\text{nd}} \text{ sales} = 3 \times 50 = 150$$

$$3^{\text{rd}} \text{ sales} = 3 \times 150 = 450$$

$$4^{\text{th}} \text{ sales } 3 \times 450 = 1350$$

$$5^{\text{th}} \text{ sales } 3 \times 1350 = 4050$$

$$\text{Total sales} = 50 + 150 + 450 + 1350 + 4050 = 6050$$

So there are 5 layers.

25. $ATQ (p+6)(q-3) = pq$

$$pq + 6q - 3p - 18 = pq$$

$$6q - 3p - 18 = 0$$

When $q = 4$, $p = 2$

When $q = 5$, $p = 4$

When $q = 6$, $p = 6$

26. $3 \ 8 \ 7 \ 4 \ 0 \ 0$

$$3 \ 8 \ 7 \ 4$$

$$3 \ 8 \ (10) \ (12) \ 7 \ 4 = 391274$$

27 The number of gadgets produced in each month is:

- Month 1: 100 gadgets
- Month 2: $100 \times 2 = 200$ gadgets
- Month 3: $200 \times 2 = 400$ gadgets
- Month 4: $400 \times 2 = 800$ gadgets
- Month 5: $800 \times 2 = 1600$ gadgets
- Month 6: $1600 \times 2 = 3200$ gadgets
- Month 7: $3200 \times 2 = 6400$ gadgets

So, at the end of 7 months, the company will produce 6400 gadgets in the 7th month. The value of $x=7$

28. . The number of candle in the 1st box= b

$$2^{\text{nd}} \text{ box} = bx3 = 3b$$

$$3^{\text{rd}} \text{ box} = 3bx3 = 9b$$

$$4^{\text{th}} \text{ box} = 9bx3 = 27b$$

$$5^{\text{th}} \text{ box} = 27bx3 = 81b$$

$$6^{\text{th}} \text{ box} = 81bx3 = 243b$$

$$7^{\text{th}} \text{ box} = 243bx3 = 729b$$

$$\text{Total no. of candies} = 13116$$

$$b + 3b + 9b + 27b + 81b + 243b + 729b = 13116$$

$$1093b = 13116$$

$$. b = 12$$

The candies in first box is are 12.

29. First number leaves remainder **3** when divided by 7.

$$\text{First number} = 7k+3$$

Second number leaves remainder 5 when divided by 7.

$$\text{Second number} = 7m + 5$$

Remainder when their sum is divided by 7:

$$(7k+3) + (7m+5) = 7(k+m) + 8 = 7(k+m) + 7 + 1 = 7(k+m+1) + 1$$

So, remainder = 1

$$\text{Difference} = 7m + 5 - (7k+3) = 7m + 5 - 7k - 3 = 7m - 7k + 5 - 3 = 7(m-k) + 2$$

So, remainder = 2

$$\begin{aligned}\text{Now product} &= (7k+3)(7m+5) = 49km + 21m + 35k + 15 = 49km + 21m + 35k + 2 \times 7 + 1 \\ &= 7(7km + 3m + 5k + 2) + 1\end{aligned}$$

So, remainder = 1

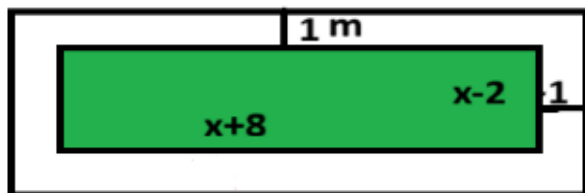
30. a) $(3q + r)^2 = 9q^2 + 6qr + r^2$

b) $(2a - 3b)^2 = 4a^2 - 12ab + 9b^2$

c) $605^2 = (600 + 5)^2 = 600^2 + 2 \times 600 \times 5 + 5^2 = 360000 + 6000 + 25 = 366025$

SECTION-D (4 MARK QUESTIONS)

31. A rectangular garden has length $(x + 8)$ meters and breadth $(x - 2)$ meters. If both the length and breadth are increased by 1 meter. Referring the data answer the following questions.

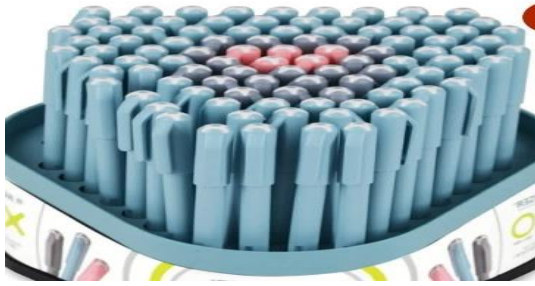


- a) Find the area of the original rectangular garden. 1M
- b) What is the area of the current rectangular garden after increase of 1m? 2M
- c) How much area increased? 1M

32. A factory produces refrigerators in two sections: section A produces $(3x+5)$ refrigerators and section B produces $(5x-2)$ refrigerators daily.

- a) What is the total production of refrigerators in the month of January? 2M
- b) Calculate total production of refrigerators for $x=10$ in that month. 2M

33. A shopkeeper has a set of $(7-x)$ pens and the cost of each pen is Rs. $(7+x)$.



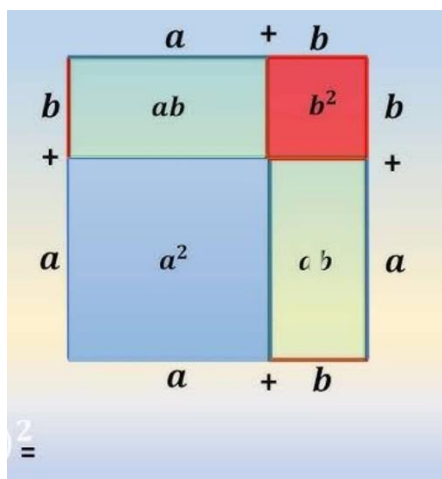
a) What is the total cost all his pens ?

2M

b) Find the cost pens in the above case if $x=4$.

2M

34. A gardener wants to make a square garden whose side is $(a+b)$ meters, where a meters is the length of the lawn and b meters is the width of the flower bed placed along the lawn.



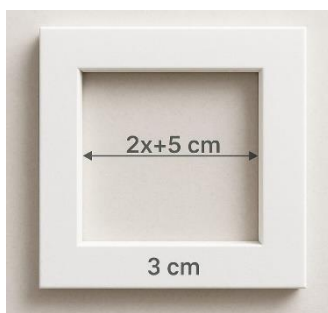
Q1. Express the total area of the garden in terms of a and b .

2M

Q2. If $a=10$ m and $b=5$ m, find the total area.

2M

35. Ramesh got many gifts on his 13th Birthday. On the next day he opened his gifts and found a nice photo frame which is square in shape as shown in figure. His elder brother asked him the following questions to solve.



- | | |
|--|-----|
| 1. What is the area of the photo which can be framed inside it ? | 1M |
| 2. What is the total area of the photo frame ? | 2 M |
| 3. What is the total area of the photo frame if $x = 10$ cm ? | 1M |

Solution of Section D

31. Solution

- a) $(x+8)(x-2) = x^2 - 2x + 8x - 16 = x^2 + 6x - 16$
- b) Area(new) = $(x+8+2)(x-2+2) = x(x+10) = x^2 + 10x$
- c) increase in area = $(x^2 + 10x) - (x^2 + 6x - 16) = 4x + 16$

32. Solution:-

- A) The total daily production = $(3x+5) + (5x-2) = 8x+3$
 So, the expression for total production in January = $31(8x + 3) = 248x + 93$
- B) Total production = $248 \times 10 + 93 = 2573$

33. a) Using distributive property to write the product:

The product of these two quantities is:

$$(7-x)(7+x)$$

Use the distributive property

$$(7-x)(7+x) = 7 \times 7 + 7 \times x - x \times 7 - x \times x = 49 + 7x - 7x - x^2 = 49 - x^2$$

The middle terms $7x$ and $-7x$ cancel out, so:

$$= 49 - x^2$$

$$B) 49 - 4^2 = 49 - 16 = 33$$

34.

- a) Area of square garden = $A = (a + b)^2 = a^2 + 2ab + b^2$
- b) $a+b=10+5=15$
 area = $15 \times 15 = 225 m^2$

35. Solution

- a) Area of photo to be framed = $(2x + 5)^2 = 4x^2 + 20x + 25 \text{ cm}^2$
- b) Side of outer square = $2x + 5 + 2 \times 3 = 2x + 11$
 area of square = $(2x + 11)^2 = 4x^2 + 44x + 121 \text{ cm}^2$
- c) area = $4x^2 + 44x + 121$
 $= 4 \times 3^2 + 44 \times 3 + 121 \text{ cm}^2$
 $= 289 \text{ cm}^2$

Class -Test Maximum Marks: 20

Section A consists of 4 questions of 1 mark each

Q.1 A shopkeeper calculates the total cost of 8 packets, each costing ₹45. If he gets 2 more packets for free, what is the total cost?

- a) ₹360 b) ₹460 c) ₹400 d) ₹360 + ₹90

Q.2 You buy a rectangular plot of land with length $(x + 8)$ metres and breadth $(x - 2)$ metres. What is its area?

- a) $x^2 + 8x - 2x$ b) $x^2 + 6x - 16$ c) $x^2 + 10x - 16$ d) $x^2 - 16$

Q.3 If a farmer has x mango trees and each yields 20 mangoes, which expression gives the total number of mangoes?

- a) $x + 20$ b) $x \times 20$ c) $x - 20$ d) $x \div 20$

Q.4 A baker has 100 cookies and packs them into bags of 8 cookies each. How many full bags will he get?

- a) 11 b) 12 c) 13 d) 14

SECTION -B

Q.5 A painter needs to paint two walls: one is 12 meters wide, the other is 15 meters wide. If the cost per meter is ₹25, calculate the total cost using the distributive property, not direct addition.

Q.6 During a trip, students travel 50 km by bus and 30 km by train each day for 5 days. Use the distributive property to find the total distance travelled. Show the steps.

Q.7 A school has 5 sections, each with 32 boys and 28 girls. Use distributive property to find the total number of students in the school. Show working.

SECTION -C

Q.8 A farmer wants to fence a rectangular field with length $(2x + 4)$ m and breadth $(x - 2)$ m. Find the area and perimeter using algebraic formulae, and explain each step

Q.9 If you add ₹100 to both price and quantity, how does the distributive property help you quickly find the total price?

SECTION -D

Q.10 A school plans a trip where students will travel by bus and train. The cost per student for the bus ride is ₹450 and for the train ride is ₹700. If the number of students going on the trip is represented by 'n', answer the following:

(a) Use distributive property to write an expression for the total transport cost for all students.

(b) Calculate the total cost for 40 students.

(c) Explain why the distributive property is helpful in budgeting and planning trips, especially when the number of students changes.

Answer key

Q.1 a) ₹360

Q.2 b) $x^2 + 6x - 16$

Q.3 b) $x \times 20$

Q.4 a) 11

Q.5 ₹675

Q.6 $5 \times (50 + 30) = 400$ km

Q.7 $5 \times (32 + 28) = 300$ students

Q.8 Area = $2x^2 - 12$; Perimeter = $6x + 4$

Q.9 $(p+100)(q+100) = pq + 100p + 100q + 10000$

Q.10 (a) $n(450 + 700) = 1150n$

(b) ₹46,000

(c) Helps simplify changing numbers, quick accurate calculation, find the the trip total cost , using distribution property marking Trip budget, if the number of students change then easy find out Total cost

CHAPTER 7:PROPORTIONAL REASONING -1

SECTION A (1 Mark Questions)

- Q1.** The ratio of two numbers is 3 : 5. If their sum is 64, what is the smaller number?
a) 20 b) 24 c) 40 d) 44
- Q2.** A child was asked by his teacher to bring red and blue coloured marbles in the ratio 7 : 3. If he has brought 30 blue marbles, how many red marbles have he brought?
a) 49 b) 60 c) 70 d) 100
- Q3.** ₹500 is being divided between two friends A and B in the ratio 2 : 3. How much will B get?
a) ₹100 b) ₹200 c) ₹300 d) ₹400
- Q4.** A recipe requires flour, sugar and butter in the ratio 4 : 2 : 1. If 28 cups of ingredients are used, how many cups of sugar are needed?
a) 4 b) 6 c) 8 d) 12
- Q5.** The ratio of boys to girls in a class is 3 : 2. If there are 45 boys, how many girls are there?
a) 20 b) 25 c) 30 d) 40
- Q6.** A drink mix requires water and syrup in the ratio 5 : 2. A student by mistake adds 10 cups of water and 6 cups of syrup. What should he do to make the ratio correct?
a) Add 1 cup of syrup b) Add 2 cups of water
c) Add 5 cups of water d) Add 3 cups of syrup
- Q7.** The number of students in classes A and B are in the ratio 4 : 5. If 8 students are shifted from class B to A, the ratio becomes 1 : 1.
How many students were there in class B initially?
a) 65 b) 72 c) 80 d) 90
- Q8.** A solution contains sugar and water in the ratio 3 : 7. If 4 liters of water is added, the ratio becomes 3 : 11. How much sugar is there in the solution?
a) 3 L b) 4 L c) 6 L d) 8 L
- Q9.** If the ratio of Amit's age to his father's age is 2 : 5 and their total age is 42 years, what is Amit's age?
a) 14 years b) 12 years c) 16 years d) 18 years
- Q10.** Two friends divide ₹840 in the ratio 4 : 3. Later they decide to divide it equally. How much money should the one who got more give to the other?
a) ₹30 b) ₹40 c) ₹60 d) ₹70

ANSWERS

1. Answer: b) 24

SOLUTION:-

Let the numbers $3x$ and $5x$

$$3x + 5x = 64$$

$$8x = 64$$

$$x = 8$$

$$\text{Smaller number} = 3x = 3 \times 8 = 24$$

2. Answer: c) 70

Solution:-

Let number of red and blue marbles are $7x$ and $3x$ respectively.

$$3x = 30$$

$$x = 10$$

$$\text{So red marbles} = 7x = 7 \times 10 = 70$$

3. Answer: c) ₹300

Solution:-

Let A and B get rupees $2x$ and $3x$ respectively

$$2x + 3x = 500$$

$$5x = 500$$

$$x = 100$$

$$\text{So B will get} = 3x = 3 \times 100 = 300$$

4. Answer: c) 8

SOLUTION:-

Flour: Sugar: Butter = $4:2:1$. Total parts = $4+2+1=7$.

$$\text{Sugar} = \frac{2}{7} \times 28 = 2 \times 4 = 8.$$

5. Answer: c) 30

SOLUTION:-

Boys: Girls = $3:2$. Boys = 45

Let number of boys and girls be $3k$ and $2k$ respectively

$$\text{So, } 3k = 45$$

$$\Rightarrow k = 45 \div 3 = 15.$$

$$\text{Girls} = 2k = 2 \times 15 = 30.$$

6. Answer: c) Add 5 cups of water

SOLUTION:- Mix requires water: syrup = 5:2 Student added 10 cups water and 6 cups syrup.

We want final amounts W:S=5:2. Current W:S=10:6 $\rightarrow$ 5:3. We need second part to be 2, but currently it is 3 (relative terms). We can either remove syrup or add water to restore 5:2. Removing syrup would make syrup smaller — not an offered choice. Check adding water: Suppose we add x cups water,

$$\text{new ratio } (10+x):6=5:2$$

$$\text{Or, } \frac{10+x}{6} = \frac{5}{2}$$

$$\text{Or, } 2(10+x) = 6 \times 5$$

$$\text{Or, } 20+2x = 30$$

$$\text{Or, } 2x=30 - 20$$

$$\text{Or, } x = 5$$

So add 5 cups of water.

7. Answer: c) 80

SOLUTION:- Students in classes A and B are in ratio 4:5. If 8 students moved from B to A, the ratio becomes 1:1 (equal).

Let initial A = 4x, B = 5x. After shifting 8 from B to A:

New A = 4x+8. New B = 5x-8. Given these are equal:

$$4x+8=5x-8$$

$$\text{Or, } 5x - 4x = 8 + 8$$

$$\text{Or, } x = 16$$

$$\text{So, initial B} = 5x = 5 \times 16 = 80$$

8. Answer: a) 3 L

SOLUTION:-

The solution has sugar : water = 3:7. If 4 liters of water is added, the ratio becomes 3:11.

Let sugar = 3x, water = 7x. After adding 4 L water: new water = 7x+4.

$$\text{Ratio } 3x : 7x+4=3:11.$$

$$\text{Or, } \frac{3x}{7x+4} = \frac{3}{11}$$

$$\text{Or, } 11 \times 3x = 3(7x+4)$$

$$\text{Or, } 33x = 21x + 12$$

Or, $33x - 21x = 12$

Or, $12x = 12$

Or, $x = 1$

So sugar = $3x = 3 \times 1 = 3$ L

9. Answer: b) 12 years

Ratio of Amit's age to father's age = 2:5. Total ages = 42.

Let Amit = $2x$, father = $5x$. Sum: $2x + 5x = 7x = 42$

So, $x = 42 \div 7 = 6$.

Amit's age = $2x = 2 \times 6 = 12$

10. Answer: c) ₹60

SOLUTION:-

Two friends divide ₹840 in ratio 4:3. Later they decide to split equally.

Total = 840. Shares initially: let $A = 4x$ & $B = 3x$

So, $4x + 3x = 840$

Or, $7x = 840$

Or, $x = 840/7 = 120$

Person A = $4x = 4 \times 120 = 480$

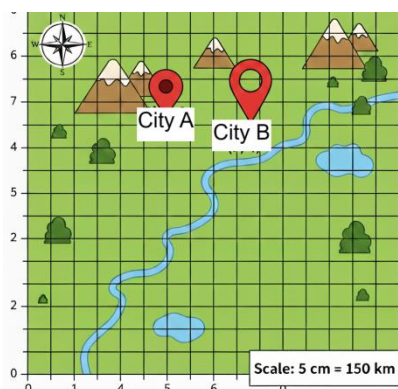
Person B = $3x = 3 \times 120 = 360$

If split equally, each should get $840 \div 2 = 420$

A currently has 480, should have 420 $\rightarrow$ must give $480 - 420 = 60$ to B.

SECTION B (2 Marks Type Questions)

Q1. On a map, a distance of 5 cm represents an actual distance of 150 km. If two cities are 12.5 cm apart on the map, what is the actual distance between them?



Q2. If 8 people can paint a wall in 6 days, how many people are needed to paint the same wall in 4 days?

- Q3.** A Juice seller sells juice by adding a certain amount of water in the juice. The ratio of water to juice in the drink is 5 : 2. If he has 15 litres of water, how much juice does he need to maintain the ratio?



- Q4.** A car takes 3 hours to cover a distance at a speed of 60 km/h. How long will it take to cover the same distance if its speed is reduced to 45 km/h?
- Q5.** Aman and Ravi decided to go for a picnic for which they contributed 1800 in the ratio 2:1 respectively. What was the contribution of Ravi ?
- Q6.** The cost of 15 identical notebooks is ₹ 375. How many such notebooks can be bought for ₹ 600?
- Q7.** The scale of a model car is 1 : 18. If the model is 12 cm long, what is the actual length of the car?
- Q8.** A hostel has enough food for 240 students for 30 days. How long would the food last if 60 more students join the hostel?
- Q9.** To make concrete for a construction work cement, sand, and gravel are mixed in the prescribed ratio 1 : 3 : 4 by volume. If 12 cubic metres of sand is used, how much cement and gravel is needed?
- Q10.** A school event includes 24 students from all three sections A,B,C of class 8 in the ratio 2:4:6. What is the total number of students taken from section A and C ?

ANSWERS

- 1. Solution:** This is a case of direct proportion. Let the actual distance be x km. The ratio of map distance to actual distance is constant.

$$\text{So, } \frac{5}{150} = \frac{12.5}{x}$$

Cross-multiplying:

$$5x = 150 \times 12.5$$

$$\text{Or, } 5x = 1875$$

$$\text{Or, } x = \frac{1875}{5} = 375 \quad \text{Answer: The actual distance between the cities is 375 km.}$$

2. Solution:

This is a case of inverse proportion. More people will take fewer days.

Let the number of people needed be x .

$$\text{So, } 8 \text{ people} \times 6 \text{ days} = x \text{ people} \times 4 \text{ days}$$

$$\text{Or, } 48 = 4x$$

$$\text{Or, } x = \frac{48}{4} = 12 \quad \text{Answer: 12 people are needed to paint the wall in 4 days.}$$

3. Solution:

Let the quantity of juice needed be x litres.

The ratio must be maintained,

$$\text{So, } \frac{\text{Water}}{\text{Juice}} = \frac{5}{2} = \frac{15}{x}$$

Cross-multiplying:

$$5 \times x = 2 \times 15 \quad \text{Or, } 5x = 30$$

$$\text{Or, } x = \frac{30}{5} = 6 \quad \text{Answer: 6 litres of juice is needed.}$$

4. Solution:

This is inverse proportion. Lower speed means more time.

Let the required time be t hours.

Since Distance = Speed $\times$ Time, and distance is constant:

$$\text{Speed}_1 \times \text{Time}_1 = \text{Speed}_2 \times \text{Time}_2$$

$$60 \times 3 = 45 \times t \quad \Rightarrow \quad 180 = 45t$$

$$t = \frac{180}{45} = 4 \quad \text{Answer: It will take 4 hours to cover the distance.}$$

5. Solution:

Total parts = $2+1 = 3$ Value of each part = $\frac{1800}{3} = ₹ 600$

So, Ravi share = $1 \times 600 = ₹ 600$

6. Solution:

This is direct proportion. More money can buy more notebooks.

Let the number of notebooks be x .

$$\text{Or, } \frac{15}{375} = \frac{x}{600}$$

$$\text{Cross-multiplying: } 15 \times 600 = 375 \times x \Rightarrow 9000 = 375x$$

$$\text{Or, } x = \frac{9000}{375} = 24 \quad \text{Answer: 24 notebooks can be bought for ₹ 600.}$$

7. Solution:

The scale 1:18 means 1 cm on the model represents 18 cm in reality.

Let the actual length be x cm.

$$\text{So, } \frac{1}{18} = \frac{12}{x}$$

$$\text{Cross-multiplying: } 1 \times x = 18 \times 12 \Rightarrow x = 216 \text{ cm}$$

We can convert this to metres: $216\text{cm} = 2.16 \text{ m}$

Answer: The actual length of the car is 2.16 metres.

8. Solution:

This is inverse proportion. More students, fewer days the food will last.

Let the number of days the food will last be d .

Total students now = $240 + 60 = 300$.

$$\text{So, } 240 \times 30 = 300 \times d$$

$$7200 = 300d$$

$$d = \frac{7200}{300} = \frac{72}{3} = 24$$

Answer: The food will last for 24 days.

9. Solution:

The given ratio is Cement: Sand: Gravel = 1: 3: 4

Let the common factor be x.

So, Sand used = $3x = 12$ cubic metres.

Therefore, $3x = 12 \Rightarrow x = 4$

Cement needed = $1 \times x = 1 \times 4 = 4$ cubic metres.

Gravel needed = $4 \times x = 4 \times 4 = 16$ cubic metres.

Answer: 4 m^3 of cement and 16 m^3 of gravel are needed.

10. Solution: Total number of students = 24

Ratio given is 2:4:6 ;and Total part = 12

So part of section A and C = 8

So total students from A and C = $\frac{8}{12} \times 24 = 16$

SECTION C (3 Marks Type Questions)

Q1. Rina and her family are organizing a school picnic for her younger brother's class. As part of the preparation, they have decided to prepare fruit juice for all the students. Rina follows a special recipe given by her mother, which requires exactly 3 liters of water to be mixed with 2 kilograms of fruit concentrate. This quantity is enough to make juice for 15 students. On the day of the picnic, the teacher informs Rina that instead of the expected 15 students, 45 students will attend because several students from other classes are joining in. Rina now needs to prepare enough fruit juice for all the students without any wastage, and she must plan carefully to buy the right quantity of ingredients. She also wants to avoid purchasing too much concentrate or water to save money.



Questions:

- i) How many litres of water will Rina need to prepare juice for all 45 students?
- ii) How many kilograms of fruit concentrate will she need for the same?

Q2. Arjun is planning a long weekend road trip with his friends. His car's fuel efficiency is such that it consumes 5 litres of petrol to travel 60 kilometers. He has mapped out a scenic route covering a total distance of 240 kilometers and wants to ensure he does not run out of fuel midway. He also wants to avoid unnecessary stops for refuelling to save time. Before starting the journey, Arjun decides to calculate the exact amount of petrol required and check if he needs to purchase extra petrol. (Efficiency



$$= \frac{\text{Distance Travelled}}{\text{Fuel Used}})$$

Questions:

- i) How many litres of petrol will Arjun need to travel 240 kilometers?
- ii) If he already has 10 litres of petrol in the tank, how many more litres should he purchase?

Q3. The school library has 120 books neatly arranged across 4 shelves, with an equal number of books on each shelf. One day, the librarian receives a generous donation of 66 additional books. She wants to distribute all the books equally among 6 shelves to keep the arrangement tidy. The librarian also wants to know how much more

space each shelf will require and how the new arrangement compares to the old one to ensure that students can easily find and access books.

Questions:

- i) How many books will there be on each shelf after the donation is added and redistributed?



- ii) How many more books does each shelf get compared to before the donation?

- Q4.** An ice-cream shop in the city centre sells 10 ice cream cones for Rs 250. During a summer festival, the shop expects a large crowd and estimates that 100 cones will be sold in a single day. The shop owner wants to calculate potential earnings to plan for extra supplies of cones and ice cream. Additionally, the owner wishes to determine the price of one cone to set a fair price for customers buying individually.



Questions:

- i) How much will the shop earn by selling 100 cones?
ii) What is the price of one ice cream cone?

- Q5.** A gardener is responsible for maintaining a small garden in the school courtyard. Every day, he waters 8 plants using 4 litres of water. One morning, the principal informs him that 20 plants in total need watering each day to keep the garden healthy and

thriving. The gardener must calculate the amount of water required and plan accordingly. He also wants to know how many plants he can water if he only has 10 litres of water on a particular day.

Questions:

- i) How many litres of water are needed for 20 plants in a day?
- ii) If he has only 10 litres of water, how many plants can he water?

Q6. The school is organizing an annual day celebration in the main hall, which has 5 rows of chairs with 20 chairs in each row. For a special event, the school expects 300 guests, which is more than the existing seating capacity. The event coordinator needs to calculate how many additional rows of chairs are required to accommodate all guests comfortably. The coordinator also wants to find out the total number of chairs after adding the necessary rows to ensure everyone has a seat.

Questions:

- i) How many more rows of chairs are required to seat all 300 guests?
- ii) How many chairs will there be in total after adding the required rows?

Q7. Maya loves baking and is preparing for her friend's birthday party. Her recipe for baking 12 muffins require 3 cups of flour. She plans to bake 36 muffins to ensure that all the guests get enough to eat. Maya also wants to check how many muffins she can make if she has only 6 cups of flour available, so she can plan whether she needs to buy more flour.

Questions:

- i) How many cups of flour will Maya need to bake 36 muffins?
- ii) If Maya has only 6 cups of flour, how many muffins can she bake?

Q8. A local farmer sells 15 kilograms of apples for Rs. 30 in his village market. During a festival, he expects a larger crowd and wants to sell 50 kilograms of apples at the same rate. The farmer wishes to calculate his potential earnings and also determine the cost per kilogram to inform his customers accurately. This will help him plan his sales and ensure he earns enough to cover the cost of extra apples.

Questions:

- i) How much will the farmer earn by selling 50 kilograms of apples?
- ii) What is the price per kilogram of apples?

Q9. A school bus travels 90 kilometers in 3 hours while taking students on regular field trips. For an upcoming school trip, the total distance is 270 kilometers. The bus driver wants to calculate how many hours the journey will take if the bus maintains the same speed. Additionally, he wants to calculate the average speed of the bus to inform the teachers and parents about the expected arrival time.

Questions:

- i) How many hours will the bus take to complete the 270 kilometers journey at the same speed?
- ii) What is the average speed of the bus in km/h?

Q10. A painting contractor usually paints 8 walls in 4 hours using a fixed number of painters. He has recently received a new project that requires painting 24 walls. The contractor wants to estimate the total hours required under the same working conditions. He also considers using twice the number of painters to finish the project faster. He wants to calculate the time it would take if he doubles the workforce to plan resources efficiently.

Questions:

- i) How many hours will it take to paint all 24 walls under the same conditions?
- ii) If the contractor uses twice the number of painters, how long will it take to paint 24 walls?

ANSWERS**Q1. Fruit Juice for a School Picnic****Given:**

- 3 litres water + 2 kg concentrate → juice for 15 students
- Students attending = 45

Solution:

i) Water needed:

$$\text{Water per student} = 3 \div 15 = 0.2 \text{ litres/student}$$

$$\text{Water for 45 students} = 0.2 \times 45 = 9 \text{ litres}$$

ii) Fruit concentrate needed:

$$\text{Concentrate per student} = 2 \div 15 \quad \text{Concentrate for 45 students} = \frac{2}{15} \times 45 = 6 \text{ kg}$$

Answer: 9 litres water, 6 kg fruit concentrate

Q2. Petrol for a Road Trip**Given:**

- 5 litres petrol → 60 km
- Distance = 240 km

Solution:

i) Petrol needed:

$$\text{Petrol per km} = 5 \div 60 \approx 0.0833 \text{ litres/km}$$

$$\text{Petrol for 240 km} = 0.0833 \times 240 = 20 \text{ litres}$$

ii) Additional petrol needed:

Already has = 10 litres

More needed = $20 - 10 = 10$ litres

Answer: 20 litres total, 10 litres more needed

Q3. Library Book Distribution

Given:

- 120 books across 4 shelves $\rightarrow 30$ books/shelf
- Donation = 66 books
- New total shelves = 6

Solution: i) Total books after donation = $120 + 66 = 186$ books

Books per shelf = $186 \div 6 = 31$ books/shelf

ii) Increase per shelf = $31 - 30 = 1$ book

Answer: 31 books per shelf, 1 more books

Q4. Ice Cream Shop Earnings

Given:

- 10 cones $\rightarrow 250$ rupees
- Expected sales = 100 cones

Solution:

i) Earnings per cone = $250 \div 10 = 25$ rupees

Earnings for 100 cones = $25 \times 100 = 2500$ rupees

ii) Price per cone = 25 rupees

Answer: 2500 rupees total, 25 rupees per cone

Q5. Watering Plants

Given:

- 4 liters water $\rightarrow 8$ plants/day
- Required for 20 plants

Solution:

i) Water per plant = $4 \div 8 = 0.5$ liters/plant

Water for 20 plants = $0.5 \times 20 = 10$ liters

ii) Plants that can be watered with 10 liters = $10 \div 0.5 = 20$ plants

Answer: 10 liters for 20 plants, 20 plants can be watered

Q6. Arranging Chairs

Given:

- 5 rows $\times$ 20 chairs = 100 chairs
- Guests = 300

Solution:

i) Extra rows needed = $(300 - 100) \div 20 = 200 \div 20 = 10$ rows

ii) Total chairs after adding rows = $(5 + 10) \times 20 = 15 \times 20 = 300$ chairs

Answer: 10 more rows, total 300 chairs

Q7. Baking Muffins

Given:

- 12 muffins $\rightarrow$ 3 cups flour
- Target = 36 muffins

Solution:

i) Flour per muffin = $3 \div 12 = 0.25$ cups/muffin

Flour for 36 muffins = $36 \times 0.25 = 9$ cups

ii) Muffins with 6 cups flour = $6 \div 0.25 = 24$ muffins

Answer: 9 cups flour for 36 muffins, 24 muffins can be baked with 6 cups

Q8. Selling Apples

Given:

- 15 kg $\rightarrow$ 30 dollars
- Selling 50 kg

Solution: i) Price per kg = $30 \div 15 = 2$ dollars/kg

Earnings for 50 kg = $50 \times 2 = 100$ dollars

ii) Price per kg = 2 dollars

Answer: 100 dollars total, 2 dollars per kg

Q9. Bus Trip Duration

Given:

- 90 km $\rightarrow$ 3 hours
- Distance = 270 km

Solution:

i) Time per km = $3 \div 90 = 0.0333$ hours/km

Time for 270 km = $0.0333 \times 270 = 9$ hours

ii) Average speed = Distance $\div$ Time = $90 \div 3 = 30$ km/h

Answer: 9 hours, 30 km/h

Q10. Painting Walls

Given:

- 8 walls $\rightarrow$ 4 hours
- New project = 24 walls

Solution:

i) Time per wall = $4 \div 8 = 0.5$ hours/wall

Time for 24 walls = $24 \times 0.5 = 12$ hours

ii) With double painters $\rightarrow$ time halves = $12 \div 2 = 6$ hours

Answer: 12 hours with same painters, 6 hours with double painters

SECTION D - (4 Marks Type Questions):

Q1. A four days scout and guide camp were arranged by the school for class 8 students. The students were so excited to go for the camp. Based on this context, answer the following questions. (2+2)



- The school arranged 6 buses to take 150 students to the camp. If 75 more students are joined, how many buses are required in all?
- In the camp, they assigned some jobs to the students. 45 students complete a job in 20 minutes. How many minutes will 30 students take to complete the same job?

