Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 11

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. Rationalise the denominator: $\frac{1}{\sqrt{6}}$

A. $\frac{\sqrt{6}}{6}$

B. $\sqrt{6}$

C. $\frac{1}{6}$

D. $\frac{\sqrt{6}}{2}$

2. Simplify: $\left(\sqrt{2}-2\right)^2$

A. $6+4\sqrt{2}$

B. $6-4\sqrt{3}$

C. $6-2\sqrt{2}$

D. $6-4\sqrt{2}$

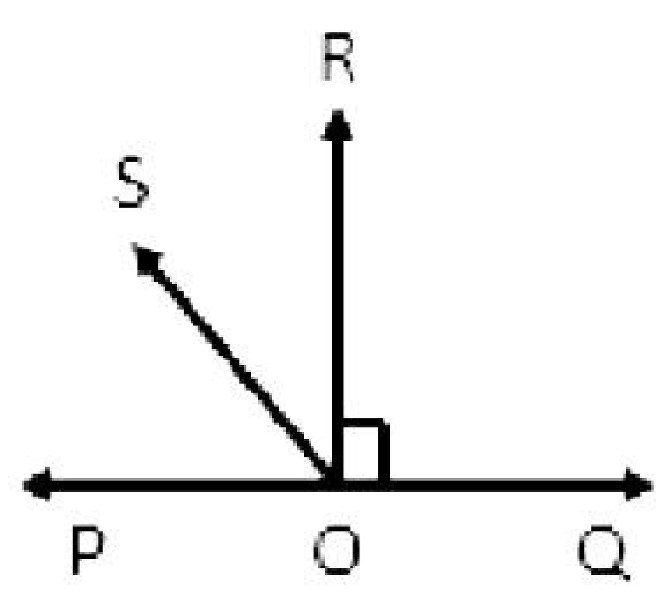
3. The total surface area of a hemisphere of radius ‘r’ is given by
   A. $3\pi r^2$ sq. units
   B. $4\pi r^2$ sq. units
   C. $2\pi r^2$ sq. units
   D. πr^2 sq. units

4. If a cone and a sphere has same diameter and height, then the diameter of a sphere is
   A. less than the height of cone
   B. two times the height of cone
   C. equal to the height of cone
   D. three times the height of cone

5. The degree of a polynomial 7 is
   A. 0
   B. 1
   C. 2
   D. 7

6. What is/are the zero/s of the polynomial $p(x) = x^2 - 1$?
   A. −1 only
   B. 1 only
   C. Both 1 and −1
   D. No roots

7. Find ∠SOP if ∠SOP = ∠ROS.



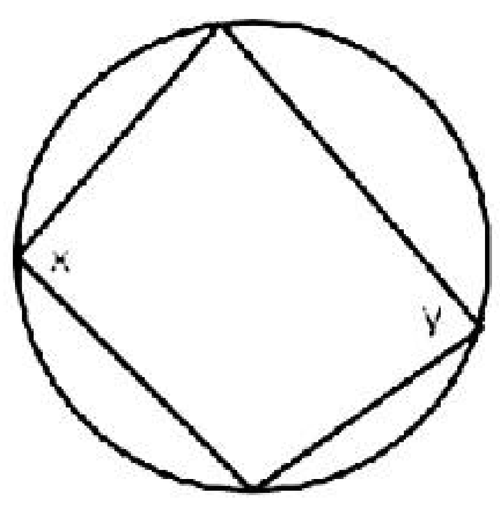
   A. 55°
   B. 65°
   C. 45°
   D. 35°

8. Corresponding sides of congruent triangles are ___________.
   A. parallel
   B. perpendicular
   C. equal
   D. proportional

9. Which of the following is false?
   A. Opposite sides of a parallelogram are equal
   B. Opposite angles of a parallelogram are equal
   C. Adjacent sides of a parallelogram are equal
   D. All are true

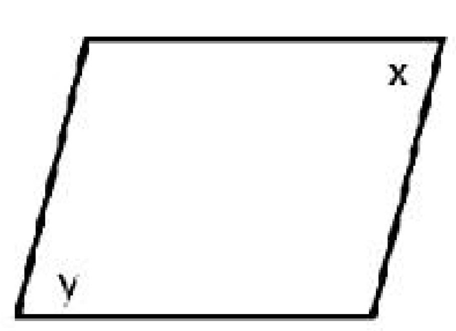
10. Angles in the same segment of a ________ are equal
   A. parallelogram
   B. triangle
   C. quadrilateral
   D. circle

11. In the given figure, find x, if y = 120°.



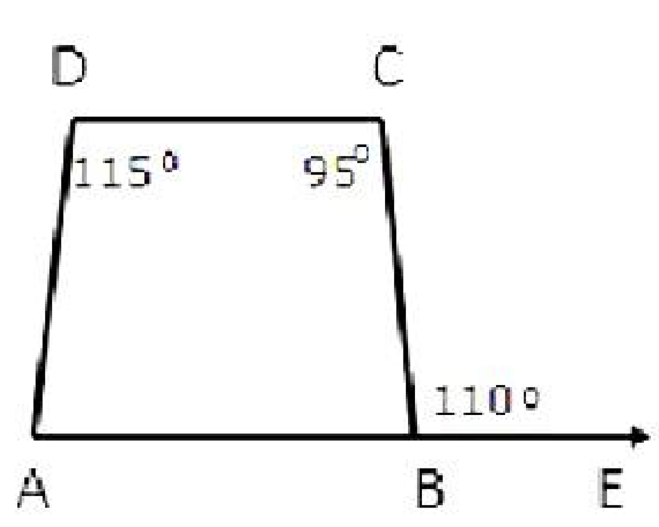
   A. 120°
   B. 70°
   C. 50°
   D. 60°

12. Below figure is a parallelogram in which y = 120°. Find x.



   A. 120°
   B. 60°
   C. 70°
   D. 50°

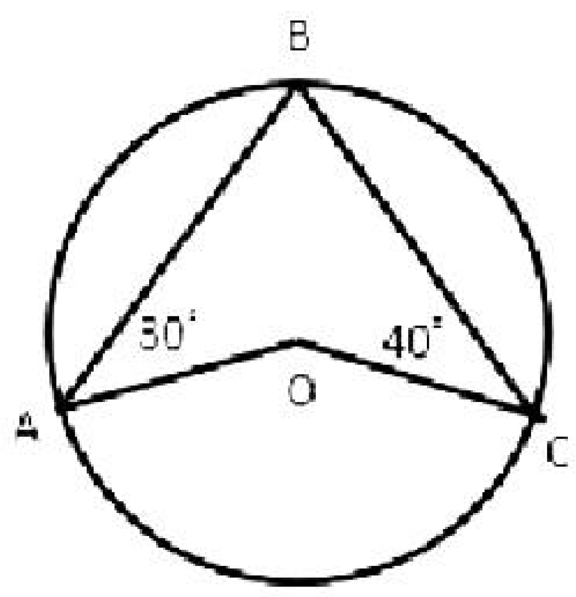
13. The measure of the angle obtained by extending side AB of ABCD is 110°. If ∠D = 115° and ∠C = 95°, find the measure of ∠CBA.



