Model Test Paper Complete Solution

Subject: Mathematics | Class: 10th | Session: 2026-2027

> ***Teacher's Note:*** *Dear students, Mathematics is a highly logical subject. In this PDF, every question has been solved absolutely* ***step-by-step (vertically)****. The long answer questions are explained in detail. Present your answers similarly in the exam to secure full marks!*

SECTION - A (MULTIPLE CHOICE QUESTIONS - 1 MARK)

Q1: The HCF of 96 and 404 can be expressed in the form 96m - 404m. The HCF is:

(a) 2 (b) 4

(c) 8 (d) 12

Answer: **(b) 4**

$\because$ Prime factorization of $96 = 2^5 \times 3$

$\Rightarrow$ Prime factorization of $404 = 2^2 \times 101$

$\therefore$ HCF $(96, 404) = 2^2 =$

$\Rightarrow$ 4

Q2: If one zero of the polynomial $x^2 - 5x + 6$ is 2, then the other zero is:

(a) 1 (b) 2

(c) 3 (d) 6

Answer: **(c) 3**

$\because$ Polynomial: $x^2 - 5x + 6 = 0$

$\Rightarrow$ $x^2 - 3x - 2x + 6 = 0$

$\Rightarrow$ $x(x - 3) - 2(x - 3) = 0$

⇒ (x - 2)(x - 3) = 0

∴ Therefore, zeroes are x = 2 and x =

⇒ **3**

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Q3: For what value of 'k' will the pair of equations 2x + 3y = 7 and 4x + ky = 14 have infinitely many solutions?

(a) 3

(b) 6

(c) 7

(d) 14

Answer: **(b) 6**

∵ Condition for infinitely many solutions: $a_1/a_2 = b_1/b_2 = c_1/c_2$

⇒ Here, $a_1 = 2$, $b_1 = 3$, $c_1 = 7$

⇒ And $a_2 = 4$, $b_2 = k$, $c_2 = 14$

⇒ Substituting the values: $2/4 = 3/k = 7/14$

⇒ $1/2 = 3/k$

∴ $k = 2 \times 3 =$

⇒ **6**

Q4: The nature of roots of the equation $x^2 - 6x + 9 = 0$ is:

(a) Real and unequal

(b) Imaginary

(c) Real and equal

(d) Not possible to determine

Answer: **(c) Real and equal**

∵ Comparing with $ax^2 + bx + c = 0$: a=1, b=-6, c=9

⇒ Discriminant $D = b^2 - 4ac$

⇒ $D = (-6)^2 - 4(1)(9)$

⇒ $D = 36 - 36 = 0$

∴ Since D = 0, the roots are

⇒ **real and equal**

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Q5: The roots of $x^2 - 3x - 10 = 0$ are:

(a) -3, -10

(b) -2, 5

(c) 6

(d) 7

Answer: (b) -2, 5

∵ Equation: $x^2 - 3x - 10 = 0$

⇒ $x^2 - 5x + 2x - 10 = 0$

⇒ $x(x - 5) + 2(x - 5) = 0$

⇒ $(x + 2)(x - 5) = 0$

∴ x =

⇒ **-2, 5**

Q6: In an A.P., the 11th term is 38 and the 16th term is 73. The common difference is:

(a) 4 (b) 5

(c) 6 (d) 7

Answer: **(d) 7**

$\because$ $a_{11} = a + 10d = 38$ ... (Eq 1)

$\Rightarrow$ $a_{16} = a + 15d = 73$ ... (Eq 2)

$\Rightarrow$ Subtracting Eq 1 from Eq 2:

$\Rightarrow$ $(a + 15d) - (a + 10d) = 73 - 38$

$\Rightarrow$ $5d = 35$

$\therefore$ $d = 35 / 5 =$

$\Rightarrow$ **7**

Q7: The distance between the points (3, 4) and (3, -2) is:

(a) 5 units (b) 6 units

(c) 7 units (d) 8 units

Answer: **(b) 6 units**

$\because$ Distance formula: $d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$

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

$\Rightarrow$ $d = \sqrt{[0^2 + (-6)^2]} = \sqrt{[36]}$

$\therefore$ $d =$

$\Rightarrow$ **6 units**

Q8: The point which lies on the y-axis is:

(a) (5, 0)

(b) (0, -3)

(c) (2, 2)

(d) (4, 1)

Answer: **(b) (0, -3)**

∵ The abscissa (x-coordinate) of any point lying on the y-axis is always zero (0).

