

Mathematics (Standard) 2026, Set 30/3/1

Q.P. Code 30/3/1 · Series L3NMK · 80 marks · 3 hours · 2026. 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.

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Section A: Multiple choice

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

Q1 · QUADRATIC EQUATIONS · 1 MARK

The roots of the quadratic equation $(x - 1)^2 = 16$ are:

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

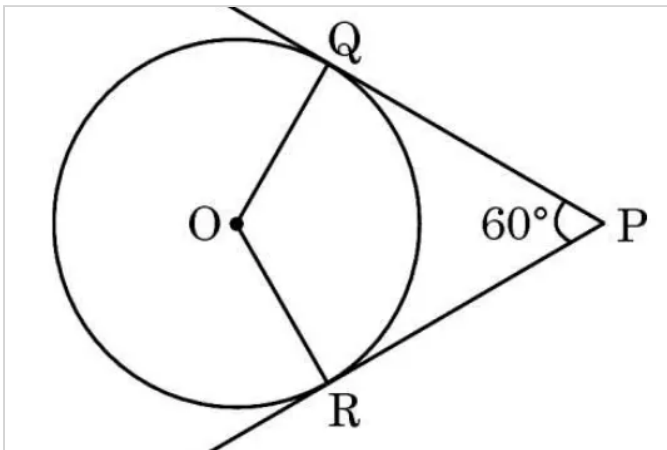
SOLUTION

$x - 1 = \pm 4$, so $x = 5$ or $x = -3$.

Answer: (C) 5, -3

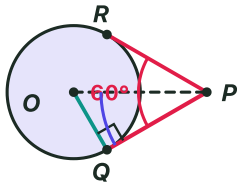
Q2 · CIRCLES · 1 MARK

In the given figure, PQ and PR are tangents to a circle with centre O and radius 3 cm. If $\angle QPR = 60^\circ$, then the length of each tangent is:



- (A) $3\sqrt{3}$ cm (B) 3 cm
(C) 6 cm (D) $\sqrt{3}$ cm

SOLUTION



$$OQ = 3, \angle OPQ = 30^\circ \rightarrow PQ = 3 / \tan 30^\circ = 3\sqrt{3} \text{ cm}$$

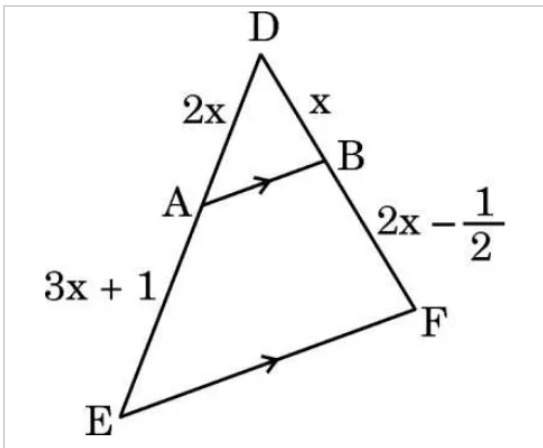
OP bisects $\angle QPR$, so $\angle OPQ = 30^\circ$. $OQ \perp PQ$ (radius and tangent).

In the right triangle OQP : $\tan 30^\circ = \frac{OQ}{PQ}$, so $PQ = \frac{3}{1/\sqrt{3}} = 3\sqrt{3} \text{ cm}$.

Answer: (A) $3\sqrt{3} \text{ cm}$

Q3 · TRIANGLES · 1 MARK

In $\triangle DEF$, $AB \parallel EF$. The value of x is:



(A) 0, 2

(B) 2 only

(C) -2

(D) 1

SOLUTION

$$AB \parallel EF, \text{ so } \frac{DA}{AE} = \frac{DB}{BF}; \frac{2x}{3x+1} = \frac{x}{2x-\frac{1}{2}}.$$

$$2x \left(2x - \frac{1}{2} \right) = x(3x+1), \text{ so } 4x^2 - x = 3x^2 + x \text{ and } x^2 - 2x = 0, \text{ giving } x = 0 \text{ or } x = 2.$$

$x = 0$ would make the sides DA and DB zero, which is impossible, so $x = 2$ only.

Answer: (B) 2 only

Q4 · REAL NUMBERS · 1 MARK

$(3 \times 11 \times 13 + 3)$ is:

(A) a prime number

(B) divisible by 13

(C) a composite number

(D) an odd number

SOLUTION

$3 \times 11 \times 13 + 3 = 3(143 + 1) = 3 \times 144 = 432$. It has factors other than 1 and itself (3, 144...), and it is even, so it is composite (not prime, not odd, and $432 \div 13$ is not whole).

Answer: (C) a composite number

Q5 · PROBABILITY · 1 MARK

Two dice are rolled together. The probability that the sum of the numbers obtained is divisible by 6 is:

- (A) $\frac{1}{6}$ (B) $\frac{11}{36}$
(C) $\frac{1}{12}$ (D) $\frac{1}{4}$

SOLUTION

The sum is 6 or 12. Sum 6: (1, 5), (5, 1), (2, 4), (4, 2), (3, 3), which is 5 outcomes. Sum 12: (6, 6), 1 outcome.

$$P = \frac{6}{36} = \frac{1}{6}.$$

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

Q6 · ARITHMETIC PROGRESSIONS · 1 MARK

The number of multiples of 4 lying between 12 and 250 is:

- (A) 59 (B) 59.5
(C) 60 (D) 61

SOLUTION

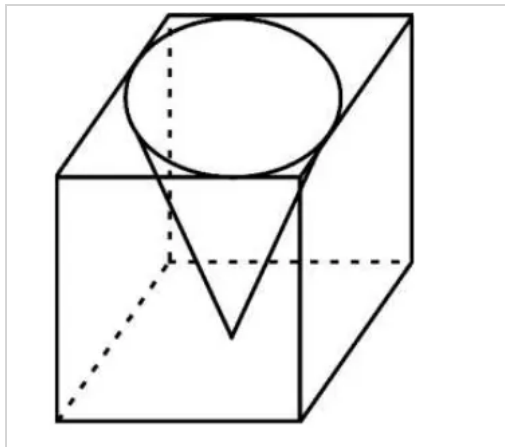
The multiples of 4 strictly between 12 and 250 are 16, 20, ..., 248 (since 12 and 250 themselves are excluded and 250 is not a multiple of 4).

