Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 13

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. The decimal form of a rational number $\frac{13}{20}$ is

A. 0.655
B. 0.560
C. 0.620
D. 0.650

2. Express 0.7777... in the form of $\frac{p}{q}$.

A. $\frac{7}{9}$
B. $\frac{7}{8}$
C. $\frac{9}{7}$
D. $\frac{8}{9}$

3. The total surface area of a sphere with radius 7 cm is

A. 616 cm^2
B. 626 cm^2
C. 516 cm^2
D. 416 cm^2

4. The curved surface area of a cone with radius r, height h and slant height l, is given by

A. πr^2
B. πrh
C. πrl
D. $2\pi rl$

5. Which of the following is a zero of polynomial $(x^4 + x^2 - 8x + 6)$?

A. 1
B. 0
C. 2
D. –1

6. Which of the following identity can be applied for evaluating 203 × 205?

A. $(x + a)(x - a)$
B. $a^2 - b^2$
C. $(x + a)(x + b)$
D. $(a - b)^2$

7. If $\Delta ABC \cong \Delta XYZ$, then which of the following is incorrect?

A. AB = XY
B. $\angle A = \angle Y$
C. BC = YZ
D. $\angle C = \angle Z$

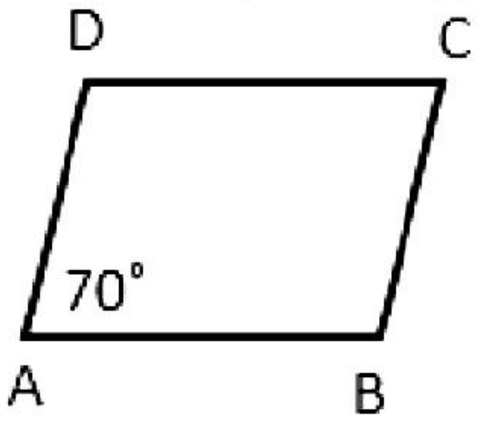
8. Lines which are parallel to a given line are

A. parallel to each other.
B. perpendicular to each other.
C. coincident lines.
D. collinear lines.

9. In a parallelogram,

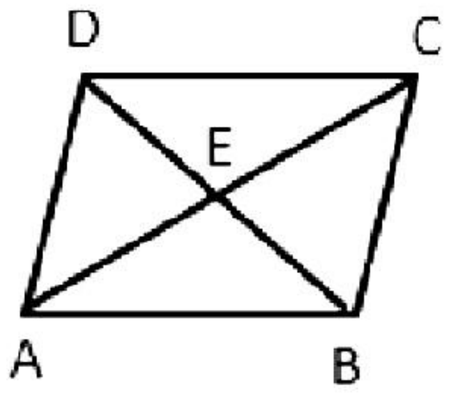
A. diagonals bisect each other
B. diagonals are perpendicular to each other
C. diagonals are of equal length
D. diagonals are angle bisectors

