CBSE EXAMINATION PAPER- 2024
MATHEMATICS BASIC (THEORY)
Class-10th
(Solved)
(Delhi & Outside Delhi Sets)

Maximum Marks: 80
Time allowed: Three hours

General Instructions:
Read the following instructions carefully and follow them:

1. *This question paper contains* ***38*** *questions.* ***All*** *questions are compulsory.*
2. *Question paper is divided into* ***FIVE*** *sections -* ***SECTION A, B, C, D*** *and* ***E.***
3. ***In section A,*** *question number* ***1*** *to* ***18*** *are multiple choice questions (MCQs) and question number* ***19*** *and* ***20*** *are Assertion - Reason based questions of* ***1*** *mark each.*
4. ***In section B,*** *question number* ***21*** *to* ***25*** *are very short answer (VSA) type questions of* ***2*** *marks each.*
5. ***In section C,*** *question number* ***26*** *to* ***31*** *are short answer (SA) type questions carrying* ***3*** *marks each.*
6. ***In section D,*** *question number* ***32*** *to* ***35*** *are long answer (LA) type questions carrying* ***5*** *marks each.*
7. ***In section E,*** *question number* ***36*** *to* ***38*** *are* ***case-based integrated units*** *of assessment questions carrying* ***4*** *marks each. Internal choice is provided in* ***2*** *marks question in each case study.*
8. *There is no overall choice. However, an internal choice has been provided in* ***2*** *questions in* ***Section B, 2*** *questions in* ***Section C, 2*** *questions in* ***Section D*** *and* ***3*** *questions in* ***Section E.***
9. *Draw neat figures wherever required. Take* $\pi = 22/7$ *wherever required if not stated.*
10. *Use of calculators is* ***NOT allowed.***

Delhi Set-1 **430/1/1**

SECTION A - 20 MARKS

Q. No. 1 to 20 are multiple Choice Questions of 1 mark each.

1. For what value of k, the product of zeroes of the polynomial $kx^2 - 4x - 7$ is 2? **1**

(a) $-\frac{1}{14}$ **(b)** $-\frac{7}{2}$

(c) $\frac{7}{2}$ **(d)** $-\frac{2}{7}$

2. In an A.P., if $a = 8$ and $a_{10} = -19$,then value of d is: **1**

(a) 3 **(b)** $-\frac{11}{9}$

(c) $-\frac{27}{10}$ **(d)** -3

3. The mid-point of the line segment joining the points$(-1,3)$ and $(8, \frac{3}{2})$ is: **1**

(a) $\left(\frac{7}{2},-\frac{3}{4}\right)$ **(b)** $\left(\frac{7}{2},\frac{9}{2}\right)$

(c) $\left(\frac{9}{2},-\frac{3}{4}\right)$ **(d)** $\left(\frac{7}{2},\frac{9}{4}\right)$

4. If $\sin\theta = \frac{1}{3}$, then $\sec\theta$ is equal to: **1**

(a) $\frac{2\sqrt{2}}{3}$ **(b)** $\frac{3}{2\sqrt{2}}$

(c) 3 **(d)** $\frac{1}{\sqrt{3}}$

5. HCF (132,77)is : **1**

(a) 11 **(b)** 77

(c) 22 **(d)** 44

6. If the roots of quadratic equation $4x^2 - 5x + k = 0$ are real and equal , then value of k is: **1**

(a) $\frac{5}{4}$ **(b)** $\frac{25}{16}$

(c) $-\frac{5}{4}$ **(d)** $-\frac{25}{16}$

7. If probability of winning a game is p, then probability of losing the game is: **1**

(a) $1+p$ **(b)** $-p$

(c) $p-1$ **(d)** $1-p$

8. The distance between the points $(2, -3)$ and $(-2, 3)$is: **1**

(a) $2\sqrt{13}$ units **(b)** 5 units

(c) $13\sqrt{2}$ units **(d)** 10 units

9. For what value of θ, $\sin^2\theta+\sin\theta+\cos^2\theta$ is equal to 2 ? **1**

(a) 45° **(b)** 0°

(c) 90° **(d)** 30°

10. A card is drawn from a well shuffled deck of 52 playing cards. The probability that drawn card is a red queen , is: **1**

(a) $\frac{1}{13}$ **(b)** $\frac{2}{13}$

(c) $\frac{1}{52}$ **(d)** $\frac{1}{26}$

11. If a certain variable x divides a statistical data arranged in order into two equal parts, then the value of x is called the: **1**

(a) mean of the data **(b)** median

(c) mode **(d)** range

12. The radius of a sphere is $\frac{7}{2}$ cm . The volume of the sphere is: **1**

(a) $\frac{231}{3}$ cu cm **(b)** $\frac{539}{12}$ cu cm

(c) $\frac{539}{3}$ cu cm **(d)** 154 cu cm

13. The mean and median of a statistical data are 21 and 23 respectively. The mode of the data is: **1**

(a) 27 **(b)** 22

(c) 17 **(d)** 23

14. The height and radius of a right circular cone are 24 cm and 7 cm respectively. The slant height of the cone is: **1**

(a) 24 cm **(b)** 31 cm

(c) 26 cm **(d)** 25 cm

15. If one of the zeroes of the quadratic polynomial $(\alpha-1)x^2+\alpha x+1$ is –3, then the value of α is: **1**

(a) $-\frac{2}{3}$ **(b)** $\frac{2}{3}$

(c) $\frac{4}{3}$ **(d)** $\frac{3}{4}$

16. The diameter of a circle is of length 6 cm. If one end of the diameter is (–4,0), the other end on x-axis is at: **1**

(a) (0,2) **(b)** (6,0)

(c) (2,0) **(d)** (4,0)

17. The value of k for which the pair of linear equations $5x+2y-7=0$ and $2x+ky+1=0$ don't have a solution, is: **1**

(a) 5 **(b)** $\frac{4}{5}$

(c) $\frac{5}{4}$ **(d)** $\frac{5}{2}$

18. Two dice are rolled together. The probability of getting a double is: **1**

(a) $\frac{2}{36}$ **(b)** $\frac{1}{36}$

(c) $\frac{1}{6}$ **(d)** $\frac{5}{6}$

19. Directions: In Q. No. 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option from the following options:

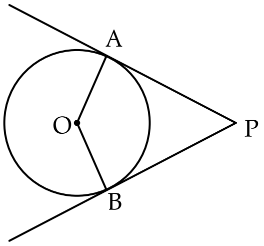
(a) Both, Assertion (A) and Reason (R) are true. Reason (R) explains Assertion (A) completely.

(b) Both, Assertion (A) and Reason (R) are true. Reason (R) does not explain Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

19.



Assertion (A): If PA and PB are tangents drawn to a circle with centre O from an external point P, then the quadrilateral OAPB is a cyclic quadrilateral.

Reason (R): In a cyclic quadrilateral, opposite angles are equal. **1**

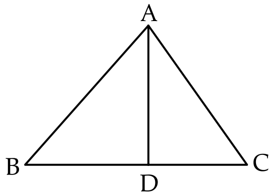
20. **Assertion (A):** Zeroes of a polynomial $p(x)=x^2-2x-3$ are –1 and 3.

Reason (R): The graph of polynomial $p(x)=x^2-2x-3$ intersects x-axis at (–1, 0) and (3, 0). **1**

SECTION B

Q. No. 21 to 25 are Very Short Answer Questions of 2 marks each.

21. D is a point on the side BC of ΔABC such that $\angle$ADC = $\angle$BAC. Show that $AC^2 = BC \times DC$. **2**



22. **(A)** Solve the following pair of linear equations for x and y algebraically: $x+2y=9$ and $y-2x=2$ **2**

OR

(B) Check whether the point (–4, 3) lies on both the lines represented by the linear equations $x+y+1=0$ and $x-y=1$. **2**

23 . (A) Prove that $6-4\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number. **2**

OR

(B) Show that $11 \times 19 \times 23 + 3 \times 11$ is not a prime number. **2**

24. Evaluate: sin A cos B + cos A sin B, if A = 30° and B = 45°. **2**

25. A bag contains 4 red, 5 white and some yellow balls.

If probability of drawing a red ball at random is $\frac{1}{5}$ then find the probability of drawing a yellow ball at random. **2**

SECTION C

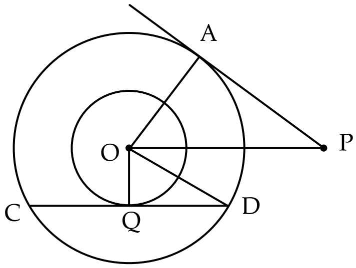
Q. No. 26 to 31 are Short Answer Questions of 3 marks each.

26. Two alarm clocks ring their alarms at regular intervals of 20 minutes and 25 minutes respectively. If they first beep together at 12 noon, at what time will they beep again together next time? **3**

27. The greater of two supplementary angles exceeds the smaller by 18°. Find measures of these two angles. **3**

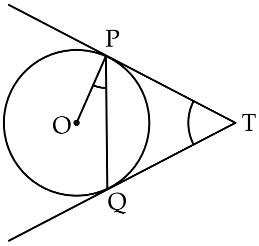
28. Find the co-ordinates of the points of trisection of the line segment joining the points (–2, 2) and (7, –4). **3**

29. **(A)** In two concentric circles, the radii are OA = r cm and OQ = 6 cm, as shown in the figure. Chord CD of larger circle is a tangent to smaller circle at Q. PA is tangent to larger circle. If PA = 16 cm and OP = 20 cm, the length CD. **3**



OR

(B) In given figure, two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ = 2 ∠OPQ. **3**



30. **(A)** A solid is in the form of a cylinder with hemi-spherical ends of same radii. The total height of the solid is 20 cm and the diameter of the cylinder is 14 cm. Find the surface area of the solid. **3**

OR

(B) A juice glass is cylindrical in shape with hemi-spherical raised up portion at the bottom. The inner diameter of glass is 10 cm and its height is 14 cm. Find the capacity of the glass. (use π = 3.14) **3**

31. Prove that: $(\cot\theta - \operatorname{cosec}\theta)^2 = \dfrac{1-\cos\theta}{1+\cos\theta}$. **3**

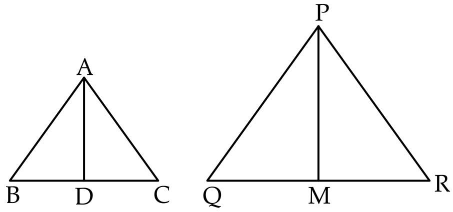
SECTION D

Q. No. 32 to 35 are Long Answer Questions of 5 marks each.

32. **(A)** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that other two sides are divided in the same ratio. **5**

OR

(B) Sides AB and AC and median AD of a ΔABC are respectively proportional to sides PQ and PR and median PM of ΔPQR. Show that ΔABC ~ ΔPQR. **5**



33. How many terms of the A.P. 27, 24, 21, …….. must be taken so that their sum is 105? Which term of the A.P. is zero? **5**

34. **(A)** The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it was 60°. Find the height of the tower and the length of original shadow. (use √3= 1.73) **5**

OR

(B) The angles of depression of the top and the bottom of an 8 m tall building from the top of a multi-storeyed building are 30° and 45° respectively. Find the height of the multi-storeyed building and the distance between the two buildings. (use √3= 1.73) **5**

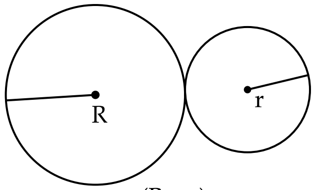
35. A chord of a circle of radius 14 cm subtends an angle of 90° at the centre. Find the area of the corresponding minor and major segments of the circle. **5**

SECTION E

Q. No. 36 to 38 are Case-Based Questions of 4 marks each.

36. To keep the lawn green and cool, Sadhna uses water sprinklers which rotate in circular shape and cover a particular area.

The diagram below shows the circular areas covered by two sprinklers :



(R >r)

Two circles touch externally. The sum of their areas is 130 π sq m and the distance between their centres is 14 m.

Based on above information, answer the following questions :

(i) Obtain a quadratic equation involving R and r from above. **1**

(ii) Write a quadratic equation involving only r. **1**

(iii) (a) Find the radius r and the corresponding area irrigated. **2**

OR

(b) Find the radius R and the corresponding area irrigated. **2**

37. Gurpreet is very fond of doing research on plants. She collected some leaves from different plants and measured their lengths in mm.

The data obtained is represented in the following table:

Length (in mm):	70-80	80-90	90-100	100-110	110-120	120-130	130-140
Number of leaves:	3	5	9	12	5	4	2

Based on the above information, answer the following questions :

(i) Write the median class of the data. **1**

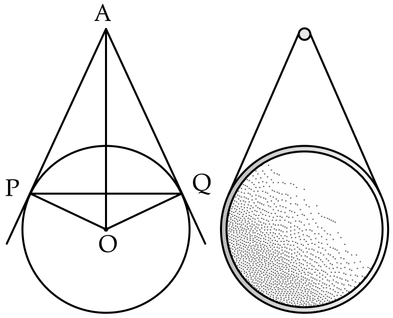
(ii) How many leaves are of length equal to or more than 10 cm? **1**

(iii) (a) Find median of the data. **2**

OR

(b) Write the modal class and find the mode of the data. **2**

38. The picture given below shows a circular mirror hanging on the wall with a cord. The diagram represents the mirror as a circle with centre O. AP and AQ are tangents to the circle at P and Q respectively such that AP = 30 cm and $\angle PAQ = 60°$.



Based on the above information, answer the questions:

(i) Find the length PQ. **1**

(ii) Find m $\angle POQ$. **1**

(iii) (a) Find the length OA. **2**

OR

(b) Find the radius of the mirror. **2**

Delhi Set-2 430/1/2

Note: *Except these, all other question have been given in Delhi Set-1*

SECTION A - 20 MARKS

Q.No. 1 to 20 are multiple Choice Questions of 1 mark each.

1. LCM (850, 500) is: **1**

(a) 850×50 **(b)** 17×500

(c) $17 \times 5^2 \times 2^2$ **(d)** $17 \times 5^3 \times 2$

8. Three coins are tossed together. The probability of getting exactly one tail, is: 1

(a) $\frac{1}{8}$ **(b)** $\frac{1}{4}$

(c) $\frac{7}{8}$ **(d)** $\frac{3}{8}$

10. Outer surface area of a cylindrical juice glass with radius 7 cm and height 10 cm, is: **1**

(a) 440 sq cm **(b)** 594 sq cm

(c) 748 sq cm **(d)** 1540 sq cm

11. On a throw of a die, if getting 6 is considered success then probability of losing the game is: **1**

(a) 0 **(b)** 1

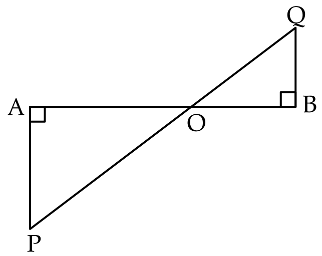
(c) $\frac{1}{6}$ **(d)** $\frac{5}{6}$

SECTION-B

Q. No. 21 to 25 are Very Short Answer Questions of 2 marks each.

23. In a ΔABC, $\angle A = 90°$. If $\tan C = \sqrt{3}$, then find the value of $\sin B + \cos C - \cos^2 B$. **2**

24. In the given figure, $AP \perp AB$ and $BQ \perp AB$. If OA = 15 cm, BO=12 cm and AP = 10 cm, then find the length of BQ.



