

**Mathematics (Basic) 2024, Set 430/4/1**

Q.P. Code 430/4/1 · Series 14 · 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.

Free paper, 1-minute analysis and quiz: [cognicraftedu.com/cbse-class-10-papers/maths-basic/2024/430-4-1](https://cognicraftedu.com/cbse-class-10-papers/maths-basic/2024/430-4-1)

**Section A: Multiple choice**

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

**Q1 · COORDINATE GEOMETRY · 1 MARK**

The distance between the points  $(2, -1)$  and  $(-1, -5)$  is:

- (A) 15 units (B) 5 units  
(C) 25 units (D) 41 units

**SOLUTION**

$$d = \sqrt{(-1 - 2)^2 + (-5 + 1)^2} = \sqrt{9 + 16} = 5 \text{ units.}$$

**Answer: (B) 5 units**

**Q2 · COORDINATE GEOMETRY · 1 MARK**

If  $C(1, -1)$  is the mid-point of the line segment  $AB$  joining points  $A(4, x)$  and  $B(-2, 4)$ , then value of  $x$  is:

- (A) 5 (B) -5  
(C) 6 (D) -6

**SOLUTION**

The  $y$ -coordinate of the mid-point:  $\frac{x + 4}{2} = -1$ , so  $x + 4 = -2$  and  $x = -6$ . (Check the  $x$ -coordinate:  $\frac{4 - 2}{2} = 1$  ✓.)

**Answer: (D) -6**

**Q3 · PROBABILITY · 1 MARK**

Which of the following relationship is correct?

- (A)  $P(E) = 1 + P(\bar{E})$  (B)  $P(\bar{E}) - P(E) = 1$   
(C)  $P(E) + P(\bar{E}) = 1$  (D)  $P(E) = 2P(\bar{E})$

**SOLUTION**

An event and its complement together make the whole sample space:  $P(E) + P(\bar{E}) = 1$ .

**Answer: (C)  $P(E) + P(\bar{E}) = 1$**

**Q4 · STATISTICS · 1 MARK**

The following distribution gives the daily income of 50 workers of a factory. The lower limit of the modal class is:

| Income (in ₹)     | 400–424 | 425–449 | 450–474 | 475–499 | 500–524 |
|-------------------|---------|---------|---------|---------|---------|
| Number of workers | 12      | 14      | 8       | 6       | 10      |

- (A) 425 (B) 449  
(C) 424.5 (D) 425.5

**SOLUTION**

The highest frequency is 14, so the modal class is 425 – 449.

The classes have gaps (424 then 425), so they are first made continuous by subtracting 0.5 from each lower limit and adding 0.5 to each upper limit: the class becomes 424.5 – 449.5. The lower limit is 424.5.

**Answer: (C) 424.5**

**Q5 · TRIGONOMETRY · 1 MARK**

A lamp post 9 m high casts a shadow  $3\sqrt{3}$  m long on the ground. The Sun's elevation at this moment is:

- (A)  $60^\circ$  (B)  $90^\circ$   
(C)  $45^\circ$  (D)  $30^\circ$

**SOLUTION**

$$\tan \theta = \frac{9}{3\sqrt{3}} = \sqrt{3}, \text{ so } \theta = 60^\circ.$$

**Answer: (A)  $60^\circ$**

**Q6 · POLYNOMIALS · 1 MARK**

If one zero of a quadratic polynomial  $kx^2 + 4x + k$  is 1, then the value of  $k$  is:

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

**SOLUTION**

$$k(1)^2 + 4(1) + k = 0 \text{ gives } 2k + 4 = 0, \text{ so } k = -2.$$

**Answer: (B) -2**

**Q7 · POLYNOMIALS · 1 MARK**

The number of quadratic polynomials having zeroes -1 and 3 is:

- (A) 1 (B) 2  
(C) 3 (D) more than 3

**SOLUTION**

$k(x + 1)(x - 3)$  has these zeroes for every non-zero constant  $k$ , so there are infinitely many.

**Answer: (D) more than 3**

**Q8 · QUADRATIC EQUATIONS · 1 MARK**

The roots of the quadratic equation  $x^2 - 4 = 0$  is/are:

- (A) 2 only (B) -2, 2  
(C) 4 only (D) -4, 4

**SOLUTION**

$x^2 = 4$  gives  $x = 2$  or  $x = -2$ .

**Answer: (B) -2, 2**

**Q9 · QUADRATIC EQUATIONS · 1 MARK**

Which of the following is **not** a quadratic equation?

- (A)  $(x - 2)^2 + 1 = 2x - 3$  (B)  $(2x - 1)(x - 3) = (x + 5)(x - 1)$   
(C)  $x(x + 1) + 8 = (x + 2)(x - 2)$  (D)  $2x + \frac{3}{x} = 5$

**SOLUTION**

(A)  $x^2 - 4x + 5 = 2x - 3$  gives  $x^2 - 6x + 8 = 0$ : quadratic. (B)  $2x^2 - 7x + 3 = x^2 + 4x - 5$  gives  $x^2 - 11x + 8 = 0$ : quadratic. (D) multiplying by  $x$  gives  $2x^2 - 5x + 3 = 0$ : quadratic.