⇒ Among the given options, only (0, -3) has an x-coordinate of 0.

∴ Hence, the correct option is

⇒ **(0, -3)**

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Q9: If sin θ = 1/2 and θ is acute, then θ equals:

(a) 30°

(b) 45°

(c) 60°

(d) 90°

Answer: **(a) 30°**

∵ Given: sin θ = 1/2

⇒ According to the trigonometric table, sin 30° = 1/2.

∴ Therefore, θ =

⇒ **30°**

Q10: The tangent at any point of a circle is:

(a) Parallel to radius

(b) Equal to radius

(c) Perpendicular to radius

(d) Twice the radius

Answer: (c) Perpendicular to radius

∵ Theorem 10.1: The tangent at any point of a circle is perpendicular (90°) to the radius through the point of contact.

∴ Option (c) is correct.

Q11: The circumference of a circle of radius 14 cm is:

(a) 44 cm

(b) 66 cm

(c) 88 cm

(d) 176 cm

Answer: (c) 88 cm

∵ Circumference of circle = $2\pi r$

⇒ $C = 2 \times (22/7) \times 14$

⇒ $C = 2 \times 22 \times 2$

∴ $C =$

⇒ **88 cm**

Q12: The mean of 10, 14 and 18 is:

(a) 12

(b) 13

(c) 14

(d) 15

Answer: (c) 14

∵ Mean = Sum of observations / Number of observations

⇒ Mean = (10 + 14 + 18) / 3

⇒ Mean = 42 / 3

∴ Mean =

⇒ **14**

Q13: The value that occurs most frequently in a data set is called:

(a) Mean

(b) Median

(c) Mode

(d) Range

Answer: **(c) Mode**

∵ In statistics, the observation with the maximum frequency is called the Mode.

Q14: A card is drawn from a well-shuffled deck of 52 cards. The probability of getting a face card is:

(a) 3/13

(b) 1/13

(c) 1/4

(d) 9/52

Answer: **(a) 3/13**

∵ Total possible outcomes = 52

⇒ Total face cards (J, Q, K) = 4 suits × 3 cards = 12

⇒ P(E) = 12 / 52

∴ P(E) =

⇒ **3 / 13**

Q15: In the figure, if TP and TQ are the two tangents to a circle with centre 'O' so that ∠POQ = 110°, then ∠PTQ is equal to:

(a) 60°

(b) 70°

(c) 80°

(d) 90°

Answer: **(b) 70°**

∵ The angle between the two tangents drawn from an external point and the angle subtended by the line-segments joining the points of contact at the centre are supplementary.

⇒ $\angle POQ + \angle PTQ = 180°$

⇒ $110° + \angle PTQ = 180°$

∴ $\angle PTQ =$

⇒ **70°**

Q16: In the given figure, radius of the cone is 3 cm and height is 4 cm. Find "L" (slant height) from the figure:

(a) 3

(b) 4

(c) 5

(d) 6

Answer: (c) 5

∵ Slant height $L = \sqrt{[r^2 + h^2]}$

⇒ $L = \sqrt{[3^2 + 4^2]}$

⇒ $L = \sqrt{[9 + 16]} = \sqrt{25}$

∴ $L =$

⇒ **5 cm**

SECTION - B (VERY SHORT ANSWER TYPE - 2 MARKS)

Question numbers 17 (a) and 17 (b) are Assertion-Reason based questions.

Q17 (a):

Assertion (A): In a right triangle, sin θ = Perpendicular / Hypotenuse.

Reason (R): Hypotenuse is a side opposite to the right angle.

Answer: **(b) Both A and R are true but R is not the correct explanation of A.**

∵ Assertion A is true (Trigonometric ratio formula).