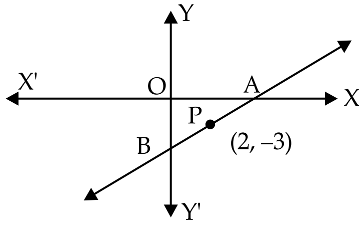
2

SECTION-C

Q. No. 26 to 31 are Short Answer Questions of 3 marks each.

26. Prove that: $\sqrt{\frac{\sec A - 1}{\sec A + 1}} + \sqrt{\frac{\sec A + 1}{\sec A - 1}} = 2\operatorname{cosec} A$ **3**

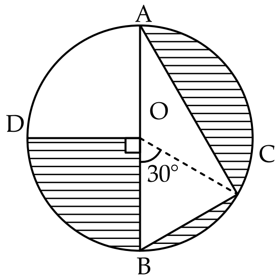
30. The line AB intersects x-axis at A and y-axis at B. The point P(2,3) lies on AB such that AP: PB = 3: 1. Find the co-ordinates of A and B. **3**



SECTION D

Q. No. 32 to 35 are Long Answer Questions of 5 marks each.

32. O is the centre of the circle. If AC = 28 cm, BC = 21 cm, $\angle BOD = 90°$ and $\angle BOC = 30°$, then find the area of the shaded region given in the figure. **5**



35. In an A.P. if $S_n = 4n^2 - n$, then

(i) find the first term and common difference. **5**

(ii) write the A.P.

(iii) which term of the A.P. is 107?

Delhi Set-3 — 430/1/3

Note: *Except these, all other question have been given in Delhi Set-1 & 2.*

SECTION A - 20 MARKS

Q.No. 1 to 20 are multiple Choice Questions of 1 mark each.

4. The curved surface area of a right circular cone of radius 7 cm is 550 sq cm. The slant height of the cone is : **1**

(a) 24 cm **(b)** 25 cm

(c) 22 cm **(d)** 20 cm

9. If HCF (96, 404) = 4, then LCM (96, 404) is: **1**

(a) 9600 **(b)** 96×404

(c) 404 **(d)** 9696

13. Which of the following cannot be the probability of an event? **1**

(a) 52% **(b)** $\frac{1}{3}\%$

(c) 0.99 **(d)** $\frac{1}{0.99}$

15. Two dice are rolled together. The probability of getting at least one 6, is: **1**

(a) $\frac{1}{3}$ **(b)** $\frac{11}{36}$

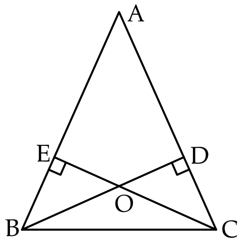
(c) $\frac{1}{6}$ **(d)** $\frac{10}{36}$

SECTION-B

Q. No. 21 to 25 are Very Short Answer Questions of 2 marks each.

24. If $\sin A = \frac{1}{2}$ and $\cos B = \frac{1}{\sqrt{2}}$, then find the value of $\sin A \sin B + \cos A \cos B$. **2**

25. In the given figure, in ΔABC, BD and CE are perpendiculars to AC and AB respectively. Prove that: $AE \times BD = AD \times CE$. **2**



SECTION-C

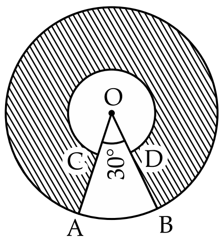
Q. No. 26 to 31 are Short Answer Questions of 3 marks each.

29. Prove that: $\sin^6\theta + \cos^6\theta + 3\sin^2\theta\cos^2\theta = 1$ **3**

31. If A(2, –1), B(a, 4), C(–2, b) and D(–3, –2) are vertices of a parallelogram ABCD taken in order, then find the values of a and b. Also, find the length of the sides of the parallelogram. **3**

Q. **No. 32 to 35 are Long Answer Questions of 5 marks each.**

32. In the given figure, two concentric circles with centre O have radii 14 cm and 7 cm. If $\angle AOB = 30°$, find the area of the shaded region. **5**



34. In an A.P. of 50 terms, the sum of first 10 terms is 250 and the sum of its last 15 terms is 2625. Find the A.P. so formed. **5**

Outside Delhi Set-1 **430/2/1**

SECTION A - 20 MARKS

(Multiple Choice Questions)

Section-A consists of 20 Multiple Choice Questions of 1 mark each.

1. The HCF of smallest 2 - digit number and the smallest composite number is: **1**

(a) 2 **(b)** 20
(c) 40 **(d)** 4

2. 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 **1**

(a) $k \neq 2$ **(b)** $k \neq -2$
(c) $k = 2$ **(d)** $k = -2$

3. Which of the following equations has 2 as a root ? **1**

(a) $x^2 - 4x + 5 = 0$ **(b)** $x^2 + 3x - 12 = 0$
(c) $2x^2 - 7x + 6 = 0$ **(d)** $3x^2 - 6x - 2 = 0$

4. In an A.P., if $d = -4$ and $a_7 = 4$, then the first term 'a' is equal to **1**

(a) 6 **(b)** 7
(c) 20 **(d)** 28

5. The distance of the point (5, 4) from the origin is **1**

(a) 41 **(b)** $\sqrt{41}$
(c) 3 **(d)** 9

6. If $\sin A = \frac{3}{5}$, then value of cot A is: **1**

(a) $\frac{3}{4}$ **(b)** $\frac{4}{3}$
(c) $\frac{4}{5}$ **(d)** $\frac{5}{4}$

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

(a) $\sec^2 A$ **(b)** -1
(c) $\cot^2 A$ **(d)** $\tan^2 A$

8. $\frac{2\tan 30°}{1-\tan^2 30°}$ is equal to **1**

(a) cos 60° **(b)** sin 60°
(c) tan 60° **(d)** sin 30°

9. A quadratic polynomial, the sum of whose zeroes is -5 and their product is 6, is **1**

(a) $x^2 + 5x + 6$ **(b)** $x^2 - 5x + 6$
(c) $x^2 - 5x - 6$ **(d)** $-x^2 + 5x + 6$

10. The zeroes of the polynomial $3x^2 + 11x - 4$ are: **1**

(a) $\frac{1}{3}, 4$ **(b)** $-\frac{1}{3}, -4$
(c) $\frac{1}{3}, -4$ **(d)** $\frac{-1}{3}, 4$

11. The annual rainfall record of a city for 66 days is given in the following table **1**

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

The difference of upper limits of modal and median classes is :

(a) 10 **(b)** 15
(c) 20 **(d)** 30

12. If P(A) denotes the probability of an event A, then **1**

(a) $P(A) < 0$ **(b)** $P(A) > 1$
(c) $0 \leq P(A) \leq 1$ **(d)** $-1 \leq P(A) \leq 1$

13. The total surface area of a solid hemisphere of radius 7 cm is: **1**

(a) 98π cm^2 **(b)** 147π cm^2
(c) 196π cm^2 **(d)** $228\frac{2}{3}\pi$ cm^2

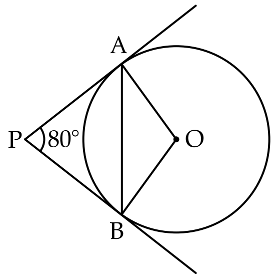
14. The difference of the areas of a minor sector of angle 120° and its corresponding major sector of a circle of radius 21 cm, is **1**

(a) 231 cm^2 **(b)** 462 cm^2
(c) 346.5 cm^2 **(d)** 693 cm^2

15. 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 **1**

(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)** $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

16. 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 **1**



(a) 40° **(b)** 80°
(c) 100° **(d)** 50°

17. A line intersecting a circle in two distinct points is called a **1**

(a) secant **(b)** chord
(c) diameter **(d)** tangent

18. If a pole 6 m high casts a shadow $2\sqrt{3}$m long on the ground, then the sun's elevation is **1**

(a) 30° (b) 45°
(c) 60° (d) 90°

(Assertion - Reason based questions)

Directions : In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

(a) Both Assertion (A) and Reason (R) are correct and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are correct but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

19. **Assertion (A)** : A line drawn parallel to any one side of a triangle intersects the other two sides in the same ratio. **1**

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

20. **Assertion (A):** The point (0, 4) lies on y -axis. **1**

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

SECTION B

(Very Short Answer Type Questions)

Q. Nos. 21 to 25 are Very Short Answer type questions of 2 marks each.

21. Find the HCF of 84 and 144 by prime factorisation method **2**

22. **(a)** The sum of two natural numbers is 70 and their difference is 10. Find the natural numbers. **2**

OR

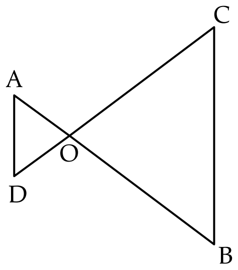
(b) Solve for x and y: **2**

$x - 3y = 7$

$3x - 3y = 5$

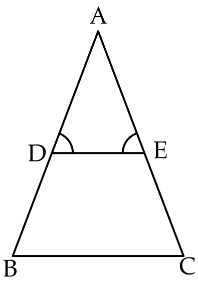
23. 15 defective pens are accidentally mixed with 145 good ones. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one. **2**

24. **(a)** In the given figure, OA·OB= OC·OD, Prove that ΔAOD ~ ΔCOB. **2**



OR

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



2

25. Prove that the tangents drawn at the ends of a diameter of a circle are parallel to each other. **2**

SECTION C

(Short Answer Type Questions)

Q. Nos. 26 to 31 are Short Answer type questions of 3 marks each.

26. Two dice are tossed simultaneously. Find the probability of getting **3**

(a) an even number on both the dice.

(b) the sum of two numbers more than 9.

27. **(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. **3**

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. **3**

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

29. **(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 $2\beta + 1$. **3**

OR

(b) Find the zeroes of the polynomial $4x^2 - 4x + 1$ and verify there relationship between the zeroes and the coefficients. **3**

30. Prove that $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ **3**

31. 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. **3**

SECTION D

(Long Answer Type Questions)

Q. Nos. 32 to 35 are Long Answer type questions of 5 marks each.

32. 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. **5**

33. 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°. **5**

Find the height of the tower and the width of the canal.[Use $\sqrt{3} = 1.732$]

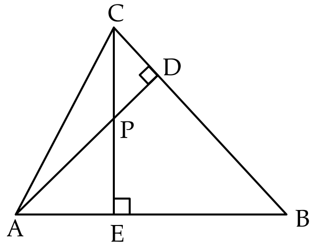
34. (a) In the given figure, altitudes CE and AD of ΔABC intersect each other at the point P. **1+2+2**

Show that

(i) Δ AEP ~ Δ CDP

(ii) Δ ABD ~ Δ CBE

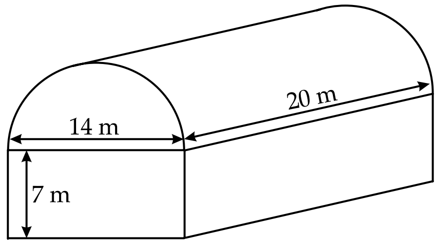
(iii) Δ AEP ~ Δ ADB



OR

(b) AD and PM are medians of triangles ABC and PQR, respectively,where Δ ABC ~ Δ PQR. Prove that $\frac{AB}{PQ} = \frac{AD}{PM}$. **5**

35. (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 m × 20 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 m³. Then, how much space is left in the industry ? **5**

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 π = 3.14) **5**

SECTION E

(Case Study based Questions)

Q. Nos. 36 to 38 are Case Study based Questions of 4 marks each.

36. 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 8^{th} day ? **1**

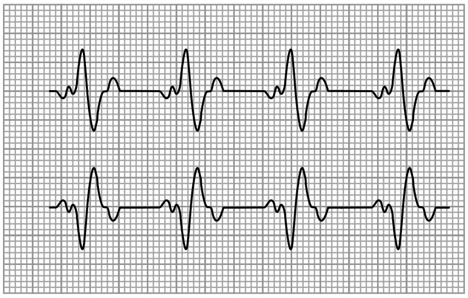
(ii) How much money will be there in the piggy bank after 8 days ? **1**

(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

(ii) (b) Find the total money saved, when the piggy bank is full. **2**

37. 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 :

Number of heart beats per minute	Number of Women
65 - 68	2
68-71	4
71-74	3
74 - 77	8
77- 80	7
80- 83	4
83-86	2

Based on the above information, answer the following questions :

(i) How many women are having heart beat in the range 68 –77 ? **1**

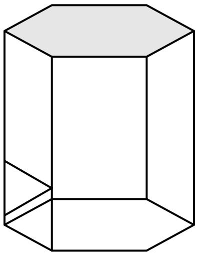
(ii) What is the median class of heart beats per minute for these women ? **1**

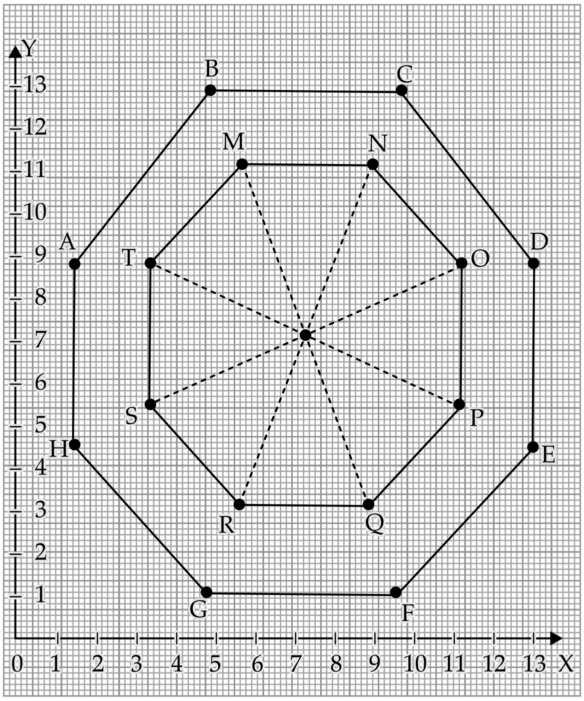
(iii) (a) Find the modal value of heart beats per minute for these women. **2**

OR

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

38. The top of a table is hexagonal in shape.





On the basis of the information given above, 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**

Outside Delhi Set-2 430/2/2

Note: *Except these, all other question have been given in Outside Delhi Set-1*

SECTION A

(Multiple Choice Questions)

Section-A consists of 20 Multiple Choice Questions of 1 mark each.

5. If $\sin^2\theta = \frac{3}{4}$, then θ is **1**

(a) 30° **(b)** 45°
(c) 60° **(d)** 90°

6. The zeroes of the polynomial $3x^2 - 5x - 2$, are: **1**

(a) $\frac{1}{3}, 2$ **(b)** $\frac{-1}{3}, 2$
(c) $\frac{-1}{3}, -2$ **(d)** $\frac{1}{3}, -2$

7. A pole $7\sqrt{3}$ m high casts a shadow 21 m long on the ground, then the sun's elevation is: **1**

(a) 30° **(b)** 45°
(c) 60° **(d)** 90°

16. Which of the following quadratic equations has –1 as a root? **1**

(a) $x^2 - 4x - 5 = 0$ **(b)** $-x^2 - 4x + 5 = 0$
(c) $x^2 + 3x + 4 = 0$ **(d)** $x^2 - 5x + 6 = 0$

17. The distance of the point (3, 4) from the origin is **1**

(a) 25 **(b)** 5
(c) 7 **(d)** 1

18. If the first term of an AP is –3 and common difference –2, then the seventh term is **1**

(a) –9 **(b)** 9
(c) –17 **(d)** –15

SECTION B

(Very Short Answer Type Questions)

Q. Nos. 21 to 25 are Very Short Answer type questions of 2 marks each.

22. A lot consists of 165 ball pens of which 30 are defective and the others are good. Rakshita will buy a pen if it is good. The shopkeeper draws one pen at random and gives it to Rakshita. What is the probability that she will buy it? **2**

SECTION C

(Short Answer Type Questions)

Q. Nos. 26 to 31 are Short Answer type questions of 3 marks each.

26. To warn ships for underwater rocks, a light house spreads a red coloured light over a sector of angle 80° to a distance of 16.5 km. Find the area of the sea over which the ships are warned. (Use $\pi = 3.14$) **3**

27. **(a)** Zeroes of the quadratic polynomial $x^2 + x - 6$ are 'α' and 'β'. Construct a quadratic polynomial whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$. **3**

OR

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

SECTION D

(Long Answer Type Questions)

Q. Nos. 32 to 35 are Long Answer type questions of 5 marks each.

34. From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Use $\sqrt{3} = 1.732$) **5**

35. A cottage industry produces a certain number of pottery articles in a day. It was observed that on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was ₹ 90, find the number of articles produced and the cost of each article. **5**

Outside Delhi Set-3 430/2/3

Note: *Except these, all other question have been given in Outside Delhi Set-1 & 2*

SECTION A

(Multiple Choice Questions)

Section-A consists of 20 Multiple Choice Questions of 1 mark each.

