CBSE EXAMINATION PAPER-2024
Mathematics (Standard)
Class-10th
(Solved)
(Delhi & Outside Delhi Sets)

Time : 3 Hours **Max. Marks : 80**

General Instructions:

Read the following instructions carefully and follow them:

*(i) This question paper contains **38** questions. **All** questions are **compulsory**.*

*(ii) This question paper is divided into **FIVE** sections - **A, B, C, D** and **E.***

*(iii) In **Section A,** Question numbers **1** to **18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion – Reason based questions of **1** mark each.*

*(iv) In **Section B,** Question numbers **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

*(v) In **Section C,** Question numbers **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

*(vi) In **Section D,** Question numbers **32** to **35** are long answer (LA) type questions, carrying **5** marks each.*

*(vii) In **Section E,** Question numbers **36** to **38** are **case-study based integrated** questions carrying **4** marks each. Internal choice is provided in **2** marks question in each case-study.*

*(viii) 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 of 2 marks in Section **E**.*

(ix) Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.

*(x) Use of calculators is **NOT allowed**.*

Delhi Set-1 **30/1/1**

SECTION – A

This section consists of 20 questions of 1 mark each.

1. If the sum of zeroes of the polynomial $2x^2 - k\sqrt{2x} + 1$ is $\sqrt{2}$, then value of k is:

(A) $\sqrt{2}$ **(B)** 2
(C) $2\sqrt{2}$ **(D)** $\frac{1}{2}$

2. If the probability of a player winning a game is 0.79, then the probability of his losing the same game is:

(A) 1.79 **(B)** 0.31
(C) 0.21% **(D)** 0.21

3. If the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and equal, then which of the following relation is true?

(A) $a = \frac{b^2}{c}$ **(B)** $b^2 = ac$
(C) $ac = \frac{b^2}{4}$ **(D)** $c = \frac{b^2}{a}$

4. In an A.P., if the first term $a = 7$, nth term $a_n = 84$ and the sum of first n terms $S_n = \frac{2093}{2}$, then n is equal to:

(A) 22 **(B)** 24
(C) 23 **(D)** 26

5. If two positive integers p and q can be expressed as $p = 18\,a^2b^4$ and $q = 20\,a^3b^2$, where a and b are prime numbers, then LCM(p, q) is:

(A) $2\,a^2b^2$ **(B)** $180\,a^2b^2$
(C) $12\,a^2b^2$ **(D)** $180\,a^3b^4$

6. AD is a median of ΔABC with vertices A(5, –6), B(6, 4) and C(0, 0). Length AD is equal to:

(A) $\sqrt{68}$ units **(B)** $2\sqrt{15}$ units
(C) $\sqrt{101}$ units **(D)** 10 units

7. If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is:

(A) $1 - \frac{1}{m}$ **(B)** $m^2 - 1$
(C) $\frac{1}{m}$ **(D)** $-m$

8. From the data 1, 4, 7, 9, 16, 21, 25 if all the even numbers are removed, then the probability of getting at random a prime number from the remaining is:

(A) $\frac{2}{5}$ **(B)** $\frac{1}{5}$
(C) $\frac{1}{7}$ **(D)** $\frac{2}{7}$

9. From some data $x_1, x_2, \ldots x_n$ with respective frequencies $f_1, f_2, \ldots f_n$, the value of $\sum_{1}^{n} f_i(x_i - \bar{x})$ is equal to:

(A) $n\bar{x}$ **(B)** 1

(C) Σf_i **(D)** 0

10. The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is:

(A) $-\frac{5}{2}$ **(B)** $\frac{5}{2}$

(C) –5 **(D)** 10

11. If the distance between the points (3, –5) and (x, –5) is 15 units, then the values of x are:

(A) 12, –18 **(B)** –12, 18

(C) 18, 5 **(D)** –9, –12

12. If $\cos(\alpha + \beta) = 0$, then value of $\cos\left(\frac{\alpha+\beta}{2}\right)$ is equal to:

(A) $\frac{1}{\sqrt{2}}$ **(B)** $\frac{1}{2}$

(C) 0 **(D)** $\sqrt{2}$

13. A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is:

(A) 1 : 1 **(B)** 1 : 4

(C) 2 : 3 **(D)** 3 : 2

14. The middle most observation of every data arranged in order is called:

(A) mode **(B)** median

(C) mean **(D)** deviation

15. The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is:

(A) $\frac{4\pi}{3}$ cu cm **(B)** $\frac{5\pi}{3}$ cu cm

(C) $\frac{8\pi}{3}$ cu cm **(D)** $\frac{2\pi}{3}$ cu cm

16. Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5, is:

(A) $\frac{7}{36}$ **(B)** $\frac{11}{36}$

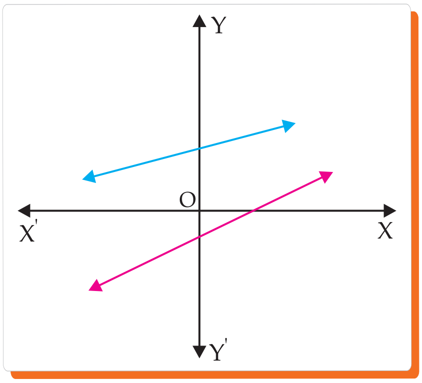
(C) $\frac{5}{36}$ **(D)** $\frac{4}{9}$

17. The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at:

(A) (0, 0) **(B)** (4, 0)

(C) (–2, 0) **(D)** (–6, 0)

18. In the given figure, graphs of two linear equations are shown. The pair of these linear equations is:



(A) consistent with unique solution.

(B) consistent with infinitely many solutions.

(C) inconsistent.

(D) inconsistent but can be made consistent by extending these lines.

Directions:

In Q. No. 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 true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, 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): The tangents drawn at the end points of a diameter of a circle, are parallel.

Reason (R): Diameter of a circle is the longest chord.

20. Assertion (A): If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial.

Reason (R): A polynomial of degree $n(n > 1)$ can have at most n zeroes.

SECTION – B

This section consists of 5 questions of 2 marks each.

21. Solve the following system of linear equations $7x - 2y = 5$ and $8x + 7y = 15$ and verify your answer.

22. In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card.

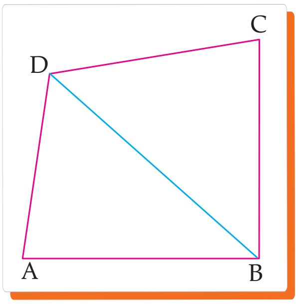
23. (a) Evaluate : $2\sqrt{2}\cos 45° \sin 30° + 2\sqrt{3}\cos 30°$

OR

(b) If $A = 60°$ and $B = 30°$, verify that: $\sin(A + B) = \sin A \cos B + \cos A \sin B$

24. In the given figure, ABCD is a quadrilateral. Diagonal BD bisects ∠B and ∠D both.

Prove that:



(i) $\Delta ABD \sim \Delta CBD$

(ii) $AB = BC$

25. **(a)** Prove that $5 - 2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number.

OR

(b) Show that the number $5 \times 11 \times 17 + 3 \times 11$ is a composite number.

SECTION – C

This section consists of 6 questions of 3 marks each.

26. **(a)** Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y.

OR

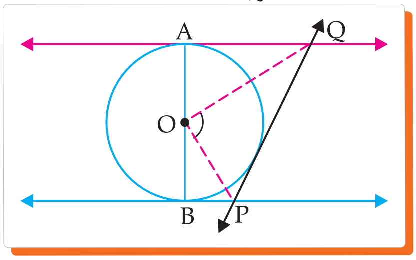
(b) ABCD is a rectangle formed by the points A(–1, –1) B(–1, 6), C(3, 6) and D(3, –1). P, Q, R and S are mid-points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other.

27. In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject.

28. Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta.\text{cosec}\,\theta$

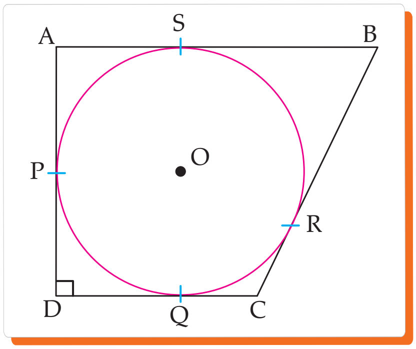
29. Three years ago, Rashmi was thrice as old as Nazma. Ten years later, Rashmi will be twice as old as Nazma. How old are Rashmi and Nazma now?

30. **(a)** In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that $\angle POQ = 90°$



OR

(b) A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD is which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, $BC = 30$ cm and $BS = 24$ cm, then find the length DC.



31. The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder.

SECTION – D

This section consists of 4 questions of 5 marks each.

32. An arc of a circle of radius 21 cm subtends an angle of 60° at the centre. Find:

(i) the length of the arc.

(ii) the area of the minor segment of the circle made by the corresponding chord.

33. **(a)** The sum of first and eight terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P.. Hence, also find the sum of its first 20 terms

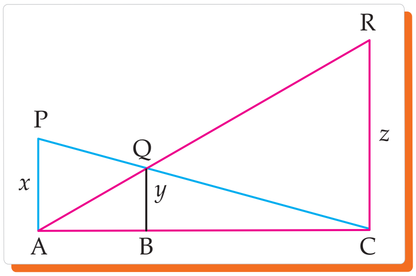
OR

(b) In a A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P.. Also, find the sum of all the terms of the A.P..

34. **(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 the other two sides are divided in the same ratio.

OR

(b) In the given figure PA, QB and RC are each perpendicular to AC. If $AP = x$, $BQ = y$ and $CR = z$, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$



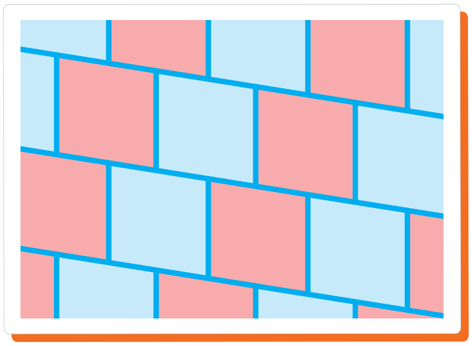
35. A pole 6 m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60° and the angle of depression of the point P from the top of the tower is 45°. Find the height of the tower and the distance of point P from the foot of the tower.

(use $\sqrt{3} = 1.73$)

SECTION – E

This section consists of 3 Case-Study Based Questions of 4 marks each.

36. A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor.



(i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information. **1**

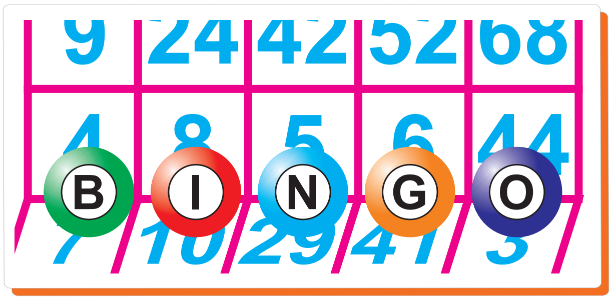
(ii) Write the corresponding quadratic equation in standard form. **1**

(iii)(a) Find the value of x, the length of side of a tile by factorisation. **2**

OR

(b) Solve the quadratic equation for x, using quadratic formula. **2**

37. BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it. The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game.



The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following:

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

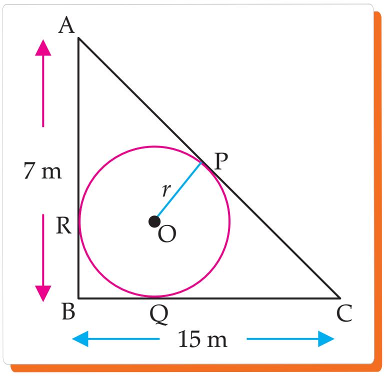
(ii) When first ball was picked up, what was the probability of calling out an even number? **1**

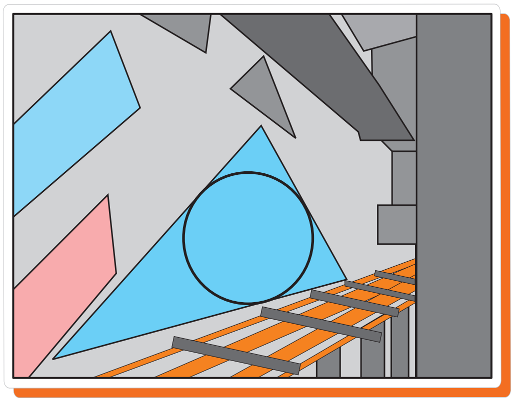
(iii)(a) Find median of the given data. **2**

OR

(b) Find mode of the given data. **2**

38. A backyard is in the shape of a triangle ABC with right angle at B. $AB = 7$ m and $BC = 15$ m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that $AP = x$ m.





Based on the above information, answer the following questions:

(i) Find the length of AR in terms of x. **1**

(ii) Write the type of quadrilateral BQOR. **1**

(iii)(a) Find the length PC in terms of x and hence find the value of x. **2**

OR

(b) Find x and hence find the radius r of circle. **2**

Delhi Set-2 **30/1/2**

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

SECTION – A

This section consists of 20 question of 1 mark each.

4. If $\sin A = \frac{2}{3}$, then value of cot A is:

(A) $\frac{\sqrt{5}}{2}$ **(B)** $\frac{3}{2}$

(C) $\frac{5}{4}$ **(D)** $\frac{2}{3}$

7. Which of the following is not probability of an event?

(A) 0.89 (B) 52%

(C) $\frac{1}{13}\%$ (D) $\frac{1}{0.89}$

13. If the sum and the product of zeroes of a quadratic polynomial are $2\sqrt{3}$ and 3 respectively, then a quadratic polynomial is:

(A) $x^2+2\sqrt{3}x-3$ (B) $(x-\sqrt{3})^2$

(C) $x^2-2\sqrt{3}x-3$ (D) $x^2+2\sqrt{3}x+3$

17. nth term of an A.P. is $7n + 4$. The common difference is:

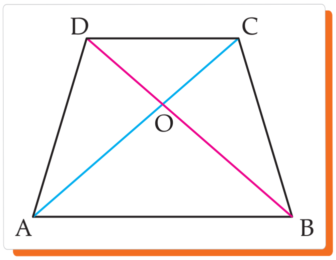
(A) $7n$ (B) 4

(C) 7 (D) 1

SECTION – B

This section consists of 5 questions of 2 marks each.

21. Diagonals AC and BD of a trapezium ABCD intersect at O, where AB || DC. If $\frac{DO}{OB} = \frac{1}{2}$, then show that $AB = 2\,CD$



23. Solve the following system of linear equations:
$2p + 3q = 13$ and $5p - 4q = -2$

SECTION – C

This section consists of 6 questions of 3 marks each.

27. In a chemistry lab, there is some quantity of 50% acid solution and some quantity of 25% acid solution. How much of each should be mixed to make 10 litres of 40% acid solution?

29. A wooden toy is made by scooping out a hemisphere of same radius as of cylinder, from each end of a wooden solid cylinder. If the height of the cylinder is 20 cm and its base is of radius 7 cm, find the total surface area of the toy.

SECTION – D

This section consists of 4 questions of 5 marks each.

33. From the top of a building 60 m high, the angles of depression of the top and bottom of the vertical lamp post are observed to be 30° and 60° respectively.

(i) Find the horizontal distance between the building and the lamp post.

(ii) Find the distance between the tops of the building and the lamp post.

35. A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area and the volume of the vessel.

Delhi Set-3 **30/1/3**

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

SECTION – A

This section consists of 20 question of 1 mark each.

2. In an A.P., if the first term (a) = –16 and the common difference (d) = –2, then the sum of first 10 terms is:

(A) –200 (B) –70

(C) –250 (D) 250

7. One card is drawn at random from a well shuffled deck of 52 playing cards. The probability that it is a red ace card, is:

(A) $\frac{1}{13}$ (B) $\frac{1}{26}$

(C) $\frac{1}{52}$ (D) $\frac{1}{2}$

9. For θ = 30°, the value of (2 sin θ cos θ) is:

(A) 1 (B) $\frac{\sqrt{3}}{2}$

(C) $\frac{\sqrt{3}}{4}$ (D) $\frac{3}{2}$

16. If α, β are the zeroes of the polynomial $6x^2 - 5x - 4$, then $\frac{1}{\alpha}+\frac{1}{\beta}$ is equal to:

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

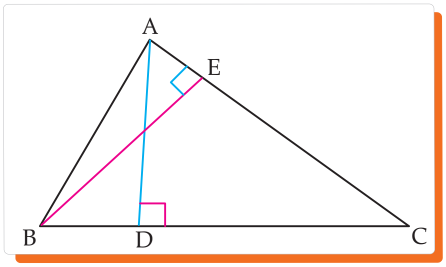
(C) $\frac{4}{5}$ (D) $\frac{5}{24}$

SECTION – B

This section consists of 5 questions of 2 marks each.

24. Solve the following system of linear equations algebraically:
$2x + 5y = -4$; $4x - 3y = 5$

25. In ΔABC, altitudes AD and BE are drawn. The AD = 7 cm, BE = 9 cm and EC = 12 cm then, find the length of CD.



SECTION – C

This section consists of 6 questions of 3 marks each.

26. The sum of the digits of a 2-digit number is 14. The number obtained by interchanging its digits exceeds the given number by 18. Find the number.

