

# Kerala NMMS Mathematics

## Sample Paper – 3

Duration: 30 Minutes

Maximum Marks: 30

### Instructions

- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Mathematics portion of **Kerala NMMS (SAT)**.
- Each correct answer carries **+1 mark**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 7–8 (SCERT Kerala) — Number System, Algebra, Mensuration, Geometry, Comparing Quantities, Ratio & Proportion, Data Handling, Exponents.**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited. Rough work may be done in the space provided.

Q1. Which property does the following equation illustrate?

$$\frac{2}{3} \times \left( \frac{4}{5} + \left( -\frac{1}{2} \right) \right) = \frac{2}{3} \times \frac{4}{5} + \frac{2}{3} \times \left( -\frac{1}{2} \right)$$

- (A) Commutative property of multiplication
- (B) Distributive property of multiplication over addition
- (C) Associative property of multiplication
- (D) Closure property of multiplication

Q2. The rational number exactly halfway between  $-\frac{3}{4}$  and  $\frac{1}{4}$  is:

- (A)  $-\frac{1}{2}$
- (B)  $-\frac{1}{8}$



(C)  $-\frac{1}{4}$

(D)  $\frac{1}{8}$

**Q3.** Simplify:  $\left(-\frac{4}{7}\right) \times \frac{21}{8} \times \left(-\frac{2}{3}\right)$

(A) 1

(B)  $-1$

(C)  $\frac{3}{2}$

(D)  $-\frac{3}{2}$

**Q4.** Which of the following rational numbers is in **standard form**?

(Standard form: GCD of |numerator| and denominator equals 1, and denominator is positive.)

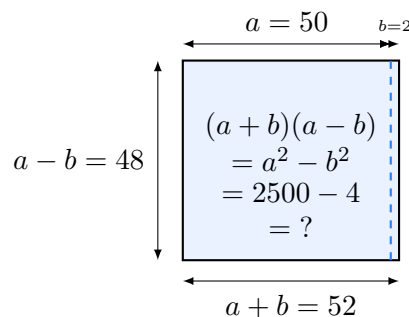
(A)  $\frac{-6}{-4}$

(B)  $\frac{15}{25}$

(C)  $\frac{-8}{12}$

(D)  $\frac{-7}{9}$

**Q5.** Using the identity  $(a + b)(a - b) = a^2 - b^2$ , find the value of  $52 \times 48$ .



(A) 2,450

(B) 2,496

(C) 2,504



(D) 2,400

**Q6.** Factorize  $x^2 - 16$  using the difference of squares identity.

(A)  $(x + 4)^2$

(B)  $(x - 4)^2$

(C)  $(x + 4)(x - 4)$

(D)  $(x + 8)(x - 2)$

**Q7.** Solve:  $\frac{2x + 1}{3} = \frac{x - 2}{2}$

(A)  $x = -8$

(B)  $x = 8$

(C)  $x = -4$

(D)  $x = 4$

**Q8.** A train covers 240 km at a uniform speed. If its speed had been 20 km/h more, it would have taken 1 hour less to cover the same distance. Find the original speed of the train.

(A) 40 km/h

(B) 80 km/h

(C) 50 km/h

(D) 60 km/h

**Q9.** Simplify:  $\frac{a^2 - 4}{a - 2}$ , given that  $a \neq 2$ .

(A)  $a - 2$

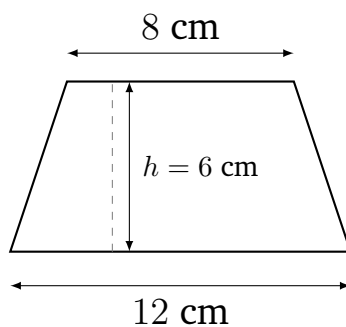
(B)  $a + 2$

(C)  $a^2 + 2$

(D)  $2a$

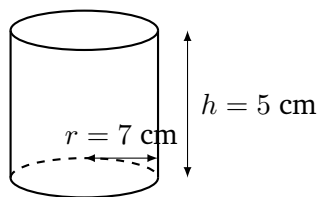
**Q10.** Find the area of the trapezium shown below.





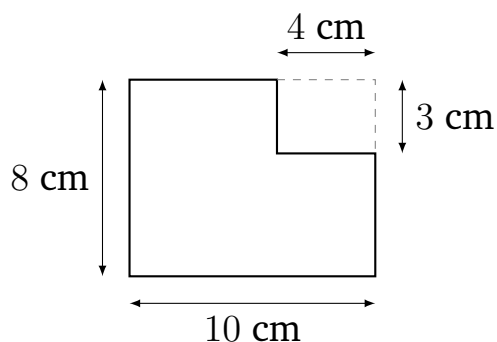
- (A)  $48 \text{ cm}^2$
- (B)  $72 \text{ cm}^2$
- (C)  $60 \text{ cm}^2$
- (D)  $36 \text{ cm}^2$

**Q11.** Find the volume of the cylinder shown below. (Use  $\pi = \frac{22}{7}$ )



- (A)  $770 \text{ cm}^3$
- (B)  $154 \text{ cm}^2$
- (C)  $385 \text{ cm}^3$
- (D)  $1,540 \text{ cm}^3$

**Q12.** An L-shaped figure is formed by removing a  $4 \text{ cm} \times 3 \text{ cm}$  rectangle from the top-right corner of a  $10 \text{ cm} \times 8 \text{ cm}$  rectangle. Find the perimeter of the L-shaped figure.

