

Mathematics (Basic) 2025, Set 430/6/1

Q.P. Code 430/6/1 · Series F6EGH · 80 marks · 3 hours · March 2025. Questions are from the official CBSE paper. Step-by-step solutions are written by CogniGuru and checked against CBSE's published answer key. Where the key itself disagrees with the arithmetic, the solution says so.

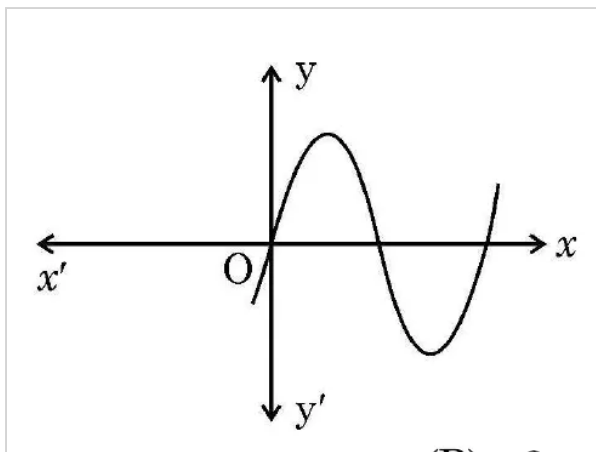
Free paper, 1-minute analysis and quiz: cognicraftedu.com/cbse-class-10-papers/maths-basic/2025/430-6-1

Section A: Multiple choice

20 questions, 1 mark each. MCQs (Q1 to Q18) and assertion-reason (Q19, Q20).

Q1 · POLYNOMIALS · 1 MARK

In the given figure, graph of polynomial $p(x)$ is shown. Number of zeroes of $p(x)$ is:



(A) 3

(B) 2

(C) 1

(D) 4

SOLUTION

The zeroes are the points where the graph meets the x -axis. The curve crosses it at 3 points.

Answer: (A) 3

Q2 · ARITHMETIC PROGRESSIONS · 1 MARK

22nd term of the A.P.: $\frac{3}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{-3}{2}, \dots$ is:

(A) $\frac{45}{2}$

(B) -9

(C) $\frac{-39}{2}$

(D) -21

SOLUTION

$$a = \frac{3}{2} \text{ and } d = \frac{1}{2} - \frac{3}{2} = -1. \quad a_{22} = \frac{3}{2} + 21(-1) = -\frac{39}{2}.$$

Answer: (C) $-\frac{39}{2}$

Q3 · LINEAR EQUATIONS · 1 MARK

The line $2x - 3y = 6$ intersects x -axis at:

- (A) (0, -2) (B) (0, 3)
(C) (-2, 0) (D) (3, 0)

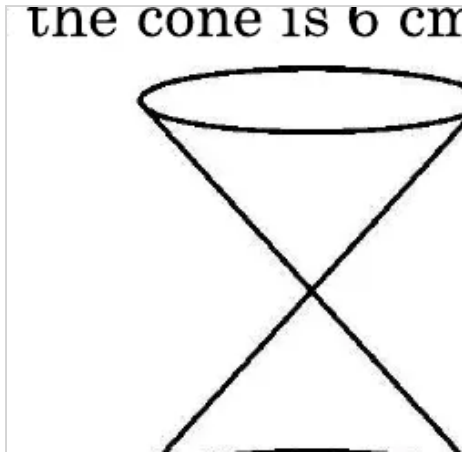
SOLUTION

On the x -axis $y = 0$, so $2x = 6$ and $x = 3$. The point is (3, 0).

Answer: (D) (3, 0)

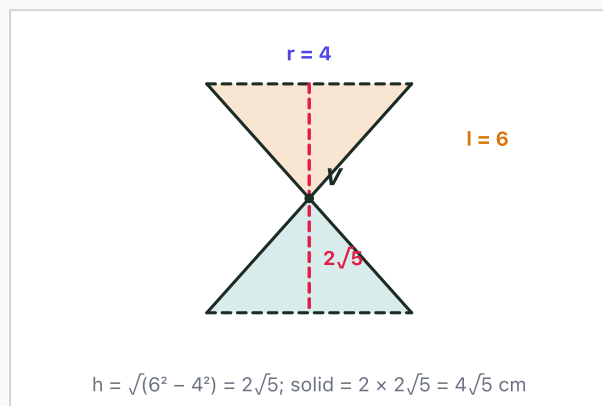
Q4 · SURFACE AREAS AND VOLUMES · 1 MARK

Two identical cones are joined as shown in the figure. If radius of base is 4 cm and slant height of the cone is 6 cm, then height of the solid is:



- (A) 8 cm (B) $4\sqrt{5}$ cm
(C) $2\sqrt{5}$ cm (D) 12 cm

SOLUTION



Height of one cone $= \sqrt{6^2 - 4^2} = \sqrt{20} = 2\sqrt{5}$ cm.

The solid is two such cones tip to tip: height $= 2 \times 2\sqrt{5} = 4\sqrt{5}$ cm.

Answer: (B) $4\sqrt{5}$ cm

Q5 · LINEAR EQUATIONS · 1 MARK

The value of k for which the system of equations $3x - 7y = 1$ and $kx + 14y = 6$ is inconsistent, is:

(A) -6

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

(C) 6

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

SOLUTION

Inconsistent needs $\frac{3}{k} = \frac{-7}{14} \neq \frac{1}{6}$. $\frac{3}{k} = -\frac{1}{2}$ gives $k = -6$, and then $\frac{3}{k} = -\frac{1}{2} \neq \frac{1}{6} \checkmark$.

Answer: (A) -6

Q6 · PROBABILITY · 1 MARK

Two dice are rolled together. The probability of getting a sum more than 9 is:

(A) $\frac{5}{6}$

(B) $\frac{5}{18}$

(C) $\frac{1}{6}$

(D) $\frac{1}{2}$

SOLUTION

Sum 10: $(4, 6), (5, 5), (6, 4) - 3$. Sum 11: $(5, 6), (6, 5) - 2$. Sum 12: $(6, 6) - 1$. Total 6 of 36: $P = \frac{1}{6}$.

