

Mathematics (Basic) 2024, Set 430/2/1

Q.P. Code 430/2/1 · Series DA2AB · 80 marks · 3 hours · March 2024. 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 · REAL NUMBERS · 1 MARK

The HCF of smallest 2-digit number and the smallest composite number is:

- (A) 2 (B) 20
(C) 40 (D) 4

SOLUTION

The smallest 2-digit number is $10 = 2 \times 5$ and the smallest composite number is $4 = 2^2$. HCF = 2.

Answer: (A) 2

Q2 · LINEAR EQUATIONS · 1 MARK

The value of ' k ' for which the pair of linear equations $x + y - 4 = 0$ and $2x + ky - 8 = 0$ has infinitely many solutions, is:

- (A) $k \neq 2$ (B) $k \neq -2$
(C) $k = 2$ (D) $k = -2$

SOLUTION

Infinitely many solutions need $\frac{1}{2} = \frac{1}{k} = \frac{-4}{-8} = \frac{1}{2}$, so $k = 2$.

Answer: (C) $k = 2$

Q3 · QUADRATIC EQUATIONS · 1 MARK

Which of the following equations has 2 as a root?

- (A) $x^2 - 4x + 5 = 0$ (B) $x^2 + 3x - 12 = 0$
(C) $2x^2 - 7x + 6 = 0$ (D) $3x^2 - 6x - 2 = 0$

SOLUTION

Substitute $x = 2$: (A) $4 - 8 + 5 = 1$; (B) $4 + 6 - 12 = -2$; (C) $8 - 14 + 6 = 0$ ✓; (D) $12 - 12 - 2 = -2$. Only (C) gives 0.

Answer: (C) $2x^2 - 7x + 6 = 0$

Q4 · ARITHMETIC PROGRESSIONS · 1 MARK

In an A.P., if $d = -4$ and $a_7 = 4$, then the first term ' a ' is equal to:

- (A) 6 (B) 7
(C) 20 (D) 28

SOLUTION

$$a_7 = a + 6d = a - 24 = 4, \text{ so } a = 28.$$

Answer: (D) 28

Q5 · COORDINATE GEOMETRY · 1 MARK

The distance of the point $(5, 4)$ from the origin is:

- (A) 41 (B) $\sqrt{41}$
(C) 3 (D) 9

SOLUTION

$$\sqrt{5^2 + 4^2} = \sqrt{41}.$$

Answer: (B) $\sqrt{41}$

Q6 · TRIGONOMETRY · 1 MARK

If $\sin A = \frac{3}{5}$, then value of $\cot A$ is:

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

SOLUTION

Opposite = 3, hypotenuse = 5, adjacent = 4. $\cot A = \frac{4}{3}$.

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

Q7 · TRIGONOMETRY · 1 MARK

$\frac{1 + \tan^2 A}{1 + \cot^2 A}$ is equal to:

- (A) $\sec^2 A$ (B) -1
(C) $\cot^2 A$ (D) $\tan^2 A$

SOLUTION

$$\frac{\sec^2 A}{\operatorname{cosec}^2 A} = \frac{\sin^2 A}{\cos^2 A} = \tan^2 A.$$

Answer: (D) $\tan^2 A$

Q8 · TRIGONOMETRY · 1 MARK

$\frac{2 \tan 30^\circ}{1 - \tan^2 30^\circ}$ is equal to:

- (A) $\cos 60^\circ$ (B) $\sin 60^\circ$
(C) $\tan 60^\circ$ (D) $\sin 30^\circ$

SOLUTION

$$\frac{2/\sqrt{3}}{1 - 1/3} = \frac{2/\sqrt{3}}{2/3} = \sqrt{3} = \tan 60^\circ. \text{ (This is the double-angle formula } \tan 2A \text{ with } A = 30^\circ.)$$

Answer: (C) $\tan 60^\circ$

Q9 · POLYNOMIALS · 1 MARK

A quadratic polynomial, the sum of whose zeroes is -5 and their product is 6 , is:

