SAMPLE QUESTION PAPER (BASIC) - 10

Class 10 - Mathematics

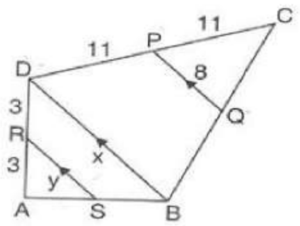
Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

Section A

1. In the adjoining figures $RS||DB||PQ$. If CP = PD = 11 and DR = RA = 3. Then. **[1]**



a) x = 10, y = 7 b) x = 14, y = 6

c) x = 16, y = 8 d) x = 12, y = 10

2. A polynomial of degree ________ is called a cubic polynomial. **[1]**

a) 2 b) 0

c) 1 d) 3

3. Aruna has only Re 1 and Rs 2 coins with her. If the total number of coins that she has is 50 and the amount of money with her is Rs 75, then the number of Rs 1 and Rs 2 coins are, respectively **[1]**

a) 35 and 15 b) 35 and 20

c) 15 and 35 d) 25 and 25

4. The sum of two numbers is 35 and their difference is 13. The numbers are **[1]**

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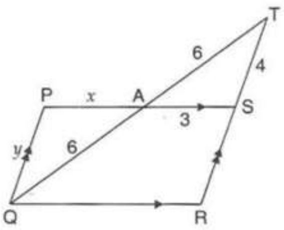
a) 24 and 11

b) 25 and 12

c) 20 and 15

5. In the given figure if PS||QR and PQ||SR and AT = AQ = 6, AS = 3, TS = 4, then **[1]**



a) x = 2, y = 3.

b) x = 1, y = 2.

c) x = 3, y = 4.

d) x = 4, y = 5.

6. A number is selected at random from the numbers 3, 5, 5, 7, 7, 7, 9, 9, 9, 9. The probability that the selected number is their average is **[1]**

a) $\frac{7}{10}$

b) $\frac{3}{10}$

c) $\frac{9}{10}$

d) $\frac{1}{10}$

7. If sin A = $\frac{1}{2}$, then the value of cot A is **[1]**

a) $\sqrt{3}$

b) $\frac{\sqrt{3}}{2}$

c) $\frac{1}{\sqrt{3}}$

d) 1

8. In a data, if l = 60, h = 15, f_1 = 16, f_0 = 6, f_2 = 6, then the mode is **[1]**

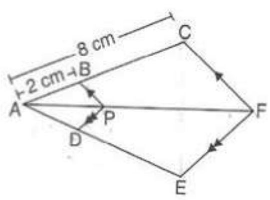
a) 67.5

b) 72

c) 60

d) 62

9. In the given figure if $BP||CF$, $DP||\mathrm{E}F$,then AD : DE is equal to **[1]**



a) 1 : 3

b) 1 : 4

c) 3 : 4

d) 2 : 3

10. If HCF (26,169) = 13, then LCM (26,169) = **[1]**

a) 13

b) 26

c) 52

d) 338

11. If one root of the equation $2x^2 + ax + 6 = 0$ is 2 then a = ? **[1]**

a) -7

b) $\frac{7}{2}$

c) $\frac{-7}{2}$

d) 7

12. The mid-point of the line segment joining the points A (-2, 8) and B (- 6, - 4) is **[1]**

a) (- 4, -6)

b) (4, 2)

c) (2, 6)

d) (– 4, 2)

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13. Which of the following cannot be determined graphically? **[1]**

a) Mode

b) Median

c) Mean

d) None of these

14. $9 \sec^2 A - 9 \tan^2 A =$ **[1]**

a) 1

b) 9

c) 0

d) 8

15. The ________ is the angle between the horizontal and the line of sight to an object when the object is below the horizontal level. **[1]**

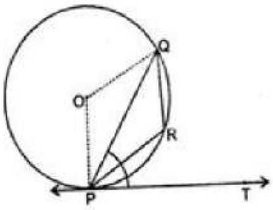
a) angle of projection

b) angle of elevation

c) None of these

d) angle of depression

16. In the given figure, PQ is a chord of a circle and PT is the tangent at P such that $\angle QPT = 60^o$, Then $\angle PRQ$ is equal to: **[1]**



a) 150°

b) 120°

c) 140°

d) 110°

17. If the diagonals of a quadrilateral divide each other proportionally then it is a **[1]**

a) square

b) rectangle

c) trapezium

d) parallelogram

18. The roots of a quadratic equation $x^2 - 4px + 4p^2 - q^2 = 0$ are **[1]**

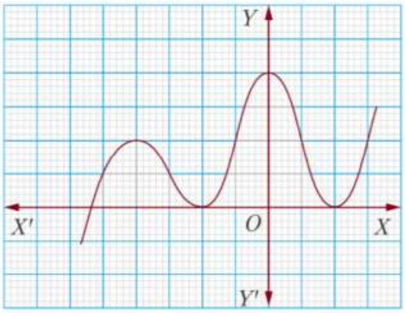
a) 2p + q, 2p - q

b) p + 2q, p - 2q

c) 2p + q, 2p + q

d) 2p - q, 2p - q

19. **Assertion (A):** The graph y = f(x) is shown in figure, for the polynomial f(x). The number of zeros of f(x) is 3. **[1]**
Reason (R): The number of zero of the polynomial f(x) is the number of point of which f(x) cuts or touches the axes.



a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** Two identical solid cubes of side 5 cm are joined end to end. The total surface area of the **[1]**

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resulting cuboid is 300 cm^2.

Reason (R): Total surface area of a cuboid is 2(lb + bh + lh)

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Find the roots of the quadratic equation $15x^2 - 10\sqrt{6}x + 10 = 0$. **[2]**

22. Find the ratio in which line formed by joining (-1, 1) and (5, 7) is divided by the line x + y = 4. **[2]**

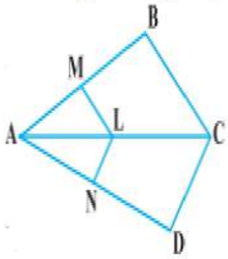
OR

Find the co-ordinates of the points which divide the line segment joining the points (–4, 0) and (0, 6) in four equal parts.

23. Find the HCF and LCM of 612 and 1314 using prime factorisation method. **[2]**

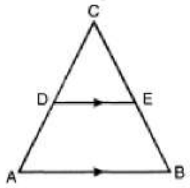
24. In a ΔABC right angled at B, if AB = 4 and BC = 3, find all the six trigonometric ratios of $\angle A$ **[2]**

25. In the given figure, $LM \| CB$ and LN$\|$CD. Prove that $\frac{AM}{AB} = \frac{AN}{AD}$. **[2]**



OR

In the given figure, ∠A = ∠B and AD = BE. Show that DE $\|$AB.