1. The total surface area of a cube of side 20 cm is **1**

(a) $240 cm^2$ **(b)** $160 cm^2$

(c) $2400 cm^2$ **(d)** $1600 cm^2$

9. If n is any natural number, then which of the following numbers ends with digit 0? **1**

(a) $(3 \times 2)^n$ **(b)** $(5 \times 2)^n$

(c) $(6 \times 2)^n$ **(d)** $(4 \times 2)^n$

10. If $5 \cos A - 4 = 0$ then the value of tan A is **1**

(a) $\frac{3}{4}$ **(b)** $\frac{4}{3}$

(c) $\frac{3}{5}$ **(d)** $\frac{4}{5}$

14. The value of 'p' for which the pair of equations $-2x + 3y - 9 = 0$ and $4x + py + 7 = 0$ has a unique solution is **1**

(a) $p \neq 6$ **(b)** $p = 6$

(c) $p = -6$ **(d)** $p \neq -6$

15. $\frac{\operatorname{cosec}^2 A - \cot^2 A}{1 - \sin^2 A}$ is equal to **1**

(a) $\sin^2 A$ **(b)** $\cos^2 A$

(c) $\sec^2 A$ **(d)** $\tan^2 A$

SECTION B

(Very Short Answer Type Questions)

Q. Nos. 21 to 25 are Very Short Answer type questions of 2 marks each.

23. Find the LCM of 231 and 396 by prime factorisation method. **2**

SECTION C

(Short Answer Type Questions)

Q. Nos. 26 to 31 are Short Answer type questions of 3 marks each.

28. All the kings and queens are removed from a deck of 52 playing cards. Remaining cards are well shuffled and then a card is drawn at random. Find the probability that the drawn card is **1+1+1**

(a) an ace of hearts

(b) a black card

(c) a jack of spades

31. Prove that $5\sqrt{2} - 3$ is an irrational number, given that $\sqrt{2}$ is an irrational number. **3**

SECTION E

(Long Answer Type Questions)

Q. Nos. 32 to 35 are Long Answer type questions of 5 marks each.

35. The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice the breadth. Find the length and breadth of the plot. Also, find the cost of levelling the plot at the rate of ₹80 per square metre.

ANSWERS

Delhi Set–1 **430/1/1**

SECTION–A

1. Option (b) is correct.

Explanation:

Given that,

Polynomial as $kx^2 - 4x - 7$

Product of zeroes = 2

We know that,

For $ax^2 + bx + c$,

Product of zeroes = $\frac{c}{a}$

So, we have,

$\Rightarrow \quad 2 = \frac{-7}{k}$

$\Rightarrow \quad k = \frac{-7}{2}$

2. Option (d) is correct.

Explanation:

Given that,

$\Rightarrow a = 8, a_{10} = -19$

We know that,

$\Rightarrow \quad a_{10} = a + 9d = -19$

$\Rightarrow \quad 8 + 9d = -19$

$\Rightarrow \quad 9d = -19 - 8$

$\Rightarrow \quad 9d = -27$

$\Rightarrow \quad d = \frac{-27}{9}$

$\Rightarrow \quad d = -3$

3. Option (d) is correct.

Explanation:

The points are, (–1, 3) and (8, $\frac{3}{2}$)

Using midpoint formula,

$$(x, y) = \left(\frac{-1+8}{2}, \frac{3+\frac{3}{2}}{2}\right)$$

$$(x, y) = \left(\frac{7}{2}, \frac{9}{4}\right)$$

So, $\left(\frac{7}{2}, \frac{9}{4}\right)$ is the required midpoint.

4. Option (b) is correct.

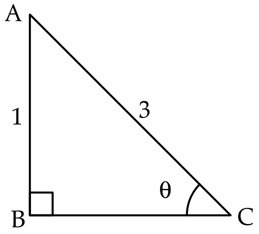
Explanation:

Given that,

$\Rightarrow \quad \sin\theta = \frac{1}{3}$

We have,

In right ΔABC,



$$BC = \sqrt{9-1} = \sqrt{8} = 2\sqrt{2}$$

$\Rightarrow \sec\theta = \frac{AC}{BC} = \frac{3}{2\sqrt{2}}$

5. Option (a) is correct.

Explanation:

HCF of 132 and 77

$132 = 2 \times 2 \times 3 \times 11$

$77 = 7 \times 11$

HCF (132, 77) = 11

6. Option (b) is correct.

Explanation:

Given that,

Roots of quadratic equation $4x^2 - 5x + k = 0$ are real and equal

On comparing with $ax^2 + bx + c = 0$

We get, $a = 4$, $b = -5$ and $c = k$

For real and equal roots,

$\Rightarrow \quad b^2 - 4ac = 0$

$\Rightarrow \quad (-5)^2 - 4(4)(k) = 0$

$\Rightarrow \quad 16k = 25$

$\Rightarrow \quad k = \frac{25}{16}$

7. Option (d) is correct.

Explanation:

Given that,

P(winning) = p

So, P(loosing) = P(not winning) = $1 - p$

8. Option (a) is correct.

Explanation:

Given the points are (2, –3) and (–2, 3)

Using the distance formula,

$\rightarrow \sqrt{(2-(-2))^2 + (-3-3)^2}$

$\rightarrow \sqrt{16+36}$

$\rightarrow \sqrt{52} = 2\sqrt{13}$

So, the distance between the points is $2\sqrt{13}$ units.

9. Option (c) is correct.

Explanation:

Given that,

$\Rightarrow \quad \sin^2\theta + \sin\theta + \cos^2\theta = 2$

$\Rightarrow (\sin^2\theta + \cos^2\theta) + \sin\theta = 2$

$\Rightarrow \quad 1 + \sin\theta = 2$

(As $\sin^2\theta + \cos^2\theta = 1$)

$\Rightarrow \quad \sin\theta = 1 = \sin 90^\circ$

$\Rightarrow \quad \theta = 90^\circ$

10. Option (d) is correct.

Explanation:

We know that,

In a well shuffled deck of cards,

Total outcomes = 52

Favourable outcomes of getting red queen = 2

So, P(red queen) = $\frac{2}{52} = \frac{1}{26}$

11. Option (b) is correct.

Explanation:

Median is the statistical measure that divides a statistical data arranged in order into two equal parts.

12. Option (c) is correct.

Explanation:

Given that,

Radius of sphere, $r = \frac{7}{2}$ cm

We know that,

Volume of Sphere $= \frac{4}{3}\pi r^3$

Volume $= \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$

Volume $= \frac{11 \times 7 \times 7}{3} = \frac{539}{3}\text{cm}^3$

13. Option (a) is correct.

Explanation:

Given that,

Mean = 21

Median = 23

Using empirical relation,

Mode = 3Median – 2Mean

Mode = 3 × 23 – 2 × 21

Mode = 69 – 42 = 27

14. Option (d) is correct.

Explanation:

Given that,

Height of cone, h = 24 cm

Radius of cone, r = 7 cm

Slant height of cone,

$l = \sqrt{24^2 + 7^2}$

$l = \sqrt{625} = 25\text{cm}$

15. Option (b) is correct.

Explanation:

Given that,

One zero of polynomial = –3

$P(x) = (\alpha - 1)x^2 + \alpha x + 1$

Also, P(–3) = 0

$\Rightarrow \quad (\alpha - 1)(3)^2 + 3\alpha + 1 = 0$

$\Rightarrow \quad 9\alpha - 9 + 3\alpha + 1 = 0$

$\Rightarrow \quad 12\alpha = 8$

$\Rightarrow \quad \alpha = \frac{8}{12} = \frac{2}{3}$

16. Option (c) is correct.

Explanation:

Given that,

Length of diameter of circle = 6 cm

One end of diameter = (–4, 0)

Other end of diameter on x-axis will be of the form $(x, 0)$

Using distance formula,

$\rightarrow \sqrt{(x-(-4))^2 + (0-0)^2} = 6$

$\rightarrow x + 4 = 6$

$\rightarrow x = 2$

So, the other end of diameter is (2, 0).

17. Option (b) is correct.

Explanation:

Given that,

Pair of linear equations as $5x + 2y - 7 = 0$ and $2x + ky + 1 = 0$

For no solution,

$\rightarrow \frac{5}{2} = \frac{2}{k} \neq \frac{-7}{1}$

$\rightarrow \frac{5}{2} = \frac{2}{k}$

$\rightarrow k = \frac{4}{5}$

18. Option (c) is correct.

Explanation:

We know that,

On rolling two dice,

Total number of possible outcomes = 36

Favourable outcomes are {(1, 1), (2,2), (3, 3), (4, 4), (5, 5), (6, 6)} = 6

So, P(doublet) = $\frac{6}{36} = \frac{1}{6}$

19. Option (c) is correct.

Explanation:

In the given figure OAPB is a cyclic quadrilateral with PA and PB as tangents drawn from an external point P.

Also, $\angle$AOB + $\angle$APB = 180°

As the sum of opposite angles of a cyclic quadrilateral is 180°

So, Assertion is true but reason is false.

20. Option (a) is correct.

Explanation:

For the polynomial,

$\Rightarrow \quad p(x) = x^2 - 2x - 3$

$\Rightarrow \quad p(x) = x^2 - 3x + x - 3$

$\Rightarrow \quad p(x) = x(x - 3) + 1(x - 3)$

$\Rightarrow \quad p(x) = (x - 3)(x + 1)$

So, the zeroes are 3 and –1

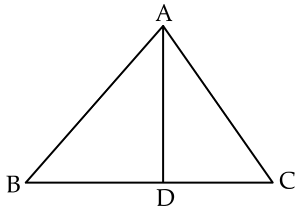
Also, the graph of given polynomial intersects x-axis at points (3, 0) and (–1, 0)

So, both assertion and reason are true and reason explains assertion completely.

SECTION–B

21. Given that,

$\angle ADC = \angle BAC$



In ΔADC and ΔBAC, we have

$\angle ADC = \angle BAC$ (given)

$\angle C = \angle C$ (common)

By AA similarity criterion

$\Delta ADC \sim \Delta BAC$

So, $\frac{AC}{BC} = \frac{DC}{AC}$

$\Rightarrow AC^2 = BC \times DC$

22. (A)

Given the pair of linear equations as,

$\Rightarrow x + 2y = 9$ ----(i)

$\Rightarrow -2x + y = 2$ ----(ii)

Multiplying eqn(i) by 2 and adding to eqn (ii), we get

$\Rightarrow (-2x + y) + (2x + 4y) = 2 + 18$

$\Rightarrow 5y = 20$

$\Rightarrow y = 4$

Putting in eqn(i),

$\Rightarrow x + 2(4) = 9$

$\Rightarrow x = 9 - 8 = 1$

So, the required solution is $x = 1$ and $y = 4$

OR

(B)

Given the equations of line are

$\Rightarrow x + y = -1$ ---(i)

$\Rightarrow x - y = 1$ ---(ii)

The intersection point of both the lines will be the point that lies on both the lines,

So, adding eqn (i) and (ii),

$\Rightarrow (x + y) + (x - y) = -1 + 1$

$\Rightarrow 2x = 0$

$\Rightarrow x = 0$

Putting in eqn (i),

$\Rightarrow 0 + y = -1$

$\Rightarrow y = -1$

So, the point will be $(x, y) = (0, -1)$

Hence, the point (–4, 3) does not lie on both the lines.

23.

(A)

Let us assume that $6 - 4\sqrt{5}$ be a rational number

Let $6 - 4\sqrt{5} = \frac{a}{b}$ [$b \neq 0$; a and b are integers]

$\Rightarrow \sqrt{5} = \frac{\left(6 - \frac{a}{b}\right)}{4}$

We know that,

$\left(6 - \frac{a}{b}\right)/4$ is a rational number.

But this contradicts the fact that $\sqrt{5}$ is an irrational number.

So, our assumption is wrong.

Therefore, $6 - 4\sqrt{5}$ is an irrational number

OR

(B)

We have

$11 \times 19 \times 23 + 3 \times 11$

$\Rightarrow 11(19 \times 23 + 3)$

$\Rightarrow 11(437 + 3)$

$\Rightarrow 11(440)$

$\Rightarrow 11(2 \times 2 \times 2 \times 5 \times 11)$

$\Rightarrow 2 \times 2 \times 2 \times 5 \times 11 \times 11$

As it can be represented as a product of more than two primes (1 and number itself).

So, it is not a prime number.

24. Given that,

$A = 30^\circ$ and $B = 45^\circ$

$\Rightarrow \sin A \cos B + \cos A \sin B$

We have,

$\Rightarrow \sin 30^\circ \times \cos 45^\circ + \cos 30^\circ \times \sin 45^\circ$

On putting the values, we get,

$\Rightarrow \frac{1}{2} \times \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$

$\Rightarrow \frac{1}{2\sqrt{2}} + \frac{\sqrt{3}}{2\sqrt{2}}$

$\Rightarrow \frac{(1 + \sqrt{3})}{2\sqrt{2}}$

Or

$\Rightarrow \frac{(\sqrt{2} + \sqrt{6})}{4}$

25. Given that,

Bag contains

Number of red balls = 4

Number of white balls = 5

Let the number of yellow balls be y

Also, P(red ball) = $\frac{1}{5}$

Total number of balls = $4 + 5 + y = (9 + y)$

So, P(red) = $\frac{4}{(9 + y)} = \frac{1}{5}$

$\Rightarrow \frac{1}{5} = \frac{4}{(9 + y)}$

$\Rightarrow 9 + y = 20$

$\Rightarrow y = 11$

So, the number of yellow balls is 11.

SECTION–C

26. Given that,

Two alarms ring at regular intervals of 20 and 25 minutes, respectively.

The time they will beep together again is their LCM

So, LCM(20, 25)

$20 = 2 \times 2 \times 5$

$25 = 5 \times 5$

$\text{LCM}(20, 25) = 2 \times 2 \times 5 \times 5 = 100$

So, they will beep together after 100 minutes or 1 h 40 minutes

They will beep again after 12 noon at 1:40 pm.

27. Let the smaller angle be x

Greater angle $= x + 18$

As the angles are supplementary,

So, Sum of angles $= 180^\circ$

$\Rightarrow \quad x + (x + 18)^\circ = 180^\circ$

$\Rightarrow \quad 2x + 18^\circ = 180^\circ$

$\Rightarrow \quad 2x = 162^\circ$

$\Rightarrow \quad x = 81^\circ$

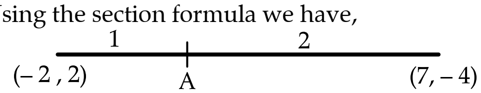
Greater angle $= (x + 18)^\circ = (81 + 18)^\circ = 99^\circ$

So, the measures of angles are 81° and 99°.

28. Given the points are (–2, 2) and (7, –4)

Let the points of trisection be A and B

Using the section formula we have,



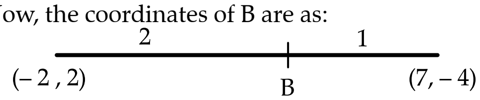
Coordinates of A are as:

$$\left[\left(\frac{1(7)+2(-2)}{1+2}\right),\left(\frac{1(-4)+2(2)}{1+2}\right)\right]$$

$$=\left[\left(\frac{3}{3}\right),\left(\frac{0}{3}\right)\right]$$

$$=(1,0)$$

Now, the coordinates of B are as:



$$\left[\left(\frac{2(7)+1(-2)}{2+1}\right),\left(\frac{2(-4)+1(2)}{2+1}\right)\right]$$

$$=\left[\left(\frac{12}{3}\right),\left(\frac{-6}{3}\right)\right]$$

$$=(4,-2)$$

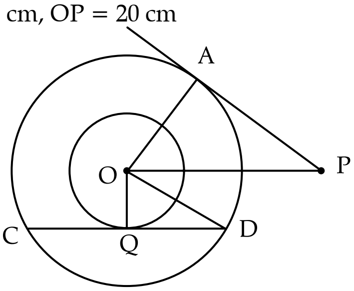
Hence, the coordinates of points of trisection are (1, 0) and (4, –2).