$$248 = 16 + (n - 1) \times 4, \text{ so } n - 1 = 58 \text{ and } n = 59.$$

Answer: (A) 59

Q7 · SURFACE AREAS AND VOLUMES · 1 MARK

A cone of maximum size is carved out from a solid cube of edge length l . The volume of the cone is:



(A) $\frac{\pi l^3}{12}$
 (C) $l^3 \left(1 - \frac{\pi}{3}\right)$

(B) $\frac{\pi l^3}{3}$
 (D) $\frac{\pi l^3}{8}$

SOLUTION

The largest cone has its base circle inscribed in a face, so the radius is $\frac{l}{2}$, and its height is the edge l .

$$V = \frac{1}{3} \pi \left(\frac{l}{2}\right)^2 l = \frac{\pi l^3}{12}.$$

Answer: (A) $\frac{\pi l^3}{12}$

Q8 · LINEAR EQUATIONS · 1 MARK

Equation of another line parallel to the line represented by $2x - 6y = 7$ is:

(A) $y = 3x - 7$

(B) $2x = 9 - 6y$

(C) $x - 3y = 7$

(D) $x = \frac{7}{2} - 3y$

SOLUTION

A parallel line has the same slope: $2x - 6y = 7$ gives $y = \frac{1}{3}x - \frac{7}{6}$, slope $\frac{1}{3}$.

(C) $x - 3y = 7$ gives $y = \frac{1}{3}x - \frac{7}{3}$: the same slope and a different intercept, so it is parallel (and not the same line).

The others have slopes 3, $-\frac{1}{3}$, $-\frac{1}{3}$.

Answer: (C) $x - 3y = 7$

Q9 · TRIGONOMETRY · 1 MARK

If the length of the shadow of a tower is $\sqrt{3}$ times that of its height, then altitude of the Sun is:

(A) 45°

(B) 30°

(C) 60°

(D) 15°

SOLUTION

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

Answer: (B) 30°

Q10 · QUADRATIC EQUATIONS · 1 MARK

If the roots of the quadratic equation $\sqrt{3}x^2 - kx + 2\sqrt{3} = 0$ are real and equal, then the value(s) of k is/are:

- (A) $\pm\sqrt{24}$ (B) 0
(C) 4 (D) -5

SOLUTION

Equal roots need $D = 0$: $k^2 - 4(\sqrt{3})(2\sqrt{3}) = k^2 - 24 = 0$, so $k = \pm\sqrt{24}$.

Answer: (A) $\pm\sqrt{24}$

Q11 · ARITHMETIC PROGRESSIONS · 1 MARK

The n^{th} term of the A.P. $\frac{-1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \dots$ is:

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

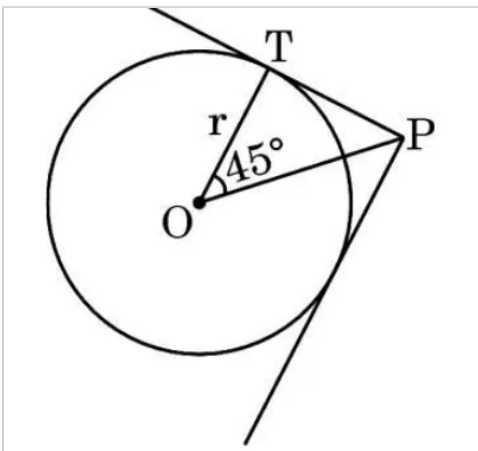
SOLUTION

$a = -\frac{1}{3}$ and $d = \frac{2}{3} + \frac{1}{3} = 1$. $a_n = -\frac{1}{3} + (n-1) \times 1 = n - \frac{4}{3}$.

Answer: (B) $n - \frac{4}{3}$

Q12 · CIRCLES · 1 MARK

In the given figure, PT is a tangent to the circle with centre O and radius r . If $\angle POT = 45^\circ$, then the length of OP is:



- (A) $r\sqrt{2}$ (B) $\sqrt{2}r$
(C) $2r$ (D) r^2

SOLUTION

$OT \perp PT$, so in the right triangle OTP : $\cos 45^\circ = \frac{OT}{OP} = \frac{r}{OP}$, so $OP = \frac{r}{1/\sqrt{2}} = r\sqrt{2}$.

Answer: (A) $r\sqrt{2}$

Q13 · TRIANGLES · 1 MARK

It is given that $\triangle ABC \sim \triangle QRP$ such that $AB = 9$ cm, $BC = 5$ cm and $PR = 2$ cm. Length of side QR is:

- (A) 0.9 cm
(B) $\frac{5}{18}$ cm
(C) $\frac{10}{9}$ cm
(D) 3.6 cm

SOLUTION

$A \leftrightarrow Q, B \leftrightarrow R, C \leftrightarrow P$. So $AB \leftrightarrow QR$ and $BC \leftrightarrow RP$.

$$\frac{AB}{QR} = \frac{BC}{RP}: \frac{9}{QR} = \frac{5}{2}, \text{ so } QR = \frac{18}{5} = 3.6 \text{ cm.}$$

Answer: (D) 3.6 cm

Q14 · POLYNOMIALS · 1 MARK

The sum and product of zeroes of a quadratic polynomial $p(x)$ are $\frac{-1}{3}$ and 2 respectively. The polynomial $p(x)$ is:

- (A) $3x^2 - x + 6$
(B) $x^2 + \frac{1}{3}x - 2$
(C) $3x^2 - x + 2$
(D) $-3x^2 - x - 6$

SOLUTION

$$k[x^2 - (\text{sum})x + \text{product}] = k \left[x^2 + \frac{1}{3}x + 2 \right].$$

With $k = -3$: $-3x^2 - x - 6$, which is option (D).