Answer: (C) $\frac{1}{6}$

Q7 · COORDINATE GEOMETRY · 1 MARK

$ABCD$ is a rectangle with its vertices at $(2, -2), (8, 4), (4, 8)$ and $(-2, 2)$ taken in order. Length of its diagonal is:

(A) $4\sqrt{2}$

(B) $6\sqrt{2}$

(C) $4\sqrt{26}$

(D) $2\sqrt{26}$

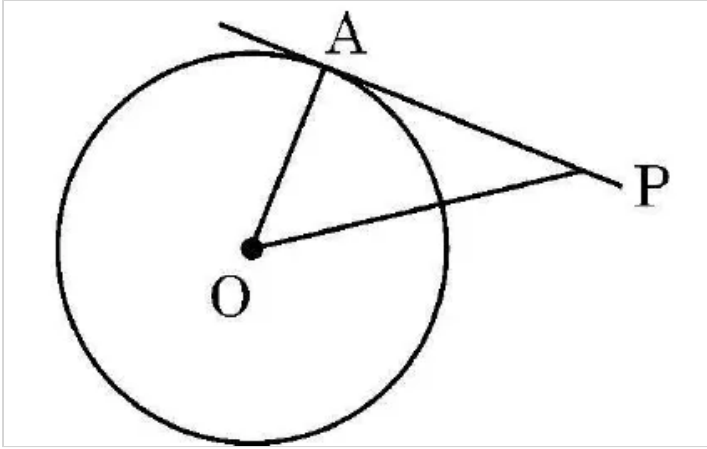
SOLUTION

A diagonal joins the opposite vertices $(2, -2)$ and $(4, 8)$: $\sqrt{(4-2)^2 + (8+2)^2} = \sqrt{4+100} = \sqrt{104} = 2\sqrt{26}$.
(The other diagonal, $(8, 4)$ to $(-2, 2)$, gives $\sqrt{100+4}$, the same.)

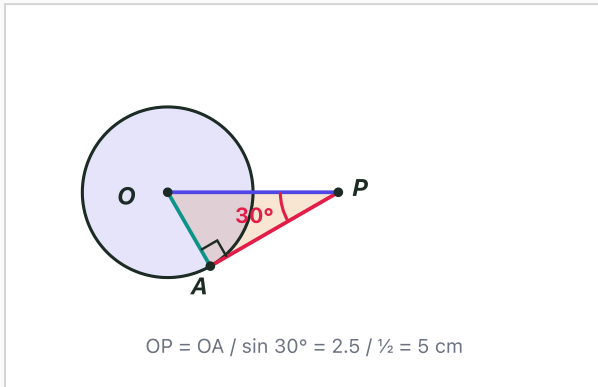
Answer: (D) $2\sqrt{26}$

Q8 · CIRCLES · 1 MARK

In the given figure, PA is tangent to a circle with centre O . If $\angle APO = 30^\circ$ and $OA = 2.5$ cm, then OP is equal to:



- (A) 2.5 cm
(B) 5 cm
(C) $\frac{5}{\sqrt{3}}$ cm
(D) 2 cm

SOLUTION

$OA \perp PA$, so in the right triangle OAP : $\sin 30^\circ = \frac{OA}{OP}$, giving $OP = \frac{2.5}{1/2} = 5$ cm.

Answer: (B) 5 cm

Q9 · PROBABILITY · 1 MARK

If probability of happening of an event is 57%, then probability of non-happening of the event is:

- (A) 0.43
(B) 0.57
(C) 53%
(D) $\frac{1}{57}$

SOLUTION

$P(\text{not happening}) = 1 - 0.57 = 0.43$.

Answer: (A) 0.43

Q10 · AREAS RELATED TO CIRCLES · 1 MARK

OAB is sector of a circle with centre O and radius 7 cm. If length of arc $AB = \frac{22}{3}$ cm, then $\angle AOB$ is equal to:

- (A) $\left(\frac{120}{7}\right)^\circ$ (B) 45°
(C) 60° (D) 30°

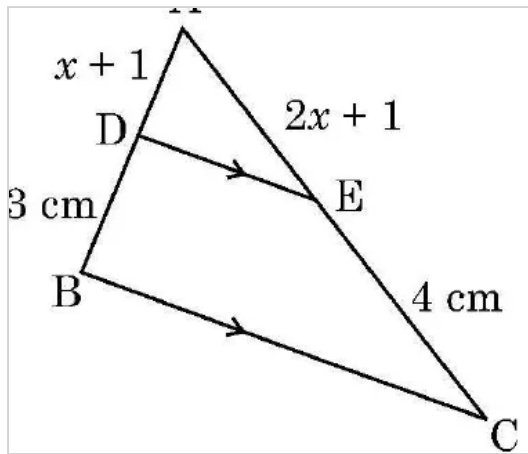
SOLUTION

$$\frac{22}{3} = \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 7 = \frac{\theta}{360} \times 44, \text{ so } \theta = \frac{22 \times 360}{3 \times 44} = 60^\circ.$$

Answer: (C) 60°

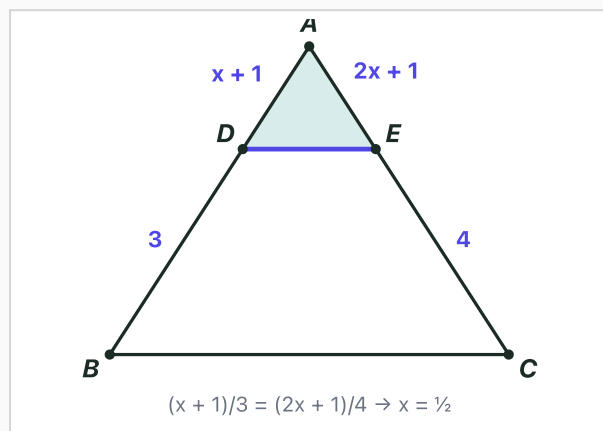
Q11 · TRIANGLES · 1 MARK

In $\triangle ABC$, $DE \parallel BC$. If $AE = (2x + 1)$ cm, $EC = 4$ cm, $AD = (x + 1)$ cm and $DB = 3$ cm, then value of x is:



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

SOLUTION



$$DE \parallel BC, \text{ so } \frac{AD}{DB} = \frac{AE}{EC}: \frac{x + 1}{3} = \frac{2x + 1}{4}. 4x + 4 = 6x + 3, \text{ so } x = \frac{1}{2}.$$

Answer: (B) $\frac{1}{2}$

Q12 · PROBABILITY · 1 MARK

Three coins are tossed together. The probability that exactly one coin shows head, is:

- (A) $\frac{1}{8}$ (B) $\frac{1}{4}$
 (C) 1 (D) $\frac{3}{8}$

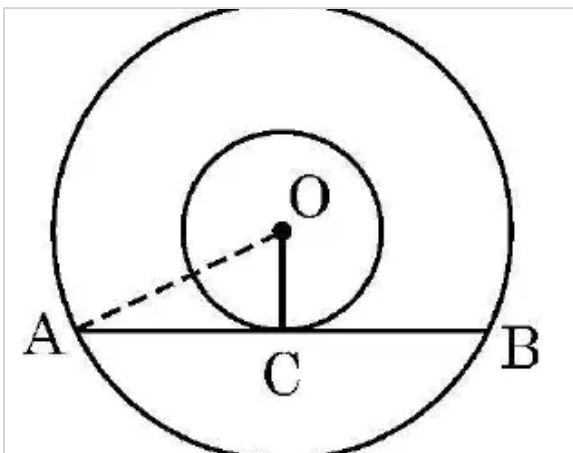
SOLUTION

There are 8 outcomes. Exactly one head: HTT, THT, TTH , which is 3. $P = \frac{3}{8}$.