29. (A)

Given that,

OA = r cm, OQ = 6 cm,

PA = 16 cm, OP = 20 cm



In ΔAOP,

We have, ∠OAP = 90°

(Radius is perpendicular to tangent at point of contact)

So, $OP^2 = OA^2 + AP^2$

$\Rightarrow \quad (20)^2 = r^2 + (16)^2$

$\Rightarrow \quad r^2 = 400 - 256 = 144$

$\Rightarrow \quad r = 12$ cm

Also, OA = OD = 12 cm (Radius of circle)

In ΔQOD,

We have, ∠OQD = 90°(Radius is perpendicular to tangent at point of contact)

So, $\quad OD^2 = OQ^2 + QD^2$

$\Rightarrow \quad (12)^2 = (6)^2 + (QD)^2$

$\Rightarrow \quad QD^2 = 144 - 36 = 108$

$\Rightarrow \quad QD = 6\sqrt{3}$ cm

Also, CD = 2QD (As chord is bisected at the point of contact of circle)

So, CD = $2 \times 6\sqrt{3} = 12\sqrt{3}$ cm

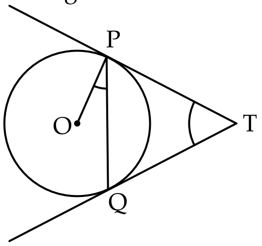
Hence, the length of CD is $12\sqrt{3}$ cm.

OR

(B)

Given that,

TP and TQ are tangents to circle



To prove: ∠PTQ = 2∠OPQ

We have,

TP = TQ (Lengths of tangents from an external point to a circle are equal)

∠TQP= ∠TPQ ---- (i)

(angles of equal sides are equal)

Also ∠OPT = 90° (Radius is perpendicular to tangent at point of contact)

$\Rightarrow$∠OPQ + ∠QPT = 90°

$\Rightarrow$ ∠TPQ = 90° – ∠OPQ -----(ii)

In ΔPTQ, we have,

∠PTQ + ∠TQP + ∠TPQ = 180°

(Sum of angles of triangle)

From (i) and (ii),

$\Rightarrow$ ∠PTQ + ∠TPQ + ∠TPQ = 180°

$\Rightarrow$ ∠PTQ + 2(90° – ∠OPQ) = 180°

$\Rightarrow$ ∠PTQ + 180° – 2∠OPQ = 180°

$\Rightarrow$ ∠PTQ = 2∠OPQ

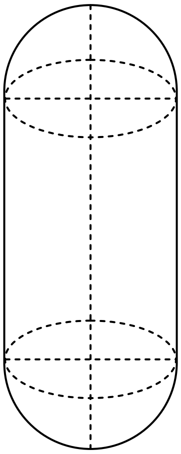
Hence, proved.

30. (A)

Given that,

Height of solid = 20 cm

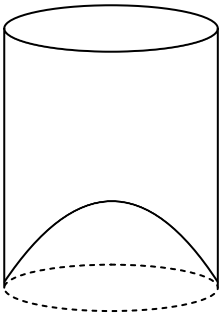
Diameter of cylinder = 14 cm



We have,
Height of cylinder, $h = 20 - 7 - 7 = 6$ cm
Radius of cylindrical and hemispherical part,
$r = 7$ cm
Surface area of solid = Surface area of cylinder + 2 × Surface area of hemisphere
$= 2\pi rh + 2 \times 2\pi r^2$
$= 2\pi rh + 4\pi r^2$
$= 2\pi r(h + 2r)$
$= 2 \times \frac{22}{7} \times 7 \times (6 + 14)$
$= 2 \times 22 \times 20$
$= 880 \text{ cm}^2$
Hence, the surface area of solid is 880 cm^2.

OR

(B) Given that,
Diameter of glass = 10 cm
Height of glass = 14 cm



Capacity of glass = Volume of cylinder – Volume of hemisphere
We have,
Radius of cylinder or hemispherical part, $r = 5$ cm
Height of cylinder, $h = 14$ cm
So,
Capacity of glass $= \pi r^2 h - \left(\frac{2}{3}\right) \times \pi r^3$
$= \pi r^2\left(h - \frac{2r}{3}\right)$
$= 3.14 \times (5)^2 \times (14 - \frac{10}{3})$
$= 3.14 \times 25 \times \frac{32}{3}$
$= 837.33 \text{ cm}^3$
So, the capacity of glass is 837.33 cm^3.

31. Taking LHS,
$(\cot\theta - \operatorname{cosec}\theta)^2$
$\Rightarrow \cot^2\theta + \operatorname{cosec}^2\theta - 2 \times \cot\theta \times \operatorname{cosec}\theta$

$$\Rightarrow \frac{\cos^2\theta}{\sin^2\theta} + \frac{1}{\sin^2\theta} - 2 \times \frac{\cos\theta}{\sin\theta} \times \frac{1}{\sin\theta}$$

$$\Rightarrow \frac{(1+\cos^2\theta)}{\sin^2\theta} - \frac{2\cos\theta}{\sin^2\theta}$$

$$\Rightarrow \frac{(1+\cos^2\theta - 2\cos\theta)}{\sin^2\theta}$$

$$\Rightarrow \frac{(1-\cos\theta)^2}{\sin^2\theta} \qquad (\text{As } \sin^2\theta = 1 - \cos^2\theta)$$

$$\Rightarrow \frac{(1-\cos\theta)^2}{(1-\cos^2\theta)}$$

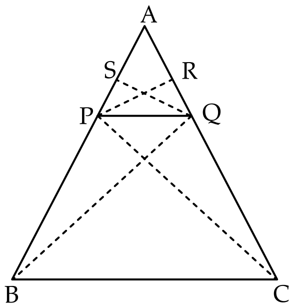
$$\Rightarrow \frac{(1-\cos\theta)^2}{[(1-\cos\theta)(1+\cos\theta)]}$$

$$\Rightarrow \frac{(1-\cos\theta)}{(1+\cos\theta)}$$

LHS = RHS **Hence, proved.**

SECTION–D

32. (A)



Given: ΔABC, where PQ || BC

To prove: $\frac{AP}{BP} = \frac{AQ}{CQ}$

Construction: Join BQ, PC
Draw PR ⊥ AQ and AC
QS⊥AP and AB
Proof: ΔPQB, and ΔPQC are on the same base PQ and lie between same parallel PQ and BC.
So, ar(PQB) = ar(PCQ) ...(i)

$$\frac{ar(APQ)}{ar(PBQ)} = \frac{\frac{1}{2} \times AP \times SQ}{\frac{1}{2} \times PB \times SQ}$$

$$\frac{ar(APQ)}{ar(PBQ)} = \frac{AP}{PB} \qquad ...(ii)$$

$$\frac{ar(APQ)}{ar(PCQ)} = \frac{\frac{1}{2} \times AQ \times PR}{\frac{1}{2} \times QC \times PR}$$

$$\frac{ar(APQ)}{ar(PCQ)} = \frac{AQ}{QC} \qquad ...(iii)$$

From, (i), (ii) and (iii),

$\Rightarrow \frac{AP}{BP} = \frac{AQ}{QC}$

Hence proved.

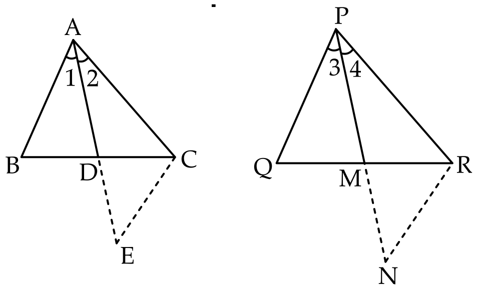
OR

(B)

Given that, AD and PM are medians of ΔABC and ΔPQR respectively.

Also,

$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$



To prove: ΔABC ~ ΔPQR

Construction: Produce AD to E so that AD = DE and Join CE

Similarly produce PM to N such that PM = MN, also Join RN.

Now, we have,

In ΔABD and ΔCDE,

AD = DE [By Construction]

BD = DC [∵ AD is the median]

And, ∠ADB = ∠CDE [Vertically opposite angles]

So, ΔABD ≅ ΔCED (By SAS Congruence criterion)

Also, AB = CE (By CPCT) ...(i)

In ΔPQM and ΔMNR,

PM = MN [By Construction]

QM = MR [∵ AD is the median]

And, ∠PMQ = ∠NMR [Vertically opposite angles]

So, ΔPQM ≅ ΔMNR (By SAS Congruence criterion)

Also, PQ = RN (By CPCT) ...(ii)

Now,

$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$

From (i) and (ii),

$\frac{CE}{RN} = \frac{AC}{PR} = \frac{AD}{PM}$

$\frac{CE}{RN} = \frac{AC}{PR} = \frac{2AD}{2PM}$

$\frac{CE}{RN} = \frac{AC}{PR} = \frac{AE}{PN}$

So, ΔACE ~ΔPRN [By SSS similarity criterion]

Therefore, ∠2 = ∠4

Similarly, ∠1 = ∠3

Adding them,

∠1 + ∠2 = ∠3 + ∠4

⇒ ∠A = ∠P ...(iii)

Now, In ΔABC and ΔPQR we have,

$\frac{AB}{PQ} = \frac{AC}{PR}$ (given)

⇒ ∠A = ∠P (from (iii))

So, ΔABC ~ ΔPQR [By SAS Similarity criteria]

Hence proved.

33. Given that,

AP 27, 24, 21, …..

For the given AP,

First term, $a = 27$

Common difference, $d = 24 - 27 = -3$

Sum, S = 105 (given)

Let n number of terms be taken for sum to be 105

So, we have,

$105 = \frac{n}{2}[2 \times 27 + (n-1)(-3)]$

$210 = n[54 - 3n + 3]$

$210 = n(57 - 3n)$

$210 = 57n - 3n^2$

$3n^2 - 57n + 210 = 0$

$n^2 - 19n + 70 = 0$

$\Rightarrow n^2 - 14n - 5n + 70 = 0$

$\Rightarrow n(n-14) - 5(n-14) = 0$

$\Rightarrow (n-14)(n-5) = 0$

$\Rightarrow n = 5, 14$

So, 5 and 14 terms of the given AP must be taken to get sum as 105.

Now,

Let p^{th} term of the AP be zero

$\Rightarrow a_p = 0$

$\Rightarrow a + (p-1)d = 0$

$\Rightarrow 27 + (p-1)(-3) = 0$

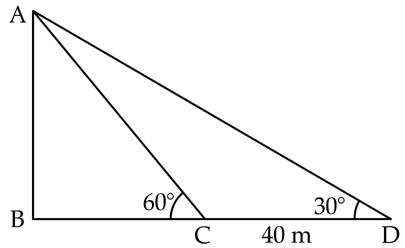
$\Rightarrow 27 - 3p + 3 = 0$

$\Rightarrow 30 = 3p$

$\Rightarrow p = 10$

Hence, 10^{th} term of the given AP is zero.

34. (A)



Let AB be the tower

From the given conditions,

CD = 40 m (given)

Let BC = x m

And Height of tower AB be h m

Now,

In ΔABC,

$\Rightarrow \tan 60^\circ = \frac{AB}{BC}$

$\Rightarrow \tan 60^\circ = \frac{h}{x}$

$\Rightarrow \sqrt{3} = \frac{h}{x}$

$\Rightarrow h = \sqrt{3}x$ **---(i)**

In ΔABD,

$\Rightarrow \quad \tan 30^o = \frac{AB}{BD}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{(x+40)}$

$\Rightarrow \quad x + 40 = \sqrt{3}h$

$\Rightarrow \quad x + 40 = \sqrt{3}(\sqrt{3}x)$ (From (i))

$\Rightarrow \quad x + 40 = 3x$

$\Rightarrow \quad 2x = 40$

$\Rightarrow \quad x = 20$ m

So, $h = 20\sqrt{3}$ m

Hence,

Height of tower = $20\sqrt{3}$ m

Length of original shadow = 20 m

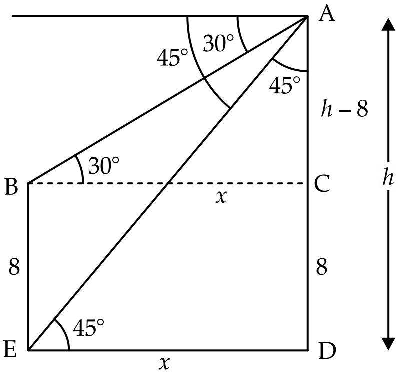
OR

(B)

Let AD be the multi-storied building of height h m.

And angle of depression of the top and bottom are 30° and 45°.

We assume that BE = 8, CD = 8 and BC = x, ED = x and AC = h − 8.



In ΔAED,

$\Rightarrow \quad \tan 45^o = \frac{AD}{DE}$

$\Rightarrow \quad 1 = \frac{h}{x}$

$\Rightarrow \quad h = x$

Also, In ΔABC,

$\Rightarrow \quad \tan 30^o = \frac{AC}{BC}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{(h-8)}{x}$

$\Rightarrow \quad x = h\sqrt{3} - 8\sqrt{3}$

$\Rightarrow \quad h = h\sqrt{3} - 8\sqrt{3}$ (As $h = x$)

$\Rightarrow \quad h = \frac{8\sqrt{3}}{\sqrt{3}-1}$

On simplifying,

$\Rightarrow \quad h = 4(3 + \sqrt{3})$ m

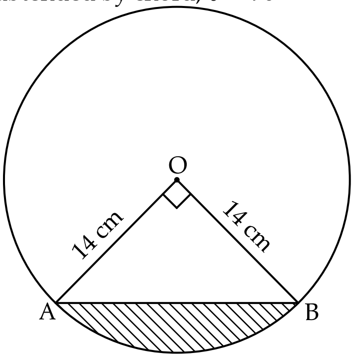
And $x = 4(3 + \sqrt{3})$ m

So, the height of multi-storied building is $4(3 + \sqrt{3})$ m and the distance between two buildings is $4(3 + \sqrt{3})$m

35. Given that,

Radius of circle, r = 14 cm

Angle subtended by chord, $\theta = 90^o$



We have,

Area of minor sector = $\frac{\pi r^2}{360^o}$

$= \frac{22}{7} \times 14 \times 14 \times \frac{90^o}{360^o}$

$= 154$ cm^2

Area of $\Delta AOB = \frac{1}{2} \times 14 \times 14 = 98$ cm^2

Now,

Area of minor segment = Area of minor sector – Area of ΔAOB

Area of minor segment = 154 – 98 = 56 cm^2

Also,

Area of major segment = Area of circle – Area of minor sector

Area of major segment = $\pi r^2 - 56$

$= \frac{22}{7} \times 14 \times 14 - 56$

$= 616 - 56$

$= 560$ cm^2

So, the area of major segment = 560 cm^2

SECTION–E

36. (i)

We have,

$R + r = 14$ (given)

Also,

Sum of areas = 130π m^2

$\Rightarrow \pi R^2 + \pi r^2 = 130\pi$

$\Rightarrow R^2 + r^2 = 130$ ---(i)

is the required quadratic equation.

(ii)

We have,

$R + r = 14$

$R = 14 - r$

Putting in eqn (i),

$\Rightarrow \quad (14 - r)^2 + r^2 = 130$

$\Rightarrow \quad 196 + r^2 - 28r + r^2 = 130$

$\Rightarrow \quad 2r^2 - 28r + 66 = 0$

$\Rightarrow \quad r^2 - 14r + 33 = 0$

Is the required quadratic equation in r only.