Q2. Nita invited four friends for her birthday party. She ordered Red velvet cake, pizza and coke.(1+2+1)



- The cost of 2 kg cake is ₹ 190. If Nita ordered 5kg cake, how much she paid for it?
- She planned to buy 10 bottles of coke for the party. After sometimes 7 more friends joined with her party. So, how many bottles of coke she has to order?
- The rent of party hall for ₹ 1200 for 2 hours. Nita's party started at 5:00 pm and ended by 8:30 pm. what amount did she pay for the party hall?

Q3. A hostel has enough food for 300 students for 30 days. Due to a cultural program few students join the hostel . (2+2)

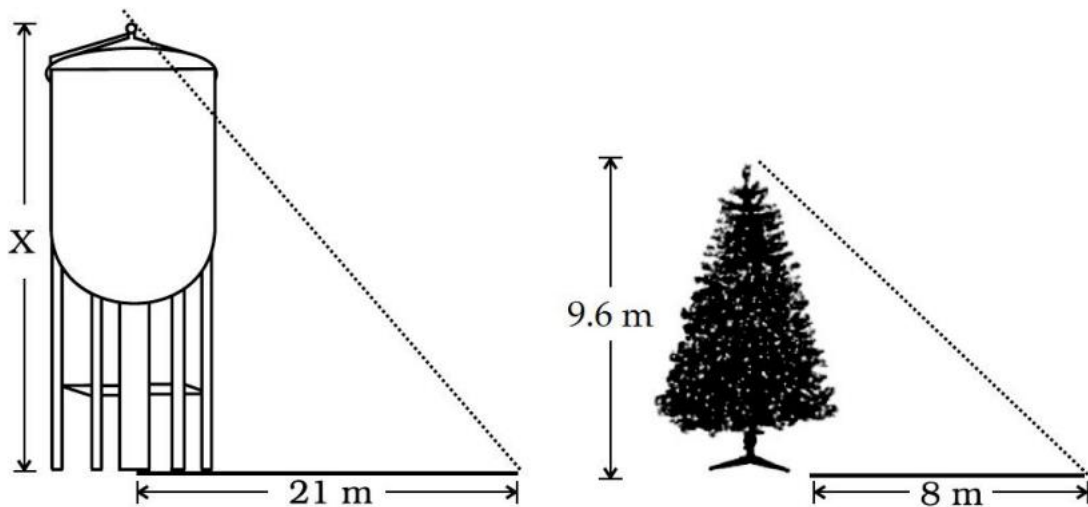


- i) How long would the food last if 60 more students join the hostel?
- ii) How long would the food last if instead of joining the hostel 60 students left the hostel?

Q4. When Trisha was 4 years old, her mother's age was 10 times her age. What is the ratio of Trisha's age to her mother's age? What would be the ratio of their ages when Trisha is 12 years old? Would it remain the same?



Q5. One day Maths teacher explaining about Direct and Inverse proportion with the help of many examples. He has given the example of relation between the length of shadow and height of the water tank and height. A water tank casts a shadow 21 m long. A tree of height 9.6 m casts a shadow 8 m long at the same time.



- (a) Find the height of the water tank in the above situation.
- (b) In a different situation a water tank casts a shadow 27 m long. A tree of height 10.5 m casts a shadow 9 m long at the same time. The lengths of the shadows are directly proportional to their heights. Find the height of the tank.

ANSWERS

1. Solutions:

- i) Number of buses is directly proportional to number of students.

Let us assume number of buses required is x

Now number of students will be $(150+75) = 225$

$$\therefore \frac{150}{6} = \frac{225}{x} \Rightarrow x = \frac{225 \times 6}{150} \Rightarrow x = 9$$

$\therefore$ Total number of buses required is 9.

- ii) Here number of students are inversely proportional to number of days required to complete a job.

Let us assume 30 students will take y minutes to complete the job.

$$\therefore 45 \times 20 = 30 \times y \Rightarrow y = \frac{45 \times 20}{30} \Rightarrow y = 30$$

$\therefore$ Total 30 minutes will be required by 30 students to complete the job.

2. Solution:

- i) Here cost of cake is directly proportional to weight of cake.

$$\therefore \frac{190}{2} = \frac{x}{5} \Rightarrow x = \frac{5 \times 190}{2} \Rightarrow x = 475$$

$\therefore$ She paid ₹475 for 5kg cake.

- ii) Initially Nita had 4 friends in the party, now she has $(4+7)=11$ friends

$\therefore$ initially there were total 5 persons (including Nita), now there are total 12 persons in the party

Number of coke bottles are directly proportional to number of friends

$$\therefore \frac{10}{5} = \frac{x}{12} \Rightarrow x = \frac{12 \times 10}{5} \Rightarrow x = 24$$

$\therefore$ Total number of coke bottles required is 24.

- iii) Rent is directly proportional to duration of the party.

Duration of the party was 8:30 pm-5 pm = 3hrs and 30 mins. = $\frac{7}{2}$ Hours

$$\therefore \frac{1200}{2} = \frac{x}{7/2} \Rightarrow x = \frac{7 \times 1200}{2 \times 2} \Rightarrow x = 2100$$

$\therefore$ Nita had to pay total ₹2100 for the party as the rent of the party hall.

3. Solution:

- i) This is an inverse proportion scenario. The more the students, the fewer days the food will last.

Let the number of days the food will last be D .

Total number of students now = $300 + 60 = 360$.

$$\text{So, } 300 \times 30 = 360 \times D$$

$$9000 = 360D$$

$$D = 9000/360 = 25$$

Answer: The food will last for 25 days.

- ii) This is an inverse proportion scenario. The more the students, the fewer days the food will last.

Let the number of days the food will last be D .

Total number of students now = $300 - 60 = 240$.

$$\text{So, } 300 \times 30 = 240 \times D$$

$$9000 = 240D$$

$$D = 9000/240 = 37.5$$

Answer: The food will last for 37 days.

4. Solution:

The ratio of Trisha's age to her mother's age when Trisha is 4 years old is 4 : 40 (her mother's age is 10 times Trisha's age). In the simplest form, it is 1 : 10.

When Trisha is 12 years old (i.e., 8 years later), the ratio of their ages will be 12 : 48 (8 years later, her mother would be 48 years old). In the simplest form, it is 1 : 4.

When we add (or subtract) the same number from the terms of a ratio, the ratio changes and is not necessarily proportional to the original ratio.

5. Solutions: . (a) According to the given condition in the question, the length of the shadows are in direct proportion.

$$\therefore \frac{8}{9.6} = \frac{21}{x} \Rightarrow x = \frac{21 * 9.6}{8} = 25.2 \text{ m}$$

b) According to the given condition in the question, the length of the shadows are in direct proportion

$$\therefore \frac{9}{10.5} = \frac{27}{x} \Rightarrow x = \frac{27 * 10.5}{9} = 31.5 \text{ m}$$

SELF ASSESSMENT

SECTION A (1 MARK)

Q1. A car travels 120 km in 3 hours. If the speed remains constant, the distance travelled in 5 hours will be: (1)

- a) 150 km b) 180 km c) 200 km d) 240 km

Q2. It takes 12 workers 15 days to complete a task. How many workers are required to complete the same task in 10 days, assuming constant efficiency? (1)

- a) 18 b) 20 c) 15 d) 12

Q3. If the cost of 4 pens is ₹60 and the cost of 6 pens is ₹90, then the relationship between cost and number of pens is:

(1)

- a) Inverse Proportion b) Direct Proportion c) Neither a nor b d) Can't be determined

Q4. A tap fills a tank in 8 hours. If three such taps are opened together, how long will it take to fill the same tank?

(1)

- a) 2 hours b) 2 hours 40 minutes c) 3 hours d) 3 hours 20 minutes

SECTION B (2 MARKS)

Q5. On a map, 1 cm represents 8 km. If two towns are 6.5 cm apart on the map, find the actual distance between them. (2)

Q6. A mixture contains water and milk in the ratio 3:2. If there are 15 liters of milk, find the amount of water in the mixture.

(2)

Q7. The marks obtained by two students in Mathematics and Science are given below:

Riya: 36 (Maths), 45 (Science)

Sita: 48 (Maths), 60

(Science)

Are their marks in Maths and Science in the same proportion? Justify your answer.(2)

SECTION C (3 MARKS)

Q8. 15 painters can paint a building in 28 days. (3)

- a) How many days will 21 painters take to paint the same building?
b) If 7 painters leave after 10 days, how many more days will it take for the remaining painters to finish the work?

Q9. A work can be completed by 18 workers in 20 days. If 6 workers leave after 10 days, how many more days will the remaining workers take to finish the work?

(3)

SECTION D (4 MARKS)

Q10. A company planned to complete a road construction project in 50 days using 40 workers. After 20 days, 10 workers left the job. The remaining workers continued to work at the same rate. (4)

Answer the following questions:

- a) How much of the work was completed in the first 20 days?
- b) How many workers were left after 20 days?
- c) How many more days will the remaining workers take to complete the remaining work?
- d) Identify whether this situation is a direct or inverse proportion and justify your answer.

ANSWER KEY

- | | | | | |
|-----------------------|--------------------------------------|---------------|-----------------------|----|
| 1. c | 2. a | 3. b | 4. b | 5. |
| 52 km | | | | |
| 6. 22.5 ltrs
hours | 7. Yes because both ratios are equal | 8. a) 20 days | b) 33 days | 18 |
| 9. 15 days | 10. a) $\frac{2}{5}$ b) 30 | c) 40 days | d) Inverse Proportion | |

PART -II

CHAPTER 1: FRACTIONS IN DISGUISE

SECTION – A Multiple Choice Questions (MCQ)

- Q1.** Priya uses 12 GB out of her 40 GB monthly data plan. What percentage of the plan has she used?
(a) 25% (b) 30% (c) 35% (d) 20%
- Q2.** Which of the following decimals is equivalent to 37.5%?
(a) 3.75 (b) 0.0375 (c) 0.375 (d) 37.5
- Q3.** A student scored 18 out of 24 in a test. What fraction (in simplest form) represents the score, and what is its percentage equivalent?
(a) $\frac{3}{4}$ and 75% (b) $\frac{3}{4}$ and 70% (c) $\frac{2}{3}$ and 66.7% (d) $\frac{9}{12}$ and 75%
- Q4.** A shopkeeper buys a book for ₹180 and sells it for ₹225. What is his profit percentage?
(a) 20% (b) 25% (c) 22% (d) 30%
- Q5.** Ramesh sold his bicycle for ₹4,200, incurring a loss of 16%. What was the cost price?
(a) ₹5,000 (b) ₹4,800 (c) ₹5,200 (d) ₹4,500
- Q6.** A canteen earned a gross profit of ₹1,800. After paying ₹450 in expenses, what is the net profit percentage if the cost price was ₹3,600?
(a) 37.5% (b) 50% (c) 37% (d) 37.8%
- Q7.** The price of a mobile phone increased from ₹12,000 to ₹14,400. What is the percentage increase?
(a) 18% (b) 20% (c) 24% (d) 22%
- Q8.** A runner's timing decreased from 20 seconds to 17 seconds. By what percentage did her timing improve?
(a) 13% (b) 15% (c) 17% (d) 14%
- Q9.** A jacket's price was reduced by 10% and then reduced again by 10%. What is the overall percentage decrease from the original price?
(a) 20% (b) 19% (c) 18% (d) 21%
- Q10.** ₹5,000 is deposited at 10% simple interest per annum. What is the total interest earned in 3 years?
(a) ₹1,500 (b) ₹1,550 (c) ₹1,655 (d) ₹1,000

Answer Key (1 marks questions)

- | | | | | |
|--------------|---------------|-------------------------------|-------------|-----------------|
| Q1. (b) 30% | Q2. (c) 0.375 | Q3. (a) $\frac{3}{4}$ and 75% | Q4. (b) 25% | Q5 (a) ₹5,000 |
| Q6 (a) 37.5% | Q7. (b) 20% | Q8. (b) 15% | Q9. (b) 19% | Q10. (a) ₹1,500 |

Very short answer type questions (2 marks questions)

1. A water bottle contains 750 mL of water, and Riya drinks 25% of it during sports practice. How much water did she drink?
2. In a class of 40 students, 0.6 of the students participate in sports. How many students are in sports activities?
3. A shopkeeper gives a 15% discount on a school bag priced at ₹800. What is the discount amount and final price?
4. A farmer finds that 52% of his 200-acre land is degraded. How much land is degraded?
5. During a FIFA screening event, 45% of 2,000 people in a town watched the match. How many people watched it?
6. A recipe requires the ratio of juice to water as 3:5. If 40% of the mixture is juice, check whether this matches the ratio.
7. A student scored 18 out of 25 in a test. Express the score as a percentage.
8. A phone battery was at 80% in the morning and dropped by 0.35 of its charge by evening. What percentage charge is left?
9. A coach divides a 90-minute practice session into warm-up, play, and cool-down in the ratio
10% : 80% : 10%. How many minutes are spent warming up?
10. A shop sold $\frac{2}{5}$ of its stock of notebooks on Monday. If there were 250 notebooks initially, how many were sold?

ANSWER KEY(2 marks questions)

1. 187.5 mL
 $25\% = 0.25$, so water drunk = $0.25 \times 750 = 187.5$ mL
2. Total students: 40
Decimal part: 0.6
Calculation: $40 \times 0.6 = 24$
Answer: 24 students are in sports activities
3. Market price = ₹800
Discount = 15% of 800 = ₹120, Final Price = $800 - 120 = ₹680$
4. Total land 200 acres
Percentage Degraded = 52% of 200 = $0.52 \times 200 = 104$ acres

104 acres of land is degraded

5. Total People: 2,000

Percentage Watching: 45%

$$45\% \text{ of } 2000 = 0.45 \times 2000 = 900$$

900 people watched the match

6. No, it does not matches

Ratio 3:5 means juice fraction = $\frac{3}{8} = 0.375 = 37.5\%$

So it does not exactly match 40%

Correct Answer: No, it does not match.

7. Score = 18

Total marks = 25

$$\frac{18}{25} \times 100 = 72\%$$

8. 45% charge left

$$0.35 = 35\% \text{ used, so remaining} = 80\% - 35\% = 45\%$$

9. 9 minutes

$$10\% \text{ of } 90 = 9 \text{ minutes}$$

10. Number of notebooks sold = $\frac{2}{5} \times 250 = 100$

= 100 notebooks

Short answer type questions (3 marks questions)

1. A shopkeeper mixes 4 parts of orange juice with 6 parts of water to make a fruit punch. If he prepares 5 litres of this punch, how many litres of actual orange juice are in the container? Also, express the orange juice content as a percentage of the total mixture.
2. During a seasonal clearance, a jacket originally priced at ₹2,500 is sold for ₹1,800. Calculate the percentage discount offered on the jacket. If the shopkeeper still makes a 20% profit on this sale, what was the original cost price for him?
3. A student scores 18 out of 25 in a monthly math test. In the next test, the score improves to 22 out of 25. Calculate the percentage increase in the marks obtained. What percentage of the total marks did the student miss in the second test?
4. A small village has a population of 4,000 people. If 45% of the population are men and 35% are women, find the total number of children in the village. Express the number of children as a ratio to the number of men.

5. A baker uses a recipe where the weight of sugar is 25% of the weight of flour. If he uses 500 grams of flour, how much sugar does he need? If he decides to reduce the sugar by 10% for a "low-sugar" version, what will be the new weight of the sugar?
6. A smartphone battery drops from 80% to 20% after 4 hours of heavy usage. What is the average percentage of battery consumed per hour? If the phone is put on a power saver that reduces consumption by 50%, how many more hours will the remaining 20% last?
7. A farmer harvested 1,200 kg of rice this year, which is 20% more than his harvest last year. How many kilograms did he harvest last year? If he expects a further 10% increase next year based on this year's harvest, what is his target?
8. A car travels 150 km using 12 litres of petrol. Calculate the mileage of the car (km per litre). If the price of petrol rises from ₹95 to ₹104.50 per litre, calculate the percentage increase in the fuel cost.
9. An alloy consists of copper, zinc, and nickel in the ratio of 5:3:2. If the total weight of the alloy block is 15 kg, find the weight of each metal. What percentage of the alloy is made of zinc?
10. A person invests ₹10,000 in a savings scheme that offers 10% interest compounded annually. Calculate the total amount in the account after 2 years. How much extra money was earned in the second year compared to the first year?

ANSWER KEY (3 marks questions)

1. Fruit Punch Mixture

Amount of Orange Juice: 2 litres (Calculation: $4/10 \times 5 = 2$)

Percentage of Orange Juice: 40% (Calculation: $4/10 \times 100$)

2. Clearance Sale

Percentage Discount: 28% (Calculation: $700/2500 \times 100$)

Original Cost Price: ₹1,500 (Calculation: $1800 \div 1.20$)

3. Student Test Scores

Percentage Increase: 22.22% (Calculation: $4/18 \times 100$)

Percentage of Marks Missed: 12% (Calculation: $3/25 \times 100$)

4. Village Population

Total Children: 800 (Calculation: 20% of 4000)

Ratio (Children to Men): 4:9 (Calculation: 800:1800)

5. Baker's Recipe

Sugar Needed: 125 grams (Calculation: 25% of 500)

New Sugar Weight: 112.5 grams (Calculation: $125 - 12.5$)

6. Battery Consumption

Consumption Per Hour: 15% per hour (Calculation: $60\% \div 4$)

Remaining Life: 2.67 hours (Calculation: $20\% \div 7.5\%$)

7. Farmer's Harvest

Harvest Last Year: 1,000 kg (Calculation: $1200 \div 1.20$)

Next Year's Target: 1,320 kg (Calculation: $1200 + 120$)

8. Fuel Costs

Car Mileage: 12.5 km/l (Calculation: $150 \div 12$)

Percentage Increase in Price: 10% (Calculation: $9.50/95 \times 100$)

9. Metal Alloy

Weights: Copper = 7.5 kg, Zinc = 4.5 kg, Nickel = 3 kg

Percentage of Zinc: 30% (Calculation: $3/10 \times 100$)

10. Savings Investment

Amount after 2 years: ₹12,100 (Calculation: $10000 \times 1.10 \times 1.10$)

Extra interest in Year 2: ₹100 (Calculation: Year 1 interest = 1000; Year 2 interest = 1100)

Case Based Questions (4 marks questions)

1. Arjun has a monthly mobile data plan of 30 GB. In the first week he used 7.5 GB, in the second week he used 9 GB, and in the third week he used 4.5 GB.

(a) What fraction of his total plan did he use in the first week? Express it as a percentage and as a decimal.

(b) After three weeks, what percentage of data is still remaining? Show your working using the FDP (Fraction–Decimal–Percentage) relationship.

(c) If data costs ₹9 per GB beyond the plan, and he continues using data at the average weekly rate in the fourth week too, will he exceed his plan? If yes, how much extra will he pay?

2. Riya runs the school canteen stall for one week during the Annual Fest. She purchased supplies worth ₹3,600. She sold items worth ₹5,040 in total. Her additional expenses (stall rent, packaging, electricity) were ₹480.

(a) Calculate her gross profit and express it as a percentage of the cost price.

(b) Calculate her net profit. Is the net profit percentage higher or lower than the gross profit percentage? Explain why.

(c) If next year she wants a net profit of exactly 30% on cost price with the same expenses of ₹480, what should her total sales target be?

3. Kavya tracks her sprint timing every month. Her 100 m timings over four months are shown below. Use this data to answer the questions.

Month	January	February	March	April
Time (seconds)	18.0	17.1	16.2	15.66

(a) Calculate the percentage decrease in timing from January to February, and from February to March. Are the decreases the same in value? Explain.

(b) From January to April, what is the overall percentage decrease in timing? Is this the same as adding up the three monthly percentage decreases? Why or why not?

(c) Her coach says: "If you reduce your time by 5% every month starting April, you will reach under 13 seconds within 4 months." Is the coach correct? Verify by calculating.

4. Rohan decides to save ₹2,000 in a Fixed Deposit at the beginning of the year. His bank offers two FD options:

FD OPTIONS

Option A: Simple Interest at 8% per annum — interest paid out every year, principal returned at maturity (3 years).

Option B: Compound Interest at 8% per annum — interest added back each year (compounding), full amount returned at end of 3 years.

(a) For Option A, prepare a table showing interest earned and amount in FD at the end of each year. What is the total amount received after 3 years?

(b) For Option B, prepare a similar table. What is the total amount received after 3 years? (Round to nearest rupee.)

(c) How much more does Rohan earn under Option B compared to Option A? Express this extra amount as a percentage of the principal ₹2,000.

(d) Rohan's sister says: "The difference between simple and compound interest is always small, so it doesn't matter which you choose." Do you agree? Justify your answer using the numbers from (a) and (b).

5. Dev wants to buy gaming accessories online. GST is split equally into CGST and SGST. Study the items below and answer the questions.

Item	Qty	Price per unit IN ₹	GST Rate
Wireless Mouse	1	800	18%
USB Hub	2	350	18%
Solar power Grid	1	240	5%

- (a) Calculate the subtotal (before tax), CGST, and SGST for each item separately. Prepare a complete bill showing the final amount payable.
- (b) What percentage of the total bill amount (including GST) is the total tax paid? Express your answer to one decimal place.
- (c) Dev's budget is ₹2,000. He considers dropping the USB Hub. Will he stay within budget after doing so? By how much does he save or exceed?

ANSWER KEY (4 marks questions)

1 (a)

Week 1 used = 7.5 GB out of 30 GB

Fraction = $7.5/30 = 1/4$

Percentage = $(1/4) \times 100 = 25\%$

Decimal = 0.25

Week 1 = $1/4$ of plan = $25\% = 0.25$

(b)

Total used in 3 weeks = $7.5 + 9 + 4.5 = 21$ GB

Remaining = $30 - 21 = 9$ GB

Fraction remaining = $9/30 = 3/10$

Percentage remaining = $(3/10) \times 100 =$

30%

30% of data is still remaining.

(c)

Average weekly use = $21 \div 3 = 7$ GB/week

Week 4 usage = 7 GB $\rightarrow$ Total = $21 + 7 = 28$ GB

28 GB < 30 GB, so plan is NOT exceeded.

No extra charge. Rohan stays within his plan by 2 GB.

If he had used 9 GB in week 4 (same as week 2), total = 30 GB — exactly at limit, still no charge.

2. School Canteen Entrepreneur

(a)

Cost Price (CP) = ₹3,600; Selling Price (SP) = ₹5,040

Gross Profit = SP – CP = 5,040 – 3,600 = ₹1,440

Gross Profit % = $(1,440 / 3,600) \times 100 = 40\%$

Gross Profit = ₹1,440 = 40% of CP

(b)

Net Profit = Gross Profit – Expenses = 1,440 – 480 = ₹960

Net Profit % = $(960 / 3,600) \times 100 = 26.67\%$

Net Profit = ₹960 (26.67% of CP) — lower than gross profit %.

Net profit % is lower because additional expenses reduce the profit without changing the cost price base.

(c)

Net Profit needed = 30% of CP = $0.30 \times 3,600 = ₹1,080$

Required Gross Profit = Net Profit + Expenses = 1,080 + 480 = ₹1,560

Required Sales = CP + Gross Profit = 3,600 + 1,560 =

₹5,160

Sales target = ₹5,160

3. Sports Training Progress

(a)

Jan → Feb: decrease = $18.0 - 17.1 = 0.9$ s; decrease % = $(0.9/18.0) \times 100 = 5\%$

Feb → Mar: decrease = $17.1 - 16.2 = 0.9$ s; decrease % = $(0.9/17.1) \times 100 \approx 5.26\%$

Jan → Feb = 5%, Feb → Mar $\approx 5.26\%$ — same drop in seconds, but different % because the base changes.

This is a key insight: equal absolute changes give different percentage changes when the base differs.

(b)

Overall: Jan → Apr decrease = $18.0 - 15.66 = 2.34$ s

Overall % decrease = $(2.34 / 18.0) \times 100 = 13\%$

Sum of 3 monthly % drops $\approx 5 + 5.26 + 3.33 = 13.59\%$ (approximately)

Overall % decrease = 13%, NOT equal to the sum of monthly %.

Successive percentage changes cannot be simply added — each % operates on a different (smaller) base.

(c)

Start: 15.66 s. Reduce 5% each month for 4 months.

After month 1: $15.66 \times 0.95 = 14.877$ s

After month 2: $14.877 \times 0.95 = 14.133$ s

After month 3: $14.133 \times 0.95 = 13.426$ s

After month 4: $13.426 \times 0.95 = 12.755$ s

After 4 months: ≈ 12.76 s < 13 s. Coach is CORRECT.

Compound reduction: each month's 5% is applied to the previous month's time, not the original.

4. Pocket Money & Smart Savings

(a)

Principal = ₹2,000; Rate = 8% p.a. , Annual Interest = ₹160

	Interest Paid Out	Amount in FD
Year 1 – Beginning	—	₹2,000
Year 1 – Ending	₹160 returned	₹2,000
Year 2 – Ending	₹160 returned	₹2,000
Year 3 – Ending	₹160 returned	₹2,000
Total received	₹480 + ₹2,000	₹2,480

Option A total = ₹2,480

(b)

Interest compounds each year on the growing principal.

	Interest Added Back	Amount in FD
Year 1 – Beginning	—	₹2,000
Year 1 – Ending	₹160 added	₹2,160
Year 2 – Ending	₹173 added	₹2,333
Year 3 – Ending	₹187 added	₹2,520
Total received	entire amount	₹2,520

Option B total = ₹2,520 (exact: ₹2,519.42, rounded)

(c)

Extra earned = $2,520 - 2,480 = ₹40$

As % of principal: $(40 / 2,000) \times 100 = 2\%$

Option B earns ₹40 more = 2% extra on principal.

(d)

Difference = ₹40 on ₹2,000 over 3 years.

Over longer periods or larger sums, compounding grows exponentially — the gap widens significantly.

Disagree with Rohan's sister.

Even here ₹40 matters. For a 10-year FD of ₹1,00,000 at 8%, the difference would be ₹16,000+. Choice of FD type always matters.

5. Gaming Setup Shopping

(a)

CGST = SGST = GST Rate / 2. Calculate for each item:

Item	Subtotal	CGST	SGST	Total
Wireless Mouse (18%)	₹800	₹72	₹72	₹944
USB Hub ×2 (18%)	₹700	₹63	₹63	₹826
Solar panel Grid (5%)	₹240	₹6	₹6	₹252
GRAND TOTAL	₹1,740	₹141	₹141	₹2022

Total bill = ₹2022

(b)

Total tax = CGST + SGST = 141 + 141 =

₹282 Tax % of total bill = $(282 / 2022) \times$

100 = 13.94%

Tax is 13.94% of the total bill amount.

(c)

Drop USB Hub: remove ₹826 (including GST) from bill

New total = 2022 – 826 = ₹1,196

Budget = ₹2,000; ₹1,196 < ₹2,000

Yes, he stays within budget. He saves ₹804.

CLASS TEST

1. A fruit seller had 250 apples. He found that 10% of them were rotten. How many good apples are left with him?
(a) 240 (b) 225 (c) 215 (d) 230
2. What is the value of 15% of 120 added to 20% of 50?
(a) 25 (b) 32 (c) 28 (d) 30
3. A bag that originally cost ₹800 is being sold at a discount of 15%. What is the sale price of the bag?
(a) ₹680 (b) ₹720 (c) ₹650 (d) ₹700
4. An alloy contains 30% copper, 40% zinc, and the rest is nickel. In a 5 kg block of this alloy, what is the weight of the nickel?
(a) 1.2 kg (b) 2.0 kg (c) 1.5 kg (d) 1.8 kg

Very short answer type questions (Each of 2 marks)

5. During a FIFA screening event, 45% of 2,000 people in a town watched the match. How many people watched it?
6. A recipe requires the ratio of juice to water as 3:5. If 40% of the mixture is juice, check whether this matches the ratio.
7. Out of 80 questions in a competition, a student answered 75% correctly. How many questions did the student get wrong?

Short answer type questions(3 marks questions)

8. A shopkeeper mixes 2 parts of lime cordial with 8 parts of water to make a refreshing drink. If he prepares 10 litres of this drink, how many litres of lime cordial are used? Also, express the lime cordial content as a percentage of the total mixture.
9. The price of a laptop was reduced from ₹40,000 to ₹34,000 during a flash sale. Calculate the percentage discount offered. If the price is further reduced by 5% on the sale price for bank card users, what is the final price?

Case Based Questions (4 marks question)

Maya is shopping for a new laptop that originally costs \$800. She finds the laptop at three different stores, each offering a different type of discount:

- Store A offers a flat $\frac{1}{4}$ off the original price.
- Store B offers a discount of 0.3 times the original price.
- Store C offers a 20% discount.

1. Calculate the final price: What is the sale price of the laptop at each of the three stores?
2. Compare the deals: Which store offers the best deal, and how much money would Maya save compared to the most expensive option?
3. Combine the values: If Store C offers an *additional* 5% discount on the already discounted price for paying in cash, what would the final cost be, and how does this compare to the discount at Store B?

Answer key

1. (b) 225
2. (c) 28
3. (a) ₹680
4. (c) 1.5 kg
5. 900 people (45% of 2,000 = 0.45 times 2,000)
6. No, it does not match. (A 3:5 ratio means juice is $\frac{3}{8}$ of the total. $\frac{3}{8} \times 100 = 37.5\%$, which is not 40%)
7. 20 questions (Correct: 60; Wrong: $80 - 60 = 20$)
8. 2 Litres; 20% Total parts = $2 + 8 = 10$. Lime cordial = $(\frac{2}{10}) \times 10 \text{ L} = 2 \text{ Litres}$.
Percentage = $(\frac{2}{10}) \times 100 = 20\%$.
9. 15% discount; ₹32,300 Final Price Discount = $40,000 - 34,000 = 6,000$. Percentage Discount = $(\frac{6,000}{40,000}) \times 100 = 15\%$. Additional 5% of 34,000 = 1,700. Final Price = $34,000 - 1,700 = ₹32,300$.
- 10.

1. Calculate the final price at each store:

- Store A ($\frac{1}{4}$ off): $800 \div 4 = 200$ discount. Price = \$600.
- Store B (0.3 off): $800 \times 0.3 = 240$ discount. Price = \$560.
- Store C (20% off): $800 \times 0.20 = 160$ discount. Price = \$640.

2. Compare the deals:

- Best Deal: Store B (\$560).
- Comparison: Store B is \$80 cheaper than the most expensive option, Store C ($\$640 - \$560 = \$80$).

3. Store C Additional Discount:

- Take Store C's price (\$640) and subtract an extra 5% (5% of 640 = \$32).
- New Price at Store C: \$608.
- Conclusion: Store B (\$560) is still the cheapest by \$48.

CHAPTER 2: THE BAUDHAYANA – PYTHAGORAS THEOREM

SECTION -A (1 Mark Each)

1. The hypotenuse of an isosceles right triangle with sides 1, 1 is:
a) 1 b) 2 c) $\sqrt{2}$ d) 0
2. $\sqrt{2}$ can be written as fraction:
a) Yes b) No c) Sometimes d) Only integers
3. If hypotenuse is 13 and one side 5, other side is:
a) 12 b) 8 c) 10 d) 6
4. A triple (a,b,c) satisfying $a^2+b^2=c^2$ is called:
a) Algebraic triple b) Baudhāyana triple c) Even triple d) Linear triple
5. Fermat's Last Theorem deals with:
a) $n=1$ b) $n=2$ c) $n>2$ d) $n<2$
6. A right triangle with integer sides is called:
a) Rational triangle b) Baudhāyana triangle c) Acute triangle d) Scalene triangle
7. Halving square area involves:
a) Diagonal square b) Inner square c) Circle d) Triangle
8. The relation $a^2+b^2=c^2$ is valid for:
a) Any triangle b) Right triangle c) Equilateral d) Isosceles only

Direction for question 9-10: Choose the correct option for each question:

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

9. Assertion (A): (6, 8, 10) is a primitive Baudhāyana triple.

Reason (R): All numbers have a common factor.

