CBSE Class X Mathematics (Basic) Set 1 (430/4/1)

Time Allowed :3 Hours	**Maximum Marks :**80	**Total Questions :**38

General Instructions

Read the following instructions very carefully and strictly follow them:

1. This paper consists of 39 questions. All questions are compulsory.
2. This paper is divided into five sections - A, B, C, D and E.
3. Section A Nos. 1 to 20 are Multiple Choice Questions. Each carries 1 mark.
4. Section B Nos. 21 to 26 are Very Short Answer type questions. Each carries 2 marks. Answer to these questions should be in the range of 30 to 50 words.
5. Section C Nos. 27 to 33 are Short Answer (SA) type questions. Each carries 3 marks. Answer to these questions should be in the range of 50 to 80 words.
6. Section D Nos. 34 to 36 are Long Answer type questions. Each carries 5 marks. Answer to these questions should be in the range of 80 to 120 words.
7. Section E Nos. 37 to 39 are of 3 source-based/case-based units of assessment carrying 4 marks each with sub-parts.
8. There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.

Section A

1. The distance between the points (2, –1) and (–1, –5) is:

(A) 15 units

(B) 5 units

(C) 25 units

(D) 41 units

Correct Answer: (B) 5 units

Solution: The distance between two points (x_1, y_1) and (x_2, y_2) is given by the formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Substitute the values of the given points $(x_1, y_1) = (2, -1)$ and $(x_2, y_2) = (-1, -5)$:

$$d = \sqrt{((-1) - 2)^2 + ((-5) - (-1))^2}$$

$$d = \sqrt{(-3)^2 + (-4)^2}$$

$$d = \sqrt{9 + 16}$$

$$d = \sqrt{25} = 5$$

Thus, the distance between the points is 5 units.

Quick Tip

When calculating the distance between two points, use the distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

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2. If C(1, –1) is the mid-point of the line segment AB joining points A(4, x) and B(–2, 4), then value of x is:

(A) 5

(B) –5

(C) 6

(D) –6

Correct Answer:(D) –6

Solution:

The formula for the midpoint $M(x_m, y_m)$ of the line segment joining two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is:

$$x_m = \frac{x_1 + x_2}{2}, \quad y_m = \frac{y_1 + y_2}{2}$$

Given that $C(1, -1)$ is the midpoint of the line segment joining points $A(4, x)$ and $B(-2, 4)$, we can use the midpoint formula.

For the x-coordinate:

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

Thus, the x-coordinate is correct.

For the y-coordinate:

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

Multiplying both sides by 2:

$$-2 = x + 4$$

Solving for x:

$$x = -2 - 4 = -6$$

Thus, the value of x is -6.

Quick Tip

To find the midpoint of a line segment, use the midpoint formula: $x_m = \frac{x_1+x_2}{2}, y_m = \frac{y_1+y_2}{2}$.

3. Which of the following relationship is correct?

(A) $P(E) = 1 + P(E)$

(B) $P(E) - P(E) = 1$

(C) $P(E) + P(E) = 1$

(D) $P(E) = 2P(E)$

Correct Answer: (C) $P(E) + P(E) = 1$

Solution: In probability, the sum of the probability of an event E and its complement E' is always 1. This is because:

$$P(E) + P(E') = 1$$

Option (C) is correct because it reflects this relationship.

Quick Tip

The sum of the probabilities of an event and its complement is always 1. That is, $P(E) + P(E') = 1$.

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4. The following distribution gives the daily income of 50 workers of a factory:

Income (in ₹)	400 – 424	425 – 449	450 – 474	475 – 499	500 – 524
Number of workers	12	14	8	6	10

The lower limit of the modal class is:

(A) 425

(B) 449

(C) 424.5

(D) 425.5

Correct Answer: (c) 424.5

Solution:

1. Identify the modal class. The modal class is the class interval with the highest frequency. Here, the highest frequency is 14, corresponding to the class interval $425 - 449$.

2. The lower limit of this modal class is the lower boundary of the class interval. Hence, the lower limit is:

$$\text{Lower Limit} = 424.5$$

Quick Tip

To find the lower limit of a class interval, subtract 0.5 from the starting value of the interval. This adjustment accounts for continuity correction.

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5. A lamp post 9 m high casts a shadow 33 m long on the ground. The Sun's elevation at this moment is:

(A) 60°

(B) 90°

(C) 45°

(D) 30°

Correct Answer: (a) 60°

Solution:

1. Represent the problem using a right triangle, where the height of the lamp post is the opposite side, and the length of the shadow is the adjacent side.

2. Use the tangent of the angle of elevation:

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}} = \frac{9}{3\sqrt{3}}$$

3. Simplify the fraction:

$$\tan(\theta) = \frac{9}{3\sqrt{3}} = \sqrt{3}$$

4. The angle θ whose tangent is $\sqrt{3}$ is 60°.

5. Therefore, the Sun's elevation is 60°.

Quick Tip

For problems involving shadows and heights, use trigonometric ratios. Remember common values of $\tan$, $\sin$, and $\cos$ for 30°, 45°, and 60°.

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6. If one zero of a quadratic polynomial $kx^2 + 4x + k$ is 1, then the value of k is:

(A) 2

(B) –2

(C) 4

(D) –4

Correct Answer: (B) –2

Solution: Let the given polynomial be $kx^2 + 4x + k$. We know that one of the roots is 1. So, substitute $x = 1$ into the polynomial and set it equal to zero:

$$k(1)^2 + 4(1) + k = 0$$

$$k + 4 + k = 0$$

$$2k + 4 = 0$$

$$2k = -4$$

$$k = -2$$

Thus, the value of k is -2.

Quick Tip

When one root of a quadratic polynomial is given, substitute it into the polynomial and solve for the coefficient.

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7. The number of quadratic polynomials having zeroes –1 and 3 is:

(A) 1

(B) 2

(C) 3

(D) more than 3 **Correct Answer:** (d) more than 3

Solution:

1. A quadratic polynomial with roots -1 and 3 can be expressed as:

$$k(x+1)(x-3), \quad \text{where } k \neq 0$$

Here, k is any non-zero constant.

2. Since k can take infinitely many non-zero values, the number of quadratic polynomials with these zeroes is more than 3.

Quick Tip

The general form of a quadratic polynomial with given roots is $k(x-\alpha)(x-\beta)$, where k is any non-zero constant.