   A. 110°
   B. 95°
   C. 115°
   D. 70°

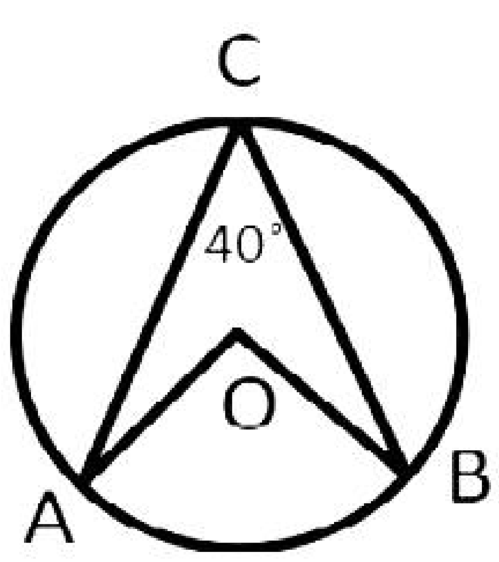
14. A quadrilateral with opposite sides parallel is called a
   A. parallelogram
   B. rectangle
   C. square
   D. rhombus

15. In the given figure, O is the centre of the circle, ∠OAB = 30° and ∠OCB = 40°. Find ∠AOC.



   A. 70°
   B. 60°
   C. 40°
   D. 140°

16. Find the reflex angle AOB in the given figure.



   A. 270°
   B. 260°
   C. 290°
   D. 280°

17. ___________ chords of a circle subtend equal angles at the centre.
   A. parallel
   B. perpendicular
   C. equal
   D. Unequal

18. Diagonals of a parallelogram _____________
   A. are parallel to each other.
   B. bisect each other.
   C. are perpendicular to each other.
   D. are equal.

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)**: If x + y = 10 and x = z, then z + y = 10.
    Statement R (Reason): Equals are added to equals, then the wholes 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)**: If ABCD is a parallelogram, then AD = AB.
    Statement R (Reason): Opposite sides of a parallelogram 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.

Section B

Section B consists of 5 questions of 2 mark each.

21. Write $\left(\frac{a}{2}-\frac{b}{3}\right)^3$ in the expanded form. [2]

22. Expand using suitable identity: $\left(\frac{a}{6}+\frac{b}{5}-2\right)^2$. [2]

23. Express $\frac{10}{7}$ in the decimal form. [2]

24. Find two rational numbers between 3 and 4. [2]

OR

Subtract $5\sqrt{3}+7\sqrt{5}$ from $3\sqrt{5}-7\sqrt{3}$.

25. Factorise: $27(x + y)^3 + 8(2x - y)^3$ [2]

OR

Write the degree of each of the following polynomials:

(i) $5x^3 + 4x^2 + 7x$ (ii) $4 - y^2$

Section C

Section C consists of 6 questions of 3 marks each.

26. Sides of a triangle are in the ratio of 12:17:25 and its perimeter is 540 cm. Find its area. [3]

27. Determine which of the following polynomials has (x + 1) as a factor: [3]

(i) $x^3 + x^2 + x + 1$

(ii) $x^4 + x^3 + x^2 + x + 1$

(iii) $x^4 + 3x^3 + 3x^2 + x + 1$

28. Prove that the medians bisecting the equal sides of an isosceles triangle are equal. [3]

OR

If the perpendiculars drawn from the mid-point of one side of a triangle to its other two sides are equal, then show that the triangle is isosceles.

29. Show the following data by a frequency polygon: [3]

Expenditure (Rs.)	Families
200–400	240
400–600	300
600–800	450
800–1000	350
1000–1200	160

30. Curved surface area of a cone is 308 cm^2 and its slant height is 14 cm. Find the [3]
   (i) radius of the base and
   (ii) total surface area of the cone.

OR

A conical tent is 10 m high and the radius of its base is 24 m. Find the
   (i) slant height of the tent
   (ii) the cost of the canvas required to make the tent, if the cost of 1 m^2 canvas is Rs. 63.

31. Distribution of weight (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.

Section D

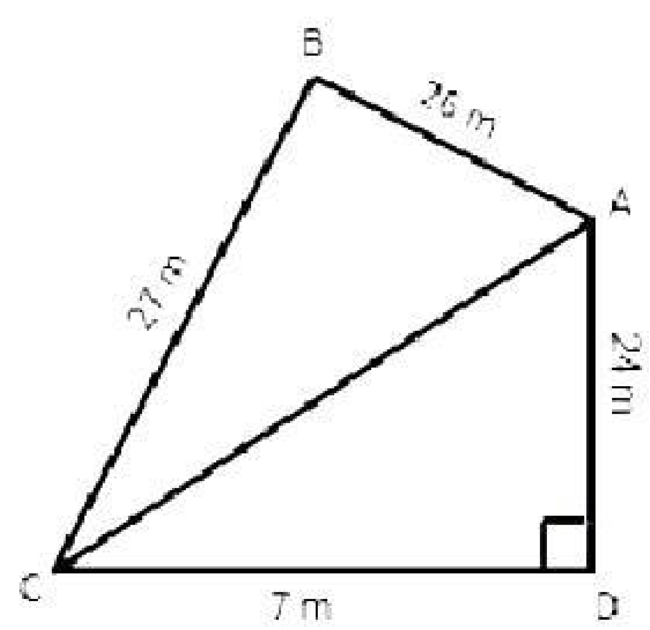
Section D consists of 4 questions of 5 marks each.

32. Find the value of k, if $2x - 3$ is a factor of $2x^3 - 9x^2 + x + k$. [5]

OR

Verify whether $2x^4 - 6x^3 + 3x^2 + 3x - 2$ is divisible by $x^2 - 3x + 2$ or not?

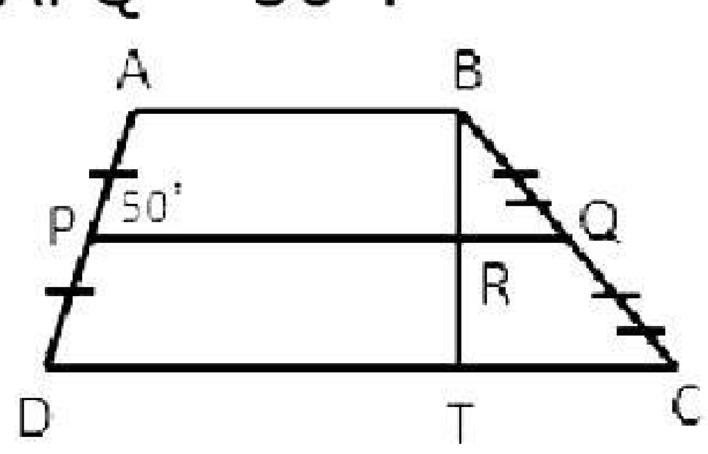
33. Find the area of a quadrilateral ABCD. [5]



34. ABCD is a rhombus and AB is produced to E and F such that AE = AB = BF. Prove that ED produced and FC produced are perpendicular to each other. [5]

OR

ABCD is trapezium, side AB is parallel to side DC. Points P and Q are the mid-points of sides AD and BC, respectively. AB = 7 cm, DC = 13 cm, BR = 4 cm, ∠APQ = 50°.



Find

i. length of PQ

ii. ∠PDC

iii. length of RT

35. In ΔABC, the internal bisectors of ∠B and ∠C meet at O. Prove that OA is the internal bisector of ∠A. [5]

Section E

Case study-based questions are compulsory.

