SAMPLE PAPER TEST 5 FOR BOARD EXAM 2025

SUBJECT: MATHEMATICS
CLASS : X

MAX. MARKS : 80
DURATION : 3 HRS

General Instruction:

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 sub-parts 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

Questions 1 to 20 carry 1 mark each.

1. The LCM of smallest two-digit composite number and smallest composite number is:
(a) 12 (b) 4 (c) 20 (d) 44

2. When 2120 is expressed as the product of its prime factors we get
(a) $2 \times 5^3 \times 53$ (b) $2^3 \times 5 \times 53$ (c) $5 \times 7^2 \times 31$ (d) $5^2 \times 7 \times 33$

3. In the ΔABC, D and E are points on side AB and AC respectively such that DE || BC.
If AE = 2 cm, AD = 3 cm and BD = 4.5 cm, then CE equals
(a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm

4. The ratio in which x-axis divides the join of (2, -3) and (5, 6) is:
(a) 1: 2 (b) 3 : 4 (c) 1: 3 (d) 1: 5

5. The solution of the following pair of equation is:
$x - 3y = 2$, $3x - y = 14$
(a) x = 5, y = 1 (b) x = 2, y = 3 (c) x = 1, y = 2 (d) x = 1, y = 4

6. For the following distribution:

Class	0-5	6-11	12-17	18-23	24-29
Frequency	13	10	15	8	11

the upper limit of the median class is
(a) 18.5 (b) 20.5 (c) 25.5 (d) 17.5

7. The ratio of outer and inner perimeters of circular path is 23:22. If the path is 5 m wide, the diameter of the inner circle is
(a) 55 m (b) 110 m (c) 220 m (d) 230 m

8. In ΔABC, right angled at B, AB = 5 cm and sin C = 1/2. Determine the length of side AC.
(a) 10 cm (b) 15 cm (c) 20 cm (d) none of these

9. What is the positive real root of $64x^2 - 1 = 0$?
(a) 1/8 (b) 1/4 (c) 1/2 (d) 1/6

10. If cosec A = 13/12, then the value of $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$

(a) 4 (b) 5 (c) 6 (d) 3

11. If x = a cos θ and y = b sin θ, then the value of $b^2x^2 + a^2y^2$ is

(a) $a^2 + b^2$ (b) a^2/b^2 (c) a^2b^2 (d) None of these

12. ABCD is a trapezium with AD ∥ BC and AD = 4cm. If the diagonals AC and BD intersect each other at O such that AO/OC = DO/OB =1/2, then BC =

(a) 6cm (b) 7cm (c) 8cm (d) 9cm

13. Volumes of two spheres are in the ratio 64:27. The ratio of their surface areas is

(a) 3:4 (b) 4:3 (c) 9:16 (d) 16:9

14. A card is selected from a deck of 52 cards. The probability of being a red face card is

(a) 3/26 (b) 3/13 (c) 2/13 (d) 1/2

15. If two tangents inclined at an angle of 60^o are drawn to a circle of radius 3cm, then the length of each tangent is equal to

(a) $\frac{3\sqrt{3}}{2}$ cm (b) 3 cm (c) 6 cm (d) $3\sqrt{3}$

16. If the mean of a frequency distribution is 8.1 and $\sum f_i = 20$, $\sum f_i x_i = 132 + 5k$, then k =

(a) 3 (b) 4 (c) 5 (d) 6

17. If the radii of two circles are in the ratio of 4 : 3, then their areas are in the ratio of :

(a) 4 : 3 (b) 8 : 3 (c) 16 : 9 (d) 9 : 16

18. If one zero of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is

(a) 10 (b) –10 (c) 5 (d) –5

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

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

19. Assertion (A): The HCF of two numbers is 9 and their LCM is 2016. If the one number is 54, then the other number is 336.

Reason (R): Relation between numbers and their HCF and LCM is product of two numbers a, b = HCF (a, b) × LCM (a, b).

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

Reason (R): The y co-ordinate of the point on x-axis is zero.

SECTION – B

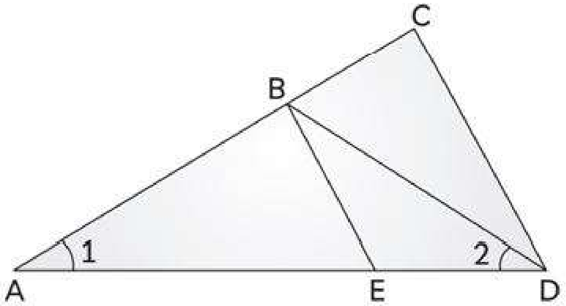
Questions 21 to 25 carry 2 marks each.

21. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

OR

A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find the area of that part of the field in which the horse can graze (use π = 3.14)

22. In the given figure below, AD/AE=AC/BD and ∠1=∠2. Show that Δ BAE~ ΔCAD .



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

24. For what value of k for which the following pair of linear equations have infinitely many solutions: 2x + 3y = 7, (k – 1)x + (k + 2)y = 3k is

25. Simplify: $\frac{\tan^2\theta}{1+\tan^2\theta}+\frac{\cot^2\theta}{1+\cot^2\theta}$

OR

If 7 $\sin^2$A + 3 $\cos^2$A = 4, then find tan A

SECTION – C

Questions 26 to 31 carry 3 marks each.

26. A part of monthly hostel charges in a college is fixed and the remaining depends on the number of days one has taken food in the mess. When a student 'A' takes food for 22 days, he has to pay Rs. 1380 as hostel charges; whereas a student 'B', who takes food for 28 days, pays Rs. 1680 as hostel charges. Find the fixed charges and the cost of food per day.

OR

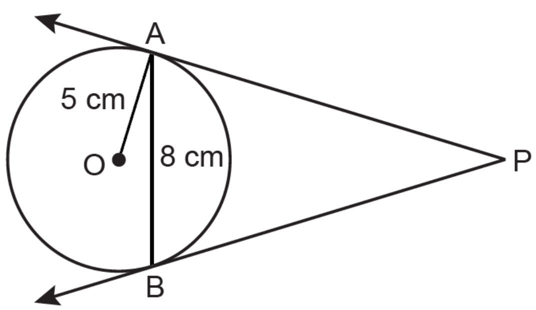
Meena went to a bank to withdraw Rs 2,000. She asked the cashier to give her Rs. 50 and Rs. 100 notes only. Meena got 25 notes in all. How many notes of Rs. 50 and Rs. 100 she received?