Answer: (D) $\frac{3}{8}$

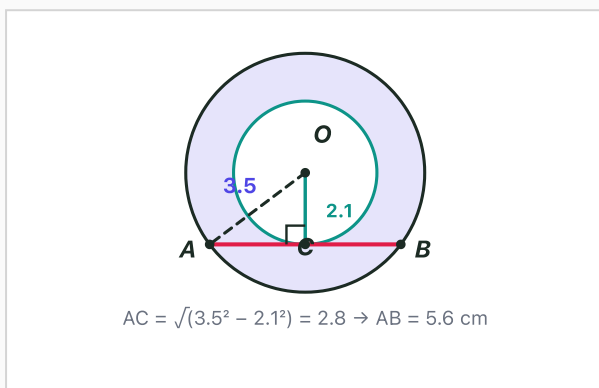
Q13 · CIRCLES · 1 MARK

In two concentric circles centred at O , a chord AB of the larger circle touches the smaller circle at C . If $OA = 3.5$ cm, $OC = 2.1$ cm, then AB is equal to:



- (A) 5.6 cm (B) 2.8 cm
 (C) 3.5 cm (D) 4.2 cm

SOLUTION



$OC \perp AB$ (radius and tangent). $AC = \sqrt{OA^2 - OC^2} = \sqrt{12.25 - 4.41} = \sqrt{7.84} = 2.8$ cm.

The perpendicular from the centre bisects the chord, so $AB = 2 \times 2.8 = 5.6$ cm.

Answer: (A) 5.6 cm

Q14 · TRIGONOMETRY · 1 MARK

If $\sqrt{3} \sin \theta = \cos \theta$, then value of θ is:

- (A) $\sqrt{3}$ (B) 60°
 (C) $\frac{1}{\sqrt{3}}$ (D) 30°

SOLUTION

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{1}{\sqrt{3}}, \text{ so } \theta = 30^\circ.$$

Answer: (D) 30°

Q15 · STATISTICS · 1 MARK

To calculate mean of a grouped data, Rahul used assumed mean method. He used $d = (x - A)$, where A is assumed mean. Then $\bar{x}$ is equal to:

- (A) $A + \bar{d}$ (B) $A + h\bar{d}$
 (C) $h(A + \bar{d})$ (D) $A - \bar{d}$

SOLUTION

With $d = x - A$, $x = A + d$, so the mean is $\bar{x} = A + \bar{d}$. (The factor h appears only in the step-deviation method, where $u = \frac{x - A}{h}$.)

Answer: (A) $A + \bar{d}$

Q16 · ARITHMETIC PROGRESSIONS · 1 MARK

If the sum of first n terms of an A.P. is given by $S_n = \frac{n}{2}(3n + 1)$, then the first term of the A.P. is:

- (A) 2 (B) $\frac{3}{2}$
 (C) 4 (D) $\frac{5}{2}$

SOLUTION

$$\text{The first term is } S_1 = \frac{1}{2}(3 + 1) = 2.$$

Answer: (A) 2

Q17 · TRIGONOMETRY · 1 MARK

In $\triangle ABC$, $\angle B = 90^\circ$. If $\frac{AB}{AC} = \frac{1}{2}$, then $\cos C$ is equal to:

- (A) $\frac{3}{2}$ (B) $\frac{1}{2}$
 (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{1}{\sqrt{3}}$

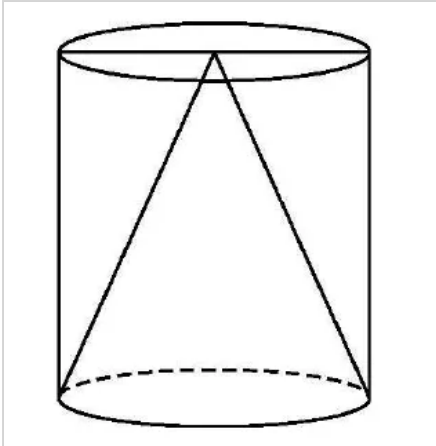
SOLUTION

$$\sin C = \frac{AB}{AC} = \frac{1}{2}, \text{ so } C = 30^\circ \text{ and } \cos C = \cos 30^\circ = \frac{\sqrt{3}}{2}.$$

Answer: (C) $\frac{\sqrt{3}}{2}$

Q18 · SURFACE AREAS AND VOLUMES · 1 MARK

The volume of air in a hollow cylinder is 450 cm^3 . A cone of same height and radius as that of cylinder is kept inside it. The volume of empty space in the cylinder is:



- (A) 225 cm^3
(C) 250 cm^3

- (B) 150 cm^3
(D) 300 cm^3

SOLUTION

The cone has one third of the volume of the cylinder: $\frac{1}{3} \times 450 = 150 \text{ cm}^3$. The empty space is $450 - 150 = 300 \text{ cm}^3$.

Answer: (D) 300 cm^3

Q19 · REAL NUMBERS · 1 MARK

Assertion (A): $(a + \sqrt{b}) \cdot (a - \sqrt{b})$ is a rational number, where a and b are positive integers.

Reason (R): Product of two irrationals is always rational.

- (A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true, but R is not the correct explanation of A
(C) A is true, but R is false
(D) A is false, but R is true

SOLUTION

(A) $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$, an integer, so it is rational. True.

(R) $\sqrt{2} \times \sqrt{3} = \sqrt{6}$ is irrational, so the product of two irrationals need not be rational. False.

Answer: (C) A is true, but R is false

Q20 · TRIANGLES · 1 MARK

Assertion (A): $\triangle ABC \sim \triangle PQR$ such that $\angle A = 65^\circ$, $\angle C = 60^\circ$. Hence $\angle Q = 55^\circ$.

Reason (R): Sum of all angles of a triangle is 180° .