Answer: (D) $-3x^2 - x - 6$

Q15 · TRIGONOMETRY · 1 MARK

Given that $\sin 2\alpha = \frac{\sqrt{3}}{2}$, the value of $\sin 3\alpha$ is:

- (A) $\frac{3\sqrt{3}}{4}$
(B) $\frac{1}{2}$
(C) 1
(D) $\frac{\sqrt{3}}{4}$

SOLUTION

$$\sin 2\alpha = \frac{\sqrt{3}}{2} \text{ gives } 2\alpha = 60^\circ \text{ for an acute angle, so } \alpha = 30^\circ.$$

$$\sin 3\alpha = \sin 90^\circ = 1.$$

Answer: (C) 1

Q16 · STATISTICS · 1 MARK

The median and mode of a distribution are 25.2 and 26.1 respectively. The mean of the distribution is:

- (A) 24.75
(B) 24.25
(C) 24.3
(D) 25.5

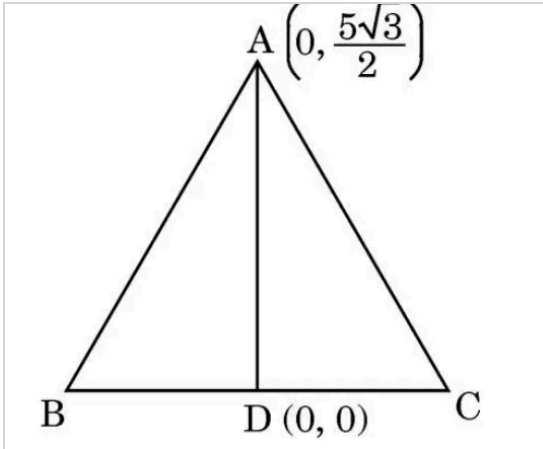
SOLUTION

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean: } 26.1 = 75.6 - 2 \text{ Mean, so Mean} = \frac{49.5}{2} = 24.75.$$

Answer: (A) 24.75

Q17 · COORDINATE GEOMETRY · 1 MARK

In the given figure, $\triangle ABC$ is an equilateral triangle. AD is a median of the triangle joining the points $A \left(0, \frac{5\sqrt{3}}{2}\right)$, $D(0, 0)$. Points B and C are (in same order):



(A) $(-5, 0), (5, 0)$

(B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$

(C) $(-10, 0), (10, 0)$

(D) $(-5\sqrt{3}, 0), (5\sqrt{3}, 0)$

SOLUTION

In an equilateral triangle of side s , the median (also the altitude) is $\frac{\sqrt{3}}{2}s$. Here $AD = \frac{5\sqrt{3}}{2}$, so $s = 5$.

D is the mid-point of BC at the origin, so $B = \left(-\frac{5}{2}, 0\right)$ and $C = \left(\frac{5}{2}, 0\right)$.

Answer: (B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$

Q18 · TRIGONOMETRY · 1 MARK

The value of $\left(\frac{1}{2}\tan^2 45^\circ - \cos^2 60^\circ\right)$ is:

(A) 0

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

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

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

SOLUTION

$\tan 45^\circ = 1$ and $\cos 60^\circ = \frac{1}{2}$: $\frac{1}{2}(1) - \frac{1}{4} = \frac{1}{4}$.

Answer: (C) $\frac{1}{4}$

Q19 · CIRCLES · 1 MARK

Assertion (A): Radius is the smallest distance of a tangent from the centre of the circle.

Reason (R): Radius is perpendicular to the tangent.

(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 radius to the point of contact is perpendicular to the tangent. True.

(A) Every other point of the tangent is outside the circle, and the perpendicular is the shortest distance from the centre to a line. So the radius is the smallest distance. True, and it follows from (R).

Answer: (A) Both A and R are true and R is the correct explanation of A

Q20 · TRIGONOMETRY · 1 MARK

Assertion (A): $\tan 2\theta$ is not defined at $\theta = 45^\circ$.

Reason (R): $\sin 90^\circ \neq \cos 90^\circ$.

(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) At $\theta = 45^\circ$, $\tan 2\theta = \tan 90^\circ = \frac{\sin 90^\circ}{\cos 90^\circ} = \frac{1}{0}$, which is not defined. True.

(R) $\sin 90^\circ = 1$ and $\cos 90^\circ = 0$, so they are unequal. True. But being unequal is not why $\tan 90^\circ$ is undefined (that is because $\cos 90^\circ = 0$), so R does not explain A.

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 · REAL NUMBERS · 2 MARKS

Find the length of the plank that can be used to measure the lengths 4 m 20 cm and 5 m 4 cm exactly, in the least time.

SOLUTION

In cm: 4 m 20 cm = 420 cm and 5 m 4 cm = 504 cm. The longest plank that measures both exactly takes the fewest placements, and it is the HCF.

$420 = 2^2 \times 3 \times 5 \times 7$ and $504 = 2^3 \times 3^2 \times 7$. $\text{HCF} = 2^2 \times 3 \times 7 = 84$.

Answer: 84 cm

Q22 · ARITHMETIC PROGRESSIONS · 2 MARKS

(a) In an A.P., the first term is 32 and the last term is -10 . If the common difference is -2 , then find the number of terms and their sum.

OR

(b) Find the sum of the first 28 terms of an A.P. whose n^{th} term is given by $a_n = 3n - 2$.

SOLUTION

(a) $32 + (n - 1)(-2) = -10$, so $-2(n - 1) = -42$ and $n = 22$. $S_{22} = \frac{22}{2}(32 + (-10)) = 11 \times 22 = 242$.

(b) $a_1 = 3(1) - 2 = 1$ and $a_{28} = 3(28) - 2 = 82$. $S_{28} = \frac{28}{2}(1 + 82) = 14 \times 83 = 1162$.

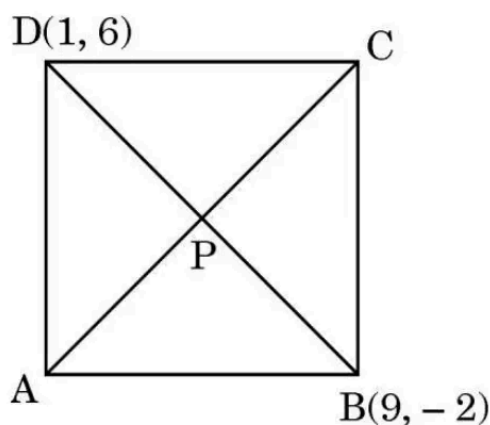
Answer: (a) 22 terms, sum 242 (b) 1162

Q23 · COORDINATE GEOMETRY · 2 MARKS

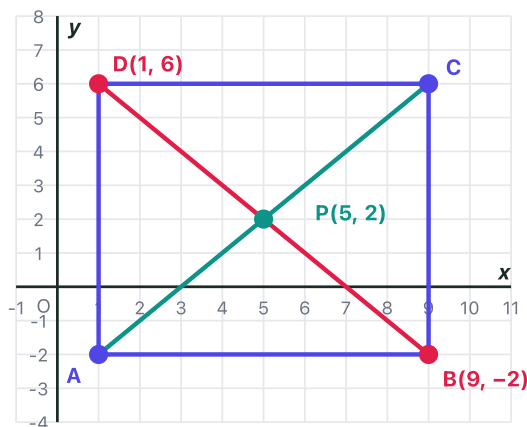
(a) Diagonals AC and BD of square $ABCD$ intersect at P . Coordinates of points B and D are $(9, -2)$ and $(1, 6)$ respectively. (i) Find the co-ordinates of point P . (ii) Find the length of the side of the square.