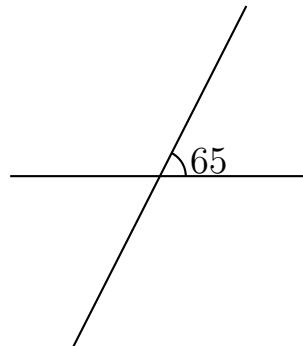


- (A) 40 cm
- (B) 32 cm
- (C) 44 cm
- (D) 36 cm

**Q13.** Find the curved (lateral) surface area of a cone with base radius  $r = 6$  cm and slant height  $l = 10$  cm. (Use  $\pi = \frac{22}{7}$ )

- (A)  $132 \text{ cm}^2$
- (B)  $\frac{1320}{7} \text{ cm}^2$
- (C)  $220 \text{ cm}^2$
- (D)  $\frac{660}{7} \text{ cm}^2$

**Q14.** In the figure below, two straight lines intersect. One of the angles formed is 65. Find the vertically opposite angle and the adjacent supplementary angle.



- (A) Vertically opposite = 65; adjacent supplementary = 90
- (B) Vertically opposite = 65; adjacent supplementary = 65
- (C) Vertically opposite = 65; adjacent supplementary = 115
- (D) Vertically opposite = 115; adjacent supplementary = 65

**Q15.** The diagonals of a rectangle are each 10 cm long. If one side of the rectangle is 6 cm, find the length of the other side.

- (A) 8 cm
- (B) 4 cm



(C)  $\sqrt{136}$  cm

(D) 7 cm

**Q16.** What is the sum of interior angles of an octagon?

(A) 720

(B) 900

(C) 960

(D) 1080

**Q17.** Two right-angled triangles have equal hypotenuses and one pair of equal corresponding legs. The congruence rule that applies is:

(A) SSS (Side-Side-Side)

(B) RHS (Right angle – Hypotenuse – Side)

(C) ASA (Angle-Side-Angle)

(D) AAS (Angle-Angle-Side)

**Q18.** The population of a town is 12,500. If it increases by 4% in one year, what is the new population?

(A) 12,000

(B) 13,500

(C) 13,000

(D) 12,800

**Q19.** An article is sold for Rs. 594 at a profit of 10%. Find the cost price of the article.

(A) Rs. 540

(B) Rs. 560

(C) Rs. 520

(D) Rs. 600



- Q20.** Find the amount when Rs. 10,000 is invested at 8% per annum compounded annually for 2 years.
- (A) Rs. 11,600  
(B) Rs. 12,000  
(C) Rs. 11,000  
(D) Rs. 11,664
- Q21.** A television set costs Rs. 18,000 before VAT. If the rate of VAT is 12%, what is the final cost including VAT?
- (A) Rs. 18,216  
(B) Rs. 20,160  
(C) Rs. 19,800  
(D) Rs. 21,600
- Q22.** A shopkeeper gives a 15% discount on an article marked at Rs. 1,200. Find the discount amount.
- (A) Rs. 150  
(B) Rs. 120  
(C) Rs. 180  
(D) Rs. 200
- Q23.** If the cost of 7 notebooks is Rs. 84, find the cost of 11 notebooks.
- (A) Rs. 132  
(B) Rs. 144  
(C) Rs. 120  
(D) Rs. 154
- Q24.** A hostel has enough food for 40 students for 30 days. If 10 more students join, for how many days will the food last?
- (A) 20 days



- (B) 36 days
- (C) 32 days
- (D) 24 days

**Q25.** Find the value of  $x$  if  $2 : x = 8 : 12$ .

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

**Q26.** Find the mode of the data: 5, 7, 3, 5, 9, 7, 5, 3, 7, 5.

The frequency table for this data is shown below.

| Value | Tally | Frequency |
|-------|-------|-----------|
| 3     |       | 2         |
| 5     |       | 4         |
| 7     |       | 3         |
| 9     |       | 1         |