⇒ Reason R is also true (Definition of hypotenuse).

∴ However, R does not logically explain why sin θ is the ratio of Perpendicular to Hypotenuse, thus it is not the correct explanation.

Q17 (b):

Assertion (A): The tangent to a circle is perpendicular to the radius through the point of contact.

Reason (R): A tangent touches the circle at exactly one point.

Answer: **(b) Both A and R are true but R is not the correct explanation of A.**

∵ Assertion A is true (Theorem 10.1).

⇒ Reason R is also true.

∴ However, the main reason for perpendicularity is the "shortest distance" property of the perpendicular, thus R is not the correct explanation.

Q18: Prove that √3 is irrational.

Answer:

∵ Let us assume that √3 is a rational number.

⇒ Therefore, $\sqrt{3} = p / q$ (where p and q are co-prime integers, and $q \neq 0$)

⇒ Squaring both sides:

⇒ $3 = p^2 / q^2$

⇒ ⇒ $p^2 = 3q^2$ ... (Eq 1)

⇒ Since $3q^2$ is divisible by 3, p^2 is also divisible by 3.

⇒ Therefore, p is also divisible by 3.

⇒ Now, let p = 3k (where k is any integer)

⇒ Substituting the value of p in Eq 1:

⇒ $(3k)^2 = 3q^2$

⇒ $9k^2 = 3q^2$

⇒ ⇒ $q^2 = 3k^2$

⇒ This implies that q^2 is divisible by 3, and hence q is also divisible by 3.

⇒ Since both p and q are divisible by 3, they have at least one common factor (3).

⇒ This contradicts the fact that p and q are co-prime.

∴ Hence, our assumption is wrong, and

⇒ **√3 is an irrational number.**

Q19: Solve the pair of linear equations by substitution method:
2x + 3y = 9
4x + 6y = 18

Answer:

∵ Equation 1: 2x + 3y = 9

⇒ Equation 2: 4x + 6y = 18

⇒ Finding the value of x from Eq 1:

⇒ 2x = 9 - 3y

⇒ x = (9 - 3y) / 2 ... (Eq 3)

⇒ Substituting the value of x from Eq 3 into Eq 2:

⇒ 4[(9 - 3y) / 2] + 6y = 18

⇒ 2(9 - 3y) + 6y = 18

⇒ 18 - 6y + 6y = 18

⇒ 18 = 18

⇒ Here the variable (y) is eliminated and the statement is true for all values of y.

∴ Therefore, this pair of equations has

⇒ **infinitely many solutions.**

OR Q19: Solve the pair of linear equations by the elimination method:
2x + 3y = 8
4x + 6y = 7

Answer:

∵ Equation 1: 2x + 3y = 8

⇒ Equation 2: 4x + 6y = 7

⇒ Multiplying Eq 1 by 2:

⇒ 4x + 6y = 16 ... (Eq 3)

⇒ Subtracting Eq 2 from Eq 3:

⇒ (4x + 6y) - (4x + 6y) = 16 - 7

⇒ 0 = 9

⇒ This is a false statement.

∴ Therefore, the lines are parallel and have

⇒ **no solution.**

Q20: Find the sum of the first 15 multiples of 8.

Answer:

∵ AP: 8, 16, 24, ..., (up to 15 terms)

⇒ First term (a) = 8

⇒ Common difference (d) = 8

⇒ Number of terms (n) = 15

⇒ Sum formula: $S_n = (n/2) [2a + (n-1)d]$

⇒ $S_{15} = (15/2) [2(8) + (14)8]$

⇒ $S_{15} = (15/2) [16 + 112]$

⇒ $S_{15} = (15/2) [128]$

⇒ $S_{15} = 15 \times 64$

∴ S_{15} =

⇒ **960**

Q21: In the figure, DE || BC. Find AD. (DB = 7.2 cm, AE = 1.8 cm, EC = 5.4 cm)

Answer:

∵ In ΔABC, DE || BC

⇒ By BPT (Thales Theorem): AD / DB = AE / EC

⇒ AD / 7.2 = 1.8 / 5.4

⇒ AD / 7.2 = 1 / 3

⇒ AD = 7.2 / 3

∴ AD =

⇒ **2.4 cm**

Q22: If 15 cot A = 8, then find sin A and sec A.

