

Mathematics (Basic) 2025, Set 430/3/1

Q.P. Code 430/3/1 · Series EF3GH · 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/2025/430-3-1

Section A: Multiple choice

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

Q1 · REAL NUMBERS · 1 MARK

If $p = 2^3 \times 3^2 \times 5$ and $q = 2^2 \times 3^3$, then the LCM of p and q is:

- (A) $2^3 \times 3^3$ (B) $2^2 \times 3^2$
(C) $2^2 \times 3^2 \times 5$ (D) $2^3 \times 3^3 \times 5$

SOLUTION

LCM takes each prime at its highest power: 2^3 , 3^3 and 5. $\text{LCM} = 2^3 \times 3^3 \times 5$.

Answer: (D) $2^3 \times 3^3 \times 5$

Q2 · REAL NUMBERS · 1 MARK

3^n , where n is a natural number, cannot end with the digit:

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

SOLUTION

A number ending in 5 is divisible by 5, but 3^n has only the prime factor 3. So 3^n can never end in 5. (Its last digits go 3, 9, 7, 1.)

Answer: (B) 5

Q3 · REAL NUMBERS · 1 MARK

A prime number has:

- (A) exactly two prime factors (B) exactly one prime factor
(C) at least one prime factor (D) at least two prime factors

SOLUTION

A prime p has the factors 1 and p only, and the only prime among them is p itself: exactly one prime factor.

Answer: (B) exactly one prime factor

Q4 · LINEAR EQUATIONS · 1 MARK

For what value(s) of k does the system of equations $kx + 2y = 3$ and $2x + y = 5$ have a unique solution?

- (A) k = a real number
(B) $k \neq 8$
(C) $k \neq 4$
(D) $k = 4$

SOLUTION

A unique solution needs $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$: $\frac{k}{2} \neq \frac{2}{1}$, so $k \neq 4$.

Answer: (C) $k \neq 4$

Q5 · QUADRATIC EQUATIONS · 1 MARK

If $x = \sqrt{x}$, ($x \neq 0$) is expressed as a quadratic equation in the form $ax^2 + bx + c = 0$, then the value of $a + b + c$ is:

- (A) 0
(B) 1
(C) 2
(D) 3

SOLUTION

Squaring both sides, $x^2 = x$, that is $x^2 - x + 0 = 0$. So $a = 1$, $b = -1$, $c = 0$ and $a + b + c = 0$.

Answer: (A) 0

Q6 · COORDINATE GEOMETRY · 1 MARK

If point $(1, 2)$ is the mid-point of the line segment joining the points $(3, 5)$ and $(2a, b)$, then $(a, b) =$

- (A) $(-1, -1)$
(B) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$
(C) $\left(-\frac{1}{2}, -1\right)$
(D) $\left(-1, -\frac{1}{2}\right)$

SOLUTION

$\frac{3 + 2a}{2} = 1$ gives $2a = -1$ and $a = -\frac{1}{2}$.

$\frac{5 + b}{2} = 2$ gives $b = -1$. So $(a, b) = \left(-\frac{1}{2}, -1\right)$.

Answer: (C) $\left(-\frac{1}{2}, -1\right)$

Q7 · COORDINATE GEOMETRY · 1 MARK

The distance of point $(-3, 4)$ from y -axis is:

- (A) -3
(B) 3
(C) 4
(D) 5

SOLUTION

The distance from the y -axis is the absolute value of the x -coordinate: $|-3| = 3$. (A distance cannot be negative.)

Answer: (B) 3

Q8 · TRIGONOMETRY · 1 MARK

The value of $\frac{\sec^2 30^\circ + \tan^2 30^\circ}{\sin^2 45^\circ + \cos^2 45^\circ}$ is:

- (A) 1
(B) $\frac{5}{3}$
(C) $\frac{13}{3}$
(D) 7

SOLUTION

$\sec^2 30^\circ = \frac{4}{3}$, $\tan^2 30^\circ = \frac{1}{3}$, and $\sin^2 45^\circ + \cos^2 45^\circ = 1$. The value is $\frac{4/3 + 1/3}{1} = \frac{5}{3}$.

Answer: (B) $\frac{5}{3}$

Q9 · TRIANGLES · 1 MARK

Which types of triangles are always similar?

- (A) Right-angled triangles
(B) Acute-angled triangles
(C) Isosceles triangles
(D) Equilateral triangles

SOLUTION

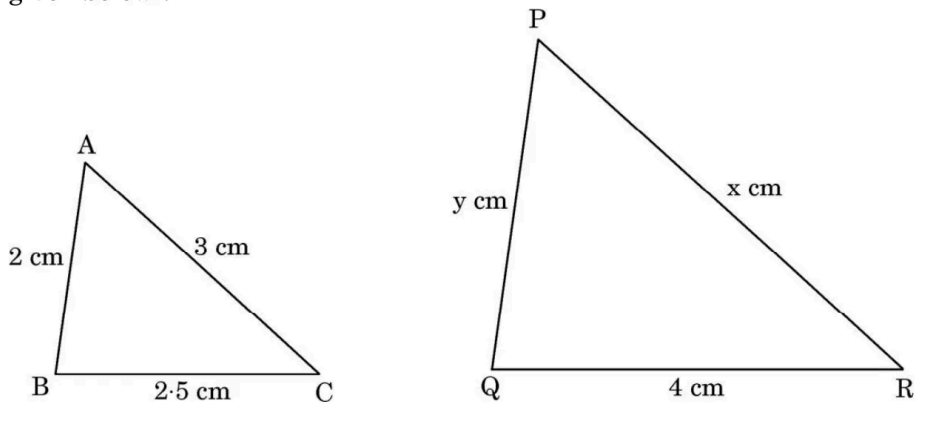
All equilateral triangles have angles $60^\circ, 60^\circ, 60^\circ$, so any two are similar by AAA. The other types can have different angles.