- (A) 3
- (B) 7
- (C) 5
- (D) 9

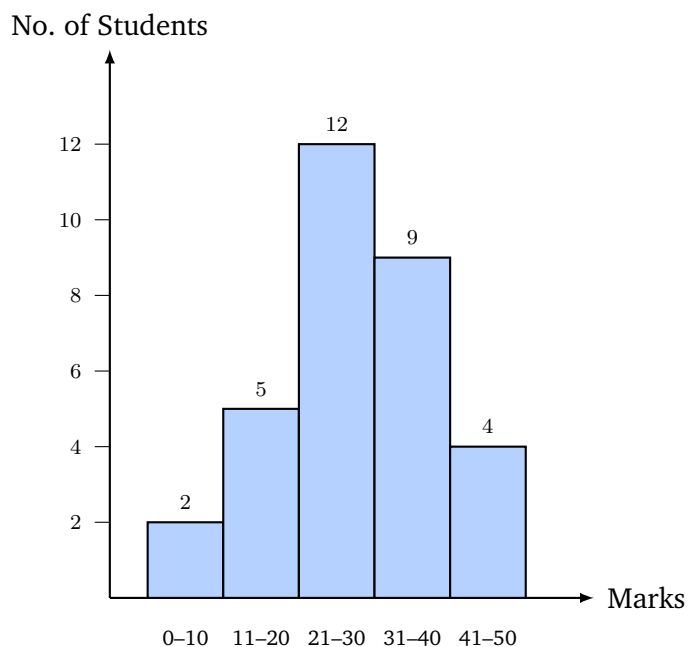
**Q27.** A card is drawn at random from cards numbered 1 to 20. What is the probability that the drawn card bears a prime number?

- (A)  $\frac{2}{5}$
- (B)  $\frac{1}{2}$
- (C)  $\frac{3}{10}$



(D)  $\frac{1}{4}$

**Q28.** In a class, the marks (out of 50) are distributed as shown in the histogram below. How many students scored **above 30 marks**?



- (A) 9  
(B) 4  
(C) 11  
(D) 13

**Q29.** Simplify  $2^{-3} \times 4^2$  and express the result as a single power of 2.

- (A)  $2^{-1}$   
(B)  $2^1$   
(C)  $2^{-7}$   
(D)  $2^7$

**Q30.** If  $2^x = 64$ , find the value of  $x$ .

- (A) 4  
(B) 5  
(C) 6



(D) 7



## Detailed Solutions

### Solution 1 — Rational Numbers: Property of Operations

#### Solution

**Concept:** The *distributive property* of multiplication over addition states that for rational numbers  $a, b, c$ :

$$a \times (b + c) = a \times b + a \times c$$

**Step 1:** Identify the left side:  $\frac{2}{3} \times \left(\frac{4}{5} + \left(-\frac{1}{2}\right)\right)$ . The outer factor  $\frac{2}{3}$  multiplies the bracketed sum.

**Step 2:** The right side  $\frac{2}{3} \times \frac{4}{5} + \frac{2}{3} \times \left(-\frac{1}{2}\right)$  shows  $\frac{2}{3}$  *distributed* into each term of the sum. This is precisely the distributive property.

**Why other options are wrong:**

- (A) *Commutative* property swaps the order of operands:  $a \times b = b \times a$ . No reordering occurs here.
- (C) *Associative* property regroups factors:  $(a \times b) \times c = a \times (b \times c)$ . The grouping does not change here.
- (D) *Closure* property ensures the result stays within the set of rational numbers; it is not about expanding expressions.

**Answer: (B)**

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### Solution 2 — Rational Numbers: Midpoint on Number Line

#### Solution

**Concept:** The number halfway between  $p$  and  $q$  is their arithmetic mean  $\frac{p+q}{2}$ .

**Step 1:** Set  $p = -\frac{3}{4}$  and  $q = \frac{1}{4}$ .

**Step 2:**

$$\text{Midpoint} = \frac{p+q}{2} = \frac{-\frac{3}{4} + \frac{1}{4}}{2} = \frac{-\frac{2}{4}}{2} = \frac{-\frac{1}{2}}{2} = -\frac{1}{4}$$

**Why other options are wrong:**



- (A)  $-\frac{1}{2}$ : This is the sum  $p + q$  itself, not divided by 2.
- (B)  $-\frac{1}{8}$ : Arises from dividing only  $q$  by 2 instead of computing the mean correctly.
- (D)  $\frac{1}{8}$ : A positive value; lies to the right on the number line and is not between  $-\frac{3}{4}$  and  $\frac{1}{4}$  symmetrically.

**Answer: (C)**

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### Solution 3 — Rational Numbers: Product of Three Rationals

#### Solution

**Concept:** The product of an even number of negative factors is positive. Multiply numerators and denominators separately.

**Step 1:** Two negatives are present, so the overall product is positive.

**Step 2:** Compute:

$$\left(-\frac{4}{7}\right) \times \frac{21}{8} \times \left(-\frac{2}{3}\right) = \frac{(-4) \times 21 \times (-2)}{7 \times 8 \times 3} = \frac{+168}{168} = 1$$

**Why other options are wrong:**

- (B)  $-1$ : Incorrect sign; two negatives give a positive product.
- (C)  $\frac{3}{2}$ : Results from forgetting to cancel the factor of 7 in 21 with the denominator 7.
- (D)  $-\frac{3}{2}$ : Wrong both in sign and in value.

**Answer: (A)**

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## Solution 4 — Rational Numbers: Standard Form

### Solution

**Concept:** A rational number  $\frac{p}{q}$  is in **standard form** when (i)  $\gcd(|p|, |q|) = 1$  and (ii)  $q > 0$ .