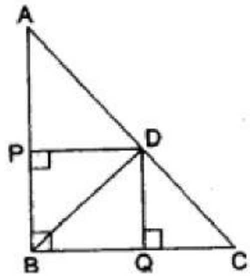
Section C

26. A train covers a distance of 90 km at a uniform speed. Had the speed been 15 km/hour more, it would have taken 30 minutes less for the journey. Find the original speed of the train. **[3]**

27. In a right triangle ABC, right-angled at B, D is point on hypotenuse such that $BD \perp AC$. If $DP \perp AB$ and $DQ \perp BC$ then prove that **[3]**

a. $DQ^2 = DP \cdot QC$

b. $DP^2 = DQ \cdot AP$.



28. The line segment joining the points P (3,3) and Q (6, - 6) is trisected at the points A and B such that A is nearer to P. If A also lies on the line given by 2x + y + k = 0, find the value of k. **[3]**

OR

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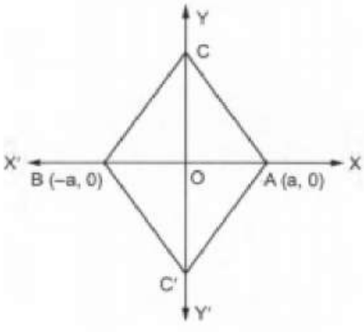
The base AB of two equilateral triangles ABC and ABC' with side 2a lies along the X-axis such that the mid-point of AB is at the origin. Find the coordinates of the vertices C and C' of the triangles.



29. If two positive integers p and q are written as $p = a^2b^3$ and $q = a^3 b$, a and b are a prime number then. **[3]**
Verify.LCM $\times$(p.q.) $\times$ HCF (p.q.) = pq

30. A peacock is sitting on the top of a tree.It observes a serpent on the ground making an angle of depression of 30^o. The peacock catches the serpent in 12 s with the speed of 300 m/min. What is the height of the tree? **[3]**

OR

From an aeroplane vertically above a straight horizontal road, the angles of depression of two consecutive mile stones on opposite sides of the aeroplane are observed to be α and β. Show that the height in miles of aeroplane above the road is given by $\frac{\tan\alpha\tan\beta}{\tan\alpha+\tan\beta}$.

31. Compute the mode of the following data: **[3]**

Class Interval	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50
Frequency	3	8	13	18	28	20	13	8	6	4

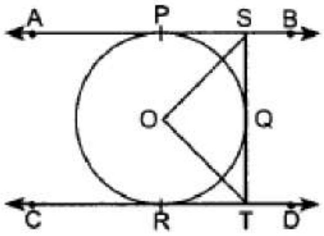
Section D

32. A fraction becomes $\frac{1}{3}$ if 1 is subtracted from both its numerator and denominator. If 1 is added to both the numerator and denominator, it becomes $\frac{1}{2}$. Find the fraction. **[5]**

OR

A person invested some amount at the rate of 12% simple interest and the remaining at 10%. He received yearly interest of ₹ 130 but if he had interchanged the amount invested, he would have received ₹ 4 more as the interest. How much money did he invest at different rates?

33. In figure AB and CD are two parallel tangents to a circle with centre O. ST is tangent segment between the two parallel tangents touching the circle at Q. Show that $\angle SOT = 90^o$ **[5]**



34. Find upto three places of decimal the radius of the circle whose area is the sum of the areas of two triangles whose sides are 35, 53, 66 and 33, 56, 65 measured in centimetres (Use π = 22/7). **[5]**

OR

Two circular beads of different sizes are joined together such that the distance between their centres is 14 cm. The sum of their areas is 130π cm^2. Find the radius each bead.

35. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting **[5]**

i. a king of red suit

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ii. a face card

iii. a red face card

iv. a queen of black suit

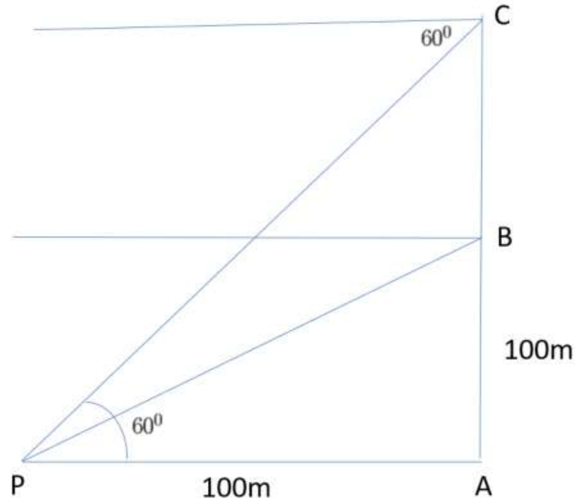
v. a jack of hearts

vi. a spade.

Section E

36. **Read the text carefully and answer the questions:** **[4]**

A hot air balloon is rising vertically from a point A on the ground which is at distance of 100m from a car parked at a point P on the ground. Amar, who is riding the balloon, observes that it took him 15 seconds to reach a point B which he estimated to be equal to the horizontal distance of his starting point from the car parked at P.



(i) Find the angle of depression from the balloon at a point B to the car at point P.

(ii) Find the speed of the balloon?

(iii) After certain time Amar observes that the angle of depression is 60°. Find the vertical distance travelled by the balloon during this time.

OR

Find the total time taken by the balloon to reach the point C from ground?

37. **Read the text carefully and answer the questions:** **[4]**

The students of a school decided to beautify the school on an annual day by fixing colourful flags on the straight passage of the school. They have 27 flags to be fixed at intervals of every 2 metre. The flags are stored at the position of the middlemost flag. Ruchi was given the responsibility of placing the flags. Ruchi kept her books where the flags were stored. She could carry only one flag at a time.

(i) How much distance did she cover in pacing 6 flags on either side of center point?

(ii) Represent above information in Arithmetic progression

(iii) How much distance did she cover in completing this job and returning to collect her books?

OR

What is the maximum distance she travelled carrying a flag?

38. **Read the text carefully and answer the questions:** **[4]**

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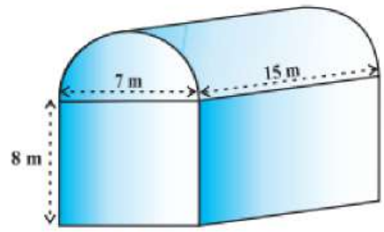
Shanta runs an industry in a shed which was in the shape of a cuboid surmounted by half cylinder. The dimensions of the base were 15 m × 7 m × 8 m.

The diameter of the half cylinder was 7 m and length was 15 m.



(i) Find the volume of the air that the shed can hold.

(ii) If the industry requires machinery which would occupy a total space of 300 m^3 and there are 20 workers each of whom would occupy 0.08 m^3 space on an average, how much air would be in the shed when it is working?

(iii) Find the surface area of the cuboidal part.

OR

Find the surface area of the cylindrical part.