Answer: (D) Equilateral triangles

Q10 · TRIANGLES · 1 MARK

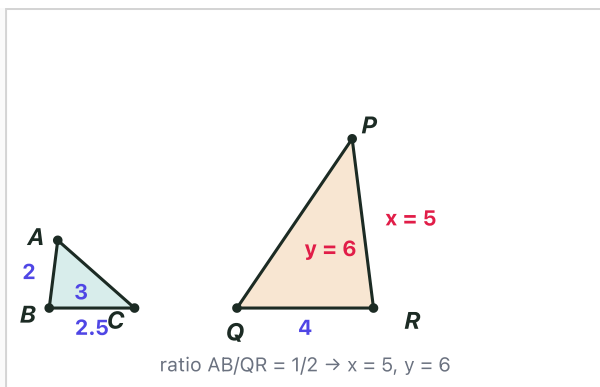
What values of x and y will make $\triangle ABC$ similar to $\triangle QRP$ in the figures given below?

given below ?



- (A) $x = 6, y = 5$
(B) $x = 5, y = 6$
(C) $x = 6, y = 6$
(D) $x = 12, y = 3.2$

SOLUTION



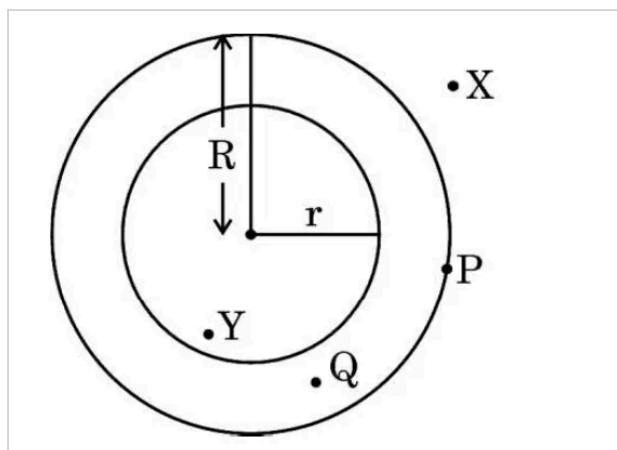
$\triangle ABC \sim \triangle QRP$ matches $A \leftrightarrow Q, B \leftrightarrow R, C \leftrightarrow P$. So $\frac{AB}{QR} = \frac{BC}{RP} = \frac{AC}{QP}$.

$$\frac{2}{4} = \frac{2.5}{x} = \frac{3}{y} = \frac{1}{2}, \text{ so } x = 5 \text{ and } y = 6.$$

Answer: (B) $x = 5, y = 6$

Q11 · CIRCLES · 1 MARK

In the given figure, from which point can the tangent ****not**** be drawn to the circle with radius r ?



(A) X

(B) P

(C) Q

(D) Y

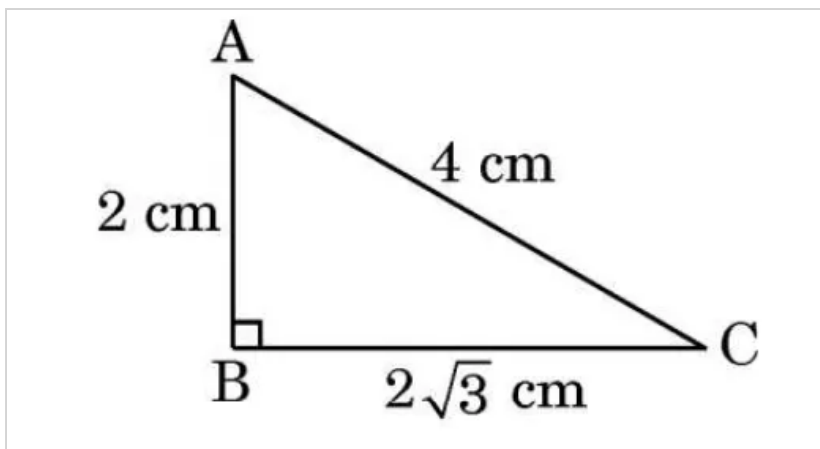
SOLUTION

A tangent to the inner circle can be drawn from a point on it or outside it. Y lies inside the circle of radius r , and no tangent can be drawn from an interior point.

Answer: (D) Y

Q12 · TRIGONOMETRY · 1 MARK

In the given figure, the angle of elevation of point A from point C is:



- (A) 30° (B) 45°
(C) 60° (D) Cannot be determined

SOLUTION

In the right triangle ABC at B : $\sin C = \frac{AB}{AC} = \frac{2}{4} = \frac{1}{2}$, so $\angle C = 30^\circ$. (Check: $\tan C = \frac{2}{2\sqrt{3}} = \frac{1}{\sqrt{3}}$ ✓.)

Answer: (A) 30°

Q13 · AREAS RELATED TO CIRCLES · 1 MARK

The angle of the sector of a circle whose area is one-eighth of the area of the circle is:

- (A) $22\frac{1}{2}^\circ$ (B) 45°
(C) 60° (D) 90°

SOLUTION

$$\frac{\theta}{360} = \frac{1}{8}, \text{ so } \theta = 45^\circ.$$

Answer: (B) 45°

Q14 · AREAS RELATED TO CIRCLES · 1 MARK

The perimeter of a quadrant of a circle of circumference 22 cm is:

- (A) 29 cm (B) 22 cm
(C) 12.5 cm (D) 5.5 cm

SOLUTION

$$2\pi r = 22, \text{ so } r = \frac{22 \times 7}{2 \times 22} = 3.5 \text{ cm.}$$

$$\text{Perimeter of a quadrant} = \frac{1}{4}(22) + 2r = 5.5 + 7 = 12.5 \text{ cm.}$$

Answer: (C) 12.5 cm

Q15 · SURFACE AREAS AND VOLUMES · 1 MARK

A cone and cylinder have same height and same radius. The volume of the cone and the volume of the cylinder are in the ratio:

- (A) 1 : 1 (B) 1 : 3
(C) 3 : 1 (D) 1 : 2

SOLUTION

$$\frac{V_{\text{cone}}}{V_{\text{cylinder}}} = \frac{\frac{1}{3}\pi r^2 h}{\pi r^2 h} = \frac{1}{3}. \text{ The ratio is } 1 : 3.$$

Answer: (B) 1 : 3

Q16 · STATISTICS · 1 MARK

The following table shows the marks scored by 23 students of a class (marks 0–10, 10–20, 20–30, 30–40, 40–50 with 5, 3, 4, 8, 3 students). The lower limit of the modal class is:

Marks	0–10	10–20	20–30	30–40	40–50
Number of Students	5	3	4	8	3

- (A) 10 (B) 20
(C) 30 (D) 40

SOLUTION

The modal class has the highest frequency, which is 8, for the class 30 – 40. Its lower limit is 30.