**Step 1:** Check each option systematically.

**Step 2:**

- (A)  $\frac{-6}{-4}$ : Denominator is  $-4 < 0$ . Not standard form.
- (B)  $\frac{15}{25}$ :  $\gcd(15, 25) = 5 \neq 1$ . Not standard form ( $= \frac{3}{5}$  in standard form).
- (C)  $\frac{-8}{12}$ :  $\gcd(8, 12) = 4 \neq 1$ . Not standard form ( $= \frac{-2}{3}$  in standard form).
- (D)  $\frac{-7}{9}$ :  $\gcd(7, 9) = 1$  and denominator  $9 > 0$ . **This is in standard form.**

**Answer: (D)**

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## Solution 5 — Algebra: Identity $(a + b)(a - b) = a^2 - b^2$

### Solution

**Concept:** The difference of squares identity avoids direct multiplication:  $(a + b)(a - b) = a^2 - b^2$ .

**Step 1:** Write  $52 = 50 + 2$  and  $48 = 50 - 2$ , identifying  $a = 50$ ,  $b = 2$ .

**Step 2:**

$$52 \times 48 = (50 + 2)(50 - 2) = 50^2 - 2^2 = 2500 - 4 = 2496$$

**Why other options are wrong:**

- (A) 2,450: From  $49 \times 50$ , which is a different product.
- (C) 2,504: From adding instead of subtracting  $b^2$ :  $50^2 + 2^2 = 2504$ .
- (D) 2,400: From computing only  $50 \times 48 = 2400$ , ignoring the  $+2$  portion.

**Answer: (B)**

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**Solution 6 — Algebra: Factorization (Difference of Squares)****Solution**

**Concept:**  $a^2 - b^2 = (a + b)(a - b)$ .

**Step 1:** Recognize  $x^2 - 16 = x^2 - 4^2$ , with  $a = x$  and  $b = 4$ .

**Step 2:** Apply the identity:

$$x^2 - 16 = (x + 4)(x - 4)$$

**Why other options are wrong:**

- (A)  $(x + 4)^2 = x^2 + 8x + 16$ . Contains a middle term; does not equal  $x^2 - 16$ .
- (B)  $(x - 4)^2 = x^2 - 8x + 16$ . Again contains a middle term.
- (D)  $(x + 8)(x - 2) = x^2 + 6x - 16 \neq x^2 - 16$ .

**Answer: (C)**

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**Solution 7 — Algebra: Linear Equation in One Variable**

**Solution**

**Concept:** Cross-multiply to clear fractions, then collect like terms and solve.

**Step 1:** Cross-multiply:

$$\frac{2x+1}{3} = \frac{x-2}{2} \implies 2(2x+1) = 3(x-2)$$

**Step 2:** Expand and solve:

$$4x + 2 = 3x - 6 \implies 4x - 3x = -6 - 2 \implies x = -8$$

**Verification:** LHS =  $\frac{2(-8)+1}{3} = \frac{-15}{3} = -5$ ; RHS =  $\frac{-8-2}{2} = \frac{-10}{2} = -5$ . ✓

**Why other options are wrong:**

- (B)  $x = 8$ : Sign error;  $-6 - 2 = -8$ , not  $+8$ .
- (C)  $x = -4$ : Error in expanding  $3(x - 2)$  incorrectly.
- (D)  $x = 4$ : Positive sign error on the value.

**Answer:** (A)

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## Solution 8 — Algebra: Word Problem (Train Speed)

**Solution**

**Concept:** Time =  $\frac{\text{Distance}}{\text{Speed}}$ . The time difference gives the equation.

**Step 1:** Let original speed =  $v$  km/h. Then:

$$\frac{240}{v} - \frac{240}{v+20} = 1$$

**Step 2:** Multiply through by  $v(v+20)$ :

$$240(v+20) - 240v = v(v+20) \implies 4800 = v^2 + 20v$$

$$v^2 + 20v - 4800 = 0$$

Using the quadratic formula with  $a = 1$ ,  $b = 20$ ,  $c = -4800$ :

$$v = \frac{-20 + \sqrt{400 + 19200}}{2} = \frac{-20 + \sqrt{19600}}{2} = \frac{-20 + 140}{2} = 60 \text{ km/h}$$



**Why other options are wrong:**

- (A) 40 km/h:  $\frac{240}{40} - \frac{240}{60} = 6 - 4 = 2 \neq 1$ . Does not satisfy the equation.
- (B) 80 km/h:  $\frac{240}{80} - \frac{240}{100} = 3 - 2.4 = 0.6 \neq 1$ .
- (C) 50 km/h:  $\frac{240}{50} - \frac{240}{70} \approx 4.8 - 3.43 \approx 1.37 \neq 1$ .