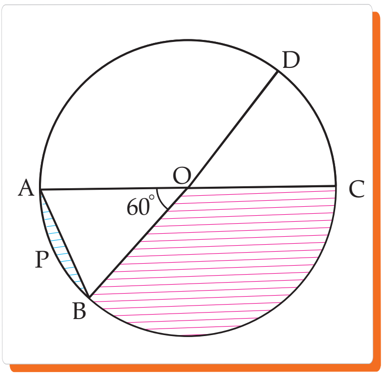
27. The inner and outer radii of a hollow cylinder surmounted on a hollow hemisphere of same radii are 3 cm and 4 cm respectively. If height of the cylinder is 14 cm, then find its total surface area (inner and outer).

SECTION – D

This section consists of 4 questions of 5 marks each.

32. From the top of a 15 m high building, the angle of elevation of the top of a tower is found to be 30°. From the bottom of the same building, the angle of elevation of the top of the tower is found to be 60°. Find the height of the tower and the distance between tower and the building.

35. In the given figure, diameters AC and BD of the circle intersect at O. If $\angle AOB = 60°$ and $OA = 10$ cm, then:



(i) Find the length of the chord AB.

(ii) Find the area of shaded region.

(Take $\pi = 3.14$ and $\sqrt{3} = 1.73$)

Outside Delhi Set-1 **30/2/1**

SECTION A

This section consists of 20 questions of 1 mark each.

1. The value of k for which the system of equations $3x - y + 8 = 0$ and $6x - ky + 10 = 0$ has infinitely many solutions, is

(A) –2 **(B)** 2

(C) $\frac{1}{2}$ **(D)** $-\frac{1}{2}$

2. Point P divides the line segment joining the points A(4, –5) and B(1, 2) in the ratio 5 : 2. Co-ordinates of point P are

(A) $\left(\frac{5}{2}, \frac{-3}{2}\right)$ **(B)** $\left(\frac{11}{7}, 0\right)$

(C) $\left(\frac{13}{7}, 0\right)$ **(D)** $\left(0, \frac{13}{7}\right)$

3. The common difference of an A.P. in which $a_{15} - a_{11} = 48$, is

(A) 12 **(B)** 16

(C) –12 **(D)** –16

4. The quadratic equation $x^2 + x + 1 = 0$ has .... roots.

(A) real and equal **(B)** irrational

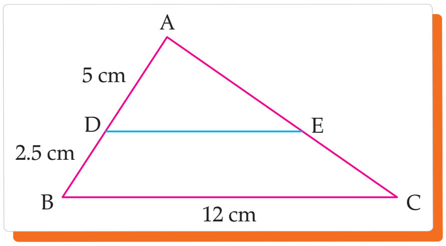
(C) real and distinct **(D)** not-real

5. If the HCF(2520, 6600) = 40 and LCM(2520, 6600) = $252 \times k$, then the value of k is

(A) 1650 **(B)** 1600

(C) 165 **(D)** 1625

6. In the given figure ΔABC is shown. DE is parallel to BC. If $AD = 5$ cm, $DB = 2.5$ cm and $BC = 12$ cm, then DE is equal to



(A) 10 cm **(B)** 6 cm

(C) 8 cm **(D)** 7.5 cm

7. If $\sin\theta = \cos\theta$, $(0° < \theta < 90°)$, then value of $(\sec\theta \cdot \sin\theta)$ is:

(A) $\frac{1}{\sqrt{2}}$ **(B)** $\sqrt{2}$

(C) 1 **(D)** 0

8. Two dice are rolled together. The probability of getting the sum of the two numbers to be more than 10, is

(A) $\frac{1}{9}$ **(B)** $\frac{1}{6}$

(C) $\frac{7}{12}$ **(D)** $\frac{1}{12}$

9. If α and β are zeroes of the polynomial $5x^2 + 3x - 7$, the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is

(A) $-\frac{3}{7}$ **(B)** $\frac{3}{5}$

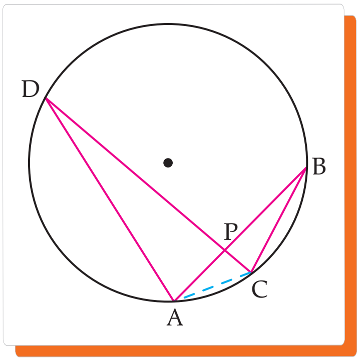
(C) $\frac{3}{7}$ **(D)** $-\frac{5}{7}$

10. The perimeters of two similar triangles ABC and PQR are 56 cm and 48 cm respectively. $\frac{PQ}{AB}$ is equal to

(A) $\frac{7}{8}$ **(B)** $\frac{6}{7}$

(C) $\frac{7}{6}$ **(D)** $\frac{8}{7}$

11. AB and CD are two chords of a circle intersecting at P. Choose the correct statement from the following:



(A) $\Delta ADP \sim \Delta CBA$ **(B)** $\Delta ADP \sim \Delta BPC$

(C) $\Delta ADP \sim \Delta BCP$ **(D)** $\Delta ADP \sim \Delta CBP$

12. If value of each observation in a data is increased by 2, then median of the new data

(A) increases by 2 **(B)** increases by $2n$

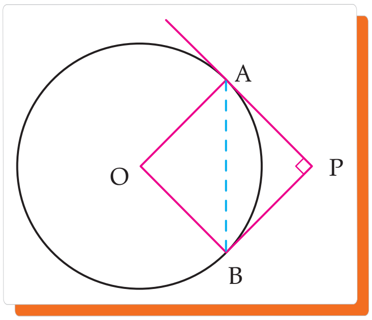
(C) remains same **(D)** decreases by 2

13. A box contains cards numbered 6 to 55. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square, is

(A) $\frac{7}{50}$ **(B)** $\frac{7}{55}$

(C) $\frac{1}{10}$ **(D)** $\frac{5}{49}$

14. In the given figure, tangents PA and PB to the circle centred at O, from point P are perpendicular to each other. If $PA = 5$ cm, then length of AB is equal to



(A) 5 cm **(B)** $5\sqrt{2}$ cm

(C) $2\sqrt{5}$ cm **(D)** 10 cm

15. XOYZ is a rectangle with vertices X(–3, 0), O(0, 0), Y(0, 4) and Z(x, y). The length of its each diagonal is

(A) 5 units **(B)** $\sqrt{5}$ units

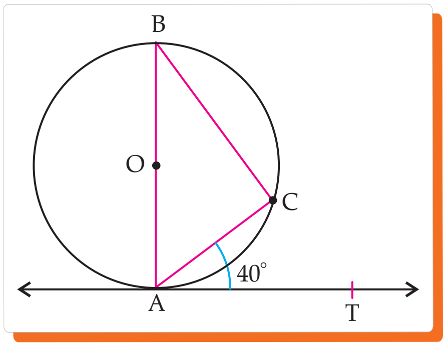
(C) $x^2 + y^2$ units **(D)** 4 units

16. Which term of the A.P. –29, –26, –23, ..., 61 is 16?

(A) 11^{th} **(B)** 16^{th}

(C) 10^{th} **(D)** 31^{st}

17. In the given figure, AT is tangent to a circle centred at O. If $\angle CAT = 40°$, then $\angle CBA$ is equal to



(A) 70° **(B)** 50°

(C) 65° **(D)** 40°

18. After an examination, a teacher wants to know the marks obtained by maximum number of the students in her class. She requires to calculate .... of marks.

(A) median **(B)** mode

(C) mean **(D)** range

Directions: In Question 19 and 20, Assertion (A) and Reason (R) are given. Select the correct option from the following:

(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of Assertion (A).

(C) Assertion (A) is true but Reason (R) is not true.

(D) Assertion (A) is not true but Reason (R) is true.

19. Assertion (A): If $\sin A = \frac{1}{3}(0° < A < 90°)$, then the value of cos A is $\frac{2\sqrt{2}}{3}$

Reason (R): For every angle θ, $\sin^2\theta + \cos^2\theta = 1$.

20. Assertion (A): Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm^2.

Reason (R): Area of each surface of a cube of side 10 cm is 100 cm^2.

SECTION – B

This section consists of 5 questions of 2 marks each.

21. Can the number $(15)^n$, n being a natural number, end with the digit 0?

Give reasons.

22. Find the type of triangle ABC formed whose vertices are A(1, 0), B(–5, 0) and C(–2, 5).

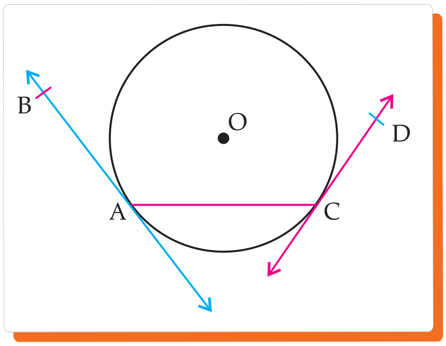
23. (a) Evaluate : $2 \sin^2 30° \sec 60° + \tan^2 60°$.

OR

(b) If $2 \sin(A + B) = \sqrt{3}$ and $\cos(A - B) = 1$, then find the measures of angles A and B.

$0 \le A, B, (A + B) \le 90°$.

24. In the given figure, AB and CD are tangents to a circle centred at O. Is $\angle BAC = \angle DCA$? Justify your answer.



25. **(a)** In what ratio is the line segment joining the points (3, –5) and (–1, 6) divided by the line $y = x$?

OR

(b) A(3, 0), B(6, 4) and C(–1, 3) are vertices of a triangle ABC. Find length of its median BE.

SECTION – C

This section consists of 6 questions of 3 marks each.

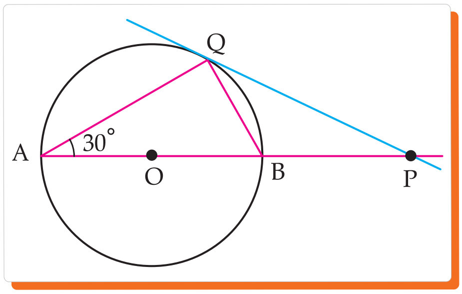
26. **(a)** If the sum of first m terms of an A.P. is same as sum of its first n terms $(m \neq n)$, then show that the sum of its first $(m + n)$ terms is zero.

OR

(b) In a A.P., the sum of the three consecutive terms is 24 and the sum of their squares is 194. Find the numbers.

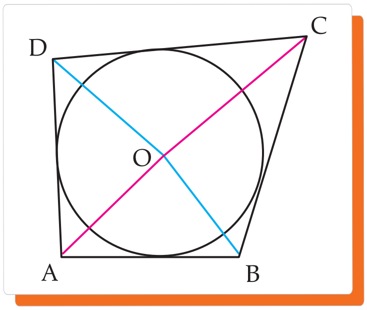
27. Prove that $\sqrt{5}$ is an irrational number.

28. **(a)** In the given figure, PQ is tangent to a circle at O and $\angle BAQ = 30°$, show that $BP = BQ$.



OR

(b) In the given figure, AB, BC, CD and DA are tangents to the circle with centre O forming a quadrilateral ABCD.
Show that $\angle AOB + \angle COD = 180°$



29. Prove that $\dfrac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta} = \dfrac{1-\sin\theta}{\cos\theta}$.

30. In a test, the marks obtained by 100 students (out of 50) are given below:

Marks obtained:	0-10	10-20	20-30	30-40	40-50
Number of students:	12	23	34	25	6

Find the mean marks of the students.

31. In a 2-digit number, the digit at the unit's place is 5 less than the digit at the ten's place. The product of the digits is 36. Find the number.

SECTION – D

This section consists of 4 questions of 5 marks each.

32. **(a)** Using graphical method, solve the following system of equations:
$3x + y + 4 = 0$ and $3x - y + 2 = 0$

OR

(b) Tara scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each wrong answer, then Tara would have scored 50 marks. Assuming that Tara attempted all question, find the total number of questions in the test.

33. **(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 the other two sides are divided in the same ratio.

OR

(b) Sides AB and AC and median AD to ΔABC are respectively proportional to sides PQ and PR and median PM of another triangle PQR. Show that ΔABC ~ ΔPQR.

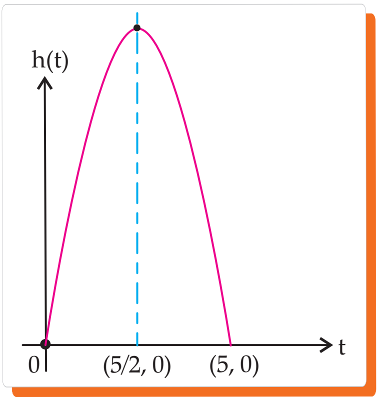
34. From the top of a 45 m high light house, the angles of depression of two ships, on the opposite side of it, are observed to be 30° and 60°. If the line joining the ships passes through the foot of the light house, find the distance between the ships. (Use $\sqrt{3} = 1.73$)

35. The perimeter of a certain sector of a circle of radius 5.6 m is 20.0 m. Find the area of the sector.

SECTION – E

This section consists of 3 Case-Study Based Questions of 4 marks each.

36. A ball is thrown in the air so that t seconds after it is thrown, its height h metre above its starting point is given by the polynomial $h = 25t - 5t^2$.



Observe the graph of the polynomial and answer the following questions:

(i) Write zeroes of the given polynomial. **1**

(ii) Find the maximum height achieved by ball. **1**

(iii) (a) After throwing upward, how much time did the ball take to reach to the height of 30 m? **2**

OR

(b) Find the two different values of t when the height of the ball was 20 m. **2**

37. The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.

A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.

Based on the above, answer the following questions:

(i) Find slant height of the conical part. **1**

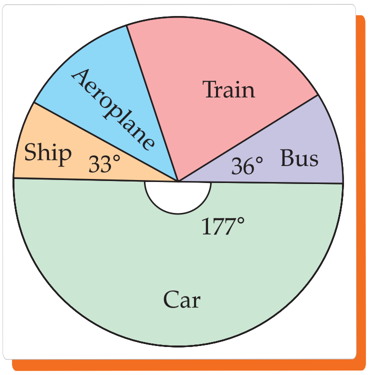
(ii) Determine the floor area of the tent. **1**

(iii) (a) Find area of the cloth used for making tent. **2**

OR

(b) Find total volume of air inside an empty tent. **2**

38. In a survey on holidays, 120 people were asked to state which type of transport they used on their last holiday. The following pie chart shows the results of the survey.



Observe the pie chart and answer the following questions:

(i) If one person is selected at random, find the probability that he/she travelled by bus or ship. **1**

(ii) Which is most favourite mode of transport and how many people used it? **1**

(iii) (a) A person is selected at random. If the probability that he did not use train is $\frac{4}{5}$, find the number of people who used train. **2**

OR

(b) The probability that randomly selected person used aeroplane is $\frac{7}{60}$. Find the revenue collected by air company at the rate of ₹ 5,000 per person. **2**

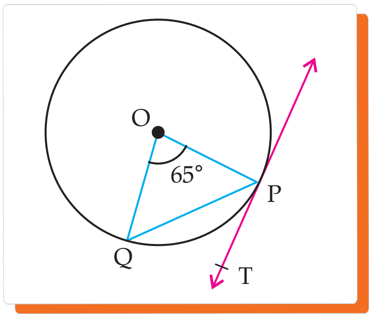
Outside Delhi Set-2 — 30/2/2

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

SECTION – A

This section consists of 20 questions of 1 mark each.

2. In the given figure, PT is tangent to a circle with centre O. Chord PQ subtends an angle of 65° at the centre. The measure of ∠QPT is:



(A) 65° **(B)** 57.5°

(C) 67.5° **(D)** 32.5°

6. If α and β are zeroes of the polynomial $2x^2 - 9x + 5$, then value of $\alpha^2 + \beta^2$ is

(A) $\frac{1}{4}$ **(B)** $\frac{61}{4}$

(C) 1 **(D)** $\frac{71}{4}$

13. Value of k for which $x = 2$ is a solution of the equation $5x^2 - 4x + (2 + k) = 0$, is

(A) 10 **(B)** –10

(C) 14 **(D)** –14

15. The sum of first 200 natural numbers is

(A) 2010 **(B)** 2000

(C) 20100 **(D)** 21000

SECTION – B

This section consists of 5 questions of 2 marks each.

23. Explain why 7 × 11 × 13 + 13 and 7 × 6 × 5 × 4 × 3 × 2 × 1 + 5 are composite numbers.

24. The vertices of a ΔABC are A(–2, 4), B(4, 3) and C(1, –6). Find length of the median BD.

SECTION – C

This section consists of 6 questions of 3 marks each.

28. Three consecutive integers are such that sum of the square of second and product of other two is 161. Find the three integers.

31. Prove that $\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta$.

SECTION – D

This section consists of 4 questions of 5 marks each.

32. The angle of elevation of an aircraft from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. The aircraft is flying at a constant height of $3500\sqrt{3}$ m at a uniform speed. Find the speed of the aircraft.

33. If the length of a rectangle is reduced by 5 cm and its breath is increased by 2 cm, then the area of the rectangle is reduced by 80 cm^2. However, if we increase the length by 10 cm and decrease the breadth by 5 cm, its area is increased by 50 cm^2. Find the length and breadth of the rectangle.

Outside Delhi Set-3 **30/2/3**

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

SECTION – A

This section consists of 20 questions of 1 mark each.