OR

(b) Find the coordinates of a point on the line $x + y = 5$ which is equidistant from $(6, 4)$ and $(5, 2)$.



SOLUTION



(a)(i) The diagonals of a square bisect each other, so P is the mid-point of BD : $P = \left(\frac{9+1}{2}, \frac{-2+6}{2} \right) = (5, 2)$.

(a)(ii) $BD = \sqrt{(9-1)^2 + (-2-6)^2} = \sqrt{128} = 8\sqrt{2}$. A square of side s has diagonal $s\sqrt{2}$, so $s = 8$.

(b) Let the point be (x, y) . $(x - 6)^2 + (y - 4)^2 = (x - 5)^2 + (y - 2)^2$ gives $-12x - 8y + 52 = -10x - 4y + 29$, that is $2x + 4y = 23$.

With $x + y = 5$: $2(5 - y) + 4y = 23$, so $2y = 13$ and $y = \frac{13}{2}$, $x = -\frac{3}{2}$. The point is $\left(-\frac{3}{2}, \frac{13}{2}\right)$.

Answer: (a) $P(5, 2)$, side = 8 units (b) $\left(-\frac{3}{2}, \frac{13}{2}\right)$

Q24 · TRIANGLES · 2 MARKS

The diagonals of a quadrilateral $ABCD$ intersect each other at the point O such that $\frac{AO}{OC} = \frac{BO}{OD}$. Show that quadrilateral $ABCD$ is a trapezium.

SOLUTION

$\frac{AO}{OC} = \frac{BO}{OD}$ means $\frac{AO}{BO} = \frac{OC}{OD}$. Also $\angle AOB = \angle COD$ (vertically opposite).

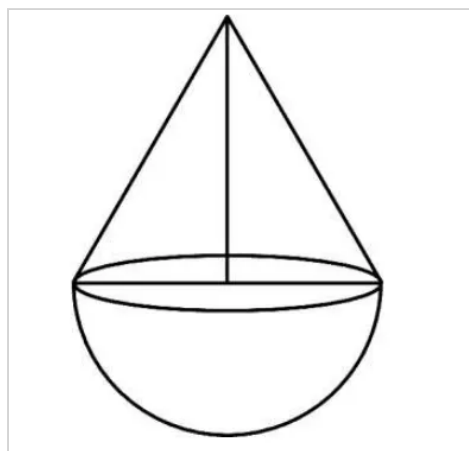
So $\triangle AOB \sim \triangle COD$ by SAS, and $\angle OAB = \angle OCD$. These are alternate angles for AB and DC with transversal AC , so $AB \parallel DC$.

One pair of opposite sides is parallel, so $ABCD$ is a trapezium.

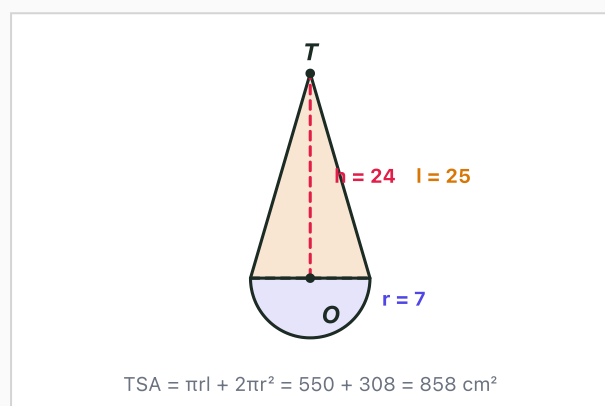
Answer: Shown

Q25 · SURFACE AREAS AND VOLUMES · 2 MARKS

A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy.



SOLUTION



Height of the cone = $31 - 7 = 24$ cm and its radius = 7 cm. Slant height $l = \sqrt{7^2 + 24^2} = 25$ cm.

The total surface area is the curved area of the cone plus the curved area of the hemisphere (the joining base is hidden): $\pi r l + 2\pi r^2 = \frac{22}{7} \times 7 \times 25 + 2 \times \frac{22}{7} \times 49 = 550 + 308 = 858 \text{ cm}^2$.

Answer: 858 cm²

Section C: Short answer

6 questions, 3 marks each.

Q26 · TRIGONOMETRY · 3 MARKS

(a) If $\sin \theta + \cos \theta = \sqrt{3}$, then prove that $\tan \theta + \cot \theta = 1$.

OR

(b) Prove that: $(\sin A + \sec A)^2 + (\cos A + \operatorname{cosec} A)^2 = (1 + \sec A \operatorname{cosec} A)^2$.

SOLUTION

(a) Square: $\sin^2 \theta + \cos^2 \theta + 2 \sin \theta \cos \theta = 3$, so $\sin \theta \cos \theta = 1$.

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

(Note: $\sin \theta \cos \theta \leq \frac{1}{2}$ for every real angle, so no real θ satisfies the given condition; the result follows from the algebra, which is what the question asks.)

(b) LHS = $\sin^2 A + 2 \sin A \sec A + \sec^2 A + \cos^2 A + 2 \cos A \operatorname{cosec} A + \operatorname{cosec}^2 A$. Here $\sin A \sec A = \tan A$ and $\cos A \operatorname{cosec} A = \cot A$, so LHS = $1 + 2(\tan A + \cot A) + \sec^2 A + \operatorname{cosec}^2 A$.