- (A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true, but R is not the correct explanation of A
(C) A is true, but R is false
(D) A is false, but R is true

SOLUTION

(R) The angle sum of a triangle is 180° . True.

(A) $\angle B = 180^\circ - 65^\circ - 60^\circ = 55^\circ$, and in similar triangles $\angle Q = \angle B = 55^\circ$. True. But the equality $\angle Q = \angle B$ comes from similarity, which R does not state, so R alone is not the full explanation.

Answer: (B) Both A and R are true, but R is not the correct explanation of A

Section B: Very short answer

5 questions, 2 marks each.

Q21 · QUADRATIC EQUATIONS · 2 MARKS

(a) Solve the equation $4x^2 - 9x + 3 = 0$, using quadratic formula.

OR

(b) Find the nature of roots of the equation $3x^2 - 4\sqrt{3}x + 4 = 0$.

SOLUTION

(a) $D = (-9)^2 - 4(4)(3) = 81 - 48 = 33$. $x = \frac{9 \pm \sqrt{33}}{8}$.

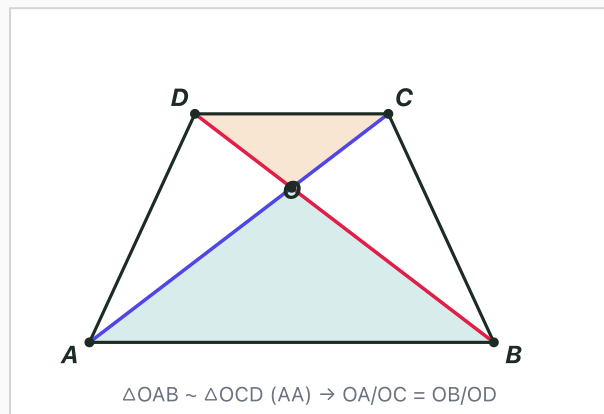
(b) $D = (-4\sqrt{3})^2 - 4(3)(4) = 48 - 48 = 0$, so the roots are real and equal.

Answer: (a) $\frac{9 \pm \sqrt{33}}{8}$ (b) real and equal

Q22 · TRIANGLES · 2 MARKS

In a trapezium $ABCD$, $AB \parallel DC$ and its diagonals intersect at O . Prove that $\frac{OA}{OC} = \frac{OB}{OD}$.

SOLUTION



In $\triangle OAB$ and $\triangle OCD$: $\angle OAB = \angle OCD$ and $\angle OBA = \angle ODC$ (alternate angles, $AB \parallel DC$).

So $\triangle OAB \sim \triangle OCD$ by AA, and the corresponding sides are proportional: $\frac{OA}{OC} = \frac{OB}{OD}$.

Answer: Proved

Q23 · PROBABILITY · 2 MARKS

A box contains 120 discs, which are numbered from 1 to 120. If one disc is drawn at random from the box, find the probability that (i) it bears a 2-digit number (ii) the number is a perfect square.

SOLUTION

(i) 2-digit numbers from 10 to 99: 90 of the 120 discs. $P = \frac{90}{120} = \frac{3}{4}$.

(ii) Perfect squares up to 120: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, which is 10. $P = \frac{10}{120} = \frac{1}{12}$.

Answer: (i) $\frac{3}{4}$ (ii) $\frac{1}{12}$

Q24 · TRIGONOMETRY · 2 MARKS

(a) Evaluate: $\frac{\cos 45^\circ}{\tan 30^\circ + \sin 60^\circ}$

OR

(b) Verify that $\sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$, for $A = 30^\circ$.

SOLUTION

(a) $\tan 30^\circ + \sin 60^\circ = \frac{1}{\sqrt{3}} + \frac{\sqrt{3}}{2} = \frac{2+3}{2\sqrt{3}} = \frac{5}{2\sqrt{3}}$. The value is $\frac{1/\sqrt{2}}{5/(2\sqrt{3})} = \frac{2\sqrt{3}}{5\sqrt{2}} = \frac{\sqrt{6}}{5}$.

(b) LHS = $\sin 60^\circ = \frac{\sqrt{3}}{2}$. RHS = $\frac{2/\sqrt{3}}{1+1/3} = \frac{2/\sqrt{3}}{4/3} = \frac{\sqrt{3}}{2}$. LHS = RHS ✓.

Answer: (a) $\frac{\sqrt{6}}{5}$ (b) verified

Q25 · REAL NUMBERS · 2 MARKS

Using prime factorisation, find the HCF of 180, 140 and 210.

SOLUTION

$180 = 2^2 \times 3^2 \times 5$, $140 = 2^2 \times 5 \times 7$, $210 = 2 \times 3 \times 5 \times 7$.

The common primes at their smallest powers are 2 and 5: HCF = $2 \times 5 = 10$.

Answer: 10

Section C: Short answer

6 questions, 3 marks each.

Q26 · POLYNOMIALS · 3 MARKS

(a) If α, β are zeroes of the polynomial $8x^2 - 5x - 1$, then form a quadratic polynomial in x whose zeroes are $\frac{2}{\alpha}$ and $\frac{2}{\beta}$.

OR

(b) Find the zeroes of the polynomial $p(x) = 3x^2 + x - 10$ and verify the relationship between zeroes and its coefficients.

SOLUTION

(a) $\alpha + \beta = \frac{5}{8}$ and $\alpha\beta = -\frac{1}{8}$. New sum = $\frac{2}{\alpha} + \frac{2}{\beta} = \frac{2(\alpha + \beta)}{\alpha\beta} = \frac{2 \times 5/8}{-1/8} = -10$. New product = $\frac{4}{\alpha\beta} = -32$.

The polynomial is $x^2 + 10x - 32$ (or $k(x^2 + 10x - 32)$ for any non-zero k).

(b) $3x^2 + x - 10 = (x + 2)(3x - 5)$, so the zeroes are -2 and $\frac{5}{3}$.

$$\text{Sum} = -2 + \frac{5}{3} = -\frac{1}{3} = -\frac{1}{3} \checkmark. \text{ Product} = -2 \times \frac{5}{3} = -\frac{10}{3} = -\frac{10}{3} \checkmark.$$

Answer: (a) $x^2 + 10x - 32$ (b) zeroes $-2, \frac{5}{3}$; relations verified

Q27 · QUADRATIC EQUATIONS · 3 MARKS

Find length and breadth of a rectangular park whose perimeter is 100 m and area is 600 m².

SOLUTION

Let the length be a and the breadth b . $2(a + b) = 100$ gives $a + b = 50$ and $ab = 600$.

$a(50 - a) = 600$ gives $a^2 - 50a + 600 = 0$, so $(a - 30)(a - 20) = 0$ and $a = 30$ or 20 .