Answer: (C) 30

Q17 · STATISTICS · 1 MARK

For a distribution, if mean = 15 and mode = 12, then its median is:

- (A) 12 (B) 13
(C) 14 (D) 15

SOLUTION

Mode = 3 Median – 2 Mean: $12 = 3M - 30$, so $3M = 42$ and $M = 14$.

Answer: (C) 14

Q18 · PROBABILITY · 1 MARK

A pair of dice is thrown simultaneously. Let E denote the event that "The sum of numbers obtained on both dice is at least 9." The number of outcomes in favour of event E is:

- (A) 4 (B) 6
(C) 10 (D) 26

SOLUTION

Sum 9: (3, 6), (4, 5), (5, 4), (6, 3) – 4. Sum 10: (4, 6), (5, 5), (6, 4) – 3. Sum 11: (5, 6), (6, 5) – 2. Sum 12: (6, 6) – 1.

Total = $4 + 3 + 2 + 1 = 10$.

Answer: (C) 10

Q19 · TRIGONOMETRY · 1 MARK

Assertion (A): For $\sin \theta = 1$, $\cos \theta$ must be 0.

Reason (R): $\sin^2 \theta - \cos^2 \theta = 1$.

(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) $\sin \theta = 1$ gives $\cos^2 \theta = 1 - 1 = 0$, so $\cos \theta = 0$. True.

(R) The identity is $\sin^2 \theta + \cos^2 \theta = 1$, not with a minus sign. False.

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

Q20 · QUADRATIC EQUATIONS · 1 MARK

Assertion (A): Every quadratic equation has two real roots.

Reason (R): A quadratic polynomial can have at most two zeroes.

(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) $x^2 + 1 = 0$ has no real roots, so a quadratic equation need not have two real roots. False.

(R) A polynomial of degree 2 has at most 2 zeroes. True.

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

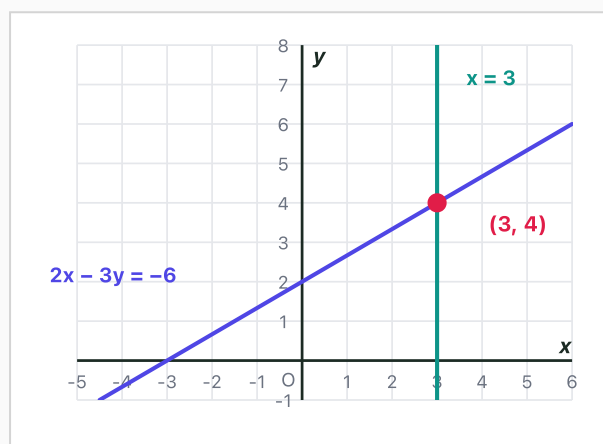
Section B: Very short answer

5 questions, 2 marks each.

Q21 · LINEAR EQUATIONS · 2 MARKS

Solve the following system of equations graphically: $2x - 3y = -6$ and $x = 3$.

SOLUTION



$x = 3$ is a vertical line. $2x - 3y = -6$: points $(0, 2)$, $(-3, 0)$ and $(3, 4)$.

The lines meet at $(3, 4)$: $x = 3$ and $y = 4$. (Check: $6 - 12 = -6$ ✓.)

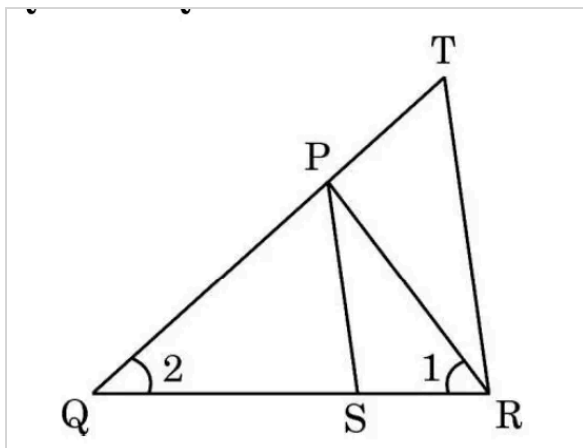
Answer: $x = 3, y = 4$

Q22 · TRIANGLES · 2 MARKS

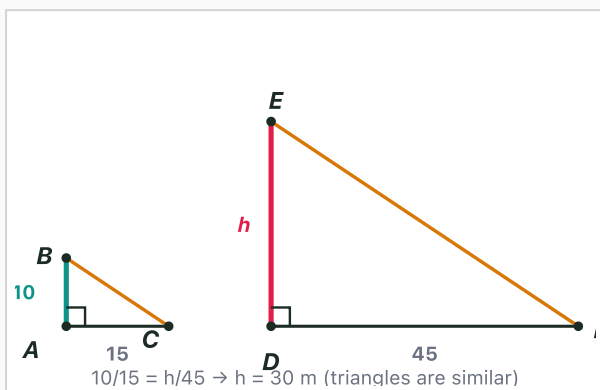
(a) A vertical pole of height 10 m casts a shadow of 15 m on the ground and at the same time, a tower casts a shadow of 45 m on the ground. Find the height of the tower.

OR

(b) In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$. Prove that $\triangle PQS \sim \triangle TQR$.



SOLUTION



(a) At the same time the sun's rays make the same angle, so the two right triangles (pole and shadow, tower and shadow) are similar: $\frac{10}{15} = \frac{h}{45}$.

$$h = \frac{10 \times 45}{15} = 30 \text{ m.}$$

(b) In $\triangle PQR$, $\angle 1 = \angle 2$, so the sides opposite them are equal: $PQ = PR$.