27. Prove that √5 is an irrational number.

28. Prove that: $\frac{\cos^2\theta}{1-\tan\theta}+\frac{\sin^2\theta}{1-\cot\theta}=1+\sin\theta\cos\theta$

29. If the zeroes of the polynomial x^2 + px + q are double in value to the zeroes of $2x^2$ – 5x – 3, then find the values of p and q

30. In the given figure, AB is a chord of length 8 cm of a circle of radius 5 cm. The tangents to the circle at A and B intersect at P. Find the length of AP.



OR

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

31. Two dice are thrown at the same time. What is the probability that the sum of the two numbers appearing on the top of the dice is (i) 7? (ii) 14? (iii) equal to 12?

SECTION – D

Questions 32 to 35 carry 5 marks each.

32. A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years.

Age (in years)	Number of policy holders
Below 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

33. Some students planned a picnic. The total budget for food was Rs. 2,000. But 5 students failed to attend the picnic and thus the cost of food for each member increased by Rs. 20. How many students attended the picnic and how much did each student pay for the food?

OR

A cottage industry produces a certain number of toys in a day. The cost of production of each toy (in rupees) was found to be 55 minus the number of toys produced in a day. On a particular day, the total cost of production was Rs. 750. Find out the number of toys produced on that day.

34. State and prove Basic Proportional Theorem.

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

OR

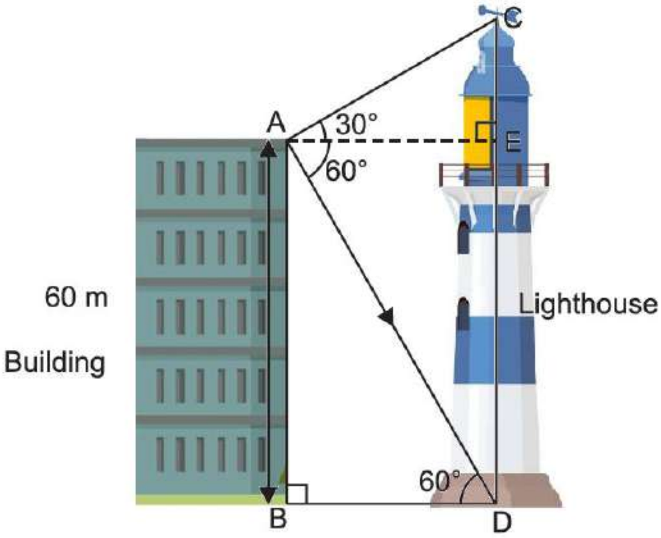
(b) A solid is in the shape of a cone surmounted on a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.

SECTION – E(Case Study Based Questions)

Questions 36 to 38 carry 4 marks each.

36. Case Study – 1

Ram is watching the top and bottom of a lighthouse from the top of the building. The angles of elevation and depression of the top and bottom of a lighthouse from the top of a 60 m high building are 30° and 60° respectively.



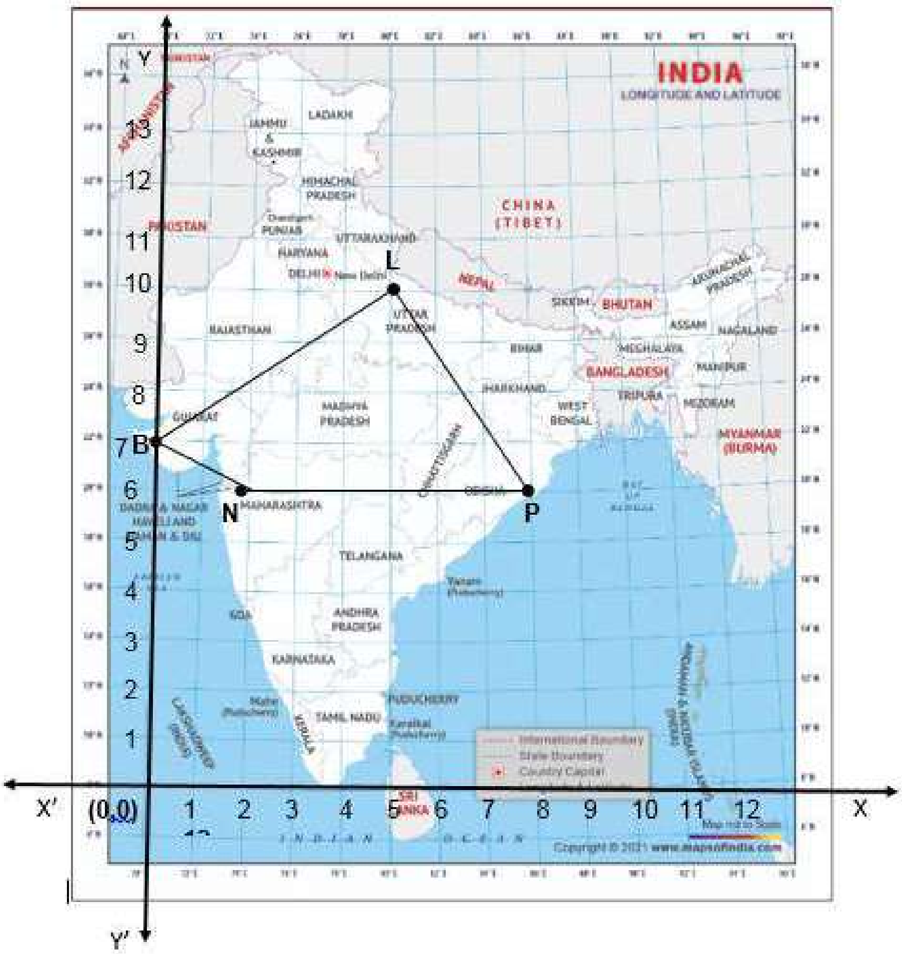
Find (i) the difference between the heights of the lighthouse and the building.
(ii) the distance between the lighthouse and the building.

