SOLVED PAPER

C.B.S.E. 2020

Class–X

Delhi/Outside Delhi

Mathematics (Basic)

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

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper comprises **four** sections – A, B, C and D.*
*This question paper carries **40** questions. **All** questions are compulsory.*

(ii) ***Section A** – Question no. **1** to **20** comprises of **20** questions of one **mark** each.*

(iii) ***Section B** – Question no. **21** to **26** comprises of **6** question of **two marks** each.*

(iv) ***Section C** – Question no. **27** to **34** comprises of **8** questions of **three** marks each.*

(v) ***Section D** – Question no. **35** to **40** comprises of **6** questions to **four** marks each.*

(vi) *There is no overall choice in the question paper. However, an internal choice has been provided in 2 questions of one mark, 2 questions of two marks, 3 questions of three marks and 3 questions of four marks. You have to **attempt only** one **of the choice** in such questions.*

(vii) *In addition to this, separate instructions are given with each section and question, wherever necessary.*

(viii) *use of calculators is not permitted.*

Delhi Set-I | **Code No. 430/1/1**

SECTION-A

Nos. 1 to 10 are multiple choice questions. Select the correct option.

1. HCF of 144 and 198 is **1**

(a) 9 **(b)** 18 **(c)** 6 **(d)** 12

2. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is **1**

(a) 27·5 **(b)** 24·5 **(c)** 28·4 **(d)** 25·8

3. In Fig. 1, on a circle of radius 7 cm, tangent PT is drawn from a point P such that PT = 24 cm. If O is the centre of the circle, then the length of PR is **1**

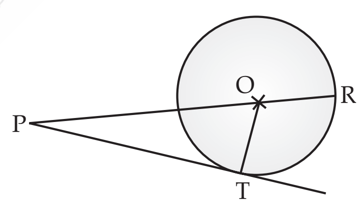


Fig. 1

(a) 30 cm **(b)** 28 cm **(c)** 32 cm **(d)** 25 cm

4. 225 can be expressed as

(a) 5×3^2 **(b)** $5^2 \times 3$ **(c)** $5^2 \times 3^2$ **(d)** $5^3 \times 3$

5. The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is **1**

(a) $\frac{4}{15}$ **(b)** $\frac{2}{15}$ **(c)** $\frac{1}{15}$ **(d)** $\frac{1}{5}$

6. If one zero of a quadratic polynomial $(kx^2 + 3x + k)$ is 2, then the value of k is **1**

(a) $\frac{5}{6}$ **(b)** $-\frac{5}{6}$ **(c)** $\frac{6}{5}$ **(d)** $-\frac{6}{5}$

7. $2.\overline{35}$ is **1**

(a) an integer **(b)** a rational number **(c)** an irrational number **(d)** a natural number

8. The graph of a polynomial is shown in Fig. 2, then the number of its zeroes is **1**

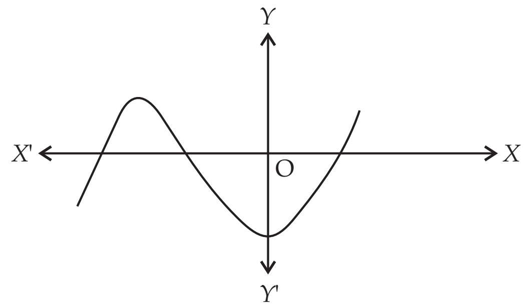


Fig. 2

(a) 3 **(b)** 1 **(c)** 2 **(d)** 4

9. Distance of point P(3, 4) from x-axis is **1**

(a) 3 units **(b)** 4 units **(c)** 5 units **(d)** 1 unit

10. If the distance between the points A(4, p) and B(1, 0) is 5 units, then the value(s) of p is (are) **1**

(a) 4 only **(b)** –4 only **(c)** ± 4 **(d)** 0

Question numbers 11 to 15, Fill in the blanks.

11. If the point C(k, 4) divides the line segment joining two points A(2, 6) and B(5, 1) in ratio 2 : 3, the value of k is **1**

OR

If points A(–3, 12), B(7, 6) and C(x, 9) are collinear, then the value of x is ....

12. If the equations $kx - 2y = 3$ and $3x + y = 5$ represent two intersecting lines at unique point, then the value of k is **1**

OR

If quadratic equation $3x^2 - 4x + k = 0$ has equal roots, then the value of k is ....

13. The value of (sin 20° cos 70° + sin 70° cos 20°) is **1**

14. If $\tan (A + B) = \sqrt{3}$ and $\tan (A - B) = \frac{1}{\sqrt{3}}$, A > B, then the value of A is **1**

15. The perimeters of two similar triangles are 25 cm and 15 cm respectively. If one side of the first triangle is 9 cm, then the corresponding side of second triangle is **1**

Question numbers 16 to 20, answer the following.

16. If 5 tan θ = 3, then what is the value of $\left(\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}\right)$? **1**

17. The areas of two circles are in the ratio 9 : 4, then what is the ratio of their circumferences ? **1**

18. If a pair of dice is thrown once, then what is the probability of getting a sum of 8 ? **1**

19. In Fig. 3, in Δ ABC, DE || BC such that AD = 2·4 cm, AB = 3·2 cm and AC = 8 cm, then what is the length of AE ? **1**

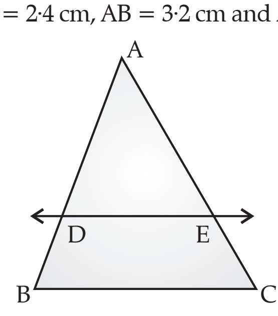


Fig. 3

20. The n^{th} term of an A.P. is $(7 - 4n)$, then what is its common difference ? **1**

SECTION-B

Question numbers 21 to 26 carry 2 marks each.

21. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball, find the number of blue balls in the bag. **2**

22. Prove that $\sqrt{\dfrac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$. **2**

OR

Prove that $\dfrac{\tan^2\theta}{1+\tan^2\theta} + \dfrac{\cot^2\theta}{1+\cot^2\theta} = 1$

23. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5. **2**

OR

Find the probability that 5 Sundays occur in the month of November of a randomly selected year.

24. In Fig. 4, a circle touches all the four sides of a quadrilateral ABCD. If AB = 6 cm, BC = 9 cm and CD = 8 cm, then find the length of AD. **2**

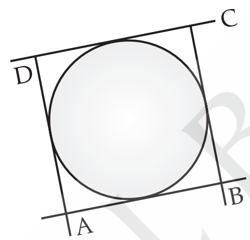


Fig. 4

25. The perimeter of a sector of a circle with radius 6.5 cm is 31 cm, then find the area of the sector. **2**

26. Divide the polynomial $(4x^2 + 4x + 5)$ by $(2x + 1)$ and write the quotient and the remainder. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

27. If α and β are the zeroes of the polynomial $f(x) = x^2 - 4x - 5$ then find the value of $\alpha^2 + \beta^2$. **3**

28. Draw a circle of radius 4 cm. From a point 7 cm away from the centre of circle. Construct a pair of tangents to the circle. **3**

OR

Draw a line segment of 6 cm and divide it in the ratio 3 : 2.

29. A solid metallic cuboid of dimension 24 cm × 11 cm × 7 cm is melted and recast into solid cones of base radius 3·5 cm and height 6 cm. Find the number of cones so formed. **3**

30. Prove that $(1 + \tan A - \sec A) \times (1 + \tan A + \sec A) = 2 \tan A$ **3**

OR

Prove that $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - 1} + \dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta + 1} = 2\sec^2\theta$

31. Given that $\sqrt{3}$ is an irrational number, show that $(5 + 2\sqrt{3})$ is an irrational number. **3**

OR

An army contingent of 612 members is to march behind an army band of 48 members in a parade. The two groups are to march in the same number of coloumns. What is the maximum number of coloumns in which they can march ?

32. Prove that, in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. **3**

Read the following passage carefully and then answer the questions given at the end.

33. To conduct Sports Day activities, in your rectangular shaped school ground ABCD, lines have been drawn with chalk powder at a distance of 1 m each. 100 flower pots have been placed at a distance of 1 m from each other along AD, as shown in Fig. 5. Niharika runs $\frac{1}{4}$ th the distance AD on the 2nd line and posts a green flag. Preet runs $\frac{1}{5}$ th the distance AD on the eighth line and posts a red flag. **3**

(i) What is the distance between the two flags?

(ii) If Rashmi has to post a blue flag exactly half way between the line segment joining the two flags, where should she post the blue flag?

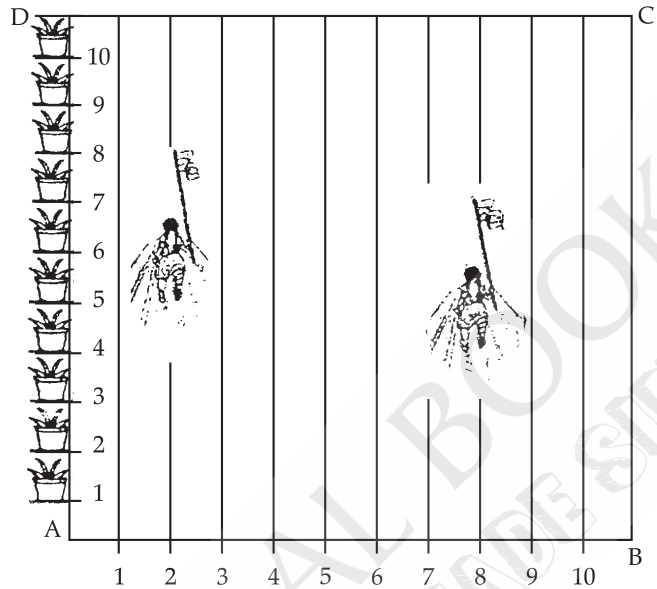


Fig. 5

34. Solve graphically : $2x + 3y = 2$, $x - 2y = 8$ **3**

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

35. A two digit number is such that the product of its digits is 14. If 45 is added to the number; the digits interchange their places. Find the number. **4**

36. If 4 times the 4^{th} term of an A.P. is equal to 18 times the 18^{th} term, then find the 22^{nd} term.

OR

How many terms of the AP : 24, 21, 18, ... must be taken so that their sum is 78 ? **4**

37. The angle of elevation of the top of a building from the foot of a tower is 30°. The angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 60 m high, find the height of the building. **4**

38. In Fig. 6, DEFG is a square in a triangle ABC right angled at A. **4**

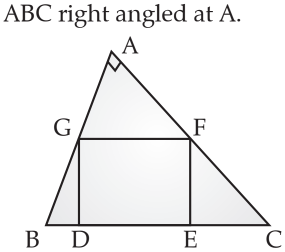


Fig. 6

Prove that

(i) $\Delta AGF \sim \Delta DBG$

(ii) $\Delta AGF \sim \Delta EFC$

OR

In an obtuse ΔABC ($\angle B$ is obtuse), AD is perpendicular to CB produced. Then prove that $AC^2 = AB^2 + BC^2 + 2BC \times BD$.

39. An open metal bucket is in the shape of a frustum of cone of height 21 cm with radii of its lower and upper ends are 10 cm and 20 cm respectively. Find the cost of milk which can completely fill the bucket at the rate of ₹40 per litre. **4**

OR

A solid is in the shape of a cone surmounted on a hemisphere. The radius of each of them being 3.5 cm and the total height of the solid is 9.5 cm. Find the volume of the solid.

40. Find the mean of the following data :

Classes	0 - 20	20 - 40	40 - 60	60 - 80	80 -100	100 - 120
Frequency	20	35	52	44	38	31

Delhi Set-II — Code No. 430/1/2

SECTION-A

Question numbers 1 to 10 are multiple choice questions of 1 mark each. Select the correct option.

8. The area of a triangle with vertices $A(5, 0)$, $B(8, 0)$ and $C(8, 4)$ in square units is **1**

(a) 20 **(b)** 12 **(c)** 6 **(d)** 16

9. The sum and product of the zeroes of a quadratic polynomial are 3 and – 10 respectively. The quadratic polynomial is **1**

(a) $x^2 - 3x + 10$ **(b)** $x^2 + 3x - 10$ **(c)** $x^2 - 3x - 10$ **(d)** $x^2 + 3x + 10$

10. From an external point Q, the length of tangent to a circle is 12 cm and the distance of Q from the centre of circle is 13 cm. The radius of circle (in cm) is **1**

(a) 10 **(b)** 5 **(c)** 12 **(d)** 7

Question numbers 21 to 26, Fill in the blanks.

15. The value of $\sin^2 65° + \sin^2 25°$ is **1**

Question numbers 21 to 26 carry 2 marks each.

20. ΔABC is isosceles with $AC = BC$. If $AB^2 = 2AC^2$, then find the measure of $\angle C$. **1**

SECTION-B

Question numbers 21 to 26, Carry two marks each.

24. Divide the polynomial $(9x^2 + 12x + 10)$ by $(3x + 2)$ and write the quotient and the remainder. **2**

26. A road which is 7 m wide surrounds a circular park whose circumference is 88 m. Find the area of the road. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

32. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact. **3**

33. A right triangle ABC, right angled at A, is circumscribing a circle. If AB = 6 cm and BC = 10 cm, find the radius of the circle. **3**

34. Find the zeroes of the quadratic polynomial $x^2 + 7x + 10$, and verify the relationship between the zeroes and the coefficients. **3**

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

40. The difference of two natural numbers is 5 and the difference of their reciprocals is $\frac{1}{10}$. Find the numbers. **4**

Delhi Set-III — Code No. 430/1/3

SECTION-A

Question numbers 1 to 10 are multiple choice questions of 1 mark each. Select the correct option.

8. QP is a tangent to a circle with centre O at a point P on the circle. If ΔOPQ is isosceles, then $\angle OQP$ equals. **1**

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

9. If α and β are the zeroes of the polynomial $x^2 + 2x + 1$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to : **1**

(a) – 2 **(b)** 2 **(c)** 0 **(d)** 1

10. The coordinates of a point A on y-axis, at a distance of 4 units from x-axis and below it, are **1**

(a) (4, 0) **(b)** (0, 4) **(c)** (– 4, 0) **(d)** (0, – 4)

Question numbers 11 to 15, Fill in the blanks.

15. If $\cot \theta = \frac{12}{5}$, then the value of $\sin \theta$ is **1**

Question numbers 21 to 26 carry 2 marks each.

20. The areas of two similar triangles ABC and PQR are 25 cm² and 49 cm² respectively. If $QR = 9.8$ cm, find BC. **1**

SECTION-B

Question numbers 11 to 15, Fill in the blanks.

24. The radii of two circles are 19 cm and 9 cm respectively. Find the radius of a circle which has circumference equal to sum of their circumferences. **2**

25. Divide the polynomial $16x^2 + 24x + 15$ by $(4x + 3)$ and write the quotient and the remainder. **2**

26. If tangents PA and PB drawn from an external point P to a circle with centre O are inclined to each other at an angle of 80°, then find $\angle POA$. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

32. Find the zeroes of the quadratic polynomial $6x^2 - 3 - 7x$ and verify the relationship between the zeroes and the coefficients. **3**

33. Three horses are tied each with 7 m long rope at three corners of a triangular field having sides 20 m, 34 m and 42 m. Find the area of the plot which can be grazed by the horses. **3**

34. Prove that the tangents drawn at the end points of a diameter of a circle are parallel. **3**

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

40. A person on tour has ₹ 4200 for his expenses. If he extends his tour for 3 days, he has to cut down his daily expenses by ₹ 70. Find the original duration of the tour. **4**

■■■

Outside Delhi Set-I — Code No. 430/2/1

SECTION-A

Question numbers 1 to 10 are multiple choice questions of 1 mark each. Select the correct option.