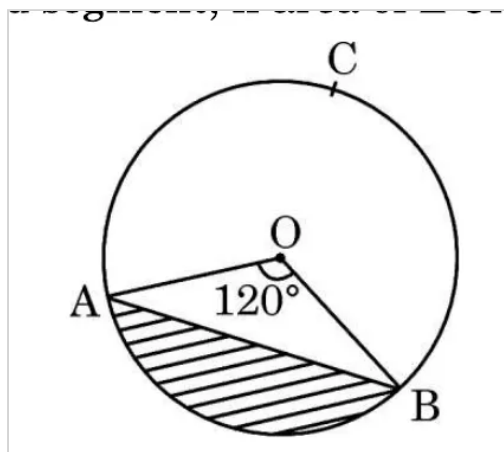
$$\tan A + \cot A = \frac{1}{\sin A \cos A} = \sec A \operatorname{cosec} A \text{ and } \sec^2 A + \operatorname{cosec}^2 A = \frac{1}{\cos^2 A \sin^2 A} = \sec^2 A \operatorname{cosec}^2 A.$$

$$\text{LHS} = 1 + 2 \sec A \operatorname{cosec} A + \sec^2 A \operatorname{cosec}^2 A = (1 + \sec A \operatorname{cosec} A)^2 = \text{RHS}.$$

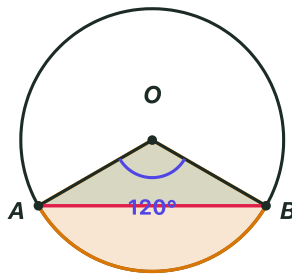
Answer: Proved (both parts)

Q27 · AREAS RELATED TO CIRCLES · 3 MARKS

In the given figure, chord AB subtends an angle of 120° at the centre of the circle with radius 7 cm. Find (i) perimeter of major sector $OACB$, and (ii) area of the shaded segment, if area of $\triangle OAB = 21.2 \text{ cm}^2$.



SOLUTION



$$\text{segment} = \frac{1}{2}\pi r^2 - 21.2 = 51.33 - 21.2 = 30.1 \text{ cm}^2$$

$$\text{major sector perimeter} = \frac{240}{360} \times 2\pi r + 2r = \frac{130}{3} \text{ cm}$$

(i) The major sector has central angle $360^\circ - 120^\circ = 240^\circ$. Perimeter = major arc $+ 2r = \frac{240}{360} \times 2 \times \frac{22}{7} \times 7 + 14 = \frac{88}{3} + 14 = \frac{130}{3} \approx 43.3 \text{ cm}$.

(ii) Segment = minor sector – triangle $= \frac{120}{360} \times \frac{22}{7} \times 7 \times 7 - 21.2 = \frac{154}{3} - 21.2 \approx 51.33 - 21.2 = 30.1 \text{ cm}^2$.

Answer: (i) $\frac{130}{3} \approx 43.3 \text{ cm}$ (ii) $\approx 30.1 \text{ cm}^2$

Q28 · REAL NUMBERS · 3 MARKS

Prove that $\sqrt{5}$ is an irrational number.

SOLUTION

Suppose $\sqrt{5} = \frac{p}{q}$ with p, q co-prime integers and $q \neq 0$.

$5q^2 = p^2$, so 5 divides p^2 and therefore 5 divides p . Write $p = 5a$.

$25a^2 = 5q^2$, so $q^2 = 5a^2$; 5 divides q^2 and so 5 divides q .

5 divides both p and q , contradicting that they are co-prime. So $\sqrt{5}$ is irrational.

Answer: Proved

Q29 · QUADRATIC EQUATIONS · 3 MARKS

Find two consecutive negative integers, sum of whose squares is 481.

SOLUTION

Let the integers be x and $x + 1$. $x^2 + (x + 1)^2 = 481$, so $2x^2 + 2x - 480 = 0$ and $x^2 + x - 240 = 0$.

$(x + 16)(x - 15) = 0$, so $x = -16$ or $x = 15$. We need negative integers, so $x = -16$ and the other is -15 .

(Check: $256 + 225 = 481 \checkmark$.)

Answer: -16 and -15

Q30 · COORDINATE GEOMETRY · 3 MARKS

A point $P(x, 7)$ divides a line segment joining the points $A(-5, 4)$ and $B(7, 9)$ in a certain ratio. Find the ratio and hence find the value of x .

SOLUTION

Let $AP : PB = k : 1$. The y -coordinate: $\frac{9k + 4}{k + 1} = 7$, so $9k + 4 = 7k + 7$ and $k = \frac{3}{2}$. The ratio is $3 : 2$.