10. Assertion (A): $\sqrt{2}$ has a terminating decimal expansion.

Reason (R): $\sqrt{2}$ is irrational.

Answer Key:

1. Answer: c) $\sqrt{2}$

Explanation: In an isosceles right triangle with sides 1 and 1: $c^2 = 1^2 + 1^2 = 2 \Rightarrow c = \sqrt{2}$

2. Answer: b) No

Explanation: $\sqrt{2}$ is an irrational number, so it cannot be written as a fraction of integers.

3. Answer: a) 12

Explanation: $c^2 = 13^2 = 169$, $a^2 = 5^2 = 25$, $b^2 = 169 - 25 = 144 \Rightarrow b = 12$

4. Answer: b) Baudhāyana triple

Explanation: Any triple satisfying $a^2 + b^2 = c^2$ is called a Baudhāyana (Pythagorean) triple.

5. Answer: c) $n > 2$

Explanation: Fermat's Last Theorem states that $x^n + y^n = z^n$ has no solution for $n > 2$.

6. Answer: b) Baudhāyana triangle

Explanation: A right triangle with integer sides is called a Baudhāyana (Pythagorean) triangle.

7. Answer: b) Inner square

Explanation: Halving a square's area is done by forming a tilted inner square inside the original.

8. Answer: b) Right triangle

Explanation: The relation $a^2 + b^2 = c^2$ holds only for right-angled triangles on-terminating decimals.

9. Answer: d

Explanation: (6, 8, 10) is not primitive (common factor 2), so A is false but R is true.

10. Answer: d

Explanation: Irrational numbers have non-terminating decimals.

SECTUIN – B (2 Mark Each)

Q.1. A fireman places a ladder against a wall. The ladder touches the wall at a height of 12 m and its foot is 5 m away from the wall. What should be the minimum length of the ladder to reach the roof?

Q.2. A rectangular park has length 15 m and breadth 8 m. A boy wants to walk diagonally. How much shorter is the diagonal path compared to walking along two sides?

Q.3. An architect designs a triangular glass frame with side lengths 9 m, 12 m and 15 m. Before installation, the engineer must check whether the frame forms a right angle. How can the engineer verify it mathematically?

Q.4. A student walks 6 m east and then 8 m north. If she walks directly instead, how much distance does she save?

Q. 5. An artisan makes a square tile courtyard of side 6 m. The king asks him to create a new square courtyard having exactly double the area of the original courtyard.

Q.6. A tree casts a shadow of 16 m. Distance from top of tree to tip of shadow is 20 m. Find height of tree.

Q.7. A graphic designer creates a square logo of area 50 cm^2 . She wants another square logo with half area. Find the side of the logo.

Q.8. A rescue worker moves 9 km east and 12 km north. What is the direct distance to return?

Q.9. Express 50 as the sum of two square numbers in two ways.

Q. 10. A farmer walks 20 m east and 15 m north daily. How much distance can he save using a shortcut?

ANSWERS

Q.1. Height of wall = 12 m

length from wall(base)= 5 m

Length of ladder = $\sqrt{12^2 + 5^2}$

= $\sqrt{144 + 25}$

= $\sqrt{169} = 13 \text{ m}$

= 13 m

Q.2. Length of rectangular park= 15 m

breadth of park = 8m

Diagonal = $\sqrt{15^2 + 8^2} = \sqrt{289} = 17 \text{ m}$

Two sides = $15 + 8 = 23 \text{ m}$

Difference = $23 - 17 = 6 \text{ m}$

Q.3.It must verify pythagoras theorem

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

$9^2+12^2= 81+144= 225$

$15^2= 225$

frame forms a right angle.

Since both are equal, the frame forms a right triangle

Q.4. Direct = $\sqrt{6^2 + 8^2} = \sqrt{100} = 10 \text{ m}$

$$\text{Original} = 6 + 8 = 14 \text{ m}$$

$$\text{Saved} = 4 \text{ m}$$

$$\text{Q.5. Side of the courtyard} = 6 \text{ m}$$

$$\text{Area of square} = 36\text{m}^2$$

For double the area he will use the diagonal of the original square as the side of the new square.

$$d = 6^2 + 6^2 = 36 + 36 = 72 = 6\sqrt{2}\text{m}$$

$$\text{Q.6. length of shadow (base)} = 16\text{m}$$

$$\text{distance from top of tree to tip of shadow (hypotenuse)} = 20 \text{ m}$$

$$\text{Height}^2 = 20^2 - 16^2$$

$$= 400 - 256 = 144$$

$$\text{Height} = \sqrt{144} = 12 \text{ m}$$

Q.7. To solve this, use the formula for the area of a square:

$$A = s^2$$

$$\text{Area of first square} = 50 \text{ cm}^2$$

$$\text{Required area (half)} = 50 \div 2 = 25 \text{ cm}^2$$

Find the side of the new square

$$s = \sqrt{A} = \sqrt{25} = 5 \text{ cm}$$

The side of the new square logo is 5 cm.

$$\text{Q.8. Direct distance} = \sqrt{9^2 + 12^2} = \sqrt{225} = 15 \text{ km}$$

$$\text{Q.9. } 50 = 1^2 + 7^2$$

$$50 = 5^2 + 5^2$$

Q.10. For shortcut he will go diagonally

$$d = \sqrt{20^2 + 15^2}$$

$$= \sqrt{400 + 225}$$

$$= \sqrt{625}$$

$$d = 25 \text{ m}$$

$$\text{Original path} = 35 \text{ m}$$

$$\text{Saved} = 10 \text{ m}$$

SECTION- C (3 Mark Each)

1. Your father wants to make a ramp to roll his bike into the garage. The height of the garage door is 1 meter, and the distance from the base of the ramp to the door is 4 meters. How long should the ramp be?
2. A square tile has side 6 cm. Without calculating area directly, explain how to construct a square tile having double its area. What will be the side of the new square tile?
3. You're cleaning the windows of your house. The window is 12 feet above the ground, and the ladder's base is 5 feet away from the wall. How long does the ladder need to be?
4. A lotus stands 2 m above water. When bent, it touches water 4 m away. Find water depth.
5. A carpenter wants to make a rectangular wooden frame for a window. To ensure that all corners are perfect right angles, he measures three sides as 9 cm, 12 cm, and 15 cm. Can he be sure that the frame has a right angle? Explain using the concept of Pythagorean triplets.
6. You want to walk from one corner of the park to the other. The park is 100 meters long and 80 meters wide. How far will you walk if you take the diagonal shortcut?
7. You just bought a new coffee table and want to make sure it has perfect right angles. If the horizontal and vertical sides are 12 feet and 16 feet, how can you check if the table's corner forms a perfect right angle?
8. A student claims that reducing the side of a square paper to half will also halve its area. Is this correct? Justify.
9. Two square plots have sides 6 m and 8 m. Find side of square with combined area.
10. You're buying a new TV and need to know if it will fit in your cabinet. The cabinet is 36 inches wide and 24 inches high. The TV is 42 inches. Will it fit, and how do you figure out if it will?

ANSWERS:

1. To find the length of the ramp, we can use the **Pythagorean theorem**, which states that:

$c^2 = a^2 + b^2$, where c is the hypotenuse (the length of the ramp), a is the vertical side (height of the garage door, 1 meter) and b is the horizontal side (distance from the base of the ramp to the door, 4 meters).

Now, substitute the values into the Pythagorean theorem: $c^2 = 1^2 + 4^2$

$$c^2 = 17$$

To find c , we take the square root of both sides:

$$c = \sqrt{17} \approx 4.12 \text{ meters}$$

2. Draw the diagonal of the original square. Construct a new square on this diagonal.
Length of the diagonal = $\sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$ cm
So, the new square has side **$6\sqrt{2}$ cm**.

3. This situation also forms a right triangle, where:

The height of the window (12 ft) is the vertical side

The distance of the ladder's base from the wall (5 ft) is the horizontal side

The ladder itself is the hypotenuse (the longest side)

To find the ladder's length, we use the Pythagorean theorem: $c^2 = a^2 + b^2$,

Substitute the given values:

$$c = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$$

So, the ladder needs to be **13 feet long** to safely reach the window.

4. Let depth of water be x. The situation can be represented as follows:

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

$$16 + x^2 = x^2 + 4x + 4$$

$$12 = 4x \rightarrow x = \mathbf{3 \text{ m}}$$

So, the depth of water is 3 m

5. Check using the Pythagoras theorem:

$$9^2 + 12^2 = 81 + 144 = 225$$

$$15^2 = 225$$

Since $9^2 + 12^2 = 15^2$, the sides form a **Pythagorean triplet (scaled form of 3, 4, 5)**.

Therefore, the carpenter **can be sure the frame has a perfect right angle**.

6. If you walk across a park of dimensions $a = 100$ m and $b = 80$ m.

Here, the diagonal is the shortest path and let it be denoted by c.

By Pythagorean theorem, $c^2 = a^2 + b^2$

Substitute the values: $c = \sqrt{100^2 + 80^2} = \sqrt{10000 + 6400} = \sqrt{16400} = 128.06$ (approx.) So, you will walk about **128.1 meters**.

7. To check if the corner is a perfect right angle, measure the diagonal. If it satisfies the theorem, the angle is 90° . The dimensions of the table is $a = 12$ m and $b = 16$ m.

So, by Pythagorean Theorem, $c = \sqrt{12^2 + 16^2} = \sqrt{144 + 256} = \sqrt{400} = 20$

So, if the diagonal measures **20 feet**, then the corner forms a **perfect right angle**.

8. No. Area depends on the square of the side.

If side becomes half, new area = $(1/2)^2 = 1/4$ of original.

So, area becomes **one-fourth, not half**.

9. Given that the square plots are of dimensions 6 m and 8 m respectively. We need to find the side of square plot with combined area.

Combined area = $6^2 + 8^2 = 100$ sq. m.

So, the side of the final square plot is given by :

$$c = \sqrt{100} = 10 \text{ m}$$

10. The TV will fit only if its diagonal is **less than or equal to** the cabinet's diagonal.

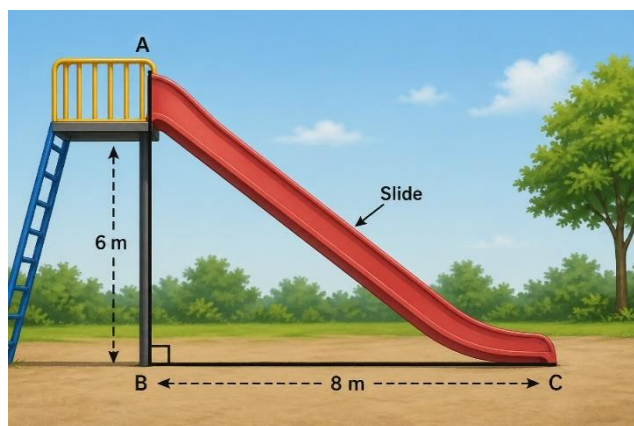
The dimensions of the TV is given by $a = 36$ inches and $b = 24$ inches. So, by using Pythagorean Theorem, $c = \sqrt{36^2 + 24^2} = \sqrt{1296 + 576} = \sqrt{1872} = 43.27$ (approx.)

So, the cabinet's diagonal is about **43.3 inches**, which is **larger than 42 inches**, so **yes, the TV will fit**.

Case Study Based Questions (4 Mark Each)

Case Study Question 1. ($4 \times 1 = 4$ marks)

A school is planning to install a slide in the playground. The slide is fixed from the top of a vertical platform to the ground. The height of the platform is 6 m, and the distance of the base of the slide from the foot of the platform is 8 m. The slide, the ground, and the platform form a right-angled triangle.



Answer the following questions:

- (i) Which side represents the hypotenuse in the given situation?

(a) Height of platform (b) Base distance (c) Slide (d) None

- (ii) Using the Pythagoras theorem, find the length of the slide. ($c^2 = a^2 + b^2$)

(a) 10 m (b) 12 m (c) 14 m (d) 16 m

- (iii) If the height is doubled and base remains same, what will be the new hypotenuse?

(a) 20 m (b) $\sqrt{(12)^2 + (8)^2}$ (c) 16 m (d) 18 m

- (iv) Which of the following sets satisfies the Pythagorean triplet?

(a) (6, 8, 10) (b) (5, 6, 7) (c) (2, 3, 4) (d) (7, 9, 12)

ANSWER:

(i) (c) Slide

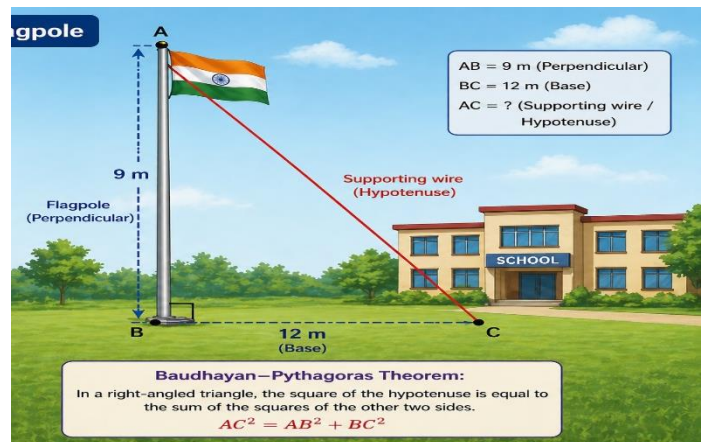
(ii)(a) 10 m (iii) (b) $\sqrt{(12)^2 + (8)^2}$

(iv)(a) (6, 8, 10)

Case Study 2: The School Flagpole

Scenario:

A school wants to fix a support wire from the top of a vertical flagpole to a point on the ground to keep it stable. The height of the flagpole is **9 m**, and the point on the ground is **12 m** away from the base of the pole. The wire forms a straight line from the top of the pole to the ground, making a right-angled triangle.



Questions:

- a) Identify the base, perpendicular, and hypotenuse in the given situation. (1 Mark)
- b) Find the length of the supporting wire using the Pythagoras Theorem. (2 Marks)
- c) If the wire available is only **14 m long**, is it sufficient? Justify your answer. (1 Mark)

Answer Key :

a) Base = 12 m , Perpendicular = 9 m , Hypotenuse = Supporting wire

b) Using Pythagoras Theorem:

$$\text{Hypotenuse}^2 = 9^2 + 12^2 = 81 + 144 = 225, \text{Hypotenuse} = \sqrt{225}, \text{Hypotenuse} = 15 \text{ m}$$

c) No, the wire is not sufficient because required length = 15 m but available = 14 m.

Case Study 3: The Lotus in the Pond

In a tranquil village, there is a rectangular pond. A local gardener, during his morning walkthrough, noticed a lotus flower standing perfectly vertical in the center of the pond.

The stem of the lotus extends **1 unit** above the water surface. When a strong wind blows, the stem bends, and the tip of the lotus flower touches the surface of the water at a point exactly **3 units** away from its original vertical position.

The gardener wants to use the **Baudhayana-Pythagoras Theorem** to find the depth of the pond to ensure it is suitable for more flowers.

Based on this scenario, answer the following questions:

- a) Identify the right-angled triangle formed by the lotus, the water surface, and the vertical position. What are the lengths of its sides?
- b) Calculate the depth of the pond (in units) using the Baudhayana theorem $a^2 + b^2 = c^2$.

- c) Verify the solution to check if the total length of the stem (depth + 1) matches the calculated hypotenuse.

ANSWER:

- a) Identifying the Sides

Let the depth of the pond be x units.

Perpendicular (Height): The depth of the pond = x

Base: The distance from the original position to where the tip touches the water = 3 units.

Hypotenuse: The total length of the stem, which is the depth plus the height above water = $(x + 1)$ units.

Therefore, we have a right-angled triangle with sides x , 3, and hypotenuse $(x+1)$

- b) Calculating the Depth

According to the Baudhayana-Pythagoras Theorem:

$$(\text{Base})^2 + (\text{Perpendicular})^2 = (\text{Hypotenuse})^2$$

$$3^2 + x^2 = (x+1)^2 \Rightarrow 9 + x^2 = x^2 + 2x + 1, \Rightarrow 9 = 2x + 1, \Rightarrow 8 = 2x, \Rightarrow x = 4$$

- c) The depth of the pond is 4 units.

Verification

Depth (x): 4 units

Length above water: 1 unit

Total Stem Length (Hypotenuse): $4 + 1 = 5$ units.

Check: $\{\text{Base}\}^2 + \{\text{Perpendicular}\}^2 = 3^2 + 4^2 = 9 + 16 = 25.$

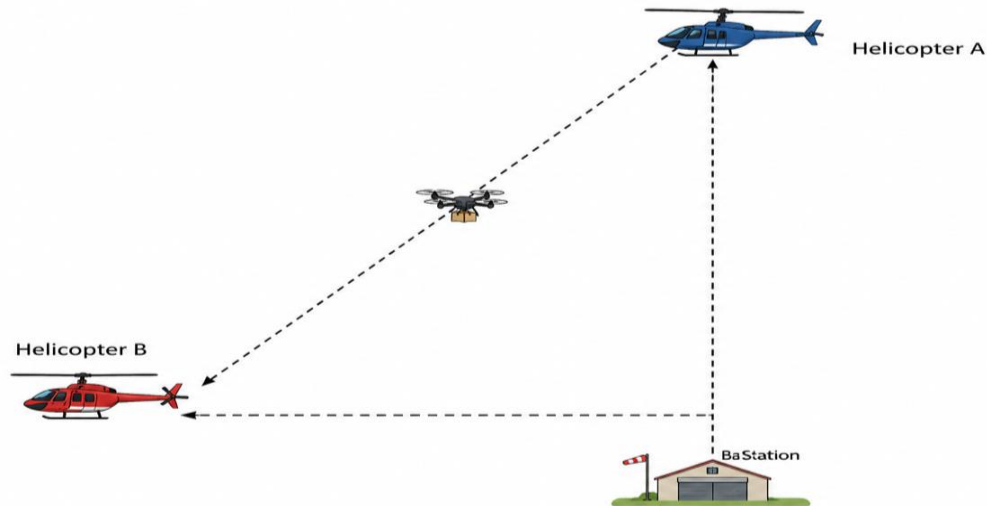
Hypotenuse Check: $5^2 = 25.$

Since $(25 = 25)$, the solution is verified. The depth is 4 units.

Case Study 4: The Safe Landing Rescue Operation

Scenario: Two rescue helicopters, Helicopter A and Helicopter B, take off simultaneously from the same base station on a flat, open field to deliver relief supplies. Helicopter A flies directly North at a speed of 300 km/h, while Helicopter B flies directly West at a speed of 400 km/h.

After exactly 1.5 hours of flying, the base station needs to send a direct drone to deliver a spare part to Helicopter B from Helicopter A's current position, moving in a straight line.



Questions:

- What is the total distance traveled by Helicopter A North in 1.5 hours? - (1)
- What is the total distance traveled by Helicopter B West in 1.5 hours? - (1)
- What is the shortest distance between the two helicopters after 1.5 hours?

(Apply the Baudhayana-Pythagoras theorem). - (1)

- If the speed of the helicopters was changed such that their distances from the base were 9 km and 12 km, what would the distance between them be? - (1)

ANSWER:

- Distance of Helicopter A (North):** Speed = 300 km/h, Time = 1.5 hours (3/2 hours)

Distance = Speed X times , Distance_A = 300 X 1.5 = 450 km

- Distance of Helicopter B (West):** Speed = 400 km/h, Time = 1.5 hours

Distance B = 400 X 1.5 = 600 km

- Shortest Distance (Hypotenuse):**

The path of the helicopters (North and West) forms a right-angled triangle with the base station. The shortest distance is the hypotenuse.

Base b = 600 km (Helicopter B)

By Baudhayana Theorem: $\text{Hypotenuse}^2 = \text{Base}^2 + \text{Perpendicular}^2$

$$C^2 = 600^2 + 450^2$$

$$C^2 = 360,000 + 202,500$$

$$C^2 = 562,500$$

$$c = \sqrt{562,500} = 750 \text{ km}$$

- Baudhayana Triple Check (9, 12):**

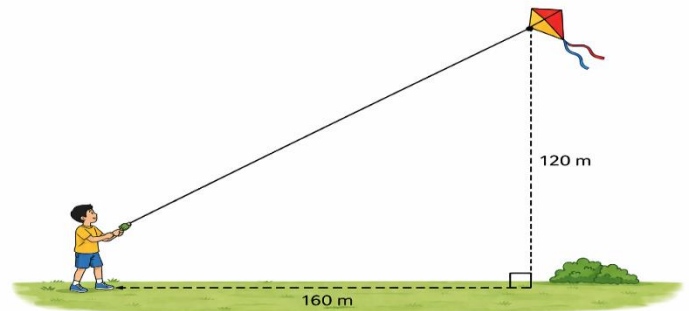
If $a=9$, $b=12$, then $c^2 = 9^2 + 12^2$

$$c^2 = 81 + 144 = 225$$

$$c = \sqrt{225} = 15 \text{ km}$$

Case Study 5: Designing a Kite (4 Marks)

Case: A boy is flying a kite, and the string is stretched tight to a point on the ground. The kite is at a vertical height of 120 m, and the horizontal distance from the boy to the point directly below the kite is 160 m.



- Identify the base, perpendicular, and hypotenuse in this scenario. (1 Mark)
- Calculate the total length of the string (hypotenuse). (2 Marks)
- If the boy reduces the string length by 20 meters, will the kite still be at the same height?
(1Mark)

ANSWER:

(a) Base (horizontal distance) = 160 m

Perpendicular (vertical height) = 120 m

Hypotenuse (string of the kite) = the slant length from the boy to the kite

(b) Length of the string (hypotenuse)

Using the Pythagoras Theorem: $C^2 = a^2 + b^2$

Here, ($a = 160$), ($b = 120$)

$$c = \sqrt{160^2 + 120^2}$$

$$c = \sqrt{\{25600 + 14400\}} = \sqrt{\{40000\}} = 200$$

Length of the string = 200 m

(c) If the string is reduced by 20 m

New string length = ($200 - 20 = 180$) m

Now, since the hypotenuse becomes shorter while the base (160 m) remains the same, the triangle must shrink. Therefore, the height will decrease.

Conclusion: No, the kite will not remain at the same height. It will come down.

CLASS TEST

SECTION-A: MCQs (1 Mark Each)

Q.1. If hypotenuse is 17 and one side is 8, the other side is:

- a) 15 b) 9 c) 10 d) 7

Q.2. A set of three natural numbers satisfying ($a^2 + b^2 = c^2$) is called:

- a) Rational triple b) Baudhāyana triple c) Prime triple d) Integer set

Q.3. Fermat's Last Theorem states that there are no solutions for:

- a) ($n=2$) b) ($n=3$) c) ($n>2$) d) ($n=1$)

Q.4. The Pythagoras relation is applicable to:

- a) Scalene triangle b) Right-angled triangle c) Acute triangle d) Obtuse triangle

SECTION-B (2 Marks Each)

Q.5. A ladder is placed against a wall such that it reaches a height of 15 m. The base of the ladder is 8 m away from the wall. Find the length of the ladder.

Q.6. A gardener makes a square lawn of side 7 m. He wants to create another square lawn having double the area of the first one. Find the side of the new lawn.

Q.7. A designer makes a square poster of area 72 cm^2 . She wants another square poster with half the area. Find the side of the new poster.

SECTION-C (3 Marks Each)

Q.8. A mason measures three sides of a triangular frame as 6 cm, 8 cm, and 10 cm. Check whether the frame forms a right-angled triangle using the Pythagoras Theorem.

Q.9. A rectangular playground is 120 m long and 50 m wide. Find the distance between opposite corners of the playground (diagonal).

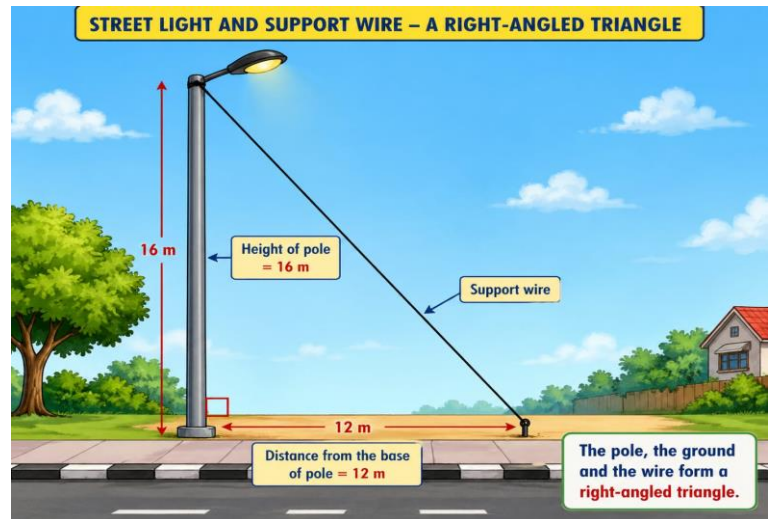
SECTION-D

Case Study Based Questions (4 Marks Each)

Q.10. Case Study: The Street Light Support

Scenario:

A street light is fixed vertically on the ground. A support wire is attached from the top of the pole to a point on the ground to provide stability. The height of the pole is 16 m, and the point on the ground is 12 m away from the base of the pole. The wire forms a right-angled triangle.



Questions:

- Identify the base, perpendicular, and hypotenuse in this situation. (1 Mark)
- Find the length of the support wire using the Pythagoras Theorem. (2 Marks)
- If the available wire is 20 m long, is it sufficient? Justify your answer. (1 Mark)

Answer Key:

SECTION-A: MCQs

Q.1. Given: Hypotenuse = 17, one side = 8

Using Pythagoras:

$$\text{Other side} = \sqrt{17^2 - 8^2} = \sqrt{289 - 64} = 15$$

Answer: (a) 15

Q.2. A triple satisfying ($a^2 + b^2 = c^2$) is called a Baudhāyana (Pythagorean) triple.

Answer: (b) Baudhāyana triple

Q.3. Fermat's Last Theorem states no whole number solutions exist for:

$$A^n + b^n = c^n, \quad n > 2$$

Answer: (c) $n > 2$

Q.4. The relation ($a^2 + b^2 = c^2$) is valid only for a right-angled triangle.

Answer: (b) Right-angled triangle

SECTION-B

Q.5. Height = 15 m, Base = 8 m

$$\text{Ladder length} = \sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289} = 17 \text{ m}$$

Answer: 17 m

Q.6. Side of first square = 7 m

$$\text{Area} = (7^2 = 49, \text{ m}^2)$$

$$\text{New area} = (2 \times 49 = 98, \text{ m}^2)$$

$$\text{New side} = \sqrt{98} = \sqrt{49 \times 2} = 7\sqrt{2} \text{ m}$$

$$\text{Answer: } 7\sqrt{2} \text{ m}$$

Q.7. Given area = 72 cm²

$$\text{Half area} = (72 \div 2 = 36 \text{ cm}^2)$$

$$\text{Side} = \sqrt{36} = 6 \text{ cm}$$

$$\text{Answer: } 6 \text{ cm}$$

SECTION-C

Q.8. Sides = 6 cm, 8 cm, 10 cm

$$\text{Check: } 6^2 + 8^2 = 36 + 64 = 100$$

$$10^2 = 100$$

Since both are equal, it satisfies Pythagoras.

Answer: Yes, it is a right-angled triangle (Pythagorean triplet).

Q.9. Length = 120 m, Breadth = 50 m

$$\text{Diagonal} = \sqrt{(120^2 + 50^2)}$$

$$= \sqrt{14400 + 2500}$$

$$= \sqrt{16900}$$

$$= 130 \text{ m}$$

$$\text{Answer: } 130 \text{ m}$$

SECTION-D (Case Study)

Q.10. a) Identification:

Base = 12 m (distance on ground)

Perpendicular = 16 m (height of pole)

Hypotenuse = Wire

b) Length of wire:

$$\text{Wire length} = \sqrt{16^2 + 12^2}$$

$$= \sqrt{256 + 144}$$

$$= \sqrt{400}$$

$$= 20 \text{ m}$$

Answer: 20 m

c) Sufficiency check:

Required wire = 20 m

Available wire = 20 m

Answer: Yes, the wire is sufficient as it is exactly equal to the required length.

CHAPTER 3: PROPORTIONAL REASONING -2

Section A (MCQs-1 Mark)

1. A chef mixes four spices in the ratio 8 : 4 : 2 : 1 (Coriander : Cumin : Turmeric : Fenugreek)
If she uses 1 spoon of turmeric how many spoons of cumin are needed?
a) 8 b) 4 c) 2 d) 1
2. On two different maps, the RF (Representative Fraction) values are
1: 50,000 and 1: 2,00,000. (Means 1 cm on the map represents 50,000 cm on the ground
and 1 cm on the map represents 2,00,000 cm respectively.) Which map will show a 10
km road longer on paper?
a) First map b) Second map c) Same length d) Cannot be determined
3. The sides of a triangle are in the ratio 3 : 4 : 5. If the shortest side is 6 cm, what is the
perimeter?
a) 24 cm b) 30 cm c) 36 cm d) 48 cm
4. 20 workers can complete a road in 4 days. How many workers are needed to complete
the same work in 2 days?
a) 10 b) 20 c) 30 d) 40
5. In a pie chart, the angle representing Grade C is 72° . If the total number of students is
40, how many got Grade C?
a) 10 b) 8 c) 12 d) 6
6. If X and Y vary inversely and $X = 6$ when $Y = 8$, find Y when $X = 12$.
a) 4 b) 9 c) 16 d) 2
7. A concrete mix has ratio 1: 1.5: 3 (cement: sand: gravel). If the total mixture is 11 units,
how much cement is required?
a) 1 b) 2 c) 3 d) 4
8. Ram and Shyam together take 36 minutes to complete a task. Ram alone can do it in 60
minutes. How long will Shyam alone take?
a) 1 hour b) 1.5 hours c) 2 hours d) 45 minutes
9. A map uses RF 1 : 10,00,000. means 1 cm on the map represents 10 km on the ground. If
the actual distance is 150 km, what is the map distance?
a) 10 cm b) 15 cm c) 150 cm d) 0.15 cm
10. A school has 8 periods of 45 minutes each. If the number of periods increases to 10
while total time remains the same, what is the new duration of each period?
(a) 36 min b) 40 min c) 45 min d) 50 min

Solutions

1. Answer: a) 8
2. Answer: a) First map
First map: $1 \text{ cm} = 0.5 \text{ km} \rightarrow 10 \text{ km} = 20 \text{ cm}$
Second map: $1 \text{ cm} = 2 \text{ km} \rightarrow 10 \text{ km} = 5 \text{ cm}$
3. Answer: a) 24 cm
 $3 \text{ parts} = 6 \text{ cm} \rightarrow 1 \text{ part} = 2 \text{ cm}$
Sides = 6, 8, 10 $\rightarrow$ Perimeter = 24 cm
4. Answer: d) 40
Workers $\times$ Days = Constant
 $20 \times 4 = x \times 2 \rightarrow x = 40$
5. Answer: b): 8
6. Answer: a) 4
 $XY = \text{constant} \rightarrow 6 \times 8 = 12 \times y \rightarrow y = 4$
7. Answer: b) 2
Total parts = 5.5
Scale factor = $11 \div 5.5 = 2$
Cement = $1 \times 2 = 2 \text{ units}$
8. Answer: b) 1.5 hours
Together rate = $1/36 \text{ per min} = 5/3 \text{ per hour}$
Ram's rate = 1 per hour
Shyam's rate = $5/3 - 1 = 2/3$
Time = $1 \div (2/3) = 1.5 \text{ hours}$
9. Answer: b) 15 cm
 $1 \text{ cm} = 10 \text{ km} \rightarrow 150 \div 10 = 15 \text{ cm}$
10. Answer: a) 36 min
Total time = $8 \times 45 = 360 \text{ min}$
New duration = $360 \div 10 = 36 \text{ min}$

Section B: (2 Marks each)

1. If 36 pencils cost ₹180, how much will 25 such pencils cost?
2. A city map has a Representative Fraction (RF) of 1:2,00,000. If a park is 4 cm away from a temple on the map, what is the actual geographical distance between them in kilometers?
(A distance of 1 cm on the map is equivalent to a geographical distance of 2,00,000 cm)
3. To create a specific shade of green, a painter mixes Yellow, Blue, and White paint in the ratio 7:3:2. What fraction of the total mixture is Blue paint?