1. HCF of two numbers is 27 and their LCM is 162. If one of the numbers is 54, then the other number is **1**

(a) 36 **(b)** 35 **(c)** 9 **(d)** 81

2. The cumulative frequency table is useful in determining **1**

(a) Mean **(b)** Median **(c)** Mode **(d)** All of these

3. In Fig. 1, O is the centre of circle. PQ is a chord and PT is tangent at P which makes an angle of 50° with PQ. $\angle POQ$ is **1**

(a) 130° **(b)** 90° **(c)** 100° **(d)** 75°

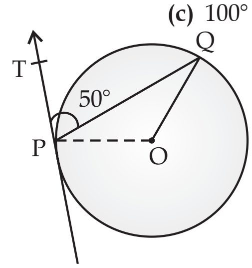


Figure-1

4. $2\sqrt{3}$ is **1**

(a) an integer **(b)** a rational number **(c)** an irrational number **(d)** a whole number

5. Two coins are tossed simultaneously. The probability of getting at most one head is **1**

(a) $\frac{1}{4}$ **(b)** $\frac{1}{2}$ **(c)** $\frac{2}{3}$ **(d)** $\frac{3}{4}$

6. If one zero of the polynomal $(3x^2 + 8x + k)$ is the reciprocal of the other, then value of k is **1**

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

7. The decimal expansion of $\frac{23}{2^5 \times 5^2}$ will terminate after how many places of decimal ? **1**

(a) 2 **(b)** 4 **(c)** 5 **(d)** 1

8. The maximum number of zeroes a cubic polynomial can have, is **1**

(a) 1 **(b)** 4 **(c)** 2 **(d)** 3

9. The distance of the point (–12, 5) from the origin is **1**

(a) 12 **(b)** 5 **(c)** 13 **(d)** 169

10. If the centre of a circle is (3, 5) and end points of a diameter are (4, 7) and (2, y), then the value of y is **1**

(a) 3 **(b)** –3 **(c)** 7 **(d)** 4

Question numbers 11 to 15, Fill in the blanks.

11. The area of triangle formed with the origin and the points (4, 0) and (0, 6) is **1**

OR

The co-ordinate of the point dividing the line segment joining the points A(1, 3) and B(4, 6) in the ratio 2 : 1 is ....

12. Value of the roots of the quadratic equation, $x^2 - x - 6 = 0$ are **1**

13. If $\sin\theta = \frac{5}{13}$, then the value of $\tan\theta$ is **1**

14. The value of the $(\tan^2 60° + \sin^2 45°)$ is **1**

15. The corresponding sides of two similar triangles are in the ratio 3 : 4, then the ratios of the areas of triangles is **1**

Question numbers 16 to 20, answer the following.

16. Find the value of (cos 48° – sin 42°). **1**

OR

Evaluate : (tan 23°) × (tan 67°)

17. In figure–2, $\overset{\frown}{PQ}$ and $\overset{\frown}{AB}$ are two arcs of concentric circles of radii 7 cm and 3·5 cm respectively, with centre O. If $\angle$ POQ = 30°, then find the areas of shaded region. **1**

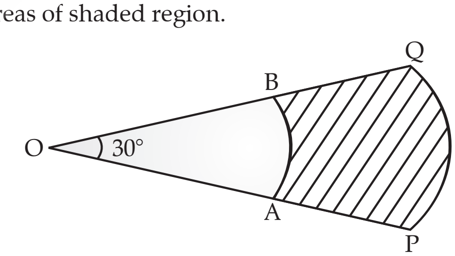


Figure-2

18. A card is drawn at random from a well shuffled deck of 52 playing cards. What is the probability of getting a black king ? **1**

19. A ladder 25 m long just reaches the top of a building 24 m high from the ground. What is the distance of the foot of ladder from the base of the building ? **1**

20. If $3k - 2$, $4k - 6$ and $k + 2$ are three consecutive terms of A.P., then find the value of k. **1**

SECTION-B

Question numbers 21 to 26 carry 2 marks each.

21. In a lottery, there are 10 prizes and 25 blanks. What is the probability of getting a prize ? **2**

22. In a family of three children, find the probability of having at least two boys. **2**

OR

Two dice are tossed simultaneously. Find the probability of getting

(i) an even number on both dice.

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

23. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of larger circle which touches the smaller circle. **2**

24. Prove that : $\dfrac{1}{1+\sin\theta}+\dfrac{1}{1-\sin\theta} = 2\sec^2\theta$ **2**

OR

Prove that : $\dfrac{1-\tan^2\theta}{1+\tan^2\theta} = \cos^2\theta - \sin^2\theta$

25. The wheel of a motorcycle is of radius 35 cm. How many revolutions are required to travel a distance of 11 m ? **2**

26. Divide $(2x^2 - x + 3)$ by $(2 - x)$ and write the quotient and the remainder. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

27. If α and β are the zeroes of the polynomial $f(x) = 5x^2 - 7x + 1$ then find the value of $\left(\dfrac{\alpha}{\beta}+\dfrac{\beta}{\alpha}\right)$. **3**

28. Draw a line segment of length 7 cm and divide it in the ratio 2 : 3. **3**

OR

Draw a circle of radius 4 cm and construct the pair of tangents to the circle from an external point, which is at a distance of 7 cm from its centre.

29. The minute hand of a clock is 21 cm long. Calculate the area swept by it and the distance travelled by tip in 20 minutes. **3**

30. If $x = 3\sin\theta + 4\cos\theta$ and $y = 3\cos\theta - 4\sin\theta$ then prove that $x^2 + y^2 = 25$. **3**

OR

If $\sin\theta + \sin^2\theta = 1$; then prove that $\cos^2\theta + \cos^4\theta = 1$.

31. Prove that $\sqrt{3}$ is an irrational number. **3**

OR

Using Euclid's algorithm, find the HCF of 272 and 1032.

32. In a rectangle ABCD, P is any interior point. Then prove that $PA^2 + PC^2 = PB^2 + PD^2$. **3**

33. In a classroom, 4 friends are seated at the points A, B, C, and D as shown in Fig. -3, Champa and Chameli walk into the class and after observing for a few minutes Champa asks Chameli, 'Don't you think ABCD is a square ?' Chameli disagrees. Using distance formula, find which of them is correct. **3**

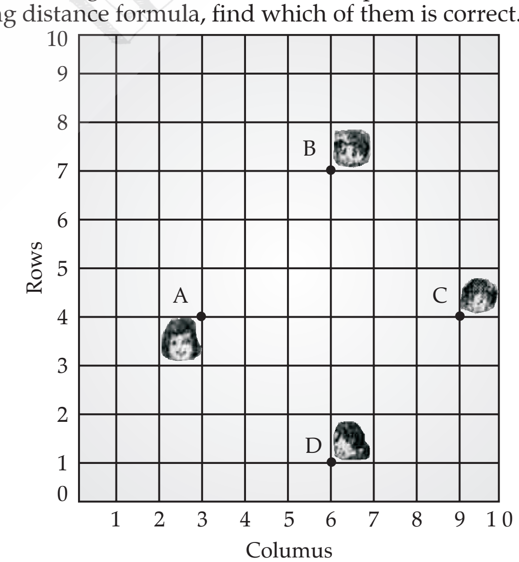


Figure-3

34. Solve graphically : **3**
$2x - 3y + 13 = 0; 3x - 2y + 12 = 0$

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

35. The product of two consecutive positive integers is 306. Find the integers. **4**

36. The 17^{th} term of an A.P. is 5 more than twice its 8^{th} term. If 11^{th} term of A.P. is 43; then find its n^{th} term. **4**

OR

How many terms of A.P. 3, 5, 7, 9, ... must be taken to get the sum 120 ?

37. A person standing on the bank of a river observes that the angle of elevation of the top of a tree standing on 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 tree and width of the river. [Take $\sqrt{3}$ = 1·732] **4**

38. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides. **4**

OR

Prove that the length of tangents drawn from an external point to a circle are equal.

39. From a solid cylinder whose height is 15 cm and the diameter is 16 cm, a conical cavity of the same height and same diameter is hollowed out, Find the total surface area of remaining solid. (Give your answer in terms of π). **4**

OR

The height of a cone is 10 cm. The cone is divided into two parts using a plane parallel to its base at the middle of its height. Find the ratio of the volumes of the two parts.

40. The mode of the following frequency distribution is 36. Find the missing frequency (f). **4**

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 -50	50 - 60	60-70
Frequency	8	10	f	16	12	6	7

Outside Delhi Set-II — Code No. 430/2/2

SECTION-A

Question numbers 1 to 10 are multiple choice questions. Select the correct option.

8. If α and β are the zeroes of the polynomial $2x^2 - 13x + 6$, then α + β is equal to **1**

(a) – 3 **(b)** 3 **(c)** $\frac{13}{2}$ **(d)** $-\frac{13}{2}$

9. The mid-point of the line-segment AB is $P(0, 4)$. If the coordinates of B are (– 2, 3) then the co-ordinates of A are **1**

(a) (2, 5) **(b)** (– 2, – 5) **(c)** (2, 9) **(d)** (– 2, 11)

10. In Fig. 1, AP, AQ and BC are tangents of the circle with centre O. If AB = 5 cm, AC = 6 cm and BC = 4 cm, then the length of AP (in cm) is **1**

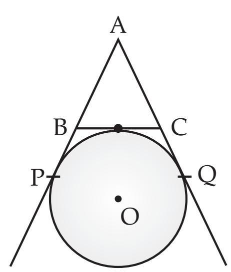


Figure-1

(a) 15 **(b)** 10 **(c)** 9 **(d)** 7.5

Question numbers 11 to 15 Fill in the blanks.

15. The value of (sin 43° · cos 47° + sin 47° cos 43°) is **1**

Answer the following question number 16 to 20.

19. In a ΔPQR, S and T are points on the sides PQ and PR respectively, such that $ST \parallel QR$. If PT = 2 cm and TR = 4 cm, find the ratio of the areas of ΔPST and ΔPQR. **1**

20. Two different coins are tossed simultaneously, What is the probability of getting at least one head ? **1**

SECTION-B

Question numbers 21 to 26 carry 2 marks each.

25. A circle is inscribed in a ΔABC touching AB, BC and AC at P, Q and R respectively. If $AB = 10$ cm, $AR = 7$ cm and $CR = 5$ cm, then find the length of BC. **2**

26. The length of the minute hand of clock is 14 cm. Find the area swept by the minute hand in 15 minutes. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

33. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. If the total height of the toy is 15.5 cm, find the total surface area of the toy. **3**

34. In the Fig. 4, two circles touch each other at a point C. Prove that the common tangent to the circles at C, bisects the common tangent at P and Q. **3**

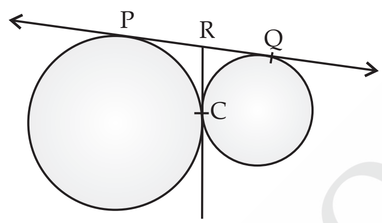


Figure -4

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

39. Find the median for the given frequency distribution : **4**

Class	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75
Frequency	2	3	8	6	6	3	2

40. If the price of a book is reduced by ₹ 5, a person can buy 4 more books for ₹ 600. Find the original price of the book. **4**

Outside Delhi Set-III — Code No. 430/2/3

SECTION-A

Question numbers 1 to 10 are multiple choice questions. Select the correct option.

8. x-axis divides the line segment joining $A(2, -3)$ and $B(5, 6)$ in the ratio : **1**

(a) 2 : 3 **(b)** 3 : 5 **(c)** 1 : 2 **(d)** 2 : 1

9. If the sum of the zeroes of the quadratic polynomial $kx^2 + 2x + 3k$ is equal to their product, then k equals **1**

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

10. A chord of a circle of radius 10 cm, subtends a right angle at its centre. The length of the chord (in cm) is **1**

(a) $\frac{5}{\sqrt{2}}$ **(b)** $5\sqrt{2}$ **(c)** $10\sqrt{2}$ **(d)** $10\sqrt{3}$

Question numbers 11 to 15, Fill in the blanks.

15. The value of $\frac{\sin\theta}{\cos(90-\theta)} + \frac{\cos 43°}{\sin 47°}$ is **1**

Answer the following question numbers 16 to 20.

19. A card is drawn at random from a well-shuffled pack of 52 cards. Find the probability of getting a red king. **1**

20. Two similar triangles ABC and PQR have their areas 25 cm^2 and 49 cm^2 respectively. If $QR = 9.8$ cm, find BC. **1**

SECTION-B

Question numbers 21 to 26 carry 2 marks each.

25. An isosceles triangle *ABC*, with *AB* = *AC*, circumscribes a circle, touching *BC* at *P*, *AC* at *Q* and *AB* at *R*. Prove that the contact point *P* bisects *BC*. **2**

26. The radius of a circle is 17.5 cm. Find the area of the sector of the circle enclosed by two radii and an arc 44 cm in length. **2**

SECTION-C

Question numbers 27 to 34 carry 3 marks each.

33. A horse is tethered to one corner of a rectangular field of dimensions 70 m × 52 m, by a rope of length 21 m. How much area of the field can it graze ? **3**

34. Find the quadratic polynomial, the sum and product of whose zeroes are – 3 and 2 respectively. Hence find the zeroes. **3**

SECTION-D

Question numbers 35 to 40 carry 4 marks each.

39. Three consecutive positive integers are such that the sum of the square of the first and product of the other two is 46. Find the integers. **4**

40. Find the mean of the following distribution : **4**

Class	10 - 25	25 - 40	40 - 55	55 - 70	70 - 85	85 - 100
Frequency	2	3	7	6	6	6

■■■

Solutions

Delhi Set-I — Code No. 430/1/1

SECTION - A

1. Correct Option : (b)

Explanation :

Using prime factorization method,

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

and

$$198 = 2 \times 3 \times 3 \times 11 = 2 \times 3^2 \times 11$$

$$\therefore \quad HCF = 2 \times 3^2 = 2 \times 9 = 18$$

2. Correct Option : (b)

Explanation :

Since, Mode = 3 Median – 2 Mean

Therefore, 29 = 3 (26) – 2 Mean

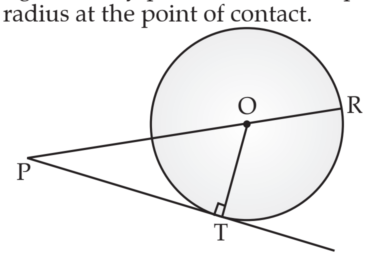
or, 2 Mean = 78 – 29

or, $\text{Mean} = \dfrac{49}{2} = 24.5$

3. Correct Option : (c)

Explanation :

The tangent at any point of a circle is perpendicular to the radius at the point of contact.



$\therefore \quad OT \perp PT$

In right-angled triangle *PTO*,

$OP^2 = OT^2 + PT^2$ (By Pythagoras Theorem)

$\Rightarrow \quad OP^2 = (7)^2 + (24)^2$ (Given, radius, OT = 7 cm & PT = 24 cm)

$\Rightarrow \quad OP^2 = 49 + 576$

$\Rightarrow \quad OP^2 = 625$

$\Rightarrow \quad OP = 25$ cm

Hence, $PR = OP + OR = 25 + 7 = 32$ cm ($\because OR = OT =$ radii of circle)

4. Correct Option : (c)

Explanation :

By Prime factorization of 225, we get

$$225 = 3 \times 3 \times 5 \times 5 = 3^2 \times 5^2 \text{ or } 5^2 \times 3^2$$

5. Correct Option : (d)

Explanation :

Number of multiples of 4 between 1 to 15 are : 4, 8, 12

i.e., $n(E) = 3$

∴ Probability (a number selected from numbers 1, 2, ... 15 is a multiple of 4) $= \dfrac{3}{15} = \dfrac{1}{5}$

6. Correct Option : (d)

Explanation :

Since, 2 is a zero of the quadratic polynomial

$$p(x) = kx^2 + 3x + k.$$

Therefore, $p(2) = 0$

or, $k(2)^2 + 3(2) + k = 0$

or, $4k + 6 + k = 0$

or, $5k = -6$

or, $k = -\frac{6}{5}$

7. Correct Option : (b)

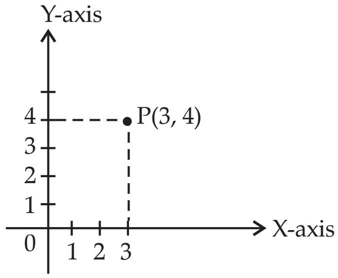
Explanation : $2.\overline{35}$ is a rational number because it is a non terminating repeating decimal.