$$x = \frac{3(7) + 2(-5)}{3 + 2} = \frac{21 - 10}{5} = \frac{11}{5}.$$

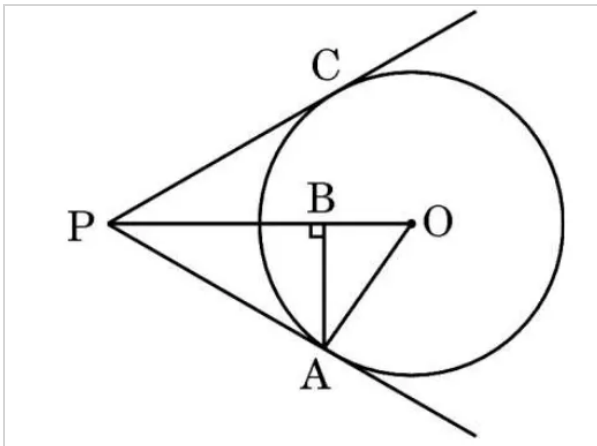
Answer: Ratio 3 : 2; $x = \frac{11}{5}$

Q31 · CIRCLES · 3 MARKS

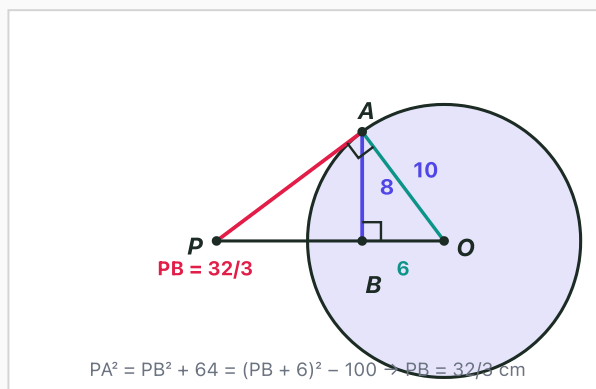
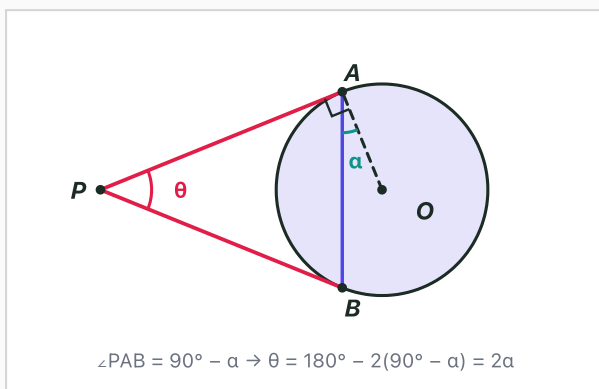
(a) Two tangents PA and PB are drawn to a circle with centre O from an external point P . Prove that $\angle APB = 2\angle OAB$.

OR

(b) In the given figure, PA is the tangent to the circle with centre O such that $OA = 10$ cm, $AB = 8$ cm and $AB \perp OP$. Find the length of PB .



SOLUTION



(a) $OA \perp AP$, so $\angle PAB = 90^\circ - \angle OAB$. (i)

Tangents from P are equal, $PA = PB$, so $\angle PAB = \angle PBA$ and $\angle APB = 180^\circ - 2\angle PAB$.

Using (i): $\angle APB = 180^\circ - 2(90^\circ - \angle OAB) = 2\angle OAB$.

(b) In the right triangle OBA : $OB = \sqrt{10^2 - 8^2} = 6$ cm. Let $PB = y$, so $OP = y + 6$.

$PA^2 = PB^2 + AB^2 = y^2 + 64$ (right angle at B) and $PA^2 = OP^2 - OA^2 = (y + 6)^2 - 100$ (right angle at A).

$y^2 + 64 = y^2 + 12y + 36 - 100$, so $12y = 128$ and $y = \frac{32}{3}$ cm ≈ 10.67 cm.

Answer: (a) proved (b) $PB = \frac{32}{3}$ cm

Section D: Long answer

4 questions, 5 marks each.

Q32 · STATISTICS · 5 MARKS

(a) The median of the following data is 137. Find the values of x and y , given that total of frequencies is 68.

OR

(b) Find mean and mode of the following distribution (classes 0 – 10, 10 – 20, 20 – 30, 30 – 40, 40 – 50, 50 – 60, 60 – 70 with frequencies 3, 6, 11, 10, 13, 3, 4).

Class	65–85	85–105	105–125	125–145	145–165	165–185	185–205
Frequency (a)	4	5	x	20	14	y	4

SOLUTION

(a) Cumulative frequencies: 4, 9, $9 + x$, $29 + x$, $43 + x$, $43 + x + y$, $47 + x + y$. The total is $47 + x + y = 68$, so $x + y = 21$.

$\frac{N}{2} = 34$ and the median 137 lies in 125 – 145: $l = 125$, $cf = 9 + x$, $f = 20$, $h = 20$. Median = $125 + \frac{34 - (9 + x)}{20} \times 20 = 125 + 25 - x = 150 - x$.

$150 - x = 137$, so $x = 13$ and $y = 21 - 13 = 8$.

(b) The table is: classes 0 – 10, 10 – 20, 20 – 30, 30 – 40, 40 – 50, 50 – 60, 60 – 70 with frequencies 3, 6, 11, 10, 13, 3, 4 (total 50). Take $a = 35$, $h = 10$, $u = \frac{x - 35}{10} = -3, -2, -1, 0, 1, 2, 3$.

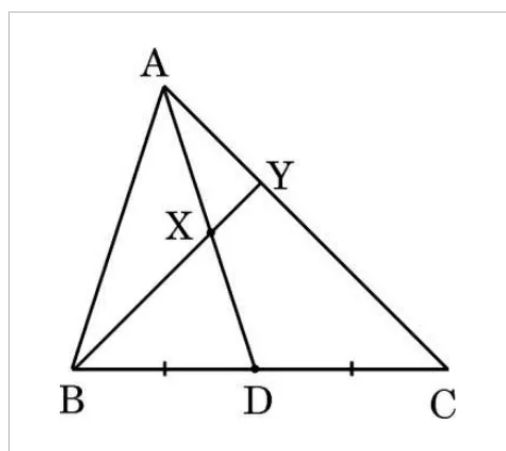
$\sum f_i u_i = -9 - 12 - 11 + 0 + 13 + 6 + 12 = -1$. Mean = $35 + \frac{-1}{50} \times 10 = 34.8$.

Modal class 40 – 50 ($f_1 = 13$, $f_0 = 10$, $f_2 = 3$): Mode = $40 + \frac{13 - 10}{26 - 10 - 3} \times 10 = 40 + \frac{30}{13} \approx 42.3$.

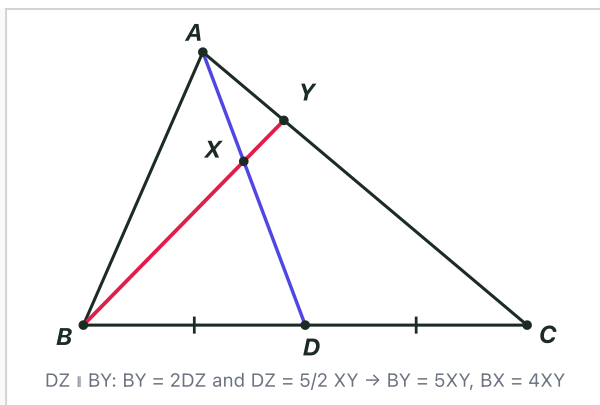
Answer: (a) $x = 13$, $y = 8$ (b) mean = 34.8, mode ≈ 42.3

Q33 · TRIANGLES · 5 MARKS

In $\triangle ABC$, AD is a median. X is a point on AD such that $AX : XD = 2 : 3$. BX is extended so that it intersects AC at Y . Prove that $BX = 4XY$.



SOLUTION



Draw $DZ \parallel BY$ with Z on AC (the Z lies between Y and C).