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8. The roots of the quadratic equation $x^2 - 4 = 0$ is/are:

(A) 2 only

(B) –2, 2

(C) 4 only

(D) –4, 4

Correct Answer: (B) –2, 2

Solution: The given quadratic equation is $x^2 - 4 = 0$, which is a difference of squares:

$$x^2 - 4 = (x-2)(x+2) = 0$$

Thus, the roots are $x = 2$ and $x = -2$.

Quick Tip

To solve equations of the form $x^2 - a^2 = 0$, factor them as $(x - a)(x + a) = 0$.

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9. Which of the following is not a quadratic equation?

(A) $(x - 2)^2 + 1 = 2x - 3$

(B) $(2x - 1)(x - 3) = (x + 5)(x - 1)$

(C) $x(x + 1) + 8 = (x + 2)(x - 2)$

(D) $2x + \frac{x}{3} = 5$

Correct Answer: (c) $x(x + 1) + 8 = (x + 2)(x - 2)$

Solution:

1. Expand each equation to check its degree:

- For (a), expanding gives a degree of 2, so it is a quadratic equation.

- For (b), expanding gives a degree of 2, so it is a quadratic equation.

- For (c), after expansion, the terms cancel out, and the degree becomes less than 2. Hence, it is *not* a quadratic equation.

- For (d), it contains $\frac{1}{x}$, making it not a polynomial, but not a quadratic equation either.

2. Thus, the correct answer is (c).

Quick Tip

A quadratic equation must have a degree of exactly 2. Expand and simplify equations to check their degree.

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10. The common difference of an A.P., if $a_{23} - a_{19} = 32$, is:

(A) 8

(B) –8

(C) –4

(D) 4

Correct Answer: (A) 8

Solution: In an arithmetic progression (A.P.), the n-th term is given by the formula:

$$a_n = a_1 + (n-1)d$$

Given that $a_{23} - a_{19} = 32$, we can use the formula for the n-th term:

$$a_{23} = a_1 + 22d, \quad a_{19} = a_1 + 18d$$

Subtracting the two equations:

$$a_{23} - a_{19} = (a_1 + 22d) - (a_1 + 18d) = 32$$

$$22d - 18d = 32$$

$$4d = 32 \quad \Rightarrow \quad d = 8$$

Thus, the common difference is 8.

Quick Tip

In an A.P., the difference between any two terms can be calculated using the formula $a_n - a_m = (n-m)d$, where d is the common difference.

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11. $\tan^2\theta - \sin^2\theta$ is equal to:

(A) 1

(B) –1

(C) $\sec^2\theta$

(D) $\sin^2\theta$

Correct Answer: (b) -1

Solution:

1. Rewrite $\frac{1}{\tan^2\theta}$ in terms of $\sin$ and $\cos$:

$$\frac{1}{\tan^2\theta} = \frac{1}{\frac{\sin^2\theta}{\cos^2\theta}} = \frac{\cos^2\theta}{\sin^2\theta}$$

2. Subtract $\frac{1}{\sin^2\theta}$:

$$\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta} = \frac{\cos^2\theta - 1}{\sin^2\theta}$$

3. Using the identity $\cos^2\theta - 1 = -\sin^2\theta$, substitute:

$$\frac{\cos^2\theta - 1}{\sin^2\theta} = \frac{-\sin^2\theta}{\sin^2\theta} = -1$$

4. Therefore, the value is -1.

Quick Tip

Always use trigonometric identities to simplify expressions. For example, $\cos^2\theta - 1 = -\sin^2\theta$ is useful in subtraction problems.

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12. The region between a chord and either of the two arcs of a circle is called:

(A) an arc

(B) a sector

(C) a segment

(D) a semicircle

Correct Answer: (C) a segment

Solution: In a circle, the region between a chord and either of the two arcs is called a segment. A sector is the region between two radii and the corresponding arc, while an arc is simply a part of the circumference.

Quick Tip

Remember that a segment is formed by a chord and the arc between the chord's endpoints, while a sector is formed by two radii.

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13. If $1080 = 2^x \cdot 3^y \cdot 5$, then $(x - y)$ is equal to:

(A) 6

(B) –1

(C) 1

(D) 0

Correct Answer: (D) 0

Solution: We first find the prime factorization of 1080:

$$1080 = 2^3 \cdot 3^3 \cdot 5$$

Comparing this with the given equation $1080 = 2^x \cdot 3^y \cdot 5$, we get:

$$x = 3, \quad y = 3$$

Thus, $x - y = 3 - 3 = 0$.

Quick Tip

When given a number in terms of its prime factorization, equate the powers of corresponding prime factors to find the values of the exponents.

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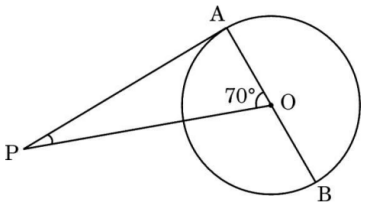
14. In the given figure, PA is a tangent from an external point P to a circle with center O. If $\angle AOP = 70°$, then the measure of $\angle APO$ is:

(A) 70°

(B) 90°

(C) 110°

(D) 20°



Correct Answer: (D) 20°

Solution: We know that the radius of a circle is perpendicular to the tangent at the point of contact. Therefore:

$$\angle OAP = 90^\circ$$

We are given that:

$$\angle AOP = 70^\circ$$

Since PA is a tangent, the angles $\angle OAP$ and $\angle APO$ form a linear pair at point P. Hence:

$$\angle OAP + \angle APO = 180^\circ$$

Substituting the known values:

$$90^\circ + \angle APO = 180^\circ$$

$$\angle APO = 180^\circ - 90^\circ - 70^\circ = 20^\circ$$

Thus, the correct answer is:

$$\boxed{(D)20^\circ}$$

Quick Tip

The angle between a tangent and the radius at the point of contact is always 90°.

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15. The median group in the following frequency distribution is:

Class	0–10	10–20	20–30	30–40	40–50	50–60
Frequency	5	8	20	15	7	5

(A) 10 – 20

(B) 20 – 30

(C) 30 – 40

(D) 40 – 50

Correct Answer: (B) 20 – 30

Solution: The median group corresponds to the group where the cumulative frequency exceeds half the total frequency. First, find the cumulative frequencies:

$$\text{Cumulative Frequency:} \quad 5, \quad 13, \quad 33, \quad 48, \quad 55, \quad 60$$

First, calculate the cumulative frequency:

$$\text{Cumulative Frequency:} \quad 5, \quad 5{+}8 = 13, \quad 13{+}20 = 33, \quad 33{+}15 = 48, \quad 48{+}7 = 55, \quad 55{+}5 = 60$$

The total frequency is 60, and half of this is 30. The cumulative frequency just greater than 30 is 33, which corresponds to the group 20–30.
Thus, the median group is:

$$\boxed{(B) 20\text{–}30}$$

Quick Tip

To find the median group in a frequency distribution, calculate the cumulative frequencies and find the group where the cumulative frequency exceeds half the total frequency.