8. Correct Option : (a)

Explanation : Since, the graph cuts the x-axis at 3 points. Hence, the number of zeroes of polynomial $p(x)$ is 3.

9. Correct Option : (b)

Explanation :



Point $P(3, 4)$ is 4 units from the x-axis and 3 units from the y-axis.

10. Correct Option : (c)

Explanation :

Given, points are $A(4, p)$ and $B(1, 0)$.

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

$\therefore$ $5 = \sqrt{(1-4)^2 + (0-p)^2}$

$\Rightarrow$ $25 = 9 + p^2$

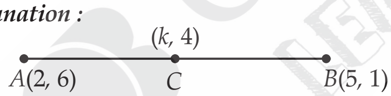
$\Rightarrow$ $p^2 = 25 - 9$

$\Rightarrow$ $p^2 = 16$

$\Rightarrow$ $p^2 = \pm 4$

11. $\boldsymbol{k = \frac{16}{5}}$

Explanation :



By section formula,

$m:n = 2:3$

$\frac{mx_2 + nx_1}{m+n} = k, \frac{my_2 + ny_1}{m+n} = 4,$

Now, $\frac{2 \times 5 + 3 \times 2}{2+3} = k$

or, $k = \frac{16}{5}$

OR

$\boldsymbol{x = 2}$

Explanation : The points are collinear, then area of triangle = 0

$\therefore \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] = 0$

or, $\frac{1}{2}[-3(6-9) + 7(9-12) + x(12-6)] = 0$

or, $\frac{1}{2}(9 - 21 + 6x) = 0$

or, $\frac{1}{2}(-12 + 6x) = 0$

or, $6x = 12$

or, $x = 2$

12. $\boldsymbol{k \neq -6}$

Explanation :

For unique solution

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

Here, $a_1 = k, b_1 = -2$ and $a_2 = 3, b_2 = 1$

$\therefore$ $\frac{k}{3} \neq -\frac{2}{1}$

or, $k \neq -6$

OR

$\boldsymbol{k = \frac{4}{3}}$

Explanation :

Given, quadratic equation is $3x^2 - 4x + k = 0$

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

$a = 3, b = -4$ and $c = k$

For equal roots, $b^2 - 4ac = 0$

or, $(-4)^2 - 4(3)(k) = 0$

or, $16 - 12k = 0$

or, $k = \frac{16}{12}$

or, $k = \frac{4}{3}$

13. 1

Explanation :

$\sin 20° \cos 70° + \sin 70° \cos 20°$ $[\because \sin(90 + \theta) = \cos\theta$
$\cos(90 - \theta) = \sin\theta]$

$\Rightarrow \sin 20° \cos(90° - 20°) + \sin(90° - 20°) \cos 20°$

$\Rightarrow \sin 20° \cdot \sin 20° + \cos 20° \cdot \cos 20°$

$\Rightarrow \sin^2 20° + \cos^2 20° = 1$ $(\sin^2\theta + \cos^2\theta = 1)$

14. A = 45°

Explanation :

$\because$ $\tan(A + B) = \sqrt{3} = \tan 60°$

Hence, $A + B = 60°$ ...(i)

Again, $\tan(A - B) = \frac{1}{\sqrt{3}} = \tan 30°$

or, $A - B = 30°$ ...(ii)

Adding eqns. (i) & (ii), we get

$2A = 90°$

or, $A = 45°$

15. 5.4 cm

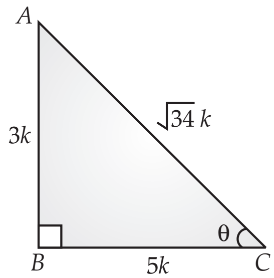
Explanation :

Ratio of the perimeter of 2 similar triangles
= ratio of corresponding sides

$\therefore$ $\frac{25}{15} = \frac{9}{\text{side}}$

$\Rightarrow$ $\text{side} = \frac{9 \times 15}{25} = 5.4 \text{ cm}$

16.



Given, $5 \tan \theta = 3$

$\therefore \quad \tan \theta = \frac{3}{5}$

$$AC^2 = AB^2 + BC^2$$
$$= (3k)^2 + 25k^2$$

$\therefore \quad AC = \sqrt{34}k$

So, $\cos \theta = \frac{5}{\sqrt{34}}$

and $\sin \theta = \frac{3}{\sqrt{34}}$

$$\therefore \quad \frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta} = \frac{5\left(\frac{3}{\sqrt{34}}\right) - 3\left(\frac{5}{\sqrt{34}}\right)}{4\left(\frac{3}{\sqrt{34}}\right) + 3\left(\frac{5}{\sqrt{34}}\right)}$$

$$= \frac{\frac{15-15}{\sqrt{34}}}{\frac{12+15}{\sqrt{34}}} = \frac{\frac{0}{\sqrt{34}}}{\frac{27}{\sqrt{34}}} = 0$$

Alternative Solution :

Given : $5 \tan \theta = 3$

$\therefore \quad \tan \theta = \frac{3}{5}$

$$\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}$$

Divide numerator and denominator by $\cos \theta$

$$\Rightarrow \quad \frac{\frac{5\sin\theta}{\cos\theta} - \frac{3\cos\theta}{\cos\theta}}{\frac{4\sin\theta}{\cos\theta} + \frac{3\cos\theta}{\cos\theta}}$$

$$\Rightarrow \quad \frac{5\tan\theta - 3}{4\tan\theta + 3}$$

$$\Rightarrow \quad \frac{5 \times \frac{3}{5} - 3}{4 \times \frac{3}{5} + 3} = \frac{3-3}{\frac{12}{5}+3} = \frac{0}{\frac{27}{5}} = 0$$

17. Given,

$$\frac{\text{Area of } 1^{\text{st}} \text{ cricle}}{\text{Area of } 2^{\text{nd}} \text{ circle}} = \frac{9}{4}$$

i.e., $\frac{\pi r_1^2}{\pi r_2^2} = \frac{9}{4}$

or, $\frac{r_1^2}{r_2^2} = \frac{9}{4}$

Taking square root both sides,

$$\frac{r_1}{r_2} = \frac{3}{2}$$

So, $\frac{\text{circumference of } 1^{\text{st}} \text{ circle}}{\text{circumference of } 2^{\text{nd}} \text{ circle}}$

$$= \frac{2\pi r_1}{2\pi r_2}$$
$$= \frac{r_1}{r_2}$$
$$= \frac{3}{2}$$

Hence, the ratio of their circumference is 3 : 2.

18. Number of possible outcomes, $n(S) = 36$

The favourable outcomes are (sum of getting 8)

$$= \{(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)\}$$

i.e., $n(E) = 5$

$\therefore$ Probability (getting sum of 8)

$$= \frac{n(E)}{n(S)} = \frac{5}{36}$$

19. Since, $DE \parallel BC$

$\therefore \quad \frac{AD}{DB} = \frac{AE}{EC}$ (By BPT)

or, $\frac{2.4}{AB - AD} = \frac{AE}{AC - AE}$

or, $\frac{2.4}{3.2 - 2.4} = \frac{AE}{8 - AE}$

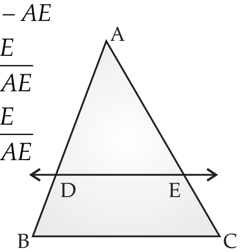
or, $\frac{2.4}{0.8} = \frac{AE}{8 - AE}$

or, $3(8 - AE) = AE$

or, $24 - 3AE = AE$

or, $4AE = 24$

or, $AE = 6$ cm



20. Given, n^{th} term of *A.P.*,

$$a_n = 7 - 4n$$

put $n = 1$, then $a_1 = 7 - 4 = 3$

put $n = 2$, then $a_2 = 7 - 8 = -1$

$\therefore$ Common difference $= a_2 - a_1$

$$= -1 - 3$$
$$= -4$$

SECTION - B

21. Let number of blue balls in the bag $= x$

Total no. of balls in bag $= 5 + x$

[$\because$ No. of red balls = 5]

Probability of drawing a blue ball

$$= \frac{\text{No. of blue balls}}{\text{Total no. of balls}}$$

i.e., $P(B) = \frac{x}{5+x}$

Probability of drawing a red ball

$$= \frac{\text{No. of red balls}}{\text{Total no. of balls}}$$

i.e., $P(R) = \frac{5}{5+x}$

Given, $P(B) = 3P(R)$

$\therefore \quad \dfrac{x}{5+x} = 3\left(\dfrac{5}{5+x}\right)$

or, $x = 15$

Hence, number of blue balls in the bag = 15.

22.

$$\text{LHS} = \sqrt{\frac{1-\sin\theta}{1+\sin\theta}}$$
$$= \sqrt{\frac{(1-\sin\theta)(1-\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}}$$
$$= \sqrt{\frac{(1-\sin\theta)^2}{1-\sin^2\theta}}$$
$$= \sqrt{\frac{(1-\sin\theta)^2}{\cos^2\theta}}$$
$$= \frac{1-\sin\theta}{\cos\theta}$$
$$= \frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}$$
$= \sec\theta - \tan\theta$

= RHS **Hence Proved.**

OR

$$\text{LHS} = \frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^2\theta}{1+\cot^2\theta}$$
$$= \frac{\tan^2\theta}{\sec^2\theta} + \frac{\cot^2\theta}{\text{cosec}^2\theta}$$
$$= \frac{\frac{\sin^2\theta}{\cos^2\theta}}{\frac{1}{\cos^2\theta}} + \frac{\frac{\cos^2\theta}{\sin^2\theta}}{\frac{1}{\sin^2\theta}}$$
$= \sin^2\theta + \cos^2\theta$

= 1

= RHS **Hence Proved.**

23. Total no. of possible outcome, $n(S) = 6^2 = 36$

The sum less than 5 = {(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (3, 1)}

No. of favourable outcomes, $n(E) = 6$

$\therefore$ Probability (have sum less than 5) = $\dfrac{n(E)}{n(S)} = \dfrac{6}{36} = \dfrac{1}{6}$

OR

Total no. of days in November = 30

So, it has 4 weeks and 2 days. 4 weeks have 4 Sundays.

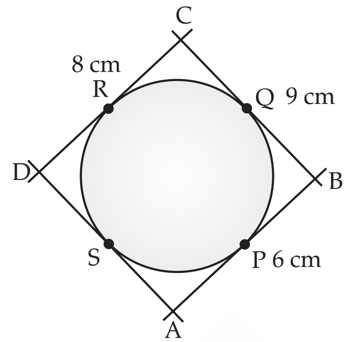
The two remaining days should be

1. Sunday, Monday
2. Monday, Tuesday
3. Tuesday, Wednesday
4. Wednesday, Thursday
5. Thursday, Friday
6. Friday, Saturday
7. Saturday, Sunday

If in the above list Sunday come two times and total no. of days in a week is 7.

So, the probability of getting 5 Sundays in the month of November = $\dfrac{2}{7}$

24.



Here, $AP = AS$

[Tangents drawn from an external point to a circle are equal in length]

Let $AP = AS = x$

Similarly, $BP = BQ$, $CQ = CR$ and $RD = DS$

Since, $AP = x$

$\Rightarrow \quad BP = AB - AP = 6 - x$ [$\because AB = 6$ cm]

Now, $BP = BQ = 6 - x$

$\Rightarrow \quad CQ = BC - BQ = 9 - (6 - x)$ [$\because BC = 9$ cm]

$= 3 + x$

Now, $CQ = CR = 3 + x$

$\Rightarrow \quad RD = CD - CR = 8 - (3 + x)$ [$\because CD = 8$ cm]

$= 5 - x$

Now, $RD = DS = 5 - x$

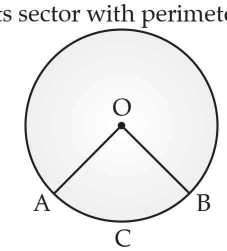
$\Rightarrow \quad AD = AS + SD$

$= x + 5 - x = 5$

$\therefore \quad AD = 5$ cm.

25. Given, Radius = 6.5 cm

Let O be the centre of a circle with radius 6.5 cm and $OACBO$ be its sector with perimeter 31 cm.



Thus, we have

$OA + OB + arc\ ACB = 31$ cm

$\Rightarrow \quad 6.5 + 6.5 + arc\ ACB = 31$ cm

$\Rightarrow \quad arc\ ACB = 18$ cm

Now, Area of sector $OACBO$

$= \dfrac{1}{2} \times \text{radius} \times arc\ ACB$

$= \dfrac{1}{2} \times 6.5 \times 18 = 58.5 \text{ cm}^2$

26.

```
            2x + 1
2x + 1 ) 4x² + 4x + 5
         4x² + 2x
         –    –
         ---------
              2x + 5
              2x + 1
              –   –
              ------
                   4
```

Hence, quotient = $2x + 1$ and remainder = 4

SECTION - C

27. Given, polynomial $f(x) = x^2 - 4x - 5$

On comparing it by $ax^2 + bx + c$, we get

$$a = 1, b = -4 \text{ and } c = -5$$

Since, given α and β are the zeroes of the polynomial.

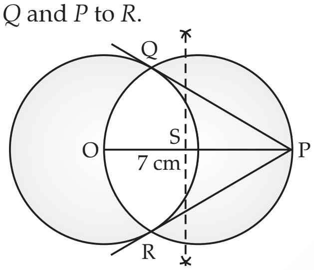
$\therefore$ Sum of zeroes, $\alpha + \beta = -\frac{b}{a} = \frac{-(-4)}{1} = 4$

and product of zeroes, $\alpha\beta = \frac{c}{a} = \frac{-5}{1} = -5$

Now,
$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$
$$= (4)^2 - 2(-5)$$
$$= 16 + 10$$
$$= 26$$

28. Steps of construction :

1. Draw a line segment $OP = 7$ cm
2. Taking O as centre and radius 4 cm, draw a cirlce.
3. Taking OP as diameter draw another circle which intersects the first circle at Q and R.
4. Join P to Q and P to R.



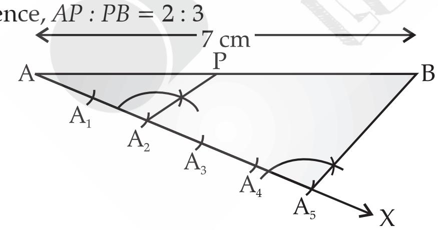
PQ and *PR* are required tangents.

OR

Steps of construction :

1. Draw a line segment $AB = 7$ cm
2. Draw any ray AX making an acute angle downward with AB.
3. Mark the points $A_1, A_2, A_3, \ldots\ldots A_5$ on AX such that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5$
4. Join BA_5.
5. Through the point A_2, draw a line parallel to BA_5, to meet AB on P.

Hence, $AP : PB = 2 : 3$



29. Volume of cuboid $= 24 \times 11 \times 7$ cm^3

$$\text{Volume of 1 cone} = \frac{1}{3}\pi r^2 h$$
$$= \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 6 \text{ cm}^3$$

Let no. of cones formed be n.

Now, according to question,

Volume of n cones = Volume of cuboid

$$n \times \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 6 = 24 \times 11 \times 7$$

$$\therefore \quad n = \frac{24 \times 11 \times 7 \times 3 \times 7}{22 \times 3.5 \times 3.5 \times 6}$$

or, $n = 24$

30. LHS $= (1 + \tan A - \sec A) \times (1 + \tan A + \sec A)$
$$= (1 + \tan A)^2 - \sec^2 A$$
$$= 1 + \tan^2 A + 2\tan A - \sec^2 A$$
$$= \sec^2 A + 2\tan A - \sec^2 A$$
$$= 2\tan A = \text{RHS}$$
Hence Proved.

