Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 15

Time: 3 Hours **Total Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A - E.
2. Section A has 18 multiple choice questions and 2 Assertion-Reason based questions 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 study based questions carrying 4 marks each with subparts of 1, 1, and 2 marks each, respectively.
7. All Questions are compulsory. However, an internal choice in 2 Question of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.

Section A

Section A consists of 20 questions of 1 mark each.

Choose the correct answers to the questions from the given options. [20]

1. Zero is a ___________
   A. rational number
   B. positive number
   C. negative number
   D. none of the above

2. On rationalizing the denominator of $\frac{1}{\sqrt{6}}$ we get
   A. 6
   B. $\sqrt{6}$
   C. $\frac{1}{6}$
   D. $\frac{\sqrt{6}}{6}$

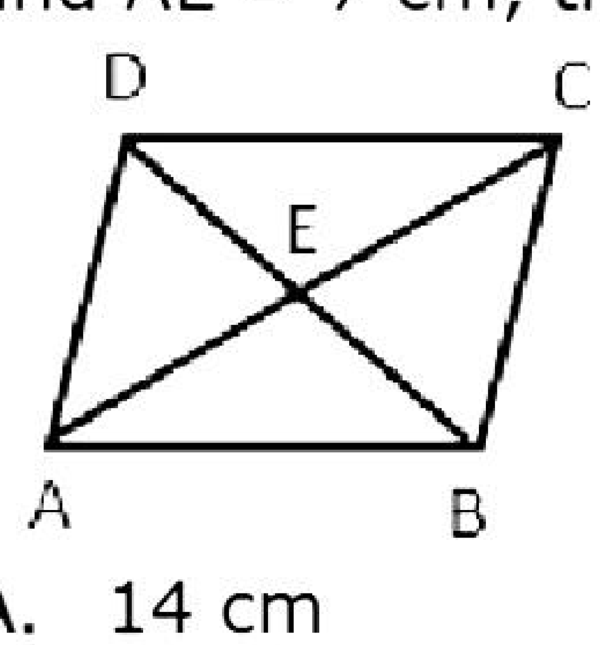
3. If the measures of the sides of a triangle is given by a, b and c, then we calculate the semi-perimeter by the formula
   A. $\frac{a+b+c}{2}$
   B. $\frac{a+b+c}{3}$
   C. $\frac{a+b+c}{4}$
   D. $2(a + b + c)$

4. The total surface area of a sphere is given by
   A. $5\pi r^2$
   B. $2\pi r^2$
   C. $4\pi r^2$
   D. $3\pi r^2$

5. Write the degree of the polynomial $5x^2$.
   A. 1
   B. 2
   C. 3
   D. 4

6. Write the coefficient of x in the polynomial $4x^3 + 6x^2 - 8$.
   A. 0
   B. 1
   C. 4
   D. 6

7. Let ABCD be a parallelogram. The diagonals bisect each other at E. If DE = 5 cm and AE = 7 cm, then find BD.



   A. 14 cm
   B. 10 cm
   C. 7 cm
   D. 5 cm

8. Which of the following is not a test of congruency of two triangles?
   A. ASA
   B. AAA
   C. SAS
   D. SSS

9. If two lines intersect, vertically opposite angles are ______
   A. equal
   B. supplementary
   C. complementary
   D. none of the above

10. The diagonal divides a parallelogram into two ______triangles.
   A. Right angled
   B. equilateral
   C. similar
   D. congruent

11. In a parallelogram opposite sides are _______
   A. parallel
   B. equal
   C. parallel and equal
   D. parallel but not equal

12. Two distinct lines can intersect each other in _____ point/points.
   A. 1
   B. 2
   C. 3
   D. 4

13. Sum of two linear pair of angles is
   A. 45°
   B. 90°
   C. 160°
   D. 180°

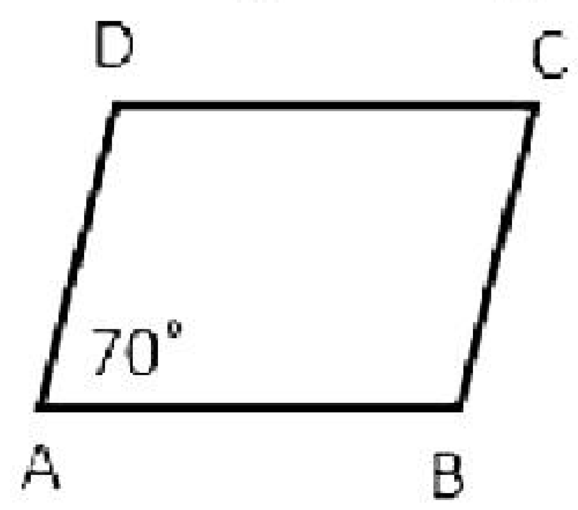
14. The sides opposite to equal angles of a triangle are ______.
   A. parallel
   B. perpendicular
   C. equal
   D. parallel and equal

15. Angles in the same segment of a circle are _______
   A. equal
   B. supplementary
   C. complementary
   D. not equal

16. ΔABC and ΔDEF are congruent, then…
   A. $\angle B = \angle E$
   B. $AC = DF$
   C. $BC = EF$
   D. all of the above

17. Equal _______ of a circle subtend equal angles at the centre.
   A. radii
   B. tangents
   C. chords
   D. secants

18. In the given figure, ABCD is a parallelogram in which $\angle A = 70°$. Calculate $\angle B$.



   A. 70°
   B. 100°
   C. 90°
   D. 110°

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

19. **Statement A (Assertion)**: ΔABC and ΔDEF are congruent, then $\angle A = \angle D$
   Statement R (Reason): Corresponding parts of congruent triangles are equal.
   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 and 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.

20. **Statement A (Assertion)**: In a circle, minor arc AXB subtends an angle of 45° at the centre of the circle, and 90° on the remaining part of the circle.
   Statement R (Reason): The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
   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 and 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.

Section B

Section B consists of 5 questions of 2 marks each.

21. If $x + \frac{1}{x} = 4$, find the values of $x^2 + \frac{1}{x^2}$ and $x^4 + \frac{1}{x^4}$. [2]

22. Factorise $\left(5a - \frac{1}{a}\right)^2 + 4\left(5a - \frac{1}{a}\right) + 4, a \neq 0.$ [2]

23. Simplify: $\frac{\sqrt{7} + \sqrt{6}}{\sqrt{7} - \sqrt{6}} + \frac{\sqrt{7} - \sqrt{6}}{\sqrt{7} + \sqrt{6}}$ [2]

24. Solve the equation for x: [2]

$2^{2x+1} = 17 \times 2^x - 2^3$

OR

Simplify: $\left(\frac{81}{16}\right)^{-3/4}\left[\left(\frac{25}{9}\right)^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right]$

25. Check whether (5, 0) and $\left(\frac{1}{2}, 2\right)$ is the solution of the linear equation 2x – 5y = 10 or not? [2]

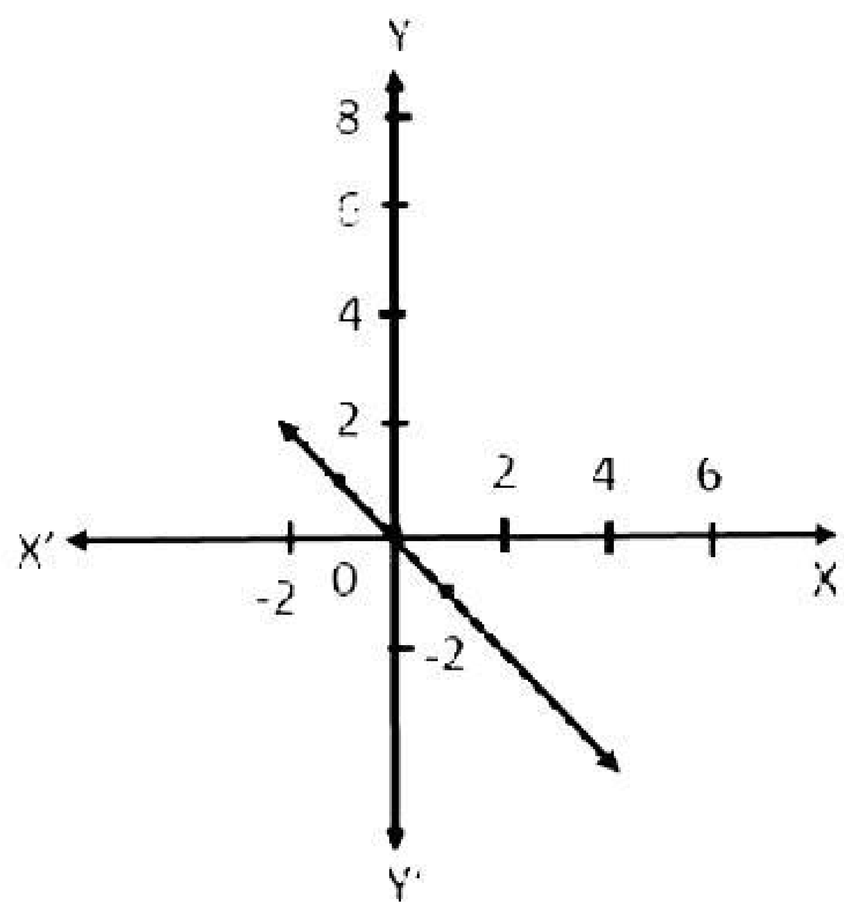
OR

Express the statement as a linear equation in two variables: The sum of a two-digit number and the number obtained by reversing the order of its digits is 121, if the digits in the units and tens place are x and y, respectively.