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16. In a circle of radius 21 cm, if an arc subtends an angle of 60° at the center of the circle, then the length of the arc is:

(A) 11 cm

(B) 44 cm

(C) $\frac{7}{22}$ cm

(D) 22 cm

Correct Answer: (D) 22 cm

Solution:

The length of an arc L is given by the formula:

$$L = \frac{\theta}{360^\circ} \times 2\pi r$$

Where: - $\theta = 60^\circ$ (central angle), - $r = 21\,\text{cm}$ (radius).

Substituting the values:

$$L = \frac{60^\circ}{360^\circ} \times 2 \times \pi \times 21$$

$$L = \frac{1}{6} \times 42\pi$$

$$L = 7\pi \approx 22\,\text{cm}$$

Thus, the length of the arc is:

$$\boxed{(D) 22\,\text{cm}}$$

Quick Tip

To calculate the length of an arc, use the formula Length of arc $= \frac{\theta}{360^\circ} \times 2\pi r$, where θ is the central angle and r is the radius.

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17. A tangent to a circle is a line that touches the circle at:

(A) one point only

(B) two points

(C) three points

(D) infinite number of points

Correct Answer: (A) one point only

Solution: By definition, a tangent to a circle is a straight line that touches the circle at exactly one point. This point is known as the *point of tangency*.

Thus, the correct answer is:

$$\boxed{(A) \text{one point only}}$$

Quick Tip

A tangent to a circle touches the circle at exactly one point, and it is perpendicular to the radius at the point of contact.

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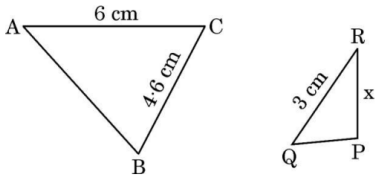
18. In the given figure, if $\triangle ABC \sim \triangle QPR$, then the value of x is:



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(A) 5.3 cm

(B) 4.6 cm

(C) 2.3 cm

(D) 4 cm

Correct Answer: (C) 2.3 cm

Solution:

Since the triangles are similar, we use the property that the corresponding sides of similar triangles are proportional. Therefore, we have:

$$\frac{AC}{QR} = \frac{BC}{RP}$$

Substitute the known values:

$$\frac{6}{3} = \frac{4.6}{x}$$

Now, solve for x:

$$2 = \frac{4.6}{x}$$

$$x = \frac{4.6}{2} = 2.3\,\text{cm}$$

Thus, the value of x is:

(C) 2.3 cm

Quick Tip

For similar triangles, the corresponding sides are proportional. Use this property to set up the ratio and solve for unknown lengths.

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19. Assertion (A): The pair of linear equations $5x + 2y + 6 = 0$ and $7x + 9y = 18$ have infinitely many solutions.

Reason (R): The pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ have infinitely many solutions if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

(A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (D) Assertion (A) is false, but Reason (R) is true

Solution:

We are given two linear equations:

$$5x + 2y + 6 = 0 \quad \text{(Equation 1)}$$

7x + 9y = 18 (Equation 2)

To find if these equations have infinitely many solutions, we check the condition for infinitely many solutions, which is:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

For the given equations, we have:

$$\frac{5}{7}, \frac{2}{9}, \frac{6}{18}$$

$$\frac{5}{7} \neq \frac{2}{9} \quad \text{and} \quad \frac{6}{18} = \frac{1}{3}$$

Since the ratios do not match, these equations do not have infinitely many solutions.

Therefore, the assertion is incorrect.

Quick Tip

To check for infinitely many solutions, ensure that the ratios of the coefficients of x, y, and the constant term are equal.

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20. Assertion (A): The probability of getting number 8 on rolling a die is zero.

Reason (R): The probability of an impossible event is zero (0).

(A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

Solution:

The total number of faces on a die is 6, numbered 1 to 6. Since 8 is not one of the numbers on the die, the probability of getting 8 is 0.

Hence, the assertion is correct. Additionally, the reason states that the probability of an impossible event is zero, which is also correct.

Quick Tip

The probability of an event that cannot occur (such as getting a number not on the die) is always zero.

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21. Given that HCF $(306, 1314) = 18$**, find LCM** $(306, 1314)$**.**

Solution:

We know the relationship between HCF and LCM of two numbers:

$$\text{HCF} \times \text{LCM} = \text{Product of the two numbers}$$

Thus:

$$18 \times \text{LCM} = 306 \times 1314$$
$$\text{LCM} = \frac{306 \times 1314}{18}$$
$$\text{LCM} = \frac{402924}{18} = 22384$$

Thus, the LCM of 306 and 1314 is 22384.

Quick Tip

The relationship between HCF and LCM is given by: HCF $\times$ LCM $=$ Product of the numbers.

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22. XY and PQ are two tangents drawn at the end points of the diameter AB of a circle. Prove that $XY \parallel PQ$.

Solution:

Let O be the center of the circle, and A and B be the endpoints of the diameter of the circle. Let the tangents XY and PQ be drawn from the points A and B on the circle, respectively. We need to prove that $XY \parallel PQ$.

Step 1: Use the property of tangents We know that the tangent to a circle at any point is perpendicular to the radius at that point. Therefore, the following conditions hold: - $OA \perp XY$, as XY is the tangent at point A. - $OB \perp PQ$, as PQ is the tangent at point B.

Step 2: Angles formed by the radius and tangents Since $OA \perp XY$ and $OB \perp PQ$, we can conclude that:

$$\angle OAX = 90^\circ \quad \text{and} \quad \angle OBP = 90^\circ$$

This means that the angles formed by the radii OA and OB with the tangents XY and PQ, respectively, are both right angles.

Step 3: Parallel lines property Now, observe that both XY and PQ are straight lines. The lines XY and PQ are both perpendicular to the corresponding radii OA and OB, and since

both radii are part of the same line segment AB, this means that the tangents XY and PQ must be parallel to each other.

Thus, we can conclude that:

$$XY \parallel PQ$$

Conclusion: Therefore, the tangents XY and PQ, drawn at the endpoints of the diameter AB of the circle, are parallel.