(iii)

We have,

$\Rightarrow \quad r^2 - 14r + 33 = 0$

$\Rightarrow \quad r^2 - 11r - 3r + 33 = 0$

$\Rightarrow \quad r(r - 11) - 3(r - 11) = 0$

$\Rightarrow \quad (r - 11)(r - 3) = 0$

$\Rightarrow \quad r = 11$(rejected) [As $R > r$]

So, $r = 3$ m

Corresponding Area irrigated $= \pi r^2 = 9\pi$ m^2

OR

We have,

$\Rightarrow \quad r^2 - 14r + 33 = 0$

$\Rightarrow \quad r^2 - 11r - 3r + 33 = 0$

$\Rightarrow r(r - 11) - 3(r - 11) = 0$

$\Rightarrow \quad (r - 11)(r - 3) = 0$

$\Rightarrow \quad r = 11$(rejected) [As R$>r$]

So, $r = 3$ m

Now,

$R + r = 14$

$\Rightarrow \quad R + 3 = 14$

$\Rightarrow \quad R = 11$ m

Corresponding area irrigated $= \pi R^2 = 121\pi$ m^2

37. For the given data we have,

Length (in mm)	Frequency (f)	Cumulative Frequency (Cf)
70-80	3	3
80-90	5	8
90-100	9	17
100-110	12	29
110-120	5	34
120-130	4	38
130-140	2	40

(i)

We have,

N = 40

$\frac{N}{2} = 20$

So, median class is 100 – 110.

(ii)

We know that, 10 cm = 100 mm

Number of leaves greater than 100 mm

= 12 + 5 + 4 + 2 = 23

(iii)

Median class is 100 – 110

So, $l = 100$

$\Rightarrow f = 12, Cf = 17$

$\Rightarrow h = 10$

$$\text{Median} = l + \frac{\left(\frac{N}{2} - Cf\right)}{f} \times h$$

$$\text{Median} = 100 + \frac{(20 - 17)}{12} \times 10$$

$$\text{Median} = 100 + 2.5$$

$$\text{Median} = 102.5$$

OR

We have,

Modal class as 100 – 110

So, $l = 100$

$\Rightarrow f_1 = 12, f_0 = 9, f_2 = 5$

$\Rightarrow h = 10$

We know that,

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$\text{Mode} = 100 + \frac{12 - 9}{24 - 9 - 5} \times 10$$

$$\text{Mode} = 100 + 3$$

$$\text{Mode} = 103$$

38. Given that,

AP = 30 cm

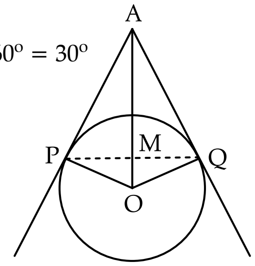
$\angle PAQ = 60^\circ$

We have,

AP = AQ = 30 cm (length of tangents are equal)

Also,

$\angle PAO = \frac{1}{2} \times \angle PAQ = \frac{1}{2} \times 60^\circ = 30^\circ$



In ΔAPM,

$\Rightarrow \quad \sin 30^\circ = \frac{PM}{AP}$

$\Rightarrow \quad \frac{1}{2} = \frac{PM}{30}$

$\Rightarrow \quad PM = 15$ cm

Also, PM = MQ = 15 cm (Chord is bisected by perpendicular from centre)

PQ = 2PM = 30 cm

(i) Length of PQ = 30 cm

(ii) As APOQ is a cyclic quadrilateral,

So, $\angle PAQ + \angle POQ = 180^\circ$

$\Rightarrow 60^\circ + \angle POQ = 180^\circ$

$\Rightarrow \angle POQ = 120^\circ$

(iii)

In ΔAOP,

$\Rightarrow \cos 30^\circ = \frac{AP}{OA}$

$\Rightarrow \quad \frac{\sqrt{3}}{2} = \frac{30}{OA}$

$\Rightarrow \quad OA = \frac{60}{\sqrt{3}}$

$\Rightarrow$ OA $= 20\sqrt{3}$ cm

OR

In ΔAOP,

$\Rightarrow \quad \tan 30^\circ = \frac{OP}{AP}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{OP}{30}$

$\Rightarrow \quad OP = \frac{30}{\sqrt{3}}$ cm

$\Rightarrow \quad OP = 10\sqrt{3}$ cm

Radius of mirror $= 10\sqrt{3}$ cm

Delhi Set–2 430/1/2

SECTION–A

1. Option (b) is correct.

LCM of (850,500)

2	850
5	425

2	500
2	250

5	85
17	17
	1

5	125
5	25
5	5
	1

$850 = 17 \times 5^2 \times 2$

$500 = 5^3 \times 2^2$

LCM (850, 500) $= 17 \times 5^3 \times 2^2$

$= 17 \times 500$

8. Option (d) is correct.

There are three possible outcomes where exactly one tail occurs : HHT, HTH and THH each of these outcomes has the same probability, because the coin are fair, So each outcomes has probability of $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

The "P" of getting are tail $= 3 \times \frac{1}{8} = \frac{3}{8}$

10. Option (a) is correct.

Outer surface area = lateral surface area of cylinder $= 2\pi rh$

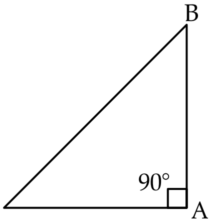
$= 2 \times \frac{22}{7} \times 7 \times 10 = 440$ sq. units.

11. Option (d) is correct.

Probability of not rolling a 6 (loosing the game) is 1 – $\frac{1}{6}$ (probability of getting 6)

$= \frac{5}{6}$

23.



$\tan C = \sqrt{3}$

$\tan C = \tan 60°$

$C = 60°$

$A + B + C = 180°$

[Sum of Angle in a triangle]

$B = 30°$

Now, $\sin B + \cos C - \cos^2 B$

$\Rightarrow \sin 30° + \cos 60° - \cos^2 30°$

$\Rightarrow \frac{1}{2} + \frac{1}{2} - \left(\frac{\sqrt{3}}{2}\right)^2$

$\Rightarrow 1 - \frac{3}{4}$

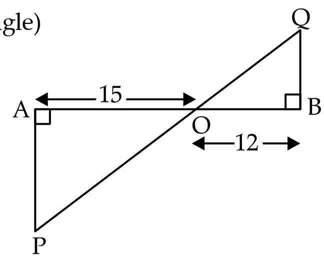
$\Rightarrow \frac{1}{4}$

24. In ΔAOP and ΔBOQ

$\angle A = \angle B = 90°$

$\angle AOP = \angle BOQ$ (Alt.angle)

AA Similarity



$\frac{AO}{OB} = \frac{AP}{BQ}$

$\frac{15}{12} = \frac{10}{BQ} \Rightarrow \frac{3}{12} = \frac{2}{BQ}$

BQ = 8 cm

26. L.H.S

$\Rightarrow \sqrt{\frac{\sec A - 1}{\sec A + 1} \times \frac{\sec A - 1}{\sec A - 1}} + \sqrt{\frac{\sec A + 1}{\sec A - 1} \times \frac{\sec A + 1}{\sec A + 1}}$

$\Rightarrow \sqrt{\frac{(\sec A - 1)^2}{\sec^2 A + 1}} + \sqrt{\frac{(\sec A + 1)^2}{\sec^2 A - 1}}$

$\Rightarrow \sqrt{\frac{(\sec A - 1)^2}{\tan^2 A}} + \sqrt{\frac{(\sec^2 A + 1)^2}{\tan^2 A}}$

$\Rightarrow \sqrt{\left(\frac{\sec A - 1}{\tan A}\right)^2} + \sqrt{\left(\frac{\sec A + 1}{\tan A}\right)^2}$

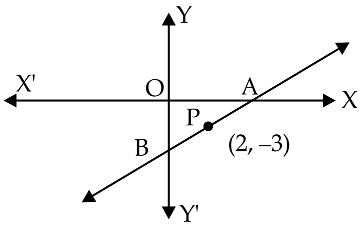
$\Rightarrow \frac{\sec A - 1}{\tan A} + \frac{\sec A + 1}{\tan A}$

$\frac{\sec A - 1 + \sec A + 1}{\tan A} \Rightarrow \frac{2 \sec A}{\tan A}$

$= \frac{2 \times \frac{1}{\cos A}}{\frac{\sin A}{\cos A}}$ $\left\{ \sec A = \frac{1}{\cos A}, \tan A = \frac{\sin A}{\cos A} \right\}$

$= \frac{2}{\sin A}$ = 2cosecA **Hence Proved**

30.



Given AP:PB = 3:1

Using section formula

$X = \frac{x_1 m_2 + x_2 m_1}{m_1 + m_2}$

$Y = \frac{y_1 m_2 + y_2 m_1}{m_1 + m_2}$

X, Y is a coordinate of P(2, –3)

Let coordinate of A $(x_1, 0)$ and coordinate of B $(0, y_2)$

$m_1 = 3$, $m_2 = 1$

$2 = \frac{x_1 \times 1 + 3 \times 0}{3 + 1}$

$8 = x_1$

$-3 = \frac{3 \times y_2 + 0 \times 1}{3 + 1}$

$-4 = y_2$

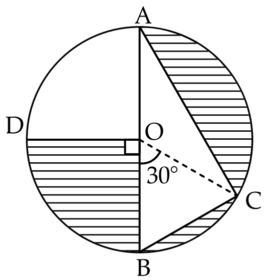
Co-ordinate of A (8,0)

Co-ordinate of B (0, – 4)

32. Given AC = 28cm.

BC = 21 cm.

Since $AB^2 = BC^2 + AC^2$



$AB^2 = 28^2+21^2$

$AB^2= 784 + 441$

$AB = 35$

Radius = $\frac{35}{2}$

Now area of shaded region = Area of circle – area of quadrilateral (AOD) – area of ΔABC

$= \pi r^2 - \frac{1}{4}\pi r^2 - \frac{1}{2} \times BC \times AC$

$= \frac{3}{4} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} - \frac{1}{2} \times 28 \times 21$

$= 427.875 \text{ cm}^2$ **Ans**

35. (i) $S_n = 4n^2 - n$

We know

$a_1 = S_1 \Rightarrow 4(1)^2-(1) = 3$

$\Rightarrow a_2 = S_2 - S_1$

$= 4(2)^2-(2) - \{4(1)^2-1\}$

$= 4 \times 4 - 2 - \{4 - 1\}$

$= 14 - 3$

$a_2 = 11$

$d = a_2 - a_1$

$d = 11-3$

$d = 8$

(ii) $a, a + d, a + 2d$

$3, 3+8, 3 + 2\times 8$

AP = 3, 11, 19 ....

(iii) $a = 3, d = 8, a_n = 107$

$a_n = a + (n - 1)d$

$\Rightarrow 107 = 3 + (n - 1)8$

$\Rightarrow \frac{104}{8} = n-1$

$= 13 + 1 = n$

$n = 14$

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SECTION–A

4. Option (b) is correct

Explanation:

Given that, Curved Surface Area of a right circular cone = 550 sq . cm

Radius of a right circular cone, $r = 7$ cm

To Find: Slant Height of a right circular cone

Curved Surface Area of a right circular cone = πrl

$550 = \frac{22}{7} \times 7 \times l$

$550 = 22 \times l$

$l = \frac{550}{22} = 25\text{cm}$

∴ Slant Height of a right circular cone, $l = 25$ cm

9. Option (d) is correct

Explanation:

Given that, HCF (96, 404) = 4

To Find : LCM (96, 404)

As we know that,

LCM of two numbers = Product of two numbers / their HCF

$= \frac{96 \times 404}{4}$

$= 9696$

13. Option (d) is correct

Explanation: Probability of an event always lie between 0 and 1.

15. Option (b) is correct

Explanation: Probability of atleast one 6 = 1 – Probability of number 6

Probability of not getting 6 on dice 1 = $\frac{5}{6}$

Probability of not getting 6 on dice 2 = $\frac{5}{6}$

Probability of number 6 = Both dice doesn't get 6

$= \frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$

Probability of atleast one 6 = $1 - \frac{25}{36} = \frac{11}{36}$

24. Given that

$\sin A = \frac{1}{2}$ and $\cos B = \frac{1}{\sqrt{2}}$

$\cos A = \sqrt{1 - \sin^2 A}$

$= \sqrt{1 - \left(\frac{1}{2}\right)^2} = \sqrt{1 - \frac{1}{4}} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$

$\sin B = \sqrt{1 - \cos^2 B}$

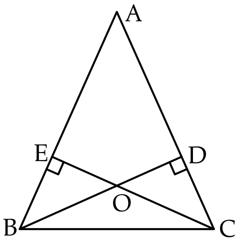
$= \sqrt{1 - \left(\frac{1}{\sqrt{2}}\right)^2} = \sqrt{1 - \frac{1}{2}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$

$\Rightarrow \sin A \sin B + \cos A \cos B$

$\Rightarrow \frac{1}{2} \times \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$

$\Rightarrow \frac{1}{2\sqrt{2}} + \frac{\sqrt{3}}{2\sqrt{2}} = \frac{1+\sqrt{3}}{2\sqrt{2}}$

25. Given that :In Δ ABC, BD and CE are perpendicular to AC and AB respectively.



To Prove: AE×BD=AD×CE

Proof: In ΔADB and Δ AEC

∠A=∠A (Common)

∠ADB = ∠AEC (each 90°)

⇒ ΔADB ~ΔAEC

When two triangles are similar, then their corresponding sides are proportional.

So, $\frac{BD}{CE} = \frac{AD}{AE}$

Hence , BD×AE=AD×CE

29. We have ,

LHS $= \sin^6\theta + \cos^6\theta + 3\sin^2\theta\cos^2\theta$

$\Rightarrow (\sin^2\theta)^3 + (\cos^2\theta)^3 + 3\sin^2\theta\cos^2\theta$

$\Rightarrow (\sin^2\theta + \cos^2\theta)^3 - 3\sin^2\theta\cos^2\theta(\sin^2\theta+\cos^2\theta)$

$+ 3\sin^2\theta\cos^2\theta$

$[a^3 + b^3 = (a+b)^3 - 3ab(a+b)]$

$\Rightarrow 1 - 3\sin^2\theta\cos^2\theta + 3\sin^2\theta\cos^2\theta = 1 = \text{RHS}$

31. As we know that ,

Diagonals of a parallelogram bisect each other.

Therefore, the coordinates of mid-point of AC are same as the coordinates of mid-point of BD i.e.,

By using mid point formula

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$\left(\frac{2-2}{2}, \frac{-1+b}{2}\right) = \left(\frac{a-3}{2}, \frac{4-2}{2}\right)$

$\left(0, \frac{-1+b}{2}\right) = \left(\frac{a-3}{2}, 1\right)$

$0 = \frac{a-3}{2}, \frac{-1+b}{2} = 1$

$\Rightarrow 0 = a-3$, $-1+b = 2$

$\Rightarrow a = 3$, $b = 3$

Also,

Length of the Sides of parallelogram

$\Rightarrow$ $AB = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$\Rightarrow$ $\sqrt{(3-2)^2 + (4+1)^2}$

$= \sqrt{26}$

AB = CD

[Pair of opposite sides of parallelogram are equal)

$\Rightarrow$ $CD = \sqrt{26}$

$\Rightarrow$ $BC = \sqrt{(-2-3)^2 + (3-4)^2}$

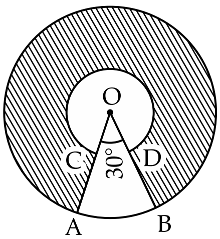
$= \sqrt{26}$

$\therefore$ BC = AD

$\Rightarrow$ $AD = \sqrt{26}$

Hence, AB = BC = CD = DA $= \sqrt{26}$

32. Area of Region ABCD = Area of bigger sector - Area of smaller Sector



$= \left(\frac{30}{360} \times \frac{22}{7} \times 14 \times 14 - \frac{30}{360} \times \frac{22}{7} \times 7 \times 7\right)$

$= \left(\frac{1}{12} \times 22 \times 2 \times 14 - \frac{1}{12} \times 22 \times 7\right)$

$= \frac{1}{12} \times 22 \times (28-7)$

$= \frac{1}{12} \times 22 \times 21$

$= \frac{77}{2}$ sq.cm

Area of circular ring $= \left(\frac{22}{7} \times 14 \times 14 - \frac{22}{7} \times 7 \times 7\right)$

$= (22 \times 14 \times 2 - 22 \times 7 \times 1)$

$= 22 \times 21 = 462$sq.cm

Hence, Required shaded area $= 462 - \frac{77}{2}$

$= 462 - 38.5 = 423.5$sq.cm

34. Let a and d be the first term and the common difference of an A.P. respectively .

$n = 50$

Given , sum of first 10 terms = 250

$S_n = \frac{n}{2}[2a + (n-1)d]$

$250 = \frac{10}{2}[2a + 9d]$

$2a + 9d = 50$ ... (1)

15^{th} term from the last $= (50 - 15+1)^{th} = 36^{th}$ term from the beginning.