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Solution

SAMPLE QUESTION PAPER (BASIC) - 10

Class 10 - Mathematics

Section A

1. **(c)** x = 16, y = 8

   Explanation: In ΔCDB, PQ$\|$DB [Given]

   $\therefore \frac{CP}{CD} = \frac{PQ}{BD}$ [Using Thales Theorem]

   $\Rightarrow \frac{11}{22} = \frac{8}{x} \Rightarrow x = \frac{8 \times 22}{11}$ = 16

   Again, In ΔABD, RS$\|$DB [Given]

   $\therefore \frac{AR}{AD} = \frac{RS}{BD}$ [Using Thales Theorem]

   $\Rightarrow \frac{3}{6} = \frac{y}{16}$

   $\Rightarrow y = \frac{3 \times 16}{6}$ = 8

   $\therefore$ x = 16, y = 8

2. **(d)** 3

   Explanation: A polynomial of degree 3 is called a cubic polynomial. A univariate cubic polynomial has the form $F(x) = a_3x^3 + a_2x^2 + a_1x + a_0$. An equation involving a cubic polynomial is called a cubic equation.

3. **(d)** 25 and 25

   Explanation: Let number of Rs 1 coins = x

   and number of Rs 2 coins = y

   Now, by given conditions:

   Total number of coins = x + y = 50 …(i)

   Also, Amount of money with her = (Number of Rs 1 $\times$ 1) + (Number of Rs 2 $\times$ coin 2)

   = x(1) + y(2) = 75

   = x + 2y = 75 …(ii)

   On subtracting Eq. (i) from Eq. (ii), we get

   (x + 2y) - (x + y) = (75 - 50)

   So, y = 25

   Putting y = 25 we get x = 25.

   Hence he has 25 one-rupee coins and 25 2-rupee coins.

4. **(a)** 24 and 11

   Explanation: let the numbers be x and y, then as per question

   x + y = 35............(1)

   x - y = 13.......... (2)

   Adding equation (1) & (2)

   2x = 48

   x = 24

   Substitute this value in eq (1) we get

   24 + y = 35

   y = 11

   Therefore the Numbers are 24 and 11

5. **(c)** x = 3, y = 4.

   Explanation: In triangles APQ and ATS,

   $\angle PAQ = \angle TAS$ [Vertically opposite angles] $\angle PQA = \angle ATS$ [Alternate angles]

   $\therefore \Delta APQ \sim \Delta AST$ [AA similarity]

   $\therefore \frac{AQ}{AT} = \frac{AP}{AS}$

   $\Rightarrow \frac{6}{6} = \frac{x}{3}$

   $\Rightarrow x = \frac{6 \times 3}{6}$ = 3

   And $\frac{AQ}{AT} = \frac{PQ}{ST}$

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$\Rightarrow \frac{6}{6} = \frac{y}{4}$

$\Rightarrow y = \frac{4\times6}{6}$ = 4

Therefore, x = 3, y = 4

6. **(b)** $\frac{3}{10}$

Explanation: Total numbers are $\Sigma x_i = 10$

x	f
3	1
5	2
7	3
9	4

Average = $\frac{3\times1+5\times2+7\times3+9\times4}{10}$

= $\frac{3+10+21+36}{10} = \frac{70}{10} = 7$

$\therefore$ m = 3

$\therefore$ Probability of average number = $\frac{3}{10}$

7. **(a)** $\sqrt{3}$

Explanation: Given: $\sin A = \frac{1}{2}$ ...(i)

And we know that, $\cot A = \frac{1}{\tan A} = \frac{\cos A}{\sin A}$ ...(ii)

We need to find the value of cos A.

$\cos A = \sqrt{1 - \sin^2 A}$ ...(iii)

Substituting eq. (i) in eq. (iii), we get

cos A = $\sqrt{\left(1 - \frac{1}{4}\right)}$

$= \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$

Substituting values of sin A and cos A in eq. (ii), we get

$\cot A = \frac{\sqrt{3}}{2} \times 2 = \sqrt{3}$

8. **(a)** 67.5

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

= 60 + $\frac{16-6}{2\times16-6-6} \times 15$

= 60 + $\frac{10}{32-12} \times 15$

= 60 + $\frac{10}{20} \times 15$

= 60 + 7.5

= 67.5

9. **(a)** 1 : 3

Explanation: Since BP$\|$CF,

Then, $\frac{AP}{PF} = \frac{AB}{BC}$ [Using Thales Theorem]

$\Rightarrow \frac{AP}{PF} = \frac{2}{6} = \frac{1}{3}$

Again, since DP$\|$ EF,

Then, $\frac{AP}{PF} = \frac{AD}{DE}$ [Using Thales Theorem]

$\Rightarrow \frac{AD}{DE} = \frac{1}{3}$

$\Rightarrow$ AD : DE = 1 : 3

10. **(d)** 338

Explanation: HCF (26, 169) = 13

We have to find the value for LCM (26, 169)

We know that the product of numbers is equal to the product of their HCF and LCM.

Therefore,

13(LCM) = 26(169)

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$LCM = \frac{26(169)}{13}$

LCM = 338

11. **(a)** -7

Explanation: One root of the equation $2x^2 + ax + 6 = 0$ is 2 i.e. it satisfies the equation

$2(2)^2 + 2a + 6=0$

$8 + 2a + 6=0$

$2a = -14$

$a = -7$

12. **(d)** (– 4, 2)

Explanation: $(x, y) = \{\frac{(-6+(-2))}{2}, \frac{(8+(-4))}{2}\}$

$= (\frac{-8}{2}, \frac{4}{2})$

$= (-4,2)$

13. **(c)** Mean

Explanation: Mode is the value with the maximum frequency. Thus, it can be determined from the graph.

Median is the middle value of the data. Thus, it can be determined from the graph.

Mean is the ratio of sum of all data values and the total number of values. Thus, it cannot be determined by graphically.

14. **(b)** 9

Explanation: $9(\sec^2 A - \tan^2 A)$

$= 9 \times 1$ $(\sec^2 A - \tan^2 A=1)$

$= 9$

15. **(d)** angle of depression

Explanation: The angle of depression is the angle between the horizontal and line of sight to an object when the object is below the horizontal level.

The angle of depression is formed when the observer is higher than the object he is looking at. It is the angle between the horizontal line and the line joining the observer 's eye and the object. It plays a very important role in determining the heights and distances.

16. **(b)** 120°

Explanation: Since OP is perpendicular to PT, then $\angle OPT = 90^\circ$

$\Rightarrow \angle OPQ + \angle QPT = 90^\circ$

$\Rightarrow \angle OPQ + 60^\circ = 90^\circ$

$\Rightarrow \angle OPQ = 30^\circ$

$\therefore \angle OPQ = \angle OQP = 30^\circ$ [Angles opposite to radii]

$\therefore \angle POQ = (180^\circ - (30^\circ + 30^\circ)) = 120^\circ$ [Angle sum property of a triangle]

$\therefore$ Reflex$\angle POQ = 360^\circ - 120^\circ = 240^\circ$

Now, since the degree measure of an arc of a circle is twice the angle subtended by it any point of the alternate segment of the circle with respect to the arc.