36. To examine the preparation of class 9 students on topic 'Number System', Mathematics teacher writes two numbers on blackboard, and asks few questions to students. Based on the above information, answer the following questions.

i. Write the decimal form of $\frac{2}{11}$. [1]

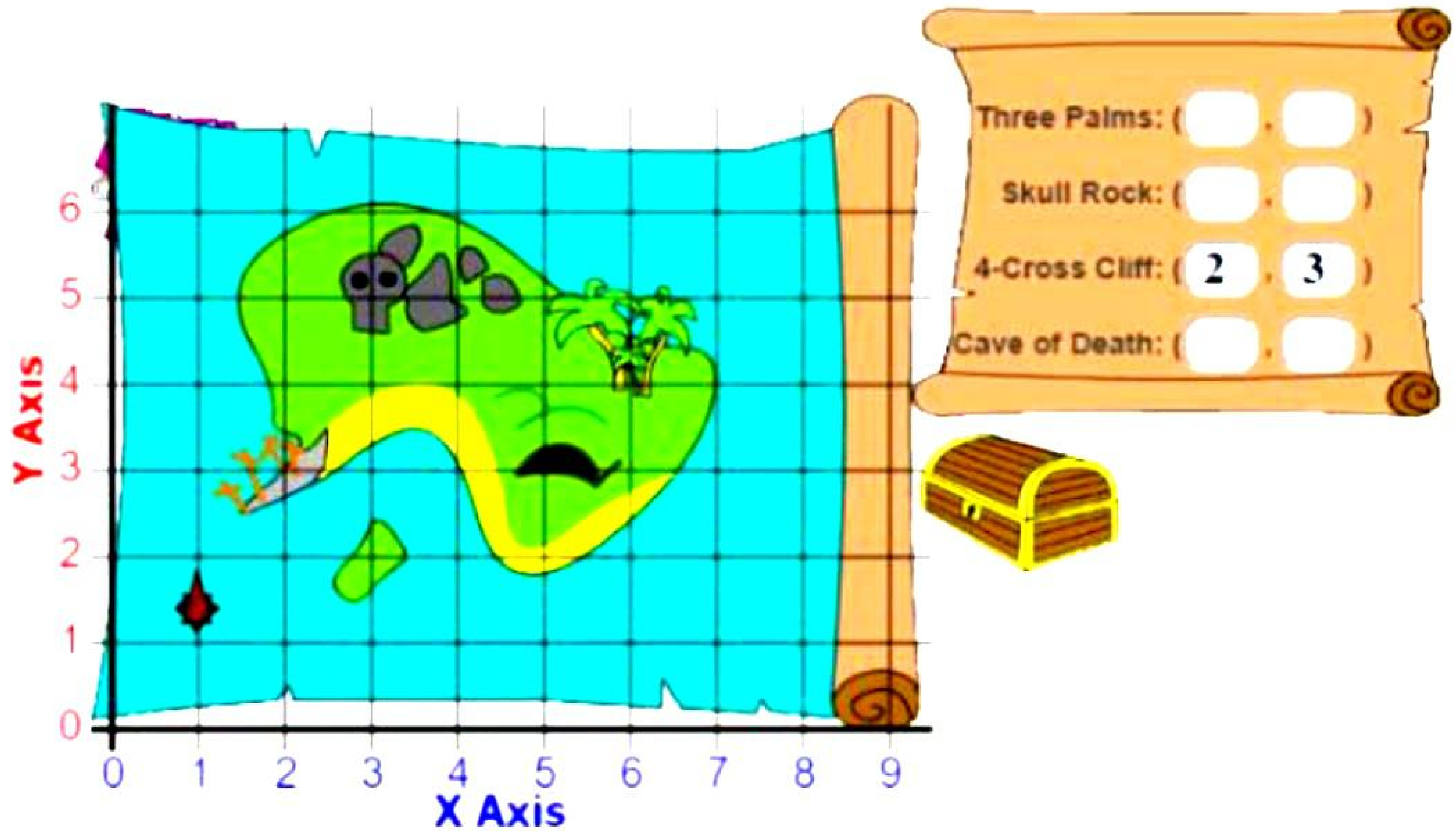
ii. Write $\frac{p}{q}$ form of $0.\overline{38}$. [2]

OR

If $\frac{p}{q}$ form of $0.\overline{38}$ is $\frac{m}{n}$, then value of (m + n) is [2]

iii. The decimal expansion of $0.\overline{38}$ is ________________ [1]

37. Rita and Renu are playing a board game of TREASURE ISLAND.



Answer the following questions.

i. What are the coordinates of CAVE of DEATH? [1]

ii. What are the coordinates of THREE PALMS? [1]

iii. Find the distance between FOUR CROSS CLIFF and the CAVE of DEATH. [2]

OR

What is the distance of SKULL ROCK from x–axis? [2]

38. Advait's mother gave him some money to buy Papaya from the market at the rate of $p(x) = x^2 - 12x - 220$. Let α, β are the zeroes of p(x). Based on the above information, answer the following questions.

i. Find the values of α and β, where α < β. [1]

ii. Find the value of p(4). [1]

iii. If α, β are the zeroes of $p(x) = x^2 + x - 2$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to [2]

OR

Factorise the polynomial $p(x) = x^2 - 24x + 128$. [2]

Solution

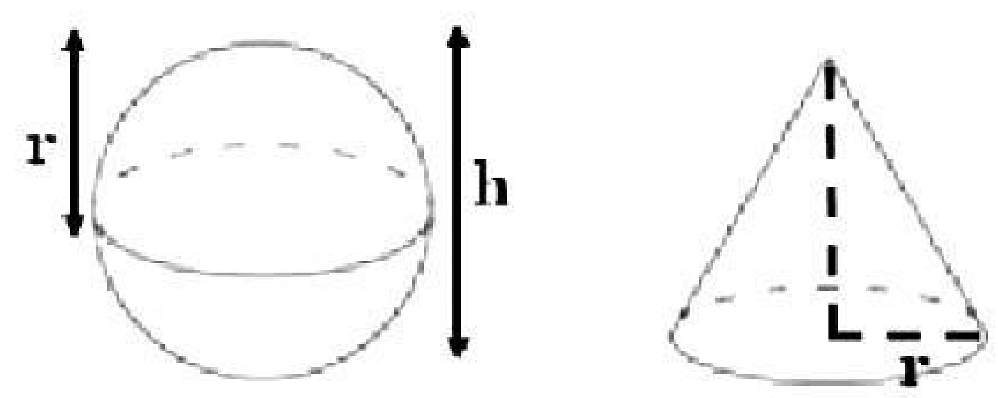
Section A

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

2. Correction option: D
Explanation:
$$\left(\sqrt{2}-2\right)^2 = \left(\sqrt{2}\right)^2 - 2 \times 2 \times \sqrt{2} + 2^2$$
$$= 2 - 4\sqrt{2} + 4$$
$$= 6 - 4\sqrt{2}$$

3. Correct option: A
Explanation:
Total surface area of a hemisphere is given by $3\pi r^2$.

4. Correct option: C
Explanation:
If a cone and a sphere has same diameter and height, then the diameter of a sphere is equal to the height of cone.