OR

$$\text{LHS} = \frac{\text{cosec}\,\theta}{\text{cosec}\,\theta - 1} + \frac{\text{cosec}\,\theta}{\text{cosec}\,\theta + 1}$$
$$= \text{cosec}\,\theta\left[\frac{1}{\text{cosec}\,\theta - 1} + \frac{1}{\text{cosec}\,\theta + 1}\right]$$
$$= \text{cosec}\,\theta\left[\frac{\text{cosec}\,\theta + 1 + \text{cosec}\,\theta - 1}{(\text{cosec}\,\theta - 1)(\text{cosec}\,\theta + 1)}\right]$$
$$= \text{cosec}\,\theta\left(\frac{2\text{cosec}\,\theta}{\text{cosec}^2\theta - 1}\right)$$
$$= \frac{2\text{cosec}^2\theta}{\text{cosec}^2\theta - 1}$$
$$= \frac{2\text{cosec}^2\theta}{\cot^2\theta} \qquad [1 + \cot^2\theta = \text{cosec}^2\theta]$$
$$= \frac{2 \times \frac{1}{\sin^2\theta}}{\frac{\cos^2\theta}{\sin^2\theta}} = \frac{2}{\cos^2\theta}$$
$$= 2\sec^2\theta = \text{RHS}$$
Hence Proved.

31. Let us assume $(5 + 2\sqrt{3})$ is a rational number.

$$\therefore \quad 5 + 2\sqrt{3} = \frac{p}{q}$$

(where, $q \neq 0$ and p and q are coprime integers)

$$\Rightarrow \quad \sqrt{3} = \frac{p - 5q}{2q}$$

This contradicts the given fact that $\sqrt{3}$ is irrational.

Hence, $(5 + 2\sqrt{3})$ is an irrational number.

OR

Let the number of columns be x.

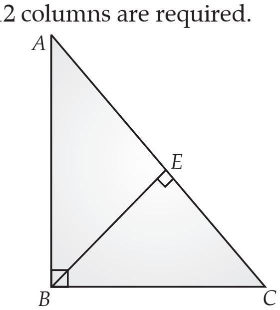
Then, x is the largest number, which should divide both 612 and 48.

$$612 = 48 \times 12 + 36$$
$$48 = 36 \times 1 + 12$$
$$36 = 12 \times 3 + 0$$

Since, HCF of 612 and 48 is $x = 12$.

Thus, 12 columns are required.

32.



Given : $AB \perp BC$

Construction : Draw $BE \perp AC$

To Prove : $AB^2 + BC^2 = AC^2$

Proof : In ΔAEB and ΔABC

$$\angle A = \angle A \quad \text{(Common)}$$
$$\angle E = \angle B \quad \text{(each 90°)}$$
$$\Delta AEB \sim \Delta ABC \quad \text{(By } AA \text{ similarity)}$$

or, $$\frac{AE}{AB} = \frac{AB}{AC}$$

or, $$AB^2 = AE \times AC \quad \text{....(i)}$$

Now, in ΔCEB and ΔCBA,

$$\angle C = \angle C \quad \text{(Common)}$$
$$\angle E = \angle B \quad \text{(each 90°)}$$
$$\Delta CEB \sim \Delta CBA \quad \text{(By } AA \text{ similarity)}$$

or, $$\frac{CE}{BC} = \frac{BC}{AC}$$

or, $$BC^2 = CE \times AC \quad \text{...(ii)}$$

On adding eqns. (i) and (ii),

$$AB^2 + BC^2 = AE \times AC + CE \times AC$$

or, $$AB^2 + BC^2 = AC\,(AE + CE)$$

or, $$AB^2 + BC^2 = AC \times AC$$

$\therefore$ $$AB^2 + BC^2 = AC^2$$ **Hence proved.**

33. (i) Considering A as origin (0, 0), AB as X-axis and AD as Y-axis.

Niharika runs in the 2nd line with green flag and distance covered (parallel to AD)

$$= \frac{1}{4} \times 100 = 25 \text{ m}$$

$\therefore$ Co-ordinates of green flag are (2, 25) and label it as P *i.e.*, P(2, 25).

Similarly, Preet runs in the eighth line with red flag and distance covered (parallel to AD)

$$= \frac{1}{5} \times 100 = 20 \text{ m}$$

$\therefore$ Co-ordinates of red flag are (8, 20) and label it as Q *i.e.*, Q (8, 20)

Now, using distance formula, distance between green flag and flag

$$PQ = \sqrt{(8-2)^2 + (20-25)^2}$$
$$= \sqrt{6^2 + (-5)^2} = \sqrt{36+25}$$
$$= \sqrt{61} \text{ m}$$

(ii) Also, Rashmi has to post a blue flag at the mid-point of PQ, therefore by using mid-point formula, we have $\left(\frac{2+8}{2}, \frac{25+20}{2}\right)$ *i.e.*, $\left(5, \frac{45}{2}\right)$

Hence, the blue flag is in the fifth line, at a distance of $\frac{45}{2}$ *i.e.*, 22.5 m along the direction parallel to AD.

34. Given,

$$2x + 3y = 2$$

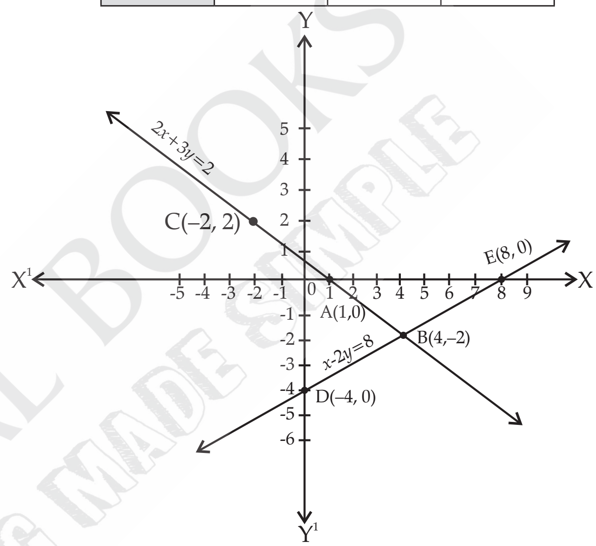
$\Rightarrow$ $$y = \frac{2-2x}{3}$$

x	1	4	– 2
y	0	– 2	2

and $$x - 2y = 8$$

$\Rightarrow$ $$y = \frac{x-8}{2}$$

x	0	8	4
y	– 4	0	– 2



Plotting the above points and drawing the lines joining them, we get the graph of above equations.

Two obtained lines intersect at point $P(4, -2)$.

Hence, Solution of the given equation is $x = 4, y = -2$

SECTION - D

35. Let the tens digit be x and ones digit be y.

Given, $$xy = 14 \quad \text{...(i)}$$

The number is $10x + y$.

Given, that when 45 is added to the number the digits get interchanged red.

Hence, $$10x + y + 45 = 10y + x$$

or, $$9x - 9y + 45 = 0$$

or, $$x - y + 5 = 0 \quad \text{...(ii)}$$

From eqn. (i) and (ii), we get

$$x - \frac{14}{x} + 5 = 0$$

or, $$x^2 - 14 + 5x = 0$$

or, $$x^2 + 5x - 14 = 0$$

or, $$x^2 + 7x - 2x - 14 = 0$$

or, $$x(x+7) - 2(x+7) = 0$$

or, $$(x+7)(x-2) = 0$$

or, $$x + 7 = 0 \text{ and } x - 2 = 0$$

or, $$x = -7 \text{ and } x = 2$$

Since, the digits cannot be negative, $x = 2$

Thus, $$y = \frac{14}{x} = \frac{14}{2} = 7$$

Therefore, number is $(10x + y) = 27$.

36. Let a be the first term and d be the common difference of the A.P.

Then, $4 \times a_4 = 18 \times a_{18}$ (Given)

$\Rightarrow 4(a + 3d) = 18(a + 17d)$

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

$\Rightarrow 2(a + 3d) = 9(a + 17d)$

$\Rightarrow 2a + 6d = 9a + 153d$

$\Rightarrow 7a = -147d$

$\Rightarrow a = -21d$

$\Rightarrow a + 21d = 0$

$\Rightarrow a + (22-1)d = 0$

$\Rightarrow a_{22} = 0$

Hence, the 22[nd] term of the A.P. is 0.

OR

Given : 24, 21, 18, ... are in AP.

Here, $a = 24$, $d = 21 - 24 = -3$

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

$\Rightarrow 78 = \frac{n}{2}[2 \times 24 + (n-1)(-3)]$

$\Rightarrow 156 = n(48 - 3n + 3)$

$\Rightarrow 156 = n(51 - 3n)$

$\Rightarrow 3n^2 - 51n + 156 = 0$

$\Rightarrow 3n^2 - 12n - 39n + 156 = 0$

$\Rightarrow 3n(n-4) - 39(n-4) = 0$

$\Rightarrow (n-4)(3n-39) = 0$

$\therefore (n-4) = 0$ and $(3n - 39) = 0$

or, $n = 4$ and $n = 13$

When $n = 4$,

$S_4 = \frac{4}{2}[2 \times 24 + (4-1)(-3)]$

$= 2(48 - 9)$

$= 2 \times 39 = 78$

When $n = 13$

$S_{13} = \frac{13}{2}[2 \times 24 + (13-1)(-3)]$

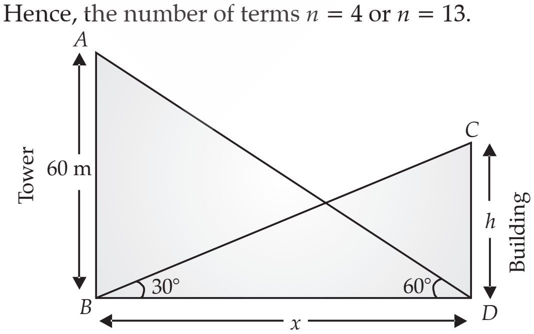
$= \frac{13}{2}[48 + (-36)]$

$= \frac{13}{2} \times 12$

$= 78$

Hence, the number of terms $n = 4$ or $n = 13$.

37.



In ΔABD, $\tan 60° = \frac{AB}{BD}$

$\sqrt{3} = \frac{60}{x}$

$\Rightarrow x = \frac{60}{\sqrt{3}}$

$= 20\sqrt{3}$ m

Now, in ΔBCD, $\angle D = 90°$

$\tan 30° = \frac{CD}{BD}$

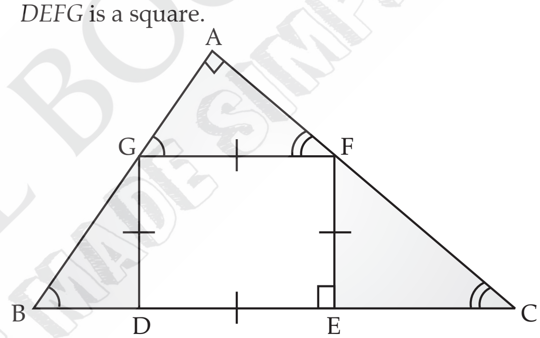
$\frac{1}{\sqrt{3}} = \frac{h}{20\sqrt{3}}$

$\Rightarrow h = \frac{20\sqrt{3}}{\sqrt{3}}$

$\Rightarrow h = 20$ m

Hence, the height of the building = 20 m.

38. Given, ABC is a triangle in which $\angle BAC = 90°$ and $DEFG$ is a square.



(i) In ΔAGF and ΔDBG,

$\angle AGF = \angle GBD$ (Corresponding angles)

$\angle GAF = \angle BDG$ (each 90°)

So, $\Delta AGF \sim \Delta DBG$ (By AA similarity)

Hence Proved.

(ii) In ΔAGF and ΔEFC,

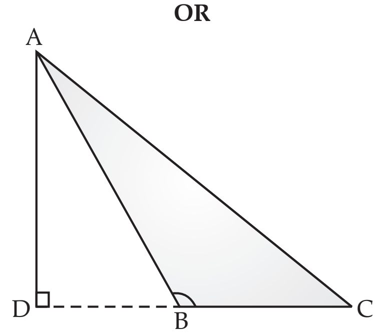
$\angle AFG = \angle FCE$ (Corresponding angles)

$\angle GAF = \angle CEF$ (each 90°)

So, $\Delta AGF \sim \Delta EFC$ (By AA similarity)

Hence Proved.

OR



Given : An obtuse triangle ABC, obtuse-angled at B and AD is perpendicular to CB produced.

To Prove : $AC^2 = AB^2 + BC^2 + 2BC \times BD$

Proof : Since, ΔADB is a right triangle, right angled at D.

$\therefore$ Pythagoras theorem, we have

$$AB^2 = AD^2 + DB^2 \quad ...(i)$$

Again, ΔADC is a right triangle, right angled at D.

$\therefore \quad AC^2 = AD^2 + DC^2$ (By Pythagoras Theorem)

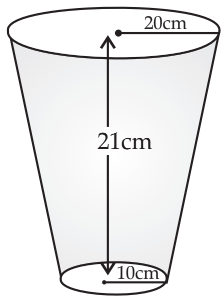
$\Rightarrow \quad AC^2 = AD^2 + (DB + BC)^2$

$\Rightarrow \quad AC^2 = AD^2 + DB^2 + BC^2 + 2DB \times BC$

$\Rightarrow \quad AC^2 = AB^2 + BC^2 + 2DB \times BC$ [Using eqn. (i)]

Hence Proved.

39.



Let r_1 and r_2 be the radii of two circular ends and h be the height of frustum, then volume.

$$= \frac{1}{3}\pi h\left[r_1^2 + r_2^2 + r_1 r_2\right]$$

Given, $r_1 = 10$ cm, $r_2 = 20$ cm and $h = 21$ cm

$\therefore$ Volume

$$= \frac{1}{3} \times \frac{22}{7} \times 21 \times [(10)^2 + (20)^2 + 10 \times 20]$$

$= 22[100 + 400 + 200]$

$= 22 \times 700$

$= 15400 \text{ cm}^3$

$= \frac{15400}{1000}$ liters

($\because$ 1000 cm^3 = 1 liter)

$= 15.4$ liters

$\therefore$ Total cost of milk $= 15.4 \times$ ₹ 40

$=$ ₹ 616

Hence, the cost of milk which can completely fill the bucket at the rate of ₹ 40 per liter is ₹ 616.

OR

Given,

Total height of the solid = 9.5 cm

Radius of the cone = Radius of the hemisphere

$= r = 3.5$ cm

Radius of the hemisphere = Hight of the hemisphere

$= 3.5$ cm

Height of cone, h

= Total height of the solid – Height of hemisphere

$= (9.5 - 3.5)$ cm

$= 6$ cm

Volume of solid = Volume of cone + Volume of hemisphere

$$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

$$= \frac{1}{3}\pi r^2 (h + 2r)$$

$$= \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times (6 + 2 \times 3.5)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times (6 + 7)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 13$$

$$= \frac{1}{3} \times 22 \times 0.5 \times 3.5 \times 13$$

$$= \frac{500.5}{3} = 166.83 \text{ cm}^3 \quad \text{(Approx.)}$$

Hence, the volume of the solid is 166.83 cm^3.

40.

C.I.	**Frequency (f_i)**	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
0-20	20	10	– 3	– 60
20-40	35	30	– 2	– 70
40-60	52	50	– 1	– 52
60-80	44	70 = a	0	0
80-100	38	90	1	38
100-120	31	110	2	62
	$\Sigma f_i = 220$			$\Sigma f_i u_i = -82$

Let a = Assumed mean = 70,

Mean,

$$\bar{x} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 70 + \frac{(-82)}{220} \times 20$$

$$= 70 - \frac{82}{11}$$

$= 70 - 7.45 = 62.55$

Delhi Set-II **Code No. 430/1/2**

SECTION - A

8. Correct Option : (c)

Explanation :

Area of the triangle formed by the given points $A(5, 0)$, $B(8, 0)$ and $C(8, 4)$

$= \frac{1}{2}[5(0-4)+8(4-0)+8(0-0)]$

$= \frac{1}{2}(-20+32+0)$

$= \frac{1}{2}\times 12$

= 6 sq. units

9. Correct Option : (c)

Explanation :

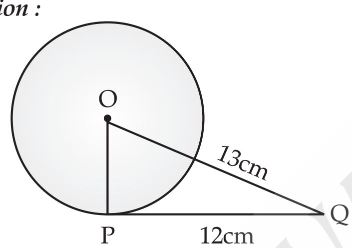
Sum of zeroes = 3 and product of zeroes = – 10

Quadratic polynomial = x^2 – (sum of zeroes)x + product of zeroes

$\therefore$ Quadratic polynomial is $x^2 - 3x - 10$.