$a_{36} = a + 35d$

Sum of last 15 terms =2625

$S_{50} - S_{35} = 2565$

$\frac{50}{2}[2a + (50-1)d] - \frac{35}{2}[2a + (35-1)d] = 2625$

$25(2a + 49d) - \frac{35}{2}(2a + 34d) = 2625$

$5(2a + 49d) - \frac{7}{2}(2a + 34d) = 525$

$10a + 245d - 7a - 119d = 525$

$3a + 126d = 525$

$a + 42d = 175$ ... (2)

From eq (1) & eq (2), we get

$\Rightarrow$ $2a + 9d = 20$

$\Rightarrow$ $2a + 84d = 350$

$\Rightarrow$ $-75d = -300$

$\Rightarrow$ $d = \frac{300}{75} = 4$

By putting the value of d in (1), we get

$\Rightarrow$ $2a + 9 \times 4 = 50$

$\Rightarrow$ $2a = 50 - 36$

$\Rightarrow$ $2a = 14$

$\Rightarrow$ $a = 7$

$\therefore$ Required A.P. is $a, a+d, a+2d, a+3d$, ... $a+49d$

= 7, 11 ,15 , 19, ..., 203

Outside Delhi Set–1 **430/2/1**

SECTION–A

1. Option (a) is correct.

Explanation: Smallest 2- digit number = 10

Smallest composite number = 4

Now, Prime factorization of 4 = 2×2

Prime factorization of 10 = 2×5

$\therefore$ H.C.F of (4, 10) = 2.

2. Option (c) is correct.

Explanation: Given, $x + y - 4 = 0$

$2x + ky - 8 = 0$

Here, $a_1 = 1 \quad b_1 = 1 \quad c_1 = -4$

And, $a_2 = 2 \quad b_2 = k \quad c_2 = -8$

For infinitely many solutions: $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Substituting, the value we get $\frac{1}{2} = \frac{1}{k} = \frac{-4}{-8}$

Thus, $\frac{1}{2} = \frac{1}{k} \Rightarrow k = 2$

or $\frac{1}{k} = \frac{-4}{-8} \Rightarrow k = 2$

Thus, value of $k = 2$ for infinitely many solutions.

3. Option (c) is correct.

Explanation: To determine which of the equations has 2 as a root, we substitute $x = 2$ into each equation:

(a) $x^2 - 4x + 5$

By substituting $x = 2$ we get,

$2^2 - 4 \times 2 + 5$

$= 4 - 8 + 5$

$= 9 - 8 = 1$

Therefore, 2 is not a root of this equation.

(b) $x^2 + 3x - 12$

By substituting $x = 2$ we get,

$2^2 + 3 \times 2 - 12$

$4 + 6 - 12 = 10 - 12 = -2$

Therefore, 2 is not a root of this equation.

(c) $2x^2 - 7x + 6$

By substituting $x = 2$ we get,

$2 \times 2^2 - 7 \times 2 + 6$

$= 8 - 14 + 6$

$= 14 - 14 = 0$

Therefore, 2 is a root of this equation

(d) $3x^2 - 6x - 2$

By substituting $x = 2$ we get,

$3 \times 2^2 - 6 \times 2 - 2$

$= 12 - 12 - 2$

$= 12 - 14 = -2.$

Therefore, 2 is not a root of this equation.

Hence, Equation (c) has 2 as root.

4. Option (d) is correct.

Explanation: $d = -4, a_7 = 4$

$$t_n = a + (n-1)d$$
$$a_7 = a + (7-1) - 4$$
$$4 = a + (-24)$$
$$4 + 24 = a$$
$$\Rightarrow \quad a = 28.$$

5. Option (b) is correct.

Explanation: The distance of a point $P(x, y)$ from origin is

$$\sqrt{(x^2 + y^2)}$$

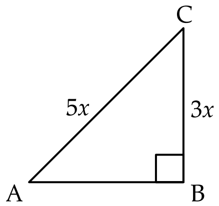
Substitute $x = 5$ and $y = 4$ we get,

$$\sqrt{(5^2 + 4^2)} = \sqrt{(25 + 16)} = \sqrt{41}$$

6. Option (b) is correct.

Explanation: We have, $\sin A = \frac{3}{5}$

As, $\sin A = \frac{P}{h}$



Let perpendicular = $3x$ and hypotenuse = $5x$

Also let ABC be a right angled Δ.

$5x$ $3x$

A B

$AC = \sqrt{AB^2 + BC^2}$ (By using Pythagoras theorem)

$$5x = \sqrt{AB^2 + (3x)^2}$$
$$(5x)^2 = AB^2 + 9x^2$$
$$AB^2 = 25x^2 - 9x^2$$
$$AB^2 = 16x^2$$
$$\Rightarrow \quad AB = 4x$$

Thus, Base = $4x$

Hence, $\cot A = \frac{B}{P} = \frac{4x}{3x} = \frac{4}{3}$

7. Option (d) is correct.

Explanation:

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

$$= \frac{\frac{\cos^2 A + \sin^2 A}{\cos^2 A}}{\frac{\sin^2 A + \cos^2 A}{\sin^2 A}} = \frac{\frac{1}{\cos^2 A}}{\frac{1}{\sin^2 A}}$$

$$= \frac{\sin^2 A}{\cos^2 A} = \tan^2 A$$

$$\therefore \quad \frac{1 + \tan^2 A}{1 + \cot^2 A} = \tan^2 A.$$

8. Option (c) is correct.

Explanation: $\dfrac{2\tan 30°}{1-\tan^2 30°}$

As, $\tan 30° = \dfrac{1}{\sqrt{3}}$

By substituting the value we get,

$$= \frac{2\times\frac{1}{\sqrt{3}}}{1-\left(\frac{1}{\sqrt{3}}\right)^2}$$

$$= \frac{\frac{2}{\sqrt{3}}}{\frac{3-1}{3}} = \frac{3}{\sqrt{3}} = \frac{3\sqrt{3}}{3} = \sqrt{3}$$

And, $\sqrt{3} = \tan 60°$.

9. Option (a) is correct.

Explanation: Given: Sum of zeroes = – 5 and product = 6

According to quadratic polynomial $ax^2 + bx + c$,

Sum of roots $= -\dfrac{b}{a} = -\dfrac{-5}{1}$

Product of roots $= \dfrac{c}{a} = 6$

Thus, $a = 1$, $b = 5$ and $c = 6$

By substituting value in quadratic polynomial we get, $1x^2 + (5)x + 6 = x^2 + 5x + 6$.

10. Option (c) is correct.

Explanation: Quadratic polynomial is in form of $ax^2 + bx + c = 0$

So, zeroes of polynomial is given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow \quad x = \frac{11 \pm \sqrt{(-11)^2 - 4\times 3\times -4}}{2\times 3}$$

$$= \frac{-11 \pm \sqrt{121+48}}{6} = \frac{-11 \pm \sqrt{169}}{6}$$

$$= \frac{-11 \pm 13}{6} = \frac{-11+13}{6} = \frac{2}{6} = \frac{1}{3}$$

$$= \frac{-11-13}{6} = \frac{-24}{6} = -4$$

Thus, zeroes of polynomial $= \left(\dfrac{1}{3}, -4\right)$

11. Option (c) is correct.

Explanation: Modal class is the one having highest frequency.

Here, highest frequency = 22 days

So modal class = 0 – 10

Now, Cumulative frequency table is:

Class - Interval	Frequency	Cumulative Frequency
0 - 10	22	22
10 - 20	10	32
20 - 30	8	40
30 - 40	15	55
40 - 50	5	60
50 - 60	6	66

Since total frequency is 66.

$$\frac{N}{2} = 33$$

And cumulative frequency greater than or equal to 33 lies in class 20-30.

So, median class is 20-30.

∴ Upper limit of median class is 30

Thus, difference between upper limits of modal and median classes is

$= 30 - 10 = 20$.

12. Option (c) is correct.

Explanation: As, probability of an event is always greater than equal to 0 and less than equal to 1.

It means probability lies between 0 and 1.

Therefore correct option is c.

13. Option (b) is correct.

Explanation: Total surface area of solid hemisphere = $3\pi r^2$

Given: radius = 7cm

$\Rightarrow$ TSA $= 3 \times \pi \times 7 \times 7$

$= 147\pi$ cm^{2s}

14. Option (b) is correct.

Explanation:

Given: radius = 21cm

Central angle $\angle AOB = 120°$

Area of minor sector $= \dfrac{\theta}{360°}\pi r^2 = \dfrac{120°}{360°} \times \dfrac{22}{7} \times 21 \times 21$

$= 462$ cm^2

Area of circle $= \pi r^2 = \dfrac{22}{7} \times 21 \times 21 = 1386$ cm^2

So, Area of major sector = 1386 – 462 = 924 cm^2

$\Rightarrow$Difference of the areas of a minor sector and its corresponding major sector

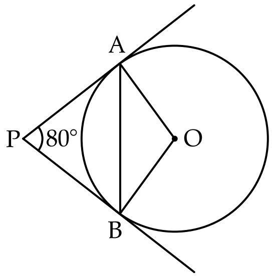
= 924 – 462 = 462 cm^2

15. Option (d) is correct.

Explanation: 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

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

16. Option (a) is correct.



Explanation:

In ΔOAB , we have

OA = OB (radii of same circle)

∴ ∠ABO = ∠BAO (Angles opposite to equal sides are equal)

As PA and PB are tangents from a point P to a circle with centre O.

So, ∠OAP = 90°

Similarly, ∠OBP = 90°

($\because$ tangents drawn from an external point to a circle are perpendicular to the circle)

Now, in quadrilateral PAOB,

$\angle P + \angle A + \angle O + \angle B = 360°$

$\Rightarrow \angle 80° + 90° + \angle O + 90° = 360°$

$\Rightarrow \angle O = 360° - (90° + 90° + 80°)$

$\angle O = 100°$

Again, in ΔOAB,

$\angle O + \angle ABO + \angle BAO = 180°$ (Angle sum property)

$100° + \angle ABO + \angle BAO = 180°$ ($\because \angle ABO = \angle BAO$)

$\Rightarrow 2\angle ABO = 180° - 100° = 80°$

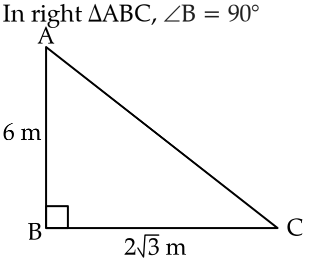
$\Rightarrow \angle ABO = 40°$

17. Option (a) is correct.

18. Option (c) is correct.

***Explanation*:**

In right ΔABC, $\angle B = 90°$



$\tan\theta = \frac{AB}{BC} = \frac{6}{2\sqrt{3}} = \sqrt{3} = \tan 60°$

$\Rightarrow \theta = 60°$

19. Option (c) is correct.

Explanation: In case of Assertion:

According to Thales theorem If a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio.

So, Assertion is true.

In case of reason:

Parallel lines can be drawn along any side of the triangle.

So, reason is false.

20. Option (a) is correct.

Explanation: In case of Assertion:

The point (0,4) has an x-coordinate = 0, which means that point lies on y-axis,

So, assertion is true.

In case of Reason:

The x- coordinate of a point, lying on y-axis is zero, because x- coordinate represents The distance of the point from y-axis is zero.

Therefore, both assertion and reason are true and reason is the correct explanation of assertion.

SECTION–B

21. Prime Factorisation of

$84 = 2 \times 2 \times 3 \times 7$

$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

So, HCF of 84 and 144 = $2\times2\times3$

= 12

22. (a) Let two natural numbers = x and y

Given sum $\Rightarrow x+y=70$ ….(i)

Difference = $x - y = 10$ …(ii)

By solving Equation Simultaneously we get,

$x + y = 70$

$x - y = 10$

$- \quad + \quad -$

$2y = 60$

$y = 30$

Substituting value of y in equation (i) is we get,

$x + 30 = 70$

$x = 40$

Thus, Natural Numbers = 40 and 30

OR

(b) Given:- $x - 3y = 7$ … (i)

$3x - 3y = 5$ ... (ii)

Solving equations and (i) and (ii) simultaneously we get,

$x - 3y = 7$

$3x - 3y = 5$

$- \quad + \quad -$

$-2x = (2)$

$x = (-1)$

Now, substitute value of x in equation (i) we get

$-1 - 3y = 7$

$\Rightarrow -3y = 7 + 1$

$\Rightarrow -3y = 8$

$\therefore y = \frac{-8}{3}$

Hence, $x = -1$ and $y = \frac{-8}{3}$

23. Numbers of defective Pens = 15

Number of Good Pens = 145

Total Number of Pens = 15+145

= 160

Probability that pen taken out is good one

$= \frac{\text{Number of Possible outcomes}}{\text{Total Number of favourable outcomes}}$

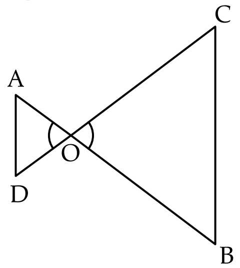
$\Rightarrow \frac{145}{160} = \frac{29}{32}.$

Thus, Probability of good pen = $\frac{29}{32}$.

24. (a)

Given:- OA $\times$ OB = OC $\times$ OD

To Prove:- ΔAOD ~ ΔCOB



Proof:– OA $\times$ OB = OC $\times$ OD

$\Rightarrow \frac{OA}{OC} = \frac{OD}{OB}$ …. (i)

Now, In ΔAOD and ΔBOC

$\frac{OA}{OC} = \frac{OD}{OB}$ (From (i))

$\angle AOD = \angle BOC$ (vertically opposite $\angle$s)

$\therefore \quad \Delta AOD \sim \Delta BOC$ (SAS similarity)

OR

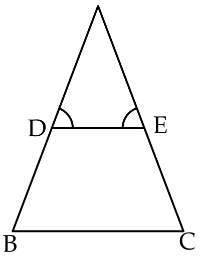
(b) Given:- $\angle D = \angle E$

$$\frac{AD}{BD} = \frac{AE}{EC}$$

To Prove: ΔABC is isosceles

Proof: In ΔADE

$\angle D = \angle E$ … (i)



And, $\frac{AD}{BD} = \frac{AE}{EC}$ (given)

$\therefore \frac{DE}{BC}$ (By converse of B.P.T)

In ΔABC

$\angle D = \angle B$ [Corresponding's are equal]

$\angle E = \angle C$

Thus $\angle B = \angle C$ (from (i))

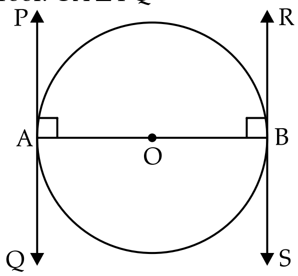
$\therefore$ AB = AC (sides opposite to equal angles) are equal

Hence, ΔABC is isosceles.

25. Given:- PQ and RS are tangents. AB is diameter

To Prove:- PQ || RS

Proof: OA $\perp$ PQ



OB $\perp$ RS (As, tangents are perpendicular to radius)

$\therefore \angle OAP = 90°, \angle OBR = 90°$

$\Rightarrow \angle OAP + \angle OBR = 90° + 90° = 180°$

If, Co-interior angles are supplementary lines are parallel to each other.