In $\triangle CBY$, D is the mid-point of BC and $DZ \parallel BY$, so Z is the mid-point of CY and $DZ = \frac{1}{2}BY$, that is $BY = 2DZ$. (i)

In $\triangle ADZ$, $XY \parallel DZ$, so $\triangle AXY \sim \triangle ADZ$: $\frac{AX}{AD} = \frac{XY}{DZ}$. $AX : AD = 2 : 5$, so $DZ = \frac{5}{2}XY$. (ii)

From (i) and (ii): $BY = 2 \times \frac{5}{2}XY = 5XY$.

$BX = BY - XY = 5XY - XY = 4XY$.

Answer: Proved

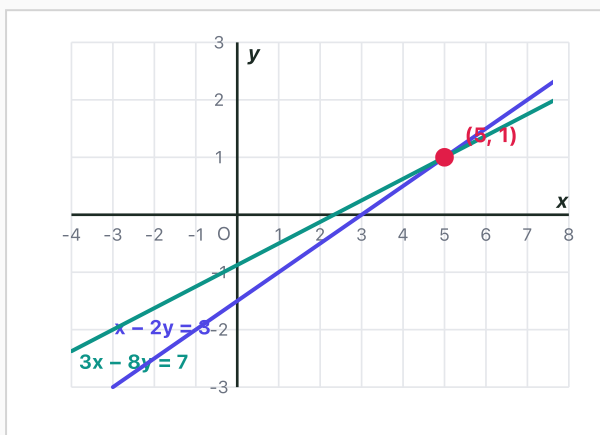
Q34 · LINEAR EQUATIONS · 5 MARKS

(a) Solve the following system of equations graphically: $x - 2y = 3$, $3x - 8y = 7$.

OR

(b) Five years ago, Adil was thrice as old as Bharat. Ten years later Adil shall be twice as old as Bharat. To know the present ages of Adil and Bharat: (i) form the linear equations representing the above information. (ii) show that the system of equations is consistent with unique solution. (iii) find the present ages of Adil and Bharat.

SOLUTION



(a) $x - 2y = 3$: points $(3, 0)$, $(5, 1)$, $(1, -1)$. $3x - 8y = 7$: points $(5, 1)$, $(-3, -2)$, $(1, -\frac{1}{2})$. The lines meet at $(5, 1)$, so $x = 5$, $y = 1$. (Check: $5 - 2 = 3 \checkmark$, $15 - 8 = 7 \checkmark$.)

(b)(i) Let Adil be x and Bharat y years old. Five years ago: $x - 5 = 3(y - 5)$, that is $x - 3y = -10$. Ten years later: $x + 10 = 2(y + 10)$, that is $x - 2y = 10$.

(ii) $\frac{a_1}{a_2} = \frac{1}{1} = 1$ and $\frac{b_1}{b_2} = \frac{-3}{-2} = \frac{3}{2}$. Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, the system is consistent with a unique solution.

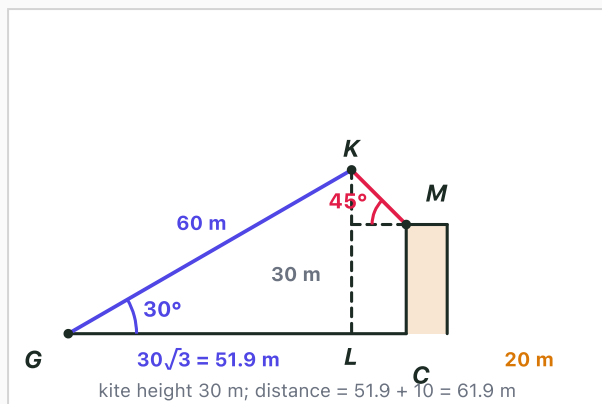
(iii) Subtracting: $(x - 2y) - (x - 3y) = 10 - (-10)$ gives $y = 20$, and then $x = 10 + 40 = 50$. Adil is 50 and Bharat is 20 years old.

Answer: (a) $x = 5, y = 1$ (b) Adil 50 years, Bharat 20 years

Q35 · TRIGONOMETRY · 5 MARKS

A boy standing on a horizontal plane is flying a kite with a string of length 60 m, at an angle of elevation of 30° . Another boy standing on the roof of a 20 m high building, finds the angle of elevation of same kite to be 45° . If both the boys are on opposite sides of the kite, find the distance of the first boy from the base of the building. Also, find the height of the kite from the ground. (Use $\sqrt{3} = 1.73$)

SOLUTION



Let the kite be K , with the first boy at G . In the right triangle formed by the string: height of K above the ground = $60 \sin 30^\circ = 30$ m.

Horizontal distance from the first boy to the point below the kite: $60 \cos 30^\circ = 30\sqrt{3} = 30 \times 1.73 = 51.9$ m.

The roof of the building is 20 m high, so the kite is $30 - 20 = 10$ m above the second boy. His angle of elevation is 45° , so he is $10 \cot 45^\circ = 10$ m horizontally from the point below the kite.

The boys are on opposite sides of the kite, so the first boy is $51.9 + 10 = 61.9$ m from the base of the building. The kite is 30 m above the ground.

Answer: 61.9 m from the base of the building; kite height 30 m

Section E: Case studies

3 case studies, 4 marks each.

Q36 · POLYNOMIALS · 4 MARKS

Case study 1. During a theatre drama, a backdrop of building arches was used. The shape of the curve shown below can be represented by the polynomial $p(x) = -x^2 + 2x + 8$, where x is the length (in feet) on stage level.