OR

The ratio of the height of a light house and the length of its shadow on the ground is $\sqrt{3} : 1$ What is the angle of elevation?

37. Case Study – 2

In a GPS, The lines that run east-west are known as lines of latitude, and the lines running north-south are known as lines of longitude. The latitude and the longitude of a place are its coordinates and the distance formula is used to find the distance between two places. The distance between two parallel lines is approximately 150 km. A family from Uttar Pradesh planned a round trip from Lucknow (L) to Puri (P) via Bhuj (B) and Nashik (N) as shown in the given figure below.



Based on the above information answer the following questions using the coordinate geometry.
(i) Find the distance between Lucknow (L) to Bhuj(B).
(ii) If Kota (K), internally divide the line segment joining Lucknow (L) to Bhuj (B) into 3 : 2 then find the coordinate of Kota (K).
(iii) Name the type of triangle formed by the places Lucknow (L), Nashik (N) and Puri (P)

OR

Find a place (point) on the longitude (y-axis) which is equidistant from the points Lucknow (L) and Puri (P).

38. Case Study – 3

Saving money is a good habit and it should be inculcated in children from the beginning. A father brought a piggy bank for his son Aditya. He puts one five-rupee coin of his savings in the piggy bank on the first day. He increases his savings by one five-rupee coin daily.

(i) If the piggy bank can hold 190 coins of five rupees in all, find the number of days he can contribute to put the five-rupee coins into it
(ii) Find the total money he saved.

OR

If 6 times the 6th term of an A.P., is equal to 9 times the 9th term, find its 15th term.

SAMPLE PAPER TEST 5 FOR BOARD EXAM 2025
(ANSWERS)

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General Instruction:

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SECTION – A
Questions 1 to 20 carry 1 mark each.

1. The LCM of smallest two-digit composite number and smallest composite number is:
(a) 12 (b) 4 (c) 20 (d) 44
Ans: (c) 20
Smallest 2-digit number = 10 = 2 x 5
Smallest composite number = 4 = 2^2
LCM = 2^2 x 5 = 20

2. When 2120 is expressed as the product of its prime factors we get
(a) $2 \times 5^3 \times 53$ (b) $2^3 \times 5 \times 53$ (c) $5 \times 7^2 \times 31$ (d) $5^2 \times 7 \times 33$
Ans: (b) $2^3 \times 5 \times 53$

3. In the ΔABC, D and E are points on side AB and AC respectively such that DE || BC.
If AE = 2 cm, AD = 3 cm and BD = 4.5 cm, then CE equals
(a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm
Ans: (c) 3 cm

4. The ratio in which x-axis divides the join of (2, -3) and (5, 6) is:
(a) 1: 2 (b) 3 : 4 (c) 1: 3 (d) 1: 5
Ans: (a) 1 : 2
Let P(x, 0) be the point on x-axis which divides the join of (2, -3) and (5, 6) in the ratio k : 1.
∴ By section formula,

$$P(x, 0) = \left(\frac{5k+2}{k+1}, \frac{6k-3}{k+1}\right)$$

$$\Rightarrow y = 0 \Rightarrow \frac{6k-3}{k+1} = 0 \Rightarrow 6k - 3 = 0 \Rightarrow k = \frac{1}{2}$$

5. The solution of the following pair of equation is:
x – 3y = 2, 3x – y = 14
(a) x = 5, y = 1 (b) x = 2, y = 3 (c) x = 1, y = 2 (d) x = 1, y = 4
Ans: (a) x = 5, y = 1

Given, equations are x – 3y = 2 …(i)
and 3x – y = 14 …(ii)
Solving equations (i) and (ii), we get y = 1
x = 2 + 3y = 2 + 3 × 1 = 5
Hence, x = 5 and y = 1

6. For the following distribution:

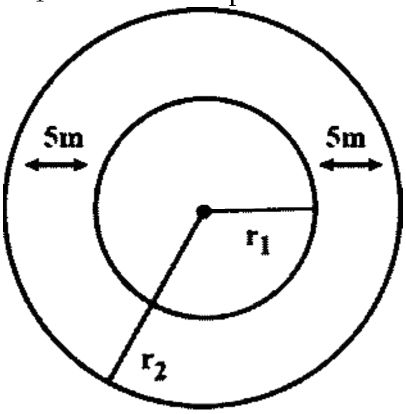
Class	0-5	6-11	12-17	18-23	24-29
Frequency	13	10	15	8	11

the upper limit of the median class is
(a) 18.5 (b) 20.5 (c) 25.5 (d) 17.5
Ans:

Class	**Frequency**	**Cf**
– 0.5 – 5.5	13	13
5.5 – 11.5	10	23
11.5 – 17.5	15	38
17.5 – 23.5	8	46
23.5 – 29.5	11	57

Here, n = 57 So, $\frac{n}{2} = 28.5$
The cumulative frequency, just greater than 28.5, is 38 which belongs to class 11.5 – 17.5.
So, the median class is 11.5 – 17.5 Its upper limit is 17.5

7. The ratio of outer and inner perimeters of circular path is 23:22. If the path is 5 m wide, the diameter of the inner circle is
(a) 55 m (b) 110 m (c) 220 m (d) 230 m
Ans: (c) 220 m
Let the radius of inner perimeter be r_1 and the outer perimeter be r_2



Now, $\frac{2r_2\pi}{2r_1\pi} = \frac{23}{22} \Rightarrow r_2 = \frac{23}{22}r_1$
According to the question, $r_2 - r_1 = 5$
$\Rightarrow \frac{23}{22}r_1 - r_1 = 5 \Rightarrow r_1 = 110 \;\&\; r_2 = 115$
∴ diameter of the inner circle = 2 x 110 = 220 m

8. In ΔABC, right angled at B, AB = 5 cm and sin C = 1/2. Determine the length of side AC.
(a) 10 cm (b) 15 cm (c) 20 cm (d) none of these
Ans: (a) 10 cm