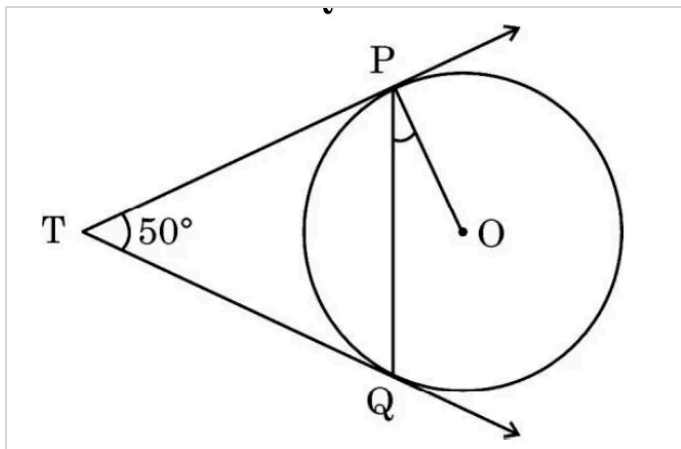
The given $\frac{QR}{QS} = \frac{QT}{PR}$ becomes $\frac{QR}{QS} = \frac{QT}{PQ}$, that is $\frac{QR}{QT} = \frac{QS}{QP}$. Also $\angle Q$ is common to $\triangle PQS$ and $\triangle TQR$.

So $\triangle PQS \sim \triangle TQR$ by SAS similarity.

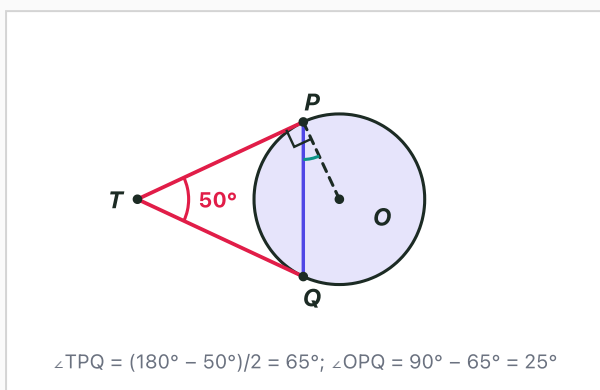
Answer: (a) 30 m (b) proved

Q23 · CIRCLES · 2 MARKS

In the given figure, TP and TQ are two tangents. If $\angle PTQ = 50^\circ$, then find the measure of $\angle OPQ$.



SOLUTION



$TP = TQ$ (tangents from an external point), so $\angle TPQ = \angle TQP$. In $\triangle TPQ$: $50^\circ + 2\angle TPQ = 180^\circ$, so $\angle TPQ = 65^\circ$.

$OP \perp TP$, so $\angle OPT = 90^\circ$ and $\angle OPQ = 90^\circ - 65^\circ = 25^\circ$.

Answer: $\angle OPQ = 25^\circ$

Q24 · TRIGONOMETRY · 2 MARKS

(a) If $\sin 3A = 1$, then find the value of $\cos 2A - \tan^2 45^\circ$.

OR

(b) If $(\sec A + \tan A)(1 - \sin A) = k \cos A$, then find the value of k .

SOLUTION

(a) $\sin 3A = 1$ gives $3A = 90^\circ$, so $A = 30^\circ$. $\cos 2A - \tan^2 45^\circ = \cos 60^\circ - 1 = \frac{1}{2} - 1 = -\frac{1}{2}$.

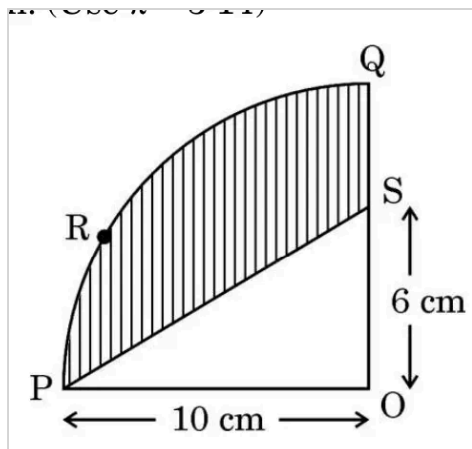
(b) $\left(\frac{1}{\cos A} + \frac{\sin A}{\cos A}\right)(1 - \sin A) = \frac{(1 + \sin A)(1 - \sin A)}{\cos A} = \frac{1 - \sin^2 A}{\cos A} = \frac{\cos^2 A}{\cos A}$.

So the left side is $\cos A = 1 \times \cos A$, and $k = 1$.

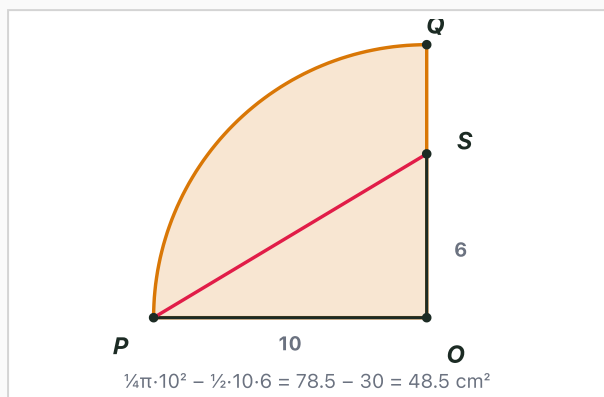
Answer: (a) $-\frac{1}{2}$ (b) $k = 1$

Q25 · AREAS RELATED TO CIRCLES · 2 MARKS

In the given figure, $OPRQ$ is a quadrant of a circle with centre O and radius 10 cm. If $OP = 10$ cm and $OS = 6$ cm, find the area of the shaded region. (Use $\pi = 3.14$)



SOLUTION



Area of the quadrant = $\frac{1}{4} \times 3.14 \times 10 \times 10 = 78.5 \text{ cm}^2$.