(C)  $x^2 + x + 8 = x^2 - 4$  gives  $x + 12 = 0$ , which is linear. So (C) is not quadratic.

**Answer: (C)  $x(x + 1) + 8 = (x + 2)(x - 2)$**

**Q10 · ARITHMETIC PROGRESSIONS · 1 MARK**

The common difference of an A.P., if  $a_{23} - a_{19} = 32$ , is:

- (A) 8 (B) -8  
(C) -4 (D) 4

**SOLUTION**

$a_{23} - a_{19} = (23 - 19)d = 4d = 32$ , so  $d = 8$ .

**Answer: (A) 8**

**Q11 · TRIGONOMETRY · 1 MARK**

$\left( \frac{1}{\tan^2 \theta} - \frac{1}{\sin^2 \theta} \right)$  is equal to:

- (A) 1 (B) -1  
(C)  $\sec^2 \theta$  (D)  $\sin^2 \theta$

**SOLUTION**

$\frac{1}{\tan^2 \theta} = \cot^2 \theta$  and  $\frac{1}{\sin^2 \theta} = \operatorname{cosec}^2 \theta$ , so the value is  $\cot^2 \theta - \operatorname{cosec}^2 \theta = -1$ .

**Answer: (B) -1**

**Q12 · AREAS RELATED TO CIRCLES · 1 MARK**

The region between a chord and either of the two arcs of a circle is called:

- (A) an arc (B) a sector  
(C) a segment (D) a semicircle

**SOLUTION**

The region cut off by a chord, between the chord and an arc, is a segment (a sector is bounded by two radii and an arc).

**Answer: (C) a segment**

**Q13 · REAL NUMBERS · 1 MARK**

If  $1080 = 2^x \times 3^y \times 5$ , then  $(x - y)$  is equal to:

- (A) 6 (B) -1  
(C) 1 (D) 0

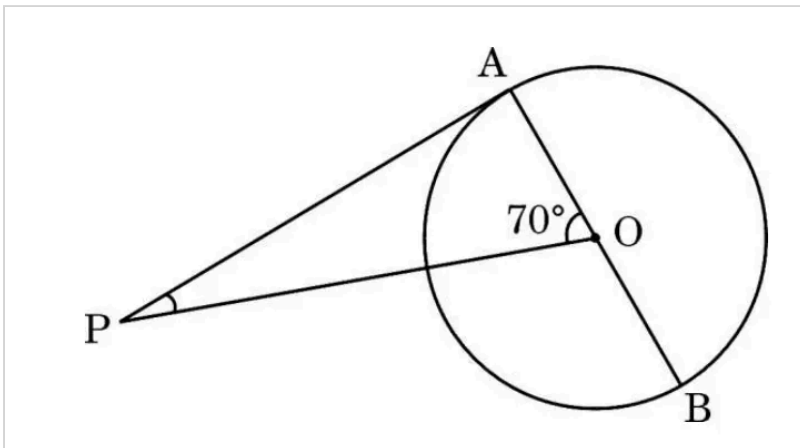
**SOLUTION**

$1080 = 2^3 \times 3^3 \times 5$ , so  $x = 3$  and  $y = 3$ .  $x - y = 0$ .

**Answer: (D) 0**

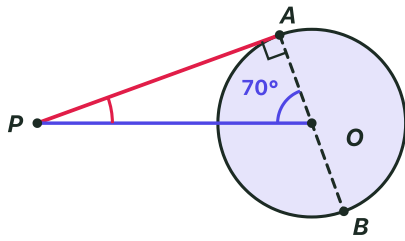
**Q14 · CIRCLES · 1 MARK**

In the given figure,  $PA$  is a tangent from an external point  $P$  to a circle with centre  $O$ . If  $\angle AOP = 70^\circ$ , then the measure of  $\angle APO$  is:



- (A)  $70^\circ$  (B)  $90^\circ$   
(C)  $110^\circ$  (D)  $20^\circ$

**SOLUTION**



$$\angle OAP = 90^\circ \rightarrow \angle APO = 180^\circ - 90^\circ - 70^\circ = 20^\circ$$

$OA \perp PA$  (radius and tangent), so in the right triangle  $OAP$ :  $\angle APO = 180^\circ - 90^\circ - 70^\circ = 20^\circ$ .

**Answer: (D)  $20^\circ$**

#### Q15 · STATISTICS · 1 MARK

The median group in the following frequency distribution is:

| Class     | 0–10 | 10–20 | 20–30 | 30–40 | 40–50 | 50–60 |
|-----------|------|-------|-------|-------|-------|-------|
| Frequency | 5    | 8     | 20    | 15    | 7     | 5     |

(A) 10 – 20

(B) 20 – 30

(C) 30 – 40

(D) 40 – 50

#### SOLUTION

$N = 60$  and  $\frac{N}{2} = 30$ . Cumulative frequencies: 5, 13, 33, ... The first one to reach 30 is 33, in the class 20 – 30.