- (A) $x^2 + 5x + 6$ (B) $x^2 - 5x + 6$
(C) $x^2 - 5x - 6$ (D) $-x^2 + 5x + 6$

SOLUTION

$$x^2 - (\text{sum})x + \text{product} = x^2 - (-5)x + 6 = x^2 + 5x + 6.$$

Answer: (A) $x^2 + 5x + 6$

Q10 · POLYNOMIALS · 1 MARK

The zeroes of the polynomial $3x^2 + 11x - 4$ are:

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

SOLUTION

$$3x^2 + 11x - 4 = (3x - 1)(x + 4), \text{ so the zeroes are } \frac{1}{3} \text{ and } -4.$$

Answer: (C) $\frac{1}{3}, -4$

Q11 · STATISTICS · 1 MARK

The annual rainfall record of a city for 66 days is given in the following table. The difference of upper limits of modal and median classes is:

Rainfall (in cm)	0–10	10–20	20–30	30–40	40–50	50–60
Number of days	22	10	8	15	5	6

- (A) 10 (B) 15
(C) 20 (D) 30

SOLUTION

The highest frequency 22 is in $0 - 10$, so the modal class is $0 - 10$ (upper limit 10).

$N = 66$, $\frac{N}{2} = 33$. Cumulative frequencies: 22, 32, 40, $\dots$, so the median class is $20 - 30$ (upper limit 30). The difference is $30 - 10 = 20$.

Answer: (C) 20

Q12 · PROBABILITY · 1 MARK

If $P(A)$ denotes the probability of an event A , then:

- (A) $P(A) < 0$ (B) $P(A) > 1$
(C) $0 \leq P(A) \leq 1$ (D) $-1 \leq P(A) \leq 1$

SOLUTION

A probability always lies between 0 (impossible event) and 1 (sure event): $0 \leq P(A) \leq 1$.

Answer: (C) $0 \leq P(A) \leq 1$

Q13 · SURFACE AREAS AND VOLUMES · 1 MARK

The total surface area of a solid hemisphere of radius 7 cm is:

- (A) $98\pi \text{ cm}^2$ (B) $147\pi \text{ cm}^2$
(C) $196\pi \text{ cm}^2$ (D) $228\frac{2}{3}\pi \text{ cm}^2$

SOLUTION

Total surface area of a solid hemisphere = $3\pi r^2 = 3\pi \times 49 = 147\pi \text{ cm}^2$.

Answer: (B) $147\pi \text{ cm}^2$

Q14 · AREAS RELATED TO CIRCLES · 1 MARK

The difference of the areas of a minor sector of angle 120° and its corresponding major sector of a circle of radius 21 cm, is:

- (A) 231 cm^2 (B) 462 cm^2
(C) 346.5 cm^2 (D) 693 cm^2

SOLUTION

Minor sector = $\frac{120}{360} \times \frac{22}{7} \times 21^2 = 462 \text{ cm}^2$. Major sector (angle 240°) = 924 cm^2 . Difference = $924 - 462 = 462 \text{ cm}^2$.

Answer: (B) 462 cm^2

Q15 · LINEAR EQUATIONS · 1 MARK

The graph of a pair of linear equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ in two variables x and y represents parallel lines, if:

- (A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
(C) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

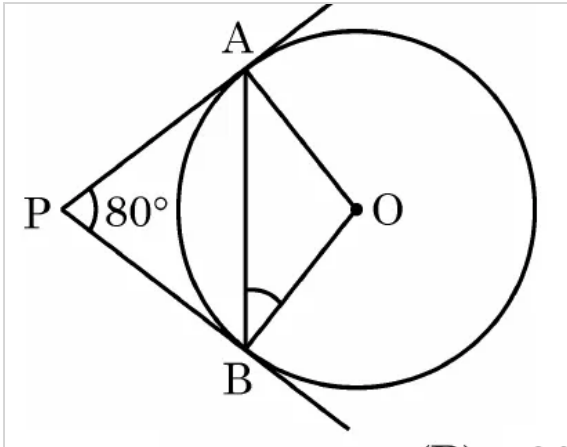
SOLUTION

Parallel lines never meet: the slopes are equal but the lines are different, so $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$. This is option (D).