9. What is the positive real root of $64x^2 - 1 = 0$?
(a) 1/8 (b) 1/4 (c) 1/2 (d) 1/6

Answer: (a) 1/8,−1/8

Given, $64x^2 - 1 = 0$

⇒ (8x + 1) (8x – 1) = 0

⇒ 8x = – 1, 8x = 1

⇒ x = 1/8,−1/8

Thus, positive root is 1/8

10. If cosec A = 13/12, then the value of $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$

(a) 4 (b) 5 (c) 6 (d) 3

Ans: (d) 3

Given cosec A = 13/12,

$\sin A = \frac{12}{13}, \cos A = \frac{5}{13}$

$$Now, \frac{2\sin A - 3\cos A}{4\sin A - 9\cos A} = \frac{2\left(\frac{12}{13}\right) - 3\left(\frac{5}{13}\right)}{4\left(\frac{12}{13}\right) - 9\left(\frac{5}{13}\right)} = \frac{24-15}{48-45} = \frac{9}{3} = 3$$

11. If x = a cos θ and y = b sin θ, then the value of $b^2x^2 + a^2y^2$ is

(a) $a^2 + b^2$ (b) a^2/b^2 (c) a^2b^2 (d) None of these

Ans: (c) a^2b^2

We have, $b^2x^2 + a^2y^2 = b^2 \times a^2\cos^2\theta + a^2 \times b^2\sin^2\theta$

$= a^2b^2 (\cos^2\theta + \sin^2\theta) = a^2b^2 \times 1 = a^2b^2$

12. ABCD is a trapezium with AD ∥ BC and AD = 4cm. If the diagonals AC and BD intersect each other at O such that AO/OC = DO/OB =1/2, then BC =

(a) 6cm (b) 7cm (c) 8cm (d) 9cm

Ans: (c) 8cm

13. Volumes of two spheres are in the ratio 64:27. The ratio of their surface areas is

(a) 3:4 (b) 4:3 (c) 9:16 (d) 16:9

Ans. (d) 16:9

14. A card is selected from a deck of 52 cards. The probability of being a red face card is

(a) 3/26 (b) 3/13 (c) 2/13 (d) 1/2

Ans: (a) 3/26

Total number of red face cards = 6

∴ Probability of being a red face card = 6/52 = 3/26

15. If two tangents inclined at an angle of 60^o are drawn to a circle of radius 3cm, then the length of each tangent is equal to

(a) $\frac{3\sqrt{3}}{2}$ cm (b) 3 cm (c) 6 cm (d) $3\sqrt{3}$

Ans: (d) $3\sqrt{3}$

16. If the mean of a frequency distribution is 8.1 and $\sum f_i = 20$, $\sum f_i x_i = 132 + 5k$, then k =

(a) 3 (b) 4 (c) 5 (d) 6

Ans: (d) 6

17. If the radii of two circles are in the ratio of 4 : 3, then their areas are in the ratio of :

(a) 4 : 3 (b) 8 : 3 (c) 16 : 9 (d) 9 : 16

Ans: (c) 16 : 9

18. If one zero of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is

(a) 10　　(b) –10　　(c) 5　　(d) –5

Ans: (b) –10

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

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

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

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

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

19. Assertion (A): The HCF of two numbers is 9 and their LCM is 2016. If the one number is 54, then the other number is 336.

Reason (R): Relation between numbers and their HCF and LCM is product of two numbers a, b = HCF (a, b) × LCM (a, b).

Ans: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

Let the other number be x.

$9 \times 2016 = 54 \times x$

$\Rightarrow x = 336$

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

Reason (R): The y co-ordinate of the point on x-axis is zero.

Ans: (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of Assertion (A)

The x co-ordinate of the point (0, 4) is zero and y co-ordinate of the point on x-axis is zero.

∴ Point (0, 4) lies on y-axis.

SECTION – B

Questions 21 to 25 carry 2 marks each.

21. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

Ans: Area swept by the minute hand in 5 minutes will be the area of a sector of 30^{o} in a circle of 14 cm radius.

Area of sector of angle $\theta = \dfrac{\theta}{360^0}\pi r^2$

Area of sector of 30° = $\dfrac{30^0}{360^0}\times\dfrac{22}{7}\times14\times14 = \dfrac{1}{12}\times\dfrac{22}{7}\times14\times14 = \dfrac{154}{3}$

= 51.33 cm²

Therefore, the area swept by the minute hand in 5 minutes is 51.33 cm²

OR

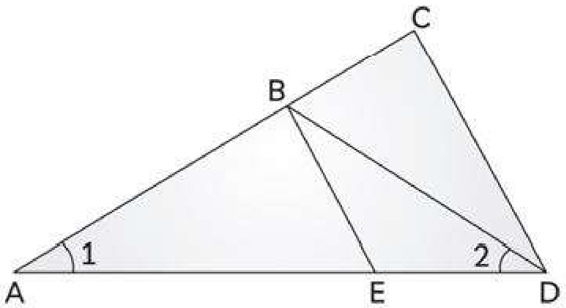
A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find the area of that part of the field in which the horse can graze (use $\pi = 3.14$)

Ans: Length of the rope = 5 m

Area of the field the horse can graze = Area of the sector with θ = 90° and r = 5

$= \theta/360° \times \pi r^2 = 90°/360° \times \pi r^2 = 1/4 \times \pi \times (5\text{ m})^2 = 25/4 \times 3.14\text{ m}^2 = 19.625\text{ m}^2$

22. In the given figure below, AD/AE=AC/BD and ∠1=∠2. Show that Δ BAE~ ΔCAD .



Ans: In ΔABC, ∠1 = ∠2

∴ AB = BD ………(i)

Given, $\frac{AD}{AE} = \frac{AC}{BD}$

Using equation (i), we get $\frac{AD}{AE} = \frac{AC}{AB}$ ……….(ii)

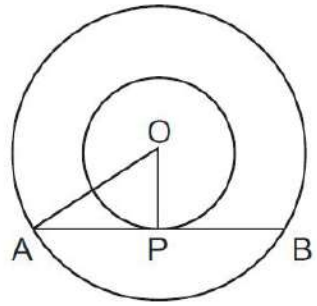
In ΔBAE and ΔCAD, by equation (ii), $\frac{AC}{AB} = \frac{AD}{AE}$

and ∠A= ∠A (common)