The length is 30 m and the breadth 20 m (the other root just swaps the two).

Answer: Length 30 m, breadth 20 m

Q28 · REAL NUMBERS · 3 MARKS

Three measuring rods are of lengths 120 cm, 100 cm and 150 cm. Find the least length of a fence that can be measured an exact number of times, using any of the rods. How many times each rod will be used to measure the length of the fence?

SOLUTION

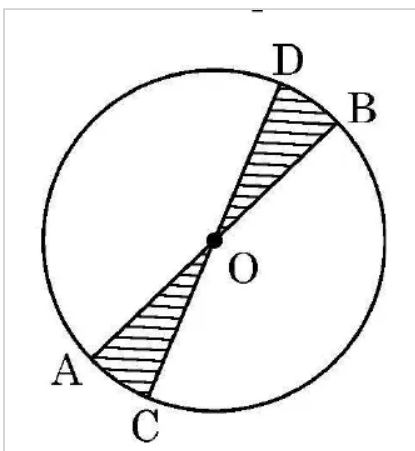
$120 = 2^3 \times 3 \times 5$, $100 = 2^2 \times 5^2$, $150 = 2 \times 3 \times 5^2$. LCM = $2^3 \times 3 \times 5^2 = 600$ cm.

The rods are used $\frac{600}{120} = 5$, $\frac{600}{100} = 6$ and $\frac{600}{150} = 4$ times respectively.

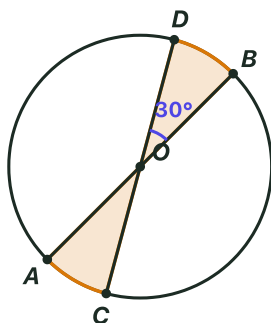
Answer: 600 cm; used 5, 6 and 4 times

Q29 · AREAS RELATED TO CIRCLES · 3 MARKS

AB and CD are diameters of a circle with centre O and radius 7 cm. If $\angle BOD = 30^\circ$, then find the area and perimeter of the shaded region.



SOLUTION



$$\begin{aligned}\text{area} &= 2 \times \frac{30}{360} \times \pi \times 7^2 = \frac{77}{3} \approx 25.67 \text{ cm}^2 \\ \text{perimeter} &= 2 \times (7 + 7 + 11/3) = 106/3 \approx 35.33 \text{ cm}\end{aligned}$$

The shaded region is two sectors of 30° (the vertically opposite angles $\angle BOD$ and $\angle AOC$), each of radius 7 cm.

$$\text{Area} = 2 \times \frac{30}{360} \times \frac{22}{7} \times 7 \times 7 = \frac{77}{3} \approx 25.67 \text{ cm}^2.$$

$$\text{Perimeter} = 2 \times (\text{arc} + 2 \text{ radii}) = 2 \left(\frac{30}{360} \times 2 \times \frac{22}{7} \times 7 + 14 \right) = 2 \left(\frac{11}{3} + 14 \right) = \frac{106}{3} \approx 35.33 \text{ cm}.$$

Answer: Area $\approx 25.67 \text{ cm}^2$; perimeter $\approx 35.33 \text{ cm}$

Q30 · TRIGONOMETRY · 3 MARKS

Prove that $\frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = \sec \theta \operatorname{cosec} \theta + 1$.

SOLUTION

$$\begin{aligned}\text{LHS} &= \frac{\sin^2 \theta}{\cos \theta (\sin \theta - \cos \theta)} + \frac{\cos^2 \theta}{\sin \theta (\cos \theta - \sin \theta)} = \frac{1}{\sin \theta - \cos \theta} \left[\frac{\sin^2 \theta}{\cos \theta} - \frac{\cos^2 \theta}{\sin \theta} \right] \\ &= \frac{\sin^3 \theta - \cos^3 \theta}{(\sin \theta - \cos \theta) \sin \theta \cos \theta} = \frac{(\sin \theta - \cos \theta)(1 + \sin \theta \cos \theta)}{(\sin \theta - \cos \theta) \sin \theta \cos \theta} \\ &= \frac{1 + \sin \theta \cos \theta}{\sin \theta \cos \theta} = \frac{1}{\sin \theta \cos \theta} + 1 = \sec \theta \operatorname{cosec} \theta + 1 = \text{RHS}.\end{aligned}$$

Answer: Proved

Q31 · ARITHMETIC PROGRESSIONS · 3 MARKS

(a) Find the A.P. whose third term is 16 and seventh term exceeds the fifth term by 12. Also, find the sum of first 29 terms of the A.P.

OR

(b) Find the sum of first 20 terms of an A.P. whose n^{th} term is given by $a_n = 5 + 2n$. Can 52 be a term of this A.P.?

SOLUTION

(a) $a + 2d = 16$ and $a_7 - a_5 = 2d = 12$, so $d = 6$ and $a = 4$. The A.P. is 4, 10, 16, ...

$$S_{29} = \frac{29}{2} [2(4) + 28 \times 6] = \frac{29}{2} \times 176 = 2552.$$

(b) $a_1 = 7$ and $d = 2$. $S_{20} = \frac{20}{2} [14 + 19 \times 2] = 10 \times 52 = 520$.

If 52 is a term: $7 + (n - 1) \times 2 = 52$ gives $n = \frac{47}{2}$, which is not a natural number. So 52 is not a term.

Answer: (a) 4, 10, 16, ...; $S_{29} = 2552$ (b) $S_{20} = 520$; 52 is not a term

Section D: Long answer

4 questions, 5 marks each.

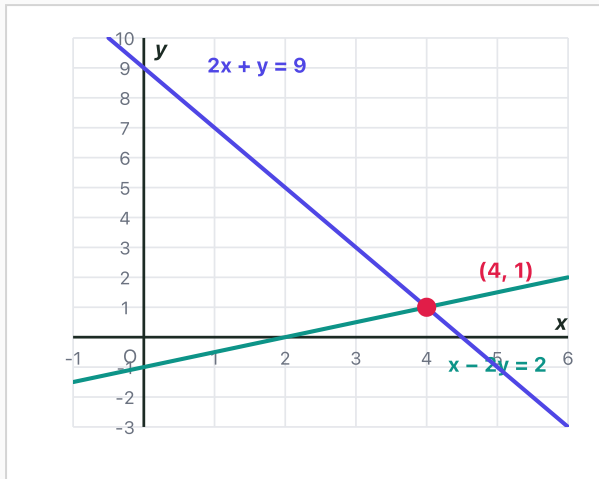
Q32 · LINEAR EQUATIONS · 5 MARKS

(a) Solve the following pair of linear equations by graphical method: $2x + y = 9$ and $x - 2y = 2$.