Answer: (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Q16 · CIRCLES · 1 MARK

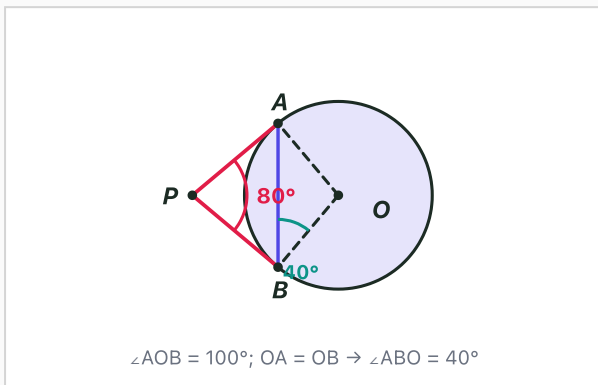
In the given figure, tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80° . $\angle ABO$ is equal to:



- (A) 40°
(C) 100°

- (B) 80°
(D) 50°

SOLUTION



$OA \perp PA$ and $OB \perp PB$, so $\angle AOB = 180^\circ - 80^\circ = 100^\circ$.

$OA = OB$, so $\triangle OAB$ is isosceles and $\angle ABO = \frac{180^\circ - 100^\circ}{2} = 40^\circ$.

Answer: (A) 40°

Q17 · CIRCLES · 1 MARK

A line intersecting a circle in two distinct points is called a:

- (A) secant
(C) diameter

- (B) chord
(D) tangent

SOLUTION

A line that cuts a circle at two distinct points is a secant. (A chord is the segment between the two points, and a tangent touches at only one point.)

Answer: (A) secant

Q18 · TRIGONOMETRY · 1 MARK

If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then the sun's elevation is:

- (A) 30° (B) 45°
(C) 60° (D) 90°

SOLUTION

$$\tan \theta = \frac{6}{2\sqrt{3}} = \sqrt{3}, \text{ so } \theta = 60^\circ.$$

Answer: (C) 60°

Q19 · TRIANGLES · 1 MARK

Assertion (A): A line drawn parallel to any one side of a triangle intersects the other sides in the same ratio.

Reason (R): Parallel lines cannot be drawn to any side of a triangle.

- (A) Both A and R are correct and R is the correct explanation of A (B) Both A and R are correct 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) This is the basic proportionality theorem (when the line meets the other two sides in distinct points). True.

(R) A line parallel to a side can obviously be drawn through any point of the triangle. False.

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

Q20 · COORDINATE GEOMETRY · 1 MARK

Assertion (A): The point $(0, 4)$ lies on y -axis.

Reason (R): The x -coordinate of a point, lying on y -axis, is zero.

- (A) Both A and R are correct and R is the correct explanation of A (B) Both A and R are correct 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) Every point of the y -axis has $x = 0$. True.

(A) $(0, 4)$ has $x = 0$, so it is on the y -axis. True, and (R) is exactly the reason.

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

Section B: Very short answer

5 questions, 2 marks each.

Q21 · REAL NUMBERS · 2 MARKS

Find the HCF of 84 and 144 by prime factorisation method.

SOLUTION

$$84 = 2 \times 2 \times 3 \times 7 \text{ and } 144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3.$$

$$\text{HCF} = \text{common primes at the smallest powers} = 2 \times 2 \times 3 = 12.$$

Answer: 12

Q22 · LINEAR EQUATIONS · 2 MARKS

(a) The sum of two natural numbers is 70 and their difference is 10. Find the natural numbers.

OR

(b) Solve for x and y : $x - 3y = 7$ and $3x - 3y = 5$.

SOLUTION

(a) $x + y = 70$ and $x - y = 10$. Adding, $2x = 80$, so $x = 40$ and $y = 30$.

(b) Subtracting the first from the second: $2x = -2$, so $x = -1$. Then $-1 - 3y = 7$ gives $y = -\frac{8}{3}$.

Answer: (a) 40 and 30 (b) $x = -1, y = -\frac{8}{3}$

Q23 · PROBABILITY · 2 MARKS

15 defective pens are accidentally mixed with 145 good ones. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

SOLUTION

Total pens = $145 + 15 = 160$. $P(\text{good}) = \frac{145}{160} = \frac{29}{32}$.