**Answer: (B) 20 – 30**

#### Q16 · AREAS RELATED TO CIRCLES · 1 MARK

In a circle of radius 21 cm, if an arc subtends an angle of  $60^\circ$  at the centre of the circle, then the length of the arc is:

(A) 11 cm

(B) 44 cm

(C)  $\frac{22}{7}$  cm

(D) 22 cm

#### SOLUTION

$$\text{Arc} = \frac{60}{360} \times 2 \times \frac{22}{7} \times 21 = 22 \text{ cm.}$$

**Answer: (D) 22 cm**

#### Q17 · CIRCLES · 1 MARK

A tangent to a circle is a line that touches the circle at:

(A) one point only

(B) two points

(C) three points

(D) infinite number of points

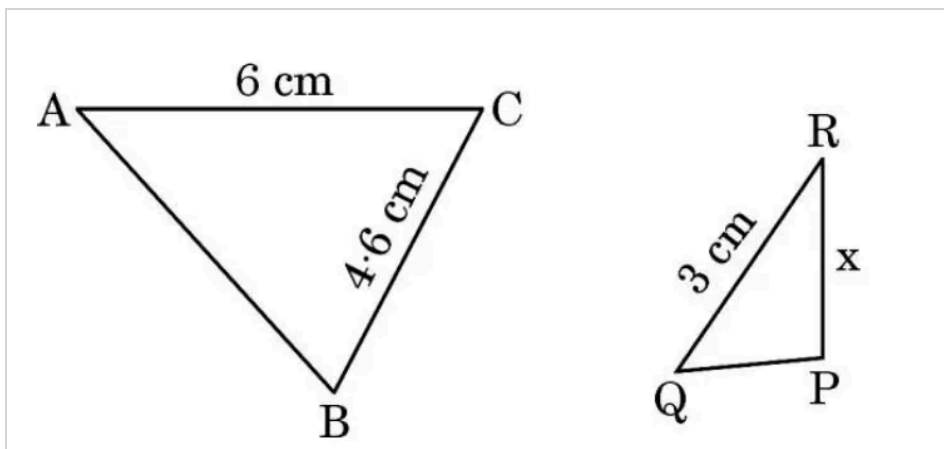
#### SOLUTION

By definition, a tangent meets the circle at exactly one point.

**Answer: (A) one point only**

**Q18 · TRIANGLES · 1 MARK**

In the given figure, if  $\triangle ABC \sim \triangle QPR$ , then the value of  $x$  is:



- (A) 5.3 cm                      (B) 4.6 cm  
(C) 2.3 cm                      (D) 4 cm

**SOLUTION**

$\triangle ABC \sim \triangle QPR$  matches  $A \leftrightarrow Q, B \leftrightarrow P, C \leftrightarrow R$ . So  $AC \leftrightarrow QR$  and  $BC \leftrightarrow PR$ .

$$\frac{AC}{QR} = \frac{BC}{PR}: \frac{6}{3} = \frac{4.6}{x}, \text{ so } x = 2.3 \text{ cm.}$$

**Answer: (C) 2.3 cm**

**Q19 · LINEAR EQUATIONS · 1 MARK**

Assertion (A): The pair of linear equations  $5x + 2y + 6 = 0$  and  $7x + 6y + 18 = 0$  have infinitely many solutions.

Reason (R): The pair of linear equations  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  have infinitely many solutions, if

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}.$$

- (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) This is the condition for coincident lines. True.

(A)  $\frac{5}{7}, \frac{2}{6} = \frac{1}{3}$  and  $\frac{6}{18} = \frac{1}{3}$ : the first ratio is different, so the lines meet at one point. A has a unique solution, not infinitely many. False.

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

**Q20 · PROBABILITY · 1 MARK**

Assertion (A): The probability of getting number 8 on rolling a die is zero (0).

Reason (R): The probability of an impossible event is zero (0).

- (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) An impossible event has no favourable outcomes, so its probability is 0. True.

(A) A die has no face with 8, so it is an impossible event and  $P = 0$ . True, and (R) is exactly why.

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

## Section B: Very short answer

5 questions, 2 marks each.

### Q21 · REAL NUMBERS · 2 MARKS

Given that  $\text{HCF}(306, 1314) = 18$ , find  $\text{LCM}(306, 1314)$ .

#### SOLUTION

$$\text{HCF} \times \text{LCM} = \text{product of the numbers: } \text{LCM} = \frac{306 \times 1314}{18} = 17 \times 1314 = 22338.$$

**Answer: 22,338**

### Q22 · CIRCLES · 2 MARKS

$XY$  and  $PQ$  are two tangents drawn at the end points of the diameter  $AB$  of a circle. Prove that  $XY \parallel PQ$ .