1. The distance between the points ($a\cos\theta$, $-a\sin\theta$) and ($a\sin\theta$, $a\cos\theta$) is

(A) a **(B)** $a\sqrt{2}$

(C) 0 **(D)** $2a$

8. The roots of the quadratic equation $4x^2 - 5x + 4 = 0$ are

(A) irrational **(B)** rational and distinct

(C) not real **(D)** rational and equal

9. The common difference of an A.P. in which $a_{20} - a_{15} = 20$, is

(A) 4 **(B)** 5

(C) $4d$ **(D)** $5d$

12. If α and $\beta(\alpha > \beta)$ are the zeroes of the polynomial $-x^2 + 8x + 9$, then $(\alpha - \beta)$ is equal to

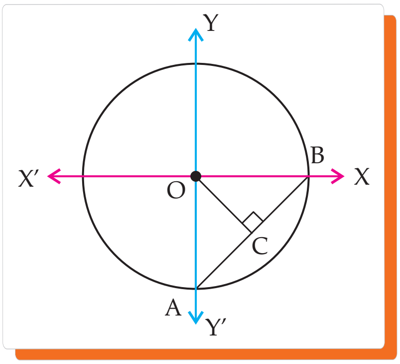
(A) –10 **(B)** 10

(C) ±10 **(D)** 8

SECTION – B

This section consists of 5 questions of 2 marks each.

23. In the given figure, a circle centred at origin O has radius 7 cm, OC is median of ΔOAB. Find the length of median OC.



25. Can the number 8^n, n being a natural number, end with the digit 0? Give reasons.

SECTION – C

This section consists of 6 questions of 3 marks each.

26. Prove that $\dfrac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta} = \dfrac{3}{4}$, if $\tan\theta = \dfrac{1}{\sqrt{7}}$

30. A dealer sells an article for ₹ 75 and gains as much percent as the cost price of the article. Find the cost price of the article.

SECTION – D

This section consists of 4 questions of 5 marks each.

32. A person standing on the bank of a river observes that the angle of elevation of the top of a tower on the opposite bank is 60°. When he moves 30 m away from the bank, he finds the angle of elevation to be 30°. Find the height of the tower and width of the river. (Take $\sqrt{3} = 1.732$)

35. (a) Using graphical method, solve the following system of equation:

$3x - 2y = 10$ and $5x + 3y = 4$

OR

(b) If three time the greater of two numbers is divided by the smaller one, we get 4 as the quotient and 3 as the remainder. Also, if seven times the smaller number is divided by greater one, we get 5 as the quotient and 1 as the remainder. Find the numbers.

ANSWERS

Delhi Set-1 **30/1/1**

SECTION – A

1. Option (B) is correct.

Explanation: Given polynomial is

$$p(x) = 2x^2 - k\sqrt{2}x + 1$$

$$\text{Sum of zeroes} = \frac{-(\text{coefficient of } x)}{\text{coefficient of } x^2}$$

$$\sqrt{2} = \frac{-(-k\sqrt{2})}{2}$$

[Given, sum of zeroes = $\sqrt{2}$]

$$\therefore \quad k = 2$$

2. Option (D) is correct.

Explanation: Probability of loosing the game
= 1 – Probability of winning the game
= 1 – 0.79 = 0.21

3. Option (C) is correct.

Explanation: If the discriminant is equal to zero, i.e., $b^2 - 4ac = 0$ where a, b, c are real numbers and $a \neq 0$, then roots of the quadratic equation $ax^2 + bx + c = 0$, are real and equal

Thus, $b^2 - 4ac = 0$ or $ac = \frac{b^2}{4}$

4. Option (C) is correct.

Explanation: Given,

$$a = 7, a_n = 84 \text{ and } S_n = \frac{2093}{2}$$

$$\because \quad a_n = a + (n-1)d$$

$$\Rightarrow \quad 84 = 7 + (n-1)d$$

$$\Rightarrow \quad 77 = (n-1)d \quad ...(i)$$

Also,

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

$$\Rightarrow \quad \frac{2093}{2} = \frac{n}{2}[2 \times 7 + (n-1)d]$$

$$\Rightarrow \quad 2093 = n[14 + 77] \quad \text{[from eq (i)]}$$

$$\Rightarrow \quad 2093 = 91n$$

$$\Rightarrow \quad n = 23$$

5. Option (D) is correct.

Explanation: Given,

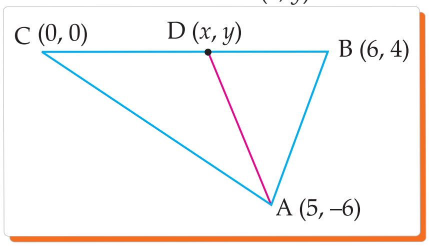
$$p = 18\,a^2b^4 \text{ and } q = 20\,a^3b^2$$

$$\text{LCM}(p, q) = \text{LCM}(18\,a^2b^4, 20\,a^3b^2)$$

$$= 180a^3b^4$$

6. Option (A) is correct.

Explanation: Coordinates of D(x, y).



Using the mid point formula, the coordinates of mid-point of BC are

$$\text{Co-ordinates of } D(x, y) = \left(\frac{6+0}{2}, \frac{4+0}{2}\right)$$

$$= (3, 2)$$

$$\text{Now, length of } AD = \sqrt{(5-3)^2 + (-6-2)^2}$$

$$= \sqrt{4 + 64} = \sqrt{68} \text{ units}$$

7. Option (C) is correct.

Explanation: Given, $\sec\theta - \tan\theta = m$ ...(i)

We know that, $\sec^2\theta - \tan^2\theta = 1$

$$\Rightarrow \quad (\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$$

$$\Rightarrow \quad \sec\theta + \tan\theta = \frac{1}{\sec\theta - \tan\theta}$$

$$\Rightarrow \quad \sec\theta + \tan\theta = \frac{1}{m} \quad \text{[from (i)]}$$

8. Option (B) is correct.

Explanation: Given data : 1, 4, 7, 9, 16, 21, 25
After removing even numbers data is:
1, 7, 9, 21, 25
Prime number : 7

Thus, required probability $= \frac{1}{5}$

9. Option (D) is correct.

10. Option (A) is correct.

Explanation: Given polynomials : $x^2 + px + q$ ...(i)
and $4x^2 - 5x - 6$ ...(ii)
Zero of polynomial $4x^2 - 5x - 6$ are:

$$x = 2 \text{ and } x = -\frac{3}{4}$$

Now, zero of polynomial $x^2 + px + q$ are 4 and $-\frac{3}{2}$

$$\therefore \quad \text{Sum of zeroes} = -\frac{p}{1} \text{ i.e., } 4 - \frac{3}{2} = -\frac{p}{1}$$

$$\text{or,} \quad \frac{5}{2} = -\frac{p}{1} \text{ or, } p = -\frac{5}{2}$$

11. Option (B) is correct.

Explanation: Here,

$$(15)^2 = (3-x)^2 + (-5+5)^2$$

$$225 = 9 - 6x + x^2$$

$$\text{or,} \quad x^2 - 6x - 216 = 0$$

$$\text{or,} \quad x^2 - 18x + 12x - 216 = 0$$

$$\text{or,} \quad x(x-18) + 12(x-18) = 0$$

$$\text{or,} \quad (x-18)(x+12) = 0 \text{ or, } x = -12, 18$$

12. Option (A) is correct.

Explanation: Given,

$$\cos(\alpha + \beta) = 0$$

$$\Rightarrow \quad \cos(\alpha + \beta) = \cos\frac{\pi}{2} \Rightarrow \alpha + \beta = \frac{\pi}{2}$$

$$\therefore \quad \cos\left(\frac{\alpha+\beta}{2}\right) = \cos\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$$

13. Option (C) is correct.

Explanation: The total surface area of a sphere = $4\pi r^2$

The surface area of one hemi-sphere = $3\pi r^2$

$\therefore$ The total surface area of two hemi-sphere = $6\pi r^2$

$$\text{Required Ratio} = \frac{4\pi r^2}{6\pi r^2} = \frac{4}{6} = \frac{2}{3}$$

14. Option (B) is correct.

Explanation: The middle most observation, after arranging all observations in ascending or descending order is called the median.

15. Option (D) is correct.

Explanation: Radius of cone = $\frac{2}{2}$ = 1 cm

Height of cone = 2 cm

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi.(1)^2 \times 2$$

$$= \frac{2\pi}{3}\text{cu cm}$$

16. Option (A) is correct.

Explanation: When two dice are tossed together,

Total possible outcomes = 6^2 = 36

No. of cases getting sum two : {(1, 1)}

No. of cases getting sum three : {(1, 2)(2, 1)}

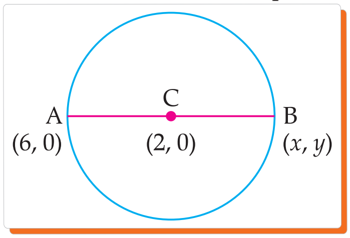
No. of cases getting sum five : {(1, 4)(4, 1), (2, 3), (3, 2)}

Thus total cases getting sum 2, 3 or 5 = 7

Therefore, required probability = $\frac{7}{36}$

17. Option (C) is correct.

Explanation: Here, centre C is mid-point of AB.



$$\therefore \quad 2 = \frac{6+x}{2} \text{ and } 0 = \frac{0+y}{2}$$

$\Rightarrow$ $x = -2$ and $y = 0$

Thus, $B(x, y) = (-2, 0)$

18. Option (D) is correct.

19. Option (B) is correct.

Explanation: **Assertion:** Two parallel tangents always lie at the end points of the diameter of the circle.

Reason: Diameter is the longest chord of a circle which passes through centre joining the two points on the circumference of a circle.

20. Option (D) is correct.

Explanation: The polynomials of the form $(x + a)^2$ and $(x - a)^2$ has only equal roots and graphs of these polynomials cut x-axis at only one point. These polynomials are quadratic Thus, Assertion is true Reason is true.

SECTION – B

21. Given system of linear equations:

$$7x - 2y = 5 \quad \text{...(i)}$$
$$8x + 7y = 15 \quad \text{...(ii)}$$

Multiplying eq (i) by 7 and eq (ii) by 2, we get

$$49x - 14y = 35$$
$$16x + 14y = 30$$
$$65x = 65$$

$\therefore$ $x = 1$

Substituting value of x is eq (i) we get

$7(1) - 2y = 5$

or, $7 - 2y = 5$

or, $-2y = -2$ or, $y = 1$

Therefore, $x = 1$ and $y = 1$

22. If one black cards is lost, then remaining cards = 51

Probability of drawing a queen of heart from remaining 51 cards = $\frac{1}{51}$

[As there is only one queen of heart card in a pack of 52 cards]

23. (a) We have,

$2\sqrt{2}\ \cos 45° \sin 30° + 2\sqrt{3}\ \cos 30°$

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

$= 1 + 3 = 4$

OR

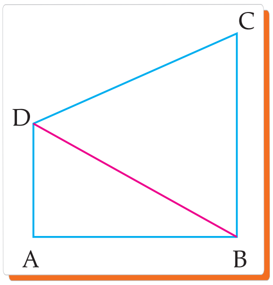
(b) LHS $\Rightarrow \sin(A + B) = \sin(60° + 30°) = \sin 90° = 1$

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

$= \sin 60° \cos 30° + \cos 60° \sin 30°$

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

24. (i) Given: diagonal BD bisects $\angle$B and $\angle$D



To prove: $\Delta ABD \sim \Delta CBD$

Proof: In ΔABD and ΔCBD

$\angle ABD = \angle CBD$ (BD bisects $\angle$B)

$\angle ADB = \angle CDB$ (BD bisects $\angle$D)

Therefore, $\Delta ABD \sim \Delta CBD$ (by AA rule)

Hence Proved

(ii) Since, $\Delta ABD \sim \Delta CBD$

Therefore, $\frac{AB}{BD} = \frac{BC}{BD}$ (by cpct)

$\therefore$ $AB = BC$

Hence Proved

25. (a) Let assume that $5 - 2\sqrt{3}$ is rational.

Therefore it can be expressed in the form of $\frac{p}{q}$

where p and q are integers and $q \neq 0$

Therefore, we write $5 - 2\sqrt{3} = \frac{p}{q}$

or, $2\sqrt{3} = 5 - \frac{p}{q}$ or, $\sqrt{3} = \frac{5q - p}{2q}$

But $\frac{5q-p}{2q}$ is a rational number as p and q are integers. This contradicts the fact that $\sqrt{3}$ is irrational, so our assumption is wrong.

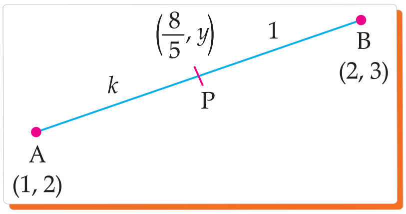
Hence $5-2\sqrt{3}$ is an irrational number.

OR

(b) The numbers are prime numbers and composite numbers.
Prime numbers can be divided by 1 and itself. A composite number has factors other than 1 and itself.
$(5 \times 11 \times 17) + (3 \times 11)$
$= (85 \times 11) + (3 \times 11)$
$= 11 \times (85 + 3)$
$= 11 \times 88 = 11 \times 11 \times 8$
$= 2 \times 2 \times 2 \times 11 \times 11$
The given expression has 2 and 11 as its factors. Therefore it is a composite number.

SECTION – C

26. (a) Let P divides the line segment AB in the ratio $k : 1$



Then by section formula,

$$\frac{8}{5} = \frac{2k+1}{k+1} \quad \text{...(i)}$$

and $$y = \frac{3k+2}{k+1} \quad \text{...(ii)}$$

from (i), we get

$$8k + 8 = 10k + 5$$

$$2k = 3 \Rightarrow k = \frac{3}{2}$$

from (ii), we get

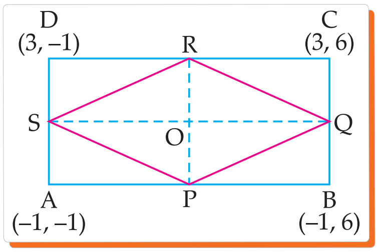
$$y = \frac{3\left(\frac{3}{2}\right)+2}{\frac{3}{2}+1} = \frac{9+4}{5} = \frac{13}{5}$$

Therefore, required ratio is 3 : 2

value of $y = \frac{13}{5}$

OR

(b) Given ABCD is a rectangle and P, Q, R and S are mid-points of sides AB, BC, CD and DA.



coordinates of $P = \left(\frac{-1-1}{2}, \frac{-1+6}{2}\right)$

$= \left(-1, \frac{5}{2}\right)$

coordinates of $Q = \left(\frac{-1+3}{2}, \frac{6+6}{2}\right)$

$= (1, 6)$

coordinates of $R = \left(\frac{3+3}{2}, \frac{6-1}{2}\right)$

$= \left(3, \frac{5}{2}\right)$

coordinates of $S = \left(\frac{3-1}{2}, \frac{-1-1}{2}\right)$

$= (1, -1)$

Now, we shall find the mid points of PR & SQ.
Mid points of P & R which is point O,

$$x = \frac{-1+3}{2} = 1$$

$$y = \frac{\frac{5}{2}+\frac{5}{2}}{2} = \frac{5}{2}$$

$$\Rightarrow \quad O(x, y) = \left(1, \frac{5}{2}\right)$$

Similarly, the midpoint of S and Q

$$\Rightarrow \quad x = \frac{1+1}{2} = 1$$

$$y = \frac{6-1}{2} = \frac{5}{2} \Rightarrow O(x, y) = \left(1, \frac{5}{2}\right)$$

Since, the midpoints of PR & QS both have the same coordinate $\left(1, \frac{5}{2}\right)$. Hence, diagonals PR and SQ bisect to each other. Hence Proved.

27. The no. of rooms will be minimum if each room accommodates maximum no. of teachers. Since in each room the same number of teachers are to be seated and all of them must be of the same subject. Therefore no. of teachers in each room must be HCF of 48, 80 and 144.