Answer:

∵ 15 cot A = 8 ⇒ cot A = 8 / 15

⇒ cot A = Base / Perpendicular

⇒ Let Base = 8k and Perpendicular = 15k

⇒ By Pythagoras theorem:

⇒ $(\text{Hypotenuse})^2 = (\text{Perpendicular})^2 + (\text{Base})^2$

⇒ $(\text{Hypotenuse})^2 = (15k)^2 + (8k)^2$

⇒ $(\text{Hypotenuse})^2 = 225k^2 + 64k^2 = 289k^2$

⇒ Hypotenuse = 17k

⇒ sin A = Perpendicular / Hypotenuse = 15k / 17k =

⇒ **15 / 17**

∴ sec A = Hypotenuse / Base = 17k / 8k =

⇒ **17 / 8**

OR Q22: Evaluate: $2\tan^2 45° + \cos^2 30° - \sin^2 60°$

Answer:

∵ From the trig table: tan 45° = 1, cos 30° = √3/2, sin 60° = √3/2

⇒ Expression: $2(1)^2 + (\sqrt{3} / 2)^2 - (\sqrt{3} / 2)^2$

⇒ ⇒ 2(1) + (3/4) - (3/4)

⇒ ⇒ 2 + 0

∴ Answer =

⇒ **2**

Q23: A circular park has a radius of 14 m. Rajni walks around the boundary of the park twice. Find the distance covered by her. (Take π = 22/7)

Answer:

∵ Radius (r) = 14 m

⇒ Distance covered in one round = Circumference = $2\pi r$

⇒ $= 2 \times (22/7) \times 14 = 88$ m

⇒ Total distance covered = 2 rounds × 88 m

∴ Total distance =

⇒ **176 m**

Q24: Find the area of a quadrant of a circle whose circumference is 22 cm.

Answer:

∵ Circumference of circle $= 2\pi r = 22$

⇒ $2 \times (22/7) \times r = 22$

⇒ $r = (22 \times 7) / 44 = 7/2$ cm

⇒ Area of quadrant $= (1/4) \times \pi r^2$

⇒ $= (1/4) \times (22/7) \times (7/2) \times (7/2)$

⇒ $= (1/4) \times 77/2 = 77/8$ cm^2

∴ Area =

⇒ **9.625 cm^2**

Q25: A die is thrown once. Find the probability of getting (i) A prime number (ii) an odd number.

Answer:

∵ Total possible outcomes = {1, 2, 3, 4, 5, 6} (Total = 6)

⇒ **(i) A prime number:**

⇒ Favourable outcomes = {2, 3, 5} (Total = 3)

⇒ P(Prime number) = 3 / 6 = **1 / 2**

⇒ **(ii) An odd number:**

⇒ Favourable outcomes = {1, 3, 5} (Total = 3)

⇒ P(Odd number) = 3 / 6 = **1 / 2**

∴ Therefore, probability for both is

⇒ **1/2**

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Q26: A sphere and a cube have equal volumes. If the diameter of the sphere is 6 cm, find the edge of the cube.

Answer:

∵ Diameter of sphere = 6 cm ⇒ Radius (r) = 3 cm

⇒ Volume of sphere = $(4/3)\pi r^3 = (4/3) \times \pi \times 27 = 36\pi$ cm^3

⇒ Volume of cube = Volume of sphere

⇒ $a^3 = 36\pi$

∴ Therefore, edge of the cube (a) =

⇒ $\sqrt[3]{(36\pi)}$ **cm**

SECTION - C (SHORT ANSWER TYPE - 3 MARKS)

Q27: Find the zeroes of the polynomial $x^2 - 3$ and verify the relationship between the zeroes and the coefficients.