#### SOLUTION

Let  $O$  be the centre;  $XY$  touches the circle at  $A$  and  $PQ$  at  $B$ . A tangent is perpendicular to the radius at the point of contact:  $\angle OAY = 90^\circ$  and  $\angle OBP = 90^\circ$ .

These are alternate interior angles made by the transversal  $AB$  with  $XY$  and  $PQ$ , and they are equal. So  $XY \parallel PQ$ .

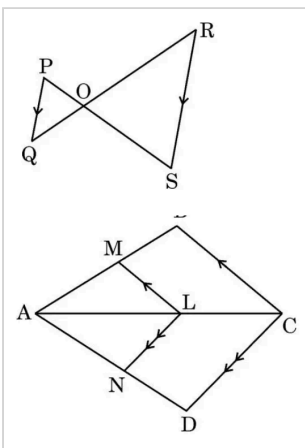
**Answer: Proved**

### Q23 · TRIANGLES · 2 MARKS

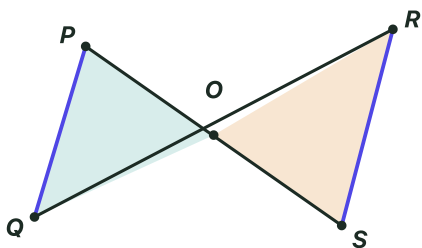
(a) In the given figure,  $PQ \parallel RS$ . Prove that  $OP \times OR = OQ \times OS$ .

OR

(b) In the given figure,  $LM \parallel CB$  and  $LN \parallel CD$ . Prove that  $\frac{AM}{AN} = \frac{AB}{AD}$ .



#### SOLUTION



$\triangle POQ \sim \triangle SOR$  (AA)  $\rightarrow OP/OS = OQ/OR \rightarrow OP \times OR = OQ \times OS$   
Sketch, not to scale.

(a) In  $\triangle POQ$  and  $\triangle SOR$ :  $\angle POQ = \angle SOR$  (vertically opposite) and  $\angle OPQ = \angle OSR$  (alternate angles,  $PQ \parallel SR$ ). By AA,  $\triangle POQ \sim \triangle SOR$ .

So  $\frac{OP}{OS} = \frac{OQ}{OR}$ , that is  $OP \times OR = OQ \times OS$ .

(b) In  $\triangle ABC$ ,  $LM \parallel CB$ , so  $\frac{AM}{AB} = \frac{AL}{AC}$ . (i) In  $\triangle ADC$ ,  $LN \parallel CD$ , so  $\frac{AN}{AD} = \frac{AL}{AC}$ . (ii)

From (i) and (ii):  $\frac{AM}{AB} = \frac{AN}{AD}$ , hence  $\frac{AM}{AN} = \frac{AB}{AD}$ .

**Answer: Proved (both parts)**

#### Q24 · POLYNOMIALS · 2 MARKS

(a) If  $\alpha, \beta$  are zeroes of the polynomial  $8x^2 + 14x + 3$ , then find the value of  $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ .

OR

(b) Find a quadratic polynomial whose zeroes are  $-9$  and  $6$ .

#### SOLUTION

(a)  $\alpha + \beta = -\frac{14}{8} = -\frac{7}{4}$  and  $\alpha\beta = \frac{3}{8}$ .  $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{-7/4}{3/8} = -\frac{14}{3}$ .

(b) Sum  $= -9 + 6 = -3$  and product  $= -54$ . The polynomial is  $x^2 + 3x - 54$  (or  $k(x^2 + 3x - 54)$ ).

**Answer: (a)  $-\frac{14}{3}$  (b)  $x^2 + 3x - 54$**

#### Q25 · TRIGONOMETRY · 2 MARKS

Evaluate:  $\sin 30^\circ \cos 60^\circ + \cos 30^\circ \sin 60^\circ - \cot 45^\circ$ .

#### SOLUTION

$$\frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} - 1 = \frac{1}{4} + \frac{3}{4} - 1 = 0.$$

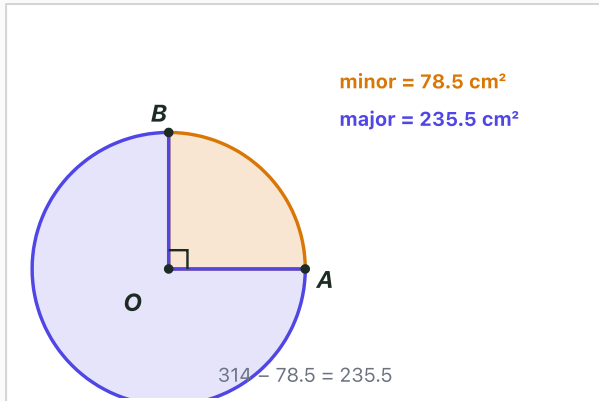
**Answer: 0**

## Section C: Short answer

6 questions, 3 marks each.

**Q26 · AREAS RELATED TO CIRCLES · 3 MARKS**

A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding (i) minor sector (ii) major sector. (Use  $\pi = 3.14$ )

**SOLUTION**

(i) Minor sector =  $\frac{90}{360} \times 3.14 \times 10 \times 10 = 78.5 \text{ cm}^2$ .