4. A car travels at 70 km/h and reaches its destination in 4 hours. If the speed is doubled to 140 km/h, how much time will it take to cover the same distance?
5. A worker is paid ₹2,100 for 6 days of work. If the worker works for 15 days, how much will they earn?
6. A scale model of a building is built with a ratio of 1:250. If the actual building is 60 meters tall, what is the height of the model in centimeters?
7. The sides of a triangle are in the ratio 2:3:4. If the smallest side is 9 cm, find the length of the longest side.
8. A juice shop sells four flavors in the ratio Mango: Orange: Guava: Apple :: 5 : 3 : 2 : 2. Calculate the central angle, specifically for the "Orange" sector in a pie chart representing this data.
9. A recipe for 4 people uses 2 cups of flour. How many cups are needed for a gathering of 16 people?
10. Divide ₹2400 between two friends in the ratio 3:5. What is the smaller share?

Solutions

1. **Solution: ₹125**
 Cost of 1 pencil = ₹ $(180 \div 36) = ₹5$
 Cost of 25 pencils = ₹ $(25 \times 5) = ₹125$
2. **Solution: 8 km.**
 $4 \times 2,00,000 \text{ cm} = 8,00,000 \text{ cm}.$
 Converting to km: $8,00,000 / 1,00,000 = 8 \text{ km}.$
3. **Solution: 3/12 or 1/4**
 Sum of parts = $7 + 3 + 2 = 12.$
 Blue is 3 parts out of 12.
4. **Solution: 2 hours** (Speed and time are inversely proportional)
5. **Solution: ₹5,250** (The worker will earn for 15 days of work)
6. **Solution: 24 cm.**
 Actual height = 6000 cm.
 Model height = $6000 / 250 = 24 \text{ cm}$

7. **Solution: 18 cm**

The longest side is exactly double the smallest side

Or the length of the longest side is $(9 \text{ cm} \div 2) \times 4 = 18 \text{ cm}$

8. **Solution: 90°**

Sum of ratio parts = $5+3+2+2 = 12$.

Central angle for Orange = $\frac{3}{12} \times 360^\circ = 90^\circ$

9. **Solution: 8 cups.**

Ratio is $2/4 = 1/2$ cups per person.

For 16 people: $16 \times \frac{1}{2} = 8$ cups.

10. **Solution: ₹900.**

Total parts = $3+5=8$.

Smaller share = $\frac{3}{8} \times ₹2400 = ₹(3 \times 300) = ₹900$

Section C: (3 Marks each)

1. Riya is buying notebooks for her new school session. She finds that 8 notebooks cost ₹280 at a stationery shop. She wants to buy 15 notebooks for the term. Using your understanding of unitary method, help Riya calculate the total cost of 15 notebooks.
2. Shabnam walks to school every day. She usually reaches school in 20 minutes when walking at a speed of 6 km/h. One day, she decides to walk a bit slower so that she reaches school in 24 minutes instead.

Using your understanding of the relationship between speed, time, and distance, help Shabnam find the speed she should walk at to reach school in 24 minutes.

Situation	Speed (km/h)	Time (minutes)	Distance (km)
Usual journey	6	20	?
Slower journey	?	24	Same

3. At a scout camp, food has been arranged for 350 cadets to last for 36 days. After a few days, 50 cadets leave the camp due to other commitments. Using your understanding of proportional reasoning, determine how many days the same food supply will now last for the remaining cadets.

Situation	Number of Cadets	Number of Days	Total Food (Cadet-days)
Initial arrangement	350	36	?
After 50 cadets leave	300	?	Same

4. A construction company is building a wall for a community project. Initially, 24 workers are assigned to complete the work in 80 hours. Due to a deadline change, the company now wants to finish the same work in just 60 hours. Using your understanding of work, time, and workforce relationships, determine how many **extra workers** need to be hired to complete the work on time.

Situation	Number of Workers	Time (hours)	Total Work (worker-hours)
Initial plan	24	80	?
New plan	?	60	Same

5. A cricket coach is planning a structured practice session for players to ensure balanced skill development. The total session lasts 150 minutes and includes four activities: warm-up/cool-down, batting, bowling, and fielding. The time for each activity is divided in the ratio:

Warm-up/Cool-down: Batting: Bowling: Fielding = 3: 4 : 3 : 5

Using your understanding of ratios and proportional distribution, determine how much time should be allocated to each activity.

Activity	Ratio	Time (minutes)
Warm-up/Cool-down	3	?
Batting	4	?
Bowling	3	?
Fielding	5	?
Total	15	150

6. A teacher is organizing numbers for a math activity and asks students to check whether certain numbers form a proportion. The numbers given are 22, 33, 42, and 63.

Using your understanding of ratios and proportion, verify whether these numbers are in proportion.

First Ratio	Value	Second Ratio	Value
A	22	c	42
B	33	d	63

We check if:

$$22 : 33 = 42 : 63$$

7. During a mathematics activity, students are asked to verify whether given sets of numbers forms a proportion. One group is given the numbers 36, 49, 6, and 7 and needs to check if they are in proportion.

Using your understanding of ratios and proportion, determine whether these numbers form a proportion or not.

First Ratio	Value	Second Ratio	Value
a	36	c	6
b	49	d	7

We check if:

$$36 : 49 = 6 : 7$$

8. Ravi wants to manage his monthly budget wisely. His total salary is ₹12,000, and he spends it on different needs such as food, clothing, house rent, education, miscellaneous expenses, and savings.

Using your understanding of data handling and representation, help Ravi present his expenditure in the form of a **pie chart** by calculating the central angle for each category.

Category	Amount (₹)	Fraction of Total	Central Angle (°)
Food	1800	$1800/12000 = 3/20$	?
Clothing	1200	$1200/12000 = 1/10$	?
House Rent	3000	$3000/12000 = 1/4$	?
Education of Children	1200	$1/10$	?
Miscellaneous Expenditure	2400	$1/5$	?
Savings	2400	$1/5$	?
Total	12000	1	360°

9. A railway station has introduced parking charges based on the duration of parking. A commuter wants to check whether the charges are fair and increase proportionally with time. Using your understanding of **direct proportion**, determine whether the parking charges are directly proportional to the parking time.

Parking Time (hours)	Charges (₹)	Ratio (Charges ÷ Time)
4	60	$60 \div 4 = 15$
8	100	$100 \div 8 = 12.5$
12	140	$140 \div 12 \approx 11.67$
24	180	$180 \div 24 = 7.5$

10. A science experiment shows that two quantities, x and y , are related such that when one increases, the other decreases proportionally. During the experiment, following observations are found. Using your understanding of **inverse variation**, determine the value of x when $y=9$

x	y	$x \times y$
6	6	36
?	9	Same (constant)

Solutions

1. First, find the cost of **1 notebook**:

Cost of 8 notebooks = ₹280

Cost of 1 notebook = $280 \div 8 = ₹35$

Now, find the cost of **15 notebooks**:

Cost of 15 notebooks = $15 \times 35 = ₹525$ (ans)

2. First, convert time into hours:

20 minutes = $20/60 = 1/3$ hour

24 minutes = $24/60 = 2/5$ hour

Now, find the distance using the usual journey:

Distance = Speed $\times$ Time

Distance = $6 \times (1/3) = 2$ km

Now, find the required speed for the slower journey:

Speed = Distance $\div$ Time

Speed = $2 \div (2/5) = 2 \times (5/2) = 5$ km/h (ANS)

3. First, find the total food available in terms of cadet-days:

Total food = $350 \times 36 = 12,600$ cadet-days

After 50 cadets leave:

Remaining cadets = $350 - 50 = 300$

Now, find the number of days the food will last:

Number of days = Total food $\div$ Number of cadets
 $= 12,600 \div 300 = 42$ days (ANS)

4. First, calculate the total work in terms of worker-hours:

Total work = $24 \times 80 = 1920$ worker-hours

Now, find the number of workers required to complete the same work in 60 hours:

Required workers = Total work $\div$ Time
 $= 1920 \div 60 = 32$ workers

Now, calculate the extra workers needed:

Extra workers = $32 - 24 = 8$ (ANS)

5. First, find the total number of parts:

$3 + 4 + 3 + 5 = 15$ parts

Now, find the value of 1 part:

Time for 1 part = $150 \div 15 = 10$ minutes

Now, calculate time for each activity:

Warm-up/Cool-down = $3 \times 10 = 30$ minutes

Batting = $4 \times 10 = 40$ minutes

Bowling = $3 \times 10 = 30$ minutes

Fielding = $5 \times 10 = 50$ minutes

6. Simplify both ratios:

First ratio:

$22 : 33 = 22/33 = 2/3$

Second ratio:

$42 : 63 = 42/63 = 2/3$

Since both ratios are equal:

$22 : 33 = 42 : 63$ Yes, the numbers 22, 33, 42, and 63 are in proportion.

7. Simplify both ratios:

First ratio:

$36 : 49 = 36/49$ (cannot be simplified further)

Second ratio:

$6 : 7 = 6/7$

Now compare:

$36/49 \neq 6/7$

(Alternatively, cross-multiply:)

$36 \times 7 = 252$

$49 \times 6 = 294$

Since $252 \neq 294$, the two ratios are not equal.

The numbers 36, 49, 6, and 7 are not in proportion.

8. To draw a pie chart, we convert each category into a central angle using:

Central Angle = (Amount / Total) $\times$ 360°

Now calculate:

$$\text{Food} = (1800/12000) \times 360 = 54^\circ$$

$$\text{Clothing} = (1200/12000) \times 360 = 36^\circ$$

$$\text{House Rent} = (3000/12000) \times 360 = 90^\circ$$

$$\text{Education} = (1200/12000) \times 360 = 36^\circ$$

$$\text{Miscellaneous} = (2400/12000) \times 360 = 72^\circ$$

$$\text{Savings} = (2400/12000) \times 360 = 72^\circ$$

Final Table with Angles

Category	Central Angle ($^\circ$)
----------	----------------------------

Food	54°
------	------------

Clothing	36°
----------	------------

House Rent	90°
------------	------------

Education of Children	36°
-----------------------	------------

Miscellaneous Expenditure	72°
---------------------------	------------

Savings	72°
---------	------------

Draw a pie chart using the above central angles to represent Ravi's salary distribution.

9. For two quantities to be in **direct proportion**, the ratio of charges to time must remain constant

From the table:

$$60/4 = 15$$

$$100/8 = 12.5$$

$$140/12 \approx 11.67$$

$$180/24 = 7.5$$

Since the ratio is **not constant**, the charges do not increase uniformly with time. The parking charges are **not in direct proportion** to the parking time.

10. Since x varies inversely as y , we have:

$$x \times y = \text{constant}$$

From the first condition:

$$6 \times 6 = 36$$

So, the constant = 36

Now, when $y = 9$

$$x = 36 \div 9 = 4$$

Section D: (4 – Marks Each)

Case Study 1: School Trip Map (Ratios in Maps)

On a map, the distance between two cities from Bhubaneswar to Puri is 5 cm. The map scale is 1 cm : 20 km.

Questions:

- Find the actual distance from Bhubaneswar to Puri according to the scale given in the map. (2 marks)
- Write the proportion used here. (1 mark)
- If map distance becomes 10 cm, what happens with actual distance? (1 mark)

Case Study 2: Fruit Distribution 🍎 (Ratios with More Than 2 Terms)

Fruits are distributed among three persons A, B and C in the ratio of 2 : 3 : 5. If total fruits = 200.

Questions:

- Find the number of fruits each person gets. (2 marks)
- Who gets the maximum fruits? (1 mark)
- Check if the ratio is in the simplest form. (1 mark)

Case Study 3: Sharing Prize Money (Dividing a Whole in a Given Ratio)

₹1200 as prize money is shared among three friends in the ratio of 3: 2: 1.

Questions:

- Find the share of each friend. (2 marks)
- Who gets the least amount? (1 mark)
- Write the fraction of total money received by the first friend. (1 mark)



Case Study 4: Pizza Sharing (A Slice of the Pie)

A pizza is divided among 4 children in the ratio of 1 : 2 : 3 : 4.

Questions:

- a) What fraction of the pizza does each child get? (2 marks)
- b) Who gets the largest share? (1 mark)
- c) Verify total parts of pizza with whole pizza. (1 mark)

Case Study 5: Workers and Days (Inverse Proportion)

8 workers can complete a construction work in 12 days.

Questions:

- a) How many days will 16 workers take to complete a work? (2 marks)
- b) Identify the type of proportion. (1 mark)
- c) What happens to the number of days if workers decrease? (1 mark)



Case Study 1: Solutions

- (a) According to the scale given in the map,

$$1 \text{ cm} = 20 \text{ km}$$

So actual distance between two cities is

$$5 \text{ cm} = 5 \times 20 = 100 \text{ km}$$

- b) It is direct proportion, i.e.,

$$\text{Map distance: Actual distance} = 1: 20$$

- c) In this map, the distance between two cities is 5 cm.

then actual distance is 100 km

If map distance becomes 10 cm

then actual distance is 200 km

So, Distance doubles.



Case Study 2: Solutions

a) Total parts = $2 + 3 + 5 = 10$

1 part = $200 \div 10 = 20$

A = 40, B = 60, C = 100

b) C gets maximum numbers of fruits, i.e., 100

c) Ratio is already in the simplest form.

Case Study 3: Solutions

a) Total parts = $3 + 2 + 1 = 6$

So 1 part = $1200 \div 6 = 200$

Each Share:

First = 600, Second = 400, Third = 200

b) Third friend gets least amount

c) Fraction = $3/6 = \frac{1}{2}$

Case Study 4: Solutions

a) Total parts = $1 + 2 + 3 + 4 = 10$

Shares:

$1/10, 2/10, 3/10, 4/10$

b) Fourth child gets largest share

c) Sum = $10/10 = 1$ (whole)

Case Study 5: Solutions

a) Workers $\times$ Days = constant

$8 \times 12 = 16 \times X$

$X = (8 \times 12) \div 16 = 6$ days

b) Inverse proportion

c) Number of days increase

CLASS TEST

Section A: (MCQ – 1 Mark each)

1. In the study of Proportional Reasoning, which of the following real-world scenarios represents an inverse proportion?
 - a) The number of pages in a book and the time required to read it at a fixed speed
 - b) The speed of a cyclist and the time taken to cover a fixed route.
 - c) The amount of petrol consumed and the distance a car travels.
 - d) The length of cloth purchased and the total price paid at a fixed rate.
2. If 3 kg of rice costs ₹90, what is the cost of 5 kg?
 - a) ₹120
 - b) ₹135
 - c) ₹150
 - d) ₹180
3. If a car travels 150 km in 3 hours, how far will it travel in 5 hours at the same speed?
 - a) 200 km
 - b) 220 km
 - c) 250 km
 - d) 300 km
4. A school library maintains a ratio of *Odiya* books: *Hindi* books: *English* books as 3:2:1. If the library has 288 *Odiya* books, how many *Hindi* books does it have?
 - a) 576
 - b) 144
 - c) 192
 - d) 96

Section B: (VSA – 2 Mark each)

5. If 20 workers take 4 days to complete a road project, how many days will it take 16 workers to complete the same project, assuming they work at the same rate?
6. A shop sells 6 pens for ₹54 and another shop sells 9 pens for ₹72. Which shop offers a better deal? Show your reasoning using unit rate.
7. On a map, 2 cm represents 1 km. What distance (in km) is represented by 7.5 cm on the map? Show your calculation.

Section C: (SA – 3 Mark each)

8. A spice mix powder recipe requires Coriander seeds : Red chillies : Toor dal : Fenugreek in the ratio 8:4:2:1. If a cook has only 2 units of red chillies and wants to maintain the same flavour profile, what amount of Coriander seeds and Fenugreek is needed?
9. A small pump can fill a water tank in 3 hours, while a large pump can fill the same tank in 2 hours. If both pumps are used simultaneously, how long will it take to fill the tank?

Section D: (LA – 4 Mark each) Case Study Based

10. A school canteen prepares lemonade using lemon juice and water in the ratio 1 : 4.
 - (a) If 2 litres of lemon juice is used, how much water is needed? (1 mark)
 - (b) What is the total quantity of lemonade prepared? (1 mark)

(c) If the canteen wants to prepare 30 litres of lemonade, how much lemon juice and water will be required? Show reasoning. (2 marks)

Solutions:

1. b) The speed of a cyclist and the time taken to cover a fixed route.

2. c) ₹150

3. c) 250 km

4. c) 192

5. 5 days

6. Shop 2 offers a better deal

7. 3.75 km

8. Coriander = $8 \times \frac{1}{2} = 4$ units

Fenugreek = $1 \times \frac{1}{2} = 0.5$ unit

9. 1.2 hours (1 hour 12 minutes)

10. (a) Water = $2 \times 4 = 8$ L

(b) Total lemonade = $2 + 8 = 10$ L

(c) Lemon juice = $1 \times 6 = 6$ L

Water = $4 \times 6 = 24$ L

CHAPTER 4: EXPLORING SOME GEOMETRIC THINGS

SECTION-A (1 MARK)

Q1. Which among the following is the best definition of a "Fractal".

- a) A shape with four equal sides and four right angles.
- b) A shape that is self-similar and repeats the same pattern at smaller scales.
- c) A 3D object that has only flat surfaces.
- d) A pattern that never repeats and changes every time.

Q2. In Step 1 of creating a Sierpinski Carpet, a square is divided into 9 smaller squares. How many squares are removed in that single step?

- a) 1
- b) 3
- c) 8
- d) 9

Q3. To find the shortest path between two points on the surface of a solid cuboid, which method is most helpful?

- a) Drawing an isometric sketch
- b) Measuring the edges with a ruler
- c) Unfolding the cuboid into its 2D net
- d) Looking at the top view only

Q4. Which solid can be created by folding a net made of four equilateral triangles?

- a) A Cube
- b) A Cylinder
- c) A Tetrahedron
- d) A Square Pyramid

Q5. Which of these solids cannot be formed by folding a flat net made only of rectangles?

- a) A Cube
- b) A Cuboid
- c) A Triangular Prism
- d) A Rectangular Box

Q6. What is the total number of faces in an Octahedron?

- a) 6
- b) 8
- c) 10
- d) 12

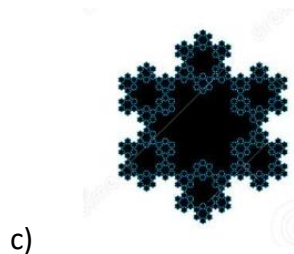
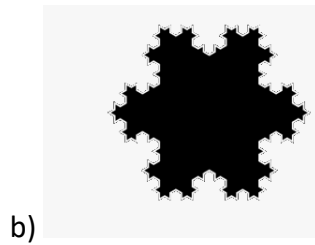
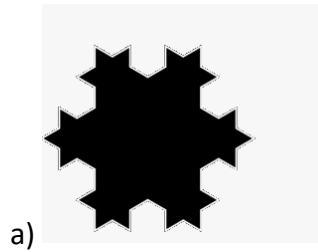
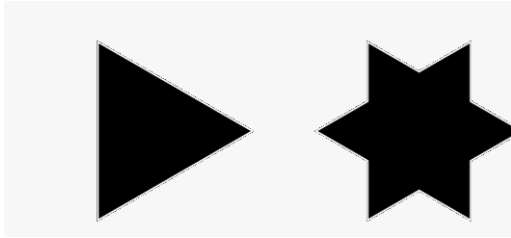
Q7. If the radius of the circular base of a cylinder is r , what is the exact length of the longer side of the rectangular part of its net?

- a) $2r$
- b) $2\pi r$
- c) $3\pi r$
- d) πr^2

Q8. If the base of a pyramid is an n -sided polygon, how many vertices does the pyramid have-

- a) $n+2$
- b) $2n$
- c) n
- d) $n+1$

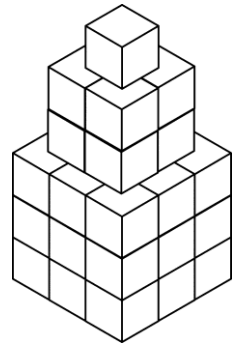
Q9. Which of the following is the next step of the Koch Snowflake pattern



d) none of these

Q10. Identify the total number of cubes given in the solid

- a) 35 b) 36 c) 27 d) 29



Answers:

- 1.b) 2. a) 3.c) 4. c) 5.c) 6. b) 7.b) 8. d) 9.a) 10.b)

SECTION B (2 Marks)

Q1: Describe the step-by-step construction of the Sierpinski Carpet up to Step 2, and state the number of remaining squares at Step 2.

Q2. A triangular prism and a square pyramid are given to you, answer which one has more faces? By how many?

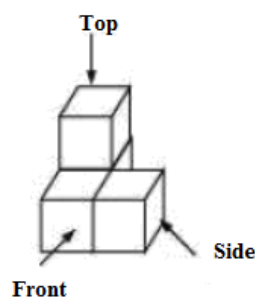
Q3. Starting with an equilateral triangle (3 sides), find the number of sides at Step 2 of Koch Snowflake.

Q4. Name a solid with rectangular profile from one view and circular from another; justify using visualization.

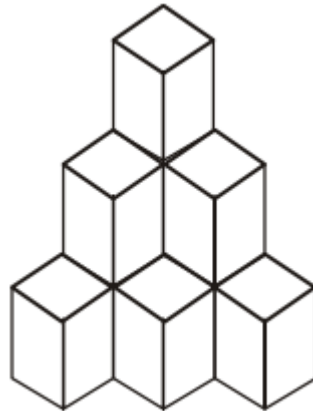
Q5 For a decagonal prism (10-sided polygons), find total faces, edges, vertices using general formula.

Q6. A solid shows a circular shape from the top and a triangular shape from the side. Identify and draw the possible solid.

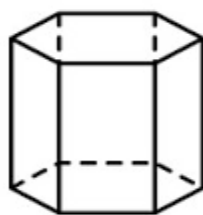
Q7. Draw the top and side view of the given solid?



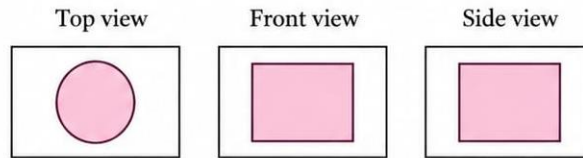
Q8. Find the total number of cubes in the given solid.



Q9. Identify the solid given below and write number of faces, vertices and edges of it.



Q10. Top view, front view and side view of a solid are shown below.



a) Identify the solid figure

b) How many edges does this solid have?

Answers:

1. Start with one square. Divide it into 9 equal smaller squares (3×3 grid). Remove the middle square → Step 1 leaves 8 squares. Now divide each of these 8 squares into 9 smaller squares and remove the middle square of each. So, at Step 2, remaining squares = $8 \times 8 = 64$ squares.

2. No. of faces of a triangular prism = 5

No. of faces of a square pyramid = 5

Both have equal number of faces.

Therefore, the difference = 0

4. From the front/side view, it looks like a rectangle.

From the top view, it looks like a circle. Hence, the solid is a cylinder.

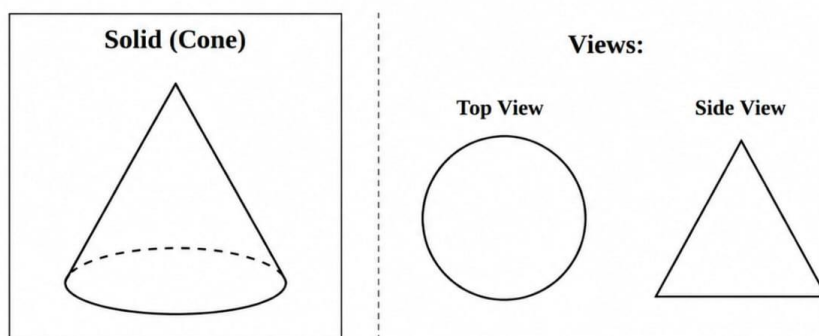
5. For an n -sided prism:

Faces = $n + 2$, Edges = $3n$, Vertices = $2n$, For $n = 10$: Faces = $10 + 2 = 12$, Edges = $3 \times 10 = 30$

Vertices = $2 \times 10 = 20$

So, a decagonal prism has 12 faces, 30 edges, 20 vertices.

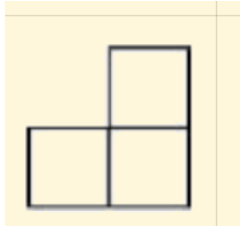
6. The possible solid is a cone.



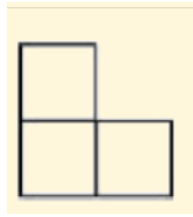
Top view: Circle, Side view: Triangle, Hence, the solid is a cone

7. Top View: 3 squares arranged in an L-shape.

Side view



top view



8. Total cubes = $6 + 3 + 1 = 10$ cubes

9. The given solid is a Hexagonal Prism (prism with hexagon bases).

For an n -sided prism:

Faces = $n + 2$, Vertices = $2n$, Edges = $3n$

Here, $n = 6$

So, Faces = $6 + 2 = 8$, Vertices = $2 \times 6 = 12$, Edges = $3 \times 6 = 18$

Hexagonal Prism $\rightarrow$ 8 faces, 12 vertices, 18 edges

10. Top view: Circle

Front view: Rectangle

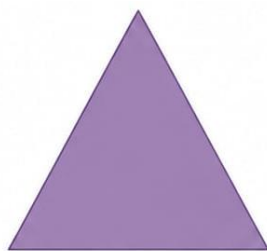
Side view: Rectangle

a) The solid is a Cylinder

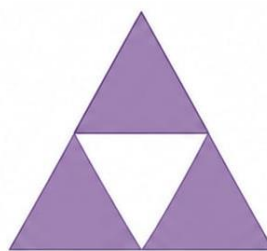
b) 0

SECTION C (3 Marks)

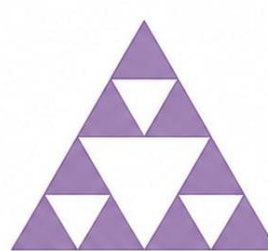
Q1. Riya is studying fractals in her art class. Her teacher shows the class the first three steps in creating the Sierpinski Triangle as shown below.



Step 0



Step 1

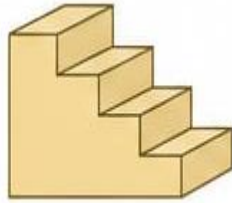


Step 2

a) How many shaded small equilateral triangles are there in Step 2

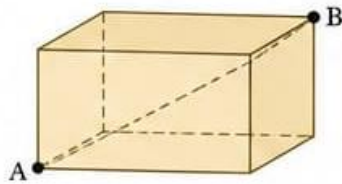
(b) What pattern do you observe in the number of shaded triangles from Step 0 to Step 2?
Using this pattern, how many shaded triangles will there be in Step 4?

Q2. A staircase is built in the shape shown below.



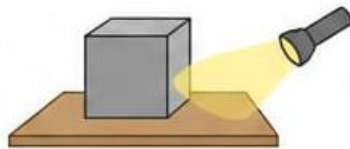
- (a) How many cuboids are used to build this staircase?
- (b) How many faces does the whole structure have?
- (c) From which side would it look the same as a rectangle?

Q3. An ant is at point A on a cuboid and wants to reach point B.



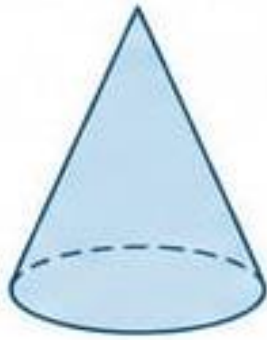
- (a) On which surface(s) can the ant move to reach B by the shortest path?
- (b) Why is the shortest path a straight line on the net of the cuboid
- (c) If the cuboid is opened into a different net, will the shortest distance change? Explain.

Q4. A solid is placed on the table and a torch is shone from different directions.



- (a) What shape of shadow will be seen on the screen?
- (b) Will the shadow change if the cube is rotated? Explain.
- (c) What is the relation between shadow and the faces of the solid?

Q5. A cone is shown below



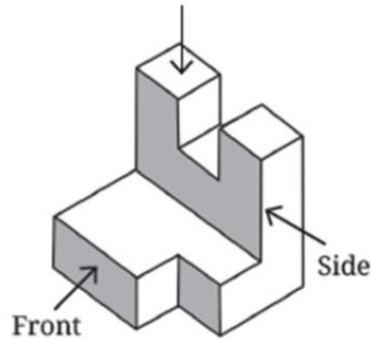
- (a) How many flat faces and curved faces does the cone have?
- (b) What is the shape of the flat face of the cone?
- (c) Where do you see cone shaped objects in real life?

Q6. Architects often use isometric drawings to show how a building will look.



- (a) What kind of 3D shape does the building mostly resemble?
- (b) Why do architects use isometric drawings instead of 2D drawings?
- (c) Which three directions (lines) are used in isometric drawings?

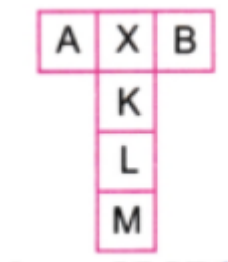
Q7. Draw the top view, front view and side view of the solid given below.



Q8. Mark the sides of an equilateral triangle into thirds. Cut off each corner of the triangle, as far as the marks. What shape do you get?

Q9. You are given solid with a trapezium-shaped profile from one viewpoint and a circular one from another view point. Identify the solid and name and draw it.

Q10. You are given the net of a cube. Name the letter that will be seen from its top view, front view and side view.(keeping 'L' at bottom)



Answers:

Section C(3 marks)

1.a) At each step, the number of shaded triangles becomes 3 times the previous step.

Step 0 = 1, Step 1 = 3, Step 2 = 9

9 small equilateral triangles

b) Multiply by 3 each step

Step 0 = 1, Step 1 = 3, Step 2 = 9, Step 3 = 27, Step 4 = 81

Pattern is powers of 3. Step 4 has 81 shaded triangles

2.a) The staircase has 4 steps, so cuboids used are:

$4 + 3 + 2 + 1 = 10$ cuboids

Answer: 10 cuboids

b) Total = 12 faces

c) From the left side or right side, it appears as a rectangle.

ie. Side view

3.a) The shortest path will lie on the unfolded net across connected faces.

It can move on the front face and top face (or equivalent adjacent faces depending on net)

b) When the cuboid is unfolded into a flat net, the surfaces become a plane.

In a plane, the shortest distance between two points is a straight line. Because straight line is the shortest distance on a flat surface.

c) No, the actual shortest distance remains the same if the same connected faces are unfolded correctly. Only the position of faces changes, not the real dimensions. Therefore, shortest distance does not change.

4.a) Since the solid shown is a cube, the shadow can appear as a square/rectangle depending on torch direction.

b) Yes, the shadow may change in orientation or size depending on angle of light, but for some positions it may still look square.

c) The shadow is a 2D projection of the visible face(s) of the 3D solid.

It depends on the shape of the face and direction of light.

5.a) A cone has: 1 flat face (circular base) and 1 curved face

b) The flat face of a cone is a circle.

c) Ice cream cone, Traffic cone, Party hat, Funnel

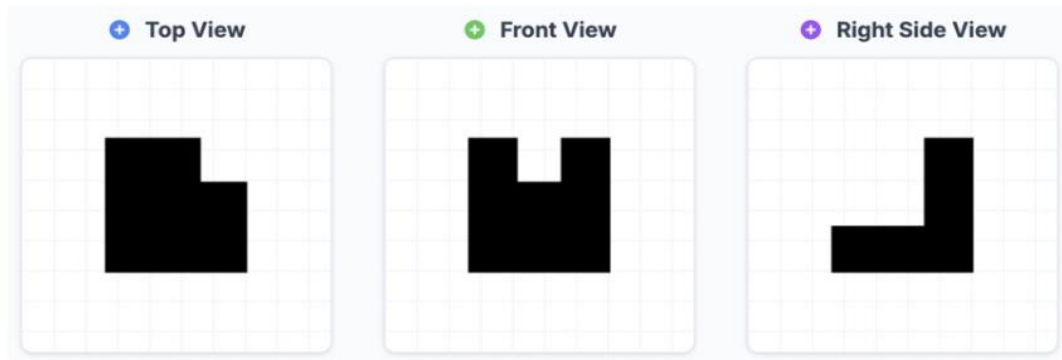
6.a) The building mostly resembles a Cuboid.

b) because they show a realistic 3D view with all dimensions together.

c) Three directions are used to represent 3D object.