10. ABCD is a parallelogram in which ∠A = 70°. Calculate ∠C.



A. 110°
B. 80°
C. 60°
D. 70°

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

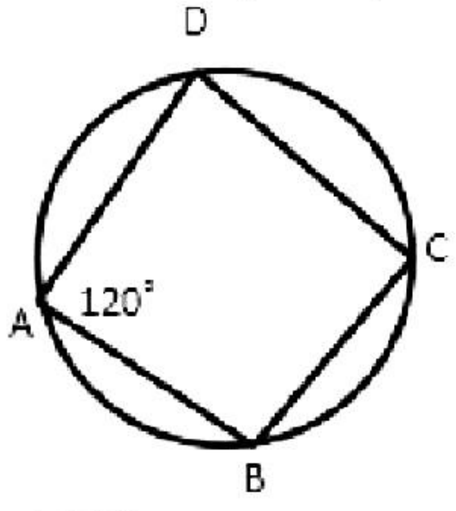


A. 10 cm
B. 14 cm
C. 5 cm
D. 7 cm

12. If two chords AB and CD are equidistant from the centre, then

A. AB > CD
B. AB = CD
C. AB || CD
D. AB < CD

13. ABCD is a cyclic quadrilateral in which ∠A = 120°. Find ∠C.



A. 110°
B. 80°
C. 60°
D. 70°

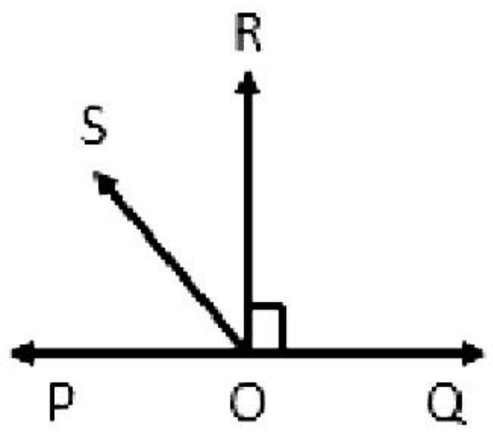
14. The line drawn through the centre of a circle to bisect a chord is _____.

A. parallel to the chord
B. perpendicular to the chord
C. also a chord
D. diameter of the circle

15. Opposite angles of a parallelogram are

A. supplementary
B. complementary
C. equal in measures
D. interior opposite angles

16. Find ∠SOP if ∠SOP = ∠ROS.



A. 15°
B. 35°
C. 25°
D. 45°

17. If x° and (3x – 20)° are a pair of vertically opposite angles, then find x.

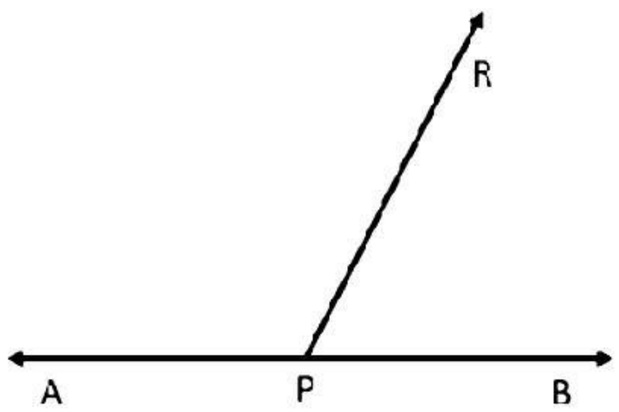
A. 10
B. 30
C. 20
D. 40

18. In a linear pair, if one angle is equal to twice the other, find the smaller angle.

A. 50°
B. 40°
C. 70°
D. 60°

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): A ray PR stands on line AB, then ∠APR + ∠RPB = 180°.



Statement R (Reason): If a ray stands on a line, then the sum of the two adjacent angles so formed is 180°.

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): ΔABC is congruent to ΔDEF if ∠B = ∠E = 90° and AC = DF.

Statement R (Reason): If corresponding hypotenuse and one side of two right angled triangles are equal, then both the triangles are congruent.

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

22. Factorise: $3(2a - b)^2 - 17(2a - b) - 28$ [2]

23. If a and b are rational numbers, then find the value of a and b in the following equation: $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} = a + b\sqrt{6}$ [2]

24. If $\left(\frac{x^{-1}y^2}{x^3y^{-2}}\right)^{1/3} \div \left(\frac{x^6y^{-3}}{x^{-2}y^3}\right)^{1/2} = x^a y^b$, prove that a + b = −1, where x and y are different positive primes. [2]

OR

Prove that $\sqrt{5}+\sqrt{2}$ is an irrational number.

25. Draw the graph of the equation passing through a point (3, 4) and parallel to the x-axis. [2]

OR

Show that x = 2 and y = 3 satisfy the linear equation 3x – 4y + 6 = 0.

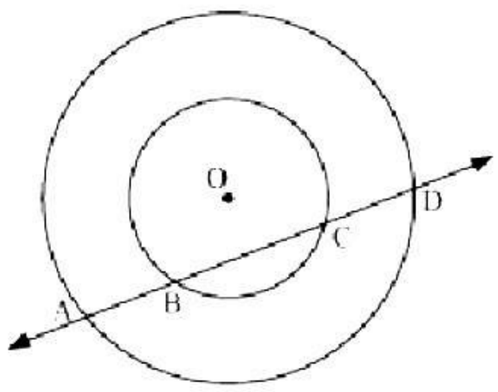
Section C

Section C consists of 6 questions of 3 marks each.