Based on the figure given above, answer the following questions:

(i) Determine the height of the arch. [1]

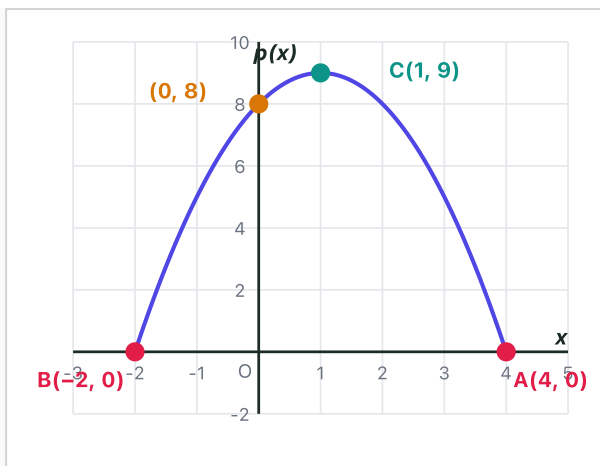
(ii) (a) Find zeroes of the polynomial $p(x)$. Which points on the graph represent the zeroes? [2]

OR

(ii) (b) Find the span of the arch on the stage floor. [2]

(iii) Write the coordinates of the point of intersection of the above curve with the y -axis. [1]

SOLUTION



- (i) The top of the arch is at $x = 1$ (the point $C(1, y)$): $p(1) = -1 + 2 + 8 = 9$. The arch is 9 feet high.
- (ii)(a) $-x^2 + 2x + 8 = -(x - 4)(x + 2) = 0$, so the zeroes are $x = -2$ and $x = 4$, which are the points B and A where the graph meets the x -axis.
- (ii)(b) $A = (4, 0)$ and $B = (-2, 0)$, so the span is $4 - (-2) = 6$ feet.
- (iii) At $x = 0$: $p(0) = 8$. The curve meets the y -axis at $(0, 8)$.

Answer: (i) 9 ft (ii)(a) zeroes -2 and 4 (points B and A) (ii)(b) 6 ft (iii) $(0, 8)$

Q37 · PROBABILITY · 4 MARKS

Case study 2. A group of friends wanted to play cards with two identical packs together. While shuffling the cards, three cards are dropped. Rest of the cards are shuffled and one card is drawn at random. Assuming that the dropped cards were a queen of hearts, a ten of spades and an ace of clubs, answer the following questions:

- (i) Find the probability that the drawn card is a face card. [1]
- (ii) Find the probability that the drawn card is either a king or a queen. [1]
- (iii) (a) Do you think that the probability of getting a queen was higher if none of the cards were dropped? Justify your answer. [2]

OR

- (iii) (b) Find the probability that the drawn card is a jack. Compare it with the probability when none of the cards were dropped. In which case is the probability of getting a jack higher? [2]

SOLUTION

Two packs have 104 cards; after dropping 3 there are 101 cards.

- (i) Face cards in two packs: $3 \times 4 \times 2 = 24$. The dropped queen of hearts was one, so 23 remain. $P = \frac{23}{101}$.
- (ii) Kings and queens: $8 + 8 = 16$ in two packs, minus the dropped queen = 15. $P = \frac{15}{101}$.
- (iii)(a) Queens with nothing dropped: $\frac{8}{104} \approx 0.0769$. With the three cards dropped: $\frac{7}{101} \approx 0.0693$. Since $8 \times 101 = 808 > 728 = 7 \times 104$, $\frac{8}{104} > \frac{7}{101}$. Yes, the probability of a queen was higher when no card was dropped.
- (iii)(b) Jacks: none of the dropped cards is a jack, so $P(\text{jack}) = \frac{8}{101}$ now, against $\frac{8}{104}$ before. $\frac{8}{101} > \frac{8}{104}$ (same top, smaller bottom), so a jack is more likely after the three cards were dropped.

Answer: (i) $\frac{23}{101}$ (ii) $\frac{15}{101}$ (iii)(a) yes, $\frac{8}{104} > \frac{7}{101}$ (iii)(b) $\frac{8}{101}$, higher than $\frac{8}{104}$

Q38 · SURFACE AREAS AND VOLUMES · 4 MARKS

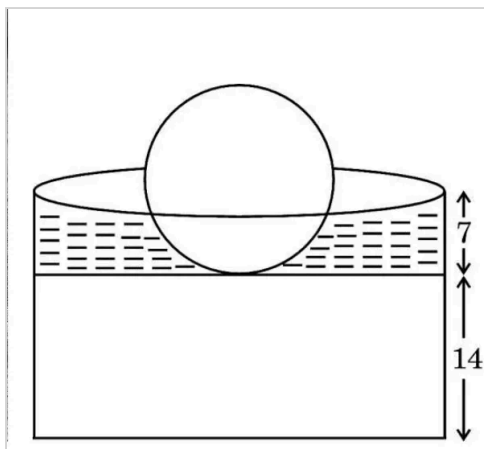
Case study 3. A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of spherical ball is 21 cm. Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.

Observe the figure and answer the following questions:

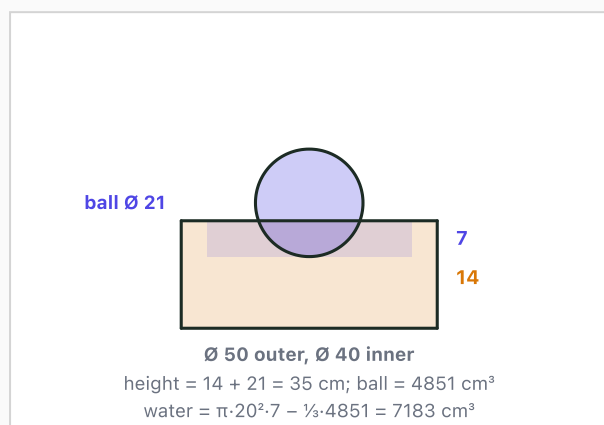
- (i) Determine the total height of the fountain. [1]
- (ii) Find the volume of the ball. [1]
- (iii) (a) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. [2]

OR

- (iii) (b) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball. [2]



SOLUTION



(i) The ball rests on the solid base: total height = 14 + 21 = 35 cm.

(ii) Radius = $\frac{21}{2}$ cm. Volume = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2} = 4851$ cm³.

(iii)(a) The water fills a cylinder of inner radius 20 cm and depth 7 cm, less the submerged third of the ball: $\frac{22}{7} \times 20 \times 20 \times 7 - \frac{1}{3} \times 4851 = 8800 - 1617 = 7183$ cm³.

(iii)(b) The outer cylinder has radius 25 cm and height 14 + 7 = 21 cm: curved area = $2\pi rh = 2 \times \frac{22}{7} \times 25 \times 21 = 3300$ cm². The ball: $4\pi r^2 = 4 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} = 1386$ cm². Sum = 4686 cm².

Answer: (i) 35 cm (ii) 4851 cm³ (iii)(a) 7183 cm³ (iii)(b) 4686 cm²

Mock quiz, 1-minute analysis and more papers: cognicraftedu.com/cbse-class-10-papers/maths-standard/2026/30-3-1

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