The unshaded part is the right triangle POS with legs $OP = 10$ and $OS = 6$: area = $\frac{1}{2} \times 10 \times 6 = 30 \text{ cm}^2$.

Shaded area = $78.5 - 30 = 48.5 \text{ cm}^2$.

Answer: 48.5 cm^2

Section C: Short answer

6 questions, 3 marks each.

Q26 · REAL NUMBERS · 3 MARKS

(a) Prove that $\sqrt{2}$ is an irrational number.

OR

(b) Find which among the following numbers a , b and c is/are composite numbers. $a = 7 \times 11 \times 13 + 13$, $b = 6 \times 5 \times 4 + 4$, $c = 7 \times 13 + 6$.

SOLUTION

(a) Suppose $\sqrt{2} = \frac{p}{q}$ with p, q co-prime and $q \neq 0$. $2q^2 = p^2$, so 2 divides p^2 and so 2 divides p . Write $p = 2m$.

$2q^2 = 4m^2$ gives $q^2 = 2m^2$, so 2 divides q . Then 2 divides both p and q , contradicting that they are co-prime. So $\sqrt{2}$ is irrational.

(b) $a = 13(77 + 1) = 13 \times 78$: composite. $b = 4(30 + 1) = 4 \times 31$: composite. $c = 91 + 6 = 97$, which is prime.

Answer: (a) proved (b) a and b are composite

Q27 · POLYNOMIALS · 3 MARKS

Find the zeroes of the polynomial $9s^2 - 6s + 1$ and verify the relationship between the zeroes and the coefficients of the given polynomial.

SOLUTION

$9s^2 - 6s + 1 = (3s - 1)^2$, so both zeroes are $s = \frac{1}{3}$.

Sum = $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$ and $-\frac{(-6)}{9} = \frac{2}{3} \checkmark$. Product = $\frac{1}{9}$ and $\frac{\text{constant}}{\text{coefficient of } s^2} = \frac{1}{9} \checkmark$.

Answer: Zeroes $\frac{1}{3}, \frac{1}{3}$; relations verified

Q28 · LINEAR EQUATIONS · 3 MARKS

(a) A fraction becomes $\frac{1}{3}$, when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$, when 8 is added to its denominator. Find the fraction.

OR

(b) Find the value of k for which the following pair of linear equations will have infinitely many solutions: $kx + 3y - (k - 3) = 0$ and $12x + ky - k = 0$. Hence, find any two solutions of the given pair of equations.

SOLUTION

(a) Let the fraction be $\frac{x}{y}$. $\frac{x-1}{y} = \frac{1}{3}$ gives $3x - y = 3$, and $\frac{x}{y+8} = \frac{1}{4}$ gives $4x - y = 8$.

Subtracting: $x = 5$ and $y = 12$. The fraction is $\frac{5}{12}$.

(b) Infinitely many solutions need $\frac{k}{12} = \frac{3}{k} = \frac{k-3}{k}$. $k^2 = 36$ and $k^2 - 6k = 0$ hold only for $k = 6$.

For $k = 6$ both equations become $2x + y = 1$. Two solutions: $(0, 1)$ and $(1, -1)$.

Answer: (a) $\frac{5}{12}$ (b) $k = 6$; solutions $(0, 1)$ and $(1, -1)$

Q29 · TRIGONOMETRY · 3 MARKS

Prove that: $\frac{1 + \operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1 - \sin A}$

SOLUTION

$$\text{LHS} = \frac{1 + \frac{1}{\sin A}}{\frac{1}{\sin A}} = \frac{\sin A + 1}{\sin A} \times \sin A = 1 + \sin A.$$

$$\text{Multiply and divide by } (1 - \sin A): \frac{(1 + \sin A)(1 - \sin A)}{1 - \sin A} = \frac{1 - \sin^2 A}{1 - \sin A} = \frac{\cos^2 A}{1 - \sin A} = \text{RHS.}$$

Answer: Proved

Q30 · PROBABILITY · 3 MARKS

A box contains 6 blue, 4 white and 8 red marbles. A marble is drawn at random from this box. Find the probability that the marble so drawn is:

- (i) white
- (ii) white or red
- (iii) not red

SOLUTION

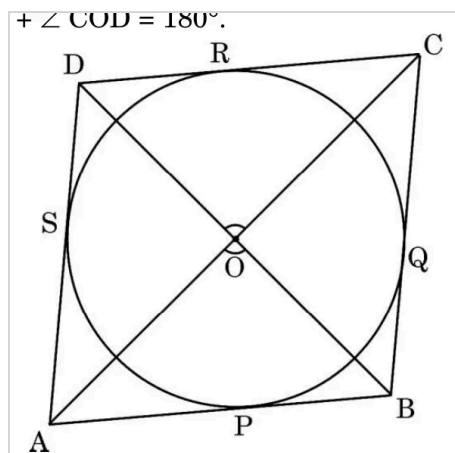
Total marbles = $6 + 4 + 8 = 18$.

$$(i) P(\text{white}) = \frac{4}{18} = \frac{2}{9}. (ii) P(\text{white or red}) = \frac{12}{18} = \frac{2}{3}. (iii) P(\text{not red}) = \frac{10}{18} = \frac{5}{9}.$$

Answer: (i) $\frac{2}{9}$ (ii) $\frac{2}{3}$ (iii) $\frac{5}{9}$

Q31 · CIRCLES · 3 MARKS

In the given figure, a circle is inscribed in a quadrilateral $ABCD$ which touches the sides AB, BC, CD and DA at P, Q, R and S respectively. Prove that $\angle AOB + \angle COD = 180^\circ$.

**SOLUTION**

Join O to A, B, C, D and to the points of contact P, Q, R, S . Tangents from a point are equal and radii are equal, so $\triangle OAP \cong \triangle OAS$ (SSS: $AP = AS, OP = OS, OA$ common). Hence $\angle AOP = \angle AOS$.

In the same way $\angle BOP = \angle BOQ, \angle COQ = \angle COR$ and $\angle DOR = \angle DOS$.