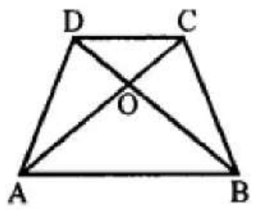
$\therefore$ Reflex$\angle POQ = 2\angle PRQ$

$\Rightarrow 240^\circ = 2\angle PRQ$

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

17. **(c)** trapezium

Explanation: Diagonals of a quadrilateral divide each other proportionally, then it is



In quadrilateral ABCD, diagonals AC and BD intersect each-other at O and $\frac{AO}{OC} = \frac{BO}{OD}$

Then, quadrilateral ABCD is a trapezium.

18. **(a)** 2p + q, 2p - q

Explanation: Given: $x^2 - 4px + 4p^2 - q^2 = 0$

$\Rightarrow (x - 2p)^2 - q^2 = 0$

Using $a^2 - b^2 = (a + b)(a - b)$,

$\Rightarrow (x - 2p + q)(x - 2p - q) = 0$

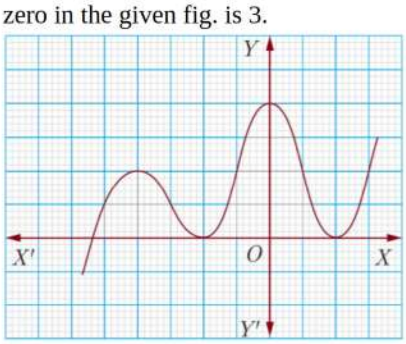
$\Rightarrow x - 2p + q = 0$ and $x - 2p - q = 0$

$\Rightarrow x = 2p - q$ and $x = 2p + q$

19. **(c)** A is true but R is false.

Explanation:

As the number of zeroes of polynomial f(x) is the number of points at which f(x) cuts (intersects) then x-axis and number of zero in the given fig. is 3.



So, A is correct but R is not correct.

20. **(d)** A is false but R is true.

Explanation: A is false but R is true.

Section B

21. $15x^2 - 10\sqrt{6}x + 10 = 0$.

$3x^2 - 2\sqrt{6}x + 2 = 0$

$3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$

$\sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$

$(\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$

$\therefore \quad x = \frac{\sqrt{2}}{\sqrt{3}}, \frac{\sqrt{2}}{\sqrt{3}}$

22. Let line x + y = 4 divides the line joining the points (- 1, 1) and (5, 7) at C(x,y) in the ratio k:1

By section formula,

$(x,y) = (\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n})$

$\therefore$ Coordinate of C are $\left(\frac{5k-1}{k+1}, \frac{7k+1}{k+1}\right)$ i.e. $x = \frac{5k-1}{k+1}$ and $y = \frac{7k+1}{k+1}$

$\because$ C lies on the line x + y = 4

$\Rightarrow \frac{5k-1}{k+1} + \frac{7k+1}{k+1} = 4$

$\Rightarrow \frac{5k-1+7k+1}{k+1} = 4$

$\Rightarrow \frac{12k}{k+1} = 4$

$\Rightarrow 12k = 4(k+1)$

$\Rightarrow 3k = k + 1$

$\Rightarrow 3k - k = 1$

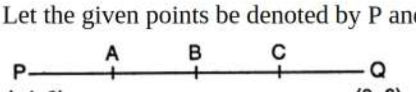
$\Rightarrow 2k = 1$

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

Hence, the ratio is 1: 2

OR

Let the given points be denoted by P and Q.



Co-ordinate of B(mid-point of PQ) are: $\left(\frac{-4+0}{2}, \frac{0+6}{2}\right)$ i.e. (–2, 3)

Co-ordinates of A (mid-point of PB) are: $\left(\frac{-4-2}{2}, \frac{0+3}{2}\right)$ i.e. $\left(-3, \frac{3}{2}\right)$

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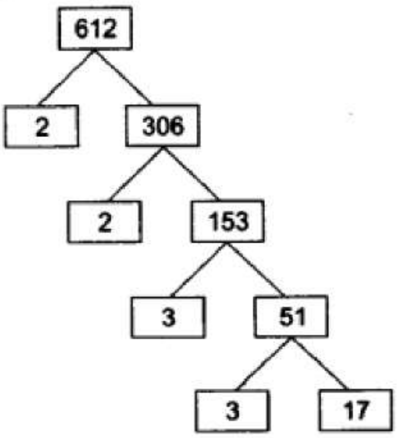
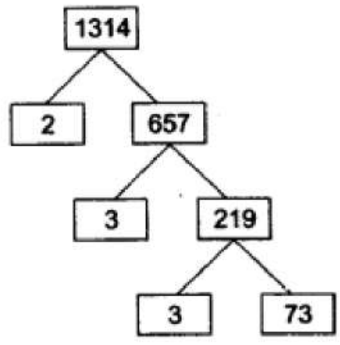
Co-ordinates of C (mid-point of BQ) are: $\left(\frac{-2+0}{2}, \frac{6+3}{2}\right)$ i.e. $\left(-1, \frac{9}{2}\right)$.

Hence, the co-ordinates of the required mid-points are $\left(-1, \frac{9}{2}\right)$, (–2, 3) and $\left(-3, \frac{3}{2}\right)$

23. We have, 612 and 1314





$\therefore \quad 612 = (2 \times 2 \times 3 \times 3 \times 17) = (2^2 \times 3^2 \times 17)$

and $1314 = (2 \times 3 \times 3 \times 73) = (2 \times 3^2 \times 73)$.

$\therefore$ HCF (612,1314) = product of common terms with lowest power

$= (2 \times 3^2) = (2 \times 9)$

HCF (612,1314) = 18

and LCM (612, 1314) = product of prime factors with highest power

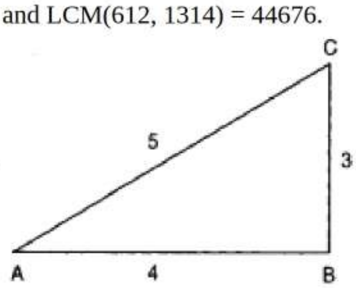
$= (2^2 \times 3^2 \times 17 \times 73) = (4 \times 9 \times 17 \times 73)$

LCM (612, 1314) = 44676.

Hence, HCF(612, 1314) = 18

and LCM(612, 1314) = 44676.

24.



We have, $AB = 4$ *and* $BC = 3$.

Using Pythagoras theorem,

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

$\Rightarrow \quad AC = \sqrt{AB^2 + BC^2}$

$\Rightarrow \quad AC = \sqrt{4^2 + 3^2} = \sqrt{25} = 5$

When we consider the t-ratios of $\angle A$, we have

$Base = AB = 4$, $perpendicular = BC = 3$ and, $Hypotenuse = AC = 5$.