PQ || RS

Hence Proved.

SECTION–C

26. Total Outcomes $6^2 = 36$.

(a) An even number on both the dice

Possible outcome $\Rightarrow$ (2,2) (2,4) (2,6)
(4,2) (4,4) (4,6)
(6,2) (6,4) (6,6)
$\Rightarrow 9$

$\therefore P(E_1) \Rightarrow \frac{9}{36} = \frac{1}{4}$

(b) The sum of two numbers more than 9

Possible Outcome $\Rightarrow$ (4,6) (5,5) (5,6)
(6,4) (6,5) (6,6)

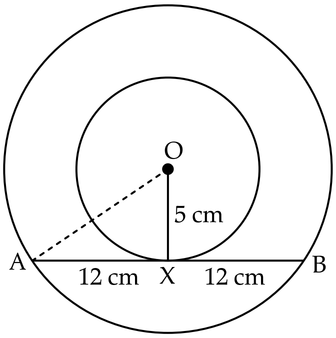
= 6

$\therefore P(E_2) = \frac{6}{36} = \frac{1}{6}$

27. (a) Given:- OX = 5 cm

AB = 24 cm

To find:- OA (Radius of Larger Circle)



Solution:- OX $\perp$ AB ($\because$ Radius drawn from the centre of a circle is $\perp$ to the Chord) … (i)

And, X is mid point of AB

($\because$ Perpendicular drawn from the centre of a circle to the chord bisects the chord) … (ii)

From (i) and (ii)

ΔOAX is a right angled triangle

$\angle OXA = 90°$

AX = 12 cm

By Using Pythagoras theorem.

$$OA^2 = OX^2 + AX^2$$
$$= 5^2 + 12^2$$
$$= 25+144$$
$$=169$$
$$OA = 13 \text{ cm.}$$

OR

(b) Given: - PA and PB are tangents

To Prove:- $\angle AOB + \angle APB = 180°$

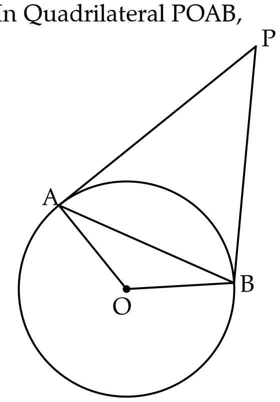
Proof;- OA $\perp$ PA

BO $\perp$ PB

[Radius of the circle is $\perp$ to the tangent.]

$\therefore \angle OAP = 90°$ and $\angle OBP = 90°$

In Quadrilateral POAB,



$\angle AOB + \angle OAP + \angle OBP + \angle APB = 360°$

(sum of all $\angle$s of a quadrilateral = 180°)

$\Rightarrow \quad \angle AOB + 90° + 90° + \angle APB = 360°$

$\Rightarrow \quad \angle AOB + \angle APB = 360° - 180°$

$\Rightarrow \quad \angle AOB + \angle APB = 180°$

Hence Proved.

28. Let us assume, to the contrary that $7-3\sqrt{5}$ is rational

$\Rightarrow 7-3\sqrt{5}=\frac{p}{q}$ where p and q are co-primes and $q \neq 0$

$\Rightarrow \sqrt{5}=\frac{p-7q}{-3q}$

$\Rightarrow \sqrt{5}=\frac{7q-p}{3q}$

Since p and q are integers

$\therefore \frac{7q-p}{3q}$ is a rational number

$\therefore \sqrt{5}$ is a rational number which is contradiction as $\sqrt{5}$ is an irrational number.

Hence, our assumption is wrong and hence $7-3\sqrt{5}$ is an irrational number.

29. (a) Given that α and β are zeroes of the Quadratic Polynomial x^2-3x+2

$\therefore$ Sum of roots $(\alpha+\beta)=\frac{-b}{a}=\frac{-(-3)}{1}=3$

& Product of roots $(\alpha\beta)=\frac{c}{a}=\frac{2}{1}=2$

Quadratic Polynomial whose zeroes are $2\alpha+1$ and $2\beta+1$ is:

Sum of roots $= 2\alpha+1+2\beta+1 = 2\alpha+2\beta+2$

$= 2(\alpha+\beta+1)$

$= 2(3+1)$ $\quad [\because \alpha+\beta=3]$

Product of roots $= (2\alpha+1)(2\beta+1)$

$= 4\alpha\beta+2\alpha+2\beta+1$

$= 4\alpha\beta+2(\alpha+\beta)+1$

$= 4\times 2+2(3)+1$

$= 8+6+1$

$\Rightarrow$ $= 15$

($\because \alpha\beta=2$ & $\alpha+\beta=3$ from above)

$\therefore$ Quadratic Polynomial $\Rightarrow x^2-$ (Sum of the roots x + Product of the roots) $= 0$

$\Rightarrow = x^2-8x+15=0.$

OR

(b) Given, Polynomial is $4x^2-4x+1$

$\Rightarrow 4x^2-2x-2x+1=0$

$\Rightarrow 2x(2x-1)-1(2x-1)=0$

$\Rightarrow (2x-1)(2x-1)=0$

$\Rightarrow x=\frac{1}{2}$

Hence, zeroes of given Polynomial is $x=\frac{1}{2}$

On comparing equation (i) with $ax^2+bx+c=0$, we get $a=4$, $b=-4$ and $c=1$

Now, sum of zeroes $=\frac{-b}{a}=\frac{-(-4)}{4}=1$

Product of zeroes $=\frac{c}{a}=\frac{1}{4}$

which Matches with:

Sum of the zeroes $=\frac{1}{2}+\frac{1}{2}=\frac{2}{2}=1$

Product of the zeroes $=\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$

Hence verified

30. Given :- $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\mathrm{cosec}\,\theta$

LHS $\Rightarrow \frac{\tan\theta}{1-\frac{1}{\tan\theta}}+\frac{\frac{1}{\tan\theta}}{1-\tan\theta}$

$\Rightarrow \frac{\tan^2\theta}{\tan\theta-1}-\frac{1}{\tan\theta(\tan\theta-1)}$

$\Rightarrow \frac{\tan^3\theta-1}{\tan\theta(\tan\theta-1)}$

$\Rightarrow \frac{(\tan\theta-1)(\tan^2\theta+\tan\theta+1)}{\tan\theta(\tan\theta-1)}$

$\Rightarrow \frac{\tan^2\theta+\tan\theta+1}{\tan\theta}$

$\Rightarrow \tan\theta+1+\frac{1}{\tan\theta}$

$\Rightarrow \tan\theta+1+\cot\theta$

$\Rightarrow \frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\sin\theta}+1$ $\quad \left(\because \tan\theta=\frac{\sin\theta}{\cos\theta} \text{ \& } \cot\theta=\frac{\cos\theta}{\sin\theta}\right)$

$\Rightarrow \frac{\sin^2\theta+\cos^2\theta}{\cos\theta\sin\theta}+1$

$\Rightarrow \frac{1}{\cos\theta\sin\theta}+1$ $\quad (\because \sin^2\theta+\cos^2\theta=1)$

$\Rightarrow 1+\sec\theta\cdot\mathrm{cosec}\,\theta$ $\quad \left(\because \frac{1}{\cos\theta}=\sec\theta \text{ \& } \frac{1}{\sin\theta}=\mathrm{cosec}\,\theta\right)$

Hence Proved.

31. $\Rightarrow$ Given:

Radius of Blades = 21cm

Centre Angle $(\theta)=120°$

Area of sector cleaned by blade $= r^2\,\frac{\theta\times\pi}{360°}$

Total area cleaned by two wipers

$= 2\times\frac{\theta}{360°}\times\pi r^2$

$= 2\times\frac{120°}{360°}\times\frac{22}{7}\times 21\times 21$

$= 924$ cm^2.

$\therefore$ Area cleaned by both wipers is 924 cm^2.

SECTION–D

32. Let Number of toys produced $= x$

Cost of Production of each toy = ₹$(55-x)$

Total Cost of Production = ₹750

$\Rightarrow x(55-x)=750$

$\Rightarrow 55x-x^2=750$

$\Rightarrow x^2-55x+750=0$

$\Rightarrow x^2-25x-30x+750=0$

$\Rightarrow x(x-25)-30(x-25)=0$

$(x-25)(x-30)=0$

So, $x=25$ and 30

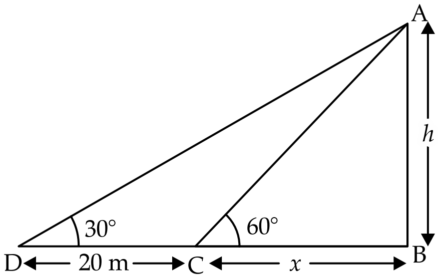
Hence, the number of toys will be either 25 or 30.

33. According to the figure.

In Right ΔABD

$$\tan 30^\circ = \frac{AB}{BC + CD}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x + 20}$$



Now, In right ΔABC

$$\tan 60^\circ = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{h}{x} \quad .....(i)$$

$$x\sqrt{3} = h \quad .... (ii)$$

Substitute value of 'h' in equation (i)

$x + 20 = h\sqrt{3}$

$\Rightarrow \quad x + 20 = x\sqrt{3} \times \sqrt{3}$

$\Rightarrow \quad x + 20 = 3x$

$\Rightarrow \quad 2x = 20$

$\Rightarrow \quad x = 10$

Substitute value of x in equation (ii)

$10\sqrt{3} = h$

Hence, height of tower $= 10\sqrt{3}$m

And, width of Canal = 10m. (1)

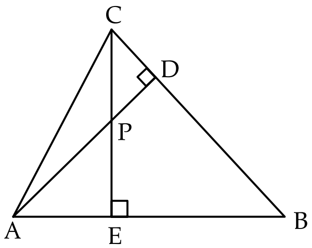
34. Given: $CE \perp AB$

$AD \perp BC$

To Prove: $\Delta AEP \sim \Delta CDP$

(ii) $\Delta ABD \sim \Delta CBE$

(iii) $\Delta AEP \sim \Delta ADB$



Proof: In ΔAEP and ΔCDP

$\angle APE = \angle CPD$ (vertically opposite $\angle$s are equal)

And, $\angle AEP = \angle PDC = 90^\circ$ (given)

$\therefore \Delta AEP \sim \Delta CDP$ (By A.A criterion)

(ii) In ΔABD and ΔCBE

$\angle B = \angle B$ (Common)

$\angle ADB = \angle CEB = 90^\circ$ (Given)

$\therefore \Delta ABD \sim \Delta CBE$ (By AA criterion)

(iii) In ΔAEP and ΔADB

$\angle A = \angle A$ (Common)

$\angle AEP = \angle ADB = 90^\circ$ (Given)

$\therefore \Delta AEP \sim \Delta ADB$ (By AA criterion)

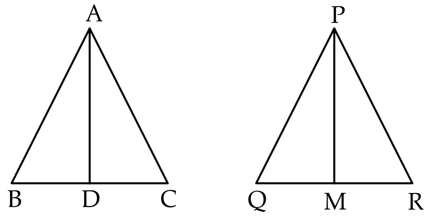
OR

(b) Given: $\Delta ABC \sim \Delta PQR$

To Prove:- $\frac{AB}{PQ} = \frac{AD}{PM}$

Proof:- $\Delta ABC \sim \Delta PQR$ (Given)

$$\therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$$



($\because$ If two triangles are similar, then their Corresponding sides are in same ratio)

$\Rightarrow \angle A = \angle P, \angle B = \angle Q$ and $\angle C = \angle R$

Now, since P and M are mid points of BC and QR respectively.

$\therefore BC = 2BD$ and $QR = 2QM$

$$\Rightarrow \frac{AB}{PQ} = \frac{2BD}{2MQ} = \frac{AC}{PR}$$

$$\Rightarrow \frac{AB}{PQ} = \frac{BD}{MQ} = \frac{AC}{PR} \quad ... (i)$$

In ΔABD and ΔPQM

$\frac{AB}{PQ} = \frac{BD}{QM}$ (from i)

$\angle B = \angle Q$ (Proved above)

$\therefore \Delta ABD \sim \Delta PQM$ (By SAS criterion)

Thus, $\frac{AB}{PQ} = \frac{AD}{PM}$ **Hence Proved.**

35. **(a)** Givens:-

Height of cuboid = 7 m

Length of cuboid = 20 m

Width of cuboid = 14 m.

Radius of cylinder $= \frac{14}{2} = 7$ m.

Height of cylinder = 20 m

volume of air inside the industry = volume of cuboid + volume of half Cylinder.

Volume of cuboid $= 7 \times 14 \times 20$

$= 1960m^3$

volume of cylinder $= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \times 20$

$= 1540m^3$

Thus, volume of air inside the industry

$= 1960 + 1540$

$= 3500m^3$

Total space occupied by machinery $= 400m^3$

$\therefore$ Space left in the industry $= 3500 - 400$

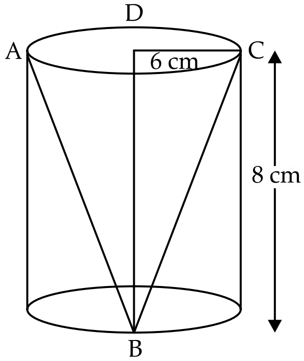
$= 3100m^3$

OR

(b) Given:- For Cylinder and cone

Height = 8 cm

Radius = 6cm



Slant height of cane

$\Rightarrow BC^2 = BD^2 + DC^2$

$= 8^2 + 6^2$

$= 64 + 36$

$BC^2 = 100$

BC = 10 cm. (2)

Total surface area of remaining solid

= CSA of cylinder + area of base + CSA of cone

$= 2\pi rh + \pi r^2 + \pi rl$

$= 2 \times \pi \times 6 \times 8 + \pi \times 6 \times 6 + \pi \times 6 \times 10$

$= 96\pi + 36\pi + 60\pi$

$= 192\pi$

$= 192 \times 3{\cdot}14$

$= 602.88 \text{ cm}^2$

SECTION–E

36. Given:-

Saving is increased by one ₹5 coin daily

So, Rehan's mother input = 5, 10, 15…

Number of coins on each day = 1,2,3,4…

Here AP is formed

So, $a = 1$, $d = 1$

(i) As number of coins are increasing by One daily.

So number of coins added on 8th day = 8.

(ii) As one ₹5 coin is added daily money after

8 days $\Rightarrow S_8 = \frac{n}{2}[2a + (n-1)d]$

$= \frac{8}{2}[2 \times 1 + (8-1)1]$

$= 4[2 + 7]$

$= 36$

Total money in 8 days = 36 × 5

= ₹ 180

(iii) (a) Number of coins Piggy bank can hold

= 120

$\therefore S_n = 120$

where $S_n = \frac{n}{2}[2a + (n-1)d]$

$\Rightarrow S_n = \frac{n}{2}[2 \times 1 + (n-1)1]$

$\Rightarrow \frac{n}{2}[2 + (n-1)] = 120$

$\Rightarrow \frac{n}{2}[2 + n - 1] = 120$

$= \frac{n}{2}[1 + n] = 120$

$= \frac{n}{2} + \frac{n^2}{2} = 120$

$= n^2 + n = 240$

$= n^2 + n - 240 = 0$

$= n^2 + 16n - 15n - 240 = 0$

$= n(n+16) - 15(n+16) = 0$

$= (n+16)(n-15) = 0$

$\Rightarrow n = -16$ and $n = 15$

Therefore, she can put coins for 15 days.

OR

For Amount 5, 10, 15…

AP = 5, 10, 15 …

$\Rightarrow a = 5$ and $d = 5$, $n = 15$.

$S_n = \frac{n}{2}[2a + (n-1)d]$

$S_n = \frac{15}{2}[2 \times 5 + (15-1)5]$

$= \frac{15}{2}[10 + 70]$

$= \frac{15}{2} \times 80$

= ₹600 (2)

∴ Total money solved = ₹600

37.