Vertical lines, Left slanting lines (30°), Right slanting lines (30°)

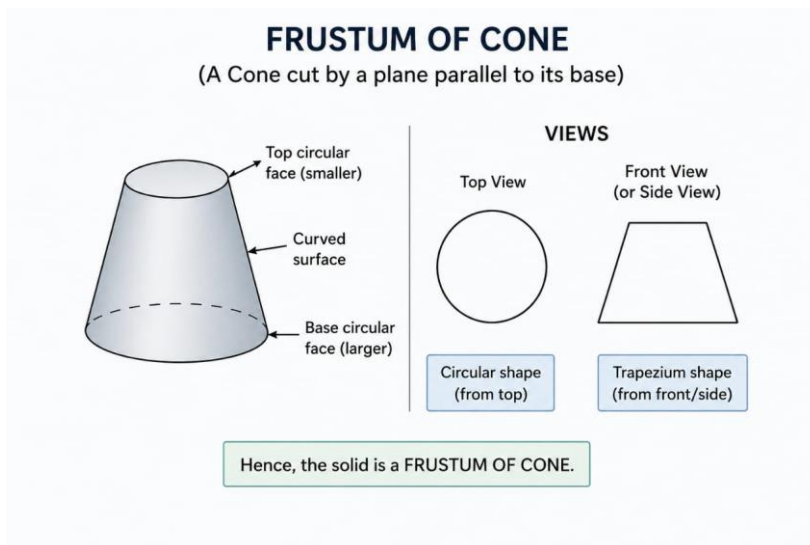
7.



8. A regular hexagon



9. A solid that looks circular from top view and trapezium from side/front view is a frustum of a cone (cut cone).



10. When folded into cube:

Top View: X, Front View: K, Side View: B

SECTION D (4 Marks)

CASE STUDY BASED QUESTIONS

Q1. PYRAMID SHAPED ROOF

An ancient monument has a roof in the shape of a square pyramid. The structure is shown below.



- (a) How many triangular faces does the roof have?
- (b) How many edges meet at the top vertex?
- (c) If the roof is opened from one edge and laid flat, how many triangles will be seen in the net?

Q2. GIFT BOX

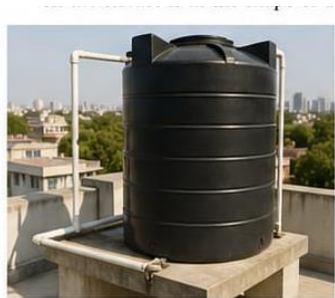
Meera receives a gift in a box shaped like a cube as shown. She wants to decorate all the faces with colorful sheets.



- (a) How many faces, edges and vertices does the box have?
- (b) How many different square sheets are needed to cover all its faces?
- (c) Meera cuts the box along one of its edges and opens it. How many squares will be in the net?
- (d) Can two different nets be made for the same cube? Explain with an example.

Q3. WATER TANK ON BUILDING

Rohan lives on the top floor of a building. The water tank on the terrace is in the shape of a cylinder.



- (a) How many flat faces and curved faces does the tank have?
- (b) What shapes are seen in the top view and front view of the tank?
- (c) Why do you think cylindrical shape is preferred for water tanks?

Q4. FRESH MILK

A milk company packs milk in tetra packs which are in the shape of a cuboid.

- (a) What is the shape of the faces of the tetra pack?
- (b) How many faces of the tetra pack are rectangles?
- (c) Can we make a closed box if any one rectangular face is missing? Why or why not?

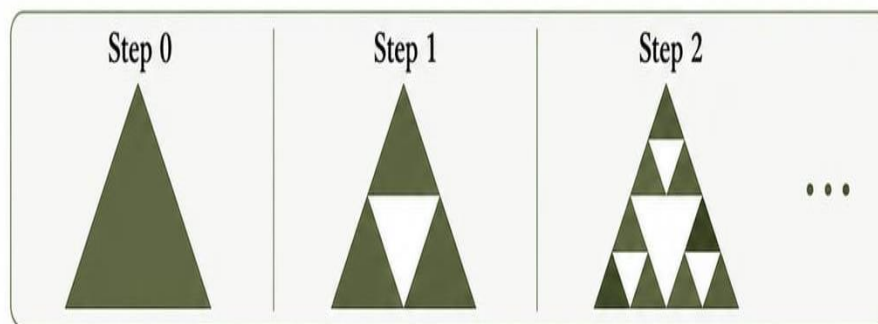


Q5. FRACTAL ART IN NATURE PARK

Riya visited a nature park where she saw a beautiful art installation based on fractals. The artist had used the pattern of the Sierpinski Triangle to design a large triangular panel.

The panel is made in steps. At Step 0, it is a solid equilateral triangle. At each step, the artist removes the inverted (upside-down) triangle from the middle of every existing triangle.

The first three steps of the design are shown in the picture.



- a) Look at the pattern carefully. How many small (dark) equilateral triangles are there in Step 2?
- b) If the artist continues the same pattern, how many small (dark) equilateral triangles will there be in Step 4?
- c) What fraction of the original triangle remains shaded (dark) in Step 2? Explain how you found it.
- D) Riya wants to make a border around the Step 2 design using a string along the outer edge of the large triangle. Will the length of the string be the same as the perimeter of the original triangle in Step 0? Give a reason for your answer

Answers:

1.a)4 b) 4 c) 4

2.a) faces=6, Edges=12, Vertices=8 b) 6 c)6 d) yes, because a cube can have 11 possible nets

3.a) flat surfaces =2, curved face=1

b) top view= circle, front view = rectangle

c)An open-ended question, it can be discussed in the class

Possible answer- The lack of sharp 90-degree corners prevents the accumulation of sediment, algae, and bacteria. Round walls are much easier to scrub and maintain for hygiene.

4. a) Rectangle b) 5 c) No

5.a) 9 b) 81 c) $\frac{9}{16}$

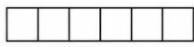
d) Yes

CLASS TEST

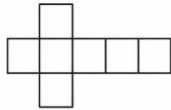
Section A (Multiple Choice Questions)

Q.1 Which of the following is the net of a cube.

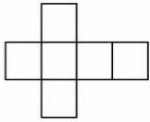
A.



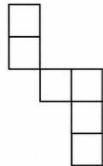
B.



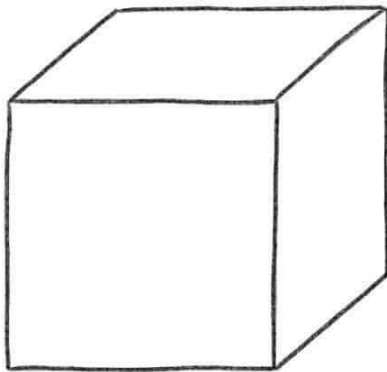
C.



D.



Q2. How many faces does the given solid have?



- a) 4 (b) 5 c) 6 (d) 8.

Q.3 Which of the following is an example of a fractal found in nature?

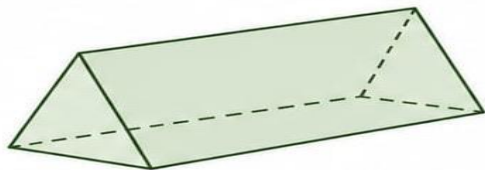
- (a) Brick wall (b) Fern leaf (c) Notebook (d) Pencil

Q.4 In the Sierpinski Carpet, the square removed in each step is the:

- (a) Corner square (b) Largest square (c) Central square (d) Outer square

SECTION-B(2 MARKS)

Q.1 The figure below shows a triangular prism.



(a) How many faces, edges and vertices does this prism have?

(b) Draw the net of this prism.

Q.2 Can two different solids have the same front view? Give an example idea.

Q.3 How many surfaces are there in 4 cones altogether?

Section C (3 marks)

Q.1 A pyramid has a hexagonal base. Find:

- (i) Number of faces
- (ii) Number of edges
- (iii) Number of vertices

Q.2 In the Sierpinski Triangle, each step divides a triangle into 4 equal parts and removes the central triangle. Find the number of triangles remaining at Step 3.

Section D (4 marks)

Q.1 Case Study : Ant and the Laddu Problem

An ant is sitting on the surface of a cuboid, and a laddu is placed on another face. The ant wants to reach the laddu using the shortest path.

Questions:

- a) What is the shortest path between two points on a plane?
- b) How can a 3D problem be converted into a 2D problem in this case?
- c) Why does unfolding the cuboid help in finding the shortest path?
- d) Does every unfolding give the shortest path? Explain.

Answers:

Section A:

- 1. (c)
- 2. (c)
- 3. (b)
- 4. (c)

Section-B

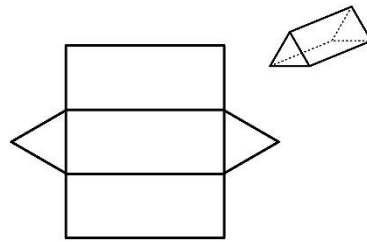
1.a)5 Faces: It has 2 triangular bases and 3 rectangular sides.

9 Edges: There are 3 edges around each triangular base (6 total) and 3 edges connecting the two bases.

6 Vertices: These are the "corners" where the edges meet (3 on each end).

b)

Triangular Prism



Faces : 5
Edges : 9
Vertices : 6

2. Yes, two different solids can have the same front view.

Solid A: A Cylinder (lying on its side).

Solid B: A Cuboid (rectangular prism).

From the front, both appear as a simple rectangle. You cannot tell that the cylinder has curved sides until you look at it from the end (the side view).

3. A cone has 2 surfaces:

1 curved surface, 1 flat circular base
So, for 4 cones there are $4 \times 2 = 8$ surfaces

Section- C

1. For an n-sided pyramid:

Faces = $n + 1$, Edges = $2n$, Vertices = $n + 1$, Here $n = 6$:

Faces = 7, Edges = 12 Vertices = 7

2. At each step, number of triangles becomes 3 times the previous step.

Step 0 = 1, Step 1 = 3, Step 2 = $3^2 = 9$ Step 3 = $3^3 = 27$

So, Triangles remaining = 27

Section D

Case Study 4: Ant and Laddu

a) A straight line

b) By unfolding the cuboid into a net

c) Because the shortest path on the surface becomes a straight line on the net

d) No, only the unfolding that gives a straight line between the points gives the shortest path.

CHAPTER 5: TALES BY DOTS & LINES

SECTION-A (1 mark Each)

Q1.The mean of two numbers is always:

- (a) greater than both numbers
- (b) less than both numbers
- (c) exactly halfway between the two numbers
- (d) equal to the larger number

Q2.The mean of a data set is 15. If every value in the data is increased by 5, what is the new mean?

- (a) 15
- (b) 10
- (c) 75
- (d) 20

Q3.The mean of a data set is 20. If every value in the data is multiplied by 3, the new mean is:

- (a) 20
- (b) 23
- (c) 60
- (d) 17

Q4.The mean of a set of data is said to be the 'centre' because:

- (a) it is always the middle-most value when data is sorted
- (b) the sum of distances of values to its left equals the sum of distances of values to its right
- (c) it is always midway between the smallest and largest value
- (d) it equals the most frequently occurring value

Q5.When a new value greater than the current mean is added to a data set, the mean:

- (a) increases
- (b) stays the same
- (c) decreases
- (d) becomes equal to the new value

Q6.To find the average family size when a frequency table is given, which formula is correct?

- (a) sum of all unique values / number of unique values
- (b) sum of (value $\times$ frequency) / total frequency
- (c) sum of all frequencies / number of values
- (d) largest value - smallest value

Q7.In a spreadsheet, which formula calculates the average of cells B2 to B10?

(a) =SUM(B2:B10)

(c) =AVERAGE(B2:B10)

(b) =MEAN(B2:B10)

(d) =AVG(B2,B10)

Q8.A line graph is most suitable for which type of data?

(a) comparing categories at one point in time

(b) showing parts of a whole

(c) visualising change over time

(d) showing frequency of individual values

Q9.The median of the data 3, 5, 7, 9, 11 is:

(a) 5

(c) 9

(b) 7

(d) 3

Q10.When a value equal to the mean is added to a data set, what happens to the mean?

(a) the mean remains unchanged

(b) the mean decreases

(c) the mean increases

(d) cannot be determined

ANSWER KEY & EXPLANATIONS — Section A

Q1. Answer: (c) The mean of two numbers is exactly halfway between them. For example, mean of 3 and 7 = $(3+7)/2 = 5$, which is halfway between 3 and 7.

Q2. Answer: (d) When a fixed number k is added to every value, the mean also increases by k .
New mean = $15 + 5 = 20$.

Q3. Answer: (c) When every value is multiplied by a fixed number k , the new mean = $k \times$ old mean = $3 \times 20 = 60$.

Q4. Answer: (b) The mean is the unique point where the total distances from values on the left equal the total distances from values on the right — making it the true 'centre' of data.

Q5. Answer: (a) Adding a value greater than the current mean shifts the balance to the right, so the mean increases to maintain balance.

Q6. Answer: (b) With a frequency table, each value must be multiplied by its frequency. Average = $\text{Sum}(\text{value} \times \text{frequency}) / \text{Total frequency}$.

Q7. Answer: (c) In spreadsheets (Excel, Google Sheets, LibreOffice Calc), the =AVERAGE() function computes the arithmetic mean of a range.

Q8. Answer: (c) Line graphs connect data points with line segments and are ideal for showing trends and changes over time (e.g., monthly temperature).

Q9. Answer: (b) Data is already sorted. 5 values, so median is the 3rd value = 7.

Q10. Answer: (a) Adding a value equal to the mean does not disturb the balance, so the mean remains unchanged.

SECTION-B (2- Marks Each)

Q11. During a cricket match, four players scored 50, 60, 70, and 80 runs. Find the mean (average) score and identify which players scored above the average.

Q12. In a school canteen, 4 students bought 2, 4, 6, and 8 apples respectively. If another student buys 20 apples, find the mean number of apples before and after, and state how the mean changes.

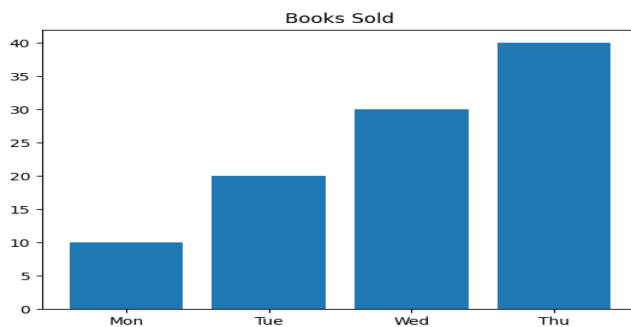
Q13. In a frequency table, the number 5 appears 4 times, the number 8 appears 3 times, and the number 10 appears 2 times. Calculate the mean.

Q14. Riya runs a small book stall.

The bar graph below shows the number of books sold over 4 days.

(a) Find the average number of books sold on a day.

(b) On which days did she sell above average?



Q15. In a spreadsheet, a student's marks in 6 subjects are stored in cells B3 to G3. Write the formula to find:

- (i) Total marks
- (ii) Average marks.

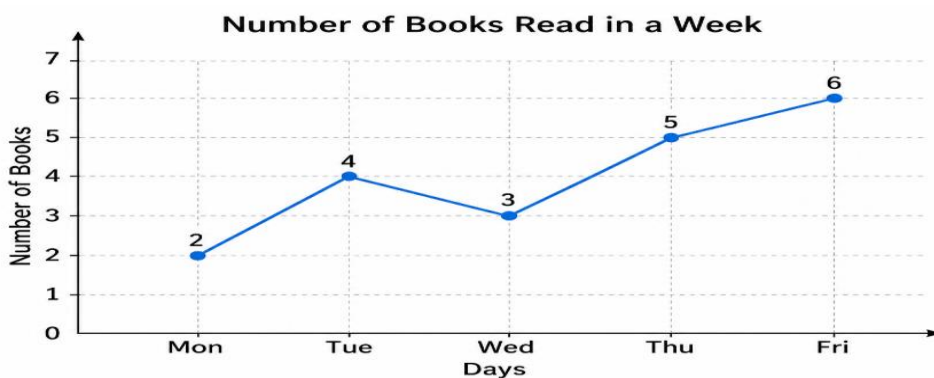
Q 16. A farmer records the average grain yield per acre as 45.5 kg. Later, he finds that one field's yield was recorded as 6 kg more than the actual. If there are 10 fields, find the correct average

Q17. Consider the data: 4, 6, 8, 10, 12. Verify that the sum of distances from the mean to values below it equals the sum of distances to values above it.

Q18. The median of a data set of 5 numbers is 13. Two new numbers, both equal to 13, are added. What is the new median? Give a reason.

Q19. Number of students who brought chocolates on different days are 8, 13, 10, 4, 5, 20, y , 10. The mean of the number of chocolates is 10.375. Find the value of y .

Q20. The following line graph shows the number of books read by a student over five days. Find the total number of books read and identify the day with the highest reading.



ANSWEY KEY(SECTION-B)

Solution 11.

Mean score

$$= (50 + 60 + 70 + 80) \div 4$$

$$= 260 \div 4$$

$$= 65 \text{ runs}$$

Players scoring above average (65 runs):

70 runs and 80 runs

Solution 12.

Initial mean

$$= (2 + 4 + 6 + 8) \div 4$$

$$= 20 \div 4$$

$$= 5 \text{ apples}$$

New mean (after adding one more student with 20 apples)
 $= (2 + 4 + 6 + 8 + 20) \div 5$
 $= 40 \div 5$
 $= 8$ apples

Change in mean:

Mean increases from 5 to 8 apples (an increase of 3 apples).

Solution 13:

$$\text{Sum} = (5 \times 4) + (8 \times 3) + (10 \times 2) = 20 + 24 + 20 = 64$$

$$\text{Total frequency} = 4 + 3 + 2 = 9$$

$$\text{Mean} = 64 / 9 \approx 7.11$$

So, Mean ≈ 7.11

Solution 14.

(a) $\text{Mean} = (10 + 20 + 30 + 40) / 4 = 25$

(b) Days above mean: Wed, Thu

Solution 15.

(i) Total marks formula: $=\text{SUM}(B3:G3)$

(ii) Average marks formula: $=\text{AVERAGE}(B3:G3)$

Solution 16:

Step 1: Total (incorrect) yield $= 45.5 \times 10 = 455$ kg

Step 2: Correct total $= 455 - 6 = 449$ kg

Step 3: Correct average $= 449 / 10 = 44.9$ kg

Correct average $= 44.9$ kg

Solution 17:

Step 1: $\text{Mean} = (4 + 6 + 8 + 10 + 12) / 5 = 40 / 5 = 8$

Step 2: Distances below mean: $4 + 2 = 6$

Step 3: Distances above mean: $2 + 4 = 6$

Verified: $\text{LHS} = \text{RHS} = 6$. Mean acts as the balancing centre.

Solution 18:

Original: 5 numbers with median = 13 (middle value = 13)

After adding: Two values of 13 are inserted. New data has 7 values.

New median: The 4th value in sorted order. Since 13 was already the middle and we're adding equal values, 13 remains the middle.

New median = 13 (unchanged). Adding values equal to the median does not change it.

Solution 19:

Mean = 10.375, Number of values = 8

Total sum = $10.375 \times 8 = 83$

Sum of known numbers = $8 + 13 + 10 + 4 + 5 + 20 + 10 = 70$

$y = 83 - 70 = 13$

Answer: $y = 13$

Solution 20:

Total books = $2 + 4 + 3 + 5 + 6 = 20$ books

Highest reading = **6 books on Friday**

SECTION- C (3-MARKS EACH)

Question 21. During a Test cricket match, the scorecard of the Indian Men's Cricket team is given below:

Player	Rohit	Virat	Rahul	Hardik	Jadeja	Gill	Ishan	Washington	Shami	Bumrah	Siraj
Runs Scored	50	60	70	80	40	55	65	75	20	15	10

a) Find the mean runs scored by the team players. (2 marks)

b) Name the players who scored above the average runs. (1 mark)

Question 22. The number of customers visiting a bakery during a week is given below:

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of Customers	25	30	28	35	40	50	45

(a) Draw a **line graph** to represent the data (2 marks)

(b) What is the increase in customers from Monday to Saturday? (1 mark)

Question 23: A teacher recorded the marks of five students as 20, 30, 40, 50, 60. Later, it was discovered that the first mark should have been 30 instead of 20, and the last mark should have been 50 instead of 60. Without changing the total marks, analyse whether the mean and median of the data will change after correction. Justify your answer with calculations.

Question 24. The daily sales (in items) of seven shops were recorded as 10, 20, 30, 40, 50, 60, 70. Later, it was found that the sales of one shop recorded as 40 should actually be 80. Find the changed median after correction. Also, compare it with the original value.

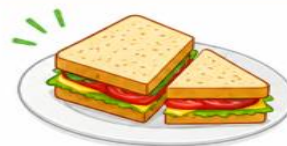
Question 25. A school canteen recorded the number of sandwiches sold in seven days. The owner forgot one value of Wednesday.

Sales Record



SCHOOL CANTEEN

A school canteen recorded the number of sandwiches sold in seven days. One value is missing.



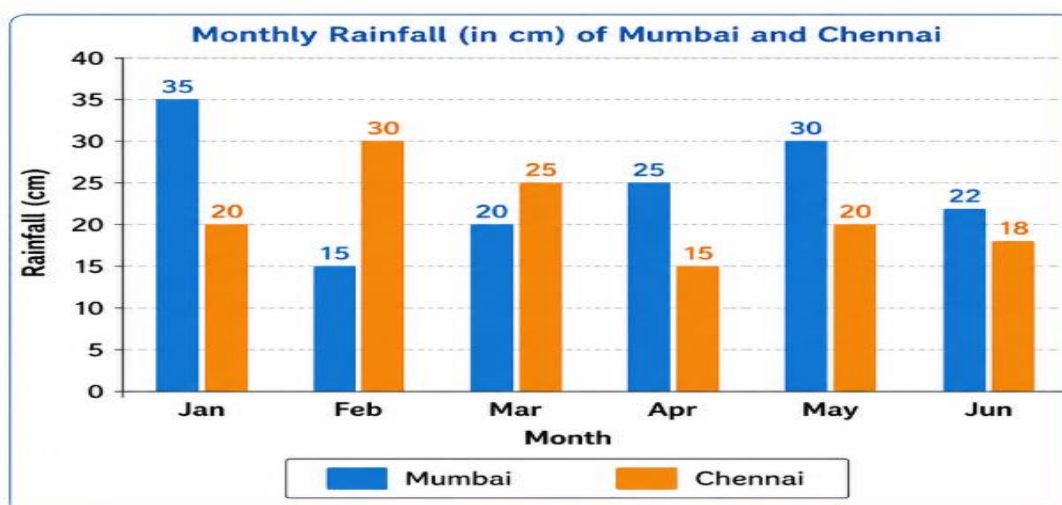
SALES RECORD

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Sandwiches Sold	12	18	?	24	30	36	42

He said that the **mean** number of sandwiches sold is **27**.

Find the number of sandwiches sold on Wednesday and explain your reasoning.

Question 26. The double bar graph below shows the monthly rainfall (in cm) of two Indian cities, Mumbai and Chennai, during six months of one year. Study the graph carefully.



Note: 1 cm = 10 millimetres of rainfall.

- Convert the above double bar graph into a **line graph** using the same data. (2 mark)
- If Mumbai receives **5 cm more rainfall in February**, compare it with Chennai's rainfall in the same month. Which city will have more rainfall and by how much?(1m)

Question 27.

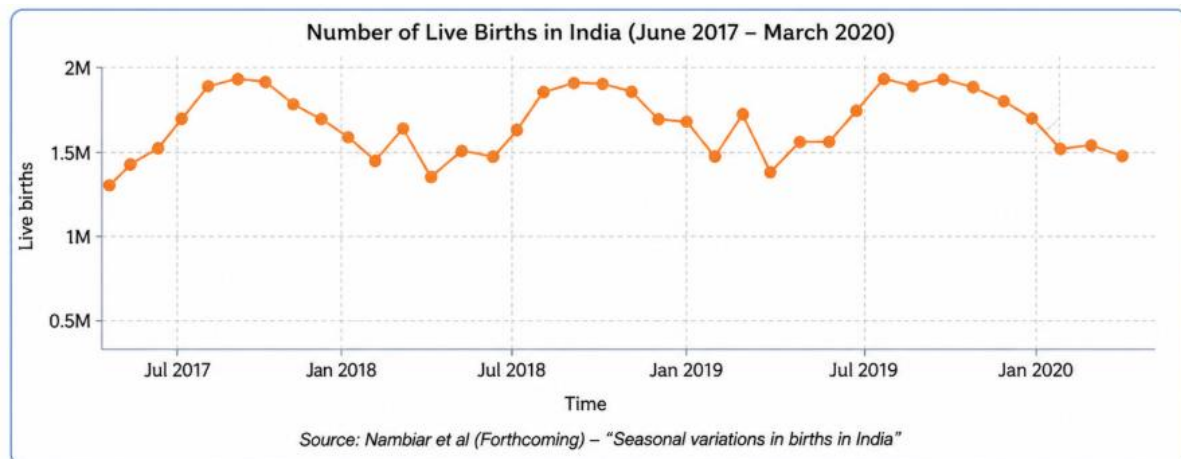
A city bus travels through several stops every morning. The conductor recorded the number of passengers boarding the bus at different stops during one trip. At some stops, 8 passengers boarded, at some stops 10 passengers boarded, and at a few stops 12 passengers boarded. The data is shown below:

Passengers Boarding at Each Stop	Number of Stops
8	3
10	5
12	2

Using the above information, find the average number of passengers boarding per stop. Also, state whether the bus became more crowded during the later stops.

Question 28

Study the line graph showing the monthly number of live births in India from June 2017 to March 2020 and answer the following questions.

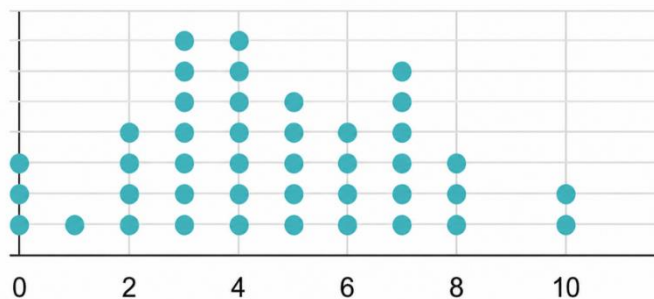


A researcher observed that the number of live births changed during different months. Based on the graph,

- (i) What was the approximate number of births in July 2017?
- (ii) What time period does the graph capture?
- (iii) Estimate the number of births in the month of March 2019.

Question 29.

A teacher collected data on how often students used their bicycles over the course of a week and displayed it in a dot plot. According to the chart, four students rode their bicycles twice during that week.



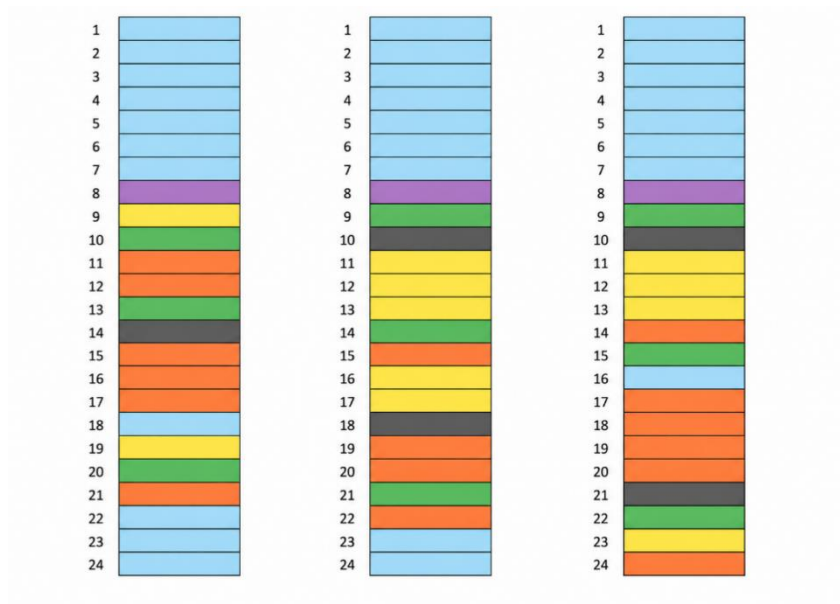
- (i) Find the average number of times students rode their cycles.
- (ii) Find the median number of times students rode their cycles.
- (iii) Which of the following statements are valid? Why?
 - (a) Everyone used their cycle at least once.
 - (b) Almost everyone used their cycle a few times.
 - (c) Some students cycled more than once on some days.
 - (d) Exactly 5 students have used their cycles more than once on some days

Question 30.

Rehman Shas an interesting hobby. He makes notes of what he does throughout the day. He records his activities by colouring a strip of paper with 48 boxes, marking time in 30-minute intervals from midnight to midnight. He has recorded six types of activities for three different days of the week on three coloured strips, shown to the right.

- (i) Sleeping
- (ii) Eating
- (iii) Meeting friends, hobbies, media, and time with family
- (iv) Attending classes, studying and homework
- (v) Showering and getting dressed, yoga or exercise
- (vi) Travelling

Observe the given activity strips carefully (shown below). Each strip represents one full day divided into 30-minute intervals. Different colours represent different activities.



Answer the following:

- (a) Identify the time interval during which Rehman is most likely attending school. (1 mark)
- (b) Which activity occupies the maximum time in a day? Justify your answer. (1 mark)
- (c) Compare any two days and state one similarity in Rehman's routine. (1 mark)

Solution Section- C

Solution 21:

- (a) Total runs scored

$$= 50 + 60 + 70 + 80 + 40 + 55 + 65 + 75 + 20 + 15 + 10 = 540$$

Number of players = 11

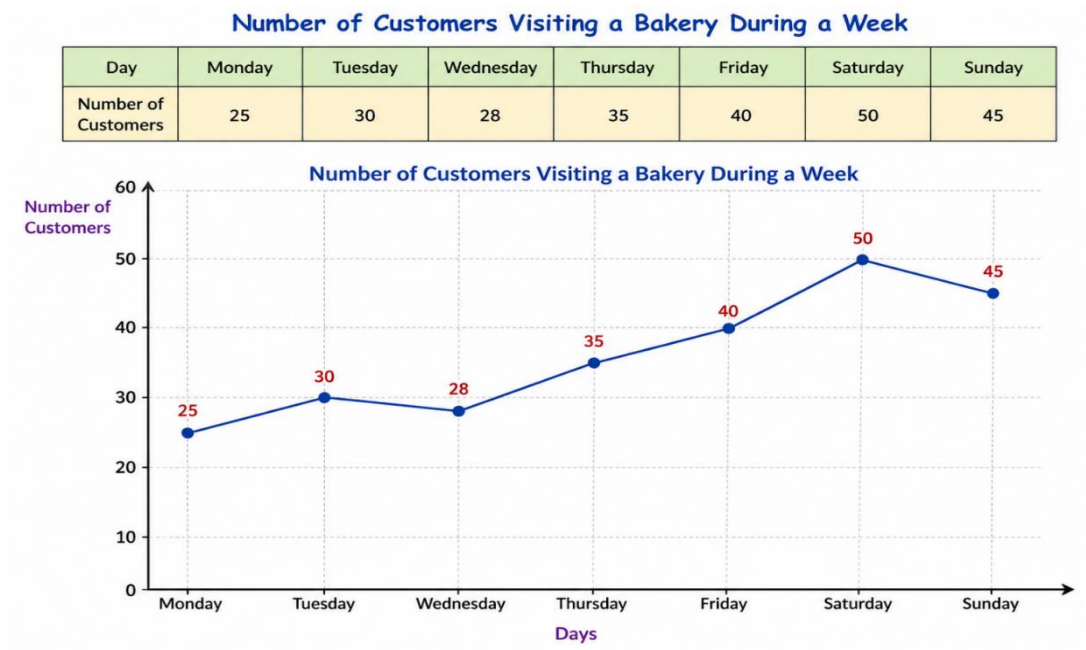
Mean runs scored = Total runs $\div$ Number of players

$$= 540 \div 11$$

$$= 49.09 \text{ (approx.)}$$

(b) Players scoring above average (49.09):
 Rohit, Virat, Rahul, Hardik, Gill, Ishan, Washington

Solution 22:



a)

b) Increase from Monday to Saturday
 $= 50 - 25$
 $= 25$ customers

Solution 23:

Original Data:

20, 30, 40, 50, 60

Mean $= (20 + 30 + 40 + 50 + 60) \div 5$
 $= 200 \div 5 = 40$

Median = Middle value = 40

Corrected Data:

30, 30, 40, 50, 50

Mean $= (30 + 30 + 40 + 50 + 50) \div 5$
 $= 200 \div 5 = 40$

Median = Middle value = 40

Solution 24:

Original Data:

10, 20, 30, 40, 50, 60, 70

Median = Middle value = 40

Corrected Data:

10, 20, 30, 50, 60, 70, 80

Median = Middle value = 50

Changed Value:

- Changed Median = 50

Comparison:

The median changes from 40 to 50 after correction.