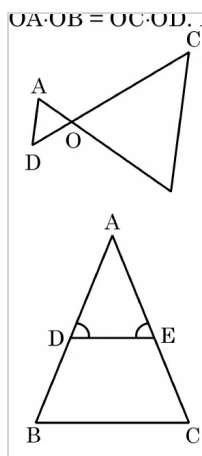
Answer: $\frac{29}{32}$

Q24 · TRIANGLES · 2 MARKS

(a) In the given figure, $OA \cdot OB = OC \cdot OD$. Prove that $\triangle AOD \sim \triangle COB$.

OR

(b) In the given figure, $\angle D = \angle E$ and $\frac{AD}{DB} = \frac{AE}{EC}$. Prove that $\triangle ABC$ is isosceles.



SOLUTION

(a) $OA \cdot OB = OC \cdot OD$ gives $\frac{OA}{OC} = \frac{OD}{OB}$. $\angle AOD = \angle COB$ (vertically opposite angles), and the including sides are proportional, so $\triangle AOD \sim \triangle COB$ by SAS.

(b) $\frac{AD}{DB} = \frac{AE}{EC}$ gives $DE \parallel BC$ (converse of the basic proportionality theorem). Then $\angle D = \angle B$ and $\angle E = \angle C$ (corresponding angles).

$\angle D = \angle E$ is given, so $\angle B = \angle C$, and the sides opposite equal angles are equal: $AB = AC$. $\triangle ABC$ is isosceles.

Answer: Proved (both parts)

Q25 · CIRCLES · 2 MARKS

Prove that the tangents drawn at the ends of a diameter of a circle are parallel to each other.

SOLUTION

Let AB be a diameter of the circle with centre O , and let the tangents at A and B be ℓ and m .

A radius is perpendicular to the tangent at the point of contact: $\angle OAl = 90^\circ$ and $\angle OBm = 90^\circ$. So the alternate interior angles made by the transversal AB with ℓ and m are equal (90° each), hence $\ell \parallel m$.

Answer: Proved

Section C: Short answer

6 questions, 3 marks each.

Q26 · PROBABILITY · 3 MARKS

Two dice are tossed simultaneously. Find the probability of getting (a) an even number on both the dice. (b) the sum of two numbers more than 9.

SOLUTION

There are 36 equally likely outcomes.

(a) Even on both: each die shows 2, 4 or 6, giving $3 \times 3 = 9$ outcomes. $P = \frac{9}{36} = \frac{1}{4}$.

(b) Sum more than 9: (4, 6), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6), which is 6. $P = \frac{6}{36} = \frac{1}{6}$.

Answer: (a) $\frac{1}{4}$ (b) $\frac{1}{6}$

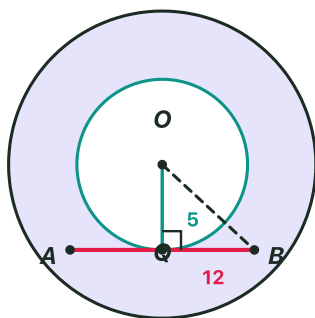
Q27 · CIRCLES · 3 MARKS

(a) In two concentric circles, a chord of length 24 cm of larger circle touches the smaller circle, whose radius is 5 cm. Find the radius of the larger circle.

OR

(b) Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.

SOLUTION



$$OB^2 = 5^2 + 12^2 = 169 \rightarrow R = 13 \text{ cm}$$

(a) The chord AB touches the smaller circle at Q , so $OQ \perp AB$ and $OQ = 5$. The perpendicular from the centre bisects the chord: $QB = 12$.

$OB^2 = OQ^2 + QB^2 = 25 + 144 = 169$, so the radius of the larger circle is $OB = 13 \text{ cm}$.

(b) Let PQ and PR be tangents from P to the circle with centre O . $OQ \perp PQ$ and $OR \perp PR$, so $\angle OQP = \angle ORP = 90^\circ$.

In the quadrilateral $OQPR$: $90^\circ + \angle QPR + 90^\circ + \angle QOR = 360^\circ$, so $\angle QPR + \angle QOR = 180^\circ$.

Answer: (a) 13 cm (b) proved

Q28 · REAL NUMBERS · 3 MARKS

Prove that $7 - 3\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number.

SOLUTION

Suppose $x = 7 - 3\sqrt{5}$ is rational. Then $\sqrt{5} = \frac{7-x}{3}$, which is rational.

This contradicts the given fact that $\sqrt{5}$ is irrational, so $7 - 3\sqrt{5}$ is irrational.