(ii) Area of the circle =  $3.14 \times 100 = 314 \text{ cm}^2$ . Major sector =  $314 - 78.5 = 235.5 \text{ cm}^2$ .

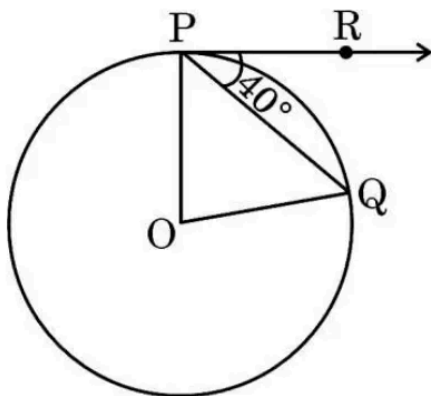
**Answer: (i) 78.5 cm<sup>2</sup> (ii) 235.5 cm<sup>2</sup>**

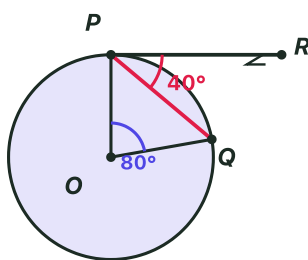
**Q27 · CIRCLES · 3 MARKS**

(a) Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

OR

(b) If  $O$  is the centre of a circle,  $PQ$  is a chord and the tangent  $PR$  at  $P$  makes an angle of  $40^\circ$  with  $PQ$ , then find the measure of  $\angle POQ$ .

**SOLUTION**



$$\angle OPQ = 90^\circ - 40^\circ = 50^\circ = \angle OQP \rightarrow \angle POQ = 80^\circ$$

(a) Let  $ABCD$  circumscribe a circle with centre  $O$ , touching  $AB, BC, CD, DA$  at  $P, Q, R, S$ . In  $\triangle AOP$  and  $\triangle AOS$ :  $OA$  is common,  $OP = OS$  (radii) and  $AP = AS$  (tangents), so they are congruent (SSS) and  $\angle AOP = \angle AOS$ . In the same way at  $B, C$  and  $D$ .

The eight angles at  $O$  add up to  $360^\circ$  and they come in four equal pairs:  $2(\angle AOP + \angle BOP + \angle COQ + \angle DOR) = 360^\circ$ . So  $\angle AOB + \angle COD = 180^\circ$ , and likewise  $\angle BOC + \angle AOD = 180^\circ$ .

(b)  $OP \perp PR$ , so  $\angle OPQ = 90^\circ - 40^\circ = 50^\circ$ .  $OP = OQ$  (radii), so  $\angle OQP = 50^\circ$ .

In  $\triangle POQ$ :  $\angle POQ = 180^\circ - 50^\circ - 50^\circ = 80^\circ$ .

**Answer: (a) proved (b)  $80^\circ$**

#### Q28 · QUADRATIC EQUATIONS · 3 MARKS

(a) Using quadratic formula, find the real roots of the equation  $2x^2 + 2x + 9 = 0$ , if they exist.

OR

(b) Find the values of ' $k$ ' for which the quadratic equation  $kx^2 - 2kx + 6 = 0$  has real and equal roots. Also, find the roots.

#### SOLUTION

(a)  $D = 2^2 - 4(2)(9) = 4 - 72 = -68 < 0$ , so the equation has no real roots.

(b) Equal roots need  $D = 4k^2 - 24k = 4k(k - 6) = 0$ , so  $k = 0$  or  $k = 6$ . For  $k = 0$  the equation is  $6 = 0$ , not a quadratic, so  $k = 6$ .

Then  $6x^2 - 12x + 6 = 0$ , that is  $x^2 - 2x + 1 = (x - 1)^2 = 0$  and the root is  $x = 1$  (twice).

**Answer: (a) no real roots (b)  $k = 6$ ; roots 1, 1**

#### Q29 · PROBABILITY · 3 MARKS

One card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is:

(i) a red king. (ii) not a black card. (iii) an ace of hearts.

#### SOLUTION

(i) There are 2 red kings:  $P = \frac{2}{52} = \frac{1}{26}$ .

(ii) Not black means red: 26 cards.  $P = \frac{26}{52} = \frac{1}{2}$ .

(iii) There is one ace of hearts:  $P = \frac{1}{52}$ .

**Answer: (i)  $\frac{1}{26}$  (ii)  $\frac{1}{2}$  (iii)  $\frac{1}{52}$**

**Q30 · REAL NUMBERS · 3 MARKS**

Prove that  $2 + 5\sqrt{3}$  is an irrational number, if it is given that  $\sqrt{3}$  is an irrational number.

**SOLUTION**

Suppose  $x = 2 + 5\sqrt{3}$  is rational. Then  $\sqrt{3} = \frac{x-2}{5}$ , which is rational.

This contradicts the given fact that  $\sqrt{3}$  is irrational, so  $2 + 5\sqrt{3}$  is irrational.