Quick Tip

When two tangents are drawn at the endpoints of a diameter of a circle, they are always parallel to each other because both tangents are perpendicular to the same line (the diameter).

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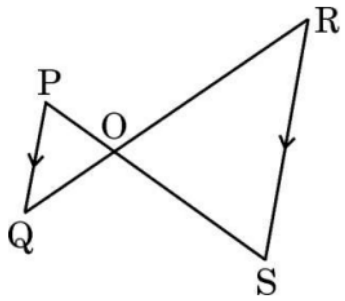
23. In the given figure, $PQ \parallel RS$. Prove that $OP = OR$ and $OQ = OS$.



Solution:

Let O be the center of the circle, and let $P, Q, R,$ and S be points on the circumference of the circle. We are given that the lines $PQ \parallel RS$, and we need to prove that $OP = OR$ and $OQ = OS$.

Step 1: Use the property of tangents and parallel lines Since $PQ \parallel RS$, we know that corresponding angles formed by the tangents and radii will be equal. Additionally, because PQ and RS are parallel lines, the angles between the radii OP and OQ, as well as OR and OS, will be congruent due to the property of corresponding angles.

Step 2: Prove the congruence of triangles Consider the triangles $\triangle OPQ$ and $\triangle ORS$. Since $PQ \parallel RS$, and the lines OP and OR are the radii of the same circle, we have the following properties: - $\angle OPQ = \angle ORS$ (Corresponding angles) - $\angle OQP = \angle OSR$ (Corresponding

angles) - $OP = OR$ (Radiuses of the same circle) - $OQ = OS$ (Radiuses of the same circle) Since these two triangles have two pairs of corresponding angles equal and one pair of corresponding sides equal (the radii), by the AA (Angle-Angle) criterion, the triangles are congruent.

Step 3: Conclusion Since the triangles $\triangle OPQ$ and $\triangle ORS$ are congruent, we can conclude that:

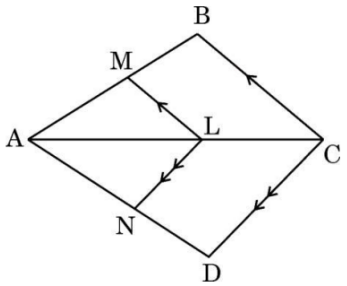
$$OP = OR \quad \text{and} \quad OQ = OS$$

Thus, the statement is proved.

Quick Tip

When two lines are parallel and radii from the same center are involved, use the property of corresponding angles and congruent triangles to prove equality of the radii.

23(b In the given figure, $LM \parallel CB$ and $LN \parallel CD$. Prove that $\frac{AM}{AN} = \frac{AB}{AD}$.



Solution:

1. Draw a construction line to extend AM, AN, and AB as shown in the figure. Use the concept of parallel lines and similar triangles.

2. From the given, $LM \parallel CB$ and $LN \parallel CD$, creating similar triangles $\triangle AML \sim \triangle ABC$ and $\triangle ANL \sim \triangle ADC$.

3. Using the property of similar triangles:

$$\frac{AM}{AB} = \frac{AL}{AC} \quad \text{and} \quad \frac{AN}{AD} = \frac{AL}{AC}$$

4. Dividing these two equations:

$$\frac{AM}{AN} = \frac{AB}{AD}$$

Quick Tip

For problems involving parallel lines and ratios, always look for similar triangles. Identify pairs of triangles with corresponding sides proportional.

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24. (a) If α, β are zeroes of the polynomial $8x^2 + 14x + 3$, then find the value of:

$$\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$$

Solution:

1. Use the given polynomial $8x^2 + 14x + 3$. From the properties of quadratic polynomials:

$$\alpha + \beta = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2} = -\frac{14}{8} = -\frac{7}{4}$$

$$\alpha\beta = \frac{\text{constant term}}{\text{coefficient of } x^2} = \frac{3}{8}$$

2. The expression $\frac{1}{\alpha} + \frac{1}{\beta}$ can be rewritten as:

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta}$$

3. Substitute the values of $\alpha + \beta$ and $\alpha\beta$:

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{-\frac{7}{4}}{\frac{3}{8}} = \frac{-7}{4} \times \frac{8}{3} = -\frac{56}{12} = -\frac{14}{3}$$

4. Therefore, the value of $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ is $-\frac{14}{3}$.

Quick Tip

For quadratic polynomials, always use the relationships:

$$\alpha + \beta = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}, \quad \alpha\beta = \frac{\text{constant term}}{\text{coefficient of } x^2}.$$

These are derived from Vieta's formulas.

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24. (b) Find a quadratic polynomial whose zeroes are -9 and 6.

Solution:

If the roots of the quadratic polynomial are $\alpha = -9$ and $\beta = 6$, then the polynomial can be written as:

$$a(x - \alpha)(x - \beta) = a(x + 9)(x - 6)$$

Expanding the expression:

$$= a(x^2 - 6x + 9x - 54)$$

$$= a(x^2 + 3x - 54)$$

The required polynomial is:

$$\boxed{a(x^2 + 3x - 54)}$$

For simplicity, let $a = 1$. Thus, the quadratic polynomial is:

$$\boxed{x^2 + 3x - 54}$$

Quick Tip

The general form of a quadratic polynomial with roots α and β is $a(x-\alpha)(x-\beta)$, where a is any constant.

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25. Evaluate:

$$\sin 30^\circ \times \cos 60^\circ + \cos 30^\circ \times \sin 60^\circ - \cot 45^\circ$$

Solution:

We know the following trigonometric values:

$$\sin 30^\circ = \frac{1}{2}, \quad \cos 60^\circ = \frac{1}{2}, \quad \cos 30^\circ = \frac{\sqrt{3}}{2}, \quad \sin 60^\circ = \frac{\sqrt{3}}{2}, \quad \cot 45^\circ = 1$$

Now, substitute these values into the expression:

$$\sin 30^\circ \times \cos 60^\circ + \cos 30^\circ \times \sin 60^\circ - \cot 45^\circ$$

$$= \frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} - 1$$

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

$$= \frac{1+3}{4} - 1 = \frac{4}{4} - 1 = 1 - 1 = 0$$

Thus, the value of the expression is:

$$\boxed{0}$$

Quick Tip

When evaluating trigonometric expressions, substitute known values of trigonometric functions to simplify the expression step by step.