Section C
Section C consists of 6 questions of 3 marks each.

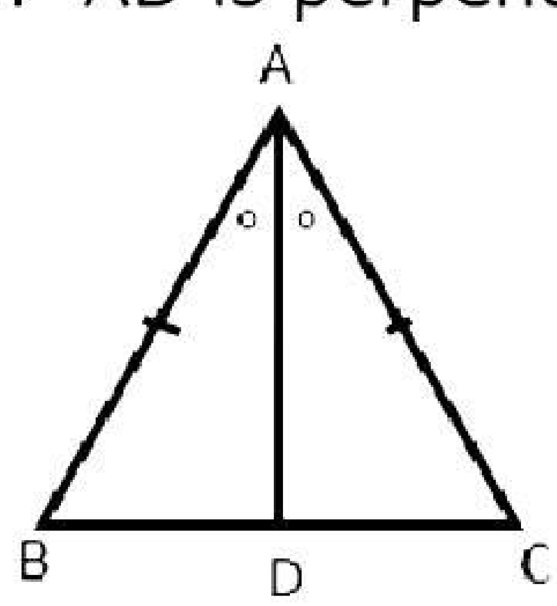
26. If h, c and V correspond to the height, curved surface and volume of a cone, prove that $3\pi Vh^3 - C^2h^2 + 9V^2 = 0$. [3]

27. For the graph below, three linear equations are given. Out of these, find the equation which represents the given graph. [3]



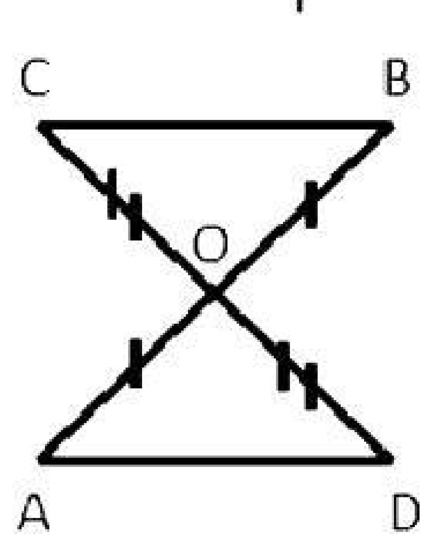
i. $y = x$
ii. $x + y = 0$
iii. $y = 2x$

28. In the given figure, AB = AC and AD is the bisector of ∠A. Prove that [3]
i. D is the mid-point of BC.
ii. AD is perpendicular to BC.



OR

In the given figure, OA = OB and OD = OC, prove that
i. ΔAOD ≅ ΔBOC
ii. AD is parallel to BC.



29. The weight distribution (in kg) of 100 people is given below. [3]

Weight in kg	Frequency
40-45	13
45-50	25
50-55	28
55-60	15
60-65	12
65-70	5
70-75	2

Construct a histogram for the above distribution.

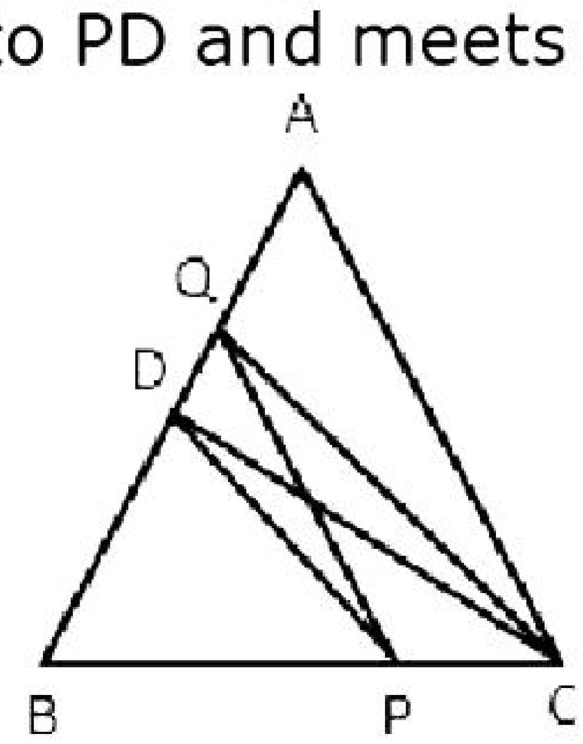
OR

The length of 40 leaves of a plant are measured correct to one millimeter, and the data obtained is represented in the following table:

Length (in mm)	Number of leaves
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

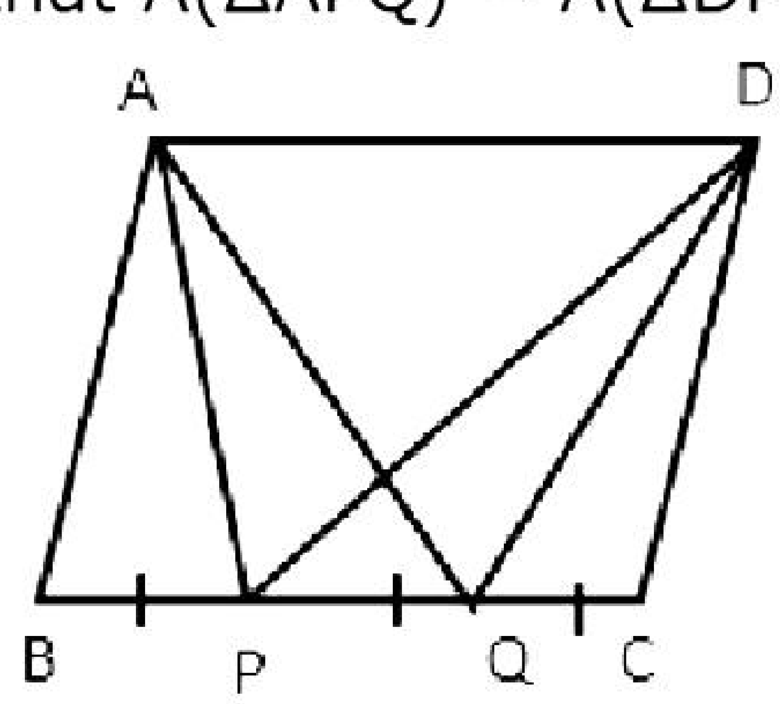
i. Draw a histogram to represent the given data.
ii. Is there any other suitable graphical representation for the same data?
iii. Is it correct to conclude that maximum leaves are 153 mm long? Why?

30. In the figure, D is the mid-point of AB and P is any point on BC. If CQ is parallel to PD and meets AB in Q, then prove that A(ΔBPQ) = ½ A(ΔABC). [3]



OR

In a parallelogram ABCD, points P and Q lie on the side BC and trisect it. Prove that A(ΔAPQ) = A(ΔDPQ) = 1/6 A(parallelogram ABCD).



31. The marks obtained by Kunal in his annual examinations are shown below: [3]

Subject	Hindi	English	Mathematics	Science	Social Studies
Marks	63	75	90	72	58

Draw a bar graph to represent the above data.

Section D

Section D consists of 4 questions of 5 marks each.

32. Use suitable identities to find the following products: [5]

i) $(x + 4)(x + 10)$

ii) $(x + 8)(x - 10)$

iii) $(3x + 4)(3x - 5)$

iv) $\left(y^2 + \frac{3}{2}\right)\left(y^2 - \frac{3}{2}\right)$

v) $(3 - 2x)(3 + 2x)$

OR

Expand each of the following, using suitable identities:

i) $(x + 2y + 4z)^2$

ii) $(2x - y + z)^2$

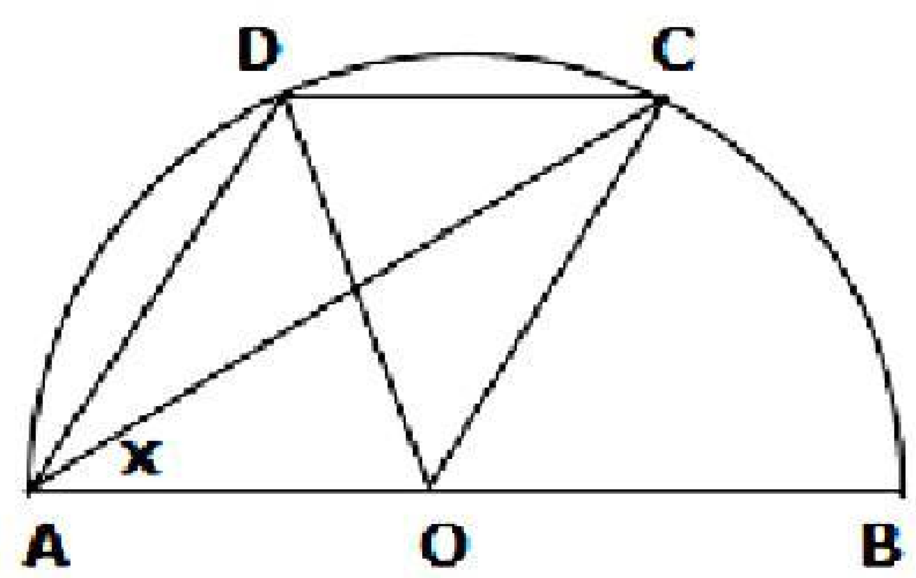
iii) $(-2x + 3y + 2z)^2$

iv) $(3a - 7b - c)^2$

v) $(-2x + 5y - 3z)^2$

33. If each diagonal of a quadrilateral separates it into two triangles of equal area, then show that the quadrilateral is a parallelogram. [5]