5. Correct option: A
Explanation:
The degree of a non-zero constant polynomial is zero.

6. Correct option: C
Explanation:
$p(x) = x^2 - 1$
$x^2 - 1 = 0$
$\Rightarrow (x - 1)(x + 1) = 0$
$\Rightarrow x = 1$ or $x = -1$

7. Correct option: C
Explanation:
From the given figure:
$\angle ROQ = 90°$ and $\angle SOP = \angle ROS = x$
But, $\angle ROQ + \angle ROP = 180°$ (Linear pair of angles)
$\therefore \angle ROQ + \angle SOP + \angle ROS = 180°$
$\therefore 90° + x + x = 180°$
$\therefore 2x = 90°$
$\therefore x = 45°$
$\therefore \angle SOP = 45°$

8. Correct option: C
Explanation:
Corresponding sides of congruent triangles are equal.

9. Correct option: C
Adjacent sides of a parallelogram are not equal.

10. Correct option: D
Explanation:
Angles in the same segment of a circle are equal.

11. Correct option: D
Explanation:
The sum of the opposite angles of a cyclic quadrilateral is 180°.
Hence, $x + y = 180^\circ$
$\Rightarrow x + 120^\circ = 180^\circ$
$\Rightarrow x = 60^\circ$

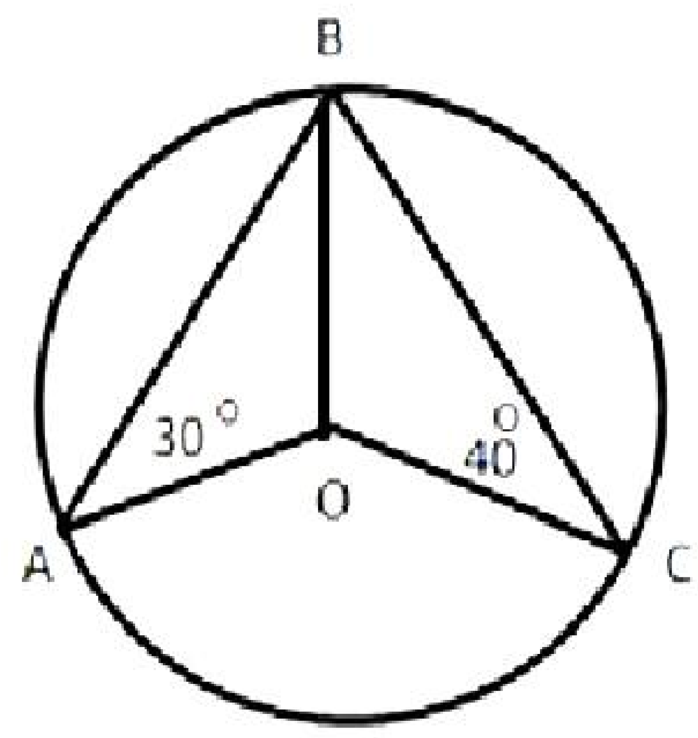
12. Correct option: A
Explanation:
Opposite angles of a parallelogram are equal.
So, $x = y = 120^\circ$

13. Correct option: D
Explanation:
$\angle CBA$ and $\angle CBE$ form a linear pair.
$\therefore \angle CBA + \angle CBE = 180°$
$\therefore \angle CBA + 110° = 180°$
$\therefore \angle CBA = 70°$

14. Correct option: A
Explanation:
A quadrilateral with opposite sides parallel is called a parallelogram.

15. Correct option: D

Explanation:



Join OB.

In ΔAOB,

AO = BO (radii of the same circle)

⇒ ∠OBA = ∠OAB = 30° .... (1) (opposite angles of equal sides are equal)

Similarly, in ΔBOC,

OB = OC (radii of the same circle)

⇒ ∠OBC = ∠OCB = 40° .... (2)

Now, ∠ABO + ∠OBC = ∠ABC

⇒ ∠ABC = 30° + 40° = 70° [From (1) and (2)]

Now, ∠ABC = ½ ∠AOC (angle subtended by an arc)

⇒ 70° = ½ ∠AOC

⇒ ∠AOC = 140°

16. Correct option: D

Explanation:

Given ∠ACB = 40°

Now, angle made by the arc at the centre is twice the angle subtended by the same arc at any point on the circumference of the circle.

⇒ ∠AOB = 2∠ACB = 2 × 40° = 80°

⇒ reflex angle AOB + ∠AOB = 360°

⇒ reflex angle AOB = 360° – 80° = 280°

17. Correct option: C

Explanation:

Equal chords of a circle subtend equal angles at the centre.

18. Correct option: B

Explanation:

Diagonals of a parallelogram bisect each other.

19. Correct option: A

Explanation:

The statement given in reason is correct and hence reason is true.

x + y = 10 ... (i)

x = z ... (ii)

If equals are added to equals, then the wholes are equal.

Hence, x + y = z + y

$\Rightarrow$ 10 = z + y [From (i)]

Hence, assertion is true and reason is the correct explanation for assertion.

20.

Correct option: D

Explanation:

The statement given in reason is correct and hence reason is true.

Therefore, if ABCD is a parallelogram, then BC = AD and AB = CD.

And, AD $\neq$ AB.

Hence, assertion is false.

Section B

21. Given equation is $\left(\frac{a}{2}-\frac{b}{3}\right)^3$.

Using identity $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$, we have

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

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

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

22. Given equation = $\left(\frac{a}{6}+\frac{b}{5}-2\right)^2$

Comparing the given equation with $(x + y + z)^2$

$x = \frac{a}{6}$, $y = \frac{b}{5}$, $z = -2$

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

Then,

$$\left(\frac{a}{6}+\frac{b}{5}-2\right)^2 = \left(\frac{a}{6}\right)^2 + \left(\frac{b}{5}\right)^2 + (-2)^2 + 2\left(\frac{a}{6}\times\frac{b}{5} + \frac{b}{5}\times(-2) + (-2)\times\frac{a}{6}\right)$$

$$= \frac{a^2}{36} + \frac{b^2}{25} + 4 + 2\left(\frac{ab}{30} - \frac{2b}{5} - \frac{a}{3}\right)$$

$$= \frac{a^2}{36} + \frac{b^2}{25} + 4 + \frac{ab}{15} - \frac{4b}{5} - \frac{2a}{3}$$

23.

$$
\begin{array}{r|l}
 & 1.428571 \\
\hline
7 & 10 \\
 & -07 \\
\hline
 & 30 \\
 & -28 \\
\hline
 & 20 \\
 & -14 \\
\hline
 & 60 \\
 & -56 \\
\hline
 & 40 \\
 & -35 \\
\hline
 & 50 \\
 & -49 \\
\hline
 & 10 \\
 & -7 \\
\hline
 & 3
\end{array}
$$

$$\Rightarrow \frac{10}{7} = 1.\overline{428571}$$

24. We know that the rational number lying between two rational numbers a and b is given by $\frac{a+b}{2}$.

Here, a = 3 and b = 4.

So, $\frac{3+4}{2} = \frac{7}{2}$ which is between 3 and 4.

That is, $3 < \frac{7}{2} < 4$

Now, a = 3 and b = $\frac{7}{2}$

So, $\frac{3+\frac{7}{2}}{2} = \frac{\frac{6+7}{2}}{2} = \frac{13}{4}$

$\Rightarrow 3 < \frac{13}{4} < \frac{7}{2} < 4$

Hence, $\frac{13}{4}$ and $\frac{7}{2}$ are two rational numbers between 3 and 4.

OR

$$3\sqrt{5} - 7\sqrt{3} - \left(5\sqrt{3} + 7\sqrt{5}\right) = 3\sqrt{5} - 7\sqrt{3} - 5\sqrt{3} - 7\sqrt{5}$$

$$= \left(3\sqrt{5} - 7\sqrt{5}\right) - \left(7\sqrt{3} + 5\sqrt{3}\right)$$

$$= -4\sqrt{5} - 12\sqrt{3}$$

$$= -\left(4\sqrt{5} + 12\sqrt{3}\right)$$

25. $27(x + y)^3 + 8(2x - y)^3$

Let $x + y = a$ and $2x - y = b$

Then, we have

$27(x + y)^3 + 8(2x - y)^3$

$= 27a^3 + 8b^3$

$= (3a)^3 + (2b)^3$

$= (3a + 2b)(9a^2 - 6ab + 4b^2)$

$= [3(x + y) + 2(2x - y)][9(x + y)^2 - 6(x + y)(2x - y) + 4(2x - y)^2]$

$= (3x + 3y + 4x - 2y)[9(x^2 + 2xy + y^2) - 6(2x^2 - xy + 2xy - y^2) + 4(4x^2 - 4xy + y^2)]$

$= (7x + y)[9x^2 + 18xy + 9y^2 - 12x^2 - 6xy + 6y^2 + 16x^2 - 16xy + 4y^2$

$= (7x + y)(13x^2 + 19y^2 - 4xy)$

OR

Degree of a polynomial is the highest power of variable in the polynomial.