∴ ΔBAE ~ ΔCAD [By SAS similarity criterion]

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

Ans: Let O be the centre of the concentric circle of radii 5 cm and 3 cm respectively. Let AB be a chord of the larger circle touching the smaller circle at P



Then AP = PB and OP⊥AB

Applying Pythagoras theorem in △OPA, we have

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

$\Rightarrow AP^2 = 16 \Rightarrow AP = 4$ cm

∴ AB = 2AP = 8 cm

24. For what value of k for which the following pair of linear equations have infinitely many solutions: 2x + 3y = 7, (k – 1)x + (k + 2)y = 3k is

Ans: For a pair of linear equations to have infinitely many solutions, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\Rightarrow \frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k} \Rightarrow \frac{2}{k-1} = \frac{3}{k+2}$

Now, 2k + 4 = 3k – 3 ⇒ k = 7

and 9k = 7k + 14 ⇒ k = 7

Hence, the value of k is 7.

25. Simplify: $\frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^2\theta}{1+\cot^2\theta}$

Ans: $\dfrac{\tan^2\theta}{1+\tan^2\theta}+\dfrac{\cot^2\theta}{1+\cot^2\theta}=\dfrac{\tan^2\theta}{\sec^2\theta}+\dfrac{\cot^2\theta}{\cos ec^2\theta}$

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

OR

If 7 $\sin^2$A + 3 $\cos^2$A = 4, then find tan A

Ans: Given, 7$\sin^2$A + 3$\cos^2$A = 4

Dividing both sides by $\cos^2$A, we get

7 tan2A + 3 = 4 $\sec^2$A [∵ $\sec^2\theta = 1 + \tan^2\theta$]

⇒ 7 $\tan^2$A + 3 = 4(1 + $\tan^2$A)

⇒ 7 $\tan^2$A + 3 = 4 + 4 $\tan^2$A

⇒ 3$\tan^2$A = 1 ⇒ $\tan^2$A = 1/3 ⇒ tan A = 1/√3

SECTION – C

Questions 26 to 31 carry 3 marks each.

26. A part of monthly hostel charges in a college is fixed and the remaining depends on the number of days one has taken food in the mess. When a student 'A' takes food for 22 days, he has to pay Rs. 1380 as hostel charges; whereas a student 'B', who takes food for 28 days, pays Rs. 1680 as hostel charges. Find the fixed charges and the cost of food per day.

Ans: Let the fixed hostel charges be Rs. x and the cost of food per day be Rs. y.

According to the question, we get

x + 22y = 1380 ...(i)

and x + 28y = 1680 ...(ii)

Subtracting (i) from (ii), we get

6y = 300 ⇒ y = 300 ÷ 6 = 50

Putting y = 50 in (i), we get

x + 22(50) = 1380 ⇒ x + 1100 = 1380 ⇒ x = 280

∴ Fixed hostel charges = Rs. 280 and cost of the food per day = Rs. 50.

OR

Meena went to a bank to withdraw Rs 2,000. She asked the cashier to give her Rs. 50 and Rs. 100 notes only. Meena got 25 notes in all. How many notes of Rs. 50 and Rs. 100 she received?

Ans: Let Meena has received x no. of Rs. 50 notes and y no. of Rs. 100 notes.

So, 50x + 100y = 2000 ... (i)

x + y = 25 ... (ii)

Solving (i) and (ii), we get y = 15

Putting y = 15 in equation (ii), we get

x + 15 = 25

⇒ x = 10

Meena has received 10 pieces of Rs. 50 notes and 15 pieces of Rs. 100 notes.

27. Prove that √5 is an irrational number.

Ans: Let $\sqrt{5}$ is a rational number then we have $\sqrt{5}=\dfrac{p}{q}$, where p and q are co-primes.

$\Rightarrow p=\sqrt{5}q$

Squaring both sides, we get $p^2=5q^2$

⇒ p^2 is divisible by 5 ⇒ p is also divisible by 5

So, assume p = 5m where m is any integer.

Squaring both sides, we get $p^2 = 25m^2$

But $p^2=5q^2$

Therefore, $5q^2 = 25m^2$ ⇒ $q^2 = 5m^2$

⇒ q^2 is divisible by 5 ⇒ q is also divisible by 5

From above we conclude that p and q have one common factor i.e. 5 which contradicts that p and q are co-primes.
Therefore, our assumption is wrong.
Hence, $\sqrt{5}$ is an irrational number.

28. Prove that: $\frac{\cos^2\theta}{1-\tan\theta}+\frac{\sin^2\theta}{1-\cot\theta}=1+\sin\theta\cos\theta$

Ans: $LHS=\frac{\cos^2\theta}{1-\tan\theta}+\frac{\sin^2\theta}{1-\cot\theta}$

$=\frac{\cos^3\theta}{\cos\theta-\sin\theta}-\frac{\sin^3\theta}{\cos\theta-\sin\theta}$

$=\frac{\cos^3\theta-\sin^3\theta}{\cos\theta-\sin\theta}=\frac{(\cos\theta-\sin\theta)(\cos^2\theta+\sin^2\theta+\cos\theta\sin\theta)}{\cos\theta-\sin\theta}$

$=\cos^2\theta+\sin^2\theta+\cos\theta\sin\theta \quad =1+\sin\theta\cos\theta=RHS$

29. If the zeroes of the polynomial $x^2 + px + q$ are double in value to the zeroes of $2x^2 - 5x - 3$, then find the values of p and q

Ans:

Let α and β be the zeroes of $2x^2 - 5x - 3$.