10. Correct Option : (b)

Explanation :



Let O be the centre of the circle.

Given that, OQ = 13 cm and PQ = 12 cm

We know that, the radius is perpendicular to the tangent at the point of contact.

$\therefore$ $OP \perp PQ$

In ΔOPQ, using pythagoras theorem,

$OP^2 + PQ^2 = OQ^2$

or, $OP^2 + 12^2 = 13^2$

or, $OP^2 = 13^2 - 12^2$

or, $OP^2 = 169 - 144$

or, $OP^2 = 25$

or, $OP = 5$ cm

15. 1

Explanation :

$\sin^2 65° + \sin^2 25°$

$= \sin^2 65° + \{\sin 25°\}^2$

$= \sin^2 65° + \{\sin (90° - 65°)\}^2$

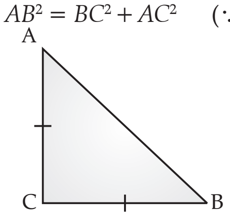
$= \sin^2 65° + \cos^2 65°$ $[\because \sin(90° - \theta) = \cos\theta]$

$= 1$ $[\because \sin^2\theta + \cos^2\theta = 1]$

20. Given, $AB^2 = 2AC^2$

$\Rightarrow$ $AB^2 = AC^2 + AC^2$

$\Rightarrow$ $AB^2 = BC^2 + AC^2$ ($\because$ Given, $BC = AC$)



It satisfies the pythagoras theorem.

So, according to converse of Pythagoras theorem, ΔABC is a right angle triangle and $\angle C = 90°$.

SECTION - B

24.

$$\begin{array}{r|l} & 3x + 2 \\ 3x+2 & 9x^2 + 12x + 10 \\ & 9x^2 + 6x \\ & - \quad - \\ \hline & \quad 6x + 10 \\ & \quad 6x + 4 \\ & \quad - \quad - \\ \hline & \quad\quad 6 \end{array}$$

Hence, quotient = $(3x + 2)$ and remainder = 6

26. Given,

Circumference of a circular park = 88 m

Width of a road = 7 m

Since, circumference $= 2\pi r$

$\therefore$ $88 = 2\pi r$

or, $r = \frac{88}{2\pi} = \frac{88\times 7}{2\times 22} = 2\times 7 = 14$ m

$\therefore$ Inner radius of the park (r) = 14 m

Outer radius of the park including the road (R)

= width + r

= 7 + 14

= 21 m

Area of the road $= \pi(R^2 - r^2)$

$= \pi(R + r)(R - r)$

$[\because a^2 - b^2 = (a + b)(a - b)]$

$= \frac{22}{7}(21+14)(21-14)$

$= \frac{22}{7}\times 35\times 7$

$= 770$ m^2

Hence, the area of the road is 770 m^2.

SECTION - C

32. Given, a circle with center O and tangent at P.

To prove : $OP \perp PQ$

Constant : Extend OR to Q, at AB

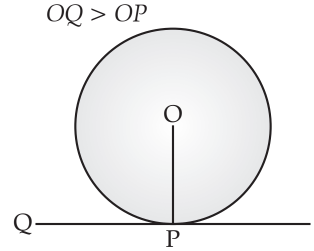
Proof : we have

$OP = OR$ (radius)

$OQ = OR + RQ$

Clearly $OQ > OR$

$\therefore$ $OQ > OP$



The shortest line joining a point to any point on given line is $\perp$r to that line.

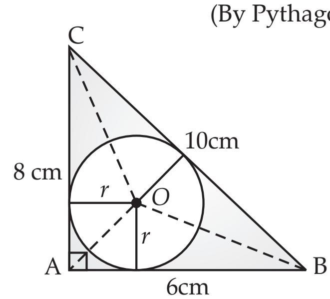
$\Rightarrow \quad OP \perp AB$

or $\quad OP \perp PQ$ **Hence Proved.**

33. In right angle triangle ABC,

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

(By Pythagoras theorem)



or, $AC^2 = BC^2 - AB^2$

$= 10^2 - 6^2 = 100 - 36 = 64$

$\therefore \quad AC = 8$ cm

Now, join OA, OB and OC.

$$ar(\Delta ABC) = ar(\Delta AOB) + ar(\Delta AOC) + ar(\Delta BOC)$$

$$\Rightarrow \frac{1}{2}\times 6\times 8 = \left(\frac{1}{2}\times 6\times r\right)+\left(\frac{1}{2}\times 8\times r\right)+\left(\frac{1}{2}\times 10\times r\right)$$

[$\because$ Area of triangle $= \frac{1}{2} \times$ base $\times$ height and r = radius of circle]

$\Rightarrow \quad 24 = 3r + 4r + 5r$

$\Rightarrow \quad 12r = 24$

$\Rightarrow \quad r = 2$ cm

34. Let $\quad p(x) = x^2 + 7x + 10$

For zeroes of polynomial put $p(x) = 0$.

$\therefore \quad x^2 + 7x + 10 = 0$

$x^2 + 5x + 2x + 10 = 0$

$x(x + 5) + 2(x + 5) = 0$

$(x + 5)(x + 2) = 0$

So, $\quad x = -2, -5$

Therefore, $\alpha = -2$ and $\beta = -5$ are the zeroes of the given polynomial.

Verification :

Sum of zeroes $= \alpha + \beta$

$= -2 + (-5)$

$= -7$

$= \frac{-7}{1}$

$= -\left(\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2}\right)$

Product of zeores $= \alpha\beta$

$= (-2)(-5)$

$= 10$

$= \frac{10}{1}$

$= \frac{\text{Contant term}}{\text{Coefficient of } x^2}$

Hence Verified.

SECTION - D

40. Given, difference of two natural numbers is 5.

Let the x, $(x + 5)$ are two natural numbers.

Reciprocals of the numbers are $\frac{1}{x}$ and $\frac{1}{x+5}$.

According to question,

$$\frac{1}{x} - \frac{1}{x+5} = \frac{1}{10}$$

$$\Rightarrow \frac{x+5-x}{x(x+5)} = \frac{1}{10}$$

$$\Rightarrow \frac{5}{x^2+5x} = \frac{1}{10}$$

$\Rightarrow \quad x^2 + 5x - 50 = 0$

By splitting the middle term, we get

$\Rightarrow \quad x^2 + 10x - 5x - 50 = 0$

$\Rightarrow \quad x(x + 10) - 5(x - 10) = 0$

$\Rightarrow \quad (x + 10)(x - 5) = 0$

$\Rightarrow \quad x = 5$ and $x = -10$

But given two numbers are natural numbers. Therefore, $x = 5$

Here, the required natural numbers are $x = 5$ and $x + 5 = 5 + 5 = 10$.

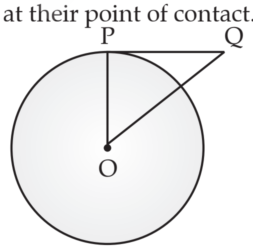
Delhi Set-III — Code No. 430/1/3

SECTION - A

8. Correct Option : (b)

Explanation :

We know that, the radius and tangent are perpendicular at their point of contact.



Now, in isosceles triangle POQ

$\angle POQ + \angle OPQ + \angle OQP = 180°$

$\Rightarrow \quad 2\angle OQP + 90° = 180°$

(Equal sides subtend equal angles)

$\Rightarrow \quad \angle OQP = 45°$

9. Correct Option : (a)

Explanation :

Given, α and β are the zeroes of polynomial $x^2 + 2x + 1$.

$\therefore$ Sum of zeroes, $(\alpha + \beta) = -\frac{2}{1} = -2$

and product of zeroes, $(\alpha\beta) = \frac{1}{1} = 1$

Now, $\quad \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta}$

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

$= -2$

10. Correct Option : (d)

Explanation :

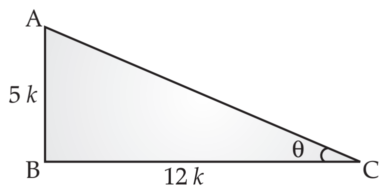
Because the point is 4 units down the x-axis *i.e.*, ordinate is – 4 and on y-axis abscissa is 0. So, the coordinates of point A is (0, – 4).

15. $\mathbf{\frac{5}{13}}$

Explanation :

Given, $\cot\theta = \frac{12}{5}$

$\therefore$ $\tan\theta = \frac{5}{12}$



In ΔABC,

$$AC^2 = AB^2 + BC^2$$
$$= (5k)^2 + (12k)^2$$
$$= 25k^2 + 144k^2$$
$$= 169k^2$$

$\therefore$ $AC = 13k$

So, $\sin\theta = \frac{5k}{13k} = \frac{5}{13}$

Where, $k \neq 0$

20. The sample space,

$$S = \{(H, H), (H, T), (T, H), (T, T)\}$$

$\therefore$ $n(S) = 4$

A is an event (getting at least one head)

$\therefore$ $A = \{(H, T), (T, H), (H, H)\}$ or $n(A) = 3$

Thus, probability of getting at least one head

$$= \frac{n(A)}{n(S)} = \frac{3}{4}$$

SECTION - B

24. Given that,

Radius of 1st circle $(r_1) = 9$ cm

Radius of 2nd circle $(r_2) = 19$ cm

Let the radius of required circle be r cm.

According to question,

Circumference of required circle

= Sum of circumference of two circles

i.e., $2\pi r = 2\pi r_1 + 2\pi r_2$

$\Rightarrow$ $2\pi r = 2\pi(r_1 + r_2)$

$\Rightarrow$ $r = r_1 + r_2$

$\Rightarrow$ $r = 9 + 19$

$\Rightarrow$ $r = 28$ cm.

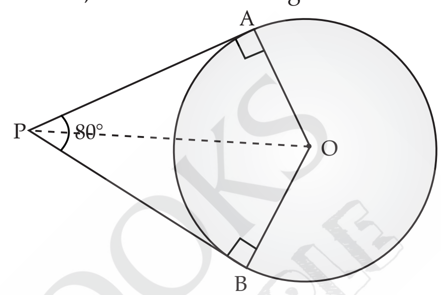
Hence, radius of required circle is 28 cm.

25.

$$\begin{array}{r|l} & 4x + 3 \\ 4x+3 & 16x^2 + 24x + 15 \\ & 16x^2 + 12x \\ & -\quad - \\ \hline & \quad 12x + 15 \\ & \quad 12x + 9 \\ & \quad -\quad - \\ \hline & \qquad 6 \end{array}$$

Hence, quotient = $4x + 3$ and remainder = 6

26. Given that, PA and PB are tangents.



$\because$ PA and PB are the tangents

$\therefore$ PO will be angle bisector of $\angle P$

Hence, $\angle APO = 40°$

Now, in ΔAPO,

$\angle P + \angle APO + \angle POA = 180°$

$90° + 40° + \angle POA = 180°$

or, $\angle POA = 50°$

SECTION - C

32. Given, quadratic polynomial :

$$p(x) = 6x^2 - 3 - 7x$$

for zeroes of polynomial, put $p(x) = 0$

$\therefore$ $6x^2 - 7x - 3 = 0$

By splitting the middle term,

$$6x^2 - 9x + 2x - 3 = 0$$
$$3x(2x - 3) + 1(2x - 3) = 0$$
$$(2x - 3)(3x + 1) = 0$$

$\therefore$ $2x - 3 = 0$ and $3x + 1 = 0$

or, $x = \frac{3}{2}$ and $x = -\frac{1}{3}$

Therefore, $\alpha = \frac{3}{2}$ and $\beta = -\frac{1}{3}$ are the zeroes of the given polynomial.

Verification :

$$\text{Sum of zeroes} = \alpha + \beta$$
$$= \frac{3}{2} + \left(-\frac{1}{3}\right)$$
$$= \frac{3}{2} - \frac{1}{3}$$
$$= \frac{9-2}{6}$$
$$= \frac{7}{6}$$

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

and Product of zeroes $= \alpha\beta$

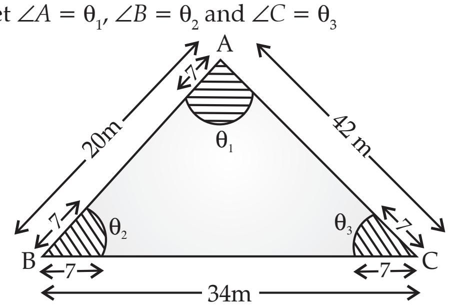
$$= \left(\frac{3}{2}\right)\left(-\frac{1}{3}\right)$$

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

$$= \frac{\text{constant term}}{\text{coefficient of } x^2}$$

Hence Verified.

33. Let $\angle A = \theta_1$, $\angle B = \theta_2$ and $\angle C = \theta_3$



We have,

$r = 7$ m, $a = 34$ m, $b = 42$ m and $c = 20$ m

(where, $BC = a$, $AC = b$ and $AB = c$)

Now, area which can be grazed by the horses

= sum of the areas of three sectors with central angles θ_1 , θ_2 and θ_3 each with radius (r) = 7 m

$$= \frac{\pi r^2\theta_1}{360°} + \frac{\pi r^2\theta_2}{360°} + \frac{\pi r^2\theta_3}{360°}$$

$$= \frac{\pi r^2}{360°}(\theta_1 + \theta_2 + \theta_3)$$

$$= \frac{\pi r^2}{360°} \times 180°$$

[$\because \theta_1 + \theta_2 + \theta_3 = 180°$ angle sum property of a triangle]

$$= \frac{\pi r^2}{\pi 2}$$

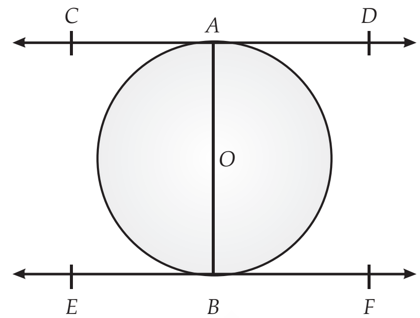
$$= \frac{22}{7} \times \frac{1}{2} \times (7)^2$$

$$= \frac{22}{7} \times \frac{1}{2} \times 7 \times 7$$

$= 77$ m^2

Hence, the area grazed by the horses is 77 m^2

34.



Let AB be the diameter of a given circle and let CD and EF be the tangents drawn to the circle at A and B respectively.

$AB \perp CD$ and $AB \perp EF$

$\therefore \quad \angle CAB = 90°$ and $\angle ABF = 90°$

$\angle CAB = \angle ABF$

and $\quad \angle ABE = \angle BAD$

$\angle CAB$ and $\angle ABF$ also $\angle ABE$ and $\angle BAD$ are alternate interior angles.

$\therefore \quad CD \parallel EF$ **Hence proved.**

SECTION - D

40. Let the original duration of tour be x days.

Amount with the person is ₹ 4200.

Daily expenses $= ₹ \dfrac{4200}{x}$

Given, tour extended for 3 days.

Hence, total number of days

$= (x + 3)$ days

$\therefore$ Daily expenses $= ₹ \dfrac{4200}{(x+3)}$

According to question.

$$\frac{4200}{x} - \frac{4200}{x+3} = 70$$

$$\Rightarrow \quad 4200\left(\frac{1}{x} - \frac{1}{x+3}\right) = 70$$

$$\Rightarrow \quad 60\left[\frac{x+3-x}{x(x+3)}\right] = 1$$

$\Rightarrow \quad 180 = x^2 + 3x$

$\Rightarrow \quad x^2 + 3x - 180 = 0$

$\Rightarrow \quad x^2 + 15x - 12x - 180 = 0$

$\Rightarrow x(x + 15) - 12(x + 15) = 0$

$\Rightarrow \quad (x + 15)(x - 12) = 0$

$\therefore \quad x + 15 = 0$ and $x - 12 = 0$

or, $\quad x = -15$ and $x = 12$

Since, x cannot be negative.

So, $\quad x = 12$

Thus, the original duration of the tour is 12 days.

■■■

Outside Delhi Set-I **Code No. 430/2/1**

SECTION - A

1. Correct Option : (d),

Explanation :

Let y be the second number.