**Answer: (D)**

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## Solution 9 — Algebra: Simplification of Rational Expression

### Solution

**Concept:** Factor the numerator using the difference of squares, then cancel the common factor.

**Step 1:** Factor  $a^2 - 4 = a^2 - 2^2 = (a + 2)(a - 2)$ .

**Step 2:** Cancel  $(a - 2)$  from numerator and denominator (valid since  $a \neq 2$ ):

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

**Why other options are wrong:**

- (A)  $a - 2$ : Results from canceling the wrong factor  $(a + 2)$  instead of  $(a - 2)$ .
- (C)  $a^2 + 2$ : Incorrect; no such simplification exists.
- (D)  $2a$ : Treating the expression as  $\frac{a \cdot a}{a} = a$  and adding  $a$ ; entirely wrong approach.

**Answer: (B)**

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**Solution 10 — Mensuration: Area of Trapezium****Solution**

**Concept:** Area of trapezium =  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$ .

**Step 1:** Parallel sides:  $a = 12$  cm,  $b = 8$  cm; height  $h = 6$  cm.

**Step 2:**

$$\text{Area} = \frac{1}{2} \times (12 + 8) \times 6 = \frac{1}{2} \times 20 \times 6 = 60 \text{ cm}^2$$

**Why other options are wrong:**

- (A)  $48 \text{ cm}^2$ : From incorrectly using only the longer base:  $\frac{1}{2} \times 12 \times 8 = 48$ .
- (B)  $72 \text{ cm}^2$ : From  $12 \times 6 = 72$  (omitting the  $\frac{1}{2}$  factor and the shorter base).
- (D)  $36 \text{ cm}^2$ : From  $\frac{1}{2} \times (8 + 4) \times 6$  (using an incorrect base of 4 instead of 12).

**Answer: (C)**

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**Solution 11 — Mensuration: Volume of Cylinder****Solution**

**Concept:** Volume of a cylinder =  $\pi r^2 h$ .

**Step 1:**  $r = 7$  cm,  $h = 5$  cm,  $\pi = \frac{22}{7}$ .

**Step 2:**

$$V = \frac{22}{7} \times 7^2 \times 5 = \frac{22}{7} \times 49 \times 5 = 22 \times 7 \times 5 = 770 \text{ cm}^3$$

**Why other options are wrong:**

- (B)  $154 \text{ cm}^2$ : This is the area of the circular base  $\pi r^2 = \frac{22}{7} \times 49 = 154 \text{ cm}^2$  – a different quantity with a different unit.
- (C)  $385 \text{ cm}^3$ : Exactly half the correct answer; error of an extra factor of  $\frac{1}{2}$ .
- (D)  $1,540 \text{ cm}^3$ : Double the correct answer; possibly from using  $h = 10$  instead of 5.

**Answer: (A)**

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## Solution 12 — Mensuration: Perimeter of L-Shape

### Solution

**Concept:** Add all outer edge lengths of the L-shaped polygon. Removing a rectangular corner introduces two new inner sides that together replace the original corner length.

**Step 1:** Label the six sides of the L-shape going clockwise from the bottom-left corner:

- Bottom: 10 cm
- Right side (shortened):  $8 - 3 = 5$  cm
- Inner horizontal step: 4 cm
- Inner vertical step: 3 cm
- Top (shortened):  $10 - 4 = 6$  cm
- Left side: 8 cm

**Step 2:**

$$P = 10 + 5 + 4 + 3 + 6 + 8 = 36 \text{ cm}$$

**Why other options are wrong:**

- (A) 40 cm: Error from taking the top side as the full 10 cm instead of the correct 6 cm:  $10 + 5 + 4 + 3 + 10 + 8 = 40$ .
- (B) 32 cm: Error from summing only four sides and omitting the two inner notch sides.
- (C) 44 cm: Overcounting by including some sides more than once.

**Answer: (D)**

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## Solution 13 — Mensuration: Curved Surface Area of Cone

### Solution

**Concept:** Curved (Lateral) Surface Area of a cone  $= \pi r l$ , where  $r$  is the base radius and  $l$  is the slant height.

**Step 1:**  $r = 6$  cm,  $l = 10$  cm,  $\pi = \frac{22}{7}$ .

**Step 2:**

$$\text{CSA} = \pi r l = \frac{22}{7} \times 6 \times 10 = \frac{1320}{7} \text{ cm}^2$$



**Why other options are wrong:**

- (A)  $132 \text{ cm}^2$ : From  $\frac{22}{7} \times 6 \times 7 = 132$  – using  $l = 7$  instead of the given  $l = 10$ .
- (C)  $220 \text{ cm}^2$ : From  $\frac{22}{7} \times 7 \times 10 = 220$  – using  $r = 7$  instead of the given  $r = 6$ .
- (D)  $\frac{660}{7} \text{ cm}^2$ : From  $\frac{22}{7} \times 3 \times 10$  – halving the radius incorrectly.

**Answer: (B)**

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## Solution 14 — Geometry: Angles Formed at Intersection

### Solution

**Concept:**

- *Vertically opposite angles* are equal.
- *Linear pair* (adjacent angles on a straight line) are supplementary: they add to 180.

**Step 1:** Given one angle = 65.

Vertically opposite angle = 65 (equal to the given angle).