The prime factorization of 48, 80 and 144 are as under

$$48 = 2^4 \times 3^1$$

$$80 = 2^4 \times 5^1$$

$$144 = 2^4 \times 3^2$$

$\therefore$ HCF of 48, 80 and 144 is $2^4 = 16$

Therefore in each room 16 teachers can be seated.

$$\therefore \text{No. of room required} = \frac{\text{Total no. of teachers}}{16}$$

$$= \frac{48+80+144}{16}$$

$$= \frac{272}{16} = 17$$

28.
$$\text{LHS} = \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$$

$$= \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1-\tan\theta}$$

$$= \frac{\tan^2\theta}{\tan\theta-1} + \frac{1}{\tan\theta(1-\tan\theta)}$$

$$= \frac{\tan^2\theta}{\tan\theta-1} - \frac{1}{\tan\theta(\tan\theta-1)}$$

$$= \frac{\tan^3\theta-1}{\tan\theta(\tan\theta-1)}$$

$$= \frac{(\tan\theta-1)(\tan^2\theta+\tan\theta+1)}{\tan\theta(\tan\theta-1)}$$

[Using $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$]

$$= \frac{\tan^2\theta+\tan\theta+1}{\tan\theta}$$

$$= \frac{\sec^2\theta+\tan\theta}{\tan\theta}$$

$$= \frac{\sec^2\theta}{\tan\theta}+1$$

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

$= \sec\theta \,.\, \text{cosec}\,\theta + 1$

$= 1 + \sec\theta \,.\, \text{cosec}\,\theta$

= RHS Hence Proved

29. Let the age of Rashmi = x years

and the age of Nazma = y years

Three years ago,

Rashmi's age = $(x - 3)$years

Nazma's age = $(y - 3)$years

According to question,

$(x - 3) = 3(y - 3)$

$\Rightarrow$ $x - 3 = 3y - 9$

$\Rightarrow$ $x = 3y - 6$ ...(i)

Ten years later,

Rashmi's age = $x + 10$

Nazma's age = $y + 10$

According to question,

$(x + 10) = 2(y + 10)$

$x + 10 = 2y + 20$

$x = 2y + 10$ ...(ii)

From eqs (i) adn (ii), we get

$3y - 6 = 2y + 10$

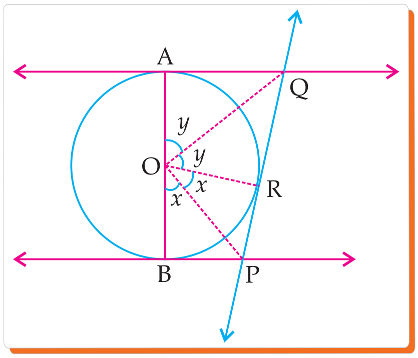
$y = 16$

Substituting value of y in eq (i), we get

$x = 3 \times 16 - 6 = 48 - 6 = 42$

Thus, the age of Rashmi is 42 years and age of Nazma is 16 years.

30. (a) In the given figure, Join OR.



In ΔOBP and ΔORP,

$PB = PR$

(Tangents drawn from outside point P)

$OB = OR$ (Radii of circle)

$OP = OP$ (Common side)

$\therefore$ $\Delta OBP \cong \Delta ORP$ (By SSS)

Therefore, $\angle BOP = \angle POR = x$ (cpct)

In ΔOAQ and ΔORQ,

$QA = QR$

(Tangents drawn from outside point Q)

$OA = OR$ (Radii of circle)

$OQ = OQ$ (common side)

$\therefore$ $\Delta OAQ \cong \Delta ORQ$ (By SSS)

Therefore, $\angle AOQ = \angle ROQ = y$ (cpct)

As, AOB is a straight line given

So, $\angle AOB = 180°$

$\therefore$ $x + x + y + y = 180°$

$\Rightarrow$ $2(x + y) = 180°$

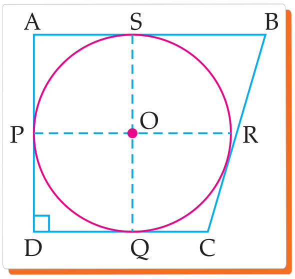
$\Rightarrow$ $x + y = 90°$

$\Rightarrow$ $\angle POQ = 90°$ Hence Proved

OR

(b) Given, $BC = 30$ cm, $BS = 24$ cm

and $AD \perp DC$



$\therefore$ $\angle ADC = 90°$

We know that, tangents to a circle from an external point are equal in length.

$\therefore$ $AS = AP$

$BS = BR$

$CR = CQ$

and $DP = DQ$

We have, $OP = OQ = OR = OS = 8$ cm

(radii of circle)

Also, $BC = BR + RC$

$BC = BS + RC$

$\therefore$ $RC = BC - BS = 30 - 24 = 6$ cm

$\Rightarrow$ $QC = 6$ cm ...(i)

Now, given $\angle D = 90°$

In quadrilateral PDQO,

$\angle OQD = \angle OPD = 90°$

(angle between radius & tangent)

$\therefore \qquad \angle POQ = 90°$ *i.e.*, *OPDQ* is a regular polygon

Further $\qquad DP = DQ$ i.e., OPDQ is a square

Hence, $\quad$ radius $= OP = DQ = 8$ cm ...(ii)

Now, $\qquad DC = DQ + QC = 8 + 6 = 14$ cm [from eqs (i) & (ii)]

31. Let r and R be the radii of inner and outer surface of a cylinder.

Given, height of cylinder $(h) = 14$ cm

Volume of cylinder $(V) = 176\ cm^3$

and $\qquad R - r = 1$ cm ...(i)

$\because \qquad V = 176\ cm^2$

$$\pi(R^2 - r^2)h = 176$$

$$\frac{22}{7}(R^2 - r^2) \times 14 = 176$$

$$R^2 - r^2 = \frac{176 \times 7}{22 \times 14} = 4$$

$\Rightarrow \qquad (R - r)(R + r) = 4$

$\Rightarrow \qquad 1(R + r) = 4$

$\Rightarrow \qquad R + r = 4$ ...(ii)

On solving eqs (i) & (ii), we get

$$2R = 5$$

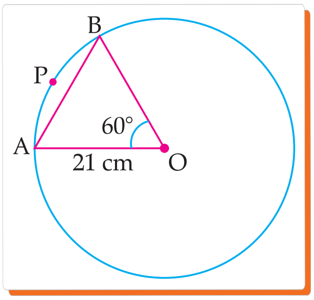
$$R = \frac{5}{2} \text{ cm} = 2.5 \text{ cm}$$

From (i), $\qquad r = R - 1$

$$r = \frac{5}{2} - 1 = \frac{3}{2} = 1.5 \text{ cm}$$

SECTION – D

32.



(i) Given, $\qquad r = 21$ cm, $\theta = 60°$

$$\text{length of the arc } APB = \frac{\theta}{360°} \times 2\pi r$$

$$= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 21$$

$$= \frac{1}{6} \times 2 \times 22 \times 3$$

$$= 22 \text{ cm}$$

(ii) Area of the minor segment = Area of sector *OAPB* – Area of triangle of *OAB*

Now, $\quad$ Area of sector $APB = \dfrac{\theta}{360°} \times \pi r^2$

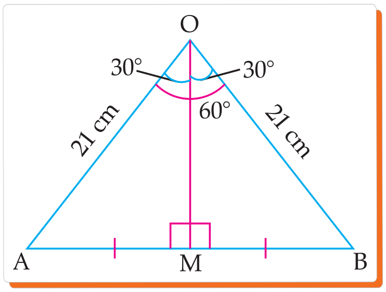
$$= \frac{60°}{360°} \times \frac{22}{7} \times (21)^2$$

$$= \frac{1}{6} \times \frac{22}{7} \times 21 \times 21$$

$$= 231 \text{ cm}^2$$

and $\quad$ Area of triangle $OAB = \dfrac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} AB \times OM$$



We draw OM ⊥ AB

$\therefore \qquad \angle OMB = \angle OMA = 90°$

and by symmetry, M is mid-point of AB

$\therefore \qquad BM = AM = \dfrac{1}{2}AB$ ...(i)

In right ΔOMA, $\qquad \sin 30° = \dfrac{AM}{AO}$

$\Rightarrow \qquad \dfrac{1}{2} = \dfrac{AM}{21}$

$\Rightarrow \qquad AM = \dfrac{21}{2}$ cm

In right ΔOMA,

$$\cos 30° = \frac{OM}{AO}$$

$\Rightarrow \qquad \dfrac{\sqrt{3}}{2} = \dfrac{OM}{21}$

$\Rightarrow \qquad OM = \dfrac{\sqrt{3}}{2} \times 21$ cm

∴ from eq (i)

$$AM = \frac{1}{2}AB$$

$\Rightarrow \qquad AB = 2\,AM = 2 \times \dfrac{21}{2}$

$$= 21 \text{ cm}$$

Thus, $\qquad$ Area of $\Delta OAB = \dfrac{1}{2} \times 21 \times \dfrac{\sqrt{3}}{2} \times 21$

$$= \frac{441\sqrt{3}}{4} \text{ cm}^2$$

Therefore, area of minor segment

$$= \left(231 - \frac{441\sqrt{3}}{4}\right) \text{cm}^2$$

33. (a) Let a and a_8 be first and eight terms of A.P.

Let common difference be d.

$\therefore \qquad a + a_8 = 32$ (given)

$\Rightarrow \quad a + [a + (8 - 1)d] = 32 \quad [\because T_n = a + (n-1)d]$

$\Rightarrow \qquad a + (a + 7d) = 32$

$\Rightarrow \qquad a + 7d = 32 - a$ ...(i)

Also, $\qquad a.a_8 = 60$ (given)

$\Rightarrow \qquad a.[a + (8 - 1)d] = 60$

$\Rightarrow \qquad a(a + 7d) = 60$

$\Rightarrow \qquad a(32 - a) = 60$ [from eq (i)]

$\Rightarrow \quad 32a - a^2 = 60$

$\Rightarrow \quad a^2 - 32a + 60 = 0$

$\Rightarrow \quad a^2 - 30a - 2a + 60 = 0$

$\Rightarrow a(a-30) - 2(a-30) = 0$

$\Rightarrow \quad (a-30)(a-2) = 0$

$\Rightarrow \quad a = 2, 30$

For $\quad a = 2$, from eq (i)

$2 + 7d = 32 - 2$

$7d = 28$

$d = 4$

For $\quad a = 30$, from eq (i)

$30 + 7d = 32 - 30$

$7d = -28$

$d = -4$

for $\quad (a, d) = (2, 4)$

$a_8 = 2 + 7 \times 4 = 30$

$\therefore \quad a + a_8 = 32$ and $a.a_8 = 60$

for $\quad (a, d) = (30, -4)$

$a_8 = 30 + 7(-4) = 2$

$\therefore \quad a + a_8 = 32$ and $a.a_8 = 60$

Taking $\quad (a, d) = (2, 4)$

$$S_{20} = \frac{20}{2}[2 \times 2 + (20-1) \times 4]$$

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

$= 10[4 + 19 \times 4]$

$= 40 \times 20 = 800$

Taking $\quad (a, d) = (30, -4)$

$$S_{20} = \frac{20}{2}[30 \times 2 + (20-1)(-4)]$$

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

$= 10[60 + 19(-4)]$

$= 10(60 - 76)$

$= 10 \times (-16) = -160$

OR

(b) Let the first term and common difference of A.P. be a and d.

$\because$ Sum of n terms of A.P., $S_n = \frac{n}{2}[2a + (n-1)d]$

$$S_9 = \frac{9}{2}[2a + (9-1)d]$$

$$= \frac{9}{2}[2a + 8d]$$

$= 9(a + 4d)$

$\Rightarrow \quad 153 = 9(a + 4d)$ $\quad [\because$ Given, $S_9 = 153]$

$\Rightarrow \quad 17 = a + 4d$

or $\quad a + 4d = 17 \quad$ ...(i)

Similarly, sum of 6 terms,

$$S_6 = \frac{6}{2}[2a + (6-1)d]$$

$\Rightarrow \quad 687 = 3(2a + 5d)$

$\Rightarrow \quad 229 = 2a + 5d$

or $\quad 2a + 5d = 229 \quad$ ...(ii)

On solving eqs (i) & (ii), we get

$3d = -195$

$\Rightarrow \quad d = -65$

Substituting value of d in eq (i), we get

$a + 4(-65) = 17$

$a = 17 + 260$

$a = 277$

Thus, first term of given A.P. is 277 and common difference is –65.

Now, Sum of all terms i.e.,

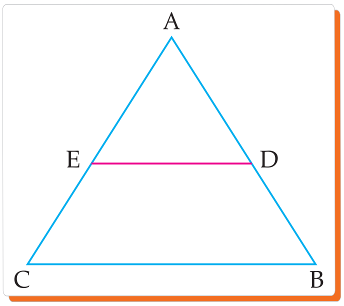
$$S_{40} = \frac{40}{2}[2 \times 277 + (40-1)(-65)]$$

$= 20[554 + 39(-65)]$

$= 20(554 - 2535)$

$= 20 \times (-1981) = -39,620$

34. (a) Given,: $\quad DE \parallel BC$



To prove: $\quad \frac{EC}{AE} = \frac{BD}{AD}$

Proof: In ΔAED and ΔACB

$\angle AED = \angle ACB$ (Corresponding angles)

$\angle ADE = \angle ABC$ (Corresponding angles)

$\angle$EAD is common to both triangles

$\Rightarrow \quad \Delta AED \sim \Delta ACB$ (by AAA similarity)

$\therefore \quad \frac{AC}{AE} = \frac{AB}{AD}$

$\Rightarrow \quad \frac{AE + EC}{AE} = \frac{AD + BD}{AD} \Rightarrow 1 + \frac{EC}{AE} = 1 + \frac{BD}{AD}$

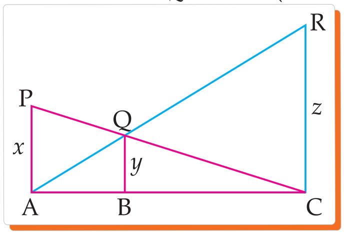
$\Rightarrow \quad \frac{EC}{AE} = \frac{BD}{AD}$ $\quad$ Hence Proved

OR

(b) In ΔCAP and ΔCBQ

$\angle CAP = \angle CBQ = 90°$

$\angle PCA = \angle QCB$ (common angle)



So, $\Delta CAP \sim \Delta CBQ$ (By AA similarly Rule)

Hence, $\quad \frac{BQ}{AP} = \frac{BC}{AC}$

$\Rightarrow \quad \frac{y}{x} = \frac{BC}{AC} \quad$ ...(i)

Now, in ΔACR and ΔABQ

$\angle ACR = \angle ABQ = 90°$

$\angle QAB = \angle RAC$ (common angle)

So, $\quad \Delta ACR \sim \Delta ABQ$

(By AA similarity Rule)

Hence, $$\frac{BQ}{CR} = \frac{AB}{AC}$$

$$\Rightarrow \quad \frac{y}{z} = \frac{AB}{AC} \quad ...(ii)$$

On adding eqs. (i) and (ii), we get

$$\frac{y}{x}+\frac{y}{z} = \frac{BC}{AC}+\frac{AB}{AC}$$

$$y\left(\frac{1}{x}+\frac{1}{z}\right) = \frac{BC+AB}{AC}$$

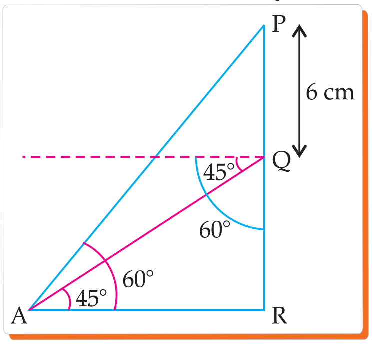
$$y\left(\frac{1}{x}+\frac{1}{z}\right) = \frac{AC}{AC} \Rightarrow y\left(\frac{1}{x}+\frac{1}{z}\right) = 1$$

$$\frac{1}{x}+\frac{1}{z} = \frac{1}{y}$$

Hence Proved

35. Consider QR as the tower, PQ as the pole on it.

Given, $\angle PAR = 60°$ and $\angle QAR = 45°$



Let $QR = h$ m

Since $PQ = 6$ m (given)

$\therefore$ $PR = 6 + h$ ...(i)

In right ΔQAR,

$$\tan 45° = \frac{QR}{AR}$$

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

$$\Rightarrow \quad AR = h \text{ m} \quad ...(ii)$$

In right ΔPAR,

$$\tan 60° = \frac{PR}{AR}$$

$$\Rightarrow \quad \sqrt{3} = \frac{6+h}{h} \quad \text{[From eq.(i) \&(ii)]}$$

$$\Rightarrow \quad \sqrt{3}h = 6 + h$$

$$\Rightarrow \quad h = \frac{6}{(\sqrt{3}-1)}$$

$$\Rightarrow \quad h = \frac{6}{(1.732-1)}$$

$$\Rightarrow \quad h = \frac{6}{0.732} = \frac{6000}{732} = 8.196$$

$$\Rightarrow \quad h = 8.20 \text{ m}$$

Height of tower, $QR = h = 8.20$ m

Distance of point P from the foot of the tower $= PR$

$= 6 + h$

$= 6 + 8.20 = 14.20$ m

SECTION – E

36. (i) Let the original side length of each tile be x units.

The area of the rectangular floor using 200 tiles $= 200\,x^2$ unit^2

The area with increased side length (each side increased by 1 unit) using 128 tiles $= 128(x + 1)^2$ unit^2

So, required quadratic equation is:

$$200x^2 = 128(x + 1)^2$$

(ii) We have,

$$200x^2 = 128(x + 1)^2$$

$$\Rightarrow \quad 200x^2 = 128(x^2 + 2x + 1)$$

$$\Rightarrow \quad 200x^2 = 128x^2 + 256x + 128$$

$\Rightarrow 72x^2 - 256x - 128 = 0$, which is the quadratic equation is standard form.