$\therefore \ \alpha+\beta = \frac{5}{2}, \quad \alpha\beta = \frac{-3}{2}$

As per the question,

It is given that 2α, 2β are the zeroes of $x^2 + px + q$

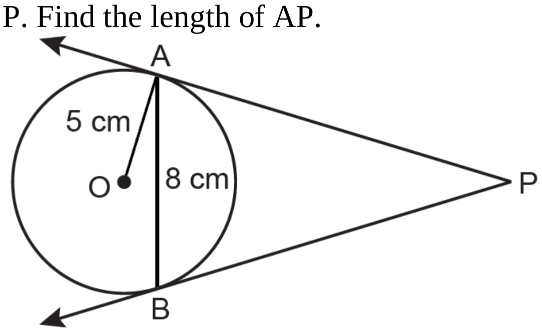
$\therefore \quad 2\alpha + 2\beta = -p$

$\Rightarrow \ 2(\alpha+\beta) = -p \ \Rightarrow \ 2\times\frac{5}{2} = -p \Rightarrow p = -5$

Also, $(2\alpha)(2\beta) = q \ \Rightarrow \ 4\alpha\beta = q$

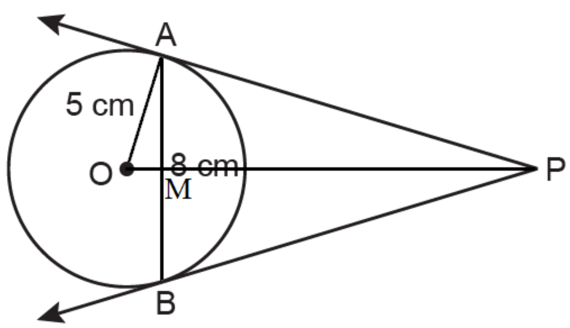
$\Rightarrow \ \alpha\beta = \frac{q}{4} \Rightarrow \frac{-3}{2}=\frac{q}{4} \ \Rightarrow q = -6$

30. In the given figure, AB is a chord of length 8 cm of a circle of radius 5 cm. The tangents to the circle at A and B intersect at P. Find the length of AP.



Ans: AB = 8 cm ⇒ AM = 4 cm

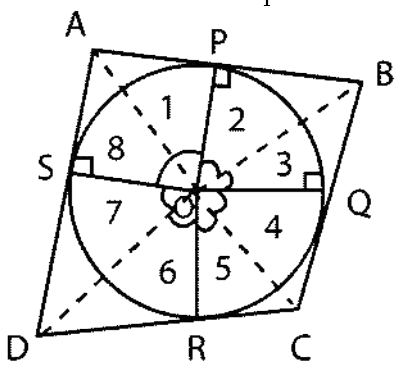
∴ OM = $\sqrt{(5^2 - 4^2)}$ = 3 cm



Let AP = y cm, PM = x cm
∴ ΔOPA is a right angle triangle
∴ $OP^2 = OA^2 + AP^2$
$(x + 3)^2 = y^2 + 25$
$\Rightarrow x^2 + 9 + 6x = y^2 + 25$ ...(i)
Also, $x^2 + 42 = y^2$ ...(ii)
$\Rightarrow x^2 + 6x + 9 = x^2 + 16 + 25$
$\Rightarrow 6x = 32$
$\Rightarrow x = 32/6 = 16/3$ cm
∴ $y^2 = x^2 + 16 = 256/9 + 16 = 400/9$
$\Rightarrow y = 20/3$ cm

OR

Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.
Ans: Let ABCD be the quadrilateral circumscribing a circle at the center O such that it touches the circle at the point P,Q,R,S. Let join the vertices of the quadrilateral ABCD to the center of the circle



In ΔOAP and ΔOAS
AP=AS (Tangents from to same point A)
PO=OS (Radii of the same circle)
OA=OA (Common side)
so, ΔOAP=ΔOAS (SSS congruence criterion)
∴ ∠POA=∠AOS (CPCT)
⇒ ∠1=∠8
Similarly, ∠2=∠3, ∠4=∠5 and ∠6=∠7
∠1+∠2 +∠3+∠4+∠5+∠6+∠7+∠8 = 360°
⇒ (∠1 +∠8) +(∠2 +∠3) + (∠4 +∠5) + (∠6 +∠7) = 360°
⇒ 2(∠1) + 2(∠2) + 2(∠5) + 2(∠6) = 360°
⇒ (∠1) + (∠2) + (∠5) + (∠6) = 180°
∴ ∠AOD + ∠COD=180°
Similarly, ∠BOC + ∠DOA = 180°

31. Two dice are thrown at the same time. What is the probability that the sum of the two numbers appearing on the top of the dice is (i) 7? (ii) 14? (iii) equal to 12?
Ans: (i) P(sum of the numbers is 7) = 6/36 = 1/6
(ii) P(sum of the numbers is 14) = 0/36 = 0
(iii) P(sum of the numbers is 12) = 1/36

SECTION – D

Questions 32 to 35 carry 5 marks each.

32. A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years.

Age (in years)	Number of policy holders
Below 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

Ans:

Age (in years)	Number of policy holders	cf
Below 20	2	2
20 – 25	4	6
25 – 30	18	24
30 – 35	21	45
35 – 40	33	78
40 – 45	11	89
45 – 50	3	92
50 – 55	6	98
55 – 60	2	100

Here, n = 100 ⇒ n/2 = 50, therefore median class is 35 – 40

So, l = 35, cf = 45, f = 33, h = 5

Now, $Median = l + \left(\frac{\frac{n}{2} - cf}{f} \times h \right) = 35 + \left(\frac{50 - 45}{33} \times 5 \right) = 35 + \left(\frac{5}{33} \times 5 \right)$

$= 35 + \frac{25}{33} = 35 + 0.76 = 35.76$

Hence, median age is 35.76 years

33. Some students planned a picnic. The total budget for food was Rs. 2,000. But 5 students failed to attend the picnic and thus the cost of food for each member increased by Rs. 20. How many students attended the picnic and how much did each student pay for the food?

Ans: Case I. Let number of students = x

and cost of food for each member = Rs. y

Then x × y = 2,000 ...(i)

Case II. New number of students = x – 5

New cost of food for each member = Rs. (y + 20)

Then (x – 5)(y + 20) = 2,000

⇒ xy + 20x – 5y – 100 = 2,000 ...(ii)

Solving (i) and (ii), we get x = –20, 25

x = –20 is rejected because number of students can't be negative.