The eight angles round O add up to 360° : $2(\angle AOP + \angle BOP + \angle COQ + \angle DOR) = 360^\circ$. So $(\angle AOP + \angle BOP) + (\angle COQ + \angle DOR) = 180^\circ$, that is $\angle AOB + \angle COD = 180^\circ$.

Answer: Proved

Section D: Long answer

4 questions, 5 marks each.

Q32 · QUADRATIC EQUATIONS · 5 MARKS

(a) Find two consecutive odd integers, sum of whose squares is 290.

OR

(b) A charity trust decides to build a rectangular hall having an area of 300 m². The length of the hall is one metre more than twice its width. Find the length and breadth of the hall.

SOLUTION

(a) Let the integers be x and $x + 2$. $x^2 + (x + 2)^2 = 290$ gives $2x^2 + 4x - 286 = 0$, that is $x^2 + 2x - 143 = 0$ and $(x - 11)(x + 13) = 0$.

$x = 11$ gives 11 and 13. (The root $x = -13$ gives the pair -13 and -11 , which also fit the words of the question; the key lists 11 and 13.)

(b) Let the breadth be x m, so the length is $(2x + 1)$ m. $(2x + 1)x = 300$ gives $2x^2 + x - 300 = 0$ and $(x - 12)(2x + 25) = 0$.

A width cannot be negative, so $x = 12$. Length = 25 m and breadth = 12 m. (Check: $25 \times 12 = 300$ ✓.)

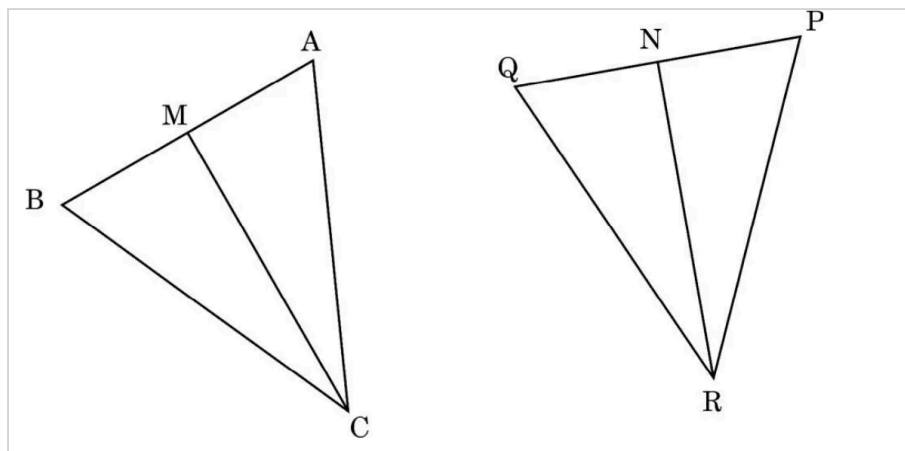
Answer: (a) 11 and 13 (also -13 and -11) (b) length 25 m, breadth 12 m

Q33 · TRIANGLES · 5 MARKS

(a) State and prove "Basic Proportionality Theorem".

OR

(b) In the given figure, CM and RN are respectively the medians of $\triangle ABC$ and $\triangle PQR$. If $\triangle ABC \sim \triangle PQR$, prove that: (i) $\triangle AMC \sim \triangle PNR$ (ii) $\angle BCM = \angle QRN$ (iii) $\triangle BMC \sim \triangle QNR$



SOLUTION

(a) ****Statement:**** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

****Given:**** $DE \parallel BC$ in $\triangle ABC$. ****To prove:**** $\frac{AD}{DB} = \frac{AE}{EC}$. ****Construction:**** draw $DM \perp AC$ and $EN \perp AB$; join BE and CD .

$$\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle DBE)} = \frac{\frac{1}{2} \cdot AD \cdot EN}{\frac{1}{2} \cdot DB \cdot EN} = \frac{AD}{DB} \text{ and } \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle ECD)} = \frac{\frac{1}{2} \cdot AE \cdot DM}{\frac{1}{2} \cdot EC \cdot DM} = \frac{AE}{EC}.$$

$\triangle DBE$ and $\triangle ECD$ are on the same base DE and between the same parallels BC and DE , so their areas are equal. Hence $\frac{AD}{DB} = \frac{AE}{EC}$.

(b)(i) $\triangle ABC \sim \triangle PQR$ gives $\frac{AB}{PQ} = \frac{AC}{PR}$ and $\angle A = \angle P$. Since CM, RN are medians, $AB = 2AM$ and $PQ = 2PN$, so $\frac{AC}{PR} = \frac{AM}{PN}$. So $\triangle AMC \sim \triangle PNR$ (SAS).

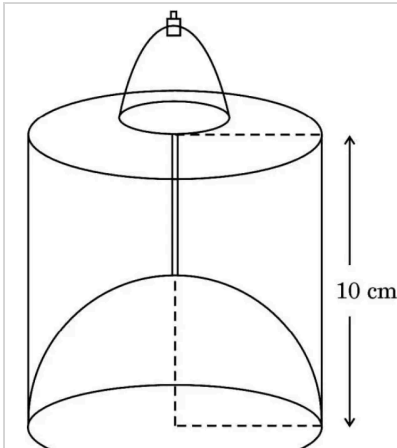
(ii) From (i), $\angle ACM = \angle PRN$. Also $\angle ACB = \angle PRQ$. Subtracting, $\angle ACB - \angle ACM = \angle PRQ - \angle PRN$, so $\angle BCM = \angle QRN$.

(iii) $\frac{BC}{QR} = \frac{AB}{PQ} = \frac{2BM}{2QN} = \frac{BM}{QN}$ and $\angle B = \angle Q$. So $\triangle BMC \sim \triangle QNR$ (SAS).