(iii) We have,

$$72x^2 - 256x - 128 = 0$$

or, $9x^2 - 32x - 16 = 0$

or, $9x^2 - 36x + 4x - 16 = 0$

or, $9x(x - 4) + 4(x - 4) = 0$ or, $(x - 4)(9x + 4) = 0$

or, $x = 4, -\frac{4}{9}$

Since, side cannot be negative, thus $x = 4$ units

OR

We have $9x^2 - 32x - 16 = 0$

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

$a = 9, b = -32$ and $c = -16$

Using quadratic formula,

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

$$\therefore \quad x = \frac{-(-32) \pm \sqrt{(-32)^2-4(9)(-16)}}{2\times 9}$$

$$= \frac{32 \pm \sqrt{1024+576}}{18}$$

$$= \frac{32 \pm \sqrt{1600}}{18} = \frac{32 \pm 40}{18}$$

$$= \frac{32+40}{18} \text{ or } \frac{32-40}{18}$$

$$= \frac{72}{18} \text{ or } \frac{-8}{18} = 4 \text{ or } \frac{-4}{9}$$

37. (i)

Numbers announced	No. of times	c.f.
0-15	8	8
15-30	9	17
30-45	10	27
45-60	12	39
60-75	9	48
	$N = 48$	

Here, $N = 48$,

then $$\frac{N}{2} = \frac{48}{2} = 24$$

$\therefore$ Median class : 30 – 45

(ii) The number of even numbers between 1 to 75 is 37, [i.e., $(75 - 1) \div 2 = 37$]

Prob.(calling out an even number) $= \frac{37}{75}$

(iii) (a) From part (i), we have median class : 30-45

We have, $l = 30, c.f. = 17, f = 10, h = 15$

$$\text{Median} = l + \frac{\frac{N}{2} - c.f.}{f} \times h$$

$$= 30 + \frac{24 - 17}{10} \times 15$$

$$= 30 + \frac{7}{10} \times 15 = 30 + \frac{105}{10}$$

$$= 30 + 10.5 = 40.5$$

OR

(b) From part (i), we see highest frequency is 12.

So, modal class is 45-60.

$l = 45, f_0 = 10, f_1 = 12, f_2 = 9, h = 15$

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

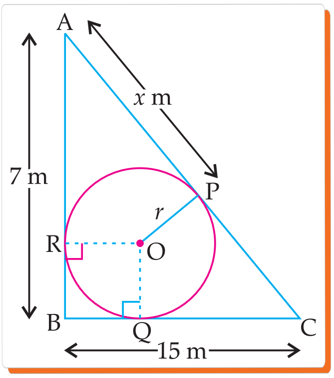
$$= 45 + \left(\frac{12 - 10}{2 \times 12 - 10 - 9}\right) \times 15$$

$$= 45 + \left(\frac{2}{24 - 19}\right) \times 15 = 45 + \frac{2}{5} \times 15$$

$$= 45 + 6 = 51$$

38. (i) Given, $AB = 7$ m,

$BC = 15$ m and $AP = x$ m



Hence, $AP = AR$

(Tangent drawn from an external point to the circle are equal in length)

$\therefore$ $AR = x$ m

(ii) Since, $AR = x$ m and $AB = 7$ m

$\therefore$ $RB = (7 - x)$m

Also, $RB = BQ$

(Tangents drawn from an external point to the circle)

$OR = OQ$ (radii of circle)

$\angle ORB = \angle OQB = 90°$

(Angle between radius and tangent)

Also, $\angle RBQ = 90°$

(angle between the walls AB and BC)

Thus, $\angle ROQ = 90°$

Thus, $\square$BQOR is square.

(iii) Here, $BC = 15$ m

$BQ = (7 - x)$m

$\therefore$ $QC = 15 - (7 - x)$

or, $QC = (8 + x)$m

Also, $QC = PC$

(Tangents from an external points C to the circle)

i.e., $PC = (8 + x)$m

In right ΔABC, using Pythagoras theorem,

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

$AC^2 = 7^2 + 15^2$

$= 49 + 225 = 274$

$\Rightarrow$ $AC = 16.55$

$\Rightarrow$ $AP + PC = 16.55$

$\Rightarrow$ $x + 8 + x = 16.55$

$\Rightarrow$ $2x = 8.55$

$\Rightarrow$ $x = 4.275 \sim 4.28$ m

OR

From part (iii) (a), we get $x = 4.28$ m

From part (ii), we know that BQOR is a square

$\therefore$ $BQ = OQ$

$\Rightarrow$ $r = 7 - x$

$\Rightarrow$ $r = 7 - 4.28$

$\Rightarrow$ $r = 2.72$ m

Delhi Set-2 30/1/2

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

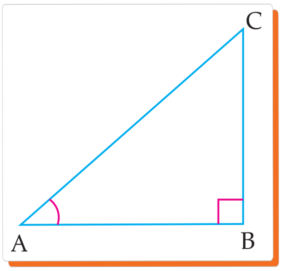
SECTION – A

4. Option (A) is correct.

Explanation: $\sin A = \frac{2}{3}$ (Given)

$$\frac{BC}{AC} = \frac{2}{3} \qquad \left[\text{Since, } \sin\theta = \frac{P}{H}\right]$$

$BC = 2x$ and $AC = 3x$



Now, In ΔABC, By Pythagoras Theroem

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

$(3x)^2 = AB^2 + (2x)^2$

$9x^2 = AB^2 + 4x^2$

$AB^2 = 9x^2 - 4x^2$

$AB^2 = 5x^2$

$AB = \sqrt{5}x$

$$\cot A = \frac{AB}{BC} \qquad \left[\text{Since, } \cot\theta = \frac{B}{P}\right]$$

$$= \frac{\sqrt{5}x}{2x} = \frac{\sqrt{5}}{2}$$

7. Option (D) is correct.

Explanation: From option (D)

$$= \frac{1}{0.89} = \frac{100}{89} = 1.123$$

We know that probability of any event can not be greater than 1.

13. Option (B) is correct.

Explanation: If α and β are the zeroes of a quadratic polynomial then Given,

$$\alpha + \beta = 2\sqrt{3} \text{ and } \alpha\beta = 3$$

Now, Quadratic polynomial is

$$p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$$
$$= x^2 - (2\sqrt{3})x + (3)$$
$$= x^2 - 2\sqrt{3}x + 3 = (x - \sqrt{3})^2$$

17. Option (C) is correct.

Explanation: Given,

$$T_n = 7n + 4 \quad (n^{th} \text{ term at an A.P.})$$

Put $n = 1$, $T_1 = 7(1) + 4 = 7 + 4 = 11$

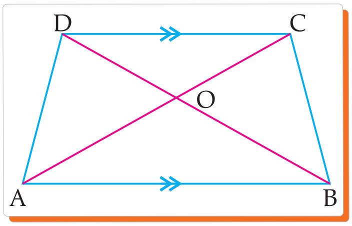
Put $n = 2$, $T_2 = 7(2) + 4 = 14 + 4 = 18$

Now, common difference

$$= T_2 - T_1 = 18 - 11 = 7$$

SECTION – B

21.



Given: (i) In trapezium ABCD

Diagonals AC and BD intersect at O

(ii) AB || DC

(iii) $\frac{DO}{OB} = \frac{1}{2}$

To prove: $AB = 2CD$

Proof: In ΔOAB and ΔOCD

$$\angle AOB = \angle COD$$

(vertically opposite angle)

$$\angle OAB = \angle OCD$$

(Alternate interior angle as given, AB || DC)

$$\Delta OAB \sim \Delta OCD$$

(by AA similarity Rule)

Now, $$\frac{OC}{OA} = \frac{CD}{AB} = \frac{DO}{BO} \Rightarrow \frac{CD}{AB} = \frac{DO}{BO}$$

$$\frac{CD}{AB} = \frac{1}{2} \quad \text{(given)}$$

Hence, $AB = 2CD$ Proved

23. $2p + 3q = 13$ ...(i)

and $5p - 4q = -2$ ...(ii)

On multiplying eq (i) by 4 and eq (ii) by 3

$$(2p + 3q = 13) \times 4$$
$$(5p - 4q = -2) \times 3$$

On adding both equations

$$8p + 12q = 52$$
$$15p - 12q = -6$$
$$23p = 46$$
$$p = \frac{46}{23}$$
$$p = 2$$

Put $p = 2$ in eq (i)

$$2(2) + 3q = 13$$
$$4 + 3q = 13$$
$$3q = 9 \Rightarrow q = \frac{9}{3}$$
$$q = 3 \Rightarrow p = 2 \text{ and } q = 3$$

SECTION – C

27. Let, taking x litres quantity of 50% acid solution and y litres quantity of 25% acid solution.

Given, After mixed both type of acid.

Solution, Total quantity is 10 litres.

Therefore, $x + y = 10$ ...(i)

According to the question,

$$\frac{50}{100}x + \frac{25}{100}y = \frac{40}{100} \times 10 \Rightarrow \frac{x}{2} + \frac{y}{4} = 4$$

$$2x + y = 16 \quad \text{...(ii)}$$

On subtracting eq (i) from eq (ii)

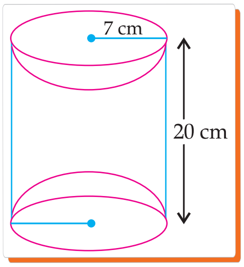
$$x = 6 \text{ litres}$$

Put $x = 6$ in eq (i) to get y

$$6 + y = 10$$
$$y = 10 - 6 \Rightarrow y = 4 \text{ litres}$$

Hence, we should take 6 litres from 50% Acid solution and 4 litres from 25% Acid solution.

29.



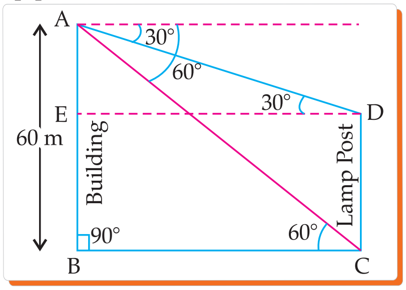
Given, $r = 7$ cm and $h = 20$ cm

Total surface Area of Toy = CSA fo cylinder + (inner CSA of Hemi-sphere) × 2

$$= 2\pi rh + (2\pi r^2) \times 2$$
$$= 2\pi rh + 4\pi r^2 = 2\pi r(h + 2r)$$
$$= 2 \times \frac{22}{7} \times 7(20 + 2 \times 7)$$
$$= 44(34) = 1496 \text{ cm}^2$$

SECTION – D

33. Let the horizontal distance between the building and lamp post is BC



(i) In ΔABC, ∠B = 90°

$$\tan C = \frac{AB}{BC} \quad \left[\because \tan\theta = \frac{P}{B}\right]$$

$$\tan 60° = \frac{60}{BC} \Rightarrow \sqrt{3} = \frac{60}{BC}$$

$$BC = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \Rightarrow BC = \frac{60\sqrt{3}}{3}$$

$$BC = 20\sqrt{3} \text{ m}$$

(ii) Here, $ED = BC = 20\sqrt{3}$ m

(Distance between two parallel lines)

In ΔAED, $\angle AED = 90°$

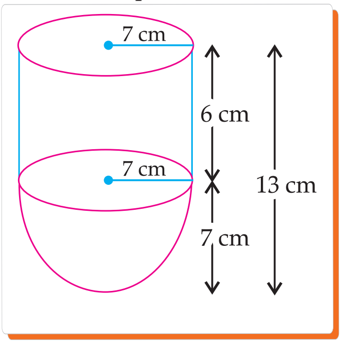
$$\cos D = \frac{ED}{AD} \qquad \left[\because \cos\theta = \frac{B}{H}\right]$$

$$\cos 30° = \frac{20\sqrt{3}}{AD}$$

$$\Rightarrow \quad \frac{\sqrt{3}}{2} = \frac{20\sqrt{3}}{AD}$$

$$AD = 40 \text{ m}$$

35. Given, diameter hemisphere $d = 14$ cm



$$r = \frac{d}{2} = \frac{14}{2}$$

$$r = 7 \text{ cm}$$

Height of cylinder $h = 6$ cm

Total inner surface Area of vessel = CSA of cylinder + CSA of hemi-sphere

$$= 2\pi rh + 2\pi r^2$$
$$= 2\pi r(h + r)$$
$$= 2 \times \frac{22}{7} \times 7(6+7)$$
$$= 44 \times 13$$
$$= 572 \text{ cm}^2$$

Now, Volume of vessel

$$= \pi r^2 h + \frac{2}{3}\pi r^3$$
$$= \pi r^2\left(h + \frac{2}{3}r\right)$$
$$= \frac{22}{7} \times (7)^2\left(6 + \frac{2}{3} \times 7\right)$$
$$= 154 \times \frac{32}{3}$$
$$= 1642.67 \text{ cm}^3$$

Delhi Set-3 **30/1/3**

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

SECTION – A

2. Option (C) is correct.

Explanation: Given,

1^{st} term $= a = -16$

common difference $= d = -2$

then, we know that

sum of n terms $= S_n$

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

Here $\quad n = 10$

So $\quad S_{10} = \frac{10}{2}[2 \times -16 + (10-1).(-2)]$

$$= 5[-32 - 18] = 5[-50]$$
$$= -250$$

7. Option (B) is correct.

Explanation: Let E = event of getting a red card which is an ace card.

S = Total elements in sample space

$\Rightarrow \quad n(S) = 52$

$\& \quad n(E) = 2$

We know that,

Probability of any event (E)

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

$$\Rightarrow P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$$

9. Option (B) is correct.

Explanation: Given,

$$\theta = 30°$$

then, $2\sin 30°.\cos 30° = 2 \times \frac{1}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2}$

16. Option (B) is correct.

Explanation: Given, α, β are the zeroes of the polynomial

$$P(x) = 6x^2 - 5x - 4$$

$\Rightarrow \quad \alpha + \beta = \text{sum of zeroes} = \frac{-(-5)}{6} = \frac{5}{6}$

$\& \quad \alpha.\beta = \frac{-4}{6} = \frac{-2}{3}$

So, $\quad \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} = \frac{\frac{5}{6}}{\frac{-2}{3}}$

$$= \frac{5}{6} \times \frac{3}{-2} = \frac{-5}{4}$$

SECTION – B

24. Let, $\quad 2x + 5y = -4 \quad$ ...(i)

$\& \quad 4x - 3y = 5 \quad$ ...(ii)

from equation (i) × 2 – equation (ii), we get

$$4x + 10y = -8$$
$$4x - 3y = 5 \quad \text{\{by method of elimination\}}$$
$$- \quad + \quad -$$

$\Rightarrow \quad 13y = -8 - 5$

$$y = \frac{-13}{13} = -1$$

Putting the value of $y = -1$ in (i) we get

$$2x + 5 \times (-1) = -4$$

$\Rightarrow \quad 2x = +5 - 4$

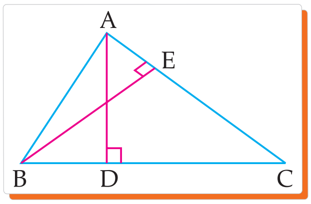
$$x = \frac{1}{2} \quad \text{So, } x = \frac{1}{2}$$

$$y = -1$$

25. Given,

$$AD = 7 \text{ cm}$$
$$BE = 9 \text{ cm}$$
$$EC = 12 \text{ cm}$$

then, $CD = ?$



Let $CD = x$ cm

In ΔBEC, $\angle BEC = 90°$ (As $BE \perp AC$ given)

⇒ from pythagoras theorem,

$$BC = \sqrt{BE^2 + EC^2}$$
$$= \sqrt{9^2 + 12^2} \text{ cm}$$
$$= \sqrt{81 + 144} \text{ cm} = \sqrt{225} \text{ cm}$$
$$BC = 15 \text{ cm}$$
$$\Rightarrow BD = (15 - x) \text{ cm}$$

Now, $\text{Area } \Delta ABC = \frac{1}{2} \times BC \times AD = \frac{1}{2} \times AC \times BE$

$\{\text{As area of } \Delta ABC = \frac{1}{2} \text{base} \times \text{height}\}$

$$\Rightarrow \frac{1}{2} \times 15 \times 7 = \frac{1}{2} AC \times 9$$
$$\Rightarrow AC = \frac{15 \times 7}{9} = \frac{35}{3} \text{ cm}$$

Now, In ΔADC,

$$\angle ADC = 90°$$

So, Again from pythagoras theorem,

$$DC^2 = AC^2 - AD^2$$
$$DC = \sqrt{\left(\frac{35}{3}\right)^2 - 7^2} \text{ cm} = 7.\sqrt{\frac{5^2}{3^2} - 1^2} \text{ cm}$$
$$= 7.\sqrt{\frac{25 - 9}{9}} \text{ cm} = 7.\frac{4}{3} \text{ cm} = \frac{28}{3} \text{ cm}$$
$$\Rightarrow DC = \frac{28}{3} \text{ cm}$$

SECTION – C

26. Let, unit digit $= x$

& tens digit $= y$

then, number $= 10y + x$

Also number obtained after interchanging its digit

$$= 10x + y$$

According to question,

$$x + y = 14 \quad \text{...(i)}$$
$$10x + y - (10y + x) = 18$$
$$\Rightarrow 9x - 9y = 18$$
$$\Rightarrow x - y = 2 \quad \text{...(ii)}$$

From eqn (i) + (ii), we have

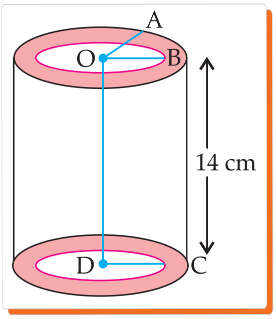
$$x + y = 14$$
$$x - y = 2$$
$$2x = 16$$
$$x = 8$$

So, $y = 14 - 8 = 6$ [from (i)]

thus,

Required number $= 10y + x = 10 \times 6 + 8 = 68$

27.