OR

(b) Nidhi received simple interest of ₹ 1,200 when invested ₹ x at 6% p.a. and ₹ y at 5% p.a. for 1 year. Had she invested ₹ x at 3% p.a. and ₹ y at 8% p.a. for that year, she would have received simple interest of ₹ 1,260. Find the values of x and y .

SOLUTION



(a) $2x + y = 9$: points $(4, 1)$, $(3, 3)$, $(0, 9)$. $x - 2y = 2$: points $(2, 0)$, $(4, 1)$, $(0, -1)$. The lines meet at $(4, 1)$, so $x = 4$, $y = 1$. (Check: $8 + 1 = 9$ ✓, $4 - 2 = 2$ ✓.)

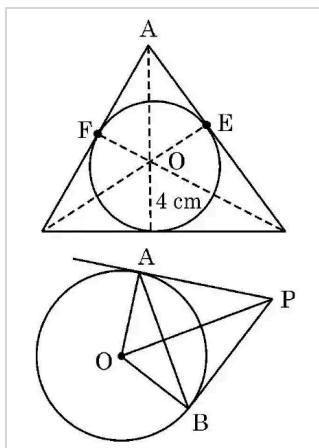
(b) $\frac{6x}{100} + \frac{5y}{100} = 1200$ gives $6x + 5y = 120000$ (i). $\frac{3x}{100} + \frac{8y}{100} = 1260$ gives $3x + 8y = 126000$ (ii).

(ii) $\times 2$: $6x + 16y = 252000$. Subtracting (i): $11y = 132000$, so $y = 12000$. Then $6x = 120000 - 60000$ and $x = 10000$.

Answer: (a) $x = 4$, $y = 1$ (b) $x = ₹10,000$, $y = ₹12,000$

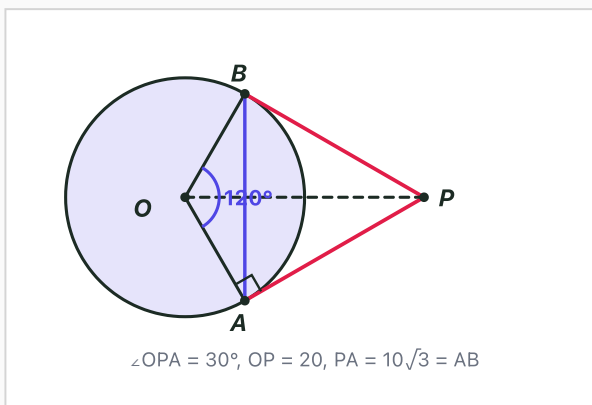
(a) The given figure shows a circle with centre O and radius 4 cm circumscribed by $\triangle ABC$. BC touches the circle at D such that $BD = 6$ cm, $DC = 10$ cm. Find the length of AE .

(b) PA and PB are tangents drawn to a circle with centre O . If $\angle AOB = 120^\circ$ and $OA = 10$ cm, then (i) Find $\angle OPA$. (ii) Find the perimeter of $\triangle OAP$. (iii) Find the length of chord AB .



$AE = AF = x$

$x = 64/11 \approx 5.8$



By Heron's formula, area = $\sqrt{(16+x)(x)(6)(10)}$. Also, area = $\frac{1}{2} \times r \times \text{perimeter} = \frac{1}{2} \times 4 \times 2(16+x) = 4(16+x)$.

$$AE = \frac{64}{11} \text{ cm.}$$

(ii) $\sin 30^\circ = \frac{OA}{OP}$ gives $OP = 20$ cm. $\tan 30^\circ = \frac{OA}{PA}$ gives $PA = 10\sqrt{3}$ cm. Perimeter = $10 + 20 + 10\sqrt{3} = 30 + 10\sqrt{3}$ cm.

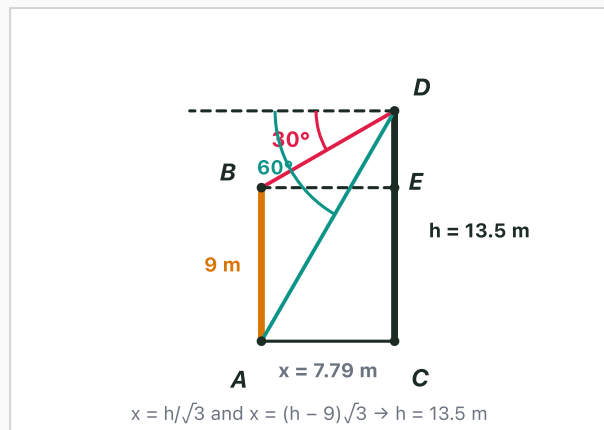
(iii) $PA = PB$ and $\angle APB = 60^\circ$, so $\triangle APB$ is equilateral and $AB = PA = 10\sqrt{3}$ cm.

Answer: (a) $\frac{64}{11}$ cm (b) (i) 30° (ii) $(30 + 10\sqrt{3})$ cm (iii) $10\sqrt{3}$ cm

Q34 · TRIGONOMETRY · 5 MARKS

The angles of depression of the top and the foot of a 9 m tall building from the top of a multi-storeyed building are 30° and 60° respectively. Find the height of the multi-storeyed building and the distance between the two buildings. (Use $\sqrt{3} = 1.73$)

SOLUTION



Let the multi-storeyed building be $CD = h$, the small one $AB = 9 \text{ m}$, and the distance between them x .

The foot A is at 60° from the top D : $\tan 60^\circ = \frac{h}{x}$, so $h = x\sqrt{3}$. (i)

The top B is at 30° : it is $h - 9$ below D , so $\tan 30^\circ = \frac{h - 9}{x}$ and $x = (h - 9)\sqrt{3}$. (ii)

Substituting (i) in (ii): $x = (x\sqrt{3} - 9)\sqrt{3} = 3x - 9\sqrt{3}$, so $x = \frac{9\sqrt{3}}{2} = 7.79 \text{ m}$. Then $h = 7.79 \times 1.73 = 13.5 \text{ m}$.

Answer: Height = 13.5 m; distance $\approx 7.79 \text{ m}$

Q35 · STATISTICS · 5 MARKS

Find 'mean' and 'mode' of the following data:

Class	15–20	20–25	25–30	30–35	35–40	40–45
Frequency	12	10	15	11	7	5

SOLUTION

$N = 12 + 10 + 15 + 11 + 7 + 5 = 60$. Class marks: 17.5, 22.5, 27.5, 32.5, 37.5, 42.5. Take $a = 27.5$ and $h = 5$:
 $u = -2, -1, 0, 1, 2, 3$.