**Step 2:** Adjacent angle (linear pair) =  $180 - 65 = 115$ .

**Why other options are wrong:**

- (A) Adjacent = 90: Only true if the two lines are perpendicular, which is not stated.
- (B) Adjacent = 65: Adjacent supplementary angles are equal only when both are 90. Here  $65 \neq 90$ .
- (D) Vertically opposite = 115: Vertically opposite angles equal the given angle (65), not its supplement.

**Answer: (C)**

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**Solution 15 — Geometry: Sides of a Rectangle Using Pythagoras****Solution**

**Concept:** A diagonal of a rectangle divides it into two right-angled triangles. By the Pythagorean theorem:  $d^2 = l^2 + w^2$ .

**Step 1:** Diagonal  $d = 10$  cm, one side  $l = 6$  cm.

**Step 2:**

$$w^2 = d^2 - l^2 = 10^2 - 6^2 = 100 - 36 = 64 \implies w = 8 \text{ cm}$$

**Why other options are wrong:**

- (B) 4 cm: From  $10 - 6 = 4$  (subtracting lengths instead of applying Pythagoras).
- (C)  $\sqrt{136}$  cm: From  $w^2 = 100 + 36 = 136$  (adding the squares instead of subtracting).
- (D) 7 cm: Check:  $6^2 + 7^2 = 36 + 49 = 85 \neq 100$ . Incorrect.

**Answer: (A)**

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**Solution 16 — Geometry: Sum of Interior Angles of a Polygon****Solution**

**Concept:** Sum of interior angles of an  $n$ -sided polygon  $= (n - 2) \times 180$ .

**Step 1:** An octagon has  $n = 8$  sides.

**Step 2:**

$$\text{Sum} = (8 - 2) \times 180 = 6 \times 180 = 1080$$

**Why other options are wrong:**

- (A) 720: Sum for a *hexagon* ( $n = 6$ ):  $(6 - 2) \times 180 = 720$ .
- (B) 900: Sum for a *heptagon* ( $n = 7$ ):  $(7 - 2) \times 180 = 900$ .
- (C) 960: Does not correspond to any standard polygon; a likely arithmetic error using  $n = 7.33$ .

**Answer: (D)**

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## Solution 17 — Geometry: Triangle Congruence (RHS)

### Solution

**Concept:** The RHS congruence rule applies *only* to right-angled triangles: if the hypotenuse and one leg (side) of two right triangles are correspondingly equal, the triangles are congruent.

**Step 1:** Both triangles are right-angled (Right angle confirmed). Their hypotenuses are equal and one leg is equal.

**Step 2:** This matches exactly the RHS criterion: Right angle, Hypotenuse, Side.

**Why other options are wrong:**

- (A) SSS: Requires all three sides to be known. We have confirmed only two sides.
- (C) ASA: Requires two angles and the included side. Only one angle (the right angle) is explicitly known.
- (D) AAS: Requires two angles and a non-included side. Again only one angle is known.

**Answer: (B)**

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## Solution 18 — Comparing Quantities: Percentage Increase

### Solution

**Concept:** New value = Original value  $\times \left(1 + \frac{\text{rate}\%}{100}\right)$ .

**Step 1:** Original population = 12,500, rate = 4%.

**Step 2:**

$$\begin{aligned}\text{Increase} &= 12,500 \times \frac{4}{100} = 500 \\ \text{New population} &= 12,500 + 500 = 13,000\end{aligned}$$

**Why other options are wrong:**

- (A) 12,000: Subtracting instead of adding, i.e., a 4% decrease.
- (B) 13,500: Corresponds to an 8% increase:  $12,500 \times 1.08 = 13,500$ .
- (D) 12,800: 4% of 12,500 is 500, not 300. The increase of 300 corresponds only to a 2.4% rate.



**Answer: (C)**

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### Solution 19 — Comparing Quantities: Cost Price from SP and Profit

#### Solution

**Concept:**  $SP = CP \times \left(1 + \frac{\text{Profit}\%}{100}\right)$ , so  $CP = \frac{SP}{1 + \text{Profit}\%/100}$ .

**Step 1:**  $SP = \text{Rs. } 594$ ,  $\text{Profit} = 10\%$ .

**Step 2:**

$$CP = \frac{594}{1 + 10/100} = \frac{594}{1.1} = \frac{594 \times 10}{11} = \frac{5940}{11} = \text{Rs. } 540$$

**Why other options are wrong:**

- (B) Rs. 560: Does not satisfy  $560 \times 1.1 = 616 \neq 594$ .
- (C) Rs. 520:  $520 \times 1.1 = 572 \neq 594$ .
- (D) Rs. 600: This would give  $SP = 600 \times 1.1 = 660 \neq 594$ ; or arises from incorrectly computing  $CP = SP - 10\%$  of  $SP$  instead of dividing by 1.1.

**Answer: (A)**

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### Solution 20 — Comparing Quantities: Compound Interest

#### Solution

**Concept:**  $\text{Amount} = P \left(1 + \frac{r}{100}\right)^n$ , where  $P$  = principal,  $r$  = rate per annum,  $n$  = years.