Answer: Proved

Q29 · POLYNOMIALS · 3 MARKS

(a) Zeroes of the quadratic polynomial $x^2 - 3x + 2$ are α and β . Construct a quadratic polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$.

OR

(b) Find the zeroes of the polynomial $4x^2 - 4x + 1$ and verify the relationship between the zeroes and the coefficients.

SOLUTION

(a) $\alpha + \beta = 3$ and $\alpha\beta = 2$. New sum $= 2(\alpha + \beta) + 2 = 8$. New product $= (2\alpha + 1)(2\beta + 1) = 4\alpha\beta + 2(\alpha + \beta) + 1 = 8 + 6 + 1 = 15$.

The polynomial is $x^2 - 8x + 15$ (or $k(x^2 - 8x + 15)$).

(b) $4x^2 - 4x + 1 = (2x - 1)^2$, so both zeroes are $\frac{1}{2}$. Sum $= 1 = -\frac{-4}{4} \checkmark$. Product $= \frac{1}{4} = \frac{1}{4} \checkmark$.

Answer: (a) $x^2 - 8x + 15$ (b) zeroes $\frac{1}{2}, \frac{1}{2}$; relations verified

Q30 · TRIGONOMETRY · 3 MARKS

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

SOLUTION

$$\text{LHS} = \frac{\sin^2 \theta}{\cos \theta (\sin \theta - \cos \theta)} + \frac{\cos^2 \theta}{\sin \theta (\cos \theta - \sin \theta)} = \frac{\sin^3 \theta - \cos^3 \theta}{\sin \theta \cos \theta (\sin \theta - \cos \theta)}.$$

$$\sin^3 \theta - \cos^3 \theta = (\sin \theta - \cos \theta)(1 + \sin \theta \cos \theta), \text{ so LHS} = \frac{1 + \sin \theta \cos \theta}{\sin \theta \cos \theta} = \sec \theta \operatorname{cosec} \theta + 1 = \text{RHS}.$$

Answer: Proved

Q31 · AREAS RELATED TO CIRCLES · 3 MARKS

A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120° . Find the area cleaned at each sweep of the blades.

SOLUTION

One wiper cleans a sector: $\frac{120}{360} \times \frac{22}{7} \times 21 \times 21 = 462 \text{ cm}^2$.

The two wipers do not overlap, so the area cleaned at each sweep is $2 \times 462 = 924 \text{ cm}^2$.

Answer: 924 cm^2

Section D: Long answer

4 questions, 5 marks each.

Q32 · QUADRATIC EQUATIONS · 5 MARKS

A cottage industry produces a certain number of toys in a day. The cost of production of each toy (in rupees) was found to be 55 minus the number of toys produced in a day. On a particular day, the total cost of production was ₹ 750. Find the total number of toys produced on that day.

SOLUTION

Let x toys be produced. The cost of each is $(55 - x)$, so the total is $x(55 - x) = 750$.

$$x^2 - 55x + 750 = 0, \text{ so } (x - 25)(x - 30) = 0 \text{ and } x = 25 \text{ or } x = 30.$$

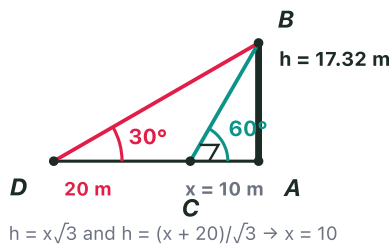
Both are valid (each cost, 30 or 25, is positive and the totals are $25 \times 30 = 750$). The industry made 25 or 30 toys that day.

Answer: 25 or 30 toys

Q33 · TRIGONOMETRY · 5 MARKS

A TV tower stands vertically on a bank of a canal. From a point on the other bank exactly opposite the tower, the angle of elevation of the top of the tower is 60° . From another point 20 m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the top of the tower is 30° . Find the height of the tower and the width of the canal. [Use $\sqrt{3} = 1.732$]

SOLUTION



Let the tower be $AB = h$, the nearer point C with $AC = x$ (the canal width), and the farther point D with $CD = 20$.