Solution 25:

Given data:

12, 18, x, 24, 30, 36, 42

Mean = 27

Number of values = 7

Total sum = Mean $\times$ Number of values
 $= 27 \times 7 = 189$

Sum of known values:

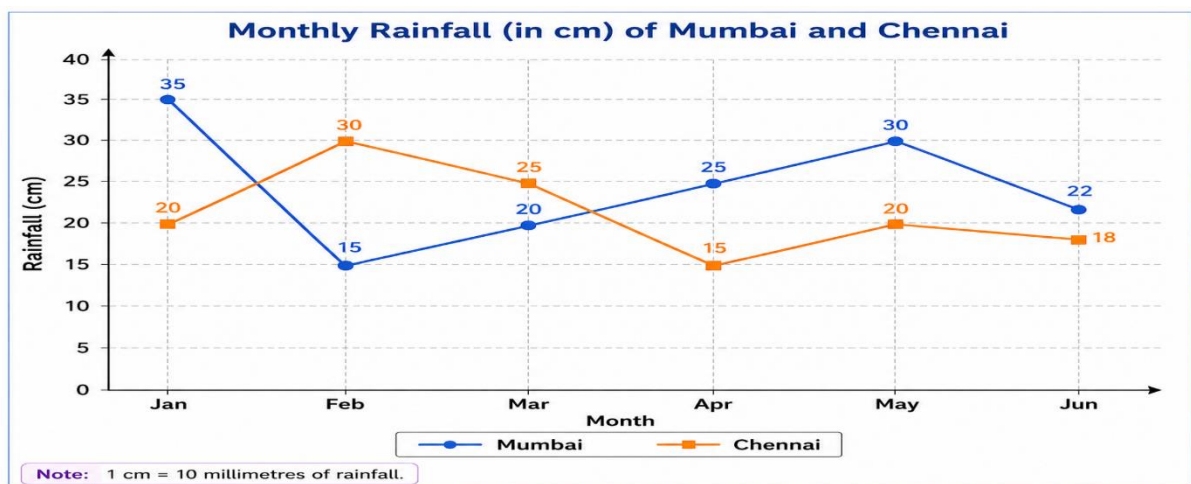
$12 + 18 + 24 + 30 + 36 + 42 = 162$

So,

$x = 189 - 162 = 27$

So, the number of sandwiches sold on Wednesday, $x = 27$

Solution 26:



(b) Rainfall in February:

- Mumbai = 15 cm
- Chennai = 30 cm

If Mumbai receives 5 cm more, then:

New rainfall of Mumbai = $15 + 5 = 20$ cm

Comparison:

- Chennai = 30 cm
- Mumbai = 20 cm

So, Chennai will still have more rainfall by 10 cm.

Solution 27:

Total passengers boarded
 $= (8 \times 3) + (10 \times 5) + (12 \times 2)$
 $= 24 + 50 + 24$
 $= 98$

Total stops
 $= 3 + 5 + 2 = 10$

Average passengers per stop
 $= 98 \div 10 = 9.8$ passengers

Since higher numbers of passengers boarded at later stops, the bus became more crowded during later stops.

Solution 28:

- (i) 1.75 million
- (ii) April 2017 to April 2020
- (iii) 1.75 million

Solution 29:

(i) Mean (Average)

Total number of students = 42

Sum of $(x \times f) = 193$

Mean = $193 / 42 = 4.6$ (approx.)

So, Mean ≈ 4.6

(ii) Median

Total observations = 42

Median position = $(42 + 1) / 2 = 21.5$

So, the median is the average of the 21st and 22nd values.

Cumulative frequencies:

Up to 3 $\rightarrow 15$

Up to 4 $\rightarrow 22$

Thus, the 21st and 22nd values are both 4.

So, Median = 4

(iii) Valid Statements

(a) Everyone used their cycle at least once. — False

(b) Almost everyone used their cycle a few times. — True

(c) Some students cycled more than once on some days. — False

(d) Exactly 5 students have used their cycles more than once on some days. — False

Final Answers:

Mean ≈ 4.6

Median = 4

Valid statement: (b) only

Solution 30:

(a) Manoj is most likely attending school between 8:00 AM and 2:00 PM, as this period shows a continuous block of the same colour representing study/school-related activity.

(b) The activity occupying the maximum time is sleeping, as it covers the longest continuous stretch (night hours) in all three strips.

(c) A similarity between any two days is that sleeping occurs during the night hours in all strips, showing a consistent daily routine.

SECTION D — CASE STUDY BASED QUESTIONS [5 × 4 = 20 MARKS]

Q31. Case Study 1: The Coconut Farm Venkayya owns a coconut farm with 15 trees. He calculates the average harvest per tree as 25.6 coconuts. His son later checks the records and finds that one tree's count was recorded as 3 more than the actual yield. He also finds a second error: another tree's count was recorded as 5 less than the actual yield.

(i) What was the total number of coconuts recorded initially? (1 mark)

(ii) Accounting for both errors, what is the corrected total? What is the correct average?
(2 mark)

(iii) By how much did the incorrect recording change the mean compared to the correct mean? S(1 mark)

Q32. Case Study 2: The Class Height Problem

Sudhakar asks Shreyas to measure the heights of all 24 students and calculate the average. Shreyas reports an average height of 150.2 cm. Sudhakar then notices that students were wearing uniform shoes that added 1 cm to each student's height. Two new students, with heights of 149 cm and 152 cm (barefoot), then join the class.



(i) What is the correct average height of the original 24 students (without shoes)? (2 mark)

(ii) The two new students join. What is the new total height? What is the new average for 26 students? (1 mark)

(iii) A student claims: 'Since one new student is shorter than the average and one is taller, the mean will stay the same.' Is this correct? Explain. (1 mark)

Q33. Case Study 3: Spreadsheet Marks Analysis

Sudhakar enters his Grade 8 students' mid-term marks in a spreadsheet. Row 1 is the header. Students' names are in column A (rows 2 onwards). Subject marks are in columns B (Odia), C (Telugu), D (English), E (Maths), F (Social Science), and G (Science). Total marks are in column H.

Nagesh's marks appear in row 3.

	A	B	C	D	E	F	G	H
1	Name	Odia(R1)	Telugu(R2)	English(R3)	Maths	Social	Science	Total
2	Ratna	25	39	29	36	34	37	
3	Nagesh	41	43	48	39	40	39	
4	Ashwin	29	31	33	34	30	28	
5	Farooq	47	46	38	42	49	44	
6	Mrinal	33	35	28	32	30	36	
7	Gowri	27	29	34	31	32	30	
8	Pankaj	16	19	22	17	18	20	

- Nagesh scored: Odia 41, Telugu 43, English 48, Maths 39, Social Science 40, Science 39. Which cell contains his Maths score? Write the formula to compute his total marks in cell H3. (2 mark)
- Write a formula to find the class average in Maths if there are 22 students (rows 2 to 23). (1 mark)
- What is the benefit of using a spreadsheet formula over manual calculation for large data sets? (1 mark)

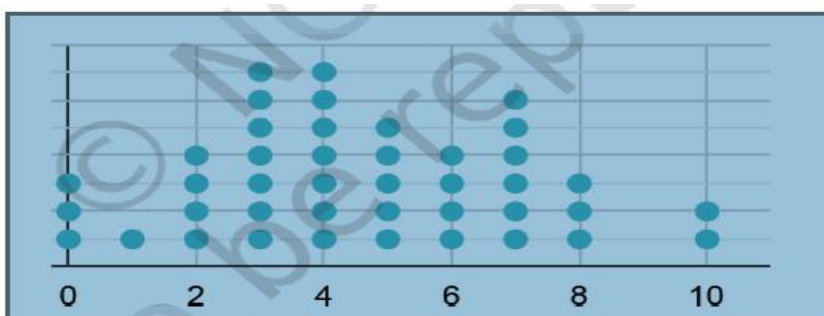
Q34.Case Study 4: Financial awareness

Five colleagues working in a company decide to track their monthly savings to improve their financial planning. Their savings (in ₹) for a particular month are: 100, 200, 300, 400, 500

- Calculate the mean and median of their savings. (1 mark)
- Next month, one of the colleagues whose savings is maximum receives a bonus and increases his savings to ₹2500. Find the new mean of the savings. (2 mark)
- If next year everyone's savings doubled the current savings, then how would it affect the mean savings?(1 mark)

Q35.Case Study 5: HEALTH IS WEALTH

The number of times students rode their cycles in a week is shown in the dot plot below. Four students rode their cycles twice in that week.



- Find the average number of times students rode their cycles. (2 mark)
- Find the median number of times students rode their cycles. (1 mark)
- If everyone cycles 1 more time then previous week. Then find the new average number of times they rode cycle. (1 mark)

ANSWER KEY OF CASE BASD QUESTIONS:

Q31. Case Study 1 Solutions:

- (i) Initial total = $25.6 \times 15 = 384$ coconuts
- (ii) Error 1: One tree over-counted by 3 $\rightarrow$ subtract 3. Error 2: One tree under-counted by 5 $\rightarrow$ add 5. Net correction = $-3 + 5 = +2$. Corrected total = $384 + 2 = 386$. Correct average = $386/15 \approx 25.73$ coconuts.
- (iii) Difference in mean: $25.73 - 25.6 = 0.13$ coconuts. The incorrect recording understated the mean by 0.13.

Q32. Case Study 2 Solutions:

- (i) Correct average (24 students): $150.2 - 1 = 149.2$ cm
- (ii) Correct total for 24 students: $149.2 \times 24 = 3580.8$ cm. Add new students: $3580.8 + 149 + 152 = 3881.8$. New average = $3881.8 / 26 \approx 149.30$ cm
- (iii) The claim is INCORRECT. One student (149 cm) is below the mean (149.2) and one (152 cm) is above. But for the mean to stay the same, both new values would need to average to exactly 149.2. Their average = $(149+152)/2 = 150.5 \neq 149.2$. Since $150.5 > 149.2$, the mean will slightly increase.

Q33. Case Study 3 Solutions:

- (i) Nagesh's Maths score is in cell E3. Formula for total in H3: $=\text{SUM}(B3:G3)$. This gives $41+43+48+39+40+39 = 250$.
- (ii) Class average in Maths: $=\text{AVERAGE}(E2:E23)$. This formula should be placed in row 24 (after the last student in row 23).
- (iii) Benefit: Spreadsheet formulas automatically recalculate when data changes, prevent arithmetic errors, and compute results for large data sets instantly — saving time and improving accuracy.

Q34. Case study 4 solutions:

- i) Mean = $\frac{100+200+300+400+500}{5} = \frac{1500}{5} = 300$, Median = 300
- (ii) New Mean = $100+200+300+400+2500/5=700$
- (iii) The mean savings will be doubled, i.e., 600 rupees.

Q35. Case study 5 solutions:

- (i) the average number of times students rode their cycles = $193/42=4.59$
- (ii) the median number of times students rode their cycles = average of 21st and 22nd observation = 4
- (iii) new average = previous avg + 1 = $4.59+1= 5.59$

CLASS TEST

SECTION A (1 MARKS EACH)

1. "In a spreadsheet, which formula would you use to calculate the sum of the values in cells B3 through G3?"

(A) =AVERAGE(B3:G3)

(B) =TOTAL(B3-G3)

(C) =ADD(B3:G3)

(D) =SUM(B3:G3)

2. When frequencies are given, mean is calculated by:

A) Ignoring frequency

B) Adding only values

C) Multiplying values by frequency and dividing by total frequency

D) Taking median

3. A dataset has a mean of 12. A new value 18 is added. What will happen to the mean?

A) Decrease

B) Remain same

C) Increase

D) Become zero

4. Assertion (A): Adding a value greater than the mean increases the mean.

Reason (R): The mean adjusts to maintain balance between values on both sides.

A) Both A and R are true, and R is the correct explanation

B) Both A and R are true, but R is not the correct explanation

C) A is true, but R is false

D) A is false, but R is true

SECTION B (2 marks question)

5. A teacher recorded the marks of 5 students in a test and found that the average (mean) marks were 24. Later, she realized that one student's marks (30) were mistakenly included and should be removed from the record.

(i) Find the total marks of all 5 students initially.

(ii) Find the new total marks after removing the incorrect entry.

6. The following data is given:

Value	2	4	6	8
Frequency	2	3	4	1

(i) Find the total number of observations.

(ii) Find the median

7. After checking the test papers, a teacher realizes that one question was wrongly evaluated. To correct this, she decides to add 5 marks to every student's score. Earlier, the average (mean)

marks of the class were 40. What will be the new average (mean) marks of the class after adding 5 marks to each student?

SECTION C (3 marks question):

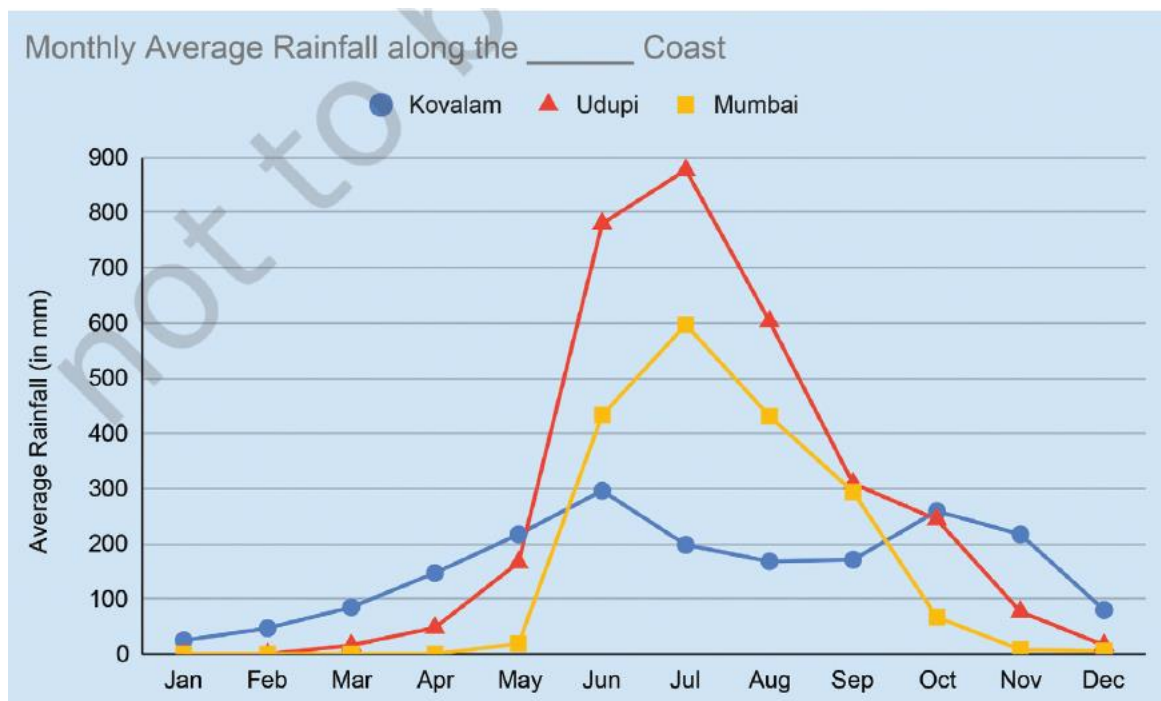
8. Ramesh keeps a record of the daily milk collection from 12 cows on his farm. He calculates the average milk collected per cow as 18.5 litres. Later, he realises that the milk recorded for one cow was 4 litres more than the actual amount.

- (i) Find the total milk collected according to the incorrect record.
- (ii) Find the correct total milk collected.
- (iii) Calculate the correct average milk collected per cow.

9. The mean of the numbers 8, 13, 10, 4, 5, 20, y , 10 is 10.375. Find the value of y .

Case study-based (4 marks question):

10. The graph shows the monthly average rainfall (in mm) for three coastal cities—Kovalam, Udupi, and Mumbai—over a year.



- (i) Which city receives the highest rainfall in July?
- (ii) Identify the month when Mumbai records its peak rainfall.
- (iii) Compare the rainfall pattern of Udupi and Kovalam during June to August.
- (iv) What general conclusion can you draw about rainfall along this coast during the monsoon months?

ANSWERS

1. D

2. C

3. C

4. A

5.(i) 120

(ii) 90

6.(i) 10

(ii) 5

7.45

8.(i) 222 litres

(ii) 218 litres

(iii) 18.17 litres

9.13

10.(i) Mumbai

(ii) July

(iii) Udupi > Kovalam; both rise June–July, slight fall in August

(iv) Heavy rainfall during monsoon (June–August), peak in July

CHAPTER 6: ALGEBRA PLAY

1 MARK QUESTION

Q1. A zoo sold **120 tickets** in total. An adult ticket cost ₹100 each, and a child ticket cost ₹60 each. The total collection was ₹9600. How many adults have purchased tickets for visiting zoo?

- a. 40 b. 50 c. 60 d. 70

Q2. A tank can hold **300 litres** of water. Pipe A fills **x litres/hour**, and Pipe B fills **twice as much**. If both pipes run together, they fill the tank in **10 hours**.

What is the value of x ?

- a. 10 b. 20 c. 30 d. 40

Q3 A coach schedules **x overs of practice** for one player. Another player practices **twice as many overs**. If the second player gives **6 overs** to the first, they end up with equal overs. How many overs did the first player originally have?

- a. 6 b. 9 c. 12 d. 15

Q4. A locker code is a **two-digit number**. The sum of its digits is 12. If the digits are reversed, the new number is **36 less** than the original. What is the original number?

- a. 57 b. 75 c. 84 d. 48

Q5. Riya goes to a grocery store. Apples cost ₹30 per kg. Bananas cost ₹20 per dozen. She buys x kg of apples and y dozens of bananas. Write the algebraic expression for the total cost.

- a. $30y+20x$ b. $30y-20x$ c. $20y+30x$ d. $30x+20y$

Q6. In a cricket match, Rohit scores run by hitting fours and sixes. Each four gives 4 runs. Each six gives 6 runs. If he hits x fours and y sixes, then the expression for his total score is

- a. $3y + 2x$ b. $4y - 6x$ c. $20y + 30x$ d. $4x + 6y$

Q7. A taxi charges ₹15 per km for the first 10 km and ₹12 per km afterwards. A passenger travels x km beyond the 10 km. If the total fare is ₹180, find x .

- a. 5km b. 3km c. 2.5km d. 4km

Q8. A shopkeeper arranges fruits in a pyramid. Bottom row has baskets with x, y, z apples. Each upper basket contains the sum of apples in the two baskets below.

How many apples are in the top basket?

- (a) $x + y + z$ (b) $x + 2y + z$ (c) $2x + 2y + 2z$ (d) $x + y + z + xy$

Q9. **Assertion (A):** In a classroom pyramid, bottom row marks are p, q, r . If each upper block is the product of two below, the top block is pqr .

Reason (R): Because $(pq)(qr) = pqr^2$.

- (a) Both A and R true, R correct explanation
 (b) Both A and R true, R not correct explanation
 (c) A true, R false
 (d) Both A & R are false

Q10. A bus ticket has a two-digit number. If the digits are reversed then their difference is divisible by _____ numbers .

- (a) 3 (b) 9 (c) both (a) and (b) (d) 11

1 MARK QUESTION SOLUTION

SOLUTION 1: (c). 60

SOLUTION 2 : (a).10

SOLUTION 3 : (c).12

SOLUTION 4 : (c).84

SOLUTION 5 : (d). $30x+20y$

SOLUTION 6 : (d). $4x+6y$

SOLUTION 7 : (c). 2.5km

SOLUTION 8 : (b) $x + 2y + z$

SOLUTION 9 : (d) Both A & R are False

SOLUTION 10 : (c) both (a) and (b)

2 MARKS QUESTION

QUESTION 1:

A shopkeeper has three price tags: ₹1, ₹2, and ₹7. He wants to bundle two items together (one as a single item, one as a pair) and multiply their prices to advertise the “combo value.” How should he arrange the digits to maximize the combo value?

QUESTION 2:

A company prints product codes by multiplying a 2-digit batch number with a 1-digit category number. The digits available are 1, 3, and 7. Which arrangement gives the highest product code?

QUESTION 3:

On the given calendar of August 2025, prepare a 2 x 2 calendar grid whose sum of dates is 84 and hence find days also.

August 2025						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

QUESTION 4:

On the given calendar of August 2025, prepare 3x3 calendar grid whose sum of dates is 99 and find days also.

QUESTION 5:

In the following grid, shapes represent numbers. In each row, the last column is the sum of the values to its left. How do you find the values of the shapes?

(a)

			27
			19

(b)

			18
			15

QUESTION 6:

A bank using digits 2, 3, 5 for security code for a customer's locker in the bank

Find the answer of the following problems:

- (a) Find the multiplier to get the largest product as the security code.
- (b) Find the security code of the customer locker.

QUESTION 7:

A teacher is 5 times older than her student. After 6 years, she will be 3 times the student's age. Find the student's present age.

QUESTION 8:

Suraj runs a small chaat stall and his expenses are as follows:

Rent for the chaat stall is Rs. 1000 per day.

The cost of making one plate of chaat (including all the ingredients and fuel) is Rs20.

- a) If he can sell 100 plates of chaat a day, what should be the selling price of his chaat to make a profit of `Rs 2000?
- b) If his customers are willing to pay only `Rs 60 for a plate of chaat, how many plates of chaat should he aims to sell in a day to make a profit of `Rs2000?

QUESTION 9:

A tank is filled by two pipes. Pipe A fills at 5 litres per minute. Pipe B fills at 8 litres per minute. If Pipe A runs for **x minutes** and Pipe B for **y minutes**,

- (a) Write the expression for total water filled.
- (b) If the tank capacity is 200 litres, form the equation and find possible values of x and y.

QUESTION 10:

A cinema hall sells tickets: Balcony ticket = ₹120, Regular ticket = ₹80. If **x balcony tickets** and **y regular tickets** are sold,

(a) Write the expression for total revenue.

(b) If the hall collects ₹4000, form the equation and find possible values of x and y.

2 MARKS QUESTION SOLUTION

SOLUTION 1:

₹21 × 7 = ₹147, (the largest combo value.)

SOLUTION 2:

Batch = 31, Category = 7 → Code = 217.

SOLUTION 3:

A 2×2 grid on a calendar looks like this:

$$\begin{array}{cc} a & a + 1 \\ a + 7 & a + 8 \end{array}$$

$$\text{Sum} = a + (a + 1) + (a + 7) + (a + 8)$$

$$= 4a + 16$$

$$4a + 16 = 84$$

$$4a = 84 - 16 = 68$$

$$a = \frac{68}{4} = 17$$

The 2×2 grid dates:

$$\begin{array}{cc} 17 & 18 \\ 24 & 25 \end{array}$$

August 1, 2025 = Friday, So:

17 → Sunday, 18 → Monday, 24 → Sunday, 25 → Monday

SOLUTION 4:

A 3×3 block on a calendar looks like:

$$\begin{array}{ccc} a & a + 1 & a + 2 \\ a + 7 & a + 8 & a + 9 \\ a + 14 & a + 15 & a + 16 \end{array}$$

$$\text{Sum} = (a + (a + 1) + (a + 2)) + (a + 7 + a + 8 + a + 9) + (a + 14 + a + 15 + a + 16)$$

$$= 9a + (1 + 2 + 7 + 8 + 9 + 14 + 15 + 16)$$

$$= 9a + 72 = 99 \Rightarrow a = 3$$

the 3×3 grid dates

$$\begin{array}{ccc} 3 & 4 & 5 \\ 10 & 11 & 12 \\ 17 & 18 & 19 \end{array}$$

Dates are 3 → Sunday, 4 → Monday, 5 → Tuesday, 10 → Sunday, 11 → Monday, 12 → Tuesday, 17 → Sunday, 18 → Monday, 19 → Tuesday

SOLUTION 5:

Each **shape** represents a number.

In each row, the **last column** is the **sum of the values to its left**.

So: Top row: (Blue square + Blue square + Blue square) = 27, Bottom row: (Red circle + Red circle + Blue square) = 19

Let: Blue square = x and Red circle = y

Equations:

$$1. \quad x + x + x = 27$$

$$2. \quad y + y + x = 19$$

From the above we get

$$1. \quad 3x = 27 \Rightarrow x = 9$$

$$2. \quad 2y + x = 19$$

Substitute $x = 9$:

$$2y + 9 = 19$$

$$2y = 10$$

$$y = 5$$

Final Values

Blue square = **9**

Red circle = **5**

Solve as above, we get the final values

Blue circle = **4** , Purple diamond = **7**

SOLUTION 6:

(a) Multiplier arrangement: 32×5 , 5 is the required multiplier.

(b) Security code (largest product): 160

SOLUTION 7:

Let the student's current age = x . Then the teacher's current age = $5x$.

6 year's later, Student's age = $x + 6$

Teacher's age = $5x + 6$

Condition: $5x + 6 = 3(x + 6)$

Solve we get $x=6$

The student's current age is **6 years**.

The teacher's current age is **30 years**.

SOLUTION 8:

Given Rent per day = ₹1000

Cost of making one plate of chaat = ₹20

(a) Selling price for 100 plates of chaat

- **Total cost per day** = Rent + Cost of 100 plate of chaat

$$1000 + (100 \times 20) = 1000 + 2000 = ₹3000$$

To make **profit = ₹2000**, total revenue must be:

$$3000(\text{cost}) + 2000(\text{profit}) = ₹5000$$

Selling price per plate of chaat:

$$\frac{5000}{100} = ₹50$$

He should sell each plate of chaat at ₹50.

(b) If selling price = ₹60 per plate of chaat

- Profit per plate of chaat = Selling price – Cost price

$$60 - 20 = ₹40$$

- Daily fixed rent = ₹1000 So total profit = (Profit per plate of chaat × Number of plate of chaat) – Rent

We want:

$$40n - 1000 = 2000$$

$$40n = 3000$$

$$n = \frac{3000}{40} = 75$$

He must sell 75 plates of chaat per day.

SOLUTION 9:

(a) $5x+8y=200$

(b) Possible integer solutions:

(i) $x=0, y=25$

(ii) $x=16, y=15$

(iii) $x=24, y=10$

(iv) $x=32, y=5$

(v) $x=40, y=0$

SOLUTION 10:

(a) Revenue = $120x + 80y$

(b) Equation: $120x + 80y = 4000 \rightarrow$ simplified to $3x + 2y = 100$

Possible integer solutions:

(i) $x=0, y=50$

(ii) $x=10, y=35$

(iii) $x=20, y=20$

(iv) $x=30, y=5$

3 MARKS QUESTION

QUESTION 1

Imagine you are at a school gathering or a family function. You want to amaze your friends by “guessing” their birthday without asking directly. You tell your friend:

“Think of your birth **month** (for example, January = 1, February = 2, ..., December = 12). Don’t tell me!”

Then guide them through a series of steps. At the end, they tell you just one number—and you magically reveal their exact birth **month and day**!

Ask your friend to follow these steps silently:

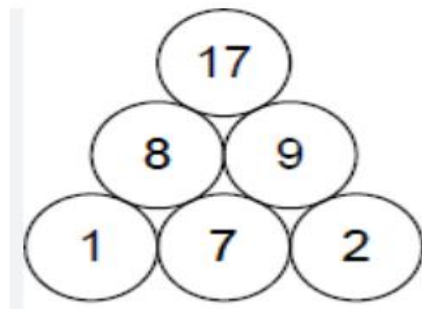
1. Think of your birth **month** (let it be m)
2. Multiply it by **5**
3. Add **6**
4. Multiply the result by **4**
5. Add your birth **day** (let it be d)
6. Tell me the final number

QUESTION 2

Rohan is participating in a fun classroom activity where students solve **number pyramids**. In this activity, each block above is formed by adding the two blocks directly below it.

During the activity, Rohan fills a 3-row pyramid like this:

- Bottom row: a, b, c
- Middle row: $a + b, b + c,$
- Top: He writes $a + b + c$



He confidently tells his teacher:

“The number at the top is simply the sum of all three bottom numbers.”

However, his teacher says there is a mistake in his reasoning.

Based on the above information, answer the following questions.

- What mistake did Rohan make while determining the top number?
- Find the correct algebraic expression for the top number.
- What important idea or step did Rohan miss while forming the top value?

QUESTION 3:

Riya is planning her study schedule for the month using a wall calendar of July 2025 calendar. While marking important dates, she notices a 2×2 block of consecutive dates on the calendar (just like a small square formed by four adjacent days).

She observes that the bottom-right date in this square is 25. Curious about patterns in the calendar, she wants to find out the other dates in that square.

- What is the top-left date of this 2×2 block?
- What is the sum of all four dates in this square?

QUESTION 4:

During a school Maths Activity Day, students are asked to build a number pyramid game. In this game, each block in the row above is formed by adding the two numbers directly below it.

A student arranges the bottom row of the pyramid using three numbers that follow a pattern—like steps increasing evenly. For example, the numbers could be marks scored in three consecutive tests where each score increases by the same amount. This forms an Arithmetic Progression (AP).

So, the bottom row is:

- First number = **a**
- Second number = **a + d**
- Third number = **a + 2d**

The student wants to understand how this pattern affects the number at the **top of the pyramid**.

- If each block above is formed by adding the two numbers below it, what will be the **top value** of the pyramid in terms of **a and d**?
- How does this result compare with the general expression **a + 2b + c** for any three numbers? What change do you observe when the numbers are in AP?

QUESTION 5:

During a school exhibition, students are designing a **number pyramid game** inspired by patterns in nature, such as spirals in plants and shells. They decide to use the famous **Fibonacci sequence**, where each number is the sum of the two previous numbers.

In their pyramid:

- Each block is formed by **adding the two blocks directly below it**.
- The **bottom row** is chosen using Fibonacci numbers: **1, 2, 3, 5**

The students are curious to see how this special number pattern affects the final result at the top of the pyramid.

- Construct the **4-row number pyramid** using the rule (add the two numbers below each block).
- Verify the **topmost number** of the pyramid. Does it follow any interesting pattern related to the Fibonacci sequence?

QUESTION 6:

During a classroom **puzzle activity**, students are given a colorful **algebra grid game** where different shapes represent hidden numbers. The challenge is to decode the value of each shape using the clues provided in the grid.

In this puzzle:

- A **circle (●)**, a **diamond (◆)**, and a **square (■)** each represent a fixed number.
- The sums of shapes in each row give important clues.

The grid shows the following information:

- Row 1:** $\bullet + \blacklozenge + \blacklozenge = 18$
- Row 2:** $\blacklozenge + \bullet + \bullet = 15$

The students must use logical reasoning to find the value of each shape and then complete the grid.

- Find the numerical values of **● (circle)** and **◆ (diamond)**.
- Using these values, determine the value of **■ (square)** and complete the grid if the third row follows the same pattern.

QUESTION 7:

During a classroom **math puzzle activity**, students are working with a **number pyramid game**, where each block above is formed by **adding the two blocks directly below it**.

Rohit observes a pattern and confidently makes a claim:

"If I double all the numbers in the bottom row of a 3-row pyramid, then the number at the top will also double."

His classmates are not fully convinced and decide to verify his statement using algebra.

- Is Rohit's claim always correct?
- Justify your answer using an algebraic approach by considering the bottom row as three numbers: **a, b, and c**.

QUESTION 8:

In a fun **math club activity**, students explore calendar patterns and number tricks. They usually work with a regular calendar, where each week has 7 days. But this time, their teacher challenges them with a creative twist:

"Imagine a special planet where a week has only 6 days instead of 7!"

The students draw a new type of calendar where numbers increase by:

- **+1 when moving right (next day)**
- **+6 when moving down (next week)**

They select a **2×2 grid of dates** (just like in a normal calendar trick) and try to understand how the pattern and sum change in this new system.

- a. How does the pattern of numbers in the 2×2 grid change when the week has **6 days instead of 7**?
- b. If the **top-left number is x** , what will be the **formula for the sum of all four numbers** in the grid?