Since, product of two numbers = LCM × HCF

Therefore, $\quad 54 \times y = 162 \times 27$

or, $\quad y = \dfrac{162 \times 27}{54} = 81$

2. Correct Option : (d),

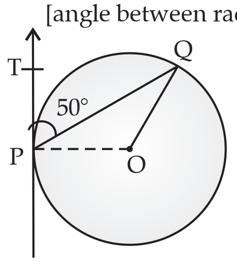
Explanation :

Cumulative frequency is defined as a running total of frequencies. It is helpful in finding the mean, median and mode.

3. Correct Option : (c),

Explanation :

Since, $\angle OPT = 90°$ [angle between radius and tangent]



$\therefore$ $\angle OPQ = 90° - 50° = 40°$

Also, $OP = OQ$ [Radii of a circle]

$\Rightarrow$ $\angle OPQ = \angle OQP = 40°$

[Equal opposite sides have equal opposite angles]

$\therefore$ $\angle POQ = 180° - \angle OPQ - \angle OQP$

[angle sum properly of a triangle]

$= 180° - 40° - 40°$

$= 100°$

4. Correct Option : (c),

Explanation :

Let us assume that $2\sqrt{3}$ is a rational number = r

i.e., $2\sqrt{3} = r$

or, $\sqrt{3} = \dfrac{r}{2}$

Now, we know that $\sqrt{3}$ is an irrational number. So, $\dfrac{r}{2}$ has to be irrational to make the equation true.

This is a contradiction to our assumption. Thus, our assumption is wrong and $2\sqrt{3}$ is an irrational number.

5. Correct Option : (d),

Explanation :

Total outcomes = {HH, HT, TH, TT} *i.e.,* $n(S) = 4$

Favourable outcomes = {HT, TH, TT} *i.e.,* $n(E) = 3$

$\therefore$ Probability of getting at most 1 head,

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$$

6. Correct Option : (a),

Explanation :

Let the zeroes be α and $\dfrac{1}{\alpha}$.

$$\text{Product of zeroes} = \alpha \cdot \frac{1}{\alpha} = \frac{\text{constant}}{\text{coefficient of } x^2}$$

or, $1 = \dfrac{k}{3}$

or, $k = 3$

7. Correct Option : (c),

Explanation :

$$\frac{23}{2^5 \times 5^2} = \frac{23 \times 5^3}{2^5 \times 5^2 \times 5^3}$$

$$= \frac{23 \times 125}{2^5 \times 5^2}$$

$$= \frac{2875}{(10)^5}$$

$$= \frac{2875}{100000}$$

$$= 0.02875$$

Hence, $\dfrac{23}{2^5 \times 5^2}$ will terminate after 5 decimal places.

8. Correct Option : (d),

Explanation : A cubic polynomial has maximum 3 of zeroes because its degree is 3.

9. Correct Option : (c),

Explanation : Since, the distance between the origin and the point (x, y) is $\sqrt{x^2 + y^2}$.

Therefore, the distance between the origin and point (– 12, 5)

$$= \sqrt{(-12)^2 + (5)^2}$$

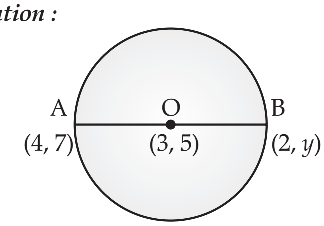
$$= \sqrt{144 + 25}$$

$$= \sqrt{169}$$

$$= 13 \text{ units}$$

10. Correct Option : (a),

Explanation :



Since, centre is the mid-point of end points of the diameter.

$\therefore$ $\text{centre} = \left(\dfrac{4+2}{2}, \dfrac{7+y}{2}\right)$

or, $(3, 5) = \left(3, \dfrac{7+y}{2}\right)$

On comparing both the sides, we get

$$5 = \frac{7+y}{2}$$

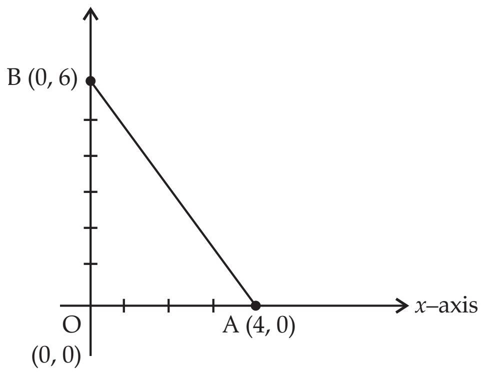
or, $7 + y = 10$

or, $y = 3$

11. 12 sq. units

Explanation :

Area of $\Delta OAB = \dfrac{1}{2} \times \text{base} \times \text{height}$

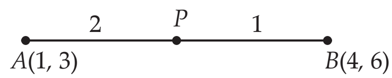


$$= \frac{1}{2} \times 4 \times 6$$

$$= 12 \text{ sq. units}$$

OR

(3, 5)



Explanation : Let point P divides the line segment joining the points $A(1, 3)$ and $B(4, 6)$ in the ratio 2 : 1. Then,

$$\text{coordinates of } P = \left(\frac{2\times4+1\times1}{2+1}, \frac{2\times6+1\times3}{2+1}\right)$$

[By section formula]

$$= \left(\frac{8+1}{3}, \frac{12+3}{3}\right)$$

$$= \left(\frac{9}{3}, \frac{15}{3}\right)$$

$$= (3, 5)$$

12. 3 and – 2

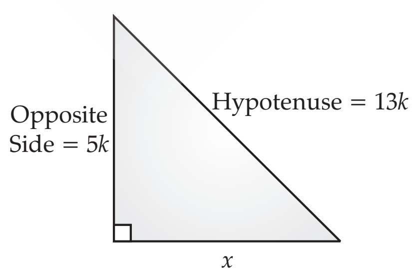
Explanation :

$$x^2 - x - 6 = 0$$
$$x^2 - 3x + 2x - 6 = 0$$
$$x(x-3) + 2(x-3) = 0$$
$$(x-3)(x+2) = 0$$
$$\therefore \quad x = 3 \text{ or } x = -2$$

13. $\mathbf{\frac{5}{12}}$

Explanation :

Given, $\sin\theta = \dfrac{\text{Opposite side}}{\text{Hypotenuse}}$



Using Pythagoras theorem,

$$x^2 + (5k)^2 = (13k)^2$$

or, $x^2 = 169k^2 - 25k^2$

or, $x^2 = 144k^2$

or, $x = 12k$ [Where $k \neq 0$]

Hence, $\tan\theta = \dfrac{\text{Opposite side}}{x} = \dfrac{5k}{12k}$

$\therefore \quad \tan\theta = \dfrac{5}{12}$

14. $\mathbf{\frac{7}{2}}$

Explanation :

$$\tan^2 60° + \sin^2 45° = \left(\sqrt{3}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2$$

$$= 3 + \frac{1}{2} = \frac{7}{2}$$

15. 9 : 16

Explanation :

Given, ratio of corresponding sides of two similar triangles

$$= \frac{3}{4}$$

Therefore,

$$\frac{\text{Area of triangle 1}}{\text{Area of triangle 2}}$$

$$= \frac{(\text{corresponding side of triangle 1})^2}{(\text{corresponding side of triangle 2})^2} = \left(\frac{3}{4}\right)^2 = \frac{9}{16}$$

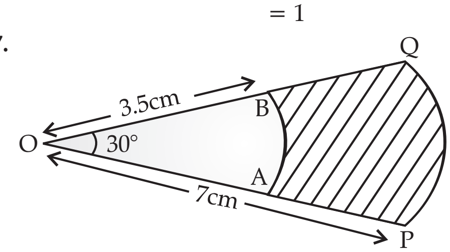
16.

$$\cos 48° - \sin 42° = \cos 48° - \sin(90° - 48°)$$
$$= \cos 48° - \cos 48°$$
$$[\because \sin(90° - \theta) = \cos\theta]$$
$$= 0$$

OR

$$\tan 23° \times \tan 67° = \tan 23° \times \tan(90° - 23°)$$
$$= \tan 23° \times \cot 23°$$
$$[\because \tan(90° - \theta) = \cot\theta]$$
$$= \tan 23° \times \frac{1}{\tan 23°}$$
$$= 1$$

17.



$$\text{Area of shaded region} = \pi\left[R^2 - r^2\right]\frac{\theta}{360°}$$

$$= \frac{22}{7}\left[7^2 - (3.5)^2\right]\frac{30°}{360°}$$

$$= \frac{22}{7}(7+3.5)(7-3.5)\times\frac{1}{12}$$

$$= \frac{22}{7}\times 10.5 \times 3.5 \times \frac{1}{12}$$

$$= 9.625 \text{ cm}^2$$

18. Total number of cards = 52

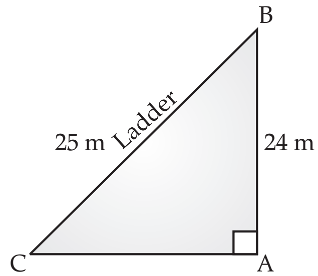
Number of black kings = 2

$\therefore$ Probability of getting a black king $= \dfrac{2}{52} = \dfrac{1}{26}$

19. Let AB be the building and CB be the ladder.

Then, $AB = 24$ m, $CB = 25$ m

and $\angle CAB = 90°$



By Pythagoras Theorem,

$$CB^2 = AB^2 + CA^2$$

or, $$CA^2 = CB^2 - AB^2 = 25^2 - 24^2 = 625 - 576 = 49$$

or, $CA = 7$ m

Hence, the distance of the foot of ladder from the building is 7 m.

20. To be term of an $A.P.$ the difference between two consecutive terms must be the same.

So, if $3k - 2$, $4k - 6$ and $k + 2$ are terms of an $A.P.$, then

then, $4k - 6 - (3k - 2) = k + 2 - (4k - 6)$

or, $4k - 6 - 3k + 2 = k + 2 - 4k + 6$

or, $k - 4 = 8 - 3k$

or, $4k = 12$

or, $k = 3$

Hence, the value of k is 3.

SECTION - B

21. Total number of possible outcomes, $n(S) = 10 + 25 = 35$

Total number of prizes, $n(E) = 10$

Probability of getting a prize

$$= \frac{n(E)}{n(S)}$$

$$= \frac{10}{35} = \frac{2}{7}$$

22. There are three children in family.

So, the total number of outcomes $= 2^3 = 8$

The number of favourable cases :

Atleast two of them are boys means all those cases in which we have either 2 or 3 boys.)

The eight combinations are BBB, BBG, BGB, BGG, GBB, GBG, GGB, GGG.

The probability of having at least two boys

$$= \frac{4}{8} = \frac{1}{2}$$

OR

The total number of all possible outcomes $= 6^2 = 36$

(i) Even number on both dice

$= \{(2, 2), (2, 4), (2, 6), (4, 2), (4, 4), (4, 6), (6, 2), (6, 4), (6, 6)\}$

Number of favourable outcomes = 9

$\therefore$ (getting an even number on both dice)

$$= \frac{9}{36} = \frac{1}{4}$$

(ii) The sum of two numbers more than 9

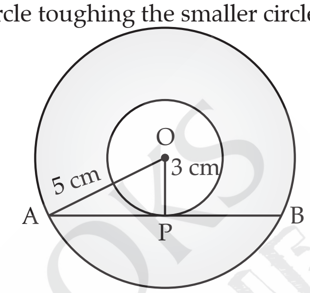
$= \{(4, 6), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)\}$

Number of favourable outcomes = 6

$\therefore$ P(getting sum of two numbers more than 9)

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

23. Let O be the centre of the two concentric circle of radii 5 cm and 3 cm, respectively. Let AB be a chord of the larger circle toughing the smaller circle at P.



Then, $AP = PB$ and $OP \perp AB$

Applying Pythagoras theorem in ΔOPA, we have

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

$\Rightarrow$ $25 = 9 + AP^2$

$\Rightarrow$ $AP^2 = 16$

$\Rightarrow$ $AP = 4$ cm

$\therefore$ $AB = 2AP = 8$ cm

24.

$$\text{LHS} = \frac{1}{1+\sin\theta} + \frac{1}{1-\sin\theta}$$

$$= \frac{(1-\sin\theta)+(1+\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}$$

$$= \frac{2}{1-\sin^2\theta}$$

$$= 2\sec^2\theta$$

$= \text{RHS}$ **Hence Proved.**

OR

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

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

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

$$= \cos^2\theta - \frac{\sin^2\theta}{\cos^2\theta} \times \cos^2\theta$$

$$= \cos^2\theta - \sin^2\theta$$

$= \text{RHS}$ **Hence Proved.**

25. Given, radius of wheel, $r = 35$ cm

Circumference of the wheel $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 35$$

$= 220$ cm

Distance to be covered $= 11$ m $= 1100$ cm

So, number of revolutions required to cover 1100 cm

$$= \frac{1100}{220} \text{ revolutions}$$

$= 5$ revolutions

26.
$$
\begin{array}{r|l}
 & -2x-3 \\
-x+2 & 2x^2-x+3 \\
 & 2x^2-4x \\
 & -\quad + \\ \hline
 & 3x+3 \\
 & 3x-6 \\
 & -\quad + \\ \hline
 & 9
\end{array}
$$

Quotient = $-2x-3$ and remainder = 9

SECTION - C

27. Since, α and β are the zeroes of the quadratic polynomial $f(x) = 5x^2 - 7x + 1$

So, $\alpha + \beta = -\left(\frac{-7}{5}\right) = \frac{7}{5}$ ...(i)

and $\alpha\beta = \frac{1}{5}$ ...(ii)

Now, $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$

$= \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$

$= \frac{\left(\frac{7}{5}\right)^2 - 2 \times \frac{1}{5}}{\frac{1}{5}}$

[from eqn. (i) and (ii)]

$= \frac{\frac{49}{25} - \frac{2}{5}}{\frac{1}{5}}$

$= \frac{\frac{49-10}{25}}{\frac{1}{5}}$

$= \frac{39 \times 5}{25} = \frac{39}{5}$

28. Same as Q.-28 of Delhi Set-I

29. Minute hand completes full circle in one hour.

So, angle swept by minute hand in 1 hour (*i.e.*, 60 minutes) = 360°

$\therefore$ Angle swept by minute hand in 1 minute

$= \frac{360°}{60°} = 6°$

Angle swept by minute hand in 20 minutes

$= 6° \times 20 = 120°$

Hence, $\theta = 120°, r = 21$ cm

Area swept by minute hand

= Area of sector

$= \frac{\theta}{360°} \times \pi r^2$

$= \frac{120°}{360°} \times \frac{22}{7} \times (21)^2$

$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21$

$= 462$ cm^2

Distance travelled by minute hand

$= 2\pi r\left(\frac{\theta}{360°}\right)$ [Arc length]

$= 2 \times \frac{22}{7} \times 21 \times \frac{120°}{360°}$

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

$= 44$ cm

30. Given, $x = 3\sin\theta + 4\cos\theta$

and $y = 3\cos\theta - 4\sin\theta$

$\therefore$ $x^2 + y^2 = (3\sin\theta + 4\cos\theta)^2 + (3\cos\theta - 4\sin\theta)^2$

$= (9\sin^2\theta + 16\cos^2\theta + 24\sin\theta\cos\theta)$

$+ (9\cos^2\theta + 16\sin^2\theta - 24\sin\theta\cos\theta)$

$= 9(\sin^2\theta + \cos^2\theta) + 16(\sin^2\theta + \cos^2\theta)$

$= 9 + 16$ [$\because \sin^2\theta + \cos^2\theta = 1$]

$= 25$ **Hence Proved.**

OR

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

$\Rightarrow \sin\theta - \cos^2\theta = 0$

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

Squaring both sides, we get

$\sin^2\theta = \cos^4\theta$

or, $1 - \cos^2\theta = \cos^4\theta$

or, $\cos^4\theta + \cos^2\theta = 1$ **Hence Proved.**

31. Let $\sqrt{3}$ be a rational number

$\therefore \sqrt{3} = \frac{p}{q}$, where p and q are co-prime integers and $q \neq 0$

On squaring both sides, we get

$3 = \frac{p^2}{q^2}$

or, $p^2 = 3q^2$

$\because$ p^2 is divisible by 3.