In $\triangle ABC$: $\tan 60^\circ = \frac{h}{x}$, so $h = x\sqrt{3}$. (i)

In $\triangle ABD$: $\tan 30^\circ = \frac{h}{x + 20} = \frac{1}{\sqrt{3}}$, so $\sqrt{3}h = x + 20$. (ii)

Substituting (i): $3x = x + 20$, so $x = 10$ m. $h = 10\sqrt{3} = 17.32$ m.

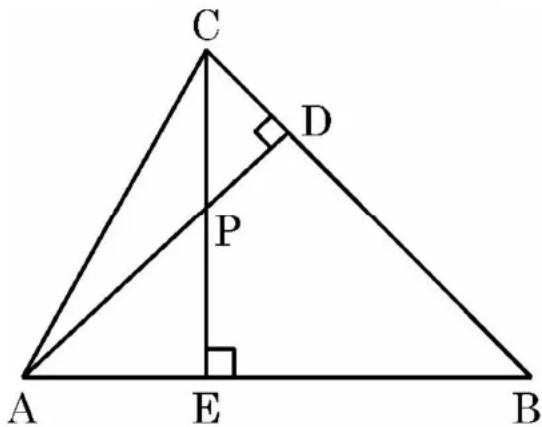
Answer: Height = 17.32 m; width of the canal = 10 m

Q34 · TRIANGLES · 5 MARKS

(a) In the given figure, altitudes CE and AD of $\triangle ABC$ intersect each other at the point P . Show that (i) $\triangle AEP \sim \triangle CDP$ (ii) $\triangle ABD \sim \triangle CBE$ (iii) $\triangle AEP \sim \triangle ADB$.

OR

(b) AD and PM are medians of triangles ABC and PQR , respectively, where $\triangle ABC \sim \triangle PQR$. Prove that $\frac{AB}{PQ} = \frac{AD}{PM}$.



SOLUTION

(a)(i) In $\triangle AEP$ and $\triangle CDP$: $\angle APE = \angle CPD$ (vertically opposite) and $\angle AEP = \angle CDP = 90^\circ$. By AA, $\triangle AEP \sim \triangle CDP$.

(ii) In $\triangle ABD$ and $\triangle CBE$: $\angle B$ is common and $\angle ADB = \angle CEB = 90^\circ$. By AA, $\triangle ABD \sim \triangle CBE$.

(iii) In $\triangle AEP$ and $\triangle ADB$: $\angle A$ is common and $\angle AEP = \angle ADB = 90^\circ$. By AA, $\triangle AEP \sim \triangle ADB$.

(b) $\triangle ABC \sim \triangle PQR$ gives $\frac{AB}{PQ} = \frac{BC}{QR}$ and $\angle B = \angle Q$. AD and PM are medians, so $BC = 2BD$ and $QR = 2QM$: $\frac{AB}{PQ} = \frac{2BD}{2QM} = \frac{BD}{QM}$.

In $\triangle ABD$ and $\triangle PQM$: $\frac{AB}{PQ} = \frac{BD}{QM}$ and $\angle B = \angle Q$. By SAS, $\triangle ABD \sim \triangle PQM$, so $\frac{AB}{PQ} = \frac{AD}{PM}$.

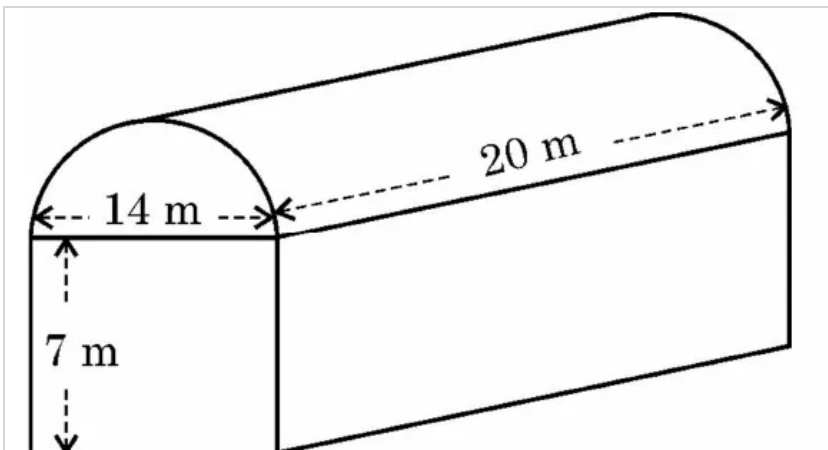
Answer: Proved (both parts)

Q35 · SURFACE AREAS AND VOLUMES · 5 MARKS

(a) A textile industry runs in a shed. This shed is in the shape of a cuboid surmounted by a half cylinder. If the base of the industry is of dimensions $14 \text{ m} \times 20 \text{ m}$ and the height of the cuboidal portion is 7 m , find the volume of air that the industry can hold. Further, suppose the machinery in the industry occupies a total space of 400 m^3 . Then, how much space is left in the industry?