$\therefore \quad \sin A = \frac{BC}{AC} = \frac{3}{5}, \cos A = \frac{AB}{AC} = \frac{4}{5}, \tan A = \frac{BC}{AB} = \frac{3}{4}$

$cosec A = \frac{AC}{BC} = \frac{5}{3}, \sec A = \frac{AC}{AB} = \frac{5}{4}$ and , $\cot A = \frac{AB}{BC} = \frac{4}{3}$

25. According to question it is given that In $\triangle ALM, LM \| CB$

$\therefore \quad \frac{AB}{AM} = \frac{AC}{AL}$

Therefore, by Thales' theorem

$\Rightarrow \frac{AM}{AB} = \frac{AL}{AC}$ ....(i)

In $\triangle ALN, LN \| CD$

$\therefore \quad \frac{AC}{AL} = \frac{AD}{AN}$

Therefore by Thales theorem

$\Rightarrow \frac{AL}{AC} = \frac{AN}{AD}$ ....(ii)

From (i) and (ii) we get

$\frac{AM}{AB} = \frac{AN}{AD}$

OR

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In $\triangle CAB$, $\angle A = \angle B$(Given)

$\therefore$ AC = CB (By isosceles triangle property)

But, AD = BE (Given).....(i)

$\Rightarrow$ AC- CD = CB - BE

$\therefore$ CD = CE ....(ii)

Dividing equation (ii) by (i),

$\frac{CD}{AD} = \frac{CE}{BE}$

By converse of BPT,

DE $\parallel$ AB.

$\therefore$ If $\angle A = \angle B$ and AD = BE then, DE $\parallel$ AB.

Section C

26. Let the original speed of the train be x km/hr.

We know that time taken to cover 'd' km with speed 's' km/h $= \frac{d}{s} \therefore$time taken to cover 90 km $= \frac{90}{x}$ hours

&, Time taken to cover 90 km when the speed is increased by 15 km/hr $= \frac{90}{x+15}$ hours

According to the question ;

$\frac{90}{x} - \frac{90}{x+15} = \frac{30}{60}$ (time reduced by 30 minutes with increased speed)

$\Rightarrow \frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$

$\Rightarrow \frac{90x+1350-90x}{x^2+15x} = \frac{1}{2}$

$\Rightarrow \frac{1350}{x^2+15x} = \frac{1}{2}$

$\Rightarrow 2700 = x^2 + 15x$

$\Rightarrow x^2 + 15x - 2700 = 0$

$\Rightarrow x^2 + 60x - 45x - 2700 = 0$

$\Rightarrow x(x + 60) - 45(x + 60) = 0$

$\Rightarrow (x + 60)(x - 45) = 0$

$\Rightarrow x + 60 = 0$ or $x - 45 = 0$

$\Rightarrow x = -60$ or $x = 45$

Since the speed cannot be negative, $x \neq -60$.

$\Rightarrow x = 45$

Thus, the original speed of the train is 45 km/hr.

27. We know that,

When the perpendicular is drawn from the vertex of a triangle on to the hypotenuse, then the triangles on both sides of the perpendicular are similar to each other and to the whole triangles.

a. In $\triangle DBC$

$\triangle DQB \sim \triangle DQC$

$\Rightarrow \frac{DQ}{QB} = \frac{QC}{DQ}$

$\Rightarrow DQ^2 = QB \cdot QC$

Since all the angles of PBQD are 90°,

PBQD is a rectangle.

$\Rightarrow$ QB = DP and PB = DQ ....(i)

$\Rightarrow DQ^2 = DP \cdot QC$

b. Similarly, since PD is a perpendicular on AB,

$\triangle APD \sim \triangle DPB$

$\Rightarrow \frac{DP}{PB} = \frac{AP}{DP}$

$\Rightarrow \frac{DP}{DQ} = \frac{AP}{DP}$ ....[using(i)]

$\Rightarrow DP^2 = DQ \cdot AP$

28. 

PQ is the line segment, A and B are the points of trisection of PQ.

We know that PA : QA = 1:2

So, the coordinates of A are

$\left(\frac{6\times1+3\times2}{2+1}, \frac{-6\times1+3\times2}{2+1}\right)$

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$= \frac{12}{3}, 0$

$= (4, 0)$

Since, A lies on the line

2x + y + k = 0

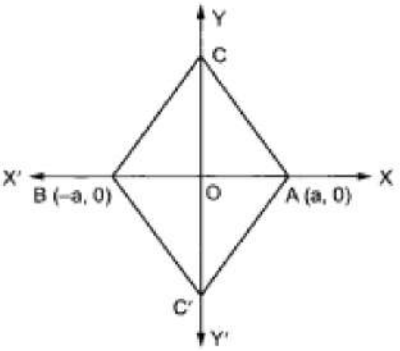
$\Rightarrow 2 \times 4 + 0 + k = 0$

$\Rightarrow 8 + k = 0$

$\Rightarrow k = -8$

OR

Since the mid-point of AB is at the origin O and AB = 2a.



$\therefore$ OA = OB = a.

Therefore, the coordinates of A and B are (a, 0) and (- a, 0) respectively.

Since triangles ABC and ABC' are equilateral. Therefore, their third vertices C and C' lie on the perpendicular bisector of base AB.

Clearly, Y'OY is the perpendicular bisector of AB.

Thus, C and C' lie on Y-axis.

Consequently, their x-coordinates are equal to zero.

In $\triangle$AOC, we have $OA^2 + OC^2 = AC^2$ [Using Pythagoras theorem]

$\Rightarrow a^2 + OC^2 = (2a)^2$ [$\because$ AB = AC = BC and AB = 2a $\therefore$ AC = 2a]

$\Rightarrow OC^2 = 4a^2 - a^2$

$\Rightarrow OC^2 = 3a^2$

$\Rightarrow OC = \sqrt{3}a$

Similarly, by applying Pythagoras theorem in $\triangle$AOC', we have,

OC' = $\sqrt{3}a$

Therefore, the coordinates of C and C are (0, $\sqrt{3}a$) and (0, - $\sqrt{3}a$) respectively.