**Step 1:**  $P = 10,000$ ,  $r = 8$ ,  $n = 2$ .

**Step 2:**

$$A = 10,000 \times \left(\frac{108}{100}\right)^2 = 10,000 \times \frac{108 \times 108}{10000} = \frac{11,664,00}{100} = 116,640$$

$$108 \times 108 = 11,664 \implies A = \text{Rs. } 11,664$$

**Why other options are wrong:**

- (A) Rs. 11,600: This is the Simple Interest amount for 2 years:  $SI = 10000 \times 8/100 \times 2$



$$2 = 1600; \text{ total} = 11,600.$$

- (B) Rs. 12,000: Over-estimate; corresponds to 10% SI for 2 years.
- (C) Rs. 11,000: SI for only 1 year at 10%, not compound at 8%.

**Answer: (D)**

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## Solution 21 — Comparing Quantities: Value Added Tax (VAT)

### Solution

**Concept:** Final price (inclusive of VAT) = Original price  $\times \left(1 + \frac{\text{VAT}\%}{100}\right)$ .

**Step 1:** Original price = Rs. 18,000, VAT = 12%.

**Step 2:**

$$\text{VAT amount} = 18,000 \times \frac{12}{100} = 2,160$$

$$\text{Final price} = 18,000 + 2,160 = \text{Rs. } 20,160$$

**Why other options are wrong:**

- (A) Rs. 18,216: From a decimal error: 12% of 18,000 computed as  $\approx 216$  (off by a factor of 10).
- (C) Rs. 19,800: From using 10% VAT:  $18,000 \times 1.10 = 19,800$ .
- (D) Rs. 21,600: From using 20% VAT:  $18,000 \times 1.20 = 21,600$ .

**Answer: (B)**

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## Solution 22 — Comparing Quantities: Discount Amount

### Solution

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

**Step 1:** Marked price = Rs. 1,200, Discount rate = 15%.



**Step 2:**

$$\text{Discount} = \frac{15}{100} \times 1200 = 15 \times 12 = \text{Rs. } 180$$

**Why other options are wrong:**

- (A) Rs. 150: From 12.5% of Rs. 1,200 (wrong rate).
- (B) Rs. 120: From 10% of Rs. 1,200 (wrong rate).
- (D) Rs. 200: Approximate result of taking  $\frac{1}{6} \times 1200 \approx 200$ , using an incorrect fraction for 15%.

**Answer: (C)**

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### Solution 23 — Ratio & Proportion: Direct Proportion

#### Solution

**Concept:** In direct proportion, cost and quantity are in a constant ratio: cost  $\propto$  quantity.

**Step 1:** Cost of 7 notebooks = Rs. 84.

Unit cost =  $\frac{84}{7} = \text{Rs. } 12$  per notebook.

**Step 2:** Cost of 11 notebooks =  $11 \times 12 = \text{Rs. } 132$ .

**Why other options are wrong:**

- (B) Rs. 144: From taking unit price as  $\text{Rs. } 144/11 \approx 13.09$  (incorrect).
- (C) Rs. 120: From  $10 \times 12 = 120$  – using 10 notebooks instead of 11.
- (D) Rs. 154: From  $11 \times 14 = 154$  – using an incorrect unit price of Rs. 14.

**Answer: (A)**

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## Solution 24 — Ratio & Proportion: Inverse Proportion

### Solution

**Concept:** Food and number of students are *inversely proportional*: more students, fewer days.

$$\text{Students} \times \text{Days} = \text{constant}$$

**Step 1:** Original: 40 students for 30 days. New total students =  $40 + 10 = 50$ .

**Step 2:**

$$40 \times 30 = 50 \times d \implies d = \frac{1200}{50} = 24 \text{ days}$$

**Why other options are wrong:**

- (A) 20 days: From  $40 \times 30 = 60 \times d$  – using 60 students instead of 50.
- (B) 36 days: From misapplying a direct proportion:  $\frac{40}{50} \times 30$  + extra, giving an incorrect result.
- (C) 32 days: From incorrect computation of the product constant.

**Answer: (D)**

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## Solution 25 — Ratio & Proportion: Finding an Unknown Term

### Solution

**Concept:** In a proportion  $a : b = c : d$ , the cross-product rule gives  $ad = bc$ .

**Step 1:**  $2 : x = 8 : 12$ , so  $\frac{2}{x} = \frac{8}{12}$ .

**Step 2:** Cross-multiply:  $2 \times 12 = 8 \times x \implies 24 = 8x \implies x = 3$ .

**Why other options are wrong:**

- (A) 4: From  $\frac{2}{x} = \frac{8}{16}$ , i.e., using 12 as 16 – arithmetic slip.
- (C) 2: From  $\frac{2}{x} = \frac{8}{8}$ , treating both terms of the second ratio as equal.
- (D) 6: From misreading  $8 : 12$  as  $4 : 12$ , giving  $2 \times 12 = 4x \implies x = 6$ .