26. Find the surface area of a sphere of radius: [3]
    (i) 10.5 cm (ii) 5.6 cm (iii) 14 cm

27. Factorise: [3]
    (i) $12x^2 - 7x + 1$ (ii) $2x^2 + 7x + 3$

28. If a line intersects two concentric circles (circles with the same centre) with centre O at A, B, C and D, prove that AB = CD. [3]



OR

If two equal chords of a circle intersect within the circle, prove that the line joining the point of intersection to the centre makes equal angles with the chords.

29. Construct a histogram for the below data. [3]

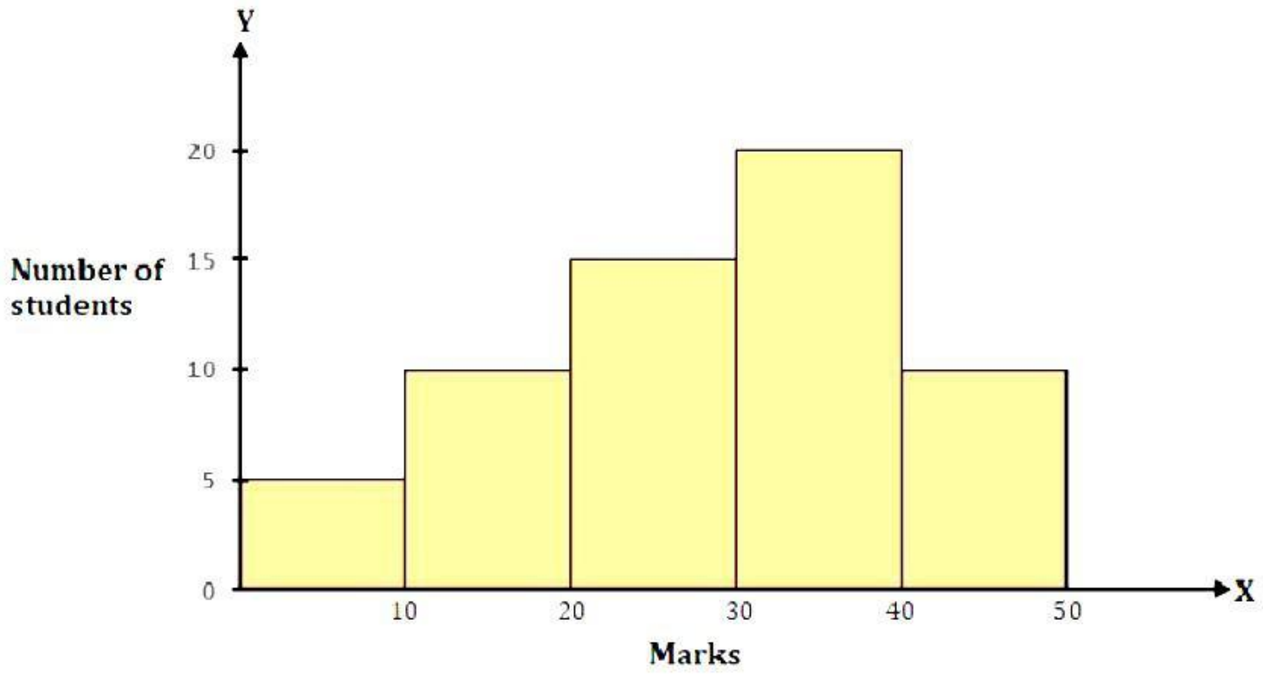
Classes	Frequency
0-10	5
10-20	7
20-30	8
30-60	15

30. A hemispherical bowl made of brass has inner diameter 10.5 cm. Find the cost of tin-plating it on the inside at the rate of Rs. 16 per 100 cm^2. [3]

OR

The diameter of the moon is approximately one fourth of the diameter of the earth. Find the ratio of their surface areas.

31. Based on below histogram, answer the questions given. [3]



(i) Which class has the highest frequency?

(ii) Find the difference between the number of students who secured marks above 30 and less than 10.

Section D

Section D consists of 4 questions of 5 marks each.