So, x = 25 ⇒ y = 80

Number of students = 25

Cost of food for each student = Rs. 80.

OR

A cottage industry produces a certain number of toys in a day. The cost of production of each toy (in rupees) was found to be 55 minus the number of toys produced in a day. On a particular day, the total cost of production was Rs. 750. Find out the number of toys produced on that day.

Ans. Let us say the number of toys produced in a day is x.

Therefore, cost of production of each toy = Rs$(55 - x)$

Given the total cost of production of the toys = Rs 750
∴ $x(55 - x) = 750$
⇒ $x^2 - 55x + 750 = 0$
⇒ $x^2 - 25x - 30x + 750 = 0$
⇒ $x(x - 25) -30(x - 25) = 0$
⇒ $(x - 25)(x - 30) = 0$
Thus, either $x -25 = 0$ or $x - 30 = 0$
⇒ $x = 25$ or $x = 30$
Hence, the number of toys produced in a day will be either 25 or 30.

34. State and prove Basic Proportional Theorem.
Ans: Statement – 1 mark
Given, To Prove, Construction and Figure – 2 marks
Correct Proof – 2 marks

35. (a) Two cubes each of volume 125 cm^3 are joined end to end. Find the volume and the surface area of the resulting cuboid.
Ans. Volume of one cube = 125 cm^3
∴ side of the cube = 5 cm
Volume of the resulting cuboid = volume of 2 cubes = 250 cm^3
∴ Length of new cuboid 5 + 5 = 10 cm
Breadth of new cuboid = 5 cm
Height of new cuboid = 5 cm
Surface area of the resulting cuboid = 2 (lb + bh + hl)
= 2 (10 × 5 + 5 × 5 + 5 × 10)
=250 cm^2

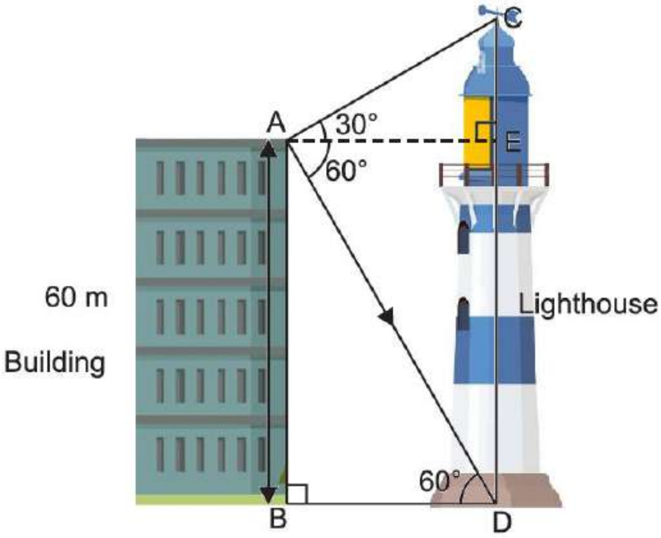
OR

(b) A solid is in the shape of a cone surmounted on a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.
Ans. Radius of hemisphere = radius of cone = 7/2 cm
Height of cone = 7/2 cm
Volume of the solid = Volume of hemisphere + Volume of cone
$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$
$= \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} (2 \times \frac{7}{2} + \frac{7}{2})$
$= \frac{539}{4}$ cm^3 or 134·75 cm^3

SECTION – E(Case Study Based Questions)

Questions 36 to 38 carry 4 marks each.

36. Case Study – 1
Ram is watching the top and bottom of a lighthouse from the top of the building. The angles of elevation and depression of the top and bottom of a lighthouse from the top of a 60 m high building are 30° and 60° respectively.



Find (i) the difference between the heights of the lighthouse and the building.
(ii) the distance between the lighthouse and the building.

OR

The ratio of the height of a light house and the length of its shadow on the ground is $\sqrt{3} : 1$ What is the angle of elevation?

Ans: In right ΔABD,

$$\tan 60^0 = \frac{AB}{BD} \Rightarrow \sqrt{3} = \frac{60}{BD} \Rightarrow BD = \frac{60}{\sqrt{3}} = 20\sqrt{3}m$$

∴ AE = $20\sqrt{3}$ m (∵ BD = AE)

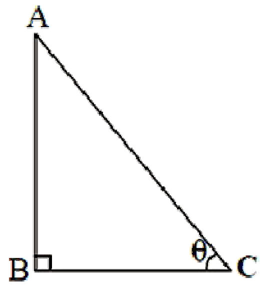
Now in right ΔAEC

$$\tan 30^0 = \frac{CE}{AE} \Rightarrow \frac{1}{\sqrt{3}} = \frac{CE}{20\sqrt{3}} \Rightarrow CE = 20m$$

(i) Difference between the heights of the lighthouse and the building = CE = 20 m
(ii) The distance between the lighthouse and the building = BD = $20\sqrt{3}$ m.

OR

Let AB be the light house, BC be its shadow and θ be the angle of elevation of the sun at that instant