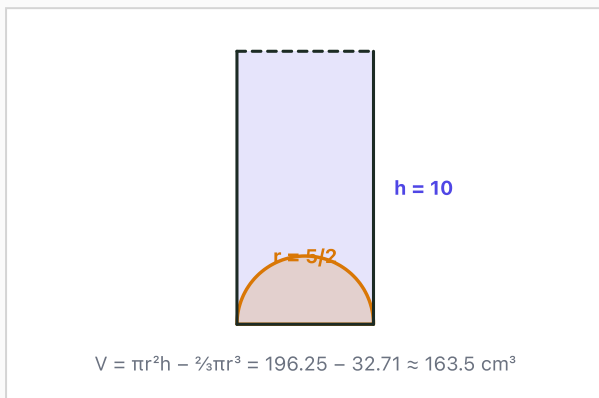
Answer: Proved (both parts)

Q34 • SURFACE AREAS AND VOLUMES • 5 MARKS

A perfume bottle is in the form of a cylinder but the bottom of the bottle has a hemispherical raised portion to reduce the capacity of the bottle. The inner diameter of the bottle is 5 cm and the height of the bottle is 10 cm. Find the capacity of the perfume bottle in mL. (Use $\pi = 3.14$ and $1 \text{ cm}^3 = 1 \text{ mL}$)



SOLUTION



Radius $r = \frac{5}{2}$ cm and height $h = 10$ cm. The capacity is the cylinder minus the raised hemisphere.

Cylinder $= \pi r^2 h = 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10 = 196.25 \text{ cm}^3$.

Hemisphere $= \frac{2}{3} \pi r^3 = \frac{2}{3} \times 3.14 \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2} \approx 32.71 \text{ cm}^3$.

Capacity $= 196.25 - 32.71 = 163.54 \approx 163.5 \text{ cm}^3$, that is $\frac{3925}{24} \approx 163.5 \text{ mL}$.

Answer: About 163.5 mL

Q35 · STATISTICS · 5 MARKS

The weights of 30 students of a class are given in the following distribution table:

Find the median weight of the students.

Weight (in kg)	40–45	45–50	50–55	55–60	60–65	65–70
Number of students	2	5	8	6	6	3

SOLUTION

Cumulative frequencies: 2, 7, 15, 21, 27, 30. $\frac{N}{2} = 15$.

The cumulative frequency 15 is reached at the class 50 – 55, which is the median class: $l = 50$, $cf = 7$, $f = 8$, $h = 5$.

$$\text{Median} = 50 + \frac{15 - 7}{8} \times 5 = 50 + 5 = 55 \text{ kg.}$$

Answer: 55 kg

Section E: Case studies

3 case studies, 4 marks each.

Q36 · ARITHMETIC PROGRESSIONS · 4 MARKS

Case study 1. In a society, a yoga instructor was hired to train the people of the society to live a healthy lifestyle. Yoga sessions were held daily from 5 p.m. to 7 p.m. in the society park. On day one, 5 people joined the yoga session, on day two, 3 more people joined, on day three, another 3 people joined and in this manner every next day, 3 more people kept on joining.

Based on the given information, answer the following questions:

- (i) On which day did 59 people join the yoga session? [1]
- (ii) How many people joined the yoga session on the 31st day? [1]
- (iii) (a) The yoga instructor was paid ₹ 100 for each person attending the yoga session. On which day would he earn ₹ 5,000? [2]

OR

- (iii) (b) What was the total amount earned by the yoga instructor in 16 days? [2]

SOLUTION

The numbers joining on days 1, 2, 3, ... are 5, 8, 11, ..., an A.P. with $a = 5$ and $d = 3$.

(i) $5 + (n - 1) \times 3 = 59$ gives $n - 1 = 18$ and $n = 19$.

(ii) $a_{31} = 5 + 30 \times 3 = 95$.

(iii)(a) ₹ 5000 at ₹ 100 a person means 50 people: $5 + (n - 1) \times 3 = 50$ gives $n = 16$.

(iii)(b) $S_{16} = \frac{16}{2}[2 \times 5 + 15 \times 3] = 8 \times 55 = 440$ people in all, so he earned $440 \times 100 = ₹44,000$.

Answer: (i) day 19 (ii) 95 people (iii)(a) day 16 (iii)(b) ₹ 44,000

Q37 · TRIGONOMETRY · 4 MARKS

Case study 2. Two motorboats A and B are waiting at the opposite banks of a river in order to reach the opposite side. From a point P on the bridge, 20 m above the river, the angles of depression of the boats are 30° and 45° respectively, as shown in the figure given below. Both the boats leave at the same time at the speed of 10 m/s and 5 m/s, respectively.

Based on the above information, answer the following questions:

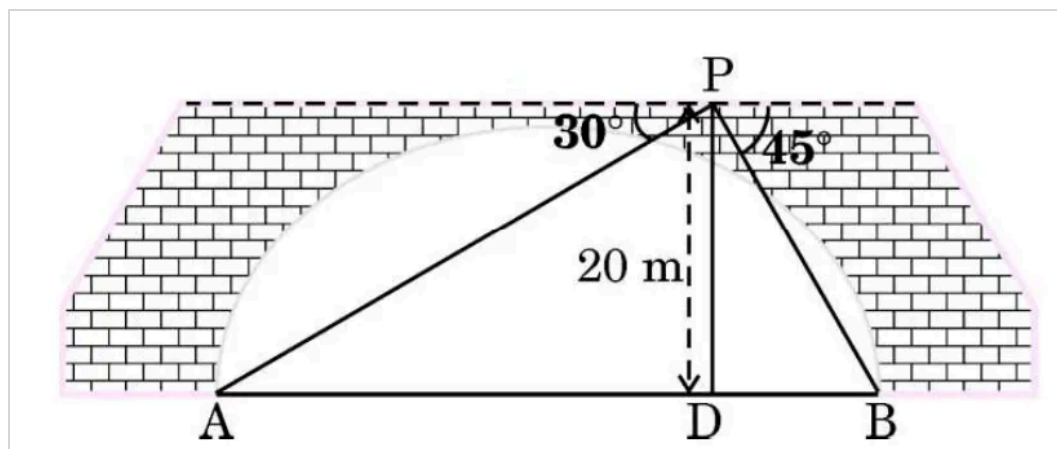
(i) Find the distance travelled by boat A to reach point D in the river, vertically below the point P. (Use $\sqrt{3} = 1.73$) [1]