**Answer: Proved**

**Q31 · TRIGONOMETRY · 3 MARKS**

Prove that:  $(\tan A + \sec A)^2 + (\tan A - \sec A)^2 = 2 \left( \frac{1 + \sin^2 A}{1 - \sin^2 A} \right)$ .

**SOLUTION**

$$\text{LHS} = \tan^2 A + 2 \tan A \sec A + \sec^2 A + \tan^2 A - 2 \tan A \sec A + \sec^2 A = 2 \tan^2 A + 2 \sec^2 A.$$

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

**Answer: Proved**

## Section D: Long answer

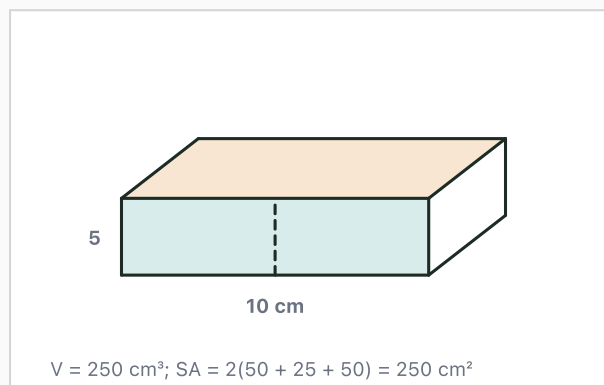
4 questions, 5 marks each.

**Q32 · SURFACE AREAS AND VOLUMES · 5 MARKS**

(a) Two cubes each of volume  $125 \text{ cm}^3$  are joined end to end. Find the volume and the surface area of the resulting cuboid.

OR

(b) A solid is in the shape of a cone surmounted on a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.

**SOLUTION**

(a) Each cube has side  $\sqrt[3]{125} = 5 \text{ cm}$ . The cuboid is  $10 \times 5 \times 5 \text{ cm}$ . Volume  $= 2 \times 125 = 250 \text{ cm}^3$ .

Surface area  $= 2(lb + bh + hl) = 2(10 \times 5 + 5 \times 5 + 5 \times 10) = 2 \times 125 = 250 \text{ cm}^2$ .

(b)  $r = \frac{7}{2} \text{ cm}$  and the cone height  $h = \frac{7}{2} \text{ cm}$ . Volume  $= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h = \pi r^3$  (since  $h = r$ ).

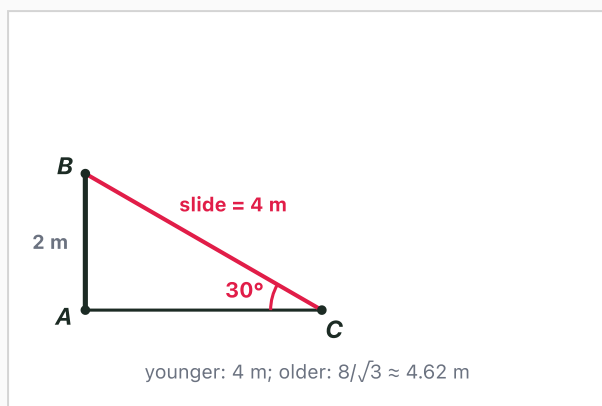
$$= \frac{22}{7} \times \frac{343}{8} = \frac{539}{4} = 134.75 \text{ cm}^3.$$

**Answer: (a)  $250 \text{ cm}^3$  and  $250 \text{ cm}^2$  (b)  $\frac{539}{4} = 134.75 \text{ cm}^3$**

**Q33 · TRIGONOMETRY · 5 MARKS**

A contractor plans to install two slides for the children to play in a park. For the children below the age of 6 years, he prefers to have a slide whose top is at a height of 2.0 m and is inclined at an angle of  $30^\circ$  to the ground, whereas for older children, he wants to have a steep slide at a height of 4.0 m and inclined at an angle of  $60^\circ$  to the ground. What would be the length of the slide in each case?

**SOLUTION**



Younger children: in the right triangle with height 2 m and angle  $30^\circ$ :  $\sin 30^\circ = \frac{2}{AC} = \frac{1}{2}$ , so  $AC = 4$  m.

Older children: height 4 m and angle  $60^\circ$ :  $\sin 60^\circ = \frac{4}{PR} = \frac{\sqrt{3}}{2}$ , so  $PR = \frac{8}{\sqrt{3}} = \frac{8\sqrt{3}}{3} \approx 4.62$  m.

**Answer: 4 m and  $\frac{8\sqrt{3}}{3} \approx 4.62$  m**

**Q34 · TRIANGLES · 5 MARKS**

(a) If  $BD$  and  $QM$  are medians of triangles  $ABC$  and  $PQR$ , respectively, where  $\triangle ABC \sim \triangle PQR$ , prove that  $\frac{AB}{PQ} = \frac{BD}{QM}$ .