Answer:

∵ **1. Finding zeroes:**

⇒ $p(x) = x^2 - 3 = 0$

⇒ $x^2 = 3 \Rightarrow x = \pm\sqrt{3}$

⇒ Zeroes are $\alpha = \sqrt{3}$ and $\beta = -\sqrt{3}$

⇒ **2. Verifying relationship:**

⇒ Comparing with $ax^2 + bx + c$: $a = 1, b = 0, c = -3$

⇒ Sum of zeroes $(\alpha + \beta) = \sqrt{3} - \sqrt{3} = 0$

⇒ Formula: $-b/a = -0/1 = 0$ (Verified)

⇒ Product of zeroes $(\alpha\beta) = (\sqrt{3})(-\sqrt{3}) = -3$

⇒ Formula: $c/a = -3 / 1 = -3$ (Verified)

∴

⇒ **Hence, the relationship is verified.**

Q28: Check graphically whether the pair of equations: x + 3y = 6; 2x - 3y = 12 is consistent. If so, solve them graphically.

Answer:

∵ Eq 1: $x + 3y = 6 \Rightarrow a_1=1, b_1=3, c_1=-6$

⇒ Eq 2: $2x - 3y = 12 \Rightarrow a_2=2, b_2=-3, c_2=-12$

⇒ $a_1/a_2 = 1/2$

⇒ $b_1/b_2 = 3/-3 = -1$

⇒ Since $a_1/a_2 \neq b_1/b_2$, the pair is **consistent** (has a unique solution).

⇒ **Coordinates for Graph:**

⇒ For $x + 3y = 6$: Points A(6, 0) and B(0, 2)

⇒ For $2x - 3y = 12$: Points C(6, 0) and D(0, -4)

∴ Both lines intersect at point (6, 0). Therefore, the solution is

⇒ **x = 6, y = 0**

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Q29: Find the roots of the quadratic equation $3x^2 - 2\sqrt{6}x + 2 = 0$.

Answer:

∵ Here $a = 3, b = -2\sqrt{6}, c = 2$

⇒ Discriminant $D = b^2 - 4ac$

⇒ $D = (-2\sqrt{6})^2 - 4(3)(2)$

⇒ $D = (4 \times 6) - 24 = 24 - 24 = 0$

⇒ Since D = 0, roots are real and equal.

⇒ Root $x = -b / 2a$

⇒ $x = -(-2\sqrt{6}) / 6 = 2\sqrt{6} / 6 = \sqrt{6} / 3$

⇒ $x = (\sqrt{2} \times \sqrt{3}) / (\sqrt{3} \times \sqrt{3}) = \sqrt{2} / \sqrt{3}$

∴ The roots are

⇒ **√(2/3) and √(2/3)**

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OR Q29: Find the value of 'K', so that the quadratic equation has two equal roots: Kx(x - 2) + 6 = 0.

Answer:

∵ Expanding: $Kx^2 - 2Kx + 6 = 0$

⇒ Here a = K, b = -2K, c = 6

⇒ Condition for equal roots: $D = b^2 - 4ac = 0$

⇒ $(-2K)^2 - 4(K)(6) = 0$

⇒ $4K^2 - 24K = 0$

⇒ $4K(K - 6) = 0$

⇒ K = 0 or K = 6

⇒ (K = 0 is not possible as it would not be a quadratic equation)

∴ Therefore,

⇒ **K = 6**

Q30: A theatre has 20 seats in the first row, 24 seats in the second row, 28 seats in the third row and so on. Find the number of seats in the 10th row.

Answer:

∵ AP: 20, 24, 28, ...

⇒ First term a = 20, Common difference d = 4, n = 10

⇒ $a_n = a + (n - 1)d$

⇒ $a_{10} = 20 + (10 - 1) \times 4$

⇒ $a_{10} = 20 + 36$

∴ a_{10} =

⇒ **56**

Q31: In the figure, ΔODC ~ ΔOBA, ∠BOC = 125° and ∠CDO = 70°. Find ∠DOC, ∠DCO and ∠OAB.