(i) $5x^3 + 4x^2 + 7x$

This is a polynomial in variable x and the highest power of variable x is 3. So, the degree of this polynomial is 3.

(ii) $4 - y^2 = -y^2 + 4$

This is a polynomial in variable y and the highest power of variable y is 2. So, the degree of this polynomial is 2.

Section C

26. Let the common ratio between the sides of a given triangle be x.

So, sides of the triangle will be 12x, 17x, and 25x.

Perimeter of this triangle = 540 cm

12x + 17x + 25x = 540 cm

54x = 540 cm

x = 10 cm

Thus, the sides of triangle are 120 cm, 170 cm, and 250 cm.

$$s = \frac{\text{perimeter of triangle}}{2} = \frac{540 \text{ cm}}{2} = 270 \text{ cm}$$

By Heron's formula,

$$\text{Area of a triangle} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \left[\sqrt{270(270-120)(270-170)(270-250)}\right]\text{cm}^2$$

$$= \left[\sqrt{270 \times 150 \times 100 \times 20}\right]\text{cm}^2$$

$$= \left[\sqrt{30 \times 9 \times 30 \times 5 \times 100 \times 4 \times 5}\right]\text{cm}^2$$

$$= \left[30 \times 3 \times 5 \times 10 \times 2\right]\text{cm}^2$$

$$= 9000 \text{ cm}^2$$

So, the area of this triangle will be 9000 cm^2.

27.

(i) If (x + 1) is a factor of $p(x) = x^3 + x^2 + x + 1$, p(−1) must be zero.

Here, $p(x) = x^3 + x^2 + x + 1$

$p(-1) = (-1)^3 + (-1)^2 + (-1) + 1 = -1 + 1 - 1 + 1 = 0$

Hence, (x + 1) is a factor of this polynomial.

(ii) If (x + 1) is a factor of $p(x) = x^4 + x^3 + x^2 + x + 1$, p(−1) must be zero.

Here, $p(x) = x^4 + x^3 + x^2 + x + 1$

$p(-1) = (-1)^4 + (-1)^3 + (-1)^2 + (-1) + 1 = 1 - 1 + 1 - 1 + 1 = 1$

As, $p(-1) \neq 0$

So, (x + 1) is not a factor of this polynomial.

(iii) If (x + 1) is a factor of polynomial $p(x) = x^4 + 3x^3 + 3x^2 + x + 1$, p(−1) must be 0.

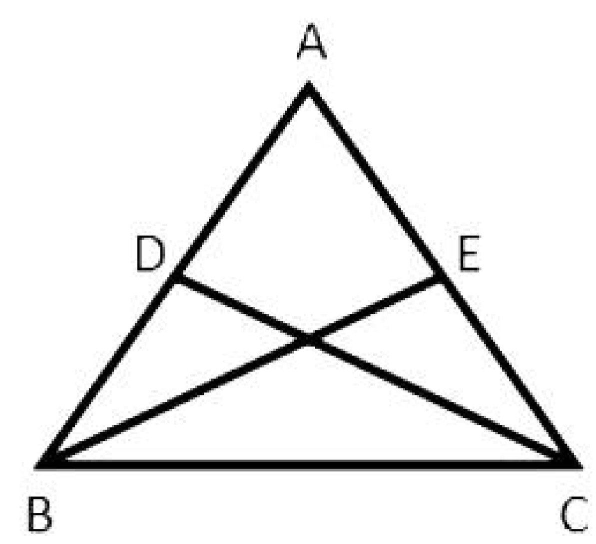
Here, $p(x) = x^4 + 3x^3 + 3x^2 + x + 1$

$p(-1) = (-1)^4 + 3(-1)^3 + 3(-1)^2 + (-1) + 1 = 1 - 3 + 3 - 1 + 1 = 1$

As, $p(-1) \neq 0$

So, (x + 1) is not a factor of this polynomial.

28.



Given: In an isosceles ΔABC, D and E are the mid-points of sides AB and AC, respectively.

To prove: Median CD = Median BE

Proof:

ΔABC is an isosceles triangle.

∴ AB = AC

⇒ ∠ACB = ∠ABC ....(1) (Angles opposite to equal sides are equal)

Since, D and E are the mid-points of sides AB and AC respectively, we have

DB = DA and EC = AE

⇒ DB = DA = EC = AE ....(2)

In ΔBCD and ΔCBE,

BC = BC (common)

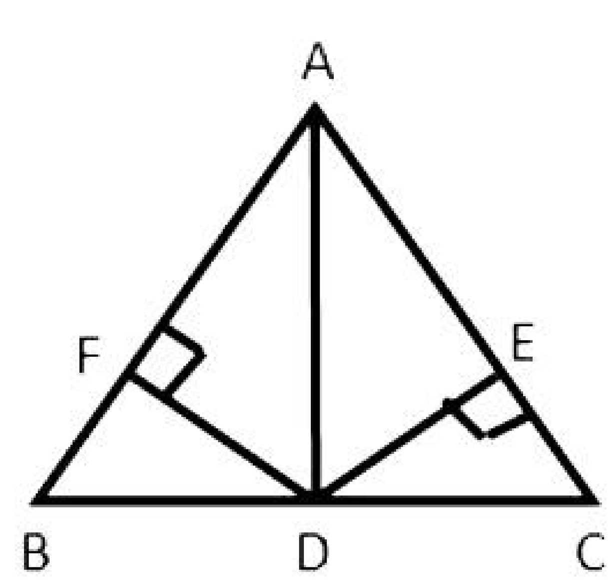
∠DBC = ∠ECB [From (1)]

BD = CE [From (2)]

∴ ΔBCD ≅ ΔCBE (SAS congruence rule)

∴ CD = BE [CPCT]

OR



Given: In ΔABC, D is the mid-point of side BC.

DE and DF are perpendiculars on AC and AB, respectively.

To prove: ΔABC is an isosceles triangle, that is, AB = AC.

Construction: Join AD

Proof:

In ΔBDF and ΔCDE,

Hypotenuse BD = Hypotenuse CD

∠DFB = ∠DEC = 90°

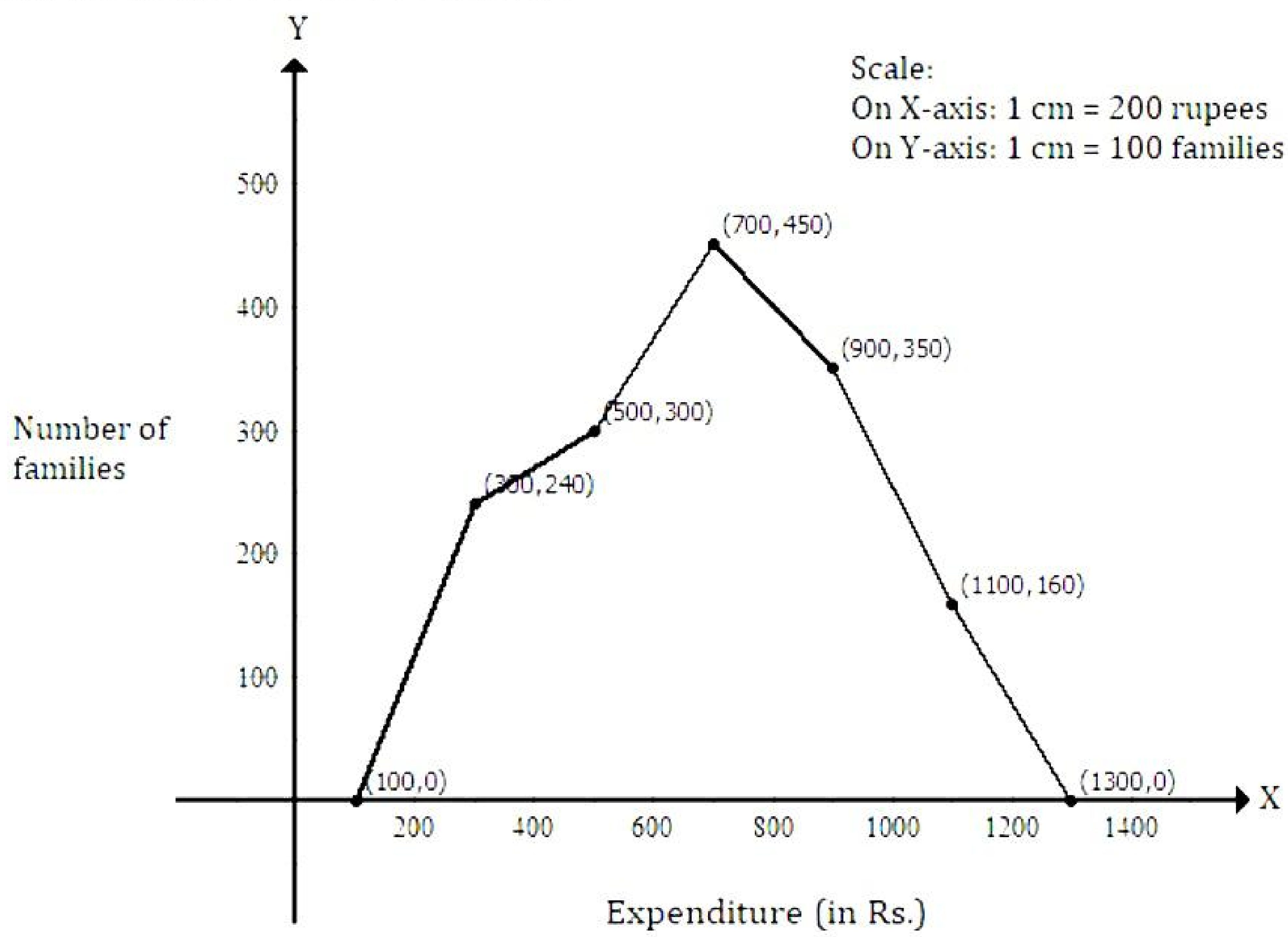
DF = DE

∴ ΔBDF ≅ ΔCDE (RHS congruence)
⇒ ∠B = ∠C (CPCT)
⇒ AC = AB (Sides opposite to equal angles are equal)
Hence, ΔABC is an isosceles triangle.

29.

Expenditure (Rs.)	Class-mark	Families	Co-ordinates of points
200–400	300	240	(300, 240)
400–600	500	300	(500, 300)
600–800	700	450	(700, 450)
800–1000	900	350	(900, 350)
1000–1200	1100	160	(1100, 160)

The frequency polygon is as follows:



30.

(i) Slant height of a cone = 14 cm
Let the radius of the base of the cone = r
CSA of cone = πrl

$$308 = \frac{22}{7} \times r \times 14$$

$$\Rightarrow 308 = 22 \times r \times 2$$

$$\Rightarrow r = \frac{308}{44} \text{ cm} = 7 \text{ cm}$$

Thus, the radius of the base of the cone is 7 cm.

(ii) Total surface area of cone = CSA of the cone + Area of the base
$= 308 + \pi r^2$

$$= \left[308 + \frac{22}{7} \times (7)^2\right] \text{ cm}^2$$

$$= (308 + 154) \text{ cm}^2$$

$$= 462 \text{ cm}^2$$

Thus, the total surface area of the cone is 462 cm^2.

OR

Height (h) of conical tent = 10 m
Radius (r) of conical tent = 24 m

(i) Let the slant height of the conical tent = l
$l^2 = h^2 + r^2 = (10 \text{ m})^2 + (24 \text{ m})^2 = 676 \text{ m}^2$
$\therefore$ l = 26 m
Thus, the slant height of the conical tent is 26 m.

(ii) CSA of a tent = $\pi rl = \left(\frac{22}{7} \times 24 \times 26\right) \text{ m}^2 = \frac{13728}{7} \text{m}^2$