34. In the given figure, AOB is a diameter and DC is parallel to AB. If $\angle CAB = x$, then find (in terms of x) the values of $\angle COB$, $\angle DOC$, $\angle DAC$ and $\angle ADC$. [5]



OR

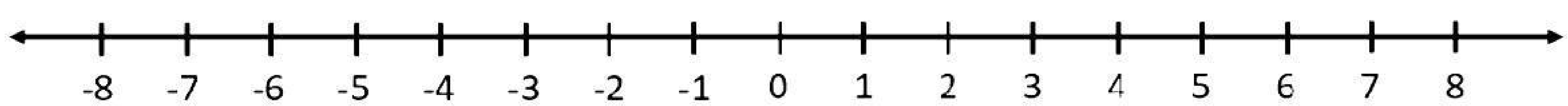
AB and CD are two chords on the same side of a circle. AB = 12 cm and CD = 24 cm. The distance between two parallel chords is 4 cm. Find the radius of the circle.

35. If two equal chords of a circle intersect within the circle, prove that the segments of one chord are equal to the corresponding segments of the other chord. [5]

Section E

Case study-based questions are compulsory.

36. Rohini’s teacher had decided to teach her students the number line in a fun and interactive way. She drew a number line on the floor and asked a student to stand on a particular number and follow the instructions given by her. Now using the given information, answer the following questions.



i. The teacher asks Rohini to take 3 steps to right, on doing so, she reaches number 6. What was the number on which Rohini stood before? [1]

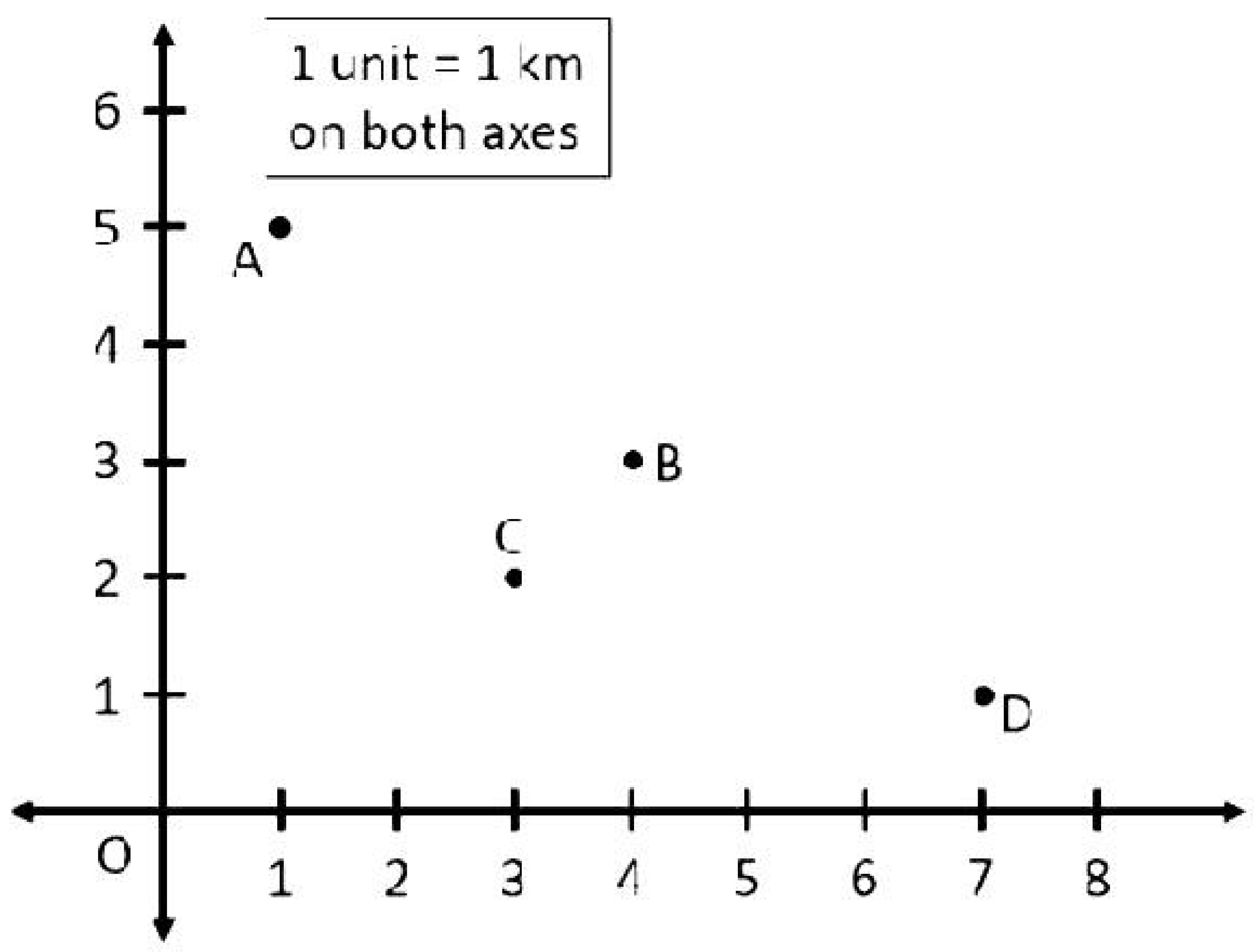
ii. Now Rohini is at 6, and teacher asks Rani to stand at −2. What will be the total steps between Rohini and Rani? [1]

iii. Now teacher asks Amey to stand between Rani and Rohini such that he is equal steps away from both of them. Find the position of Amey. [2]

OR

Now, Rani is standing at –1 and Atul is asked to stand at 4, what is the position of Atul with respect to Rani? [2]

37. Suhas runs a grocery store that offers home delivery of fresh groceries to his customers. His store is located at location A as indicated in the graph below. Now, he receives regular orders from the families living in the colonies located at B, C and D. Now, using the data given, answer the following questions.



i. Find the co-ordinates of point C. [1]

ii. Find the co-ordinates of point B. [1]

iii. Find the distance of the point farthest from the X-axis. [2]

OR

Find the distance of the point farthest from the Y-axis. [2]

38. Ajay has 'x' number of Rs. 10 notes and 'y' number of Rs. 20 notes. He went in a stationery shop to buy pencils that cost Rs. 2 each, pens worth Rs. 10 each, and erasers worth Rs. 5 each. Now using the details given, answer the following questions.

i. Find the total amount with Ajay. [1]

ii. If Ajay buys 5 pencils using Rs. 10 notes, then what will be the number of 10 rupee notes left with him? [1]

iii. If Ajay buys 2 pens using Rs. 10 notes, then what will be the number of 20 rupee notes left with him? [2]

OR

If Ajay decides to spend all his money on erasers, then the total number of erasers that he can buy will be given by. [2]

Solution

Section A

1. Correct option: A
Explanation:
0 can be expressed as $\frac{0}{4}, \frac{0}{34}$
($\frac{p}{q}$ form, where p and q are integers and $q \neq 0$).

2. Correct option: D
Explanation:
$$\frac{1}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{6}}{6}$$

3. Correct option: A
Explanation:
Semi-perimeter is given by $\frac{a+b+c}{2}$.

4. Correct option: C
Explanation:
The total surface area of a sphere is given by $4\pi r^2$.

5. Correct option: B
Explanation:
The degree of a polynomial is the highest sum of the exponents of the variable in any single term of the polynomial. Here, the exponent of x is 2. Hence, the degree is 2.

6. Correct option: A
Explanation:
Given polynomial is $4x^3 + 6x^2 - 8$. It can be written as $4x^3 + 6x^2 + 0x - 8$.
Hence, the coefficient of x is 0.