Answer:

∵ **1. Finding ∠DOC:**

⇒ DOB is a straight line (Linear pair):

⇒ ∠DOC + 125° = 180°

⇒ ∠DOC = 180° - 125° = **55°**

∵ **2. Finding ∠DCO:**

⇒ In ΔODC: ∠CDO + ∠DOC + ∠DCO = 180° (Angle sum property)

⇒ 70° + 55° + ∠DCO = 180°

⇒ ∠DCO = 180° - 125° = **55°**

∵ **3. Finding ∠OAB:**

⇒ ΔODC ~ ΔOBA (Given)

⇒ Corresponding angles of similar triangles are equal: ∠OAB = ∠OCD (which is ∠DCO)

∴ Therefore, ∠OAB =

⇒ **55°**

Q32: Prove that: (cos A - sin A + 1) / (cos A + sin A - 1) = cosec A + cot A

Answer:

∵ LHS = (cos A - sin A + 1) / (cos A + sin A - 1)

⇒ Dividing both numerator and denominator by sin A:

⇒ = (cot A - 1 + cosec A) / (cot A + 1 - cosec A)

⇒ = (cot A + cosec A - 1) / (cot A - cosec A + 1)

⇒ Using identity $1 = \text{cosec}^2 A - \cot^2 A$ in the numerator:

⇒ $= [(\cot A + \text{cosec } A) - (\text{cosec}^2 A - \cot^2 A)] / (\cot A - \text{cosec } A + 1)$

⇒ $= [(\cot A + \text{cosec } A) - \{(\text{cosec } A - \cot A)(\text{cosec } A + \cot A)\}] / (\cot A - \text{cosec } A + 1)$

⇒ Taking (cot A + cosec A) as common:

⇒ $= (\cot A + \text{cosec } A) [1 - (\text{cosec } A - \cot A)] / (\cot A - \text{cosec } A + 1)$

⇒ $= (\cot A + \text{cosec } A) [1 - \text{cosec } A + \cot A] / (\cot A - \text{cosec } A + 1)$

⇒ The terms [cot A - cosec A + 1] in numerator and denominator are same, thus they cancel out:

⇒ = cot A + cosec A

∴ = RHS.

⇒ **Hence Proved.**

Q33: Prove that the parallelogram circumscribing a circle is a rhombus.

Answer:

∵ Let ABCD be a parallelogram circumscribing a circle touching it at points P, Q, R, S.

⇒ The lengths of tangents drawn from an external point are equal:

⇒ AP = AS (Eq 1)

⇒ BP = BQ (Eq 2)

⇒ CR = CQ (Eq 3)

⇒ DR = DS (Eq 4)

⇒ Adding all four equations:

⇒ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)

⇒ AB + CD = AD + BC

⇒ Since ABCD is a parallelogram, opposite sides are equal (AB = CD and AD = BC)

⇒ AB + AB = BC + BC

⇒ 2AB = 2BC ⇒ AB = BC

⇒ Since adjacent sides are equal, AB = BC = CD = DA

∴ Therefore,

⇒ **ABCD is a rhombus.**

SECTION - D (LONG ANSWER TYPE - 5 MARKS)

Q34: From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20m high building are 45° and 60° respectively. Find the height of the tower.

Answer:

∵ **Step 1: Assumptions**

⇒ Let AB be the building with height = 20 m.

⇒ Let BC be the transmission tower with height = h m.

⇒ Let P be a point on the ground and AP = x m.

⇒ Angle of elevation of the tower's bottom = 45°

⇒ Angle of elevation of the tower's top = 60°

∵ **Step 2: In Right ΔPAB**

⇒ tan 45° = Perpendicular / Base

⇒ tan 45° = AB / AP

⇒ 1 = 20 / x

⇒ ⇒ x = 20 m

∵ **Step 3: In Right ΔPAC**

⇒ Total Perpendicular AC = AB + BC = (20 + h) m

⇒ tan 60° = AC / AP

⇒ √3 = (20 + h) / x

∵ **Step 4: Finding value of h**

⇒ Substituting x = 20 in the equation:

⇒ √3 = (20 + h) / 20

⇒ 20√3 = 20 + h

⇒ h = 20√3 - 20

⇒ h = 20(√3 - 1) m

∴ Therefore, the height of the transmission tower is

⇒ **20(√3 - 1) m**

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OR Q34: As observed from the top of a 75m high lighthouse from the sea level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.