Given, height $= 14 \text{ cm} = h$

inner radius $OB = r = 3$ cm

outer radius $OA = R = 4$ cm

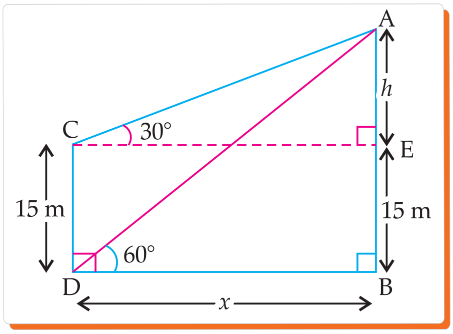
the, Total surface area

$$= 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$$
$$= 2\pi[4 \times 14 + 3 \times 14 + 4^2 - 3^2]$$
$$= 2 \times \frac{22}{7}[98 + 7] = 2 \times \frac{22}{7} \times 105 \text{ cm}^2$$
$$= 2 \times 22 \times 15 \text{ cm}^2 = 660 \text{ cm}^2$$

Hence, Required Area $= 660 \text{ cm}^2$

SECTION – D

32.



Let AB = tower

CD = building

Such that $\angle ACE = 30°$

$\angle ADB = 60°$

$AE = h$ m (say)

$EB = CD = 15$ m

& $BD = x$ m (say)

$= CE$

Now, In ΔAEC, $\angle E = 90°$ we have

$$\tan 30° = \frac{h}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$$
$$\Rightarrow x = \sqrt{3}.h \quad \text{...(i)}$$

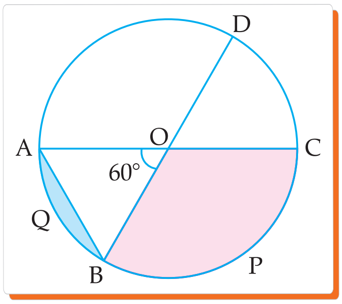
Again In ΔABD, $\angle B = 90°$, we have

$$\tan 60° = \frac{AB}{BD} \Rightarrow \sqrt{3} = \frac{h + 15}{x}$$
$$\Rightarrow \sqrt{3}.(\sqrt{3}.h) = h + 15 \quad [\because \text{ from (i) } x = \sqrt{3}.h]$$
$$\Rightarrow 3h - h = 15 \Rightarrow h = 7.5 \text{ m}$$
$$\Rightarrow x = \sqrt{3}h = \sqrt{3} \times 7.5$$
$$\approx 1.732 \times 7.5 \text{ m}$$
$$x \approx 12.99 \text{ m}$$

Hence height of the tower $= 7.5 + 15 = 22.5$ m

& distance between tower and building $= 12.99$ m

35.



Given, $OA = 10$ cm

AC & BD are diameters intersect at O

hence O is centre

$\Rightarrow \quad OA = OB = OC = 10$ cm

& $\quad \angle AOB = 60°$

$\Rightarrow \quad \angle ABO = \angle BAO = \dfrac{120°}{2} = 60°$

$[\because OA = OB \Rightarrow \angle OAB = \angle OBA]$

Hence, ΔOAB = equilateral triangle

(i) So $\quad AB = OA = OB = 10$ cm

(Sides of equilateral triangle)

(ii) Area of shaded region

= Sector area ($OBPC$) + [Sector area $OAQB$ – area of ΔOAB]

$$= \left[\frac{120°}{360°}\times\pi\times 10^2 + \frac{60°}{360°}\times\pi\times 10^2 - \frac{\sqrt{3}}{4}\times 10^2\right]\text{cm}^2$$

$$= \left(\frac{180°}{360°}\times\pi\times 100 - \frac{\sqrt{3}}{4}\times 100\right)\text{cm}^2$$

$$= \left(50\pi - \frac{\sqrt{3}}{4}\times 100\right)\text{cm}^2$$

$= (50 \times 3.14 – 1.73 \times 25)\text{cm}^2$

$= 157 \text{ cm}^2 – 43.25 \text{ cm}^2 = 113.75 \text{ cm}^2$

Hence, Required shaded area = 113.75 cm^2

Outside Delhi Set-1 — 30/2/1

SECTION – A

1. Option (B) is correct.

Explanation: Given equation are

$3x – y + 8 = 0$

$6x – ky + 16 = 0$

$a_1 = 3, b_1 = –1, c_1 = 8$

$a_2 = 6, b_2 = –k, c_2 = 16$

For Infinite many solution

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

$$\Rightarrow \quad \frac{3}{6} = \frac{-1}{-k} \Rightarrow \frac{1}{2} = \frac{1}{k}$$

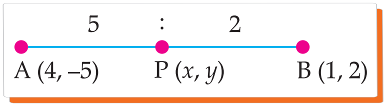
$\Rightarrow \quad K = 2$

2. Option (C) is correct.

Explanation: Let P(x, y) be the point

We know that

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$$



$$x = \frac{5\times 1 + 2\times 4}{5+2} \Rightarrow x = \frac{5+8}{7} = \frac{13}{7}$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$

$$y = \frac{5\times 2 + 2\times(-5)}{5+2} = \frac{10-10}{7}$$

$y = 0$

Therefore, Coordinates of point $P = \left(\dfrac{13}{7}, 0\right)$

3. Option (A) is correct.

Explanation: Given

$a_{15} – a_{11} = 48$

$\Rightarrow a + 14d – a – 10d = 48$

$\Rightarrow \quad 4d = 48 \Rightarrow d = 12$

4. Option (D) is correct.

Explanation: Given equation is

$x^2 + x + 1 = 0$

Where $\quad a = 1, b = 1, c = 1$

$D = b^2 – 4ac$

$(1)^2 – 4 \times 1 \times 1$

$D = – 3$

Where $\quad D < 0$

When D < 0 roots are not-real.

5. Option (A) is correct.

Explanation: Given

HCF = 40

LCM = $252 \times k$

We know that

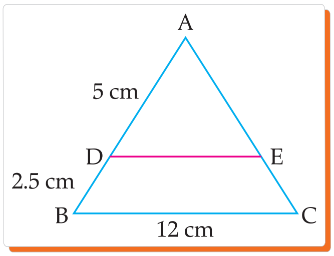
LCM × HCF = Product of two number

$\Rightarrow 40 \times 252 \times k = 2520 \times 6600$

$$\Rightarrow \quad k = \frac{2520\times 6600}{40\times 252} \quad \therefore k = 1650$$

6. Option (C) is correct.

Explanation: Given



$AD = 5$ cm

$DB = 2.5$ cm

$BC = 12$ cm

$DE \,||\, BC$

$\Delta ABC \sim \Delta ADE$

$$\frac{AD}{AB} = \frac{DE}{BC} \Rightarrow \frac{5}{7.5} = \frac{DE}{12}$$

$$\Rightarrow \quad \frac{50}{75} = \frac{DE}{12} \Rightarrow \frac{2}{3} = \frac{DE}{12}$$

$\therefore \quad$ DE = 8 cm

7. Option (C) is correct.

Explanation: Given

$\sin\theta = \cos\theta$

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

$$\Rightarrow \quad \tan\theta = 1$$
$$\theta = \frac{\pi}{4}$$

then ($\sec\theta \,.\, \sin\theta$)

Put $\theta = \frac{\pi}{4}$ $\qquad \left[\therefore \sec\frac{\pi}{4} = \sqrt{2},\ \sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}\right]$

$$\Rightarrow \sec\frac{\pi}{4}.\sin\frac{\pi}{4}$$

$$\Rightarrow \sqrt{2}.\frac{1}{\sqrt{2}} = 1$$

8. Option (D) is correct.

Explanation: When two dice are rolled together then sample space

$$S = \{(1, 1)\ (1, 2)\ (1, 3).....(6, 6)\}$$
$$n(S) = 36$$

Sum of two numbers to be more than 10

$$A = \{(6, 5)\ (5, 6)\ (6, 6)\}$$
$$n(A) = 3$$
$$\therefore P(A) = \frac{3}{36} = \frac{1}{12}$$

9. Option (C) is correct.

Explanation: Given equation is

$5x^2 + 3x - 7$

Here $\qquad a = 5, b = 3, c = -7$

α, β are zero's of the polynomial.

$$\text{So, Sum of zero's} = -\frac{b}{a}$$
$$\alpha + \beta = \frac{-b}{a},$$
$$\text{Product of zero's} = \frac{c}{a},$$
$$\alpha\beta = \frac{c}{a}$$
$$\alpha + \beta = \frac{-3}{5}, \alpha\beta = \frac{-7}{5}$$

$$\text{Find} \quad \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} \Rightarrow \frac{\frac{-3}{5}}{\frac{-7}{5}} = \frac{3}{7}$$

10. Option (B) is correct.

Explanation: The ratio of the corresponding sides of similar triangles is same as the ratio of their perimeter

$\therefore \quad \Delta ABC \sim \Delta PQR$ or $\Delta PQR \sim \Delta ABC$

$$\Rightarrow \frac{PQ}{AB} = \frac{QR}{BC} = \frac{PR}{AC} = \frac{48}{56} \Rightarrow \frac{PQ}{AB} = \frac{6}{7}$$

11. Option (D) is correct.

Explanation:

$\angle APD = \angle CPB$ [vertically opposite angle]

$\angle ADP = \angle CBP$

[Angle subtends on the same segment]

$\therefore$ AA similarity

$\Delta ADP \sim \Delta CBP$

12. Option (A) is correct.

Explanation: When value of each observation in data is increased by 2.

So, median of data is Increases by 2

13. Option (C) is correct.

Explanation: Given, A box contains card numbered 6 to 55. Perfect square number are

$$= 9, 16, 25, 36, 49$$
$$S = \{6, 7, 8......55\},$$
$$n(S) = 50$$
$$A = \{9, 16, 25, 36, 49\}$$
$$n(A) = 5$$
$$\Rightarrow \quad P(A) = \frac{5}{50} = \frac{1}{10}$$

14. Option (B) is correct.

Explanation: Given

$$PA = 5 \text{ cm}$$
$$PA \perp PB$$

$\angle OAP$ [90°, AP is a tangent]

$\angle OBP$ [90°, BP is a tangent]

So, APBO is square

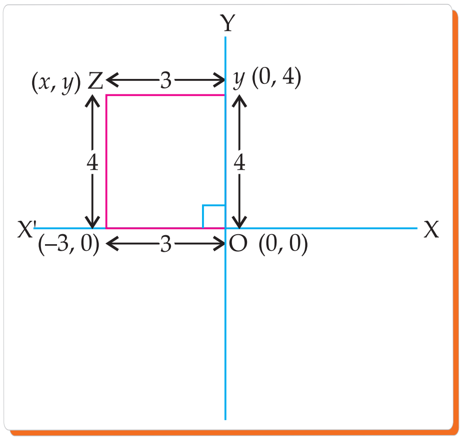
or

ΔAPB is a Right angle Triangle

$$AB^2 = AP^2 + PB^2 \qquad [AP = PB]$$
$$AB^2 = 2AP^2$$
$$AB^2 = 2 \times 5^2$$
$$\Rightarrow \quad AB = 5\sqrt{2} \text{ cm}$$

15. Option (A) is correct.

Explanation: Given



We know that, Length of Diagonals are equal In Rectangle

$$ZO = YX$$
$$\Rightarrow \sqrt{(x-0)^2+(y-0)^2} = \sqrt{(0+3)^2+(4-0)^2}$$
$$\Rightarrow \sqrt{x^2+y^2} = \sqrt{25}$$
$$\Rightarrow \quad x^2 + y^2 = 5 \qquad \text{Both Diagonal are 5 units}$$

OR

$$(ZO)^2 = (ZX)^2 + (XO)^2$$
$$(ZO)^2 = 4^2 + 3^2$$
$$(ZO)^2 = 25$$
$$ZO = 5$$

Again $(YX)^2 = (YO)^2 + (XO)^2$

$$= 4^2 + 3^2$$
$$(YX)^2 = 25$$
$$YX = 5$$

16. Option (B) is correct.

Explanation: Given

$$a = -29$$
$$d = -26 - (-29)$$
$$= -26 + 29 = 3$$
$$d = 3$$
$$a_n = 16$$

Here we know

$$a_n = a + (n-1)d$$
$$\Rightarrow \quad 16 = -29 + (n-1)3$$
$$\Rightarrow \quad \frac{16+29}{3} = n-1$$
$$\Rightarrow \quad 15 = n-1$$
$$\therefore \quad n = 16$$

17. Option (D) is correct.

Explanation: Given

$$\angle CAT = 40^\circ$$

Find $\angle CBA$

$$\angle BAT = 90^\circ$$
$$\Rightarrow \angle BAC + \angle CAT = 90^\circ$$
$$\Rightarrow \quad \angle BAC = 50^\circ$$
$$\Rightarrow \quad \angle ACB = 90^\circ \quad \text{[Angle in semi-circle]}$$

In ΔABC

$$\angle A + \angle B + \angle C = 180^\circ$$
$$50^\circ + \angle B + 90^\circ = 180^\circ$$
$$\angle B = 180^\circ - 140^\circ$$
$$\angle B = 40^\circ$$

18. Option (B) is correct.

Explanation: Mode = The Most Common or (Maximum). Number that appears in your set of data.

19. Option (A) is correct.

Explanation: Given, $\sin A = \dfrac{1}{3}$

Here, $\sin A = \dfrac{\text{Perpendicular}}{\text{Hypotenuse}}$

We know that $H^2 = P^2 + B^2$

$$\Rightarrow \quad (3)^2 = (1)^2 + B^2$$
$$\Rightarrow \quad 9 - 1 = B^2$$
$$B = 2\sqrt{2}$$
$$\cos A = \frac{\text{Base}}{\text{Hypotenuse}}$$
$$\cos A = \frac{2\sqrt{2}}{3} \rightarrow \text{True}$$

Reason

When θ is equal

then $\sin^2\theta + \cos^2\theta = 1$

$$\Rightarrow \quad H^2 = P^2 + B^2$$
$$\Rightarrow \quad \frac{H^2}{H^2} = \frac{P^2}{H^2} + \frac{B^2}{H^2}$$
$$\Rightarrow \quad [1 = \sin^2\theta + \cos^2\theta] \rightarrow \text{True}$$

20. (Bonus)

Explanation: Given

Edge of cube = 10 cm

In cube

length = Breadth = Height

When join two cube

New length is = 20 cm

height = 10 cm

width = 10 cm

It convert in cuboid

Total surface Area of cuboid

$$= 2(lb + bh + hl)$$
$$= 2[20 \times 10 + 10 \times 10 + 10 \times 20]$$
$$= 2[200 + 100 + 200]$$
$$= 2[500] = 1000 \text{ cm}^2$$

Assertion is wrong.

Reason

Area of each surface $= 10 \times 10 \text{ cm}^2$

$= 100 \text{ cm}^2$

Reason is true but not the correct explanation of assertion.

Hence, no correct option has been given.

SECTION – B

21. If 15^{15} ends with 0 or 5, then it must have 5 as a factor.

But only prime factors of 15 are 3 and 5.

$\therefore \; 15^n = (5 \times 3)n = 3^n \times 5^n$

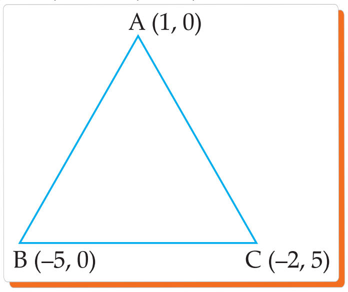
From the fundamental theorem of arithmetic, the prime factorization of every composite number is unique.

$\therefore$ 15^n can never end with 0 or 5.

22. Given

Vertices of a triangle

A(1, 0), B(– 5, 0) and C(– 2, 5)



Distance of

$$AB = \sqrt{(1+5)^2 + (0-0)^2}$$
$$\Rightarrow \quad AB = 6$$

Distance of

$$AC = \sqrt{(1+2)^2 + (0-5)^2}$$
$$\Rightarrow \quad AC = \sqrt{9+25}$$
$$\Rightarrow \quad AC = \sqrt{34}$$

$\Rightarrow$ Distance of BC

$$BC = \sqrt{(-2+5)^2 + (5-0)^2}$$
$$= \sqrt{9+25}$$
$$\Rightarrow \quad BC = \sqrt{34}$$

When two sides are equal, isosceles triangle is form.

23. (a) $2\sin^2 30^\circ \sec 60^\circ + \tan^2 60^\circ$

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

OR

(b) $2\sin(A+B) = \sqrt{3}$

$$\Rightarrow \quad \sin(A+B) = \frac{\sqrt{3}}{2}$$
$$\Rightarrow \quad \sin(A+B) = \sin 60$$
$$A + B = 60 \qquad ...(i)$$
$$\cos(A-B) = 1$$
$$\cos(A-B) = \cos 0$$
$$A - B = 0 \qquad ...(ii)$$

Adding (i) and (ii)

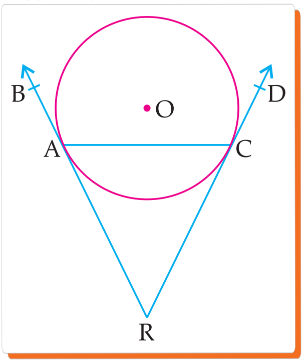
$$2A = 60$$
$$A = 30°$$

From (i)

$$30 + B = 60$$
$$B = 30°$$
$$\angle A = 30°, \angle B = 30°$$

24. Tangent to a circle from an external point are equal

$$RA = RC$$



So,

$$\angle RAC = \angle RCA$$

Let

$$\angle RAC = \angle RCA = x$$

We know that

BAR and DCR are straight line.