29. Given, $p = a^2b^3$

and $q = a^3b$

HCF(p,q) = a^2b

LCM(p, q) = a^3b^3

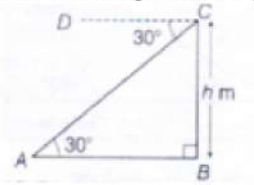
$pq = a^2b^3 \times a^3b = a^5b^4 -----------(1)$

$LCM(p,q) \times HCF(p,q) = a^3b^3 \times a^2b = a^5b^4 ----(2)$

$From\ equation\ (1)\ and\ (2)\ We\ get$

$LCM(p,q) \times HCF(p,q) = pq$

30. Let C be the position of peacock and A be the position of the serpent.



Given, $\angle DCA = 30^o$

$\Rightarrow \angle BAC = \angle DCA = 30^o$ [alternate angles]

$\because Distance = Speed \times time$

Speed = 300 m/min and time = 12 s = $\frac{12}{60}$ min

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$\therefore AC = 300 \times \frac{12}{60} = 60\ m$

In right angled $\triangle ABC$,

$\sin 30^o = \frac{P}{H} = \frac{BC}{AC} = \frac{H}{60}$

$\Rightarrow \frac{1}{2} = \frac{H}{60}$ [$\because \sin 30^o = \frac{1}{2}$]

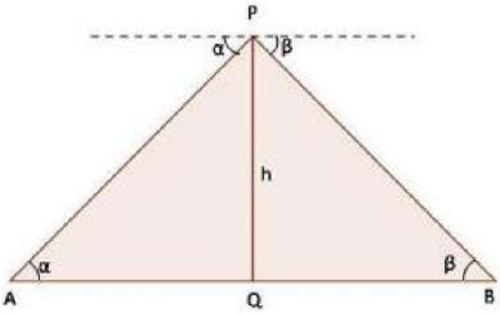
$\Rightarrow 2H = 60\ m$

$\Rightarrow H = \frac{60}{2}$

$\Rightarrow H = 30\ m$

Therefore, Height of the tree= 30 m.

OR



Let h be the height of aeroplane above the road and A and B be two consecutive milestone.

In $\Delta\ AQP\ and\ \triangle BQP$,

$\tan\alpha = \frac{h}{AQ}$ and $\tan\beta = \frac{h}{BQ}$

$\Rightarrow AQ = h\ \cot\alpha$ and $BQ = h\ \cot\beta$

$\Rightarrow AQ + BQ = h(\cot\alpha + \cot\beta)$

$AB = h\left(\frac{\tan\alpha+\tan\beta}{\tan\alpha\tan\beta}\right)$

As, given that AB = 1 mile

$\Rightarrow h = \frac{\tan\alpha\tan\beta}{\tan\alpha+\tan\beta}$

Hence proved.

31. The given series is converted from inclusive to exclusive form and on preparing the frequency table, we get

Class	Frequency
0.5 - 5.5	3
5.5 - 10.5	8
10.5 - 15.5	13
15.5 - 20.5	18
20.5 - 25.5	28
25.5 - 30.5	20
30.5 - 35.5	13
35. 5- 40.5	8
40.5 - 45.5	6
45.5 - 50.5	4

Clearly, the modal class is 20.5 - 25.5, as it has the maximum frequency.

Now, x_k (lower limit of modal class) = 20.5, h (length of interval of modal class) = 5, f_k (frequency of modal class) = 28, f_{k-1} (frequency of the class just preceding the modal class) = 18, f_{k+1} (frequency of the class just exceeding the modal class) = 20

Mode (M_o) is given by the formula ,

$M_o = x_k + \left\{h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})}\right\}$

$= 20.5 + \left[5 \times \frac{(28-18)}{(56-18-20)}\right]$

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$= 20.5 + \left[\frac{5 \times 10}{18}\right]$

= 20.5 + 2.78

= 23.28

Hence, mode = 23.28

Section D

32. Suppose the numerator and denominator of the fraction be x and y respectively.

Then the fraction is $\frac{x}{y}$.

If 1 is subtracted from both numerator and the denominator, the fraction becomes $\frac{1}{3}$.

Thus, we have $\frac{x-1}{y-1} = \frac{1}{3}$

$\Rightarrow 3(x-1) = (y-1)$

$\Rightarrow 3x - 3 = y - 1$

$\Rightarrow 3x - y - 2 = 0$

If 1 is added to both numerator and the denominator, the fraction becomes $\frac{1}{2}$.

Thus, we have $\frac{x+1}{y+1} = \frac{1}{2}$

$\Rightarrow 2(x+1) = (y+1)$

$\Rightarrow 2x + 2 = y + 1$

$\Rightarrow 2x - y + 1 = 0$

We have two equations

$3x - y - 2 = 0$

$2x - y + 1 = 0$

By using cross-multiplication, we have

$\frac{x}{(-1)\times 1-(-1)\times(-2)} = \frac{-y}{3\times 1-2\times(-2)} = \frac{1}{3\times(-1)-2\times(-1)}$

$\Rightarrow \frac{x}{-1-2} = \frac{-y}{3+4} = \frac{1}{-3+2}$

$\Rightarrow \frac{x}{-3} = \frac{-y}{7} = \frac{1}{-1}$

$\Rightarrow \frac{x}{3} = \frac{y}{7} = 1$

$\Rightarrow$ x = 3, y = 7

The fraction is $\frac{3}{7}$.

OR

Suppose that he invested ₹ x at the rate of 12% simple interest and ₹ y at the rate 10% simple interest.

Then, according to the question, $\frac{12x}{100} + \frac{10y}{100} = 130$

$\Rightarrow$ 12x+10y=13000 ....Dividing throughout by 2

$\Rightarrow$ 6x+5y=6500 ....(1)

and, $\frac{12y}{100} + \frac{10x}{100} = 134$

$\Rightarrow$ 12y+10x=13400

$\Rightarrow$ 6y+5x=6700 ....Dividing throughout by 2

$\Rightarrow$ 5x+6y=6700 ....(2)

Multiplying equation (1) by 6 and equation (2) by 5, we get

36x+30y=39000 ....(3)

25x+30y=33500 ....(4)

$\Rightarrow$subtracting (3) and (4) we get x = 500

Substituting this value of x in equation (1), we get 6(500)+5y=6500

$\Rightarrow$ 3000+5y=6500

$\Rightarrow$ 5y=6500-3000

$\Rightarrow$ 5y=3500

$\Rightarrow y = \frac{3500}{5} = 700$

So, the solution of the equation (1) and (2) is x=500 and y=700

Hence, he invested ₹ 500 at the rate of 12% simple interest and ₹ 700 at the rate of 10% simple interest.

verification.Substituting x=500, y=700,

We find that both the equation (1) and (2) are satisfied as shown below:

6x + 5y=6(500)+5(700)=3000+3500=6500

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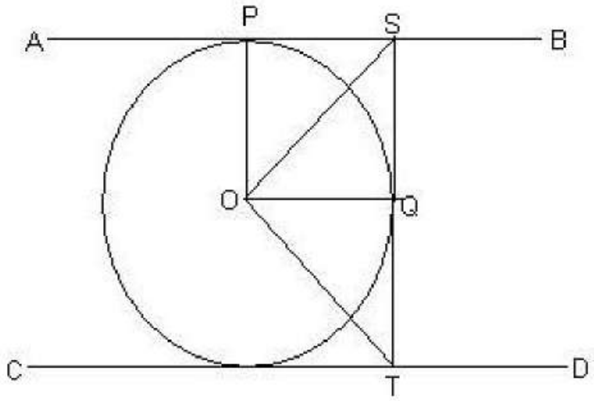
5x+6y=5(500)+6(700)=2500+4200=6700

This verifies the solution.