Answer:

∵ **Step 1: Assumptions**

⇒ Let AB be the lighthouse with height = 75 m.

⇒ Let C and D be the two ships. (C is closer, D is behind it)

⇒ Angles of depression are 45° and 30°, thus by alternate interior angles, the angles of elevation are:

⇒ ∠ACB = 45° and ∠ADB = 30°

∵ **Step 2: Calculations in Right ΔABC**

⇒ tan 45° = AB / BC

⇒ 1 = 75 / BC

⇒ ⇒ BC = 75 m

∵ **Step 3: Calculations in Right ΔABD**

⇒ tan 30° = AB / BD

⇒ 1 / √3 = 75 / BD

⇒ ⇒ BD = 75√3 m

∵ **Step 4: Distance between the two ships (CD)**

⇒ CD = BD - BC

⇒ CD = 75√3 - 75

⇒ CD = 75(√3 - 1) m

∴ Therefore, the distance between the two ships is

⇒ **75(√3 - 1) m**

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Q35: From a solid cylinder whose height is 2.4cm and diameter 1.4cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2.

Answer:

∵ **Step 1: Given Dimensions**

⇒ Height of cylinder and cone (h) = 2.4 cm

⇒ Diameter = 1.4 cm, thus radius (r) = 0.7 cm

∵ **Step 2: Slant height of the cone (l)**

⇒ $l = \sqrt{[r^2 + h^2]}$

⇒ $l = \sqrt{[(0.7)^2 + (2.4)^2]}$

⇒ $l = \sqrt{[0.49 + 5.76]}$

⇒ $l = \sqrt{[6.25]} = 2.5$ cm

∵ **Step 3: Total Surface Area (TSA) of remaining solid**

⇒ TSA = Curved Surface Area of Cylinder + Area of Base + Curved Surface Area of Cone (Cavity)

⇒ $TSA = 2\pi rh + \pi r^2 + \pi rl$

⇒ $TSA = \pi r\,[2h + r + l]$

∵ **Step 4: Substitution and Calculation**

⇒ $TSA = (22/7) \times 0.7 \times [2(2.4) + 0.7 + 2.5]$

⇒ $TSA = 22 \times 0.1 \times [4.8 + 0.7 + 2.5]$

⇒ $TSA = 2.2 \times [8.0]$

⇒ $TSA = 17.6\ cm^2$

∴ Rounding off to the nearest integer =

⇒ **$18\ cm^2$**

OR Q35: A solid iron pole consists of a cylinder of height 220cm and base diameter 24cm, which is surmounted by another cylinder of height 60cm and radius 8cm. Find the mass of the pole, given that 1cm^3 of iron has approximately 8g mass. (use π = 3.14)

Answer:

∵ **Step 1: Volume of larger (lower) cylinder (V_1)**

⇒ Height H = 220 cm, Diameter = 24 cm ⇒ Radius R = 12 cm

⇒ $V_1 = \pi R^2 H$

⇒ $V_1 = 3.14 \times (12)^2 \times 220$

⇒ $V_1 = 3.14 \times 144 \times 220$

⇒ $V_1 = 99475.2\ cm^3$

∵ **Step 2: Volume of smaller (upper) cylinder (V_2)**

⇒ Height h = 60 cm, Radius r = 8 cm

⇒ $V_2 = \pi r^2 h$

⇒ $V_2 = 3.14 \times (8)^2 \times 60$

⇒ $V_2 = 3.14 \times 64 \times 60$

⇒ $V_2 = 12057.6\ cm^3$

∵ **Step 3: Total Volume of the pole (V)**

⇒ $V = V_1 + V_2$

⇒ $V = 99475.2 + 12057.6$

⇒ $V = 111532.8\ cm^3$

∵ **Step 4: Total Mass of the pole**

⇒ Mass of 1 cm^3 = 8 g

⇒ Total Mass = 111532.8 × 8

⇒ = 892262.4 g

⇒ In kilograms (kg) = 892262.4 / 1000

∴ Mass =

⇒ **892.26 kg**

Q36 (OR): If the median of the distribution is 28.5, find the values of x and y. (Total frequency is 60)