$\therefore$ p is divisible by 3. ...(i)

Let $p = 3r$ for some positive integer r.

$\therefore$ $p^2 = 9r^2$

or, $3q^2 = 9r^2$

or, $q^2 = 3r^2$

or, q^2 is divisible by 3.

$\therefore$ q is divisible by 3. ...(ii)

From eqn. (i) and (ii), p and q are divisible by 3, which contradicts the fact the p and q are co-primes.

Hence, our assumption is wrong.

$\therefore$ $\sqrt{3}$ is an irrational number.

OR

Since, 1032 > 272

On applying Euclid's division algorithm, we get

1032 = 272 × 3 + 216

272 = 216 × 1 + 56

216 = 56 × 3 + 48

56 = 48 × 1 + 8

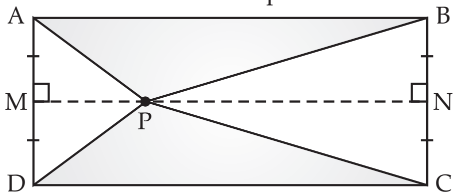
48 = 8 × 6 + 0

Since, remainder comes to be 0. Hence, the HCF is same as divisor, which is 8.

32. Given : P is any point in the interior of rectangle $ABCD$.

To Prove : $PA^2 + PC^2 = PB^2 + PD^2$

Construction : Draw a line parallel to AB and CD.



Proof : AB || MN and $AM \parallel BN$, Also, $A = 90°$

$\therefore$ $ABNM$ is rectangle.

Also, MNCD is a rectangle.

Here, $PM \perp^r AD$ and $PN \perp^r BC$

and $AM = BN$ and $MD = NC$ ...(i)

Now, in ΔAMP,

$$AP^2 = AM^2 + MP^2 \quad ...(ii)$$

In ΔPMD, $PD^2 = MP^2 + MD^2$ ...(iii)

In ΔPNB, $PB^2 = PN^2 + BN^2$ ...(iv)

In ΔPNC, $PC^2 = PN^2 + NC^2$ ...(v)

$\therefore$ $PA^2 + PC^2 = AM^2 + MP^2 + PN^2 + NC^2$

[From eqn. (ii) and (v)]

$= BN^2 + MP^2 + PN^2 + MD^2$

[From eqn. (i)]

$= (BN^2 + PN^2) + (MP^2 + MD^2)$

$= PB^2 + PD^2$

[From eqn. (iii) & (iv)]

Hence Proved.

33. Coordinates of points A, B, C, D are :

$A(3, 4), B(6, 7), C(9, 4)$ and $D(6, 1)$

Using distance formula,

$$d = \left|\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right|$$

$$AB = \left|\sqrt{(3-6)^2 + (4-7)^2}\right|$$

$$= \left|\sqrt{9+9}\right|$$

$$= \left|\sqrt{18}\right| = 3\sqrt{2} \text{ units}$$

$$BC = \sqrt{(6-9)^2 + (7-4)^2}$$

$$= \sqrt{9+9}$$

$$= \sqrt{18} = 3\sqrt{2} \text{ units}$$

$$CD = \sqrt{(9-6)^2 + (4-1)^2}$$

$$= \sqrt{9+9}$$

$$= \sqrt{18} = 3\sqrt{2} \text{ units}$$

$$DA = \sqrt{(6-3)^2 + (1-4)^2}$$

$$= \sqrt{9+9}$$

$$= \sqrt{18} = 3\sqrt{2} \text{ units}$$

Since, $AB = BC = CD = DA$

$$= 3\sqrt{2} \text{ unit}$$

and $AC = \sqrt{(3-9)^2 + (4-4)^2}$

$$= \sqrt{36+0}$$

$$= 6 \text{ units}$$

$$DB = \sqrt{(6-6)^2 + (1-7)^2}$$

$$= \sqrt{0+36}$$

$$= 6 \text{ units}$$

$\therefore$ $AC = DB$

Hence, $ABCD$ is a square and Champa is right.

34. Given equations :

$$2x - 3y + 13 = 0$$

$$3x - 2y + 12 = 0$$

$$2x - 3y = -13$$

$\Rightarrow$ $y = \dfrac{2x+13}{3}$

x	0	– 6.5	1
y	4.3	0	5

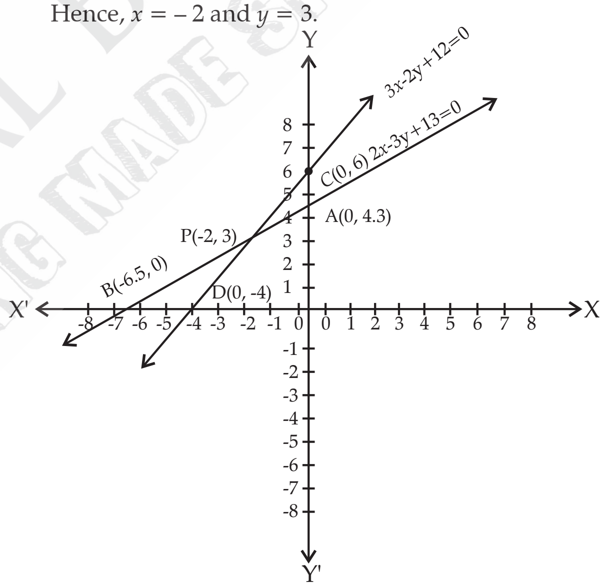
and $3x - 2y = -12$

$\Rightarrow$ $y = \dfrac{3x+12}{2}$

x	0	– 4	– 2
y	6	0	3

These lines intersect each other at point (– 2, 3)

Hence, $x = -2$ and $y = 3$.



SECTION - D

35. Let two consecutive positive integers be x and $x + 1$.

According to question,

Product of x and $(x + 1) = 306$

i.e., $x(x + 1) = 306$

or, $x^2 + x - 306 = 0$

or, $x^2 + 18x - 17x - 306 = 0$

or, $x(x + 18) - 17(x + 18) = 0$

or, $(x + 18)(x - 17) = 0$

or, $x = 17$ and -18

[neglecting-18]

Hence, numbers are $x = 17$ and $(x + 1) = 18$.

36. Given,

$\Rightarrow$ $a_{17} = 5 + 2a_8$ and $a_{11} = 43$

[Here, a_8, a_{11} and a_{17} are 8th, 11th and 17th term respectively]

Since,

n^{th} term of an $A.P.$, $a_n = a + (n-1)d$,

where a = first term

d = common difference

$\therefore \quad a + (17-1)d = 5 + 2\{a + (8-1)d\}$

$\Rightarrow \quad a + 16d = 5 + 2a + 14d$

$\Rightarrow \quad 2d - a = 5 \quad$ ...(i)

Also, $a + (11-1)d = 43$

$\Rightarrow \quad a + 10d = 43 \quad$ ...(ii)

Solving eqn. (i) and (ii), we get

$a = 3$ and $d = 4$

Hence, n^{th} term would be

$a_n = 3 + (n-1)4 = 4n - 1$

OR

Given, $A.P.$: 3, 5, 7, 9, ...

First term, $a = 3$

Common difference, $d = 2$

Also, given sum, $S_n = 120$

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

or, $120 = \frac{n}{2}[2 \times 3 + (n-1)2]$

or, $240 = n(2n + 4)$

or, $120 = n(n + 2)$

or, $n^2 + 2n - 120 = 0$

or, $n^2 + 12n - 10n - 120 = 0$

or, $n(n + 12) - 10(n + 12) = 0$

or, $(n + 12)(n - 10) = 0$

or, $n = 10$ or $n = -12$

[neglecting because n can't be negative]

$\therefore \quad n = 10$

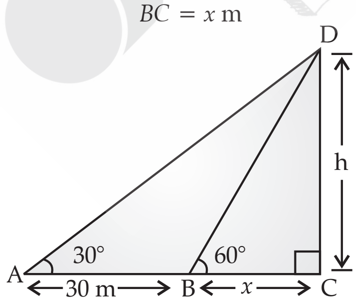
Hence, 10 terms must be taken to get the sum 120.

37. Let CD be the tree of height h m. Let B be the position bank of the river After moving 30 m away from point B.

Let new positino of man be A *i.e.*, $AB = 30$ m

The angles of elevation of the top of the tree from point A and B are 30° and 60° respectively, *i.e.*, $\angle CAD = 30°$ and $\angle CBD = 60°$

Let $BC = x$ m



In right triangle BCD, we have

$$\tan 60° = \frac{CD}{BC}$$

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

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

In right triangle ACD, we have

$$\tan 30° = \frac{CD}{AC}$$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{x+30}$$

$$\Rightarrow \quad x + 30 = \sqrt{3}h$$

$$\Rightarrow \quad x = \sqrt{3}h - 30 \quad \text{...(ii)}$$

Comparing eqn. (i) and (ii), we get

$$\Rightarrow \quad \frac{h}{\sqrt{3}} = \sqrt{3}h - 30$$

$$\Rightarrow \quad h = 3h - 30\sqrt{3}$$

$$\Rightarrow \quad -2h = -30\sqrt{3}$$

$$\Rightarrow \quad h = 15\sqrt{3}$$

$$= 15 \times 1.732$$

$$= 25.98 \text{ m}$$

Hence, the height of the tree is 25.98 m.

Now, substituting the value of $h = 15\sqrt{3}$ in eqn. we get,

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

or, $$x = \frac{15\sqrt{3}}{\sqrt{3}}$$

or, $x = 15$ m

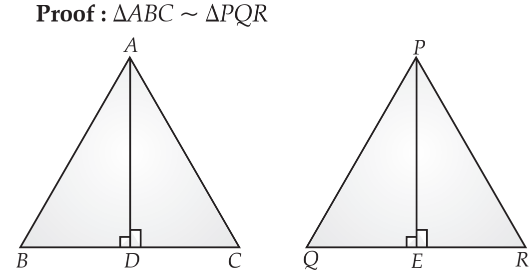
Hence, width of the river is 15 m.

38. Given, $\Delta ABC \sim \Delta PQR$

To Prove : $$\frac{ar\ (\Delta ABC)}{ar\ (\Delta PQR)} = \left(\frac{AB}{PQ}\right)^2 = \left(\frac{BC}{QR}\right)^2 = \left(\frac{AC}{PR}\right)^2$$

Construction : Draw $AD \perp BC$ and $PE \perp QR$.

Proof : $\Delta ABC \sim \Delta PQR$



$\Rightarrow \angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$ and

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} \quad \text{...(i)}$$

[$\because$ Similar triangles are equiangular and their corresponding sides are proportional]

In ΔADB and ΔPEQ,

$\angle B = \angle Q$ [From (i)]

$\angle ADB = \angle PEQ$ [each 90°]

$\therefore \quad \Delta ADB \sim \Delta PEQ$ [AA similarity] or, $\frac{AD}{PE} = \frac{AB}{PQ}$ ...(ii)

[Corresponding sides of similar triangles]

From eqs. (i) and eq. (ii),

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{AD}{PE} \quad \text{...(iii)}$$

Now $$\frac{ar\ (\Delta ABC)}{ar\ (\Delta PQR)} = \frac{\frac{1}{2}\times BC\times AD}{\frac{1}{2}\times QR\times PE}$$

$$= \left(\frac{BC}{QR}\right)\times\left(\frac{AD}{PE}\right)$$

$$= \frac{BC}{QR}\times\frac{BC}{QR}$$

or, $$\frac{ar\ (\Delta ABC)}{ar\ (\Delta PQR)} = \frac{BC^2}{QR^2} \quad \text{...(iv)}$$

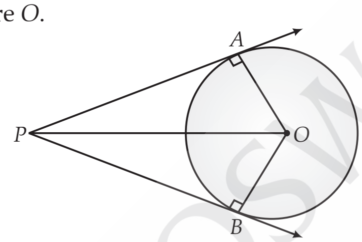
[from eq. (iii)]

From eq (iii) and eq (iv),

$$\frac{ar\ (\Delta ABC)}{ar\ (\Delta PQR)} = \left(\frac{AB}{PQ}\right)^2 = \left(\frac{BC}{QR}\right)^2 = \left(\frac{AC}{PR}\right)^2$$

OR

Given : AP and BP are tangents of circle having centre O. ½



To Prove : $AP = BP$

Construction : Join OP, AO and BO

Proof : $\angle OAP$ and $\angle OBP$

$OA = OB$ [Radius of circle]

$OP = OP$ [Common side]

$OAP = OBP = 90°$

(Radius – tangent angle)

$\Delta OAP \cong \Delta OBP$

[RHS congruency rule]

$AP = BP$ [CPCT]

Hence Proved.

39. Height of cylinder, $h = 15$ cm

Diameter of cylinder = 16 cm

$\therefore$ Radius of cylinder, $r = \frac{16}{2} = 8$ cm

Let slant height of cone be l cm

$$\therefore \quad l = \sqrt{r^2+h^2} \text{ cm}$$

$$= \sqrt{8^2+15^2}$$

$$= \sqrt{64+225}$$

$$= \sqrt{289}$$

$$\therefore \quad l = 17 \text{ cm}$$

T.S.A. of reaming solid = Top area of cylinder + C.S.A. of cylinder + C.S.A. of conical Vanity

$= \pi r^2 + 2\pi rh + \pi rl$

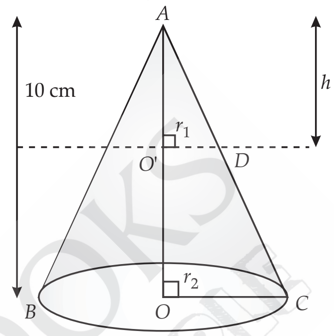
$= \pi r(r + 2h + l)$

$= \pi \times 8(3 + 2 \times 15 + 17)$

$= \pi \times 8 \times 55$

T.S.A. of reaming solid $= 440\pi$ cm²

OR



Let the radius of cone be r_2 and cut of cone r_1

Height of the cone = 10 cm

And the height the cone cut off = 5 cm

$$\Delta AOC \sim \Delta AO'D$$

$$\therefore \quad \frac{AO}{AO'} = \frac{r_2}{r_1} = \frac{10}{5}$$

$$\Rightarrow \quad r_2 = 2r_1$$

Volume of cut off cone $= \frac{1}{3}\pi r_1^2 \times 5$

$= \frac{5}{3}\pi r_1^2$ sq. units

Volume of original cone $= \frac{1}{3}\pi(2r_1)^2 \times 10$

$= \frac{40}{3}\pi r_1^2$ sq. units

Volume of frustum = Volume of original cone – Volume of cut of cone

$= \frac{40}{3}\pi r_1^2 - \frac{5}{3}\pi r_1^2$

$= \frac{35}{3}\pi r_1^2$ sq. units

Ratio of two parts $= \frac{35\pi r_1^2}{5\pi r_1^2} = \frac{7}{1}$

Hence the ratio of two parts = 7 : 1

40. Here, Modal Class = 30 – 40

So, $f_0 = f, f_1 = 16, f_2 = 12, l = 30$

and $h = 10$

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

$$\Rightarrow \quad 36 = 30 + \frac{16 - f}{2\times 16 - f - 12}\times 10$$

$$\Rightarrow \quad 6 = \frac{16 - f}{20 - f}\times 10$$

$$\Rightarrow \quad 120 - 6f = 160 - 10f$$

$$\Rightarrow \quad 4f = 40$$

$$\Rightarrow \quad f = 10$$

Outside Delhi Set-II — Code No. 430/2/2

SECTION - A

8. Correct Option : (c),

Explanation :

Given, polynomial : $2x^2 - 13x + 6$

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

$a = 2, b = -13$ and $c = 6$

Since, given a and b are the zeores of the equation

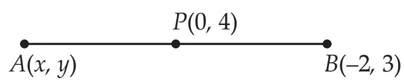
Thus, sum of zeroes, $\alpha + \beta = -\frac{b}{a}$

$= -\frac{(-13)}{2}$

$= \frac{13}{2}$

9. Correct Option : (a),

Explanation :



Using mid-point formula,

$0 = \frac{x-2}{2}$

$\Rightarrow \quad x = 2$

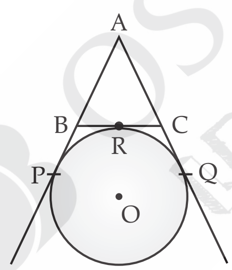
and $\quad 4 = \frac{y+3}{2}$

$\Rightarrow \quad y = 5$

$\therefore \quad A(x, y) = A(2, 5)$

10. Correct Option : (d),

Explanation :



Perimeter of $\Delta ABC = AB + BC + AC$

$= AB + BR + RC + AC$

$= (AB + BP) + (CQ + AC)$

[$\because BD = BQ, CD = CQ$, (tangents from external points)]

$= AP + AQ$

$= 2AP$

[$\because AP = AQ$, tangents from external point]

$\therefore \quad AB + BC + AC = 2AP$

or, $\quad 5 + 4 + 6 = 2AP$

or, $\quad AP = \frac{15}{2} = 7.5$ cm

15. 1

Explanation :

sin 43° cos 47° + sin 47° cos 43°

= sin 43° cos(cos 90° – 43°) + sin(90° – 43°) cos 43°

= sin 43° × sin 43° + cos 43° × cos 43°

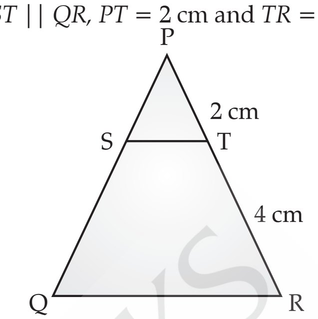
[sin (90 – θ) = cos θ

cos (90 – θ) = sin θ]

= sin²43° + cos²43°

= 1

19. Given, $ST \parallel QR$, $PT = 2$ cm and $TR = 4$ cm



In ΔPST and ΔPQR,

$\angle SPT = \angle QPR$ (common)

$\angle PST = \angle PQR$ (Corresponding angles)

$\therefore \quad \Delta PST \sim \Delta PQR$ (By AA similarity criterion)

We know that, the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides.