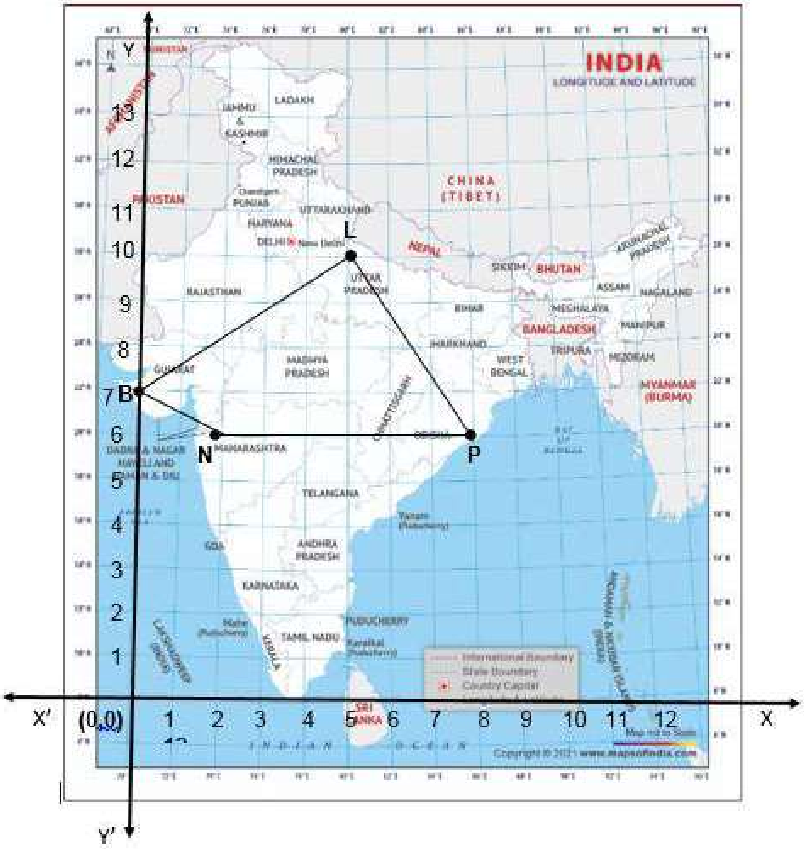
Then, in triangle ABC, we have, $\tan \theta = \frac{AB}{BC}$

$\tan \theta = \frac{\sqrt{3}}{1} = \tan 60^0 \Rightarrow \theta = 60°$

Hence, angle of elevation of the sun is 60°.

37. Case Study – 2

In a GPS, The lines that run east-west are known as lines of latitude, and the lines running north-south are known as lines of longitude. The latitude and the longitude of a place are its coordinates and the distance formula is used to find the distance between two places. The distance between two parallel lines is approximately 150 km. A family from Uttar Pradesh planned a round trip from Lucknow (L) to Puri (P) via Bhuj (B) and Nashik (N) as shown in the given figure below.



Based on the above information answer the following questions using the coordinate geometry.

(i) Find the distance between Lucknow (L) to Bhuj(B).

(ii) If Kota (K), internally divide the line segment joining Lucknow (L) to Bhuj (B) into 3 : 2 then find the coordinate of Kota (K).

(iii) Name the type of triangle formed by the places Lucknow (L), Nashik (N) and Puri (P)

OR

Find a place (point) on the longitude (y-axis) which is equidistant from the points Lucknow (L) and Puri (P).

(i)

$LB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \Rightarrow LB = \sqrt{(0 - 5)^2 + (7 - 10)^2}$

$LB = \sqrt{(5)^2 + (3)^2} \Rightarrow LB = \sqrt{25 + 9}$ $LB = \sqrt{34}$

(ii) Coordinates of Kota (K)= $\left(\frac{3\times0+2\times5}{3+2}, \frac{3\times7+2\times10}{3+2}\right) = \left(\frac{10}{5}, \frac{41}{5}\right) = \left(2, \frac{41}{5}\right)$

(iii) L(5, 10), N(2, 6), P(8, 6)

$LN = \sqrt{(2 - 5)^2 + (6 - 10)^2} = \sqrt{(3)^2 + (4)^2} = \sqrt{9 + 16} = \sqrt{25} = 5$

$NP = \sqrt{(8 - 2)^2 + (6 - 6)^2} = \sqrt{(4)^2 + (0)^2} = 4$

$PL = \sqrt{(8 - 5)^2 + (6 - 10)^2} = \sqrt{(3)^2 + (4)^2} \Rightarrow LB = \sqrt{9 + 16} = \sqrt{25} = 5$

as LN = PL ≠ NP, so Δ LNP is an isosceles triangle.

OR

Let A (0, b) be a point on the y – axis then AL = AP

$\Rightarrow \sqrt{(5 - 0)^2 + (10 - b)^2} = \sqrt{(8 - 0)^2 + (6 - b)^2}$

$\Rightarrow (5)^2 + (10 - b)^2 = (8)^2 + (6 - b)^2$

$\Rightarrow 25 + 100 - 20b + b^2 = 64 + 36 - 12b + b^2 \Rightarrow 8b = 25 \Rightarrow b = \frac{25}{8}$

So, the coordinate on y axis is $\left(0, \frac{25}{8}\right)$

38. Case Study – 3

Saving money is a good habit and it should be inculcated in children from the beginning. A father brought a piggy bank for his son Aditya. He puts one five-rupee coin of his savings in the piggy bank on the first day. He increases his savings by one five-rupee coin daily.

(i) If the piggy bank can hold 190 coins of five rupees in all, find the number of days he can contribute to put the five-rupee coins into it

(ii) Find the total money he saved.

OR

If 6 times the 6th term of an A.P., is equal to 9 times the 9th term, find its 15th term.

Ans: Child's savings day wise are 5, 10, 15, 20, 25, ... to n days

We can have at most 190 coins

i.e., 1 + 2 + 3 + 4 + 5 + ... to n term = 190

$\Rightarrow \frac{n}{2}[2\times1+(n-1)1]=190$

$\Rightarrow n(n + 1) = 380 \Rightarrow n^2 + n - 380 = 0$

$\Rightarrow (n + 20)(n-19) = 0 \Rightarrow (n + 20)(n - 19) = 0$

$\Rightarrow n = -20$ or $n = 19$

But number of coins cannot be negative

n = 19 (rejecting n = -20)

So, number of days = 19

Total money she saved = 5 + 10 + 15 + 20 + ...

= 5 + 10 + 15 + 20 + ... upto 19 terms

$=\frac{19}{2}[2\times5+(19-1)5]=\frac{19}{2}[10+90]=\frac{19}{2}[100]=19\times50=950$

OR

Let, the first term of A.P. be ‘a’ and its common difference be ‘d’

Given, $6a_6 = 9a_9$

$\Rightarrow 6(a + 5d) = 9(a + 8d)$

$\Rightarrow 6a + 30d = 9a + 72d$

$\Rightarrow -3a = 42d \quad \Rightarrow a = -14d$ …(i)

Then, 15th term i.e. $a_{15} = a + 14d = -14d + 14d$ [from (i)]

= 0

Hence, 15th term of A.P. is 0.