7. Correct option: B
Explanation:
DE = 5 cm and AE = 7 cm
$\therefore$ BD = 2DE = 2 × 5 = 10 cm (∵ E is the mid-point of BD)

OR

$$\left(\frac{a}{2}-\frac{b}{3}\right)^3=\left(\frac{a}{2}\right)^3-\left(\frac{b}{3}\right)^3-3\times\frac{a}{2}\times\frac{b}{3}\left(\frac{a}{2}-\frac{b}{3}\right)$$

$$=\frac{a^3}{8}-\frac{b^3}{27}-\frac{ab}{2}\left(\frac{a}{2}-\frac{b}{3}\right)$$

$$=\frac{a^3}{8}-\frac{b^3}{27}-\frac{a^2b}{4}+\frac{ab^2}{6}$$

Section B

21.

$$x + \frac{1}{x} = 4$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = 4^2$$

$$\Rightarrow x^2 + 2 \times x \times \frac{1}{x} + \frac{1}{x^2} = 16$$

$$\Rightarrow x^2 + 2 + \frac{1}{x^2} = 16$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 14$$

$$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = 14^2$$

$$\Rightarrow x^4 + 2x^2 \times \frac{1}{x^2} + \frac{1}{x^4} = 196$$

$$\Rightarrow x^4 + \frac{1}{x^4} = 194$$

22.

$$\left(5a - \frac{1}{a}\right)^2 + 4\left(5a - \frac{1}{a}\right) + 4, a \neq 0$$

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

$$= \left[\left(5a - \frac{1}{a}\right) + 2\right]^2$$

23.

$$\frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}-\sqrt{6}} + \frac{\sqrt{7}-\sqrt{6}}{\sqrt{7}+\sqrt{6}} = \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}-\sqrt{6}} \times \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}+\sqrt{6}} + \frac{\sqrt{7}-\sqrt{6}}{\sqrt{7}+\sqrt{6}} \times \frac{\sqrt{7}-\sqrt{6}}{\sqrt{7}-\sqrt{6}}$$

$$= \frac{\left(\sqrt{7}+\sqrt{6}\right)^2 + \left(\sqrt{7}-\sqrt{6}\right)^2}{\left(\sqrt{7}+\sqrt{6}\right)\left(\sqrt{7}-\sqrt{6}\right)}$$

$$= \frac{7+6+2\times\sqrt{7}\times\sqrt{6}+7+6-2\times\sqrt{7}\times\sqrt{6}}{7-6}$$

$= 13 + 13$

$= 26$

24.

$2^{2x+1} = 17 \times 2^x - 2^3$

$\Rightarrow 2 \times 2^{2x} = 17 \times 2^x - 2^3$

$\Rightarrow 2 \times \left(2^x\right)^2 = 17 \times 2^x - 2^3$

Put $2^x = y$

$2y^2 = 17y - 8$

$\Rightarrow 2y^2 - 17y + 8 = 0$

$\Rightarrow 2y^2 - 16y - y + 8 = 0$

$\Rightarrow 2y(y - 8) - (y - 8) = 0$

$\Rightarrow (y - 8)(2y - 1) = 0$

$\Rightarrow y - 8 = 0$ or $2y - 1 = 0$

$\Rightarrow y = 8$ or $y = \frac{1}{2}$

Now, $2^x = 8$ or $2^x = \frac{1}{2}$

$\Rightarrow 2^x = 2^3$ or $2^x = 2^{-1}$

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

OR

$$\left(\frac{81}{16}\right)^{-3/4}\left[\left(\frac{25}{9}\right)^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right] = \left(\frac{3^4}{2^4}\right)^{-3/4}\left[\left(\frac{5^2}{3^2}\right)^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right]$$

$$= \left[\left(\frac{3}{2}\right)^4\right]^{-3/4}\left[\left[\left(\frac{5}{3}\right)^2\right]^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right]$$

$$= \left[\frac{3}{2}\right]^{4\times -3/4}\left[\left[\frac{5}{3}\right]^{2\times -3/2} \div \left(\frac{5}{2}\right)^{-3}\right]$$

$$= \left[\frac{3}{2}\right]^{-3}\left[\left[\frac{5}{3}\right]^{-3} \div \left(\frac{5}{2}\right)^{-3}\right]$$

$$= \left[\frac{2}{3}\right]^{3}\left[\left[\frac{3}{5}\right]^{3} \div \left(\frac{2}{5}\right)^{3}\right]$$

$$= \frac{2^3}{3^3}\left[\frac{3^3}{5^3} \div \frac{2^3}{5^3}\right]$$

$$= \frac{2^3}{3^3}\left[\frac{3^3}{5^3} \times \frac{5^3}{2^3}\right]$$

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

$$= 1$$

25. The given linear equation is $2x - 5y = 10$.

To check whether (5, 0) is the solution of the given linear equation, substitute (5, 0) in equation.

So, we have

LHS $= 2x - 5y$

$= 2(5) - 5(0)$

$= 10$

$=$ RHS

Hence, (5, 0) is the solution of the given linear equation.

To check whether $\left(\frac{1}{2}, 2\right)$ is the solution of the given linear equation, substitute $\left(\frac{1}{2}, 2\right)$ in equation.

So, we have

LHS $= 2x - 5y$

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

$= 1 - 10$

$= -9$

$\neq$ RHS

Hence, $\left(\frac{1}{2}, 2\right)$ is not a solution of the given linear equation.

OR

Given that x is at the units place and y is at the tens place.

Hence, the two-digit number = $10y + x$

By reversing the order of digits, the number = $10x + y$

Now, $10x + y + 10y + x = 121$

$\therefore 11x + 11y = 121$

$\therefore 11(x + y) = 121$

$\therefore x + y = 11$

$\therefore x + y - 11 = 0$ is the required linear equation.

Section C

26. Let r and l denote, respectively, the radius of the base and the slant height of the cone.

Now, $l = \sqrt{r^2 + h^2}$, $V = \frac{1}{3}\pi r^2 h$, $C = \pi rl$

$3\pi Vh^3 - C^2h^2 + 9V^2$

$= 3\pi \times \frac{1}{3}\pi r^2 h \times h^3 - (\pi rl)^2 h^2 + 9 \times \left(\frac{1}{3}\pi r^2 h\right)^2$

$= \pi^2 r^2 h^4 - \pi^2 r^2 l^2 h^2 + \pi^2 r^4 h^2$

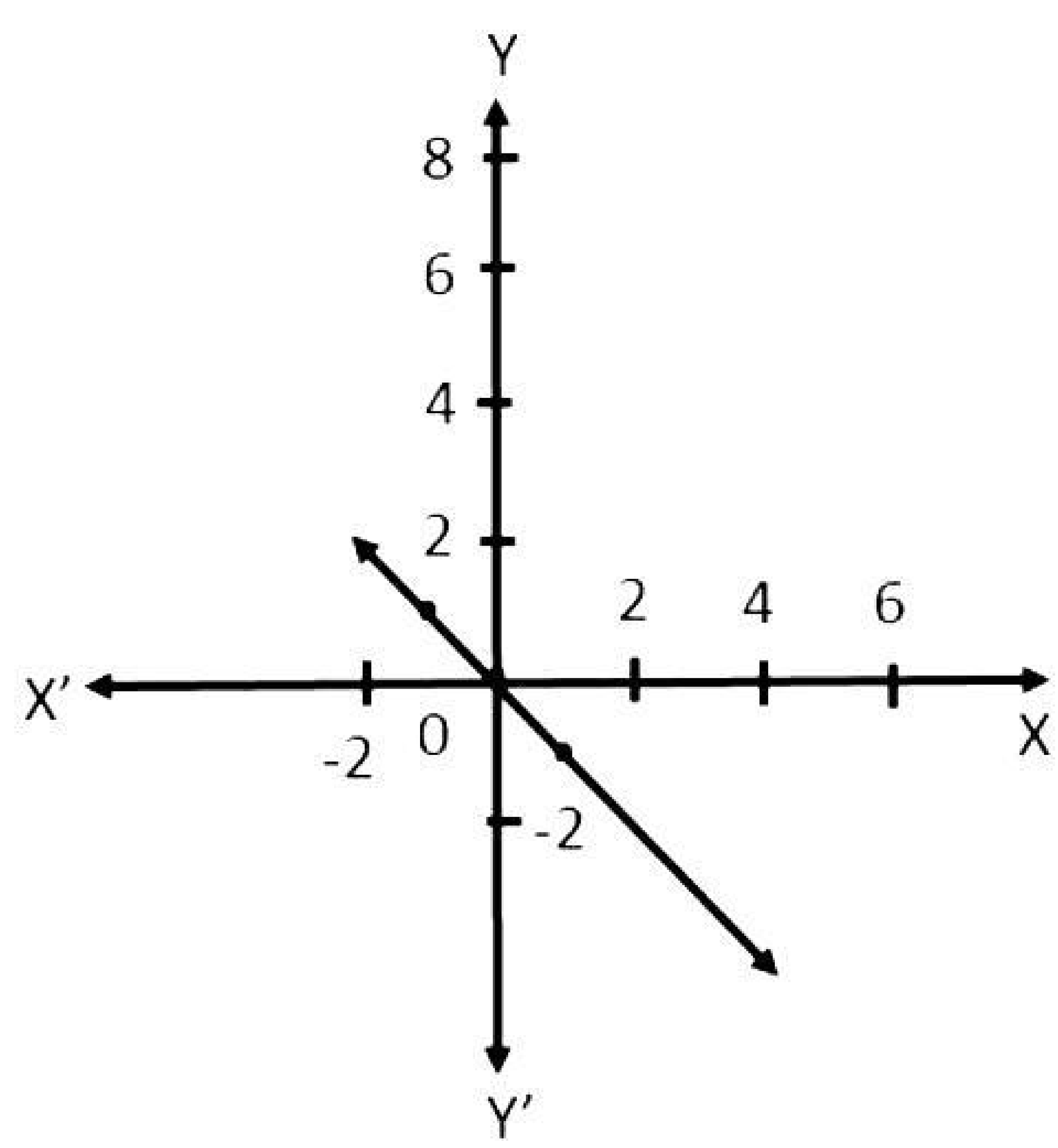
$= \pi^2 r^2 h^4 - \pi^2 r^2 h^2 (r^2 + h^2) + \pi^2 r^4 h^2$ ... $(\because l^2 = r^2 + h^2)$

$= \pi^2 r^2 h^4 - \pi^2 r^4 h^2 - \pi^2 r^2 h^4 + \pi^2 r^4 h^2$

$= 0$

$\therefore 3\pi Vh^3 - C^2h^2 + 9V^2 = 0.$

27.