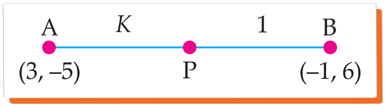
$$\angle BAC + \angle CAR = RC$$
$$\Rightarrow \quad \angle BAC + x = 180$$
$$\Rightarrow \quad \angle BAC = 180 - x$$

Similarly,

$$\angle DCA = 180 - x$$

So $\angle BAC = \angle DCA$

25. When the line segment



Let Ratio

$$m_1 : m_2 = K : 1$$

Let Co-ordinate of $P(x, y)$ divide the line segment in the ratio $K : 1$

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \; y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$

$$x = \frac{K(-1) + 1 \times 3}{K+1}, y = \frac{K \times 6 - 1 \times 5}{K+1}$$

$$x = \frac{-K+3}{K+1}, y = \frac{6K-5}{K+1}$$

Given line $\quad y = x$

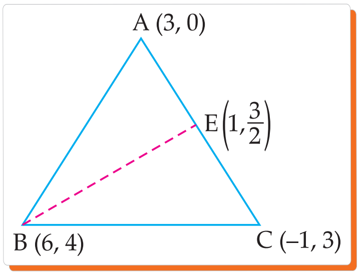
Put value of x and y in the equ. of line

$$\frac{-K+3}{K+1} = \frac{6K-5}{K+1}$$

$$\Rightarrow \quad -K + 3 = 6K - 5$$
$$\Rightarrow \quad -K - 6K = -5 - 3$$
$$7K = 8$$
$$K = \frac{8}{7}$$

OR

(b) A(3, 0), B(6, 4) and C(– 1, 3) are vertices of ΔABC and E on AC



A median of a triangle is a line segment that connects a vertex to the midpoint of the opposite side.

∴ E is mid point of AC

Co-ordinate of E

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

Distance of BE is

$$BE = \sqrt{(6-1)^2 + \left(4 - \frac{3}{2}\right)^2}$$
$$= \sqrt{5^2 + \left(\frac{5}{2}\right)^2}$$
$$= \sqrt{25 + \frac{25}{4}}$$
$$= \sqrt{\frac{125}{4}}$$
$$= \frac{5\sqrt{5}}{2}$$

SECTION – C

26. Given:

$$S_m = S_n$$

Show:

$$S_{(m+n)} = 0$$

Let the $A.P.$ be denoted as

$a_1, a_2, a_3, ...a_n.....$

With common difference d.

$$S_m = \frac{m}{2}[2a_1 + (m-1)d]$$

$$S_n = \frac{n}{2}[2a_1 + (n-1)d]$$

Given both are equal

$$\frac{m}{2}[2a_1 + (m-1)d] = \frac{n}{2}[2a_1 + (n-1)d]$$

$$\Rightarrow \frac{1}{2}[2a_1m + (m-1)md] = \frac{1}{2}[2a_1n + (n-1)nd]$$

$$\Rightarrow \frac{1}{2}[2a_1m + m^2d - md] - \frac{1}{2}[2a_1n + n^2d - nd] = 0$$

$$\Rightarrow \frac{1}{2}[2a_1m - 2a_1n + m^2d - n^2d - md + nd] = 0$$

$$\Rightarrow \frac{1}{2}[2a_1(m-n) + d(m^2 - n^2) - d(m-n)] = 0$$

$$\Rightarrow \frac{1}{2}(m-n)[2a_1 + (m+n-1)d] = 0$$

$$2a_1 = -[m + n - 1]d \text{...(i)}$$

Sum of the first $(m + n)$ term of the given A.P.

$$S_{m+n} = \frac{m+n}{2}[2a_1 + (m+n-1)d] \quad \text{...(ii)}$$

Put (i) in (ii)

$$\Rightarrow \quad S_{m+n} = \frac{m+n}{2}[-(m+n-1)d + (m+n-1)d]$$

$$S_{m+n} = 0$$

(b) **OR**

Three consecutive term are $a - d, a, a + d$

Given, Sum of three consecutive = 24

$a - d + a + a + d = 0$

$\Rightarrow \quad 3a = 24$

$a = 8 \quad \text{...(i)}$

$(a - d)^2 + a^2 + (a + d)^2 = 194$

$\Rightarrow a^2 + d^2 - 2ad + a^2 + a^2 + d^2 + 2ad = 194$

$\Rightarrow \quad 3a^2 + d^2 = 194$

$\Rightarrow \quad 3 \times 64 + d^2 = 194$

$d^2 = 194 - 192$

$d^2 = 2$

$d = \pm\sqrt{2}$

The Number $8 \pm \sqrt{2}, 8, 8 \mp \sqrt{2}$

27. If possible, let $\sqrt{5}$ be rational and let its simplest form be $\frac{p}{q}$.

Then p and q are integers having no common factor other than 1, and $q \neq 0$

Now $\quad \sqrt{5} = \frac{p}{q}$

$\Rightarrow \quad 5 = \frac{p^2}{q^2}$ [on squaring both sides]

$\Rightarrow \quad 5q^2 = p^2 \quad \text{...(i)}$

$\Rightarrow$ 5 divides p^2

$\Rightarrow$ 5 divides p

[$\because$ 5 is prime and 5 divides $p^2 \Rightarrow$ 5 divides p]

Let $p = 5R$ for some integer R

Putting $p = 5R$ in (i), we get

$5q^2 = 25R^2$

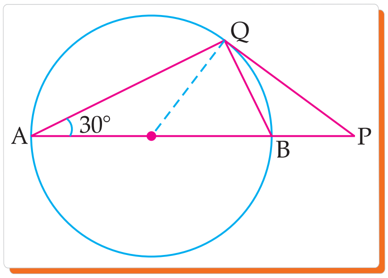
$\Rightarrow \quad q^2 = 5R^2$

$\Rightarrow$ 5 divides q^2 [$\because$ 5 divides $5R^2$]

$\Rightarrow$ 5 divides q [$\because$ 5 divides q]

Thus, 5 is a common factor of p and q. But, this contradicts the fact that p and q have no common factor other than 1. Hence, $\sqrt{5}$ is irrational.

28. (a)



$\angle BQP = \angle BAQ$

($\angle$s in alternate segment are equal)

$\Rightarrow \quad \angle BQP = 30° \quad \text{...(i)}$

($\because \angle BAQ = 30°$given)

As AB is a diameter, AQB is a Semicircle.

$\angle AQB = 90°$

(angle in semicircle = 90°)

From Fig. $\quad \angle AQP = \angle AQB + \angle BQP$

$\Rightarrow \quad \angle AQP = 90° + 30°$

$= 120°$

In ΔAQP, $\angle QPA + \angle BAQ + \angle AQP = 180°$

$\Rightarrow \quad \angle QPA + 30° + 120° = 180°$

$\Rightarrow \quad \angle QPA = 180 - (30° + 120°)$

$\Rightarrow \quad \angle QPA = 30° \quad \text{...(ii)}$

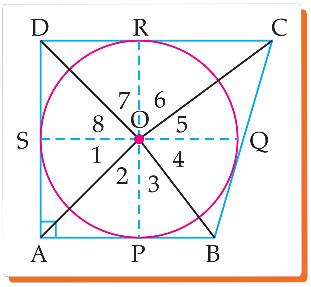
From (i) and (ii) we get

$\angle BQP = \angle QPB = 30°$

Therefore, $\quad QB = BP$

OR

(b) Given A quad. ABCD circumscribes a circle with centre O.



To Prove

$\angle AOB + \angle COD = 180°$

and $\quad \angle AOD + \angle BOC = 180°$

Join OP, OQ, OR and OS.

We know that the tangent drawn from an external point of a circle subtends equal angles at the centre.

$\therefore \quad \angle 1 = \angle 2,$

$\angle 3 = \angle 4,$

$\angle 5 = \angle 6,$

$\angle 7 = \angle 8,$

And $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8$

$= 360°$ [$\angle$S at a Point]

$\Rightarrow 2(\angle 2 + \angle 3) + 2(\angle 6 + \angle 7) = 360°$

$2(\angle 1 + \angle 8) + 2(\angle 4 + \angle 5) = 360°$

$\Rightarrow \quad \angle 2 + \angle 3 + \angle 6 + \angle 7 = 180°$

$\angle 1 + \angle 8 + \angle 4 + \angle 5 = 180°$

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

$\angle AOD + \angle BOC = 180°$

29. $\quad \sec^2\theta - \tan^2\theta = 1$

$(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

L.H.S

$$= \frac{(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) + (\sec\theta - \tan\theta)}{1 + \sec\theta + \tan\theta}$$

$$= \frac{(\sec\theta - \tan\theta)[\sec\theta + \tan\theta + 1]}{[1 + \sec\theta + \tan\theta]}$$

$$= \sec\theta - \tan\theta$$

$$= \frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}$$

$$= \frac{1 - \sin\theta}{\cos\theta}$$

L.H.S = R.H.S **Hence Proved.**

30.

Marks obtained	Number of Students f_i	x_i	$x_i - 25$	$u_i f_i$
0–10	12	5	– 20	– 240
10–20	23	15	– 10	– 230
20–30	34	25	0	0
30–40	25	35	10	250
40–50	6	45	20	120
	100			– 100

Let assumed mean = 25

$u_i = x_i - 25$

Short cut method

$$\bar{x} = a + \sum \frac{u_i f_i}{f_i}$$

$$= 25 + \frac{(-100)}{100}$$

$$= 25 - 1$$

$$\bar{x} = 24$$

31. Let the digit in ten's place be x.
Then the one's place digit will be $x - 5$
The product of two digit = 36

$$x(x-5) = 36$$

$$x^2 - 5x - 36 = 0$$

$$\Rightarrow x^2 - 9x + 4x - 36 = 0$$

$$\Rightarrow (x-9)(x+4) = 0$$

$$x = 9, -4$$

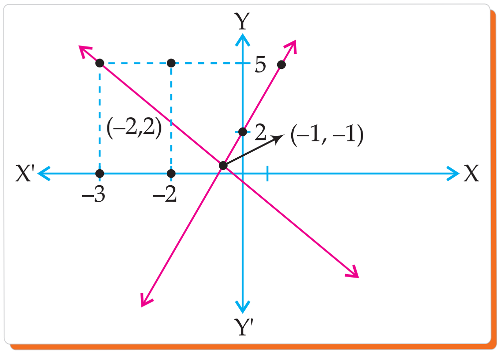
No. = 94

SECTION – D

32. (a) $3x + y + 4 = 0$ $\quad$ $3x - y + 2 = 0$

x	– 2	– 3
y	2	5

x	0	1
y	2	5



(b) Let x be the number of Right Answer
y be the number of wrong Answer
∴ According to the question,

$$3x - y = 40 \quad \text{...(i)}$$

$$4x - 2y = 50 \quad \text{...(ii)}$$

Multiply with 2 in eq. (i)

$$6x - 2y = 80 \quad \text{...(iii)}$$

$$4x - 2y = 50 \quad \text{...(iv)}$$

$$- \quad + \quad -$$

$$2x = 30$$

$$x = 15$$

Putting the value of x in eqn. (i)

$$3 \times 15 - y = 40$$

$$-y = 40 - 45$$

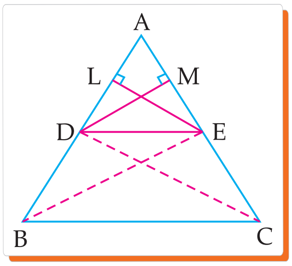
$$y = 5$$

Total no. of question

$$= 15 + 5$$

$$= 20$$

33. (a) Given: A ΔABC in which DE||BC and DE intersects AB and AC at D and



To prove $\dfrac{AD}{DB} = \dfrac{AE}{EC}$

Join BE and CD.
Draw EL ⊥ AB and DM ⊥ AC.
We have,

$$ar(\Delta ADE) = \frac{1}{2} \times AD \times EL \quad \left[\because \Delta = \frac{1}{2} B \times H\right]$$

and $$ar(\Delta DBE) = \frac{1}{2} \times DB \times EL$$

$$\therefore \quad \frac{ar(\Delta ADE)}{ar(\Delta DBE)} = \frac{\frac{1}{2} \times AD \times EL}{\frac{1}{2} \times DB \times EL}$$

$$= \frac{AD}{DB} \quad \text{...(i)}$$

Similarly

$$ar(\Delta ADE) = ar(\Delta ECD)$$

$$= \frac{1}{2} \times AE \times DM$$

and $ar(\Delta ECD)$

$$\therefore \quad \frac{ar(\Delta ADE)}{ar(\Delta ECD)} = \frac{AE}{EC} \quad \text{...(ii)}$$

Now ΔDBE and ΔECD being on the same base DE and between the same parallel DE and BC

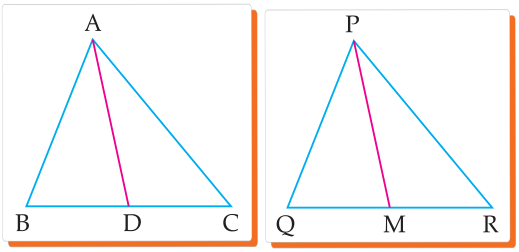
$$ar(\Delta DBE) = ar(\Delta ECD)$$

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

OR

(b) We have

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$$



$$\Rightarrow \quad \frac{AB}{PQ} = \frac{AD}{PM} = \frac{BC}{QR}$$

$$= \frac{\frac{1}{2}BC}{\frac{1}{2}QR} = \frac{BD}{QM} \quad ...(i)$$

In ΔABD and ΔPQM, we have

$$\frac{AB}{PQ} = \frac{AD}{PM} = \frac{BD}{QM} \text{ from (i)}$$

∴ ΔABD ~ ΔPQM [by SSS-Similarity]

And So, ∠B = ∠Q

[Corresponding angles of similar triangles are equal]

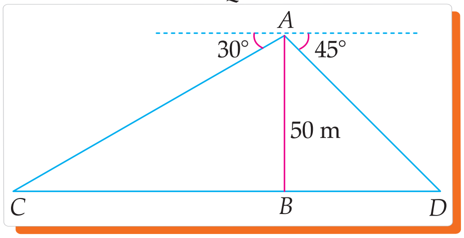
Now, in ΔABC and ΔPQR we have

∠B = ∠Q [Proved above]

and $\frac{AB}{PQ} = \frac{BC}{QR}$ [From (i)]

ΔABC ~ ΔPQR

34.



Given : Height of a light house AB = 45 m

To find: CD = ?