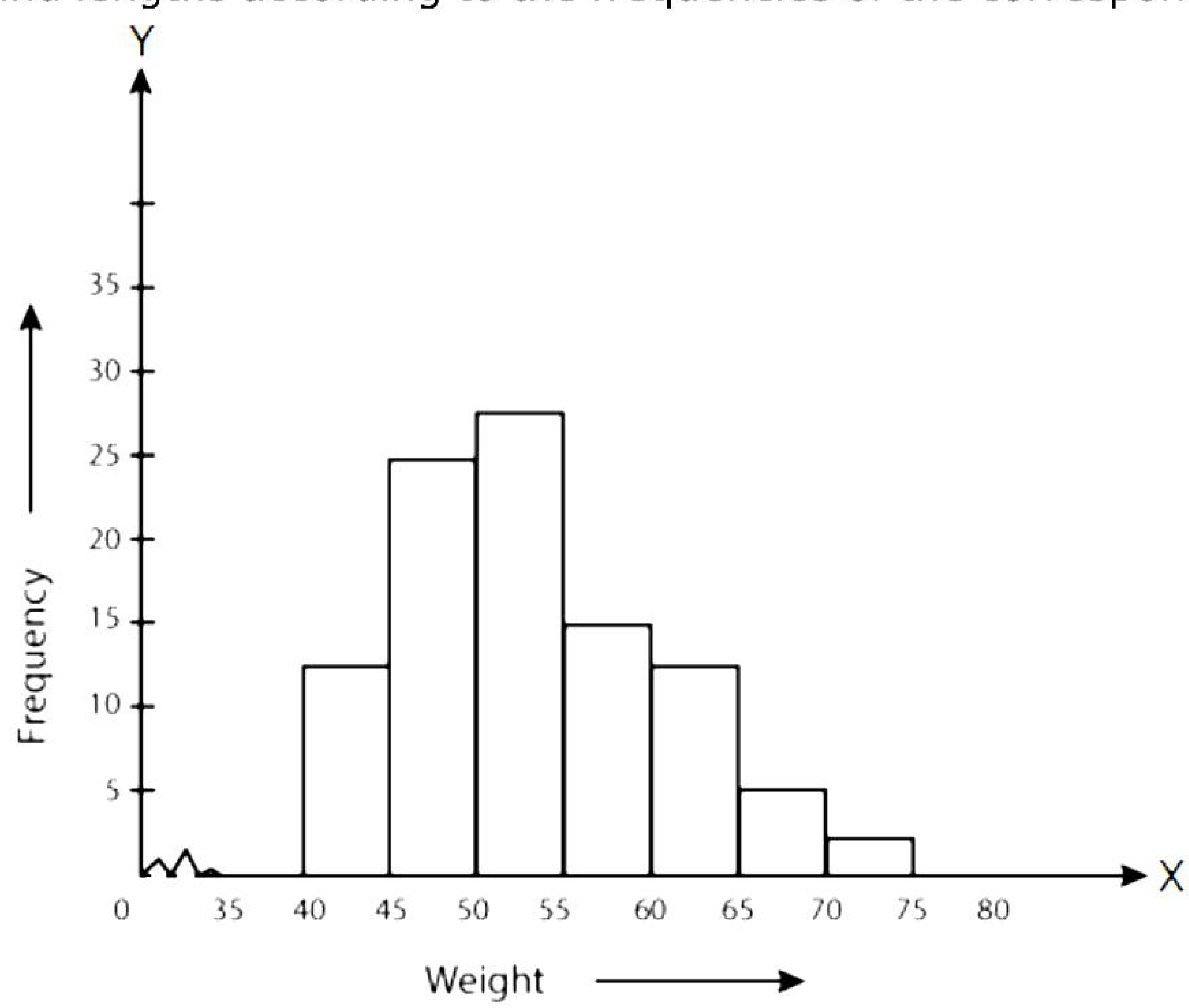
Cost of 1 m^2 canvas = Rs. 63

Then, cost of $\frac{13728}{7} \text{m}^2$ canvas = Rs. $\left(\frac{13728}{7} \times 63\right)$ = Rs. 123552

Thus, the cost of canvas required to make the tent is Rs. 123552.

31. Steps of construction:

i. We represent the weights on the horizontal axis. The scale on the horizontal axis is 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.



Section D

32. (2x − 3) is a factor of $p(x) = 2x^3 - 9x^2 + x + k$

If 2x − 3 = 0 ⇒ x = 3/2

If 2x − 3 is a factor of p(x), then p(3/2) = 0

$$\Rightarrow p\left(\frac{3}{2}\right) = 0$$

$$\Rightarrow 2\left(\frac{3}{2}\right)^3 - 9\left(\frac{3}{2}\right)^2 + \frac{3}{2} + k = 0$$

$$\Rightarrow 2 \times \frac{27}{8} - 9 \times \frac{9}{4} + \frac{3}{2} + k = 0$$

$$\Rightarrow \frac{27}{4} - \frac{81}{4} + \frac{3}{2} + k = 0$$

$$\Rightarrow \frac{27 - 81 + 6}{4} + k = 0$$

⇒ −12 + k = 0

⇒ k = 12

OR

The divisor is not a linear polynomial. It is a quadratic polynomial.

Now, $x^2 - 3x + 2 = x^2 - 2x - x + 2$

$= x(x - 2) - (x - 2)$

$= (x - 2)(x - 1)$

To show $x^2 - 3x + 2$ is a factor of the polynomial $2x^4 - 6x^3 + 3x^2 + 3x - 2$, we have to show that $(x - 2)$ and $(x - 1)$ are the factors of $2x^4 - 6x^3 + 3x^2 + 3x - 2$.

Let $p(x) = 2x^4 - 6x^3 + 3x^2 + 3x - 2$

$p(2) = 2(2)^4 - 6(2)^3 + 3(2)^2 + 3(2) - 2$

$= 32 - 48 + 12 + 6 - 2$

$= 0$

As $p(2) = 0$, $x - 2$ is a factor of $p(x)$.

$p(1) = 2(1)^4 - 6(1)^3 + 3(1)^2 + 3(1) - 2$

$= 2 - 6 + 3 + 3 - 2$

$= 0$

As $p(1) = 0$, $x - 1$ is a factor of $p(x)$.

As both $x - 2$ and $x - 1$ are the factors of $p(x)$, the product $x^2 - 3x + 2$ will also be a factor of $p(x) = 2x^4 - 6x^3 + 3x^2 + 3x - 2$.

33. AB = 26 m, BC = 27 m, CD = 7 m, DA = 24 m

Diagonal AC is joined.

In right-angled ΔADC, by Pythagoras theorem,

$AC^2 = AD^2 + CD^2$

$\therefore AC = \sqrt{24^2 + 7^2} = \sqrt{24^2 + 7^2} = \sqrt{576 + 49} = \sqrt{625} = 25$ m

To find the area of ΔABC, we have

Semi-perimeter (s) = $\frac{1}{2}(AB + BC + CA) = \frac{1}{2}(26 + 27 + 25) = 39$ m

$\therefore$ Area of ΔABC = $\sqrt{s(s - AB)(s - BC)(s - CA)}$

$= \sqrt{39(39 - 26)(39 - 27)(39 - 25)}$

$= \sqrt{39 \times 14 \times 13 \times 12}$

$= 291.849$ m^2

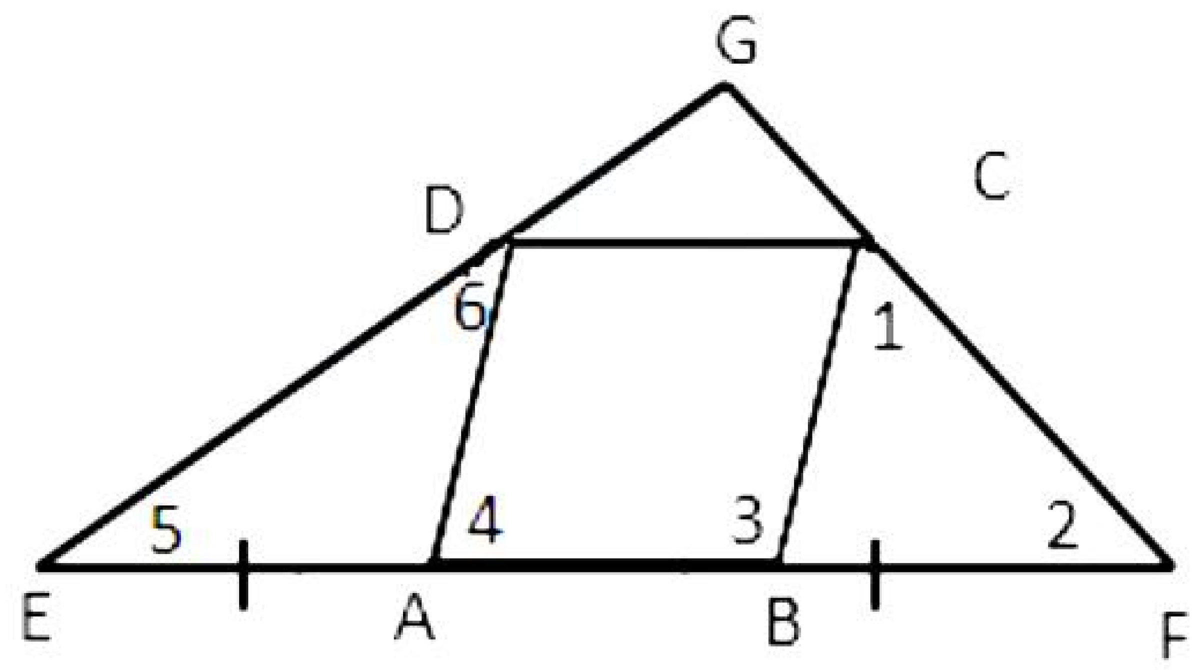
Now, Area of ΔADC = $\frac{1}{2} \times CD \times AD = \frac{1}{2} \times 7 \times 24 = 84$ m^2

Therefore, A(□ ABCD) = Area of ΔABC + Area of ΔADC

$= 291.849 + 84$

$= 375.8$ m^2

34.



Given: ABCD is a rhombus. AB is produced to E and F such that AE = AB = BF.

Construction: Join ED and CF and produce them to meet at G.

To prove: EG is perpendicular to FG.