QUESTION 9:

During a **school fair**, a teacher sets up a “*Number Pyramid Challenge*” stall. In this game, each block above is formed by **adding the two blocks directly below it**.

One student creates a pyramid using a simple pattern. He chooses numbers in such a way that each number is a multiple of the same value—like saving money where each day he saves double or triple of a base amount. So, the **bottom row** of his pyramid is:

- **$x, 2x, 3x$**

He is curious to know how this pattern affects the number at the **top of the pyramid**.

- a. Find the **top value** of the pyramid in terms of **x** .
- b. If the **top value is 72**, what is the value of **x** ?

QUESTION 10:

During a school **math magic show**, a student performs an interesting number trick and challenges the audience:

“Think of any 2-digit number. Add its digits together. Then multiply the result by 9. I guarantee your final answer will always be divisible by 9!”

The audience is amazed, but the teacher asks the class to **verify this trick using algebra** instead of just trying examples.

- a. Is this magic trick always true for every 2-digit number?
- b. Prove the result **algebraically** by representing a 2-digit number in general form.

3 MARKS QUESTION SOLUTION

SOLUTION 1:

When your friend tells you the final number:

- Subtract **24** from it
- The result will be a number where:
 - The **last two digits** = birth **day**

- The remaining digits = birth **month**

Example

Suppose your friend's birthday is **15 August**:

- Month = 8, Day = 15
- Steps:
 - $8 \times 5 = 40$
 - $40 + 6 = 46$
 - $46 \times 4 = 184$
 - $184 + 15 = 199$

They tell you **199**

Now you:

- $199 - 24 = 175$
- Last two digits = **75**

Let's correct decoding:

Actually,

$$(5m + 6) \times 4 + d = 20m + 24 + d$$

So:

$$\text{Final number} = 20m + d + 24$$

After subtracting 24:

$$= 20m + d$$

Now:

- $20m + d \rightarrow$ since $d \leq 31$, the last two digits represent the day
- The remaining part gives the month

For 15 August:

- $20 \times 8 + 15 = 160 + 15 = 175$

So:

- Day = 15
- Month = 8

SOLUTION 2:

- Bottom row: a, b, c
- Middle row:

- Left block = $a + b$
- Right block = $b + c$

- Top block:

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

Rohan's Error

Rohan wrote:

$$\text{Top} = a + b + c$$

He **ignored that the middle number b is added twice**—once in each middle block.

Correct Answer

$$\text{Top} = a + 2b + c$$

Rohan missed the idea that:

- Each number contributes based on how many times it appears in the pyramid
- The middle number b is used **twice**, so it must be counted twice

SOLUTION 3:

In a calendar:

- Moving **right** $\rightarrow +1$
- Moving **down** $\rightarrow +7$

So, if bottom-right = 25:

- Top-right = $25 - 7 = 18$
- Bottom-left = $25 - 1 = 24$
- Top-left = $24 - 7 = 17$

Grid numbers:

17 18

24 25

$$\text{Sum} = 17 + 18 + 24 + 25 = 84$$

- Top-left number = **17**
- Grid sum = **84**

SOLUTION 4:

Bottom row:

- $a, a + d, a + 2d$

Second row:

- Left = $a + (a + d) = 2a + d$
- Right = $(a + d) + (a + 2d) = 2a + 3d$

Top:

- $(2a + d) + (2a + 3d) = 4a + 4d$

So,

$$\text{Top value} = 4a + 4d = 4(a + d)$$

- In general case: Top = $a + 2b + c$
- In AP case: Since $b = a + d$ and $c = a + 2d$, the expression simplifies to
Top = $4(a + d)$

SOLUTION 5:

Bottom row:

1 2 3 5

Next row:

$$1+2 = 3 \quad 2+3 = 5 \quad 3+5 = 8$$

Next row:

$$3+5 = 8 \quad 5+8 = 13$$

Top:

$$8 + 13 = 21$$

- The **top number = 21**

Observation:

The top number **21** is also a Fibonacci number. This shows how beautifully patterns in the **Fibonacci sequence** continue to appear even when arranged in different structures like pyramids, helping students connect mathematical patterns with real-life phenomena.

SOLUTION 6:

Let:

- $\bullet = x$
- $\blacklozenge = y$

From Row 1:

$$x + 2y = 18 \dots(1)$$

From Row 2:

$$y + 2x = 15 \dots(2)$$

Solve the system:

Multiply (1) by 2:

$$2x + 4y = 36$$

Subtract (2):

$$(2x + 4y) - (2x + y) = 36 - 15$$

$$3y = 21 \rightarrow y = 7$$

Substitute into (1):

$$x + 2(7) = 18 \rightarrow x + 14 = 18 \rightarrow x = 4$$

So,

- $\bullet = 4$
- $\blacklozenge = 7$

If the third row is:

$$\blacksquare + \bullet + \blacklozenge = (\text{same total pattern, e.g., } 4 + 7 + \blacksquare)$$

Then:

$$\blacksquare + 4 + 7 = 18 \text{ (assuming same sum as Row 1)}$$

$$\blacksquare + 11 = 18 \rightarrow \blacksquare = 7$$

Final Answer:

- $\bullet$ (circle) = 4
- $\blacklozenge$ (diamond) = 7
- $\blacksquare$ (square) = 7

SOLUTION 7:

Let the bottom row be:

- a, b, c

Second row:

- a + b
- b + c

Top:

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

Now, if we **double the bottom row**, the new numbers become:

- 2a, 2b, 2c

Second row:

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

Top:

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

Conclusion:

Yes, Rohit's claim is **correct**.

When all numbers in the bottom row are doubled, the **top value also becomes double**.

SOLUTION 8:

In this new 6-day calendar:

Starting with **top-left = x**

- Top-right = $x + 1$
- Bottom-left = $x + 6$
- Bottom-right = $x + 7$

So, the grid becomes:

x	$x + 1$
$x + 6$	$x + 7$

Sum of all four numbers:

$$\begin{aligned} &= x + (x + 1) + (x + 6) + (x + 7) \\ &= 4x + 14 \end{aligned}$$

Final Answer:

- New grid sum formula = **$4x + 14$**

SOLUTION 9:

Bottom row:

- $x, 2x, 3x$

Second row:

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

Top:

- $3x + 5x = \mathbf{8x}$

If top = 72:

- $8x = 72$
- $x = 72 \div 8 = \mathbf{9}$

Final Answer:

- Top value = **$8x$**
- Value of $x = \mathbf{9}$

SOLUTION 10:

Let the 2-digit number be:

- $10a + b$ where a is the tens digit and b is the units digit.

Step 1: Add the digits

$$a + b$$

Step 2: Multiply by 9

$$9(a + b) = 9a + 9b$$

Analysis:

The expression $9a + 9b = 9(a + b)$ is clearly a **multiple of 9**.

Conclusion:

Yes, the trick is **always true**.

No matter which 2-digit number you choose, the final result will **always be divisible by 9**.

4 MARKS QUESTION (CASE BASED QUESTION)

QUESTION 1:

CONCEPT: Think of a Number Tricks

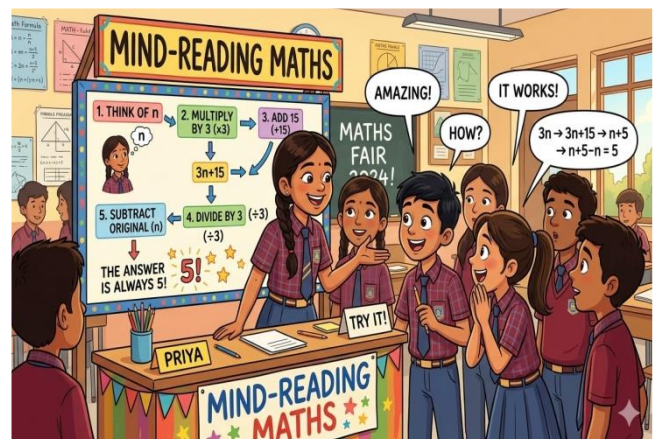
During the Annual Science Fair at Delhi Public School, Class VIII student Priya wows her classmates with a 'Mind-Reading' stall. She asks each visitor: 'Think of any secret number.

Triple it. Add 15. Divide the result by 3. Now subtract the number you first thought of.' She then confidently announces, 'Your answer is 5!'

Every single visitor confirms she is right. A

curious student named Dev asks, 'How is this

possible for any number?' Priya smiles and says, 'Algebra is the secret!' She then challenges Dev to redesign the trick so the final answer is always 9 instead of 5.



(a). Using algebra, prove step-by-step why Priya's trick always gives 5, regardless of the number chosen. Let the chosen number be n .

2M

(b). Dev wants to redesign Priya's trick so the final answer is always 9. He keeps the steps 'Triple the number (n) → Add k → Divide by 3 → Subtract original'. Find the value of k he should use.

Verify with $n = 7$

QUESTION 2:

CONCEPT: Date Guessing Trick & Number Pyramids

At a family gathering, 13-year-old Meera announces she can guess anyone's birthday using just one number. She asks Uncle Rakesh to multiply his birth month by 5, add 6, multiply by 4, add 9, multiply by 5, and then add the birth day. Uncle Rakesh quietly computes and tells Meera his result: 970. Meera instantly announces, 'Your birthday is 5th August!' The family is stunned. Meanwhile, Meera's younger brother Tarun is working on a Number Pyramid puzzle for homework. He has a 3-row pyramid where the bottom row is $[p, 11, q]$, the top number is 47, and the right middle cell is 19. He needs to find p and q using algebra.



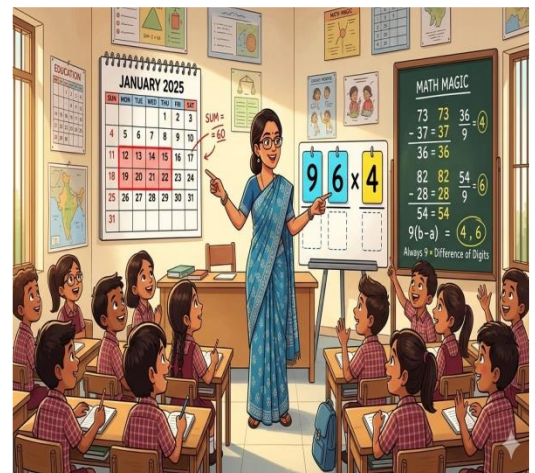
(a). Show algebraically how Meera decoded Uncle Ramesh's birthday from the result 970. Use M for month and D for day.

(b). In Taren's pyramid with bottom row $[p, 11, q]$, the right middle cell is 19 and the top number is 47. Using the pyramid rule (each cell = sum of two below), find p and q .

QUESTION 3:

CONCEPTS: Calendar Magic, Largest Product & Divisibility Tricks

During a school Maths Club session, Teacher Ananya shows students two magical tricks. First, she displays a January 2025 calendar and asks student Rahul to secretly pick any 2×2 block of four dates, add them up, and tell her only the total. Rahul says '60.' Ananya instantly names all four dates. Next, she holds up digit cards 4, 6, and 9, and challenges students to arrange them in the form (two-digit number) $\times$ (one-digit number) to get the greatest possible product. Finally, she poses a divisibility riddle: 'Take any 2-digit number with different digits



- a) Ananya uses algebra to find the 2×2 calendar block when the sum is 60. If the top-left date in the block is 'a', express all four dates in terms of a and form an equation. Solve it to find the four dates.
- b) (i) Using digits 4, 6, 9 in the form $\square \square \times \square$, find the arrangement giving the largest product. Justify using algebra.

ii) Prove using algebra that for any 2-digit number ab , the sum of the number and its reverse is always divisible by 11.

QUESTION 4:

CONCEPTS Think of a Number Tricks

Arpita performs a number trick at her school's science fair.

She tells her classmates: 'Think of any number. Multiply it by 3. Add 12 to your result. Divide the answer by 3. Now subtract the number you first thought of.' She then announces confidently, 'Your final answer is 4!' The audience is amazed as everyone confirms she is correct. Arpita explains that this is not magic — it is algebra! She then challenges her friend Arjun to design a trick where the final answer is always 7.



(a). Using algebra, prove why Arpita's trick always gives the answer 4, no matter what number the audience thinks of. Show each step clearly.

(b). Arjun wants to design a 'Think of a Number' trick that always ends with 7. He starts with: 'Think of a number $\rightarrow$ multiply by 2 $\rightarrow$ Add $\square \rightarrow$ Divide by 2 $\rightarrow$ Subtract the original.' What number should he fill in the blank to make the final answer always 7?

QUESTION 5:

CONCEPT: Digit Reversal Trick.

Meera shows Aditya a number trick: 'Think of any 2-digit number where the two digits are different. Write it down.

Now reverse the digits to form a new number. Find the difference between the larger and smaller of these two numbers. I promise the result is always exactly divisible by 9!' Aditya tries with 73: reverse is 37,

difference = $73 - 37 = 36 = 9 \times 4$. He tries 58: reverse is 85,

difference = $85 - 58 = 27 = 9 \times 3$. Meera then extends the

trick: 'Also try adding the two numbers instead of subtracting.

I predict the sum is always divisible by 11!' Aditya tests with



26 and 62: $\text{sum} = 88 = 11 \times 8$. He's convinced — but can he

prove it algebraically?

(a). Let a 2-digit number be represented as 'ab' (tens digit a, units digit b, where $a > b$). Using algebra, prove that the difference between the number and its reverse is always divisible by 9.

(b). Using algebra, prove that the SUM of any 2-digit number and its digit-reversal is always divisible by 11. Then find the original 2-digit number if the sum of the number and its reverse is 121.

4 MARKS QUESTION (CASE BASED) SOLUTION

SOLUTION 1:

Answer: (a)

Let n = number chosen.

Step 1: Triple it $\Rightarrow 3n$

Step 2: Add 15 $\Rightarrow 3n + 15$

Step 3: Divide by 3 $\Rightarrow (3n + 15) / 3 = n + 5$

Step 4: Subtract original $\Rightarrow (n + 5) - n = 5$

Since all steps are algebraically equivalent, the answer is always 5,

Regardless of the value of n . [Proved]

Answer: (b)

Let n = chosen number, k = constant to be added.

Step 1: Triple it $\Rightarrow 3n$

Step 2: Add $k \Rightarrow 3n + k$

Step 3: Divide by 3 $\Rightarrow n + k/3$

Step 4: Subtract original $\Rightarrow k/3$

We need $k/3 = 9 \Rightarrow k = 27$

Verification with $n = 7$:

$$3(7) = 21 \rightarrow 21 + 27 = 48 \rightarrow 48 / 3 = 16 \rightarrow 16 - 7 = 9 \quad [\text{Correct}]$$

Answer: $k = 27$

SOLUTION 2:

Answer (a)

Let M = birth month and D = birth day

Birth month : M

Multiply by 5 $\rightarrow 5M$

Add 6 $\rightarrow 5M + 6$

Multiply by 4 $\rightarrow 20M + 24$

Add 9 $\rightarrow 20M + 33$

Multiply by 5 $\rightarrow 100M + 165$

Add birth day $\rightarrow 100M + 165 + D$

Now, $100M + 165 + D = 970$

$100M + D = 970 - 165$

$100M + D = 805$

Then she split 805 into two parts:

Month 8 = August

Day = 5th

Answer: August 5th!

Answer (b).

Pyramid structure (3 rows):

Bottom row: $p \quad | \quad 11 \quad | \quad q$

Middle row: $p+11 \quad | \quad 11+q$

Top : $(p+11) + (11+q) = p + q + 22$

Given: right middle cell = $11 + q = 19 \Rightarrow q = 8$

Given: top = 47:

$$p + q + 22 = 47$$

$$p + 8 + 22 = 47$$

$$p = 47 - 30 = 17$$

Answer: $p = 17, q = 8$

Complete pyramid: Bottom [17, 11, 8] | Middle [28, 19] | Top [47]

SOLUTION 3:

Answer (a)

In a standard 7-day-column calendar, a 2x2 block:

Top-left: a Top-right: $a+1$

Bottom-left: $a+7$ Bottom-right: $a+8$

$$\text{Sum} = a + (a+1) + (a+7) + (a+8) = 4a + 16$$

Given sum = 60:

$$4a + 16 = 60$$

$$4a = 44$$

$$a = 11$$

The four dates are: 11, 12, 18, and 19

Verification: $11 + 12 + 18 + 19 = 60$ [Correct]

Answer (b):

Part (a): Largest Product

Using the rule: largest digit as multiplier; remaining digits in decreasing order as the 2-digit multiplicand.

Digits: 4, 6, 9. Largest = 9 (multiplier). Remaining: 6, 4 $\rightarrow$ multiplicand = 64.

$$\text{Answer: } 64 \times 9 = 576$$

Check: $96 \times 4 = 384$, $94 \times 6 = 564$, $69 \times 4 = 276$, $49 \times 6 = 294$, $46 \times 9 = 414$ -- all less than 576.

Part (b): Sum of 2-digit number and its reverse is divisible by 11

Let the number = $10a + b$

Its reverse = $10b + a$

$$\text{Sum} = (10a+b) + (10b+a) = 11a + 11b = 11(a + b)$$

Since $11(a + b)$ is a multiple of 11,

the sum is always divisible by 11. [Proved]

SOLUTION 4:

Answer (a) :

Let the number thought of = x

Step 1: Multiply by 3 $\rightarrow 3x$

Step 2: Add 12 $\rightarrow 3x + 12$

Step 3: Divide by 3 $\rightarrow (3x + 12) \div 3 = x + 4$

Step 4: Subtract original (x) $\rightarrow x + 4 - x = 4$

the result is always 4, regardless of x . [Proved]

Answer (b)

Let the number = x

Step 1: Multiply by 2 $\rightarrow 2x$

Step 2: Add k (unknown) $\rightarrow 2x + k$

Step 3: Divide by 2 $\rightarrow x + k/2$

Step 4: Subtract original (x) $\rightarrow k/2$

We need $k/2 = 7 \rightarrow k = 14$

Arjun should add 14 in the blank. [Answer: 14]

SOLUTION 5:

Answer (a) :

The number 'ab' = $10a + b$

Its reverse 'ba' = $10b + a$

Since $a > b \rightarrow \text{original} > \text{reverse}$

Difference = $(10a + b) - (10b + a)$

$$= 10a + b - 10b - a$$

$$= 9a - 9b$$

$$= 9(a - b)$$

Since $9(a-b)$ is a multiple of 9,

the difference is always divisible by 9. [Proved]

Answer (b) :

Number = $10a + b$, Reverse = $10b + a$

Sum = $(10a + b) + (10b + a) = 11a + 11b = 11(a + b)$

Sum is always divisible by 11. [Proved]

Given sum = 121:

$$11(a + b) = 121$$

$$a + b = 11$$

Possible 2-digit numbers: 29, 38, 47, 56, 65, 74, 83, 92

All have digits summing to 11.

Any such number satisfies the condition.

CLASS TEST

SECTION A

1. A 'Think of a Number' trick says: Think of $n \rightarrow$ Multiply by 4 $\rightarrow$ Subtract 8 $\rightarrow$ Divide by 4 $\rightarrow$ Subtract original. The result is always: _____.
(a). 4 (b) -2 (c) 2 (d) 0
2. In a number pyramid with bottom row [3, 7, 5], what is the top number?
(a). 15 (b) 22 (c) 20 (d) 25
3. A friend picks a 2×2 block from a calendar and says the sum is 72. What is the top-left date?
(a). 12 (b) 14 (c) 15 (d) 10
4. If a 2-digit number 'ab' is reversed to get 'ba', and $b > a$, the difference $(ba - ab)$ equals:
(a). $9(a-b)$ (b) $9(b + a)$ (c) $9(b - a)$ (d) $11(b - a)$

SECTION B

5. Design a 'Think of a Number' trick with exactly 4 steps that always ends with the answer 6. Write the algebraic proof.
6. A number pyramid has bottom row [4, c, 6] and the top number is 50. Find c and write all values in the pyramid.
7. Three digits 2, 4, and 6 are placed in $\square\square \times \square$ to form a product. Which arrangement gives the largest product? Justify briefly.

SECTION C

8. Consider any 3-digit number $abc (= 100a + 10b + c)$. Cycle its digits to form bca and cab . Show that the sum $abc + bca + cab$ is always divisible by 3 and by 37.
9. A farm has 55 animals (horses and hens). The total number of legs is 150. Using algebra, find the number of each type of animal.

SECTION D

10. Karim and the Genie: Karim has some coins. A genie offers him a deal: each time Karim goes around a magic banyan tree, his coins double. But he must pay the genie 8 coins after each round. After 3 rounds, Karim is left with exactly 8 coins — just enough to pay the genie, leaving him with 0.
 - (i) Let Karim start with x coins. Write an expression for his coins after Round 1 (after paying 8 coins).
 - (ii) Write an expression for his coins after Round 3.
 - (iii) Using the condition that after Round 3 he has exactly 8 coins before paying, find x .
 - (iv) Was Karim's deal profitable? Explain using your result.

SELF ASSESSMENT SOLUTION

1. (b). -2
2. (b). 22
3. (b). 14
4. (c). $9(b - a)$

5. Think of $n \rightarrow$ multiply by 5 $\rightarrow$ add 30 $\rightarrow$ divide by 5 $\rightarrow$ subtract original

Proof: $n \rightarrow 5n \rightarrow 5n + 30 \rightarrow n + 6 \rightarrow n + 6 - n = 6$

6. $\text{Top} = 4 + 2c + 6 = 2c + 10$

$$2c + 10 = 50 \rightarrow 2c = 40 \rightarrow c = 20$$

Bottom: 4 20 6

Middle: 24 26

Top: 50

7. Using the rule: largest digit as multiplier, rest in decreasing order.

Largest digit = 6 $\rightarrow$ multiplier

Remaining: 4, 2 $\rightarrow$ multiplicand = 42

Answer: $42 \times 6 = 252$

Check: $62 \times 4 = 248$, $64 \times 2 = 128 \rightarrow$ all less than 252

8. $abc = 100a + 10b + c$

$$bca = 100b + 10c + a$$

$$cab = 100c + 10a + b$$

$$\text{sum} = 111a + 111b + 111c = 111(a + b + c)$$

divisible by 3 : $111 = 3 \times 37$, so $111(a + b + c)$ is divisible by 3

divisible by 37 : $111 = 37 \times 3$, so $111(a + b + c)$ is divisible by 37

the sum is always divisible by both 3 and 37.

9. Let horses = h , hens = $55 - h$

Legs equation: $4h + 2(55 - h) = 150$

$$4h + 110 - 2h = 150$$

$$2h = 40 \rightarrow h = 20$$

$$\text{Hens} = 55 - 20 = 35$$

Verification: $4(20) + 2(35) = 80 + 70 = 150$

20 horses and 35 hens

10.

Answer:

Let x = initial coins, k = coins paid per round ($k=8$ in the story).

(i) After Round 1 (double, then pay k):

$$2x - k = 2x - 8$$

(ii) After Round 2 (double the result, pay k):

$$2(2x - 8) - 8 = 4x - 16 - 8 = 4x - 24$$

After Round 3:

$$2(4x - 24) - 8 = 8x - 48 - 8 = 8x - 56$$

(iii) Given: after Round 3 he has 0 coins:

$$8x - 56 = 0$$

$$8x = 56$$

$$x = 7$$

Karim started with 7 coins.

(iv) No, it was not profitable

For general k , after Round 3 he has 0:

$$8x - 56 = 0 \text{ was for } k=8. \text{ Generalising:}$$

$$\text{After Round 1: } 2x - k$$

$$\text{After Round 2: } 4x - 2k - k = 4x - 3k$$

$$\text{After Round 3: } 8x - 6k - k = 8x - 7k = 0$$

$$\Rightarrow k = 8x / 7$$

$$\text{For } x=7: k = 8(7)/7 = 8 \text{ [Confirms the story]}$$

Conclusion: Genie should set $k = 8x/7$ to drain all of Karim's coins in 3 rounds

CHAPTER 7: AREA

SECTION – A (1 mark each)

Q1. A trapezium has parallel sides 8 cm and 14 cm, and height 5 cm. Its area is:

- (a) 55 cm^2 (b) 110 cm^2 (c) 45 cm^2 (d) 70 cm^2

Q2. Two rectangles have perimeters 28 cm and 32 cm respectively, but the first has a larger area than the second. If the first rectangle has dimensions in the ratio 3:4, what is the maximum possible area of the second rectangle?

- (a) 48 cm^2 (b) 49 cm^2 (c) 56 cm^2 (d) 64 cm^2

Q3. In triangle XYZ, if altitude from X to YZ is 6 cm and altitude from Y to XZ is 8 cm, and the area is 48 cm^2 , then the ratio XZ:YZ is:

- (a) 3:4 (b) 4:3 (c) 2:3 (d) 3:2

Q4. A parallelogram and a rectangle have the same base and height. If the parallelogram is transformed by increasing one angle by 30° , what happens to its area?

- (a) Increases by 15% (b) Decreases by 15%
(c) Remains same (d) Cannot be determined

Q5. A parallelogram and a rectangle have the same base and height. Which statement is correct?

- (a) Rectangle has larger area (b) Parallelogram has larger area
(c) Both have equal area (d) Cannot be compared

Q6. A rhombus with diagonals 16 cm and 12 cm is dissected and rearranged into a rectangle. What are the dimensions of this rectangle?



- (a) $16 \text{ cm} \times 6 \text{ cm}$ (b) $15 \text{ cm} \times 6.4 \text{ cm}$
(c) $14 \text{ cm} \times 8.57 \text{ cm}$ (d) $10 \text{ cm} \times 9.6 \text{ cm}$

Q7. A trapezium ABCD has $AB \parallel CD$, with $AB = 8 \text{ cm}$, $CD = 12 \text{ cm}$, and height = 6 cm. Two identical copies are joined to form a parallelogram. What is the area of the resulting parallelogram?

- (a) 60 cm^2 (b) 120 cm^2 (c) 240 cm^2 (d) 480 cm^2

Q8. A triangle and a parallelogram have the same base and same height. If the area of the triangle is 24 cm^2 , the area of the parallelogram is:

- (a) 12 cm^2 (b) 24 cm^2 (c) 36 cm^2 (d) 48 cm^2

Q9. A regular hexagon is divided into a trapezium, equilateral triangle, and rhombus with areas in ratio 3:2:1. If the hexagon has side length 6 cm, what is the area of the trapezium portion?

- (a) $27\sqrt{3} \text{ cm}^2$ (b) $24\sqrt{3} \text{ cm}^2$ (c) $18\sqrt{3} \text{ cm}^2$ (d) $21\sqrt{3} \text{ cm}^2$

Q10. Converting area units: A classroom measures 25 ft $\times$ 30 ft. If tiles cost ₹150 per square meter, what is the approximate cost of tiling? (Given: 1 ft = 30.48 cm)

- (a) ₹10,500 (b) ₹10,800 (c) ₹11,200 (d) ₹11,500

ANSWERS:

- Q1 (a) Q2 (a) Q3 (a) Q4 (c) Q5 (c)
Q6 (d) Q7 (b) Q8 (d) Q9 (a) Q10 (a)

SECTION – B (Two marks each)

Q1. A farmer owns a triangular plot with a side of 56 m and the corresponding height of 35 m. He wants to cultivate only three-fourths of the plot with crops. Find the area to be cultivated.

Q2. A kite is made using two rhombus-shaped paper pieces. One rhombus has diagonals of 24 cm and 18 cm, and the other has diagonals of 30 cm and 16 cm. Find the total area of paper used.

Q3. A rectangular courtyard measures 18 m $\times$ 12 m. A path of uniform width 1.5 m runs along the inside of its boundary. Find the area of the path alone.

Q4. A parallelogram-shaped tile has sides 20 cm and 14 cm. Its height corresponding to the 20 cm base is 11 cm. Another tile is rectangular with the same length and width as the sides of the parallelogram. Which tile has a greater area and by how much?

Q5. In triangle PQR, QR = 10 cm and the altitude from P to QR is 6 cm. S is the midpoint of QR. Find the area of triangle PSR and justify whether the line PS divides triangle PQR into two equal parts.

Q6. A trapezium-shaped field has parallel sides of 45 m and 27 m, and the distance between them is 18 m. A farmer says the area of the field is 648 m^2 . Is the farmer correct? Show your working.

Q7. ABCD is a rhombus. Its diagonal BD = 16 cm and diagonal AC = 12 cm. The diagonals intersect at O. Find the area of triangle AOB and hence verify the formula for the area of a rhombus.

Q8. Two rectangles have the same perimeter of 48 cm. Rectangle X has dimensions 16 cm $\times$ 8 cm and Rectangle Y has dimensions 20 cm $\times$ 4 cm. Find the area of each. What does this tell you about perimeter and area?

Q9. A triangular traffic island has a side of 9 m and the corresponding height of 6 m. The municipal authority wants to paint it at a cost of ₹85 per m^2 . Find the cost of painting the island.

Q10. The diagonal of a rectangle is 13 cm and one side is 5 cm. Find the area of the rectangle and the area of each triangle formed by the diagonal.

ANSWERS:

Q1. Solution

Hint: Find the area of the full triangular plot, then take three-fourths of it.

$$\text{Area of triangular plot} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 56 \times 35 = 980 \text{ m}^2$$

$$\text{Area to be cultivated} = \frac{3}{4} \times 980 = 735 \text{ m}^2$$

Q2. Solution

Hint: Use Area of rhombus = $\frac{1}{2} \times d_1 \times d_2$ for each piece, then add.

$$\text{Area of first rhombus} = \frac{1}{2} \times 24 \times 18 = 216 \text{ cm}^2$$

$$\text{Area of second rhombus} = \frac{1}{2} \times 30 \times 16 = 240 \text{ cm}^2$$

$$\text{Total area} = 216 + 240 = 456 \text{ cm}^2$$

Q3. Solution

Hint: Area of path = Area of outer rectangle – Area of inner rectangle.

$$\text{Outer rectangle area} = 18 \times 12 = 216 \text{ m}^2$$

$$\text{The path is 1.5 m wide inside on all sides, so inner rectangle} = (18 - 3) \times (12 - 3) = 15 \times 9 = 135 \text{ m}^2$$

$$\text{Area of path} = 216 - 135 = 81 \text{ m}^2$$

Q4. Solution

Hint: Area of parallelogram = base $\times$ height; Area of rectangle = length $\times$ width.

$$\text{Area of parallelogram tile} = 20 \times 11 = 220 \text{ cm}^2$$

$$\text{Area of rectangular tile} = 20 \times 14 = 280 \text{ cm}^2$$

The rectangular tile has greater area, by $280 - 220 = 60 \text{ cm}^2$ more.

Key insight: For the same side lengths, a rectangle always has a greater area than a parallelogram because its height (= width) is greater than the height of the parallelogram.

Q5. Solution

Hint: S is the midpoint of QR, so $SR = \frac{1}{2} \times QR$. Use the same height from P.

$$\text{Area of } \triangle PQR = \frac{1}{2} \times 10 \times 6 = 30 \text{ cm}^2$$

Since S is the midpoint of QR, $SR = 5 \text{ cm}$.

$$\text{Area of } \triangle PSR = \frac{1}{2} \times SR \times \text{height from P} = \frac{1}{2} \times 5 \times 6 = 15 \text{ cm}^2$$

Yes, PS divides $\triangle PQR$ into two equal parts (each = 15 cm^2) because both triangles share the same height from P and their bases QS and SR are equal (both = 5 cm). This confirms: a median divides a triangle into two triangles of equal area.

Q6. Solution

Hint: Apply the trapezium area formula and compare with the farmer's claim.

$$\begin{aligned}\text{Area of trapezium} &= \frac{1}{2} \times \text{height} \times (\text{sum of parallel sides}) = \frac{1}{2} \times 18 \times (45 + 27) \\ &= \frac{1}{2} \times 18 \times 72 = 9 \times 72 = 648 \text{ m}^2\end{aligned}$$

The farmer is correct. The area is exactly 648 m².