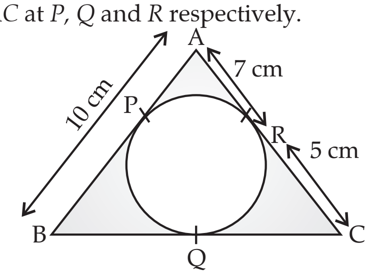
$$\therefore \quad \frac{ar(\Delta PST)}{ar(\Delta PQR)} = \frac{PT^2}{PR^2} = \frac{2^2}{(PT+TR)^2}$$

$$= \frac{4}{(2+4)^2} = \frac{4}{36} = \frac{1}{9}$$

20. Same as Q.20 Delhi Set-II.

SECTION - B

25. Given, a circle is inscribed in a ΔABC touching AB, BC and AC at P, Q and R respectively.



Since, tangents drawn to a circle from an external point are equal.

$\therefore \quad AP = AR = 7$ cm,

$CQ = CR = 5$ cm

Now, $\quad BP = (AB - AP)$

$= 10 - 7 = 3$ cm

$\therefore \quad BP = BQ = 3$ cm

$\therefore \quad BC = BQ + QC$

$= 3 + 5 = 8$ cm

26. Minute hand completes full circle degree in 1 hour.

So, degree swept by minute hand in 1 hour (60 minutes) = 360°

$\therefore$ Degree swept by minute hand in 1 minute $= \frac{360°}{60} = 6°$

and degree swept by minute hand in 15 minutes

$= 6° \times 15 = 90°$

Hence, $\theta = 90°$ and $r = 14$ cm

Area swept by minute hand

$= \text{Area of sector}$

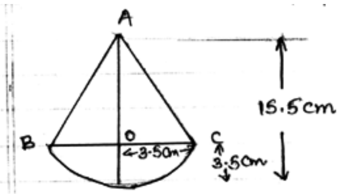
$= \dfrac{\theta}{360°} \times \pi r^2$

$= \dfrac{90°}{360°} \times \dfrac{22}{7} \times (14)^2$

$= \dfrac{1}{4} \times \dfrac{22}{7} \times 14 \times 14 = 154 \text{ cm}^2$

SECTION - C

33.



Height of hemisphere = r
= 3.5cm

height of cone = 15.5cm − 3.5cm
= 12cm = h.

Slant height of cone = $\sqrt{r^2 + h^2}$
= $\sqrt{12.25 + 144}$
= $\sqrt{156.25}$
= 12.5 cm

TSA of toy = CSA of cone + CSA of hemi-sphere.

= $\pi r l + 2\pi r^2$
= $\frac{22}{7} \times 12.5 \times 3.5 + 2 \times \frac{22}{7} \times 3.5 \times 3.5$
= $22 \times 12.5 \times 0.5 + 22 \times 3.5$
= $22 \left(12.5 \times \frac{5}{10} + 3.5\right)$
= $22 \left(12.5 \times \frac{1}{2} + 3.5\right)$
= $22 (6.25 + 3.5)$
= $22 (9.75)$
= 214.5 cm^2

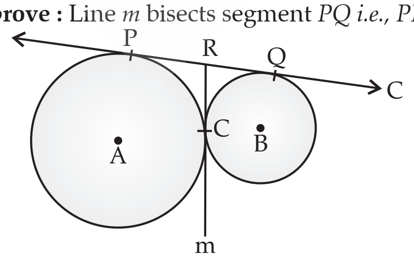
∴ Total surface area of toy is 214.5 cm^2

[Topper Answer, 2017]

34. Given : Circles with centres *A* and *B* touches externally. Line *l* is the tangent to both the circles at *P* and *Q* respectively.

Line *m* is common tangent which intersects at point *R* to line *l*.

To prove : Line *m* bisects segment *PQ* *i.e.*, *PR* = *Q*



Proof : We know that,

Tangents drawn from an external point to a circle are congruent.

Consider a circle with centre *A*. Here, point *R* is an external point and seg *RP* and seg *RC* are the tangents.

∴ $RP = RC$ ...(i)

[Tangent Segment Theorem]

Now, consider the circle with centre *B*. Here, point *R* is an external point and *RQ* and *RC* are tangents.

∴ $RQ = RC$ ...(ii)

[Tangent Segment Theorem]

From eqn. (i) & (ii) we get

$RP = RQ$

i.e., line *m* bisects segment *PQ* **Hence Proved.**

SECTION - D

39.

Class	Frequency	*c.f.*
40-45	2	2
45-50	3	5
50-55	8	13
55-60	6	19
60-65	6	25

65-70	3	28
70-75	2	30
	N = 30	

$$\text{Median} = \frac{N}{2} = \frac{30}{2} = 15$$

The cumulative frequency just greater than 15 is 19 and the corresponding class is 55 – 60.

So, Median class = 55 – 60

$l = 55, f = 6, c.f. = 13$ and $h = 5$

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

$$= 55 + \left(\frac{15-13}{6}\right) \times 5$$

$$= 55 + \frac{5}{3}$$

$$= 55 + 1.67$$

$$= 56.67 \text{ (Approx)}$$

40. Let the original price of the book is ₹ x.

Number of books bought at original price for ₹ 600 = $\frac{600}{x}$

If the price of a book is reduced by ₹ 5, then the new price of books is ₹ $(x - 5)$.

Number of book bought at reduced price for ₹ 600 = $\frac{600}{x-5}$

According to equation,

$$\frac{600}{x-5} - \frac{600}{x} = 4$$

$$\Rightarrow \frac{600x - 600x + 3000}{x(x-5)} = 4$$

$$\Rightarrow \frac{3000}{x^2 - 5x} = 4$$

$$\Rightarrow x^2 - 5x = 750$$

$$\Rightarrow x^2 - 5x - 750 = 0$$

$$\Rightarrow x^2 - 30x + 25x - 750 = 0$$

$$\Rightarrow x(x - 30) + 25(x - 30) = 0$$

$$\Rightarrow x - 30 = 0 \text{ or } x + 25 = 0$$

$$\Rightarrow x = 30 \text{ or } x = -25$$

$$\therefore x = 30$$

(Price cannot be negative)

Hence, the original price of the book is ₹ 30.

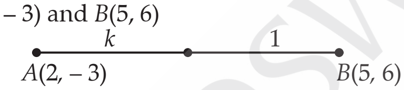
Outside Delhi Set-III Code No. 430/2/3

SECTION - A

8. Correct Option : (c),

Explanation :

Given, x-axis divide the segment joining points $A(2, -3)$ and $B(5, 6)$



Let the ratio be $k : 1$, then

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

and $$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = 0$$

Hence, $$\frac{6k - 3}{k + 1} = 0$$

or, $$6k = 3 \Rightarrow k = \frac{1}{2}$$

Thus, ratio is 1 : 2.

9. Correct Option : (d),

Explanation :

Given polynomial = $kx^2 + 2x + 3k$

Comparing it by $ax^2 + bx + c$, we get

$a = k, b = 2$ and $c = 3k$

$$\text{Sum of zeroes} = -\frac{b}{a} = -\frac{2}{k}$$

$$\text{Product of zeroes} = \frac{c}{a} = \frac{3k}{k} = 3$$

According to question,

Sum of zeroes = product of zeroes

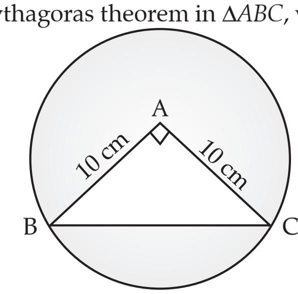
$$\Rightarrow -\frac{2}{k} = 3$$

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

10. Correct Option : (c),

Explanation :

Using pythagoras theorem in ΔABC, we get



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

$$= 10^2 + 10^2$$

$$= 100 + 100$$

$$= 200$$

or, $$BC = 10\sqrt{2} \text{ cm}$$

15. 2

Explanation :

$$\frac{\sin\theta}{\cos(90° - \theta)} + \frac{\cos 43°}{\sin 47°}$$

$$= \frac{\sin\theta}{\cos(90° - \theta)} + \frac{\cos(90° - 47°)}{\sin 47°}$$

$$= \frac{\sin\theta}{\sin\theta} + \frac{\sin 47°}{\sin 47°}$$

[$\because \cos(90° - A) = \sin A$]

$= 1 + 1$
$= 2$

19. Total no. of cards, $n(S) = 52$

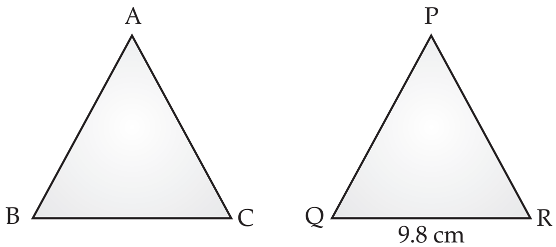
Number of red kings,

$n(E) = 2$

Prob. (getting a red king)

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

20.



Given, $\Delta ABC \sim \Delta PQR$

$ar(\Delta ABC) = 25\text{ cm}^2$,

$ar(\Delta PQR) = 49\text{ cm}^2$

and $QR = 9.8$ cm

$$\frac{ar(\Delta ABC)}{ar(\Delta PQR)} = \left(\frac{BC}{QR}\right)^2$$

$$\Rightarrow \quad \frac{25}{49} = \left(\frac{BC}{QR}\right)^2$$

$$\Rightarrow \quad \frac{5}{7} = \frac{BC}{QR} \quad \text{(Taking squre root)}$$

$$\Rightarrow \quad BC = \frac{5}{7} \times QR$$

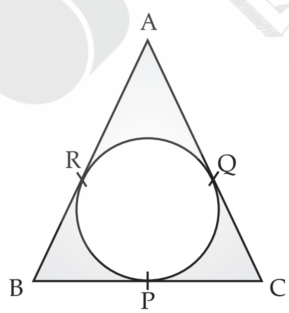
$$\Rightarrow \quad BC = \frac{5}{7} \times 9.8$$

$$\Rightarrow \quad BC = 7 \text{ cm}$$

SECTION - B

25. Given, the circle touches the sides AB at R and side AC at Q and side BC at P.

Since, the tangents drawn from externals points are equal



Then, we have tangents from points A,

i.e., $AR = AQ$ ...(i)

Tangents from point B,

i.e., $BR = BP$ ...(ii)

and tangents from point C,

i.e., $CP = CQ$ ...(iii)

Given, $AB = AC$

$\Rightarrow \quad AR + BR = AQ + CQ$

$\Rightarrow \quad AR + BP = AQ + CP$ [from eqn. (ii) & (iii)]

$\Rightarrow \quad AQ + BP = AQ + CP$ [from eqn. (i)]

$\Rightarrow \quad BP = CP$

Hence, the point of contact P bisects BC.

26. Given, arc length $= 44$ cm

radius of circle, $r = 17.5$ cm

So, area of sector $= \dfrac{\text{arc length}}{2\pi r} \times \pi r^2$

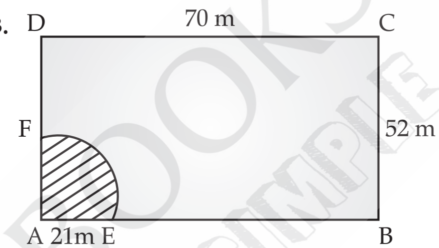
$$= \frac{\text{arc length} \times r}{2}$$

$$= \frac{44 \times 17.5}{2}$$

$= 22 \times 17.5 = 385$ sq. cm.

SECTION - C

33.



Given, Length of the rectangle, $l = 70$ m

Breadth of the rectangle, $b = 52$ m

Length of the rope $= 21$ m

Shaded portion $AEFA$ indicates the area in which the horse can graze. Clearly it is the area of a quadrant of a circle of radius, $r = 21$ m.

Area of quadrant, $AEFA = \dfrac{1}{4}\pi r^2$ sq. units

$$= \frac{1}{4} \times \frac{22}{7} \times (21)^2$$

$$= \frac{1}{4} \times \frac{22}{7} \times 21 \times 21$$

$= 346.5\text{ m}^2$

Hence, the graze area is 346.5 m^2.

34. Given, sum of zeroes $= -3$

and product of zeroes $= 2$

The quadratic polynomial will be

$x^2 -$ (sum of zeroes)x + product of zeroes $= 0$

or, $x^2 - (-3)x + 2 = 0$

or, $x^2 + 3x + 2 = 0$

or, $x^2 + 2x + x + 2 = 0$

or, $x(x + 2) + 1(x + 2) = 0$

or, $(x + 2)(x + 1) = 0$

$\therefore \quad x + 2 = 0$ and $x + 1 = 0$

or, $x = -2$ and $x = -1$

Hence, zeroes are : -2 and -1.

SECTION - D

39. Let the numbers be x, $x + 1$, $x + 2$.

According to question,

$x^2 + (x + 1)(x + 2) = 46$

$2x^2 + 3x - 44 = 0$

or, $2x^2 + 11x - 8x - 44 = 0$

or, $x(2x + 11) - 4(2x + 11) = 0$

or, $(2x + 11)(x - 4) = 0$

$\therefore \quad 2x + 11 = 0$ and $x - 4 = 0$

or, $x = -\frac{11}{2}$ and $x = 4$

But x can't be negative

$\therefore \quad x = 4$

So, numbers are 4, 5 and 6.

40.

Class Interval	Frequency (f_i)	c.f.	x_i	$U_i = \frac{x_i - a}{h}$	$f_i u_i$
10-25	2	2	17.5	– 3	– 6
25-40	3	5	32.5	– 2	– 6
40-55	7	12	47.5	– 1	– 7
55-70	6	18	62.50 = a	0	0
70-85	6	24	77.5	1	6
85-100	6	30	92.5	2	12
	$\Sigma f_i = 30$				$\Sigma f_i u_i = -1$

Let a = Assumed Mean = 62.5

Mean,

$$\bar{x} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 62.5 + \frac{-1}{30} \times 15$$

$$= 62.5 - \frac{1}{2}$$

$$= 62.5 - 0.5$$

$$= 62$$

■■■