OR

(b) From a solid cylinder of height 8 cm and radius 6 cm , a conical cavity of the same height and same radius is carved out. Find the total surface area of the remaining solid. (Take $\pi = 3.14$)



SOLUTION

(a) Cuboid: $20 \times 14 \times 7 = 1960 \text{ m}^3$. The half cylinder has radius $\frac{14}{2} = 7 \text{ m}$ and length 20 m : $\frac{1}{2} \pi r^2 h = \frac{1}{2} \times \frac{22}{7} \times 7^2 \times 20 = 1540 \text{ m}^3$.

Air the shed can hold = $1960 + 1540 = 3500 \text{ m}^3$. Space left after the machinery = $3500 - 400 = 3100 \text{ m}^3$.

(b) Slant height of the cone $l = \sqrt{6^2 + 8^2} = 10 \text{ cm}$. The remaining solid has the curved surface of the cylinder, the bottom base, and the curved surface of the cone cavity (the top face is removed entirely).

Surface area = $2\pi rh + \pi r^2 + \pi rl = \pi(2 \times 6 \times 8 + 36 + 6 \times 10) = \pi(96 + 36 + 60) = 192\pi = 192 \times 3.14 = 602.88 \text{ cm}^2$.

Answer: (a) 3500 m^3 of air; 3100 m^3 left (b) 602.88 cm^2

Section E: Case studies

3 case studies, 4 marks each.

Q36 · ARITHMETIC PROGRESSIONS · 4 MARKS

Case study 1. Saving money is a good habit and it should be inculcated in children right from the beginning. Rehan's mother brought a piggy bank for Rehan and puts one ₹ 5 coin of her savings in the piggy bank on the first day. She increases his savings by one ₹ 5 coin daily.

Based on the above information, answer the following questions:

- (i) How many coins were added to the piggy bank on 8th day? [1]
- (ii) How much money will be there in the piggy bank after 8 days? [1]
- (iii) (a) If the piggy bank can hold one hundred twenty ₹ 5 coins in all, find the number of days she can contribute to put ₹ 5 coins into it. [2]

OR

- (iii) (b) Find the total money saved, when the piggy bank is full. [2]

**SOLUTION**

The number of coins added each day is $1, 2, 3, \dots$, an A.P. with $a = 1$ and $d = 1$.

- (i) On the 8th day 8 coins are added.
- (ii) Coins after 8 days $= 1 + 2 + \dots + 8 = 36$, worth $36 \times 5 = ₹180$. (The money added each day is 5, 10, 15, ...)
- (iii)(a) $\frac{n}{2}[2(1) + (n-1)(1)] = 120$ gives $n^2 + n - 240 = 0$, so $(n+16)(n-15) = 0$ and $n = 15$ (the root -16 is rejected): 15 days.
- (iii)(b) The full bank holds 120 coins worth $120 \times 5 = ₹600$.

Answer: (i) 8 coins (ii) ₹ 180 (iii)(a) 15 days (iii)(b) ₹ 600

Q37 · STATISTICS · 4 MARKS

Case study 2. Heart Rate: The heart rate is one of the 'vital signs' of health in the human body. It measures the number of times per minute that the heart contracts or beats. While a normal heart rate does not guarantee that a person is free of health problems, it is a useful benchmark for identifying a range of health issues. Thirty women were examined by doctors of AIIMS and the number of heart beats per minute were recorded and summarized as follows:

Based on the above information, answer the following questions:

- (i) How many women are having heart beat in the range 68 – 77? [1]
 (ii) What is the median class of heart beats per minute for these women? [1]
 (iii) (a) Find the modal value of heart beats per minute for these women. [2]

OR

- (iii) (b) Find the median value of heart beats per minute for these women. [2]

Heart beats per minute	65–68	68–71	71–74	74–77	77–80	80–83	83–86
Number of women	2	4	3	8	7	4	2



SOLUTION

(i) The range 68 – 77 covers the classes 68 – 71, 71 – 74 and 74 – 77: $4 + 3 + 8 = 15$ women.