---

26. A chord of a circle of radius 10 cm subtends a right angle at the center of the circle. Find the area of the corresponding (i) minor sector (ii) major sector. (Use $\pi = 3.14$)

Solution:

Given: - Radius $r = 10\,\text{cm}$, - Central angle $\theta = 90^\circ$ (since the chord subtends a right angle at the center).

(i) Area of the minor sector: The formula for the area of a sector is:

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

Substituting the values:

$$\text{Area of sector} = \frac{90^\circ}{360^\circ} \times 3.14 \times 10^2 = \frac{1}{4} \times 3.14 \times 100 = 78.5\,\text{cm}^2$$

(ii) Area of the major sector: The area of the major sector is the area of the circle minus the area of the minor sector. The area of the circle is:

$$\text{Area of circle} = \pi r^2 = 3.14 \times 10^2 = 314\,\text{cm}^2$$

Thus, the area of the major sector is:

$$\text{Area of major sector} = 314 - 78.5 = 235.5\,\text{cm}^2$$

Thus, the area of the minor sector is $78.5\,\text{cm}^2$ and the area of the major sector is $235.5\,\text{cm}^2$.

Quick Tip

To find the area of a sector, use the formula Area of sector $= \frac{\theta}{360^\circ} \times \pi r^2$. For the major sector, subtract the area of the minor sector from the total area of the circle.

27(a). Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the center of the circle.

Solution:

Let quadrilateral $ABCD$ be a cyclic quadrilateral that circumscribes a circle with center O.

By the property of tangents, the tangents drawn from an external point to a circle are equal in length. This property helps us establish that opposite angles of a cyclic quadrilateral are supplementary.

To prove the given statement, consider the following: - The angle between two tangents drawn from a point outside the circle is supplementary to the angle formed by the line joining the points of contact at the center.

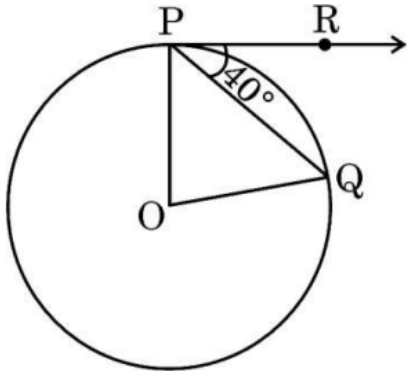
By this property, we conclude that the opposite sides of the quadrilateral subtend supplementary angles at the center O of the circle.

Thus, the opposite sides subtend supplementary angles.

Quick Tip

In cyclic quadrilaterals that circumscribe a circle, opposite sides always subtend supplementary angles at the center of the circle.

27(b) If O is the centre of a circle, PQ is a chord and the tangent PR at P makes an angle of 40° with PQ, then find the measure of $\angle POQ$.



Solution:

We are given that O is the center of the circle, PQ is a chord, and PR is the tangent at point P, making an angle of 40° with the chord PQ. We are asked to find $\angle POQ$.

From the properties of tangents and circles: 1. The tangent at any point of a circle is perpendicular to the radius at the point of tangency. Therefore, $\angle OPR = 90^\circ$. 2. The angle between the tangent and the chord, $\angle PRQ$, is given as 40°. 3. By the property of circles, the angle between a chord and a tangent at the point of contact is equal to the angle subtended by the chord at the center. Hence:

$$\angle POQ = 2 \times \angle PRQ$$

Substitute $\angle PRQ = 40^\circ$:

$$\angle POQ = 2 \times 40^\circ = 80^\circ$$

Thus, the measure of $\angle POQ$ is:

$$\boxed{80^\circ}$$

Quick Tip

The angle between a tangent and a chord at the point of contact is equal to the angle subtended by the chord at the center of the circle. This property can be used to solve problems involving tangents and chords.

---

28. (a) Using the quadratic formula, find the real roots of the equation $2x^2 + 2x + 9 = 0$, if they exist.

Solution:

The quadratic formula is given by:

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

For the given equation $2x^2 + 2x + 9 = 0$, we have: - $a = 2$ - $b = 2$ - $c = 9$

Now, calculate the discriminant:

$$\Delta = b^2 - 4ac = 2^2 - 4 \times 2 \times 9 = 4 - 72 = -68$$

Since the discriminant is negative, there are no real roots, and the roots are complex.

Therefore, the correct answer is:

$$\boxed{No real roots}$$

Quick Tip

If the discriminant b^2-4ac of a quadratic equation is negative, then the roots are complex (not real).

---

28. (b) Find the values of k for which the quadratic equation $kx^2 - 2kx + 6 = 0$ has real and equal roots. Also, find the roots.

Solution:

For real and equal roots, the discriminant must be zero:

$$\Delta = b^2 - 4ac = 0$$

The given quadratic equation is $kx^2 - 2kx + 6 = 0$, where: - $a = k$ - $b = -2k$ - $c = 6$

Substitute into the discriminant formula:

$$\Delta = (-2k)^2 - 4 \times k \times 6 = 4k^2 - 24k = 0$$

Factor the equation:

$$4k(k - 6) = 0$$

Thus, $k = 0$ or $k = 6$.

For $k = 6$, substitute into the quadratic equation:

$$6x^2 - 12x + 6 = 0$$

Dividing by 6:

$$x^2 - 2x + 1 = 0$$

Factoring:

$$(x - 1)^2 = 0$$

Thus, the roots are $x = 1$ (a real and equal root).

Therefore, the values of k are 0 and 6, and the root for $k = 6$ is $x = 1$.

Quick Tip

For real and equal roots, set the discriminant equal to zero and solve for the value of k.

29. One card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is:

(i) a red king

(ii) not a black card

(iii) an ace of hearts

Solution:

There are 52 cards in a deck, consisting of 26 red cards (13 red hearts and 13 red diamonds) and 26 black cards (13 black spades and 13 black clubs).

(i) Probability of drawing a red king: There are 2 red kings (one from hearts and one from diamonds), so the probability is:

$$P(\text{red king}) = \frac{2}{52} = \frac{1}{26}$$

(ii) Probability of drawing a card that is not black: There are 26 black cards, so the number of cards that are not black is 52 - 26 = 26 red cards. Therefore, the probability is:

$$P(\text{not black}) = \frac{26}{52} = \frac{1}{2}$$

(iii) Probability of drawing the ace of hearts: There is only one ace of hearts, so the probability is:

$$P(\text{ace of hearts}) = \frac{1}{52}$$

Thus, the answers are:

$$\boxed{P(\text{red king}) = \frac{1}{26}, \quad P(\text{not black}) = \frac{1}{2}, \quad P(\text{ace of hearts}) = \frac{1}{52}}$$

Quick Tip

To find the probability of an event, use the formula $P = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$.