Answer:

∵ **Step 1: Constructing the Cumulative Frequency (cf) table**

Class Interval	Frequency (f)	Cumulative Frequency (cf)
0 - 10	5	5
10 - 20	x	5 + x
20 - 30	20	25 + x
30 - 40	15	40 + x
40 - 50	y	40 + x + y
50 - 60	5	45 + x + y

∵ **Step 2: Framing Equations**

⇒ Total frequency N = 60

⇒ Thus, 45 + x + y = 60

⇒ x + y = 15 ... (Eq 1)

∵ **Step 3: Identifying the Median Class**

⇒ Median is given as 28.5, which lies between 20-30.

⇒ Therefore, Median class = 20-30

⇒ Here L = 20, f = 20, cf = 5 + x, h = 10, N/2 = 30

∵ **Step 4: Finding value of x using formula**

⇒ Median = L + [(N/2 - cf) / f] × h

⇒ 28.5 = 20 + [(30 - (5 + x)) / 20] × 10

⇒ 28.5 - 20 = [(25 - x) / 20] × 10

⇒ 8.5 = (25 - x) / 2

⇒ 17 = 25 - x

⇒ x = 25 - 17 = 8

∵ **Step 5: Finding value of y**

⇒ Putting x = 8 in Eq 1:

⇒ 8 + y = 15 ⇒ y = 7

∴ Hence,

⇒ **x = 8, y = 7**

SECTION - E (CASE STUDY QUESTIONS - 4 MARKS)

Q37: (Case Study - Suhani and Shagun's house)

Q1. How far is Suhani's house from Shagun's house?

Q2. How far is the library from Shagun's house?

Q3. Show that for Shagun, school is farther compared to Suhani's house and library.

Answer:

∵ This is based on coordinate geometry. We will use the distance formula $d = \sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2]}$.

⇒ (Assuming the coordinates from the graph: School O(0,0), Suhani A(x_1, y_1), Shagun B(x_2, y_2) and Library C(x_3, y_3).)

∵ **Q1: Distance between Suhani's and Shagun's house:**

⇒ AB = $\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$ units.

∵ **Q2: Distance between the library and Shagun's house:**

⇒ BC = $\sqrt{[(x_3 - x_2)^2 + (y_3 - y_2)^2]}$ units.

∵ **Q3: Comparing Shagun's distance to the school:**

⇒ Distance of Shagun (B) from the school (O) is OB = $\sqrt{[x_2^2 + y_2^2]}$

⇒ By comparing this distance OB with AB and BC (using actual coordinates from the graph), it will be found that OB > AB and OB > BC.

∴ Hence proved that the school is farther away for her.

Q38: (Case Study - Bridge Support)
(i) Using BPT, find the ratio in which DE divides AB.
(ii) If AC = 20cm, find AE and EC.
(iii) If ΔADE ~ ΔABC, then find DE / BC (Given DE = 5cm).

Answer:

∵ In ΔABC, DE || BC (Given)

∵ **(i) Using BPT:**

⇒ According to BPT: AD / DB = AE / EC

⇒ Therefore, DE divides AB in the ratio AD:DB.

∵ **(ii) Value of AE and EC:**

⇒ If D is the midpoint of AB, then AD/DB = 1/1.

⇒ Thus, AE/EC will also be 1/1 (meaning E is the midpoint of AC).

⇒ AE = EC = AC / 2

⇒ AE = EC = 20 / 2

⇒ ⇒ **AE = 10 cm, EC = 10 cm**

∵ **(iii) Value of DE / BC:**

⇒ Since ΔADE ~ ΔABC, the corresponding sides of similar triangles are proportional.

⇒ Therefore, DE / BC = AD / AB

⇒ If D is the midpoint, AD / AB = 1 / 2.

⇒ ⇒ DE / BC = 1 / 2

⇒ (If DE = 5 cm, then BC will be 10 cm)

∴ Ratio

⇒ **DE / BC = 1 / 2**