(ii) $N = 30$, $\frac{N}{2} = 15$. Cumulative frequencies: 2, 6, 9, 17, 24, 28, 30. The median class is 74 – 77.

(iii)(a) The modal class is 74 – 77 ($f_1 = 8$, $f_0 = 3$, $f_2 = 7$, $h = 3$): $\text{Mode} = 74 + \frac{8 - 3}{16 - 3 - 7} \times 3 = 74 + 2.5 = 76.5$.

(iii)(b) Median = $74 + \frac{15 - 9}{8} \times 3 = 74 + 2.25 = 76.25$.

Answer: (i) 15 (ii) 74 – 77 (iii)(a) 76.5 (iii)(b) 76.25

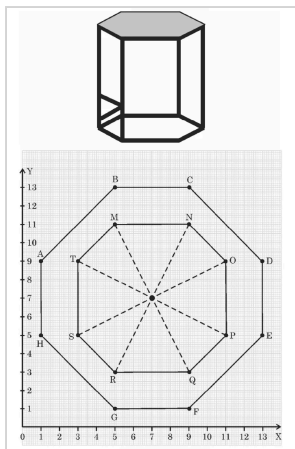
Q38 · COORDINATE GEOMETRY · 4 MARKS

Case study 3. The top of a table is hexagonal in shape. On the basis of the information given in the figure (a grid on which the points A to T are marked), answer the following questions:

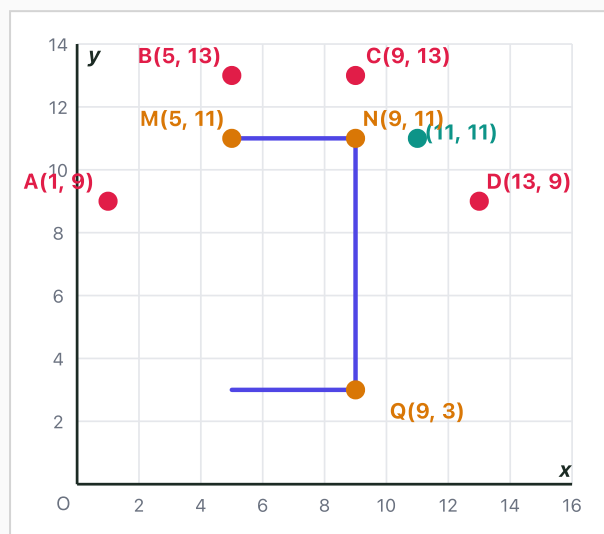
- (i) Write the coordinates of A and B. [1]
- (ii) Write the coordinates of the mid-point of line segment joining C and D. [1]
- (iii) (a) Find the distance between M and Q. [2]

OR

- (iii) (b) Find the coordinates of the point which divides the line segment joining M and N in the ratio 1 : 3 internally. [2]



SOLUTION



- (i) Reading the grid: $A = (1, 9)$ and $B = (5, 13)$.
- (ii) $C = (9, 13)$ and $D = (13, 9)$. The mid-point is $\left(\frac{9+13}{2}, \frac{13+9}{2}\right) = (11, 11)$.
- (iii)(a) $M = (5, 11)$ and $Q = (9, 3)$: $MQ = \sqrt{(9-5)^2 + (3-11)^2} = \sqrt{16+64} = \sqrt{80} = 4\sqrt{5}$ units.
- (iii)(b) $M = (5, 11)$ and $N = (9, 11)$. The point dividing MN in the ratio 1 : 3 is $\left(\frac{1 \times 9 + 3 \times 5}{4}, \frac{1 \times 11 + 3 \times 11}{4}\right) = (6, 11)$.

Answer: (i) $A(1, 9)$, $B(5, 13)$ (ii) $(11, 11)$ (iii)(a) $4\sqrt{5}$ (iii)(b) $(6, 11)$

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