From the graph, we see (1, −1), (0, 0) and (−1, 1) lie on the same line. So, these are the solutions of the required equation, i.e. if we substitute these points in the required equation, it should be satisfied.

If we substitute (1, −1) in the first equation, y = x is unsatisfied. So, y = x is not the required equation.

Putting (1, −1) in x + y = 0, we find that it satisfies the equation. In fact, all three points satisfy the second equation. So, x + y = 0 is the required equation.

We now check y = 2x. We find that even one of the pairs does not satisfy it, so it is not the required equation.

28. Given: In ΔABC, AB = AC and ∠BAD = ∠CAD

To prove:

i. BD = DC

ii. ∠ADB = ∠ADC = 90°

Proof: In ΔADB and ΔADC,

AB = AC (Given)

$\angle BAD = \angle CAD$ (Given)

AD = AD (Common side)

$\therefore \Delta ADB \cong \Delta ADC$ (by SAS congruence)

$\therefore$ BD = DC (CPCT)

$\therefore$ D is the mid-point of BC.

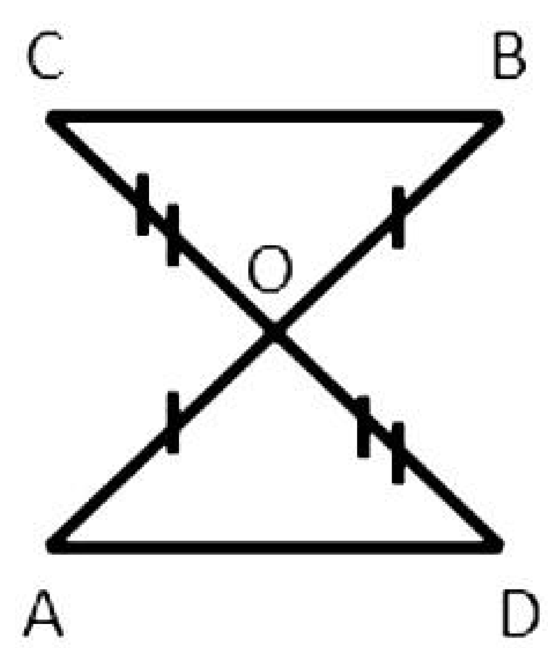
Also, $\angle ADB = \angle ADC$ (CPCT)

But, $\angle ADB + \angle ADC = 180°$ (BDC is a straight line)

$\therefore \angle ADB = \angle ADC = 90°$

$\therefore$ AD is perpendicular to BC.

OR



Given: OA = OB and OD = OC

To prove:

i. $\Delta AOD \cong \Delta BOC$

ii. AD parallel to BC

Proof: In ΔAOD and ΔBOC,

OA = OB (Given)

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

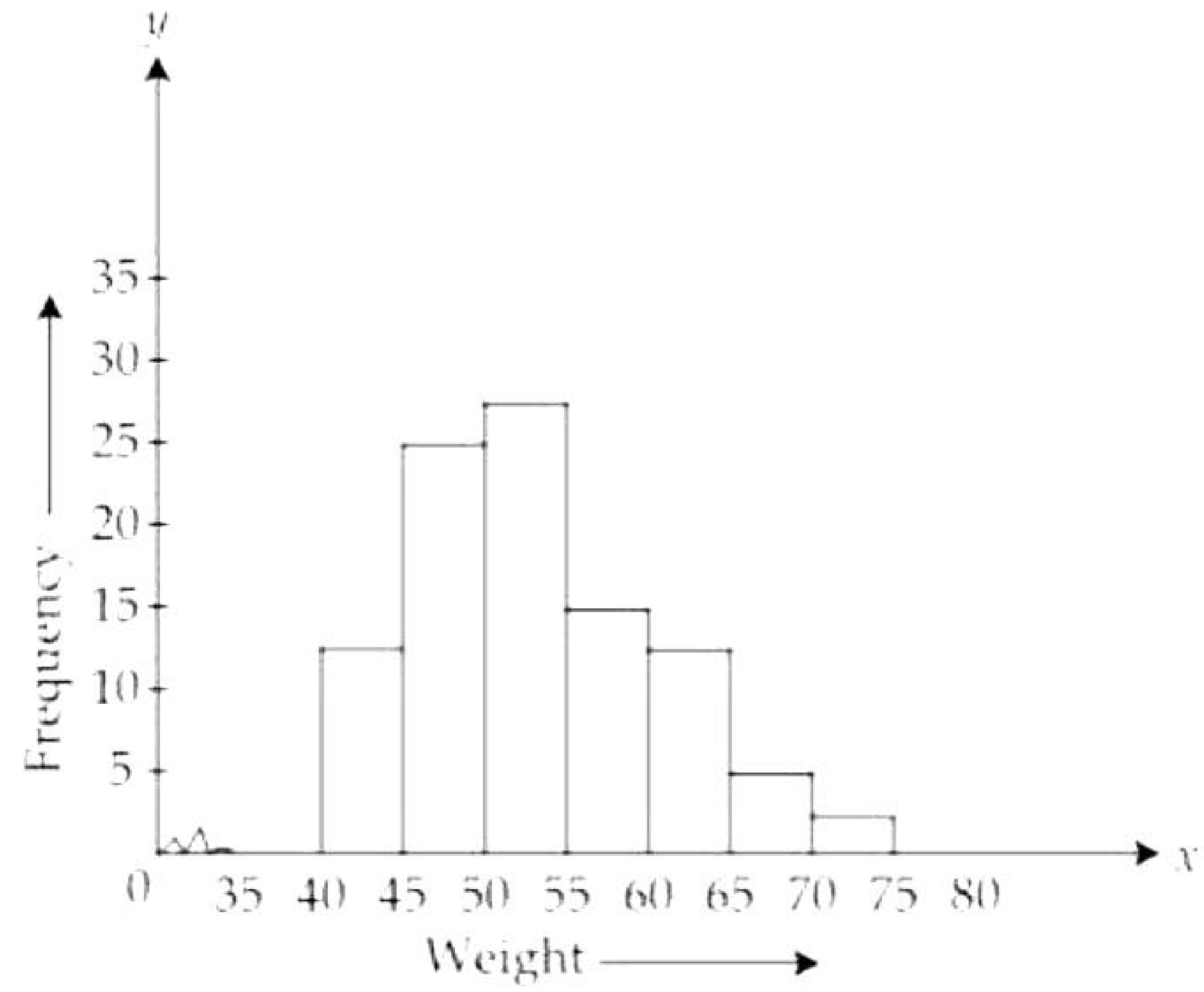
OD = OC (Given)

$\therefore \Delta AOD \cong \Delta BOC$ (SAS congruence)

$\therefore \angle OAD = \angle OBC$ (CPCT)

$\therefore$ AD is parallel to BC (converse of the alternate angle test)

29. Steps of Construction:
    i. We represent the weights on the horizontal axis. We choose the scale on the horizontal axis as 1 cm = 5 kg. Also, since the first class interval is starting from 35 and not zero, we show it on the graph by marking a *kink* or a break on the axis.
    ii. We represent the number of people (frequency) on the vertical axis. Since the maximum frequency is 28, we choose the scale as 1 cm = 5 people.
    iii. We now draw rectangles (or rectangular bars) of width equal to the class size and lengths according to the frequencies of the corresponding class intervals.