OR

(b)  $CD$  and  $GH$  are respectively the bisectors of  $\angle ACB$  and  $\angle FGE$  such that  $D$  and  $H$  lie on sides  $AB$  and  $FE$  of  $\triangle ABC$  and  $\triangle FEG$  respectively. If  $\triangle ABC \sim \triangle FEG$ , show that: (i)  $\frac{CD}{GH} = \frac{AC}{FG}$  (ii)  $\triangle DCB \sim \triangle HGE$ .

**SOLUTION**

(a)  $\triangle ABC \sim \triangle PQR$  gives  $\frac{AB}{PQ} = \frac{AC}{PR}$  and  $\angle A = \angle P$ .  $BD$  and  $QM$  are medians, so  $AC = 2AD$  and  $PR = 2PM$ :  $\frac{AB}{PQ} = \frac{AD}{PM}$ .

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

(b)(i)  $\triangle ABC \sim \triangle FEG$  gives  $\angle ACB = \angle FGE$ , and halving,  $\angle 1 = \angle 3$  and  $\angle 2 = \angle 4$  (the bisected halves). Also  $\angle A = \angle F$ . In  $\triangle ACD$  and  $\triangle FGH$ :  $\angle A = \angle F$  and  $\angle 1 = \angle 3$ , so  $\triangle ACD \sim \triangle FGH$  (AA) and  $\frac{CD}{GH} = \frac{AC}{FG}$ .

(ii) In  $\triangle DCB$  and  $\triangle HGE$ :  $\angle B = \angle E$  (from the similarity) and  $\angle 2 = \angle 4$ . By AA,  $\triangle DCB \sim \triangle HGE$ .

**Answer: Proved (both parts)**

**Q35 · ARITHMETIC PROGRESSIONS · 5 MARKS**

A manufacturer of TV sets produced 720 TV sets in the fourth year and 880 TV sets in the eighth year. Assuming that the production increases uniformly by a fixed number every year, find the production in the tenth year and the total production in the first seven years.

**SOLUTION**

Let the first year's production be  $a$  and the yearly increase  $d$ .  $a_4 = a + 3d = 720$  (i) and  $a_8 = a + 7d = 880$  (ii).

(ii) – (i):  $4d = 160$ , so  $d = 40$  and  $a = 600$ .

Production in the 10<sup>th</sup> year =  $a_{10} = 600 + 9 \times 40 = 960$ .

Total in the first 7 years =  $S_7 = \frac{7}{2}[2(600) + 6(40)] = \frac{7}{2} \times 1440 = 5040$ .

**Answer: 960 TV sets in the 10<sup>th</sup> year; 5040 in the first 7 years**

**Section E: Case studies**

3 case studies, 4 marks each.

**Q36 · STATISTICS · 4 MARKS**

Case study 1. Mutual Fund: A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds or other securities. Net Asset Value (NAV) represents a fund's per share market value. The following table shows the Net Asset Value (NAV) per unit of mutual fund of ICICI mutual funds:

Based on the above information, answer the following questions:

- (i) What is the upper limit of modal class of the data? [1]  
 (ii) What is the median class of the data? [1]  
 (iii) (a) What is the mode NAV of mutual funds? [2]

OR

- (iii) (b) What is the median NAV of mutual funds? [2]

| NAV (in ₹)             | 0–5 | 5–10 | 10–15 | 15–20 | 20–25 |
|------------------------|-----|------|-------|-------|-------|
| Number of mutual funds | 13  | 16   | 22    | 18    | 11    |

**SOLUTION**

(i) The highest frequency is 22, so the modal class is 10 – 15 and its upper limit is 15.

(ii)  $N = 80$  and  $\frac{N}{2} = 40$ . Cumulative frequencies: 13, 29, 51, 69, 80. The median class is 10 – 15.

(iii)(a)  $l = 10$ ,  $f_1 = 22$ ,  $f_0 = 16$ ,  $f_2 = 18$ ,  $h = 5$ . Mode =  $10 + \frac{22 - 16}{44 - 16 - 18} \times 5 = 10 + \frac{6}{10} \times 5 = 13$ .

(iii)(b) Median =  $l + \frac{\frac{N}{2} - cf}{f} \times h = 10 + \frac{40 - 29}{22} \times 5 = 10 + 2.5 = 12.5$ .

**Answer: (i) 15    (ii) 10 – 15    (iii)(a) 13    (iii)(b) 12.5**

**Q37 · COORDINATE GEOMETRY · 4 MARKS**

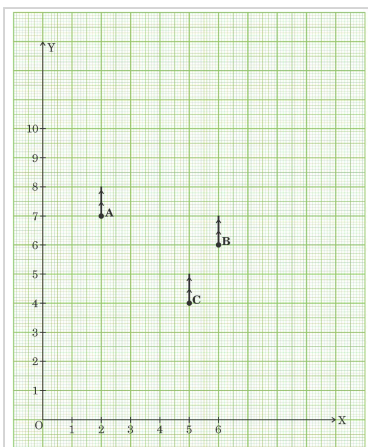
Case study 2. Resident Welfare Association (RWA) of Gulmohar Society in Delhi, have installed three electric poles A, B and C in the society's common park. Despite these three poles, some parts of the park are still in the dark. So, RWA decides to have one more electric pole D in the park. The park can be modelled as a coordinate system given below.