$\sum f_i u_i = -24 - 10 + 0 + 11 + 14 + 15 = 6$. Mean $= 27.5 + \frac{6}{60} \times 5 = 28$.

The modal class is 25 – 30 ($f_1 = 15$, $f_0 = 10$, $f_2 = 11$): Mode $= 25 + \frac{15 - 10}{30 - 10 - 11} \times 5 = 25 + \frac{25}{9} \approx 27.78$.

Answer: Mean = 28; mode ≈ 27.78

Section E: Case studies

3 case studies, 4 marks each.

Q36 · TRIANGLES · 4 MARKS

Case study 1. A triangular window of a building is shown above. Its diagram represents a $\triangle ABC$ with $\angle A = 90^\circ$ and $AB = AC$. Points P and R trisect AB and $PQ \parallel RS \parallel AC$.

Based on the above, answer the following questions:

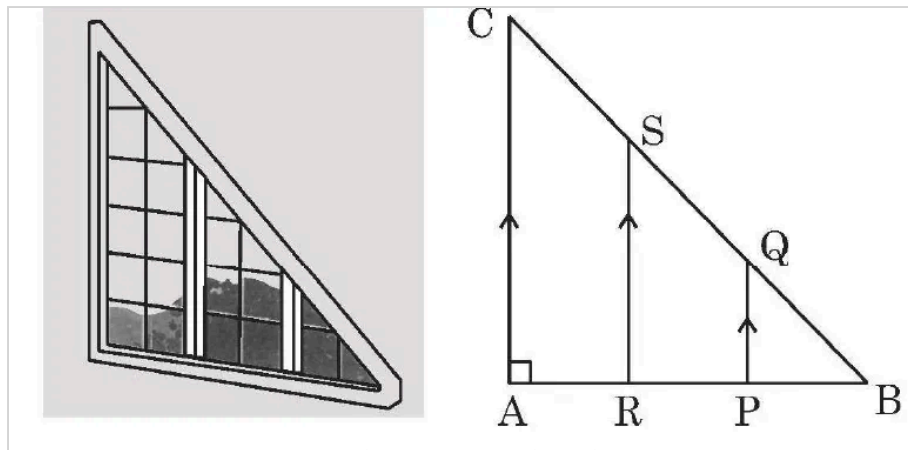
(i) Show that $\triangle BPQ \sim \triangle BAC$. [1]

(ii) Prove that $PQ = \frac{1}{3}AC$. [1]

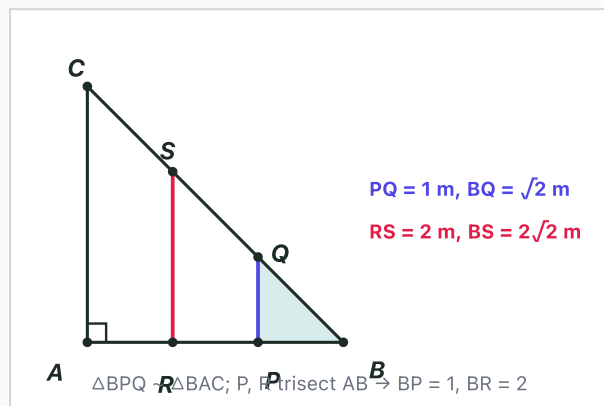
(iii) (a) If $AB = 3$ m, find length BQ and BS . Verify that $BQ = \frac{1}{2}BS$. [2]

OR

(iii) (b) Prove that $BR^2 + RS^2 = \frac{4}{9}BC^2$. [2]



SOLUTION



(i) $PQ \parallel AC$, so $\angle BQP = \angle BCA$ (corresponding angles) and $\angle B$ is common. By AA, $\triangle BPQ \sim \triangle BAC$.

(ii) P and R trisect AB , so $BP = \frac{1}{3}BA$. From the similarity, $\frac{PQ}{AC} = \frac{BP}{BA} = \frac{1}{3}$, that is $PQ = \frac{1}{3}AC$.

(iii)(a) $AB = AC = 3$ m, so $PQ = 1$ m and $BP = 1$ m. In the right triangle BPQ : $BQ = \sqrt{1^2 + 1^2} = \sqrt{2}$ m. $BR = \frac{2}{3} \times 3 = 2$ m and in the same way $RS = 2$ m, so $BS = \sqrt{2^2 + 2^2} = 2\sqrt{2}$ m. $\frac{1}{2}BS = \sqrt{2} = BQ$ ✓.

(iii)(b) $\triangle BRS \sim \triangle BAC$ with ratio $\frac{2}{3}$, so $BR = \frac{2}{3}AB$ and $RS = \frac{2}{3}AC$. $BR^2 + RS^2 = \frac{4}{9}(AB^2 + AC^2) = \frac{4}{9}BC^2$ (Pythagoras in $\triangle ABC$).

Answer: (iii)(a) $BQ = \sqrt{2}$ m, $BS = 2\sqrt{2}$ m; $BQ = \frac{1}{2}BS$ (iii)(b) proved

Q37 · SURFACE AREAS AND VOLUMES · 4 MARKS

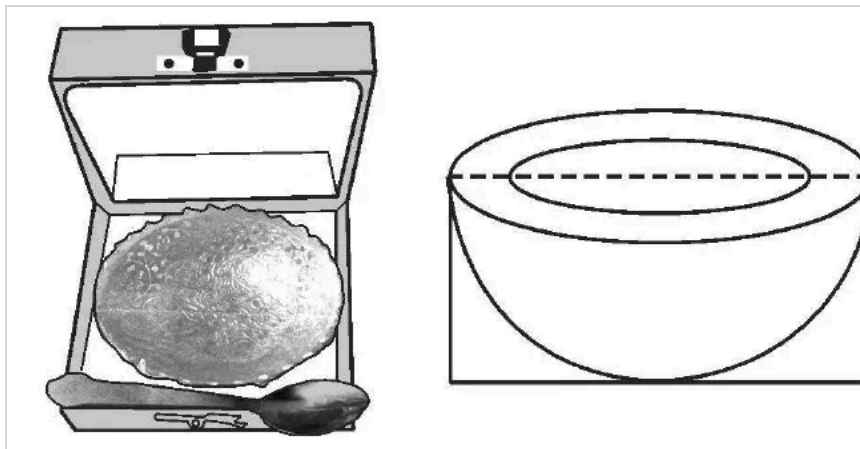
Case study 2. A hemispherical bowl is packed in a cuboidal box. The bowl just fits in the box. Inner radius of the bowl is 10 cm. Outer radius of the bowl is 10.5 cm.