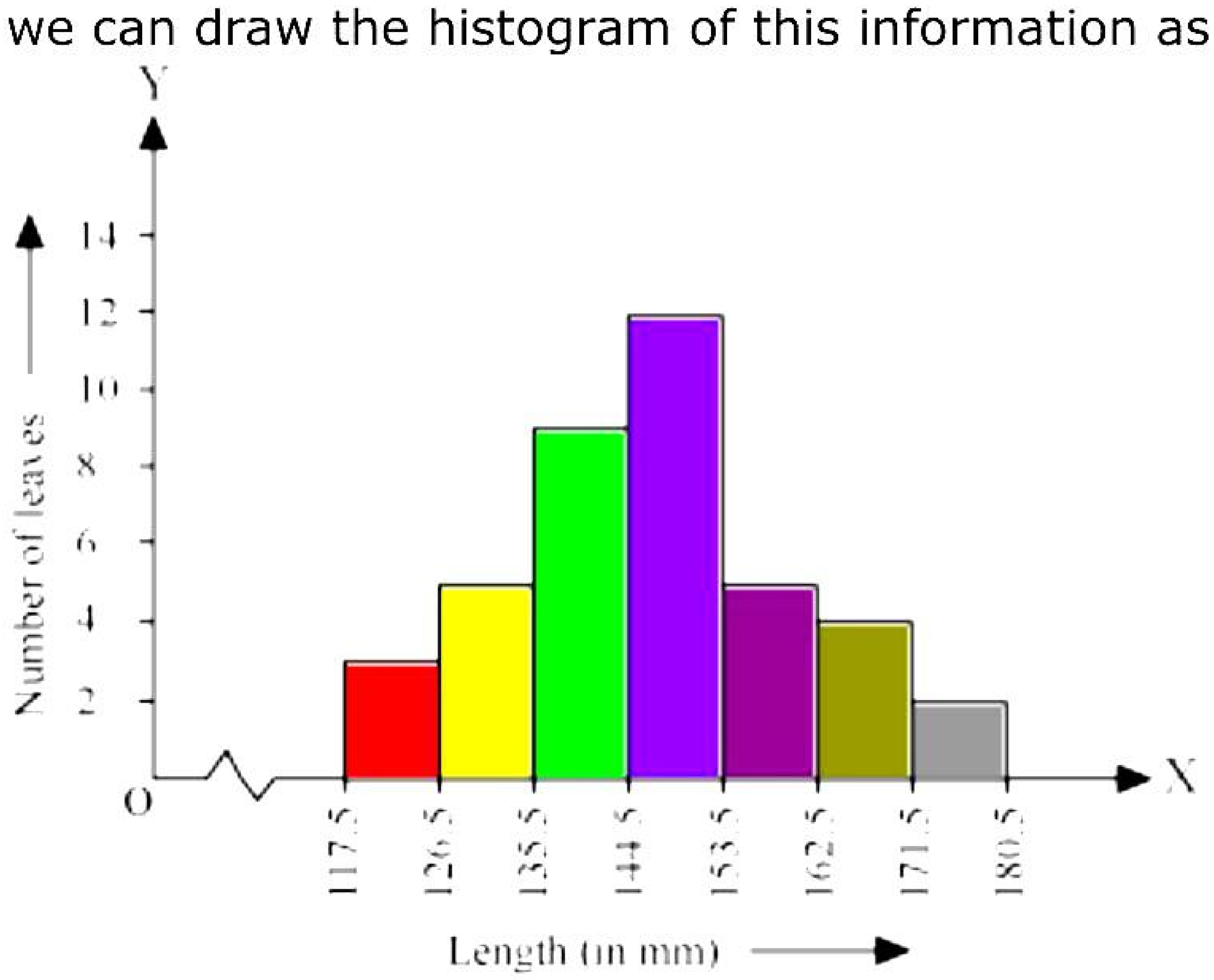


OR

i. Length of leaves are represented in a discontinuous class intervals having a difference of 1 mm in between them. So we have to add $\frac{1}{2} = 0.5$ mm to each upper class limit and also have to subtract 0.5 mm from the lower class limits so as to make our class intervals continuous.

Length (in mm)	Number of leaves
117.5 – 126.5	3
126.5 – 135.5	5
135.5 – 144.5	9
144.5 – 153.5	12
153.5 – 162.5	5
162.5 – 171.5	4
171.5 – 180.5	2

Now taking length of leaves on the x-axis and number of leaves on the y-axis, we can draw the histogram of this information as below:

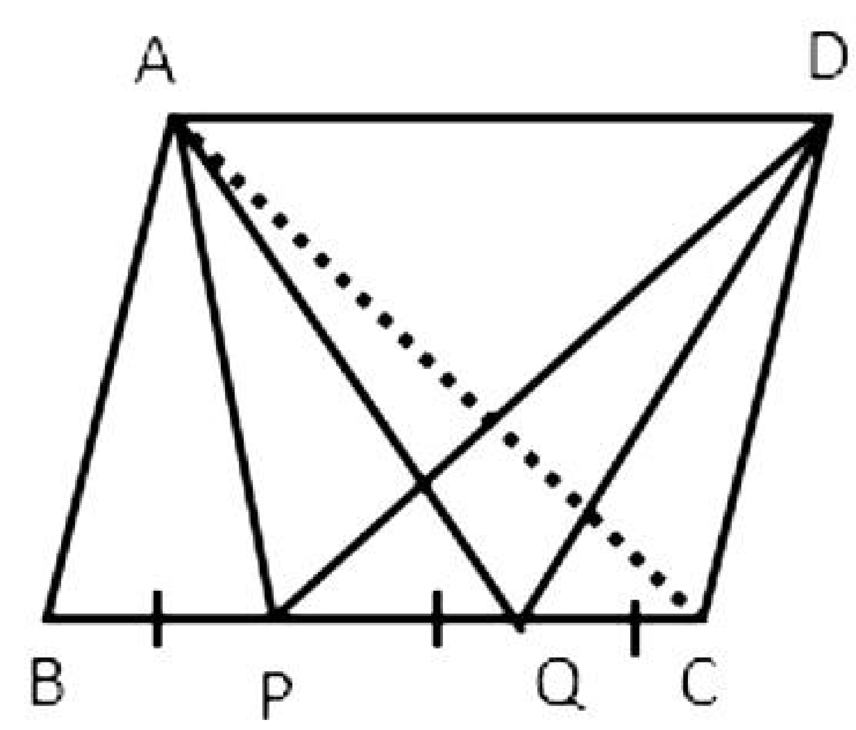


Here 1 unit on the y-axis represents 2 leaves.

ii. Other suitable graphical representation of this data could be frequency polygon.
iii. No, as maximum numbers of leaves (i.e. 12) have their length in between of 144.5 mm and 153.5 mm. It is not necessary that all have their lengths as 153 mm.

30. Given:
ΔABC in which D is the mid-point of AB and P is any point on BC.
CQ is parallel to PD.
To prove: A(ΔBPQ) = ½ A(ΔABC)
Proof:
A(ΔDPC) = A(ΔDPQ) ...(i)(Triangles on the same base and between the same parallels)
Also, A(ΔBCD) = ½ A(ΔABC) (Median CD divides ΔABC into two triangles of equal area)
⇒ A(ΔBPD) + A(ΔDPC) = ½ A(ΔABC)
∴ A(ΔBPD) + A(ΔDPQ) = ½ ar(ΔABC) ... From (i)
∴ A(ΔBPQ) = ½ A(ΔABC)

OR



Given: BP = PQ = QC
Join AC.
Bases of triangles ABP and ABC are in the ratio 1:3 i.e. BP : BC = 1 : 3 and their vertices are at the same point A.

$$\Rightarrow \frac{A(\Delta ABP)}{A(\Delta ABC)} = \frac{BP}{BC} = \frac{1}{3}$$

$$\Rightarrow A(\Delta ABP) = \frac{1}{3} A(\Delta ABC) \quad ...(i)$$

In a parallelogram ABCD, AC is a diagonal, so it bisects the parallelogram.
∴ A(ΔABC) = ½ A(parallelogram ABCD) ....(ii)

$$\Rightarrow A(\Delta ABP) = \frac{1}{3} \times \frac{1}{2} \times A(\text{parallelogram ABCD}) \quad ...(iii)$$

Since, ΔABP, ΔAPQ and ΔDPQ are on equal bases and between the same parallels;
∴ A(ΔABP) = A(ΔAPQ) = A(ΔDPQ)
∴ A(ΔAPQ) = A(ΔDPQ) = 1/6 A(parallelogram ABCD)

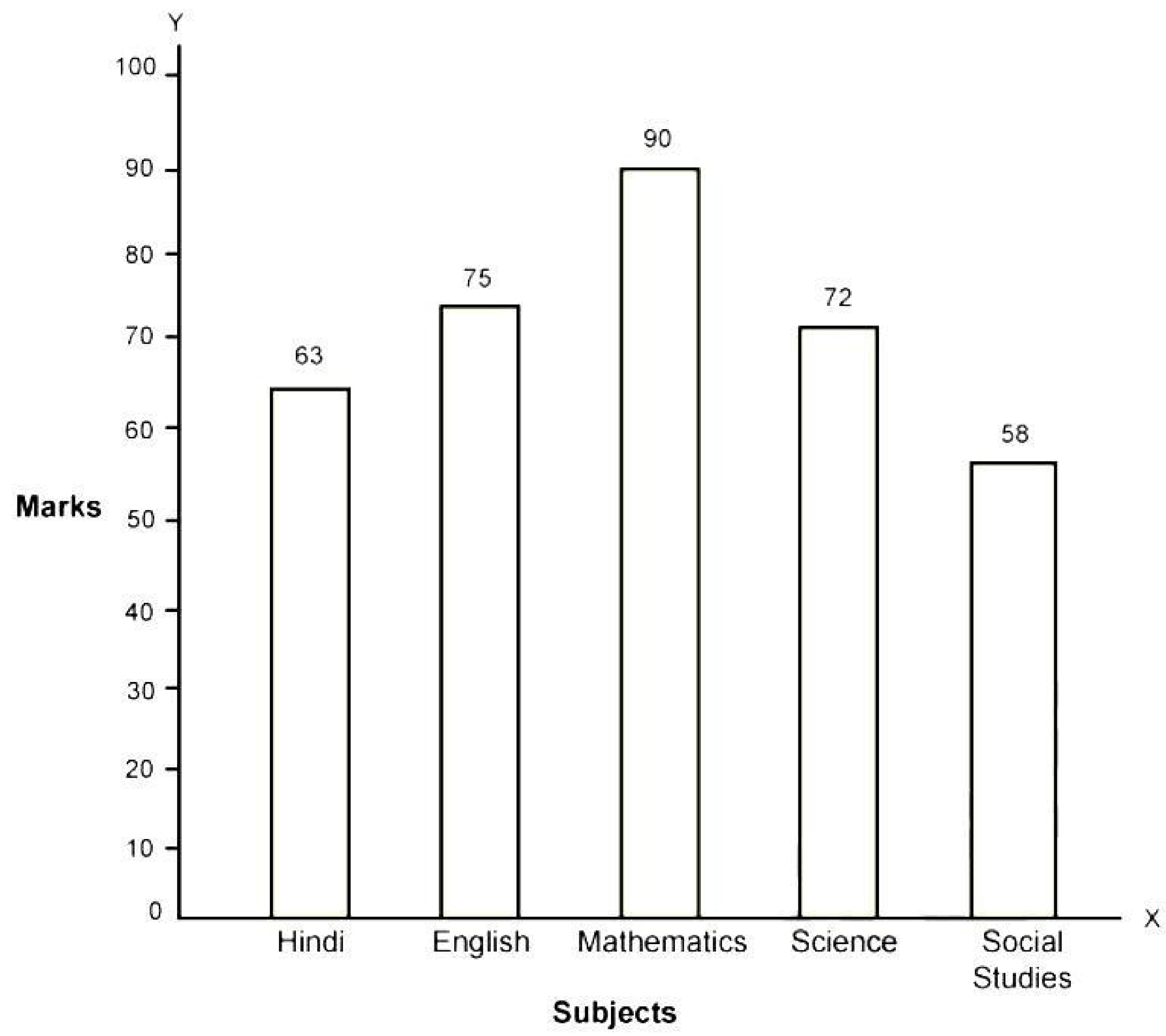
31. A bar graph can be drawn using the following steps:

i. On a graph paper, draw a horizontal line OX and vertical line OY, representing the x-axis and y-axis, respectively.

ii. Along OX, write the names of the subjects at points taken at uniform gaps. Along OY, write the marks with the scale as 1 unit = 10 marks.

iii. Heights of the various bars are Hindi - 63; English - 75; Mathematics - 90; Science - 72; Social Science – 58.

iv. On the x-axis, draw bars of equal width and height obtained in step (iii).



Section D

32.

(i) By using identity $(x + a)(x + b) = x^2 + (a + b)x + ab$

$$(x+4)(x+10) = x^2 + (4+10)x + 4\times 10$$
$$= x^2 + 14x + 40$$

(ii) By using identity $(x + a)(x + b) = x^2 + (a + b)x + ab$

$$(x+8)(x-10) = x^2 + (8-10)x + (8)(-10)$$
$$= x^2 - 2x - 80$$

(iii) $(3x+4)(3x-5) = 9\left(x+\frac{4}{3}\right)\left(x-\frac{5}{3}\right)$

By using the identity $(x + a)(x + b) = x^2 + (a + b)x + ab$

$$9\left(x+\frac{4}{3}\right)\left(x-\frac{5}{3}\right) = 9\left[x^2 + \left(\frac{4}{3}-\frac{5}{3}\right)x + \left(\frac{4}{3}\right)\left(-\frac{5}{3}\right)\right]$$
$$= 9\left[x^2 - \frac{1}{3}x - \frac{20}{9}\right]$$
$$= 9x^2 - 3x - 20$$

(iv) By using identity $(x+y)(x-y) = x^2 - y^2$

$$\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right) = \left(y^2\right)^2 - \left(\frac{3}{2}\right)^2 = y^4 - \frac{9}{4}$$

(v) By using identity $(x+y)(x-y) = x^2 - y^2$

$$(3-2x)(3+2x) = (3)^2 - (2x)^2$$
$$= 9 - 4x^2$$

OR

We know that, $(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

(i)

$$(x+2y+4z)^2 = x^2 + (2y)^2 + (4z)^2 + 2(x)(2y) + 2(2y)(4z) + 2(4z)(x)$$
$$= x^2 + 4y^2 + 16z^2 + 4xy + 16yz + 8xz$$

(ii)

$$(2x-y+z)^2 = (2x)^2 + (-y)^2 + (z)^2 + 2(2x)(-y) + 2(-y)(z) + 2(z)(2x)$$
$$= 4x^2 + y^2 + z^2 - 4xy - 2yz + 4xz$$

(iii)

$$(-2x+3y+2z)^2 = (-2x)^2 + (3y)^2 + (2z)^2 + 2(-2x)(3y) + 2(3y)(2z) + 2(2z)(-2x)$$
$$= 4x^2 + 9y^2 + 4z^2 - 12xy + 12yz - 8xz$$

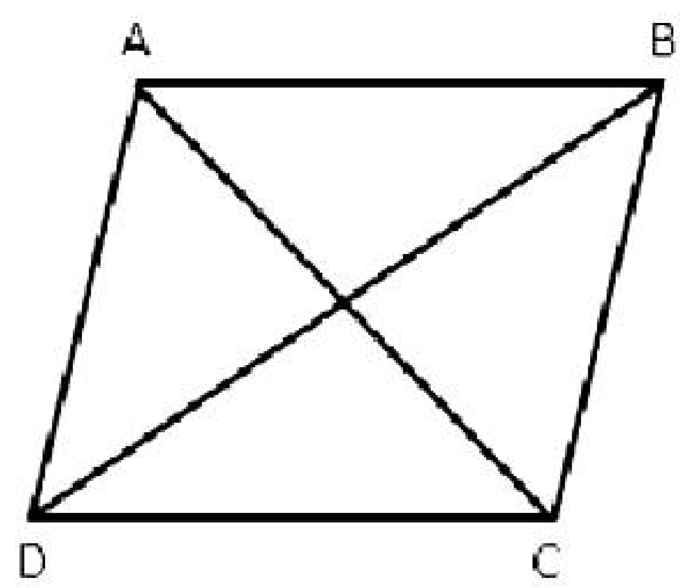
(iv)

$$(3a - 7b - c)^2 = (3a)^2 + (-7b)^2 + (-c)^2 + 2(3a)(-7b) + 2(-7b)(-c) + 2(-c)(3a)$$
$$= 9a^2 + 49b^2 + c^2 - 42ab + 14bc - 6ac$$

(v)

$$(-2x + 5y - 3z)^2 = (-2x)^2 + (5y)^2 + (-3z)^2 + 2(-2x)(5y) + 2(5y)(-3z) + 2(-3z)(-2x)$$
$$= 4x^2 + 25y^2 + 9z^2 - 20xy - 30yz + 12xz$$

33.



Each diagonal of a quadrilateral separated it into two triangles of equal area.

So, we have

A(ΔABD) = A(ΔBDC) ....(1)

And, A(ΔABD) + A(ΔBDC) = A(quadrilateral ABCD)

⇒ 2A(ΔABD) = A(quadrilateral ABCD) ....(2) [From (1)]

Also, A(ΔACB) = A(ΔADC) ....(3)

And, A(ΔACB) + A(ΔADC) = A(quadrilateral ABCD)

⇒ 2A(ΔACB) = A(quadrilateral ABCD) ....(4) [from (3)]

From equation (2) and (4),

2A(ΔABD) = 2A(ΔACB)

⇒ A(ΔABD) = A(ΔACB)

Since, ΔABD and ΔACB are on the same base AB, they must have equal corresponding altitudes.

So, altitude from D of ΔABD = altitude from C of ΔACB

DC || AB

Similarly, AD || BC.

Hence, ABCD is a parallelogram.

34. Angle at the centre is twice the angle at the circumference of a circle subtended by the same chord.

⇒ ∠COB = 2∠CAB

⇒ ∠COB = 2x

∠OCD = ∠COB = 2x ....(alternate angles)

In ΔOCD,

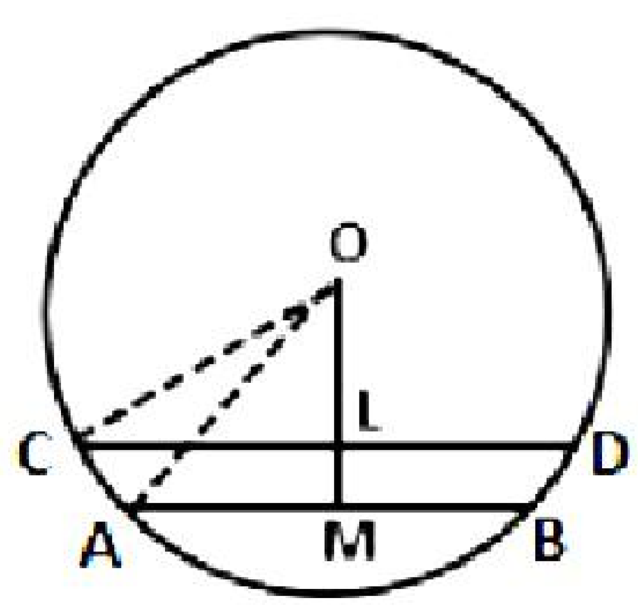
OC = OD ....(radii of the same circle)

$\angle ODC = \angle OCD = 2x$
$\Rightarrow \angle DOC = 180° - 2x - 2x$
$\Rightarrow \angle DOC = 180° - 4x$

Again, angle at the centre is twice the angle at the circumference subtended by the same chord.
$\Rightarrow \angle DAC = \frac{1}{2} \angle DOC = \frac{1}{2}(180° - 4x)$
$\Rightarrow \angle DAC = 90° - 2x$