---

30. Prove that $2 + 5\sqrt{3}$ is an irrational number, if it is given that $\sqrt{3}$ is an irrational number.

Solution:

We are given that $\sqrt{3}$ is an irrational number. We need to prove that $2+5\sqrt{3}$ is also irrational.

Assume the contrary, that $2+5\sqrt{3}$ is rational. Then, we can express it as:

$$2+5\sqrt{3}=\frac{p}{q}$$

where p and q are integers, and $q \neq 0$.

Now, solve for $\sqrt{3}$:

$$5\sqrt{3}=\frac{p}{q}-2=\frac{p-2q}{q}$$

$$\sqrt{3}=\frac{p-2q}{5q}$$

Since $\frac{p-2q}{5q}$ is a rational number (as both p and q are integers), this implies that $\sqrt{3}$ is rational, which contradicts the assumption that $\sqrt{3}$ is irrational.

Therefore, our assumption that $2+5\sqrt{3}$ is rational must be false, and hence $2+5\sqrt{3}$ is irrational.

Quick Tip

If a sum or product of a rational and irrational number is considered, the result is irrational. Here, the irrational number $\sqrt{3}$ is multiplied by 5, which keeps it irrational.

---

31. Prove that:

$$(\tan A+\sec A)^2+(\tan A-\sec A)^2=2\left(\frac{1+\sin^2 A}{1-\sin^2 A}\right)$$

Solution:

We start by expanding both squares on the left-hand side:

$$(\tan A+\sec A)^2=\tan^2 A+2\tan A\sec A+\sec^2 A$$

$$(\tan A-\sec A)^2=\tan^2 A-2\tan A\sec A+\sec^2 A$$

Now, adding the two expansions:

$$(\tan A+\sec A)^2+(\tan A-\sec A)^2=2\tan^2 A+2\sec^2 A$$

Using the identity $\sec^2 A = 1 + \tan^2 A$, we get:

$$2\tan^2 A + 2\sec^2 A = 2\tan^2 A + 2(1 + \tan^2 A) = 2\tan^2 A + 2 + 2\tan^2 A = 4\tan^2 A + 2$$

Now, for the right-hand side:

$$2\left(\frac{1 + \sin^2 A}{1 - \sin^2 A}\right)$$

Using the identity $\sin^2 A + \cos^2 A = 1$, simplify the expression to match the left-hand side.

Thus, we have proved the given identity.

Quick Tip

Use trigonometric identities such as $\sec^2 A = 1 + \tan^2 A$ and simplify step by step to prove trigonometric identities.

---

32. (a) Two cubes, each of volume 125 cm^3, are joined end to end. Find the volume and the surface area of the resulting cuboid.

Solution:

The volume of each cube is 125 cm^3. Let the side length of each cube be a. Since the volume of a cube is given by a^3, we can write:

$$a^3 = 125 \quad \Rightarrow \quad a = \sqrt[3]{125} = 5\,\text{cm}$$

When two cubes are joined end to end, the resulting cuboid will have the dimensions: - Length = $2a = 2 \times 5 = 10\,$cm, - Width = $a = 5\,$cm, - Height = $a = 5\,$cm.

Thus, the volume of the resulting cuboid is:

$$V = \text{Length} \times \text{Width} \times \text{Height} = 10 \times 5 \times 5 = 250\,\text{cm}^3$$

The surface area A of a cuboid is given by:

$$A = 2(lw + lh + wh)$$

Substituting the values:

$$A = 2(10 \times 5 + 10 \times 5 + 5 \times 5) = 2(50 + 50 + 25) = 2 \times 125 = 250\,\text{cm}^2$$

Thus, the volume of the cuboid is 250 cm^3, and the surface area is 250 cm^2.

Quick Tip

When cubes are joined end to end, the volume of the resulting cuboid is the sum of the volumes of the cubes, and the surface area can be calculated using the formula for a cuboid.

---

32. (b) A solid is in the shape of a cone surmounted by a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.

Solution:

Given: - Diameter of the hemisphere and cone = 7 cm, so the radius $r = 3.5\,\text{cm}$, - Height of the cone $h = r = 3.5\,\text{cm}$.

The volume of the solid is the sum of the volumes of the cone and the hemisphere.

1. Volume of the cone: The volume of a cone is given by:

$$V_{\text{cone}} = \frac{1}{3}\pi r^2 h$$

Substituting the values:

$$V_{\text{cone}} = \frac{1}{3} \times 3.14 \times (3.5)^2 \times 3.5 = \frac{1}{3} \times 3.14 \times 12.25 \times 3.5 = 45.475\,\text{cm}^3$$

2. Volume of the hemisphere: The volume of a hemisphere is given by:

$$V_{\text{hemisphere}} = \frac{2}{3}\pi r^3$$

Substituting the value:

$$V_{\text{hemisphere}} = \frac{2}{3} \times 3.14 \times (3.5)^3 = \frac{2}{3} \times 3.14 \times 42.875 = 89.775\,\text{cm}^3$$

Thus, the total volume of the solid is:

$$V_{\text{total}} = V_{\text{cone}} + V_{\text{hemisphere}} = 45.475 + 89.775 = 135.25\,\text{cm}^3$$

Quick Tip

When calculating the volume of a solid with a hemisphere and cone, find the volume of each part separately and then add them together.

33. A contractor plans to install two slides for children to play in a park. For children below the age of 6 years, he prefers to have a slide whose top is at a height of 2.0 m and is inclined at an angle of 30° to the ground, whereas for older children, he wants to have a steep slide at a height of 4.0 m and inclined at an angle of 60° to the ground. What would be the length of the slide in each case?

Solution:

We can use the basic trigonometric relation for a right triangle:

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

Let the length of the slide be the hypotenuse, which we need to find.

For the slide for children below 6 years: - Height = 2.0 m, - Angle = 30°.

Using the sine function:

$$\sin 30^\circ = \frac{2.0}{\text{Length of slide}}$$

$$\frac{1}{2} = \frac{2.0}{\text{Length of slide}} \quad \Rightarrow \quad \text{Length of slide} = 4.0\,\text{m}$$

For the slide for older children: - Height = 4.0 m, - Angle = 60°.