Sol: Distance between the ships = CD

∠ACB= 30° and ∠ADB = 60°

(alternate angles are equal)

Now, In right angle ΔABC

$$\tan 30 = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{45}{BC}$$

$$BC = 45\sqrt{3} \quad ...(i)$$

In right angle ΔABD,

$$\tan 60° = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{45}{BD}$$

$$BD = \frac{45 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{45\sqrt{3}}{3} = 15\sqrt{3}$$

From (i) and (ii) we get,

$$BD = BC + BD$$

$$= 45\sqrt{3} + 15\sqrt{3} = 60\sqrt{3}$$

$$= 60 \times 1.73$$

$$= 103.8 \text{ m}$$

35. Let the radius of circle be r and the arc length is l

Perimeter of a sector is given as. [∵ $l = r\theta$]

∴ $P = 2r + r\theta$ $\qquad r = 5.6$ m

$P = 20$ m

⇒ $20 = (2 \times 5.6) + 5.6\,\theta$

⇒ $20 - 11.2 = 5.6\,\theta$

⇒ $\frac{8.8}{5.6} = \theta$

$$\theta = \frac{11}{7} \text{ radian}$$

$$\left[\because \text{ I radian} = \frac{180}{\pi} \text{ degree } \pi = \frac{22}{7}\right]$$

$$\theta = \frac{11}{7} \times \frac{180}{\pi} \text{ degree}$$

$$\theta = 90° \text{ degree}$$

$$\text{Area of sector} = \frac{\theta}{360} \times \pi r^2$$

$$= \frac{90}{360°} \times \frac{22}{7} \times 5.6 \times 5.6$$

$$= \frac{1}{4} \times \frac{22}{7} \times 5.6 \times 5.6 = \frac{689.92}{28}$$

$$\text{Area} = 24.64 \text{ m}^2$$

SECTION – E

36. (i) Two

[The point at which curve touch the x-axis is zero's]

Here, $x = 0, 5$

(ii) Given

$$h = 25t - 5t^2$$

Maximum height at a point $\left(\frac{5}{2}, 0\right)$

$$h = 25 \times \frac{5}{2} - 5\left(\frac{5}{2}\right)^2$$

$$= \frac{125}{2} - \frac{125}{4}$$

$$= 62.5 - 31.25$$

$$h = 31.25$$

(iii) (a) Ball take time to reach height 30 m

$$30 = 25t - 5t^2$$

$$5t^2 - 25t + 30 = 0$$

⇒ $t^2 - 5t + 6 = 0$

⇒ $t^2 - 3t - 2t + 6 = 0$

$$(t-3)(t-2) = 0$$

$$t = 3, 2$$

(b) when height is = 20 m

$$20 = 25t - 5t^2$$

⇒ $5t^2 - 25t + 20 = 0$

⇒ $t^2 - 5t + 4 = 0$

$$t^2 - 4t - t + 4 = 0$$

$$(t-4)(t-1) = 0$$

$$t = 4, 1$$

37. Given

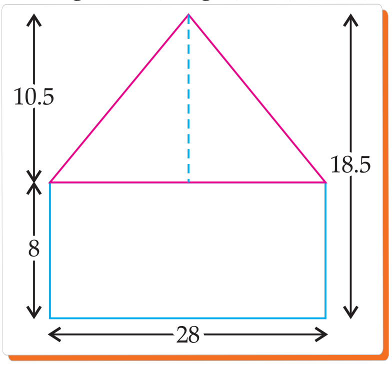
Cylindrical height = 8 m

Diameter of base = 28 m

Total height of tent = 18.5 m

(i) Radius = 14 m

$$(\text{Slant height})^2 = (\text{Height})^2 + (\text{Radius})^2$$



$$l^2 = (10.5)^2 + (14)^2$$
$$= 110.25 + 196$$
$$l^2 = 306.25$$
$$l = 17.5 \text{ m}$$

(ii) Floor Area of Tent is $= \pi r^2$

$$= \frac{22}{7} \times 14 \times 14$$
$$= 22 \times 7 \times 14$$
$$\text{Area} = 616 \text{ m}^2$$

(iii) (a) Area of cloth used for making tent.

$$= 2\pi rh \times \pi lr$$
$$= 2\pi r[h + l]$$
$$= 2 \times \frac{22}{7} \times 14[8 + 17.5]$$
$$= 2 \times 22 \times 2[25.5]$$
$$= 88 \times 25.5$$
$$= 2244 \text{ m}^2$$

OR

(b) Total volume Inside the Test

$$= \pi r^2 h + \frac{1}{3}\pi r^2 h$$
$$= \pi r^2\left(h + \frac{1}{3h}\right)$$
$$= \frac{22}{7} \times 14 \times 14\left(8 + \frac{1}{3} \times 10.5\right)$$
$$= 22 \times 2 \times 14(8 + 3.5)$$
$$= 616 \times 11.5$$
$$= 7084 \text{ cm}^3$$

38. $P(A) = \dfrac{\text{No. of favourable outcomes}}{\text{Total NO. of outcomes}}$

(i) Given

$$\text{Bus + Ship} = 33 + 36$$
$$= 69°$$

we know

$$\text{Total} = 360°$$
$$\text{(Bus or ship)} = \frac{69°}{360} \times 120$$

Total person on Bus or Ship

$$= 23 \text{ people}$$
$$\therefore \quad P(A) = \frac{23}{120}$$

A = he/she travelled by bus or ship

(ii) Car is most favourite mode of transport

$$\Rightarrow \quad \text{No. of people} = \frac{177}{360} \times 120$$
$$= 59 \text{ people}$$

(iii) (a) Probability that he did not use train is $\frac{4}{5}$

Probability that people use train is $\frac{1}{5}$

$[\because P(A) + P(\bar{A}) = 1]$

No. of people who used train $\frac{1}{5} \times 120$

$$= 24 \text{ people}$$

OR

(b) Given

Probability that randomly selected person used aeroplane is $\frac{7}{60}$

$$\text{Total No. of people} = \frac{7}{60} \times 120$$
$$= 14 \text{ people}$$

Revenue collected by air is

$$= 14 \times 5000$$
$$= ₹\ 70{,}000$$

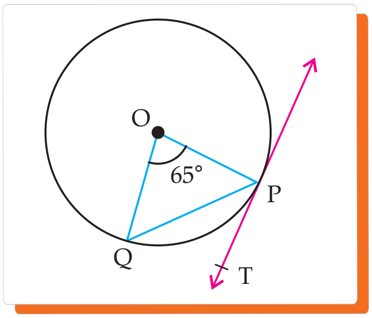
Outside Delhi Set-2 30/2/2

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

SECTION – A

2. Option (D) is correct.

***Explanation*:**



$$\angle OPQ + \angle OQP + \angle QOP = 180°$$
$$2\angle OPQ + 65° = 180°$$
$$\angle OPQ = \frac{180 - 65}{2} = 57.5°$$
$$\angle OPT = 90°$$
$$\angle OPQ + \angle QPT = 90°$$
$$\angle QPT = 90° - 57.5° = 32.5°$$

6. Option (B) is correct.

***Explanation*:** $2x^2 - 9x + 5$

$$\alpha + \beta = \frac{9}{2}$$
$$\alpha\beta = \frac{5}{2}$$
$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$
$$= \left(\frac{9}{2}\right)^2 - 2 \times \frac{5}{2}$$
$$= \frac{81}{4} - 5$$
$$= \frac{61}{4}$$

13. Option (D) is correct.

***Explanation*:** $p(x) = 5x^2 - 4x + (2 + k)$

$$p(2) = 0$$
$$5(2)^2 - 4(2) + 2 + k = 0$$
$$20 - 8 + 2 + k = 0$$
$$k = -14$$

15. Option (C) is correct.

***Explanation*:** $1 + 2 + 3 + ... + 200$

$$S_n = \frac{n(n+1)}{2} = \frac{200(200+1)}{2}$$
$$= 20100$$

SECTION – B

23. $7 \times 11 \times 13 + 13 = 13(7 \times 11 + 1)$

$= 13 \times 78$

$= 13 \times 13 \times 2 \times 3 \times 1$

It has more than 2 factors.

$\therefore$ It is composite number

$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$

$5(7 \times 6 \times 4 \times 3 \times 2 + 1)$

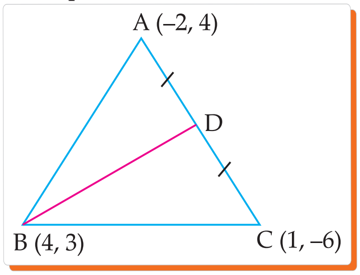
$5(1008 + 1) = 5 \times 1009$

$= 5 \times 1009 \times 1$

It is also composite number.

24. BD is the median of ΔABC

$\therefore$ D is the mid-point of side AC



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

$$D\left(\frac{-2+1}{2}, \frac{4-6}{2}\right)$$

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

$$BD = \left|\sqrt{(x_3 - x_4)^2 + (y_3 - y_4)^2}\right|$$

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

$$= \left|\sqrt{\frac{81}{4} + 16}\right|$$

$$BD = \sqrt{\frac{145}{4}} = \frac{\sqrt{145}}{2} \text{ units}$$

SECTION – C

28. Let the three consecutive no. be x, $x + 1$ and $x + 2$

$(x + 1)^2 + x(x + 2) = 161$

$\Rightarrow x^2 + 2x + 1 + x^2 + 2x - 161 = 0$

$\Rightarrow 2x^2 + 4x - 160 = 0$

$\Rightarrow x^2 + 2x - 80 = 0$

$\Rightarrow x^2 + 10x - 8x - 80 = 0$

$\Rightarrow x(x + 10) - 8(x + 10) = 0$

$\Rightarrow (x + 10)(x - 8) = 0$

If $x + 10 = 0$

$x = -10$

It is not natural number

If $x - 8 = 0$

$x = 8$

$\therefore$ Consecutive no.s are 8, 9 and 10.

31. L.H.S. $\sin^6\theta + \cos^6\theta$

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

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

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

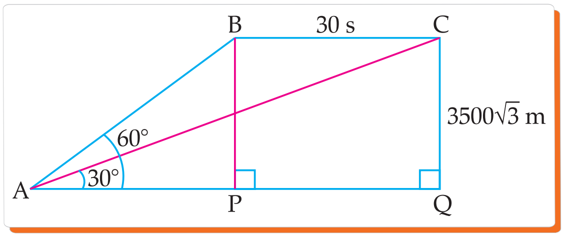
$= (1)^3 - 3\sin^2\theta\cos^2\theta\,(1)$

$= 1 - 3\sin^2\theta\cos^2\theta$ $\quad(\sin^2\theta + \cos^2\theta = 1)$

$=$ R.H.S. Hence Proved

SECTION – D

32. Let the speed of an aircraft be x m/s.



Distance $=$ Speed $\times$ time

$= x \times 30$

$BC = 30x$ m

In ΔAPB, $\tan A = \dfrac{BP}{AP}$

$$\tan 60° = \frac{3500\sqrt{3}}{AP} = \sqrt{3}$$

$\therefore$ $AP = 3500$ m

In ΔACQ, $\tan A = \dfrac{CQ}{AQ}$

$$\tan 30° = \frac{3500\sqrt{3}}{3500 + 30x}$$

$$\frac{1}{\sqrt{3}} = \frac{3500\sqrt{3}}{3500 + 30x}$$

$10500 = 3500 + 30x$

$10500 - 3500 = 7000 = 30x$

$$\therefore \quad x = \frac{7000}{30}$$

$$= \frac{700}{3}$$

$$\text{Speed of aircraft} = \frac{700}{3} \text{ m/s}$$

$$= \frac{700}{3} \times \frac{18}{5} \text{ km/h}$$

$= 140 \times 6$ km/h

$\therefore$ Speed aircraft $= 840$ km/h

33. Let the length of rectangle be x m and breadth of rectangle be y m

Area of rectangle $= xy$ m^2

$(x - 5)(y + 2) = xy - 80$

$xy - 5y + 2x - 10 = xy - 80$

$2x - 5y = -70$ ...(i)

$(x + 10)(y - 5) = xy + 50$

$xy - 5x + 10y - 50 = xy + 50$

$-5x + 10y = 100$

$-x + 2y = 20$ ...(ii)

$2x - 5y = -70$ ...(i)

from (i) & (ii) $x = 40$ m, $y = 30$ m

$\therefore$ length of rectangle $= 40$ m

and breadth of rectangle $= 30$ m

Outside Delhi Set-3 **30/2/3**

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

SECTION – A

1. Option (B) is correct.

Explanation: $d = |\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}|$

$= |\sqrt{(a\sin\theta - a\cos\theta)^2 + (a\cos\theta + a\sin\theta)^2}|$

$= |\sqrt{a^2\sin^2\theta + a^2\cos^2\theta - 2a^2\sin\theta\cos\theta + a^2\cos^2\theta + + a^2\sin^2\theta + 2a^2\sin\theta\cos\theta}|$

$= |\sqrt{2a^2(\sin^2\theta + \cos^2\theta)}|$

$= |\sqrt{2a^2}|$

$= \sqrt{2}a$ units

8. Option (C) is correct.

Explanation: $4x^2 - 5x + 4$

Discriminant $D = \sqrt{25 - 64} = \sqrt{-39} < 0$

$\therefore$ Roots are not real

9. Option (A) is correct.

Explanation: $a_{20} - a_{15} = 20$

$a + 19d - a - 14d = 20$

$5d = 20$

$d = 4$

12. Option (C) is correct.

Explanation: $-x^2 + 8x + 9$

$$\alpha + \beta = \frac{-8}{-1} = 8$$

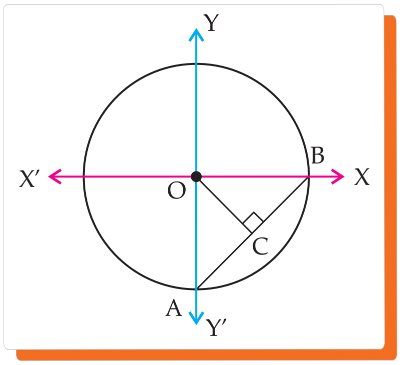
$$\alpha.\beta = \frac{9}{-1} = -9$$

$$(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$$
$$= 64 + 36 = 100$$

$$\therefore \quad \alpha - \beta = \sqrt{100} = \pm 10$$

SECTION – B

23.



In ΔOAB

As, $OA = OB$ Equal radii

$\therefore \quad \angle OBA = \angle OAB = 45°$

Now, In triangle OCB

$$\sin B = \frac{OC}{OB}$$

$$\sin 45° = \frac{OC}{7}$$

$$\frac{1}{\sqrt{2}} = \frac{OC}{7}$$

$$\therefore \quad OC = \frac{7}{\sqrt{2}}$$

$$= \frac{7\sqrt{2}}{2} \text{ cm}$$

25. For a number to end with digit 0 its prime factorisation should have 2 and 5 as a common factor

$$(8)^n = (2^3)^n = (2^{3n})$$

8^n does not have 5 in its prime factorisation.

$\therefore$ 8^n can not end with the digit 0

SECTION – C

26.

$$\text{L.H.S.} = \frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta}$$

$$= \frac{1 + \cot^2\theta - 1 - \tan^2\theta}{1 + \cot^2\theta + 1 + \tan^2\theta}$$

$$= \frac{\cot^2\theta - \tan^2\theta}{2 + \cot^2\theta + \tan^2\theta}$$

$$= \frac{7 - \frac{1}{7}}{2 + \frac{1}{7} + 7}$$

$$= \frac{\frac{49 - 1}{7}}{\frac{63 + 1}{7}}$$

$$= \frac{48}{64}$$

$$= \frac{3}{4}$$

= R.H.S. Hence Proved

30. Let the cost price be ₹ x

Selling price = ₹ 75

Gain = $75 - x$

Given, $$\frac{75 - x}{x} = \frac{x}{100}$$

$$7500 - 100x = x^2$$
$$x^2 + 100x - 7500 = 0$$
$$x^2 + 150x - 50x - 7500 = 0$$
$$x(x + 150) - 50(x + 150) = 0$$
$$(x + 150)(x - 50) = 0$$

if $x + 150 = 0$

$x = -150$ Not possible

(price cannot be negative)

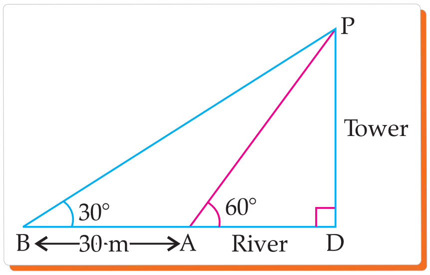
$x - 50 = 0$

$x = 50$

$\therefore$ Cost price be ₹ 50

SECTION – D

32.



Let the height of the tower (PD) be h m and width of the river (AD) be x m

In ΔAOD,

$$\tan A = \frac{PD}{AD}$$

$$\tan 60° = \frac{h}{x}$$

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

$$h = x\sqrt{3} \quad \text{...(i)}$$

In ΔDBP,

$$\tan B = \frac{PD}{BD}$$

$$\tan B = \frac{h}{x+30}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x+30}$$

$$x + 30 = \sqrt{3}h$$

$$x + 30 = 3x$$

$$x = 15 \text{ m}$$

$\therefore$ width of the river 15 m

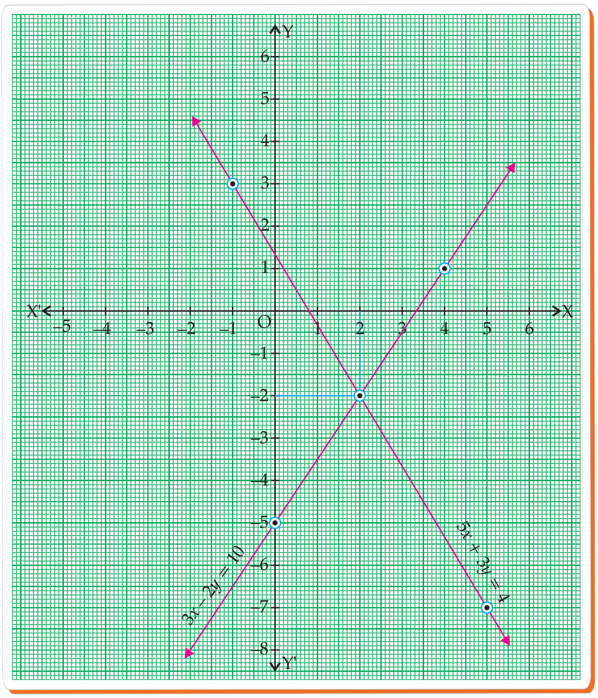
from (i) $\quad h = x\sqrt{3}$

$= 15 \times 1.732$

$= 25.980$ m

$\therefore$ Height of the tower is 25.98 m

35. (a) $\quad 3x - 2y = 10$



$$y = \frac{3x-10}{2}$$

x	0	2	4
y	–5	–2	1

$$5x + 3y = 4$$

$$y = \frac{4-5x}{3}$$

x	–1	2	5
y	3	–2	–7

$\therefore \quad x = 2$ and $y = 2$

OR

(b) Let the greater no. be x and smaller no. be y

Given, $\quad 3x = 4y + 3 \quad$ ...(i)

By using:

Dividend = Divisor × Quotient + Remainder.

$7y = 5x + 1 \quad$ ...(ii)

Multiply by eqn (i) by 5 and (ii) by 3

$15x - 20y = 15 \quad$ ...(iii)

$-15x + 21y = 3 \quad$ ...(iv)

On adding $\quad y = 18$

from eqn (i) $\quad x = \frac{18 \times 4 + 3}{3} = \frac{75}{3} = 25$

Greater number = 25

Smallest number = 18