33. Given, AB and CD are two parallel tangents to a circle with centre O.



From the figure we get,

AB⊥ST then ∠ASQ = 90° and

CD⊥TS then ∠CTQ = 90°

∠ASO = ∠QSO = $\frac{90^\circ}{2}$= 45°

Similarly, ∠OTQ = 45°

Consider ΔSOT,

∠OTS = 45° and ∠OST = 45°

∠SOT + ∠OTS + ∠OST = 180° (angle sum property)

∠SOT = 180° - (∠OTS + ∠OST) = 180° - (45° +45°)

= 180° - 90° = 90°

∴ ∠SOT = 90^0

34. We have to find upto three places of decimal the radius of the circle whose area is the sum of the areas of two triangles whose sides are 35, 53, 66 and 33, 56, 65 measured in centimetres.

For the first triangle, we have a = 35, b = 53 and c = 66.

$\therefore \quad s=\frac{a+b+c}{2}=\frac{35+53+66}{2}=77 \mathrm{cm}$

Let Δ_1 be the area of the first triangle. Then,

$\Delta_1=\sqrt{s(s-a)(s-b)(s-c)}$

$\Rightarrow \quad \Delta_1=\sqrt{77(77-35)(77-53)(77-66)}=\sqrt{77 \times 42 \times 24 \times 11}$

$\Rightarrow \quad \Delta_1=\sqrt{7 \times 11 \times 7 \times 6 \times 6 \times 4 \times 11}=\sqrt{7^2 \times 11^2 \times 6^2 \times 2^2}=7 \times 11 \times 6 \times 2=924 \mathrm{cm}^2$ ...(i)

For the second triangle, we have a = 33,b = 56,c = 65

$\therefore \quad s=\frac{a+b+c}{2}=\frac{33+56+65}{2}=77 \mathrm{cm}$

Let Δ_2 be the area of the second triangle. Then,

$\Delta_2=\sqrt{s(s-a)(s-b)(s-c)}$

$\Rightarrow \quad \Delta_2=\sqrt{77(77-33)(77-56)(77-65)}$

$\Rightarrow \quad \Delta_2=\sqrt{77 \times 44 \times 21 \times 12}=\sqrt{7 \times 11 \times 4 \times 11 \times 3 \times 7 \times 3 \times 4}=\sqrt{7^2 \times 11^2 \times 4^2 \times 3^2}$

$\Rightarrow \quad \Delta_2=7 \times 11 \times 4 \times 3=924 \mathrm{cm}^2$

Let r be the radius of the circle. Then,

Area of the circle = Sum of the areas of two triangles

$\Rightarrow \quad \pi r^2=\Delta_1+\Delta_2$

$\Rightarrow \quad \pi r^2$ = 924 + 924

$\Rightarrow \quad \frac{22}{7} \times r^2=1848$

$\Rightarrow \quad r^2=1848 \times \frac{7}{22}=3 \times 4 \times 7 \times 7 \Rightarrow r=\sqrt{3 \times 2^2 \times 7^2}=2 \times 7 \times \sqrt{3}=14 \sqrt{3} \mathrm{cm}$

OR

Let the radii of the circles are r_1 cm and r_2 cm

$\therefore r_1+r_2$ = 14 ...(i)

And, sum of their areas = $\pi r_1^2+\pi r_2^2$

$130 \pi=\pi\left(r_1^2+r_2^2\right)$

or, $130 \pi=\pi\left(r_1^2+r_2^2\right)$

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$\therefore \quad r_1^2 + r_2^2 = 130$ ...(ii)

$(r_1 + r_2)^2 = r_1^2 + r_2^2 + 2r_1r_2$

or, $(14)^2 = 130 + 2r_1r_2$

or, $2r_1r_2$ = 196 -130

Or, $2r_1r_2$= 66

$(r_1 - r_2)^2 = r_1^2 + r_2^2 - 2r_1r_2$

$(r_1 - r_2)^2$= 130 - 66

$(r_1 - r_2)^2$= 64

or,$r_1 - r_2 = 8$ ...(iii)

From (i) and (iii), $2r_1 = 22$

or, $r_1 = 11$ cm

$r_2 = 14 - 11$

$r_2 = 3\ cm$.

35. In a pack of 52 cards, Total number of outcomes = 52

i. Let E_1 be the event of getting a king of red suit.

Number of favorable outcomes = 2

Then, P(getting a king of red suit) = $P(E_1) = \frac{\text{Number of outcomes favorable to } E_1}{\text{Number of all possible outcomes}} = \frac{2}{52} = \frac{1}{26}$

Thus, the probability of getting a king of red suit is $\frac{1}{26}$.

ii. Let E_2 be the event of getting a face card.

Number of favorable outcomes = 12

Then, P(getting a face card) = $P(E_2) = \frac{\text{Number of outcomes favorable to } E_2}{\text{Number of all possible outcomes}} = \frac{12}{52} = \frac{3}{13}$

Thus, the probability of getting a face card is $\frac{3}{13}$.

iii. Let E_3 be the event of getting red face card.

Number of favorable outcomes = 6

Then, P(getting a red face card) = $P(E_3) = \frac{\text{Number of outcomes favorable to } E_3}{\text{Number of all possible outcomes}} = \frac{6}{52} = \frac{3}{26}$

Thus, the probability of getting a red face card is $\frac{3}{26}$.

iv. Let E_4 be the event of getting a queen of black suit.

Number of favorable outcomes = 2

Then, P(getting a queen of black suit) = $P(E_4) = \frac{\text{Number of outcomes favorable to } E_4}{\text{Number of all possible outcomes}} = \frac{2}{52} = \frac{1}{26}$

Therefore, the probability of getting a queen of black suit is $\frac{1}{26}$.

v. Let E_5 be the event of getting a jack of hearts.

Number of favorable outcomes = 1

Then, P(getting a jack of hearts) = $P(E_5) = \frac{\text{Number of outcomes favorable to } E_5}{\text{Number of all possible outcomes}} = \frac{1}{52}$

Then, the probability of getting a jack of hearts is $\frac{1}{52}$.

vi. Let E_6 be the event of getting a spade.