Using the sine function:

$$\sin 60^\circ = \frac{4.0}{\text{Length of slide}}$$

$$\frac{\sqrt{3}}{2} = \frac{4.0}{\text{Length of slide}} \quad \Rightarrow \quad \text{Length of slide} = \frac{4.0}{\frac{\sqrt{3}}{2}} = \frac{4.0 \times 2}{\sqrt{3}} = \frac{8}{\sqrt{3}} \approx 4.62\,\text{m}$$

Thus, the length of the slide for children below 6 years is 4.0 m, and the length for older children is approximately 4.62 m.

Quick Tip

For slides or ramps, use trigonometric functions like sine to relate the height and angle of inclination to the length of the slide.

34. (a) If BD and QM are medians of triangles ABC and PQR, respectively, where $\triangle ABC \sim \triangle PQR$, prove that:

$$\frac{AB}{PQ} = \frac{BD}{QM}$$

Solution:

Given that $\triangle ABC \sim \triangle PQR$, the corresponding sides of the triangles are proportional. This means:

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$$

Now, since BD and QM are medians, the ratio of the corresponding medians will also be the same as the ratio of the corresponding sides:

$$\frac{BD}{QM} = \frac{AB}{PQ}$$

Thus, we have proved the required result.

Quick Tip

In similar triangles, the corresponding medians are proportional to the corresponding sides.

---

35. A manufacturer of TV sets produced 720 TV sets in the fourth year and 880 TV sets in the eighth year. Assuming that the production increases uniformly by a fixed number every year, find the production in the tenth year and the total production in the first seven years.

Solution:

Let the number of TV sets produced in the first year be x, and let the increase in production each year be d. Therefore, the production in the n-th year is given by:

$$\text{Production in year } n = x + (n-1)d$$

For the fourth year, the production is 720:

$$x + 3d = 720$$

For the eighth year, the production is 880:

$$x + 7d = 880$$

Now, solve the system of equations:

$$x + 3d = 720 \quad \text{(Equation 1)}$$

$$x + 7d = 880 \quad \text{(Equation 2)}$$

Subtract Equation 1 from Equation 2:

$$(x + 7d) - (x + 3d) = 880 - 720$$

$$4d = 160 \quad \Rightarrow \quad d = 40$$

Substitute $d = 40$ into Equation 1:

$$x + 3 \times 40 = 720 \quad \Rightarrow \quad x + 120 = 720 \quad \Rightarrow \quad x = 600$$

So, the production in the first year is 600 TV sets. The production in the tenth year is:

$$x + 9d = 600 + 9 \times 40 = 600 + 360 = 960 \,\text{TV sets}$$

Now, calculate the total production in the first seven years: The total production in the first seven years is the sum of the productions for the first 7 years:

$$\text{Total production} = 7 \times \frac{x + (x + 6d)}{2} = 7 \times \frac{600 + (600 + 6 \times 40)}{2} = 7 \times \frac{600 + 840}{2} = 7 \times 720 = 5040$$

Thus, the production in the tenth year is 960 TV sets, and the total production in the first seven years is 5040 TV sets.

Quick Tip

For problems involving uniform increase or arithmetic progressions, use the formula for the n-th term and the sum of the first n terms.

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36. Case Study – 1: Mutual Fund

A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds, or other securities. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors. Net Asset Value (NAV) represents a fund's per share market value. It is the price at which the investors buy fund shares from a fund company and sell them to the fund company.

The following table shows the Net Asset Value (NAV) per unit of the mutual fund of ICICI mutual funds:

NAV (in)	Number of mutual funds
$0-5$	13
$5-10$	16
$10-15$	22
$15-20$	18
$20-25$	11

Based on the above information, answer the following questions:

(i) What is the upper limit of the modal class of the data?

(ii) What is the median class of the data?

Solution:

(i) **Upper Limit of Modal Class:**

The modal class is the class interval with the highest frequency. From the table, we see that the frequency of each class is as follows: - 0 - 5: 13 - 5 - 10: 16 - 10 - 15: 22 - 15 - 20: 18 - 20 - 25: 11

The highest frequency is 22, which corresponds to the class interval $10-15$. Therefore, the modal class is $10-15$, and the upper limit of the modal class is:

$$\boxed{15}$$

(ii) **Median Class:**

To find the median class, we first calculate the cumulative frequency.

NAV (in)	Frequency	Cumulative Frequency
$0-5$	13	13
$5-10$	16	$13+16=29$
$10-15$	22	$29+22=51$
$15-20$	18	$51+18=69$
$20-25$	11	$69+11=80$

The total number of mutual funds is 80. To find the median class, we use the formula:

$$\text{Median class} = \text{The class whose cumulative frequency is just greater than } \frac{N}{2}$$

where N is the total frequency. Since $N = 80$, we calculate:

$$\frac{80}{2} = 40$$

The cumulative frequency just greater than 40 is 51, which corresponds to the class interval $10 - 15$.

Thus, the median class is:

$$\boxed{10 - 15}$$

Quick Tip

To find the modal class, look for the class with the highest frequency. For the median class, calculate the cumulative frequencies and find the class interval corresponding to the cumulative frequency just greater than $\frac{N}{2}$, where N is the total frequency.

---

iii. (a) What is the mode NAV of mutual funds?

Solution:

The mode of a frequency distribution is the value that occurs most frequently. From the table:

NAV (in)	Number of mutual funds
$0 - 5$	13
$5 - 10$	16
$10 - 15$	22
$15 - 20$	18
$20 - 25$	11

The frequency distribution shows that the highest frequency is 22, which corresponds to the class $10 - 15$. Therefore, the modal class is $10 - 15$, and the mode NAV is the midpoint of this class interval:

$$\text{Mode NAV} = \frac{10 + 15}{2} = 12.5$$

Thus, the mode NAV of mutual funds is $\boxed{12.5}$.

Quick Tip

The mode is the value corresponding to the class with the highest frequency. For grouped data, the mode is often estimated as the midpoint of the modal class.

---

iii. (b) What is the median NAV of mutual funds?

Solution:

We already know the cumulative frequency of the data:

NAV (in)	Frequency	Cumulative Frequency
$0-5$	13	13
$5-10$	16	29
$10-15$	22	51
$15-20$	18	69
$20-25$	11	80

The total number of mutual funds is 80. The median class is the class where the cumulative frequency exceeds $\frac{80}{2} = 40$. From the cumulative frequency, we see that the class $10-15$ is the median class, as its cumulative frequency is 51.

Now, we can calculate the median using the formula for the median of grouped data:

$$\text{Median} = L + \left(\frac{\frac{N}{2} - F}{f} \right) \times h$$

Where: - $L = 10$ (lower limit of the median class), - $N = 80$ (total frequency), - $F = 29$ (cumulative frequency of the class before the median class), - $f = 22$ (frequency of the median class), - $h = 5$ (class width).