Number of heart beats per minute	Number of women (f)	Cumulative frequency
65-68	2	2
68-71	4	6
71-74	3	9
74-77	8	17
77-80	7	24
80-83	4	28
83-86	2	30
	$\sum(f) = 30$	

Number of women having heart beat in range 68-77

$\Rightarrow 4 + 3 + 8$

$= 15$ ...(i)

(ii) Total Freq. = 30

$\frac{N}{2} = \frac{30}{2} = 15$

Since Cumulative Frequency greater than or equal to 15 is lies in class Interval 74-77

∴ Median class of heart beats = 74-77.

(iii) (a) Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

where,

Modal class having highest frequency = 74-77

$l = 74$

$h = 3$

$f_1 = 8$

$f_0 = 3$

$f_2 = 7$

Thus, Mode = $74 + \left(\frac{8-3}{2\times8-3-7}\right)\times 3$

$= 74 + \frac{5}{6}\times 3$

$= 74 + \frac{5}{2} = \frac{148+5}{2}$

$= \frac{153}{2} = 76.5$

OR

(iii) **(b)** Here $N = \Sigma f = 30$.

$\therefore \frac{N}{2} = \frac{30}{2} = 15$

So, median class is 74-77.
lower limit of median class, $l = 74$
Class size $h = 3$
Cumulative frequency Preceding class, $Cf = 9$
Frequency of medias class = $f = 8$

Median = $l + \frac{\left(\frac{N}{2}-Cf\right)}{f}\times h$

$= 74 + \frac{\left(\frac{30}{2}-9\right)}{8}\times 3$

$= 74 + \frac{(15-9)}{8}\times 3$

$= 74 + \frac{6}{8}\times 3$

$= 74 + \frac{18}{8}$

$= 74 + 2.25$

$= 76.25.$

38. As per given figure

(i) Co-ordinates of A = (1, 9)
Co-ordinates of B = (5,13)

(ii) Mid-point of line segment = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Coordinates of C = (9,13)
Coordinates of D = (13,9)

Thus, mid point = $\left[\left(\frac{9+13}{2}\right)\left(\frac{13+9}{2}\right)\right]$

$= \left(\frac{22}{2}, \frac{22}{2}\right)$

$= (11, 11)$

(iii) (a) Distance between two points

$= \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

Here Coordinates of M (5, 11)
Coordinates of Q (9, 3)
Distance between M and Q

$d = \sqrt{(9-5)^2+(3-11)^2}$

$= \sqrt{(4)^2+(-8)^2}$

$= \sqrt{16+64}$

$= \sqrt{80}$

$= 4\sqrt{5}$

OR

(iii) (b) Coordinates of point which divides the line segment joining M and N in the ratio 1: 3 internally.

$x = \left(\frac{mx_2+nx_1}{m+n}\right), y = \left(\frac{my_2+ny_1}{m+n}\right)$

Co-ordinates of M = (5, 11)
Coordinates of N = (9,11)

$x = \left(\frac{1\times9+3\times5}{1+3}\right)$

$= \frac{9+15}{4} = \frac{24}{4} = 6$

$y = \left(\frac{1\times11+3\times11}{1+3}\right) = \left(\frac{11+33}{4}\right)$

$= \frac{44}{4} = 11.$

Thus Coordinates of point = (6, 11)

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SECTION–A

5. Option (c) is correct

Given, $\sin^2\theta = \frac{3}{4}$

$\Rightarrow \sin\theta = \pm\frac{\sqrt{3}}{2}$

$\Rightarrow \sin\theta = \frac{\sqrt{3}}{2}$ or $\sin\theta = -\frac{\sqrt{3}}{2}$

$\sin\theta = \sin 60°$ (Since $\sin 60° = \frac{\sqrt{3}}{2}$)
$\Rightarrow \theta = 60°$

(Case $\sin\theta = -\frac{\sqrt{3}}{2}$ is not included in our solution because in this case $\theta > 90°$and as per the syllabus we will restrict our discussion to acute angle and right angle only.)

6. Option (b) is correct

The given polynomial is $3x^2 - 5x - 2$
To find the zeroes of the given polynomial let, $3x^2 - 5x - 2 = 0$

$\Rightarrow \quad 3x^2 - 6x + x - 2 = 0$
$\Rightarrow \quad 3x(x-2) + 1(x-2) = 0$
$\Rightarrow \quad (x-2)(3x+1) = 0$
$\Rightarrow \quad x - 2 = 0$ or $3x + 1 = 0$
$\Rightarrow \quad x = 2$ or $x = \frac{-1}{3}$

Therefore, the zeroes of the given polynomial are $\frac{-1}{3}$ and 2.

7. Option (a) is correct

Let the height of the pole be BC which casts a shadow AC on the ground.

Therefore, according to question $AC = 21$ m and $BC = 7\sqrt{3}$.

Let Sun's angle of elevation is θ.

Then according to diagram,

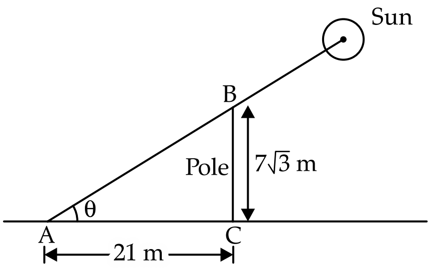
$$\tan\theta = \frac{BC}{AC}$$

$$\Rightarrow \tan\theta = \frac{7\sqrt{3}}{21} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \tan\theta = \tan 30° \qquad \left(\text{Since } \tan 30° = \frac{1}{\sqrt{3}}\right)$$

$$\Rightarrow \theta = 30°$$

Therefore, the Sun's elevation is 30°.



16. Option (a) is correct.

We know that if the root of a quadratic equation is – 1 then the quadratic equation will be satisfied by – 1.

Since $(-1)^2 - 4(-1) - 5 = 1+4-5 = 0$ therefore -1 is a root of $x^2 - 4x - 5 = 0$.

Since $-(-1)^2 - 4(-1) + 5 = -1+4+5 = 8 \neq 0$ therefore -1 is not a root of $-x^2 - 4x + 5 = 0$.

Since$(-1)^2 + 3(-1) + 4 = 1 - 3 + 4 = 2 \neq 0$ therefore -1 is not a root of $x^2+3x+4 = 0$.

Since $(-1)^2 - 5(-1) + 6 = 1+5+6 = 12 \neq 0$ therefore -1 is not a root of $x^2-5x+6 = 0$.

17. Option (b) is correct

Let d be the distance of the point (3,4) from the origin (0,0).

$$\therefore \quad d = \sqrt{(3-0)^2 + (4-0)^2} = \sqrt{9+16} = \sqrt{25} = 5$$

18. Option (d) is correct

Given, $a = -3$ and $d = -2$

We have to find the seventh term i.e., a_7

$\therefore a_7 = a + (7-1)d$

$= (-3) + 6(-2)$

$= -3 - 12 = -15$

22. Let E be the event "Rasmita will buy a pen if it is good."

Now according to question, the number of all possible outcomes of the experiment = 165

Number of outcomes favourable to $E = 165 - 30 = 135$

$$\therefore P(E) = \frac{135}{165} = \frac{9}{11}$$

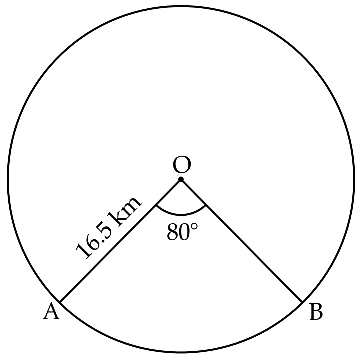
26. Distance over which light spread i.e., radius $r = 16.5$ km

Angle made by the sector $\theta = 80°$.

$\therefore$ The area of the sea over which the ships are warned

$$= \frac{\theta}{360} \times \pi r^2$$

$$= \frac{80}{360} \times 3.14 \times (16.5)^2 = \frac{2}{9} \times 3.14 \times (16.5)^2 = 189.97 \text{km}^2$$



27.(a) The given quadratic polynomial is $x^2 + x - 6$.

To find the zeros of the given polynomial let $x^2 + x - 6 = 0$

$\Rightarrow \quad x^2 + 3x - 2x - 6 = 0$

$\Rightarrow x(x+3) - 2(x+3) = 0$

$\Rightarrow (x+3)(x-2) = 0$

$\Rightarrow x + 3 = 0$ or $x - 2 = 0$

$\Rightarrow \quad x = -3, 2$

According to question let $\alpha = -3$ and $\beta = 2$.

We have to construct a quadratic polynomial whose zeros are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

Now the quadratic equation whose zeros are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ is $(x - \frac{1}{\alpha})(x - \frac{1}{\beta}) = 0$

$\Rightarrow \quad (x + \frac{1}{3})(x - \frac{1}{2}) = 0$

$\Rightarrow \quad x^2 - \frac{1}{6}x - \frac{1}{6} = 0$

$\Rightarrow \quad 6x^2 - x - 1 = 0$

Therefore, the required quadratic polynomial is. $6x^2 - x - 1$.

Alternative method: The quadratic equation is $x^2 + x - 6 = 0$

We know that for reciprocal roots, we only need to replace x by $\frac{1}{x}$ in the given equation.

Therefore, the quadratic equation whose roots are reciprocal roots of $x^2 + x - 6 = 0$ is,

$$\frac{1}{x^2} + \frac{1}{x} - 6 = 0$$

$\Rightarrow \quad 1 + x - 6x^2 = 0$

$\Rightarrow \quad 6x^2 - x - 1 = 0$

Therefore, the required quadratic polynomial is $6x^2 - x - 1$

OR

(b) The given polynomial is $2x^2+3x-2$.

To find the zeros of the given polynomial let

$2x^2 + 3x - 2 = 0$

$\Rightarrow \quad 2x^2 + 4x - x - 2 = 0$

$\Rightarrow 2x(x + 2) - 1(x + 2) = 0$

$\Rightarrow \quad (x + 2)(2x - 1) = 0$

$\Rightarrow \quad x = -2, \frac{1}{2}$

The zeros of the given polynomial are – 2 and $\frac{1}{2}$.

Now, $-2 + \frac{1}{2} = \frac{-3}{2} = -\frac{\text{cofficient of } x}{\text{cofficient of } x^2}$

and $-2\times\frac{1}{2} = -1 = \frac{\text{constant term}}{\text{cofficient of } x^2}$

34. Let the height of the tower be CE and the height of the building be AB. Draw AD || BC . Let. DE = x m. The angle of elevation from the top E of the tower to the top A of the building is 60°and the angle of depression from the bottom C of the tower to the top A of the building is 45°.

Now according to question, $AB = 7$ m

and $EC = (7 + x)$m.

$\angle DAC = \angle ACB = 45°$ (Alternate interior angles)

In ΔABC, $\tan 45° = \frac{AB}{BC}$

$\Rightarrow \frac{AB}{BC} = 1$

$\Rightarrow BC = AB = 7$ m

Now ABCD is a rectangle,

Therefore, $AD = BC = 7$ m

In ΔADE,

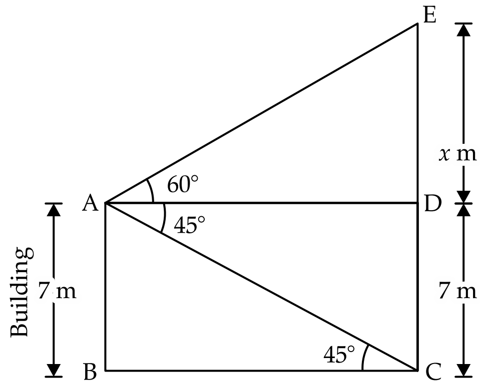
$\tan 60° = \frac{DE}{AD} = \frac{x}{7}$

$\Rightarrow \quad \sqrt{3} = \frac{x}{7}$

$\Rightarrow \quad x = 7\sqrt{3}$

$\therefore$ Height of the tower $EC = 7 + 7\sqrt{3} = 7(1 + \sqrt{3})$

$= 7(1 + 1.732) = 7 \times 2.732 = 19.124$ m



35. Let the number of articles produced be x.

Now according to question, the cost of production of each article is $2x+ 3$.

The total cost of production on that day= $x(2x+ 3)$

But we have, the total cost of production on that day was ₹90 .

$\therefore \quad x(2x+ 3) = 90$

$\Rightarrow \quad 2x^2 + 3x - 90 = 0$

$\Rightarrow \quad 2x^2 + 15x - 12x - 90 = 0$

$\Rightarrow \quad x(2x + 15) - 6(2x + 15) = 0$

$\Rightarrow \quad (2x + 15)(x - 6) = 0$

$\Rightarrow \quad x = 6, \frac{-15}{2}$

Since the number cannot be negative therefore, $x = 6$.

So, the number of articles = 6 and the cost of each article = ₹{(2×6) +3 } = ₹15 .

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SECTION–A

1. Option (c) is correct

Explanation:

Total surface area of a cube = $6 \times (\text{side})^2$

$= 6 \times (20)^2$

$= 6 \times 400$

$= 2400 \text{ cm}^2$

9. Option (b) is correct.

Explanation: Any number that ends with zero, must have factors 2 and 5.

Therefore, Answer is $(5 \times 2)^n$

10. Option (a) is correct.

Explanation: 5 cos A – 4 =0

$\cos A = \frac{4}{5}$ Since: $\sin^2 A = 1 - \cos^2 A = 1 - \left(\frac{4}{5}\right)^2 = \frac{3}{5}$

$\tan A = \frac{3}{4}$

14. Option (d) is correct.

Explanation: Given that $-2x+3y-9=0, 4x+py+7=0$

For unique solution: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\frac{-2}{4} \neq \frac{3}{p}$

$-2p \neq 4\times3$

$p \neq -6$

15. Option (c) is correct.

Explanation: $\frac{\text{cosec}^2 A - \cot^2 A}{1 - \sin^2 A} = \frac{1}{\cos^2 A} = \sec^2 A$

23. ***Explanation:*** $231 = 3 \times 7 \times 11$

$396 = 2^2 \times 3^2 \times 11$

L.C.M $= 2^2 \times 3^2 \times 7 \times 11$

$= 2772$

28. ***Explanation:*** Sample Space=n(S) = 44 (excluding queen and king cards)

(a) n(E)= Ace of Heart = 1

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{44}$$

(b) $n(F)$ = Black cards = 22

$$P(F) = \frac{n(F)}{n(S)} = \frac{22}{44} = \frac{1}{2}$$

(c) $n(G)$ = jack of spade = 1

$$P(G) = \frac{n(G)}{n(S)} = \frac{1}{44}$$

31. ***Explanation:*** Let us assume that $5\sqrt{2} - 3$ is an irrational number.

Then we can find integers a and $b (b \neq 0)$ such that

$$5\sqrt{2} - 3 = \frac{a}{b}$$

$$5\sqrt{2} = \frac{a}{b} + 3$$

$$5\sqrt{2} = \frac{a+3b}{b}$$

$$\sqrt{2} = \frac{a+3b}{5b}$$

This is a contradiction because the right-hand side is a rational number while given that $\sqrt{2}$ is an irrational.

So, Our assumption that $5\sqrt{2} - 3$ is rational is wrong.

Hence, $5\sqrt{2} - 3$ is an irrational number.

35. ***Explanation:*** Let Breadth = b

Length = $2b+1$

Area of Rectangular plot= length × breadth

$528 \text{ m}^2 = (2b+1) \times b$

$528 \text{ m}^2 = 2b^2 + b$

$2b^2 + b - 528 = 0$

$2b^2 + 33b - 32b - 528 = 0$

$b(2b + 33) - 16(2b + 33) = 0$

$(b - 16)(2b + 33) = 0$

Therefore, $b - 16 = 0$ $\quad$ $2b + 33 = 0$

$b = 16$ $\quad$ $b = \frac{-33}{2}$ (not possible)

So, breadth = b = 16 m

Length = $2b+1 = 2 \times 16 + 1 = 33$ m

Length = 33 m , Breadth = 16 m

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