Number of favorable outcomes = 13

Then, P(getting a spade) = $P(E_6) = \frac{\text{Number of outcomes favorable to } E_6}{\text{Number of all possible outcomes}} = \frac{13}{52} = \frac{1}{4}$

Therefore, the probability of getting a spade is $\frac{1}{4}$

Section E

36. **Read the text carefully and answer the questions:**

A hot air balloon is rising vertically from a point A on the ground which is at distance of 100m from a car parked at a point P on the ground. Amar, who is riding the balloon, observes that it took him 15 seconds to reach a point B which he estimated to be

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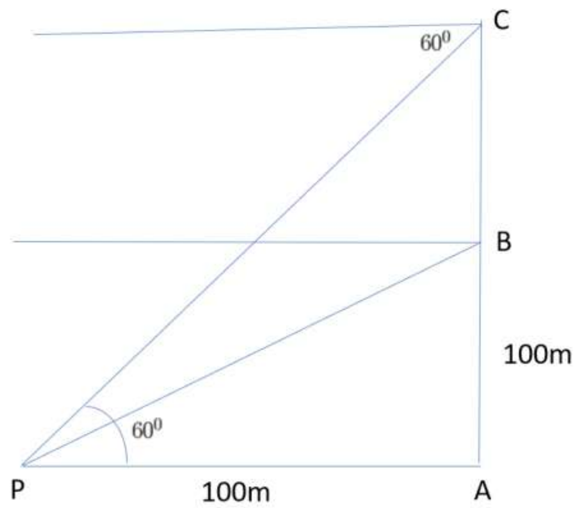
equal to the horizontal distance of his starting point from the car parked at P.



(i) The angle of depression from the balloon at a point B to the car at point P.

In △APB

tan B = $\frac{AB}{AP} = \frac{100}{100} = 1$

⇒ tan B = 1

⇒ tan B = tan 45^o

⇒ B = 45^o

(ii) The speed of the balloon is

Speed = $\frac{\text{Distance}}{\text{Time}}$

⇒ Speed = $\frac{100}{15} = \frac{25}{3}$ = 6.6 m/sec

(iii) The vertical distance travelled by the balloon when angle of depression is 60^o.

In △APC

Let BC = x

$\tan 60^\circ = \frac{AC}{AP} = \frac{AB+x}{100}$

$\Rightarrow \sqrt{3} = \frac{100+x}{100}$

$\Rightarrow 100\sqrt{3} - 100 = x$

⇒ x = $100(\sqrt{3} - 1)$

⇒ x = 73.21 m

OR

The total time taken by the balloon to reach the point C from ground.

Time = $\frac{Distance}{\text{Speed}}$

$\Rightarrow T = \frac{100(\sqrt{3}-1)}{\frac{25}{3}}$

$\Rightarrow T = 12(\sqrt{3} - 1)$ = 8.78 sec

37. **Read the text carefully and answer the questions:**

The students of a school decided to beautify the school on an annual day by fixing colourful flags on the straight passage of the school. They have 27 flags to be fixed at intervals of every 2 metre. The flags are stored at the position of the middlemost flag. Ruchi was given the responsibility of placing the flags. Ruchi kept her books where the flags were stored. She could carry only one flag at a time.

(i) Distance covered in placing 6 flags on either side of center point is 84 + 84 = 168 m

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

$\Rightarrow S_6 = \frac{6}{2}[2 \times 4 + (6 - 1) \times 4]$

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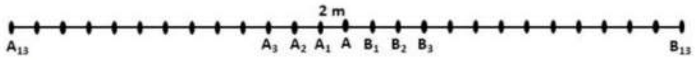
$\Rightarrow S_6 = 3[8 + 20]$

$\Rightarrow S_6 = 84$

(ii) 

Let A be the position of the middle-most flag.

Now, there are 13 flags (A_1, A_2 ... A_{12}) to the left of A and 13 flags (B_1, B_2, B_3 ... B_{13}) to the right of A.

Distance covered in fixing flag to $A_1 = 2 + 2 = 4$ m

Distance covered in fixing flag to $A_2 = 4 + 4 = 8$ m

Distance covered in fixing flag to $A_3 = 6 + 6 = 12$ m

...

Distance covered in fixing flag to $A_{13} = 26 + 26 = 52$ m

This forms an A.P. with,

First term, a = 4

Common difference, d = 4

and n = 13

(iii) $\because$ Distance covered in fixing 13 flags to the left of A = S_{13}

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

$\Rightarrow S_{13} = \frac{13}{2}[2 \times 4 + 12 \times 4]$

$= \frac{13}{2} \times [8 + 48]$

$= \frac{13}{2} \times 56$

= 364

Similarly, distance covered in fixing 13 flags to the right of A = 364

Total distance covered by Ruchi in completing the task

= 364 + 364 = 728 m

OR

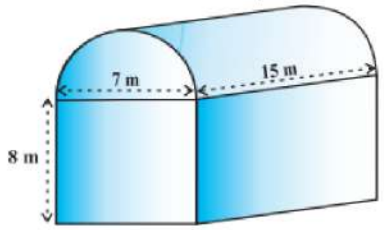
Maximum distance travelled by Ruchi in carrying a flag

= Distance from A_{13} to A or B_{13} to A = 26 m

38. **Read the text carefully and answer the questions:**

Shanta runs an industry in a shed which was in the shape of a cuboid surmounted by half cylinder. The dimensions of the base were 15 m × 7 m × 8 m.

The diameter of the half cylinder was 7 m and length was 15 m.



(i) Total volume = volume of cuboid + $\frac{1}{2}$ × volume of cylinder.

For cuboidal part we have

length = 15 m, breadth = 7 m and height = 8 m

$\therefore$ Volume of cuboidal part = $l \times b \times h = 15 \times 7 \times 8\text{m}^2 = 840\text{m}^3$

Clearly,

r = Radius of half-cylinder = $\frac{1}{2}$ (Width of the cuboid) = $\frac{7}{2}$m

and, h = Height (length) of half-cylinder = Length of cuboid = 15 m

$\therefore$ Volume of half-cylinder = $\frac{1}{2}\pi r^2 h = \frac{1}{2} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 15\text{m}^3 = \frac{1155}{4}\text{m}^3 = 288.75\text{m}^3$

Thus the volume of the air that the shed can hold = (840 + 288.75) m^3 = 1128.75 m^3

(ii) Total space occupied by 20 workers = $20 \times 0.08\text{m}^3$ = = 1.6 m^3

Total space occupied by the machinery = 300 m^3

$\therefore$ Volume of the air inside the shed when there are machine and workers inside it

= (1128.75 - 1.6 - 300) m^3

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= (1128.75 - 301.6) m^3 = 827.15 m^3

Hence, volume of air when there are machinery and workers is 827.15

(iii) Given for the cuboidal part

length L = 15 m, Width B = 7 m, Height = 8 m

Surface area of the cuboidal part

= 2(LB + BH + HL)

= 2(15 × 7 + 7 × 8 + 8 × 15)

= 2(105 + 56 + 120) = 2 × 281 = 562 m^2

OR

For the cylindrical part r = 3.5 cm and l = 15 m

Thus the surface area of the cylindrical part

$= \frac{1}{2}(2\pi rl) = 3.14 \times 3.5 \times 15$

= 164.85 m^2

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