Substitute the values:

$$\text{Median} = 10 + \left(\frac{40 - 29}{22} \right) \times 5 = 10 + \left(\frac{11}{22} \right) \times 5 = 10 + 2.5 = 12.5$$

Thus, the median NAV of mutual funds is $\boxed{12.5}$.

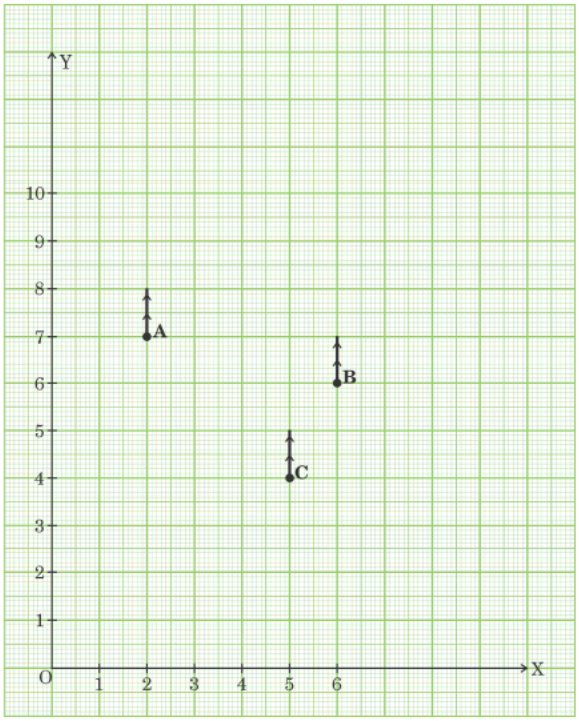
Quick Tip

To calculate the median of grouped data, use the formula Median $= L + \left(\frac{\frac{N}{2} - F}{f}\right) \times h$, where L is the lower limit of the median class, N is the total frequency, F is the cumulative frequency of the class before the median, f is the frequency of the median class, and h is the class width.

---

37. Case Study: Electric Poles in the Park

Resident Welfare Association (RWA) of Gulmohar Society in Delhi, have installed three electric poles A, B and C in the society's common park. Despite these three poles, some parts of the park are still in the dark. So, RWA decides to have one more electric pole D in the park. The park can be modelled as a coordinate system given below. The park is modeled as a coordinate system, with poles A, B, and C already installed. Based on the given information, answer the following questions:



(i) **What is the position of the pole C?**

(ii) **What is the distance of the pole B from the corner O of the park?**

(iii) **(a) Find the position of the fourth pole D so that the four points A, B, C, and D form a parallelogram ABCD.**

OR

(b) **Find the distance between poles A and C.**

Solution:

(i) The coordinates of pole A are (2, 7), B are (5, 6), and C are (4, 5). Therefore, the position of pole C is $(4, 5)$.

(ii) To find the distance of pole B from the corner O (origin), we use the distance formula:

$$\text{Distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Substituting $(x_1, y_1) = (0, 0)$ and $(x_2, y_2) = (5, 6)$:

$$\text{Distance} = \sqrt{(5-0)^2 + (6-0)^2} = \sqrt{25 + 36} = \sqrt{61}\,\text{units}$$

(iii) **(a) To find the position of pole D so that A, B, C, and D form a parallelogram:**

In a parallelogram, opposite sides are parallel and equal in length. To find the coordinates of point D, we use the vector addition formula. The vector from A to B is $\overrightarrow{AB} = (5-2, 6-7) = (3, -1)$. The vector from C to D will be equal to $\overrightarrow{AB}$, so the coordinates of D are:

$$D = C + \overrightarrow{AB} = (4, 5) + (3, -1) = (7, 4)$$

Thus, the position of pole D is $(7, 4)$.

(iii) **(b) To find the distance between poles A and C:**

We use the distance formula again, with $(x_1, y_1) = (2, 7)$ and $(x_2, y_2) = (4, 5)$:

$$\text{Distance} = \sqrt{(4-2)^2 + (5-7)^2} = \sqrt{4+4} = \sqrt{8} \approx 2.83\,\text{units}$$

Quick Tip

To calculate the distance between two points, use the distance formula:

$$\text{Distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For parallelograms, the vectors of opposite sides are equal.

---

38. Case Study – 3: Deepankar and Suryansh's Book Purchase

Deepankar bought 3 notebooks and 2 pens for ¡ 80 and his friend Suryansh bought 4 notebooks and 3 pens for ¡ 110 from the school bookshop. Based on the above information, answer the following questions:

(i) If the price of one notebook is x and the price of one pen is y, write the given situation algebraically.

(ii) **(a) What is the price of one notebook?**

(b) What is the price of one pen?

OR

(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens?

Solution:

(i) **Algebraic Representation:**

Let the price of one notebook be x and the price of one pen be y.

From the given data: - Deepankar bought 3 notebooks and 2 pens for 80, so we can write:

$$3x + 2y = 80 \quad \text{(Equation 1)}$$

- Suryansh bought 4 notebooks and 3 pens for 110, so we can write:

$$4x + 3y = 110 \quad \text{(Equation 2)}$$

(ii) **Solving the system of equations:**

We solve the system of equations:

1. From Equation 1: $3x + 2y = 80$ 2. From Equation 2: $4x + 3y = 110$

We can multiply Equation 1 by 3 and Equation 2 by 2 to eliminate y:

$$9x + 6y = 240 \quad \text{(Equation 3)}$$

$$8x + 6y = 220 \quad \text{(Equation 4)}$$

Subtract Equation 4 from Equation 3:

$$(9x + 6y) - (8x + 6y) = 240 - 220$$

$$x = 20$$

Substitute $x = 20$ into Equation 1:

$$3(20) + 2y = 80 \quad \Rightarrow \quad 60 + 2y = 80 \quad \Rightarrow \quad 2y = 20 \quad \Rightarrow \quad y = 10$$

Thus, the price of one notebook is 20 and the price of one pen is 10.

(iii) **Total amount for Suryansh's purchase:**

For 6 notebooks and 3 pens, the total cost is:

$$6x + 3y = 6(20) + 3(10) = 120 + 30 = 150$$

Thus, the total amount to be paid by Suryansh is 150.

Quick Tip

To solve a system of linear equations, you can use substitution or elimination. If you need to find the total cost, simply multiply the number of items by their prices and add them.