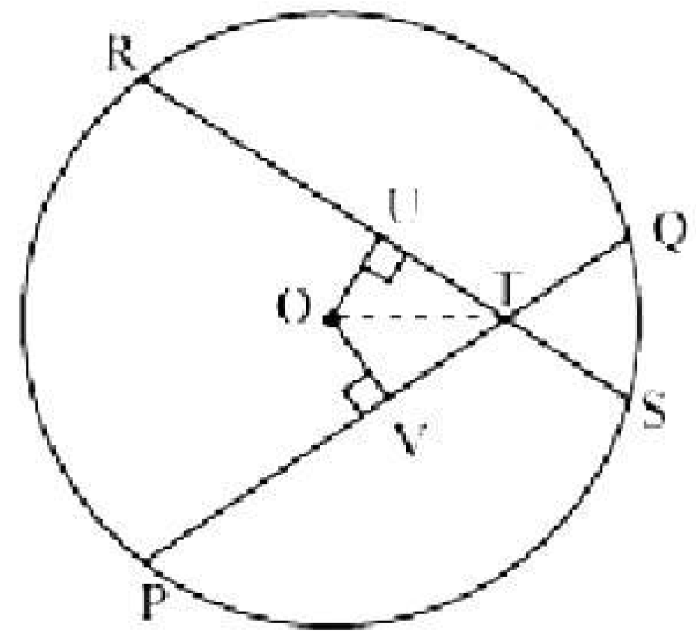
Since DC || AB,
DC || AO
$\Rightarrow \angle ACD = \angle OAC = x$ (alternate angles)
Now, $\angle ADC = 180° - \angle DAC - \angle ACD$
$= 180° - (90° - 2x) - x$
$\Rightarrow \angle ADC = 90° + x$

OR



AB = 12 cm, CD = 24 cm and LM = 4 cm
Let OL = x cm
Then OM = (x + 4) cm
Join OA and OC.
Then OA = OC = r
Since the perpendicular from the centre to a chord bisects the chord,
AM = MB = 6 cm and CL = LD = 12 cm
In triangles OAM and OCL,
$OA^2 = OM^2 + AM^2$ and $OC^2 = OL^2 + CL^2$
$r^2 = (x + 4)^2 + 6^2$ and $r^2 = x^2 + 12^2$
$(x + 4)^2 + 6^2 = x^2 + 12^2$
$x^2 + 8x + 16 + 36 = x^2 + 144$
$8x = 92$
$\Rightarrow x = \frac{92}{8} = 11.5$ cm
Then, $r^2 = (11.5)^2 + 12^2 = 276.25$
$r = \sqrt{276.25} = \sqrt{\frac{27625}{100}} = \sqrt{\frac{1105}{4}}$
$\Rightarrow r = \frac{\sqrt{1105}}{2}$ cm

35.



Let PQ and RS be two equal chords of a given circle intersecting each other at point T.

Draw OV $\perp$ chord PQ and OU $\perp$ chord RS.

In ΔOVT and ΔOUT,

OV = OU (Equal chords of a circle are equidistant from the centre)

$\angle OVT = \angle OUT$ (Each 90°)

OT = OT (common)

$\therefore \Delta OVT \cong \Delta OUT$ (RHS congruence rule)

$\therefore$ VT = UT (CPCT) ... (1)

Given, PQ = RS ... (2)

$\Rightarrow \frac{1}{2}PQ = \frac{1}{2}RS$

$\Rightarrow$ PV = RU ... (3)

On adding equations (1) and (3), we have

PV + VT = RU + UT

$\Rightarrow$ PT = RT ... (4)

On subtracting equation (4) from equation (2), we have

PQ – PT = RS – RT

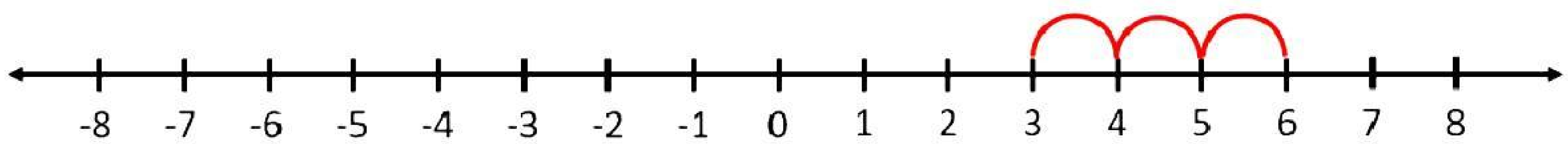
$\Rightarrow$ QT = ST ... (5)

Equations (4) and (5) show that the corresponding segments of chords PQ and RS are congruent to each other.

Section E

36.

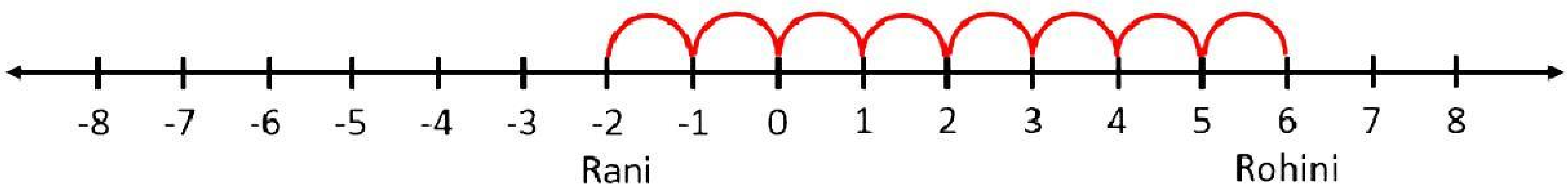
i.



3 steps right reaches 6, then 3 steps left from 6 will be 6 – 3 = 3

So, Rohini was standing on number 3 before.

ii.



To reach from 6 to –2,

Total steps = 6 – (–2) = 8

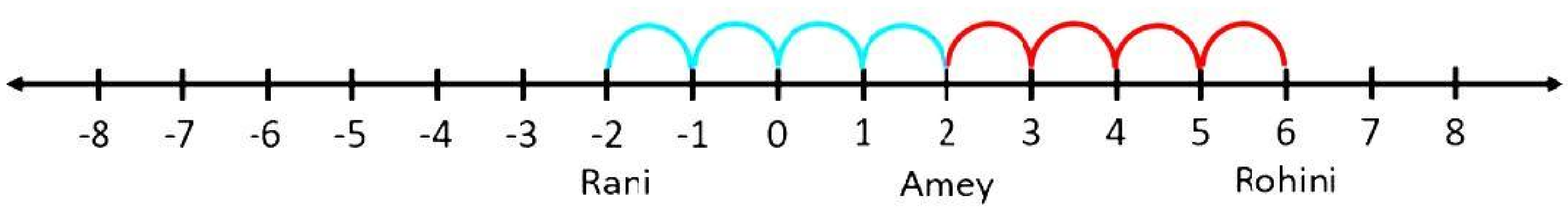
Hence, there will be total 8 steps between Rohini and Rani.

iii.

Distance between Rani and Rohini = 8 steps

So, $\frac{8}{2} = 4$

4 steps from –2 to right = –2 + 4 = 2



Hence, the position of Amey is at number 2.

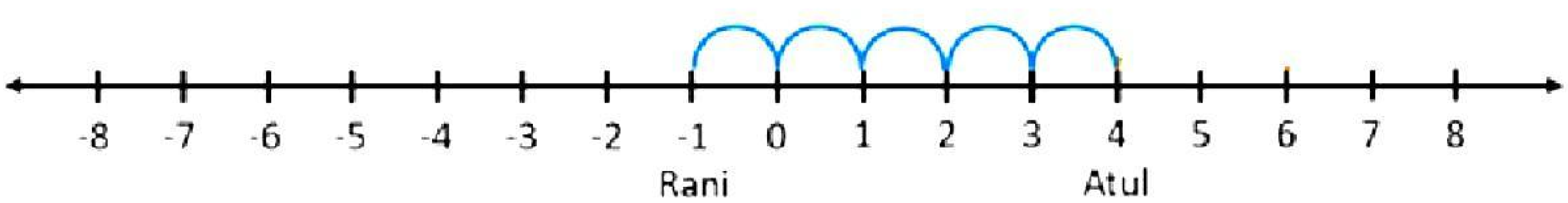
OR

Position of Atul = 4

Position of Rani = –1

Then, 4 – (–1) = 5 = position of Atul with respect to Rani

Hence, Atul is 5 steps to the right of Rani.



37.

i. The co-ordinates of point C are (3, 2).

ii. The co-ordinates of point B are (4, 3).

iii. The point farthest from the X-axis is A whose coordinates are (1, 5).

So, its distance from the X-axis is its y-coordinate, which is 5 km.

OR

The point farthest from the Y-axis is D whose coordinates are (7, 1).
So, its distance from the Y-axis is its x-coordinate, which is 7 km.

38.

i. Ajay has 'x' number of Rs. 10 notes and 'y' number of Rs. 20 notes.
Hence, total amount with Ajay = Rs. (10x + 20y)

ii. Total number of 10 rupee notes = x
Cost of one pencil = Rs. 2
Then, cost of 5 pencils = Rs. (2×5) = Rs. 10
So, number of 10 rupee notes left = x – 1

iii. As he buys pens using Rs. 10 notes, the number of Rs. 20 notes will remain the same, which is 'y'.

OR

Total amount with Ajay = Rs. (10x + 20y)
Cost of 1 eraser = Rs. 5

$\therefore$Number of erasers that can be brought = $\frac{10x + 20y}{5} = 2x + 4y$