Based on the above, answer the following questions:

- (i) Find the dimensions of the cuboidal box. [1]
 (ii) Find the total outer surface area of the box. [1]
 (iii) (a) Find the difference between the capacity of the bowl and the volume of the box. (use $\pi = 3.14$) [2]

OR

- (iii) (b) The inner surface of the bowl and the thickness is to be painted. Find the area to be painted. [2]

**SOLUTION**

(i) The bowl just fits, so the box is as wide as the outer diameter, $2 \times 10.5 = 21$ cm, and as tall as the outer radius, 10.5 cm. The box is $21 \times 21 \times 10.5$ cm.

(ii) Total outer surface area = $2(lb + bh + hl) = 2(441 + 220.5 + 220.5) = 2 \times 882 = 1764$ cm².

(iii)(a) Capacity of the bowl (inner radius 10) = $\frac{2}{3} \times 3.14 \times 10^3 = \frac{6280}{3} \approx 2093.33$ cm³. Volume of the box = $21 \times 21 \times 10.5 = 4630.5$ cm³.

Difference = $4630.5 - 2093.33 \approx 2537.17$ cm³ (here the capacity is taken as the volume, as in the key's note).

(iii)(b) Painted area = inner curved surface + the ring of the rim = $2\pi r^2 + \pi(R^2 - r^2) = 2 \times \frac{22}{7} \times 100 + \frac{22}{7}(110.25 - 100) = \frac{4400}{7} + \frac{451}{14} = \frac{9251}{14} \approx 660.79$ cm².

Answer: (i) $21 \times 21 \times 10.5$ cm (ii) 1764 cm² (iii)(a) ≈ 2537.17 cm³ (iii)(b) ≈ 660.79 cm²

Q38 · COORDINATE GEOMETRY · 4 MARKS

Case study 3. Gurveer and Arushi built a robot that can paint a path as it moves on a graph paper. Some co-ordinate of points are marked on it. It starts from (0, 0), moves to the points listed in order (in straight lines) and ends at (0, 0). Arushi entered the points P(8, 6), Q(12, 2) and S(−6, 6) in order. The path drawn by robot is shown in the figure.

Based on the above, answer the following questions:

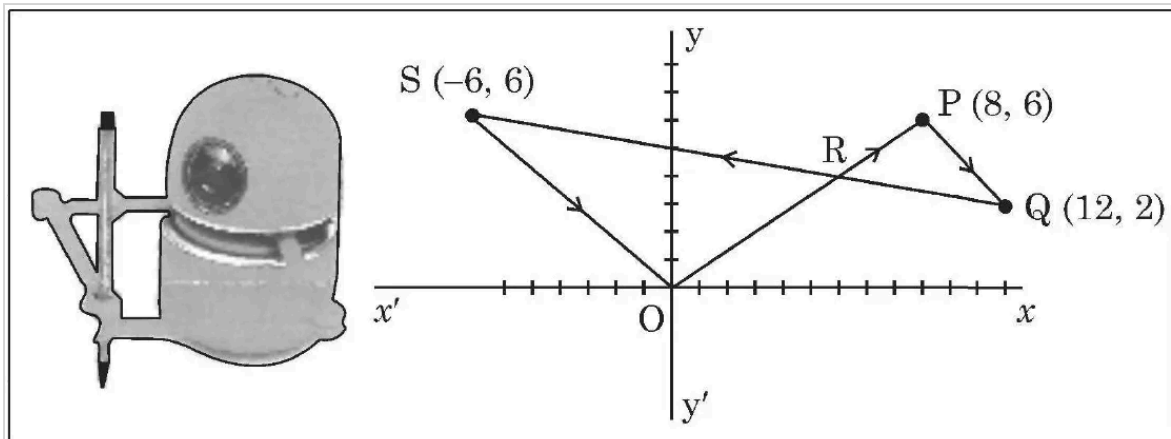
(i) Determine the distance OP. [1]

(ii) QS is represented by equation $2x + 9y = 42$. Find the co-ordinates of the point where it intersects y-axis. [1]

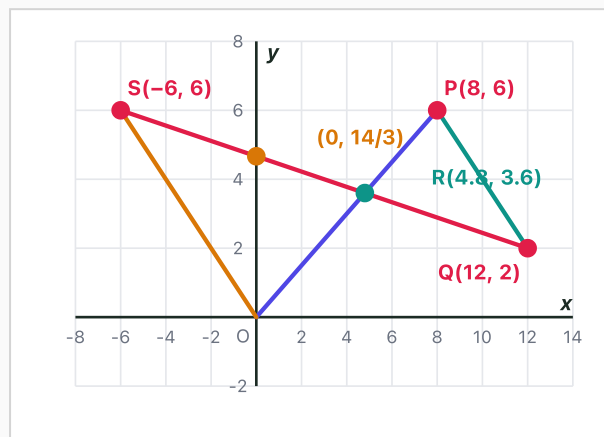
(iii) (a) Point R(4.8, y) divides the line segment OP in a certain ratio, find the ratio. Hence, find the value of y. [2]

OR

(iii) (b) Using distance formula, show that $\frac{PQ}{OS} = \frac{2}{3}$. [2]



SOLUTION



(i) $OP = \sqrt{8^2 + 6^2} = \sqrt{100} = 10$.

(ii) On the y-axis $x = 0$: $9y = 42$, so $y = \frac{14}{3}$. The point is $\left(0, \frac{14}{3}\right)$.

(iii)(a) Let R divide OP in the ratio $k : 1$: $\frac{k \times 8 + 0}{k + 1} = 4.8$, so $8k = 4.8k + 4.8$ and $k = \frac{3}{2}$. The ratio is 3 : 2.

$y = \frac{k \times 6}{k + 1} = \frac{9}{5/2} = \frac{18}{5} = 3.6$.

(iii)(b) $PQ = \sqrt{(12 - 8)^2 + (2 - 6)^2} = \sqrt{32} = 4\sqrt{2}$ and $OS = \sqrt{(-6)^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$. $\frac{PQ}{OS} = \frac{4\sqrt{2}}{6\sqrt{2}} = \frac{2}{3}$.

Answer: (i) 10 (ii) $\left(0, \frac{14}{3}\right)$ (iii)(a) 3 : 2, $y = \frac{18}{5}$ (iii)(b) shown

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Questions are from the official CBSE paper. Solutions are written by CogniGuru.