**Answer: (B)**

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**Solution 26 — Data Handling: Mode****Solution**

**Concept:** The **mode** is the value that appears most frequently in a data set.

**Step 1:** Count the frequency of each value in {5, 7, 3, 5, 9, 7, 5, 3, 7, 5}:

- 3 appears 2 times
- 5 appears 4 times
- 7 appears 3 times
- 9 appears 1 time

**Step 2:** The highest frequency is 4, for the value 5. Therefore, **Mode** = 5.

**Why other options are wrong:**

- (A) 3: Appears only 2 times; not the most frequent.
- (B) 7: Appears 3 times; second-highest frequency, but not the mode.
- (D) 9: Appears only once; the least frequent value.

**Answer:** (C)

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**Solution 27 — Data Handling: Probability of a Prime Number****Solution**

**Concept:** Probability =  $\frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$ .

**Step 1:** Total cards numbered 1 to 20; total outcomes = 20.

**Step 2:** Prime numbers from 1 to 20:

$$\{2, 3, 5, 7, 11, 13, 17, 19\}$$

Number of primes = 8.

$$P(\text{prime}) = \frac{8}{20} = \frac{2}{5}$$

**Why other options are wrong:**

- (B)  $\frac{1}{2}$ : Would need 10 prime numbers from 1 to 20; there are only 8.



- (C)  $\frac{3}{10}$ : Would correspond to 6 primes, which is the count if 1 is wrongly included and 2 are wrongly excluded.
- (D)  $\frac{1}{4}$ : Would correspond to 5 primes; incorrect count.

**Answer: (A)**

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## Solution 28 — Data Handling: Reading a Histogram

### Solution

**Concept:** “Scored above 30 marks” includes students in the 31–40 and 41–50 groups.

**Step 1:** Read the histogram frequencies:

- 31–40: 9 students
- 41–50: 4 students

**Step 2:** Total students who scored above 30 marks =  $9 + 4 = 13$ .

**Why other options are wrong:**

- (A) 9: Only the 31–40 group; the 41–50 group is omitted.
- (B) 4: Only the 41–50 group; the 31–40 group is omitted.
- (C) 11: Likely from adding  $5 + 4 + 2 = 11$  (wrong intervals chosen).

**Answer: (D)**

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## Solution 29 — Exponents: Laws of Exponents

### Solution

**Concept:** Key laws used:

- $(a^m)^n = a^{mn}$
- $a^m \times a^n = a^{m+n}$



**Step 1:** Convert  $4^2$  to a power of 2:

$$4 = 2^2 \implies 4^2 = (2^2)^2 = 2^4$$

**Step 2:** Apply the product rule:

$$2^{-3} \times 4^2 = 2^{-3} \times 2^4 = 2^{-3+4} = 2^1$$

**Why other options are wrong:**

- (A)  $2^{-1}$ : From  $2^{-3} \times 2^2 = 2^{-1}$  – converting  $4^2$  as  $2^2$  instead of  $2^4$  (i.e., confusing  $4^2$  with  $4 = 2^2$ ).
- (C)  $2^{-7}$ : From subtracting exponents:  $2^{-3-4} = 2^{-7}$  – dividing instead of multiplying.
- (D)  $2^7$ : Sign error in adding: mistaking  $-3 + 4 = 7$  instead of 1.

**Answer: (B)**

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## Solution 30 — Exponents: Solving an Exponential Equation

### Solution

**Concept:** If  $a^x = a^n$  (same base), then  $x = n$ . Express the right-hand side as a power of 2.

**Step 1:** Express 64 as a power of 2:

$$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$$

**Step 2:**  $2^x = 2^6 \implies x = 6$ .

**Why other options are wrong:**

- (A) 4:  $2^4 = 16 \neq 64$ .
- (B) 5:  $2^5 = 32 \neq 64$ .
- (D) 7:  $2^7 = 128 \neq 64$ .

**Answer: (C)**



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## Answer Key

| Q. | Ans. | Q. | Ans. | Q. | Ans. | Q. | Ans. | Q. | Ans. |
|----|------|----|------|----|------|----|------|----|------|
| 1  | B    | 2  | C    | 3  | A    | 4  | D    | 5  | B    |
| 6  | C    | 7  | A    | 8  | D    | 9  | B    | 10 | C    |
| 11 | A    | 12 | D    | 13 | B    | 14 | C    | 15 | A    |
| 16 | D    | 17 | B    | 18 | C    | 19 | A    | 20 | D    |
| 21 | B    | 22 | C    | 23 | A    | 24 | D    | 25 | B    |
| 26 | C    | 27 | A    | 28 | D    | 29 | B    | 30 | C    |

*Distribution: A – 7 questions (Q3,Q7,Q11,Q15,Q19,Q23,Q27); B – 8 questions (Q1,Q5,Q9,Q13,Q17,Q21,Q25,Q29); C – 8 questions (Q2,Q6,Q10,Q14,Q18,Q22,Q26,Q30); D – 7 questions (Q4,Q8,Q12,Q16,Q20,Q24,Q28).*