On the basis of the above information, answer the following questions:

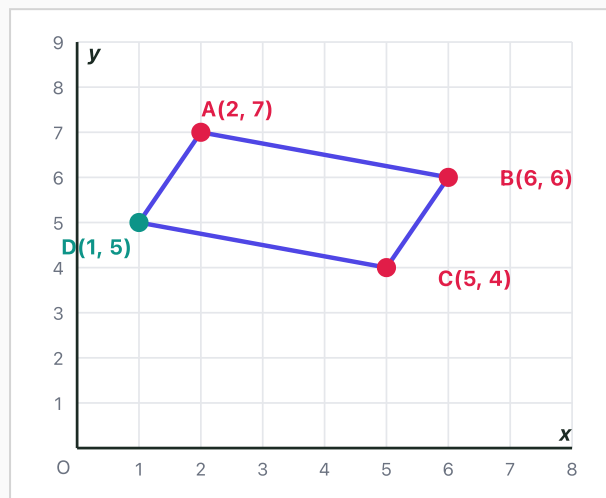
- (i) What is the position of the pole C? [1]
- (ii) What is the distance of the pole B from the corner O of the park? [1]
- (iii) (a) Find the position of the fourth pole D so that the four points A, B, C and D form a parallelogram ABCD. [2]

OR

- (iii) (b) Find the distance between poles A and C. [2]



**SOLUTION**



- (i) Reading the grid,  $C = (5, 4)$ .
- (ii)  $B = (6, 6)$ , so  $BO = \sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$  units.
- (iii)(a)  $A(2, 7)$ ,  $B(6, 6)$ ,  $C(5, 4)$ . In the parallelogram  $ABCD$  the diagonals bisect each other: the mid-point of  $AC$  equals the mid-point of  $BD$ .  $\left(\frac{2+5}{2}, \frac{7+4}{2}\right) = \left(\frac{6+x}{2}, \frac{6+y}{2}\right)$ , so  $x = 1$  and  $y = 5$ .  $D = (1, 5)$ .
- (iii)(b)  $AC = \sqrt{(5-2)^2 + (4-7)^2} = \sqrt{9+9} = 3\sqrt{2}$  units.

**Answer:** (i)  $(5, 4)$  (ii)  $6\sqrt{2}$  (iii)(a)  $D(1, 5)$  (iii)(b)  $3\sqrt{2}$

**Q38 · LINEAR EQUATIONS · 4 MARKS**

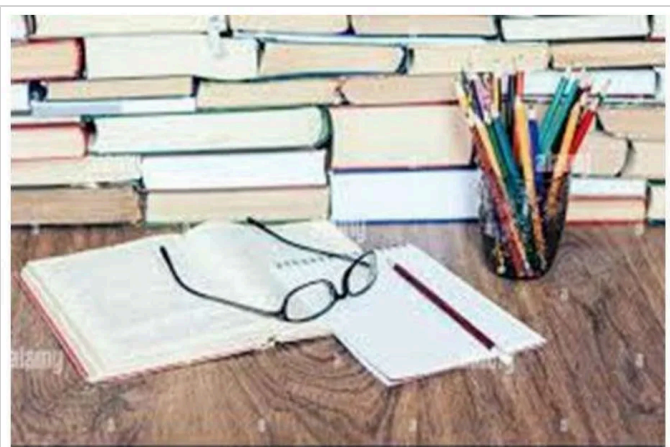
Case study 3. Deepankar bought 3 notebooks and 2 pens for ₹ 80 and his friend Suryansh bought 4 notebooks and 3 pens for ₹ 110 from the school bookshop.

Based on the above information, answer the following questions:

- (i) If the price of one notebook be ₹  $x$  and the price of one pen be ₹  $y$ , write the given situation algebraically. [1]  
(ii) (a) What is the price of one notebook? [2]

OR

- (ii) (b) What is the price of one pen? [2]  
(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens? [1]



**SOLUTION**

(i)  $3x + 2y = 80$  and  $4x + 3y = 110$ .

(ii) Multiply the first by 3 and the second by 2:  $9x + 6y = 240$  and  $8x + 6y = 220$ . Subtracting,  $x = 20$ . Then  $2y = 80 - 60 = 20$  and  $y = 10$ .

(a) A notebook costs ₹ 20. (b) A pen costs ₹ 10.

(iii)  $6 \times 20 + 3 \times 10 = 120 + 30 = ₹150$ .

**Answer:** (i)  $3x + 2y = 80$ ,  $4x + 3y = 110$  (ii)(a) ₹ 20 (ii)(b) ₹ 10 (iii) ₹ 150

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**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/2024/430-4-1](https://cognicraftedu.com/cbse-class-10-papers/maths-basic/2024/430-4-1)

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