(ii) What is the width of the river? [1]

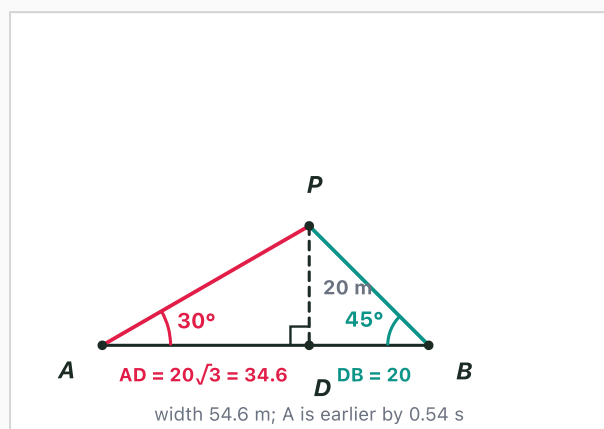
(iii) (a) Which boat will reach point D first, and how much earlier, than the other boat? [2]

OR

(iii) (b) What is the distance between the two boats after 3 seconds? [2]



SOLUTION



(i) In the right triangle PDA : $\tan 30^\circ = \frac{PD}{AD} = \frac{20}{AD}$, so $AD = 20\sqrt{3} = 20 \times 1.73 = 34.6$ m.

(ii) In $\triangle PDB$: $\tan 45^\circ = \frac{20}{DB} = 1$, so $DB = 20$ m. Width = $AD + DB = 34.6 + 20 = 54.6$ m.

(iii)(a) Boat A takes $\frac{34.6}{10} = 3.46$ s and boat B takes $\frac{20}{5} = 4$ s. Boat A reaches D first, by $4 - 3.46 = 0.54$ s.

(iii)(b) In 3 s boat A covers 30 m and boat B covers 15 m. They move towards each other, so the distance between them is $54.6 - (30 + 15) = 9.6$ m.

Answer: (i) 34.6 m (ii) 54.6 m (iii)(a) boat A, 0.54 s earlier (iii)(b) 9.6 m

Q38 · COORDINATE GEOMETRY · 4 MARKS

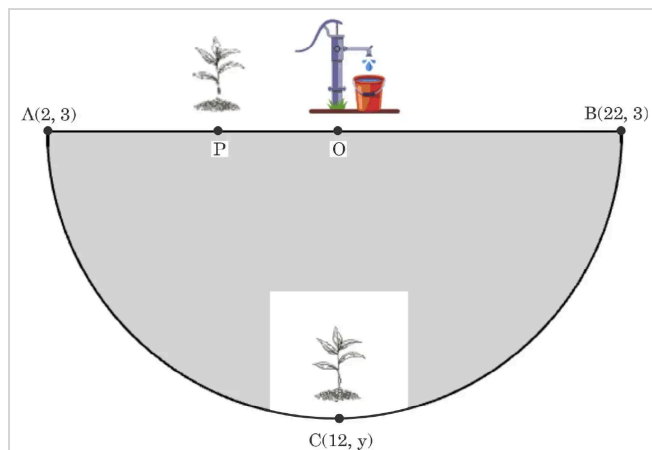
Case study 3. There is a semicircular park in Aman's society. He wishes to plant saplings along the boundary of the park. There is a borewell at the centre O of the park along the diameter AB as shown in the figure below. $A(2, 3)$, $B(22, 3)$ and $C(12, y)$.

Based on the above information, answer the following questions:

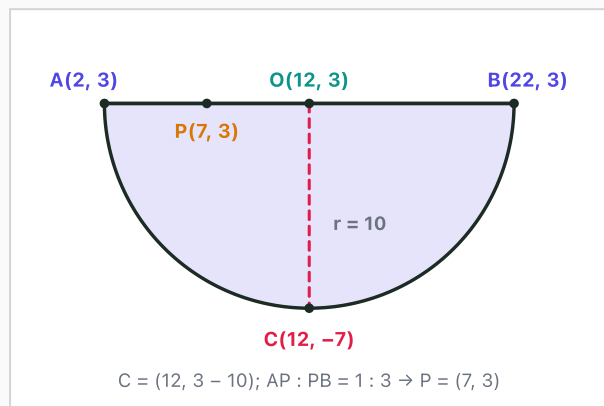
- (i) Find the coordinates of point O . [1]
- (ii) Find the radius of the semicircular park. [1]
- (iii) (a) One sapling is kept at point $C(12, y)$. Find the coordinates of C . [2]

OR

- (iii) (b) One sapling is kept at point P along AB so that $PA = \frac{1}{3}PB$. Find the coordinates of P . [2]



SOLUTION



(i) O is the centre, the mid-point of the diameter AB : $O = \left(\frac{2 + 22}{2}, \frac{3 + 3}{2} \right) = (12, 3)$.

(ii) Radius = $OA = 12 - 2 = 10$ (the distance from $(12, 3)$ to $(2, 3)$).

(iii)(a) C is on the boundary, so $OC = 10$: $\sqrt{(12 - 12)^2 + (y - 3)^2} = 10$ gives $y - 3 = \pm 10$, that is $y = 13$ or $y = -7$. The park is the semicircle below AB , so $C = (12, -7)$ (the key also lists $(12, 13)$ as a solution of the equation).

(iii)(b) $PA = \frac{1}{3}PB$ means $AP : PB = 1 : 3$. $P = \left(\frac{1 \times 22 + 3 \times 2}{4}, \frac{1 \times 3 + 3 \times 3}{4} \right) = \left(\frac{28}{4}, \frac{12}{4} \right) = (7, 3)$.

Answer: (i) $(12, 3)$ (ii) 10 (iii)(a) $(12, -7)$ (iii)(b) $(7, 3)$

Stuck on a step? CogniGuru's AI tutor explains any doubt one minute at a time, in English or Hindi.

Mock quiz, 1-minute analysis and more papers: cognicraftedu.com/cbse-class-10-papers/maths-basic/2025/430-3-1

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