Proof: AB is produced to points E and F such that AE = AB = BF ...(i)

ABCD is a rhombus.

∴ AB = BC = CD = AD ...(ii)

In ΔBCF,

BC = BF [from (i) and (ii)]

∴ $\angle 1 = \angle 2$

$\angle 3 = \angle 1 + \angle 2$ (exterior angle)

$\angle 3 = 2\angle 2$ ...(iii)

Similarly, AE = AD

∴ $\angle 5 = \angle 6$

∴ $\angle 4 = \angle 5 + \angle 6 = 2\angle 5$ ...(iv)

Adding (iii) and (iv),

∴ $\angle 4 + \angle 3 = 2\angle 5 + 2\angle 2$

∴ $180° = 2(\angle 5 + \angle 2)$ ($\angle 4$ and $\angle 3$ are consecutive interior angles)

∴ $\angle 5 + \angle 2 = 90°$

In ΔEGF,

$\angle 5 + \angle 2 + \angle EGF = 180°$

∴ $\angle EGF = 90°$

∴ EG and FG are perpendicular to each other.

OR

i. The length of the segment joining the mid-points of non-parallel sides of a trapezium is half the sum of the lengths of its parallel sides.

   PQ = ½ (AB + DC)

   ∴ PQ = ½ (7 + 13)

   ∴ PQ = 10 cm

ii. The segment joining the mid-points of non-parallel sides of a trapezium is parallel to its parallel sides.

   ∴ PQ || DC || AB

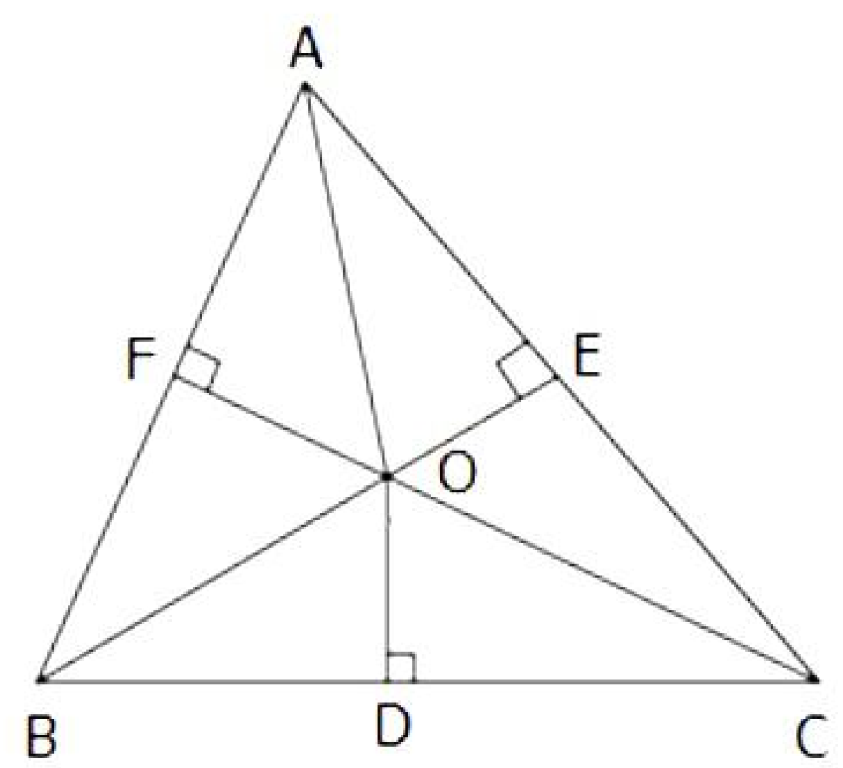
   ∴ $\angle PDC = \angle APQ$ (Corresponding angles)

   Since, $\angle APQ = 50°$

   ∴ $\angle PDC = 50°$

iii. If three parallel lines make congruent intercepts on a transversal, then they make congruent intercepts on any other transversal.
Now, AB || PQ || DC.
Also, transversals AD and BC make congruent intercepts.
∴ BR = RT
∴ RT = 4 cm

35.



Given: ΔABC in which OB and OC are the bisectors of ∠B and ∠C, respectively.
To prove: OA bisects ∠A.
Construction: Draw OD ⊥ BC, OE ⊥ CA and OF ⊥ AB.
Proof: In ΔODC and ΔOEC,
∠OCD = ∠OCE (OC bisects ∠C)
∠ODC = ∠OEC = 90° (Construction)
OC = OC (Common)
∴ ΔODC ≅ ΔOEC (AAS congruence)
∴ OD = OE (i) (CPCT)
Similarly, ΔODB ≅ ΔOFB by AAS congruence
∴ OD = OF (ii) (CPCT)
⇒ OE = OF (iii)
In ΔOEA and ΔOFA,
OA = OA (Common side)
OE = OF [From (iii)]
∴ ΔOEA ≅ ΔOFA (RHS congruence rule)
∴ ∠OAE = ∠OAF (CPCT)
∴ OA bisects ∠A.

Section E

36.

i. The decimal form of $\frac{2}{11}$. is $0.\overline{18}$.

ii. Let x = $0.\overline{38}$ ..... (1)

$\Rightarrow$ 100x = $38.\overline{38}$ ..... (2)

Subtract (1) from (2), we get

100x – x = $38.\overline{38} - 0.\overline{38}$

$\Rightarrow$ 99x = 38

$\Rightarrow x = \frac{38}{99}$

OR

Let x = $0.\overline{38}$ ..... (1)

$\Rightarrow$ 100x = $38.\overline{38}$ ..... (2)

Subtract (1) from (2), we get

100x – x = $38.\overline{38} - 0.\overline{38}$

$\Rightarrow$ 99x = 38

$\Rightarrow x = \frac{38}{99}$

$0.\overline{38} = \frac{38}{99}$

m = 38 and n = 99

$\Rightarrow$ m + n = 38 + 99 =137

iii. The decimal expansion of $0.\overline{38}$ is non–terminating repeating.

37.

i. Coordinates of CAVE of DEATH are (5, 3).

ii. The coordinates of THREE PALMS are (6, 4).

iii. The distance between FOUR CROSS CLIFF and the CAVE of DEATH is 3 units.

OR

The distance of SKULL ROCK from x–axis is 5 units.

38.

i. $p(x) = x^2 - 12x - 220$

$\Rightarrow p(x) = x^2 - 22x + 10x - 220$

$\Rightarrow p(x) = x(x - 22) + 10(x - 22)$

$\Rightarrow p(x) = (x - 22)(x + 10)$

Take $x - 22 = 0$ and $x + 10 = 0$

$\Rightarrow x = 22$ or $x = -10$

So, the zeroes are 22 and −10.

Since $\alpha < \beta$,

Therefore, $\alpha = -10$ and $\beta = 22$.

ii. As $p(x) = x^2 - 12x - 220$

Therefore, $p(4) = 16 - 48 - 220 = -252$

iii. As $p(x) = x^2 + x - 2$

$\Rightarrow p(x) = x^2 + 2x - x - 2$

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

$\Rightarrow p(x) = (x + 2)(x - 1)$

So, the zeroes are −2 and 1.

Therefore, $\frac{1}{\alpha} + \frac{1}{\beta} = -\frac{1}{2} + 1 = \frac{1}{2}$

OR

$p(x) = x^2 - 24x + 128$

$\Rightarrow p(x) = x^2 - 8x - 16x + 128$

$\Rightarrow p(x) = x(x - 8) - 16(x - 8)$

$\Rightarrow p(x) = (x - 8)(x - 16)$