Q7. Solution

Hint: Diagonals of a rhombus bisect each other at right angles. $OA = AC/2$, $OB = BD/2$.

$$OA = 12/2 = 6 \text{ cm}, OB = 16/2 = 8 \text{ cm}$$

$$\text{Area of } \triangle AOB = \frac{1}{2} \times OA \times OB = \frac{1}{2} \times 6 \times 8 = 24 \text{ cm}^2$$

Since the diagonals divide the rhombus into 4 equal triangles:

$$\text{Area of rhombus} = 4 \times \text{Area of } \triangle AOB = 4 \times 24 = 96 \text{ cm}^2$$

$$\text{Verification using formula: Area} = \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 12 \times 16 = 96 \text{ cm}^2$$

Q8. Solution

Hint: Perimeter $X = 2(16+8) = 48\text{cm}$, Perimeter $Y = 2(20+4) = 48\text{cm}$.

$$\text{Area of Rectangle } X = 16 \times 8 = 128 \text{ cm}^2$$

$$\text{Area of Rectangle } Y = 20 \times 4 = 80 \text{ cm}^2$$

Conclusion: Two shapes with the same perimeter can have different areas. Perimeter is not a reliable measure of area. The square-like rectangle (X) has greater area than the elongated rectangle (Y) for the same perimeter.

Q9. Solution

Hint: Find area of triangle first, then multiply by cost per m².

$$\text{Area of triangular island} = \frac{1}{2} \times 9 \times 6 = 27 \text{ m}^2$$

$$\text{Cost of painting} = 27 \times ₹85 = ₹2,295$$

Q10. Solution

Hint: Use Pythagorean theorem to find the missing side: $\text{diagonal}^2 = l^2 + b^2$.

$$\text{Diagonal} = 13 \text{ cm}, \text{ one side} = 5 \text{ cm}$$

$$\text{Other side} = \sqrt{(13^2 - 5^2)} = \sqrt{(169 - 25)} = \sqrt{(144)} = 12 \text{ cm}$$

$$\text{Area of rectangle} = 5 \times 12 = 60 \text{ cm}^2$$

$$\text{Area of each triangle formed by the diagonal} = \frac{1}{2} \times 60 = 30 \text{ cm}^2$$

SECTION – C (3 marks each)

Q1. A school decides to tile its quadrilateral-shaped garden ABCD using the diagonal $AC = 24 \text{ m}$ as a divider. The perpendicular from B to AC is 9 m and the perpendicular from D to AC is 7 m (on the opposite side). The tiling material costs ₹120 per m². Find:

- (i) Area of triangle ABC (ii) Area of triangle ACD (iii) Total cost of tiling the garden

Q2. A farmer's plot is in the shape of a trapezium with parallel sides 60 m and 40 m, and the distance between parallel sides of 25 m. Inside this plot, he builds a rectangular shed measuring 10 m $\times$ 8 m and a triangular water tank area with base 12 m and height 9 m. Find the remaining cultivable area of the plot after accounting for the shed and tank area.

Q3. A decorative floor tile consists of a parallelogram ABCD with base 15 cm and the corresponding height 10 cm. Inside the parallelogram, a triangle is drawn with the same base (15 cm) and height equal to half the height of the parallelogram. Find:

- (i) Area of the parallelogram
- (ii) Area of the triangle inside it
- (iii) Area of the parallelogram not covered by the triangle

Q4. A rectangular park PQRS of dimensions 50 m $\times$ 30 m has a cross path: one path of width 2m running parallel to PQ (the length), and another path of width 2 m running parallel to QR (the width). Both paths cross at the centre. Find the area of the cross path. [Hint: Avoid double-counting the overlapping square at the centre.]

Q5. An architect is designing a window pane in the shape of a regular hexagon with side 6 cm. He divides it into a trapezium, an equilateral triangle, and a rhombus. The height of each of the above-mentioned shape is $3\sqrt{3}$ cm and the lengths of parallel sides of the trapezium are 6 cm and 12 cm. Find the area of:

- (i) The trapezium
- (ii) The equilateral triangle with side 6 cm (use $\sqrt{3} \approx 1.732$)
- (iii) Total area of the hexagon pane.

Q6. A swimming pool is surrounded by a path. The pool has dimensions 25 m $\times$ 10 m. The path around it is 2 m wide on the longer sides and 1.5 m wide on the shorter sides. Tiles for the pool cost ₹200 per m^2 and tiles for the path cost ₹350 per m^2 . Find:

- (i) Area of the pool
- (ii) Area of the path
- (iii) Total cost of tiling both the pool and the path

Q7. The diagonals of a rhombus are in the ratio 3:4 and its area is 216 cm^2 . Find:

- (i) The length of each diagonal
- (ii) The perimeter of the rhombus [Hint: Use the Pythagorean theorem with half-diagonals]
- (iii) The height of the rhombus if its side is used as the base

Q8. A wall is to be painted in two sections. The lower section is a trapezium with parallel sides 8 m and 5 m and a height of 3 m. The upper section is a triangle with base 8 m and height 4 m. Paint A (for lower section) costs ₹60 per m^2 and Paint B (for upper section) costs ₹75 per m^2 . Find:

- (i) Area of the trapezoidal lower section
- (ii) Area of the triangular upper section
- (iii) Total painting cost

Q9. In triangle XYZ, M is the midpoint of XY and N is the midpoint of XZ. MN is joined and it is the half of the side YZ. The base YZ = 18 cm and the altitude from X to YZ is 12 cm also the perpendicular distance from X to MN is 6cm.

(i) Find the area of triangle XYZ.

(ii) Find the area of triangle XMN.

(iii) Find the ratio of area of triangle XMN and the area of trapezium MYZN.

Q10. A city block is in the shape of a quadrilateral ABCD where diagonal BD = 30 m. Perpendicular from A to BD = 12 m and perpendicular from C to BD = 8 m (both on opposite sides of BD). The block is divided into a park (triangle ABD) and a playground (triangle BCD). Find:

(i) Area of the park

(ii) Area of the playground

(iii) If the park needs 3 gardeners per 50 m² and the playground needs 1 coach per 100 m², how many gardeners and coaches are needed? (Round up to nearest whole number)

SOLUTIONS:

Q1. Solution

Hint: A diagonal splits a quadrilateral into two triangles. Use Area = $\frac{1}{2} \times \text{base} \times \text{height}$ for each.

(i) Area of $\triangle ABC = \frac{1}{2} \times AC \times \text{perpendicular from B} = \frac{1}{2} \times 24 \times 9 = 108 \text{ m}^2$

(ii) Area of $\triangle ACD = \frac{1}{2} \times AC \times \text{perpendicular from D} = \frac{1}{2} \times 24 \times 7 = 84 \text{ m}^2$

Total area of garden ABCD = $108 + 84 = 192 \text{ m}^2$

(iii) Cost of tiling = $192 \times ₹120 = ₹23,040$

Q2. Solution

Hint: Find the total plot area first. Then subtract the shed and tank areas.

Area of trapezoidal plot = $\frac{1}{2} \times \text{height} \times (\text{sum of parallel sides}) = \frac{1}{2} \times 25 \times (60 + 40) = \frac{1}{2} \times 25 \times 100 = 1,250 \text{ m}^2$

Area of rectangular shed = $10 \times 8 = 80 \text{ m}^2$

Area of triangular tank region = $\frac{1}{2} \times 12 \times 9 = 54 \text{ m}^2$

Remaining cultivable area = $1,250 - 80 - 54 = 1,116 \text{ m}^2$

Q3. Solution

Hint: Height of triangle = $\frac{1}{2} \times \text{height of parallelogram} = \frac{1}{2} \times 10 = 5 \text{ cm}$.

(i) Area of parallelogram = base $\times$ height = $15 \times 10 = 150 \text{ cm}^2$

(ii) Height of triangle = $\frac{1}{2} \times 10 = 5 \text{ cm}$

Area of triangle = $\frac{1}{2} \times 15 \times 5 = 37.5 \text{ cm}^2$

(iii) Area not covered by triangle = $150 - 37.5 = 112.5 \text{ cm}^2$

Q4. Solution

Hint: Area of cross path = (horizontal strip area) + (vertical strip area) – (overlapping square at centre).

Horizontal path (parallel to length PQ): $50 \times 2 = 100 \text{ m}^2$

Vertical path (parallel to width QR): $30 \times 2 = 60 \text{ m}^2$

Overlapping square at centre: $2 \times 2 = 4 \text{ m}^2$

Area of cross path = $100 + 60 - 4 = 156 \text{ m}^2$

Q5. Solution

Hint: A regular hexagon with side 6 cm can be broken into trapeziums and triangles as described. Sum all parts.

(i) Area of one trapezium = $\frac{1}{2} \times \text{height} \times (\text{sum of parallel sides}) = \frac{1}{2} \times 3\sqrt{3} \times (6 + 12)$

$$= \frac{1}{2} \times 3\sqrt{3} \times 18 = 27\sqrt{3} \text{ cm}^2 = 27 \times 1.732 \approx 46.76 \text{ cm}^2$$

(ii) Area of the equilateral triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 6 \times 3\sqrt{3} = 9\sqrt{3}$

$$= 9 \times 1.732 \approx 15.59 \text{ cm}^2$$

(iii) Area of rhombus = base $\times$ height = $6 \times 3\sqrt{3} = 18\sqrt{3} = 18 \times 1.732 \approx 31.18 \text{ cm}^2$

Total area of hexagon = $46.76 + 15.59 + 31.18 \approx 93.53 \text{ cm}^2$

Q6. Solution

Hint: Area of path = area of outer rectangle – area of pool. Outer dimensions include path on both sides.

(i) Area of pool = $25 \times 10 = 250 \text{ m}^2$

(ii) Outer rectangle dimensions:

Length = $25 + 2 \times 1.5 = 25 + 3 = 28 \text{ m}$ (1.5 m on each shorter side)

Width = $10 + 2 \times 2 = 10 + 4 = 14 \text{ m}$ (2 m on each longer side)

Outer area = $28 \times 14 = 392 \text{ m}^2$

Area of path = $392 - 250 = 142 \text{ m}^2$

(iii) Cost of pool tiling = $250 \times ₹200 = ₹50,000$

Cost of path tiling = $142 \times ₹350 = ₹49,700$

Total cost = $₹50,000 + ₹49,700 = ₹99,700$

Q7. Solution

Hint: Let diagonals be $3x$ and $4x$. Use Area = $\frac{1}{2} \times d_1 \times d_2$ to find x , then use Pythagoras for the side.

(i) Let diagonals = $3x$ and $4x$

$$\text{Area} = \frac{1}{2} \times 3x \times 4x = 6x^2 = 216$$

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

$$\text{Diagonals: } d_1 = 3 \times 6 = 18 \text{ cm and } d_2 = 4 \times 6 = 24 \text{ cm}$$

(ii) Half-diagonals: 9 cm and 12 cm

$$\text{Side of rhombus} = \sqrt{(9^2 + 12^2)} = \sqrt{(81 + 144)} = \sqrt{(225)} = 15 \text{ cm}$$

$$\text{Perimeter} = 4 \times 15 = 60 \text{ cm}$$

(iii) Area = base $\times$ height

$$216 = 15 \times \text{height} \Rightarrow \text{height} = 216/15 = 14.4 \text{ cm}$$

Q8. Solution

Hint: Use trapezium formula for lower section and triangle formula for upper section.

$$(i) \text{ Area of trapezium} = \frac{1}{2} \times \text{height} \times (\text{sum of parallel sides}) = \frac{1}{2} \times 3 \times (8 + 5) = \frac{1}{2} \times 3 \times 13 = 19.5 \text{ m}^2$$

$$(ii) \text{ Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 8 \times 4 = 16 \text{ m}^2$$

$$(iii) \text{ Cost of painting lower section} = 19.5 \times ₹60 = ₹1,170$$

$$\text{Cost of painting upper section} = 16 \times ₹75 = ₹1,200$$

$$\text{Total painting cost} = ₹1,170 + ₹1,200 = ₹2,370$$

Q9. Solution

$$(i) \text{ Area of } \triangle XYZ = \frac{1}{2} \times YZ \times \text{altitude} = \frac{1}{2} \times 18 \times 12 = 108 \text{ cm}^2$$

$$(ii) \text{ Area of } \triangle XMN = \frac{1}{2} \times MN \times \text{altitude} = \frac{1}{2} \times 9 \times 6 = 27 \text{ cm}^2$$

$$(iii) \text{ Area of trapezium MYZN} = \text{Area of } \triangle XYZ - \text{Area of } \triangle XMN = 108 - 27 = 81 \text{ cm}^2$$

$$\text{Ratio of area of triangle XMN and the area of trapezium MYZN} = \frac{27}{81} = \frac{1}{3} \text{ or } 1 : 3.$$

Q10. Solution

Hint: Each triangle's area = $\frac{1}{2} \times \text{BD} \times \text{perpendicular height from the opposite vertex}$.

$$(i) \text{ Area of park } (\triangle ABD) = \frac{1}{2} \times 30 \times 12 = 180 \text{ m}^2$$

$$(ii) \text{ Area of playground } (\triangle BCD) = \frac{1}{2} \times 30 \times 8 = 120 \text{ m}^2$$

$$(iii) \text{ Gardeners needed} = 180 \div 50 \times 3 = 3.6 \times 3 = 10.8 \rightarrow 11 \text{ gardeners (rounded up)}$$

$$\text{Coaches needed} = 120 \div 100 = 1.2 \rightarrow 2 \text{ coaches (rounded up)}$$

SECTION D – (4 marks each)

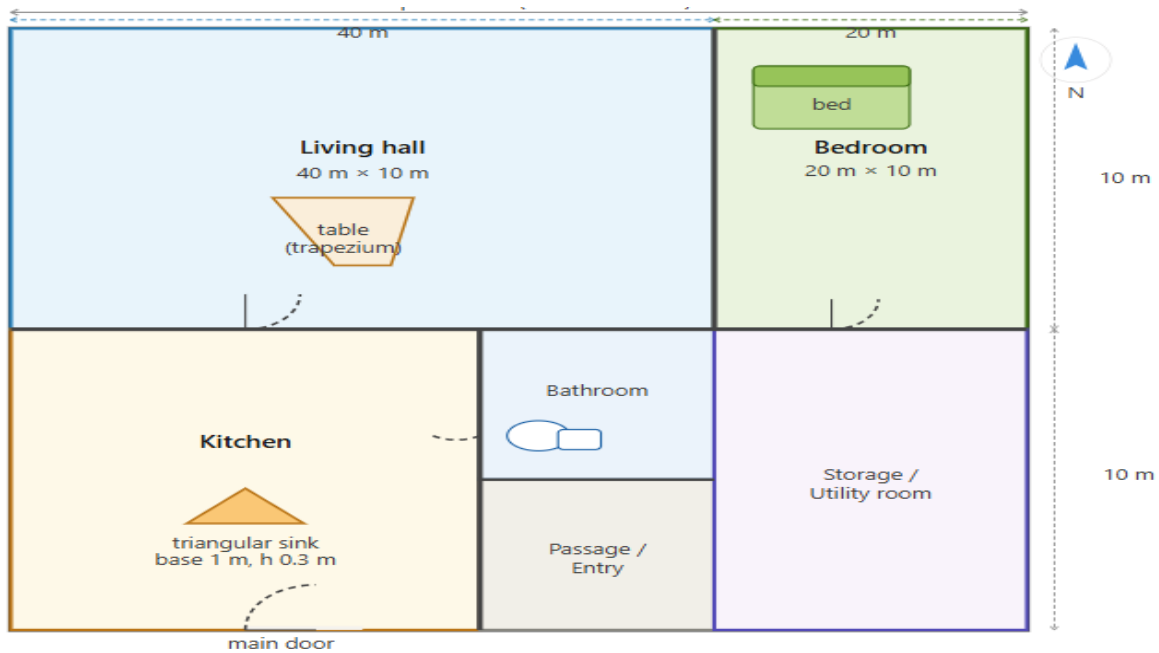
Q1: Architectural Design Problem

An architect is designing a community centre with a specific floor plan. The main hall is a rectangle ABCD with dimensions 40m $\times$ 25m. Inside this hall, there's a performance area in the shape of a regular hexagon with side length 8m, and a triangular seating area with vertices at three corners of a rectangle measuring 15m $\times$ 12m.

Additionally, there's a pathway around the rectangular hall that has uniform width of 3m on all sides, creating an outer rectangle PQRS.

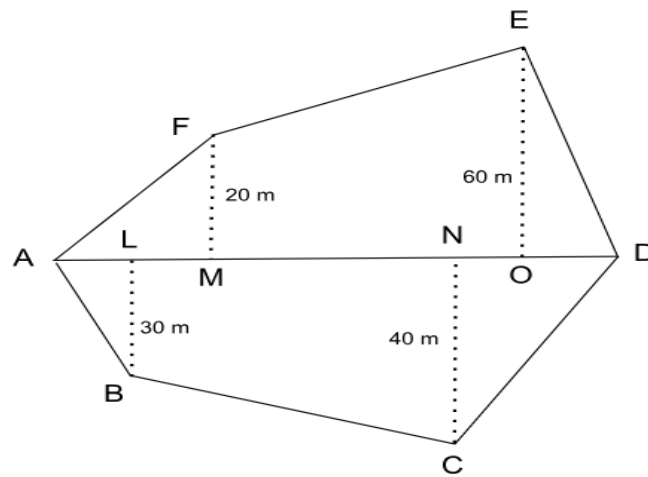
- Calculate the area of the pathway surrounding the main hall. (1 mark)
- Find the area of the regular hexagonal performance area. (2 marks)
- If the triangular seating area is inscribed in the $15\text{m} \times 12\text{m}$ rectangle with maximum possible area, determine its area. (1 mark)

Q2. Ashish wants to make a house of 1 BHK, the map of the house is given below-



- If the dimensions of the living hall are 40 m and 10m what is the area of the living room? (1 mark)
- There is a table in the living room, whose one pair of opposite side is parallel, the parallel side are of length 5m and 8m and the minimum distance between these two parallel sides is 6m. how much region of the floor occupied by the table? (1 mark)
- In the kitchen of the house there is triangular sink, which has one side 1m and the perpendicular distance corresponding to this side to the opposite vertex is measure has 0.3m what is the area of that sink? (1 mark)
- The total land available for constructing the house is 1200m^2 . What part of this house is occupied by the bedroom, which has the dimensions $20 \times 10 \text{ m}^2$. (1 mark)

Q3. Danish makes a kitchen garden nearby his house, which is irregular in shape. Danish wants to grow different crops in the different parts of this garden. The map of the kitchen garden has the following measurement.



He marked different points on the boundary of the kitchen garden and inside the garden in order to divide the garden in various parts, for growing a particular crop in a particular part of the garden. On measuring with the tape he found the following measurements of the various points and parts-

AL = 10m, AM = 20m, AN = 50m. AO = 60m and AD = 90m.

- (a) Danish wants to grow Dhaniya in the region EFMO, find the area occupied by the Dhaniya. (1 mark)
- (b) Danish grows Onion in the region CND, find the area occupied by the Onion plants. (1 mark)

- (c) If the Labour charge of sowing Dhaniya is 3 Rs/m² and that for onion is 5 Rs/m².

find the total labour charge for sowing both the crops. (2 mark)

Q4. Rajan is a farmer in Odisha who owns a large quadrilateral-shaped paddy field ABCD. The field lies alongside a canal. He draws the diagonal AC across the field, dividing it into two triangular sections. He plans to grow paddy in triangle ABC and vegetables in triangle ACD. His son Arun measures the field and records the following data.

Parameter	Value / Description
Shape of field	Quadrilateral ABCD divided by diagonal AC
Length of diagonal AC	60 m
Perpendicular from B to AC (height of $\triangle ABC$)	18 m
Perpendicular from D to AC (height of $\triangle ACD$)	14 m (on the opposite side of AC from B)
Paddy yield value	₹75 per m ²

Vegetable yield value	₹120 per m ²
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- (a) Find the area of the paddy section (triangle ABC). [1 mark]
- (b) Find the area of the vegetable section (triangle ACD). [1 mark]
- (c) Rajan estimates his total income from the field in one harvest season. Find the total expected income from both sections combined. [2 marks]

Q5. The Panchayat of a village in Odisha is renovating the floor of their community centre. The rectangular hall measures 20 m × 14 m. The floor is to be tiled in four distinct sections as described below. Each section uses a different type of tile to create a decorative pattern.

Parameter	Value / Description
Section A — Outer Border	A uniform border of width 1 m runs along all four inner walls. Tiled with plain cement tiles.
Section B — Corner Triangles	After removing the border, a right triangle is cut from each of the 4 corners of the inner rectangle. Each triangle has legs (base and height) of 3 m each. Tiled with black mosaic.
Section C — Side Trapeziums	Along each of the two longer sides (after removing corner triangles), one trapezium remains. Each trapezium has parallel sides of 12 m and 6 m, with a perpendicular height of 3 m. Tiled with terracotta.
Section D — Central Rhombus	The central portion is a rhombus with diagonals of 12 m and 6 m. Tiled with polished granite.

- (a) The hall floor is first divided into the outer border and an inner rectangle. Find the area of the outer border (Section A) and the dimensions of the inner rectangle. [1 mark]
- (b) Find the total area covered by the four corner triangles (Section B) and the two side trapeziums (Section C). [2 marks]
- (c) Find the area of the central rhombus (Section D). [1 mark]

SOLUTIONS:

Q1. (a) The length and the width of the outer rectangle are $40 + 3 + 3 = 46$ m and $25 + 3 + 3 = 31$ m, respectively.

Area of the outer rectangle = length × width = $46 \times 31 = 1,426$ sq. meters.

Area of the inner rectangle = length × width = $40 \times 25 = 1,000$ sq. meters.

Area of the pathway = $1,426 - 1,000 = 426$ square meters.

(b) A regular hexagon can be divided into six equilateral triangles of side 8 m.

Area of an equilateral triangle = $\frac{\sqrt{3}}{4} \times \text{side} \times \text{side} = \frac{\sqrt{3}}{4} \times 8 \times 8 = 16\sqrt{3}$ square m.

Then, Area of the regular hexagon = $6 \times 16\sqrt{3} = 96\sqrt{3} \text{ m}^2$

(c) The base and height of the triangle are 15 m and 12 m, respectively.

Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 15 \times 12 = 90 \text{ m}^2$

Q2. (a) As per the diagram the living hall is in the shape of rectangle, with length (l) = 40m and breadth (b) = 10m.

The area of living hall = $l \times b = 40\text{m} \times 10\text{m} = 400\text{m}^2$.

(b) The table is in the shape of trapezium.

Floor occupied by the table = Area of the table = area of the trapezium = $\frac{1}{2}$ (sum of parallel side length) $\times$ perpendicular distance between two parallel sides.

Area of the table = $\frac{1}{2} (5 + 8) \times 6 = \frac{1}{2} \times 13 \times 6 = 39\text{m}^2$.

(c) Area of the sink = area of the triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

Given the base side of the sink = 1m and perpendicular distance (height) = 0.3m

Area of the sink = $\frac{1}{2} \times 1\text{m} \times 0.3\text{m} = 0.15\text{m}^2$.

(d) Dimensions of the bedroom = 20m $\times$ 10m

Area of the bedroom = 200m^2 .

Area of the whole land available = 1200m^2 .

Part of the house occupied by the bedroom = $\frac{200\text{m}^2}{1200\text{m}^2} = \frac{1}{6}$ th part.

Q3. (a) The region EFMO is in the shape of a trapezium.

Area occupied by Dhaniya crop = area of trapezium EFMO.

Area of the trapezium = $\frac{1}{2}$ (sum of parallel side length) $\times$ perpendicular distance between two parallel sides.

Parallel sides FM = 20m & EN = 60m, the distance between parallel sides = MO = AO-AM = 60m – 20m = 40 m.

Area of region EFMO = $\frac{1}{2} (60+20) \times 40 = \frac{1}{2} \times 80 \times 40 = 1600 \text{ m}^2$.

(b) Region for onion crop is a triangle with base (ND) = AD – AN = 90m – 50m = 40m.

Corresponding height (CN) = 40m.

Area of the triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 40\text{m} \times 40\text{m} = 800\text{m}^2$.

Area occupied by the onion crop = 800m^2 .

(c) Labour charges for the Dhaniya crop = Rate $\times$ Area occupied

= Rs. 3 per sq. m $\times$ 1600 sq. m = Rs. 4,800

Labour charges for the onion crop = Rate x Area occupied

$$= \text{Rs. } 5 \text{ per sq. m} \times 800 \text{ sq. m} = \text{Rs. } 4,000$$

Total labour charges for both the crops = Rs. 4,800 + Rs. 4,000

$$= \text{Rs. } 8,800.$$

Q4. (a) Area of paddy section ($\triangle ABC$) = $\frac{1}{2} \times AC \times$ perpendicular from B

$$= \frac{1}{2} \times 60 \times 18$$

$$= \mathbf{540 \text{ m}^2}$$

(b) Area of vegetable section ($\triangle ACD$) = $\frac{1}{2} \times AC \times$ perpendicular from D

$$= \frac{1}{2} \times 60 \times 14$$

$$= \mathbf{420 \text{ m}^2}$$

(c) Income from paddy section ($\triangle ABC$) = $540 \times \text{₹}75 = \text{₹}40,500$

Income from vegetable section ($\triangle ACD$) = $420 \times \text{₹}120 = \text{₹}50,400$

Total expected income = ₹40,500 + ₹50,400 = ₹90,900

Q5. (a) Inner rectangle dimensions:

$$\text{Length} = 20 - 2 \times 1 = 18 \text{ m}$$

$$\text{Width} = 14 - 2 \times 1 = 12 \text{ m}$$

$$\text{Area of inner rectangle} = 18 \times 12 = 216 \text{ m}^2$$

Area of outer border (Section A) = Total Hall area – Inner rectangle area

$$= \mathbf{280 - 216 = 64 \text{ m}^2}$$

(b) Section B — Four corner triangles:

$$\text{Area of one triangle} = \frac{1}{2} \times 3 \times 3 = 4.5 \text{ m}^2$$

$$\mathbf{\text{Total area of 4 triangles} = 4 \times 4.5 = 18 \text{ m}^2}$$

Section C — Two side trapeziums:

$$\text{Area of one trapezium} = \frac{1}{2} \times \text{height} \times (\text{sum of parallel sides})$$

$$= \frac{1}{2} \times 3 \times (12 + 6) = \frac{1}{2} \times 3 \times 18 = 27 \text{ m}^2$$

$$\mathbf{\text{Total area of 2 trapeziums} = 2 \times 27 = 54 \text{ m}^2}$$

Combined area of Sections B and C = 18 + 54 = 72 m²

(c) Section D — Central rhombus:

$$\text{Area} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 12 \times 6$$

$$= \mathbf{36 \text{ m}^2}$$

CLASS TEST

SECTION A – (1 mark each)

Choose the correct option for each question.

Q1. A farmer's rectangular field has a length of 120 m and width of 85 m. He wants to grow crops in exactly half the field by drawing a diagonal and using one triangular portion. What will be the area of the crop region?

- (a) 5,100 m² (b) 10,200 m² (c) 2,550 m² (d) 4,080 m²

Q2. A kite-shaped rangoli is made in the form of a rhombus with diagonals of lengths 18 cm and 24 cm. What is the area of the rangoli design?

- (a) 432 cm² (b) 216 cm² (c) 864 cm² (d) 108 cm²

Q3. Two rectangular plots have the same perimeter of 40 m. Plot A measures 12 m × 8 m, and Plot B measures 14 m × 6 m. Which statement is correct?

- (a) Plot A and Plot B have equal areas
(b) Plot B has greater area than Plot A
(c) Plot A has greater area than Plot B
(d) The area cannot be compared without a diagram

Q4. A parallelogram-shaped tile has a base of 15 cm and a height of 8 cm. A rectangular tile has the same base and the same slant side as the parallelogram (slant side = 10 cm). Which tile covers more area?

- (a) The rectangular tile (b) The parallelogram tile
(c) Both cover equal area (d) Cannot be determined

SECTION B – Short Answer Questions (2 marks each)

Q5. A triangular park has a base of 42 m and a height of 28 m. A 3-metre-wide path runs along its base (outside the park). The path is a rectangle of length 42 m and width 3 m. Find the total area covered by the park and the path together.

Q6. A trapezium-shaped field has parallel sides of 36 m and 24 m, with a perpendicular height of 15 m. A farmer claims the area of his field is 375 m². Is he correct? Justify your answer with working.

Q7. In a rectangle ABCD of dimensions 10 cm × 6 cm, the diagonals AC and BD intersect at O. Find the area of each of the four triangles formed by the diagonals. Are all four triangles equal in area? Give a reason for your answer.

SECTION C – Long Answer Questions (3 marks each)

Q8. A school playground is in the shape of a quadrilateral ABCD. A rope AC divides it into two triangles. The diagonal AC = 30 m. Perpendicular from B to AC = 8 m, and perpendicular from D to AC = 7 m (on the opposite side). The school wants to lay grass turf costing ₹45 per m². Find:

- (i) The total area of the playground.
- (ii) The total cost of laying turf.

Q9. A spiral decorative frame consists of nested rectangles. The outermost rectangle is 20 cm × 20 cm, the next is 18 cm × 18 cm (with a 1 cm wide frame around it), and so on until the innermost rectangle is 10 cm × 10 cm. Each frame strip is 1 cm wide throughout. Find the total area of just the frame strips (not including the innermost rectangle). Show your working clearly.

SECTION D – Case Study (4 marks)

Q10. Read the situation carefully and answer the questions that follow.

Meena is designing a patchwork quilt for her home. The quilt is made up of colourful geometric patches stitched together. The rectangular quilt measures 120 cm × 90 cm. It is divided into patches as follows:

- Four identical triangular patches in the corners, each with base 30 cm and height 20 cm.
- One parallelogram-shaped central patch with base 60 cm and corresponding height 50 cm.
- The remaining area is covered by smaller rectangular patches.

- (i) Find the total area of the four triangular corner patches.
- (ii) Find the area of the central parallelogram patch.
- (iii) Find the area covered by the smaller rectangular patches.
- (iv) Each 1 cm² of quilt fabric costs ₹2.50. What is the cost of fabric for only the smaller rectangular patches?

ANSWERS:

Q1. (a) 5,100 m²

Q2. (b) 216 cm²

Q3. (c) Plot A has greater area than Plot B

Q4. (a) The rectangular tile

Q5. Area of triangular park = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 42 \times 28 = 588 \text{ m}^2$

Area of path (rectangle) = length × width = $42 \times 3 = 126 \text{ m}^2$

Total area = $588 + 126 = 714 \text{ m}^2$

Q6. Area of trapezium = $\frac{1}{2} \times \text{height} \times (\text{sum of parallel sides})$

= $\frac{1}{2} \times 15 \times (36 + 24) = \frac{1}{2} \times 15 \times 60 = 450 \text{ m}^2$

The farmer's claim of 375 m² is incorrect. The correct area is 450 m².

Q7. Area of rectangle ABCD = $10 \times 6 = 60 \text{ cm}^2$

Each triangle = $60 \div 4 = 15 \text{ cm}^2$

Yes, all four triangles are equal in area.

Q8. (i) The diagonal AC divides the quadrilateral into $\triangle ABC$ and $\triangle ACD$.

Area of $\triangle ABC = \frac{1}{2} \times AC \times (\text{perpendicular from B}) = \frac{1}{2} \times 30 \times 8 = 120 \text{ m}^2$

Area of $\triangle ACD = \frac{1}{2} \times AC \times (\text{perpendicular from D}) = \frac{1}{2} \times 30 \times 7 = 105 \text{ m}^2$

Total area of playground = $120 + 105 = 225 \text{ m}^2$

(ii) Cost of turf = Area $\times$ Rate = $225 \times ₹45 = ₹10,125$

Q9. The rectangles from outermost to innermost: 20×20 , 18×18 , 16×16 , 14×14 , 12×12 , 10×10 .

(Each successive rectangle is 2 cm smaller on each side, i.e., the frame is 1 cm wide all around.)

Total area of quilt from outermost frame = Area of 20×20 rectangle = 400 cm^2

Area of innermost rectangle (not counted) = $10 \times 10 = 100 \text{ cm}^2$

Total area of all frame strips = $400 - 100 = 300 \text{ cm}^2$

Q10. Total area of quilt = $120 \times 90 = 10,800 \text{ cm}^2$

(i) Area of ONE triangular corner patch = $\frac{1}{2} \times 30 \times 20 = 300 \text{ cm}^2$

Total area of FOUR triangular patches = $4 \times 300 = 1,200 \text{ cm}^2$

(ii) Area of central parallelogram patch = base $\times$ height = $60 \times 50 = 3,000 \text{ cm}^2$

(iii) Area of smaller rectangular patches

= Total quilt area – Area of triangles – Area of parallelogram

= $10,800 - 1,200 - 3,000 = 6,600 \text{ cm}^2$

(iv) Cost of fabric for rectangular patches = $6,600 \times ₹2.50 = ₹16,500$