32. Write the following cubes in expanded form: [5]

(i) $(2x+1)^3$ (ii) $(2a-3b)^3$

(iii) $\left[\frac{3}{2}x+1\right]^3$ (iv) $\left[x-\frac{2}{3}y\right]^3$

OR

Factorise:

(i) $4x^2+9y^2+16z^2+12xy-24yz-16xz$

(ii) $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$

33. What length of tarpaulin 3 m wide will be required to make conical tent of height 8 m and base radius 6 m? Assume that the extra length of material that will be required for stitching margins and wastage in cutting is approximately 20 cm. (Use $\pi = 3.14$). [5]

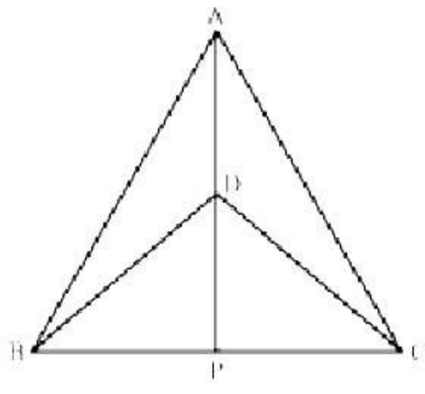
34. ΔABC and ΔDBC are two isosceles triangles on the same base BC and vertices A and D are on the same side of BC (see the given figure). If AD is extended to intersect BC at P, show that

(i) $\Delta ABD \cong \Delta ACD$

(ii) $\Delta ABP \cong \Delta ACP$

(iii) AP bisects $\angle A$ as well as $\angle D$.

(iv) AP is the perpendicular bisector of BC. [5]

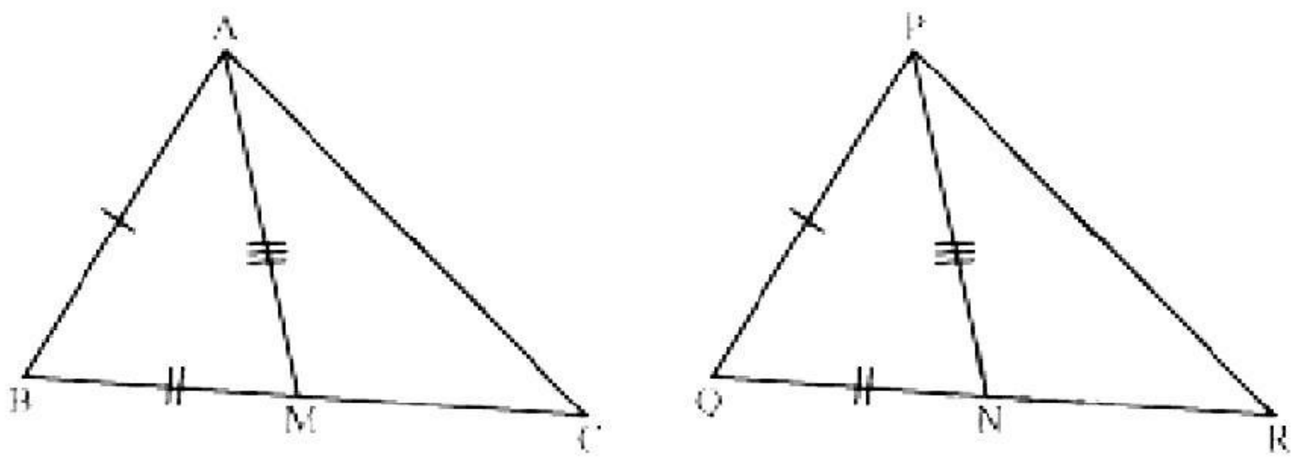


OR

Two sides AB and BC and median AM of one triangle ABC are respectively equal to sides PQ and QR and median PN of ΔPQR (see the given figure). Show that:

(i) $\Delta ABM \cong \Delta PQN$

(ii) $\Delta ABC \cong \Delta PQR$



35. If D is the mid-point of the hypotenuse AC of a right-angled ΔABC, then prove that BD = ½ AC. [5]

Section E

Case study-based questions are compulsory.

36. Decimal form of rational numbers can be classified into two types. Let x be a rational number whose decimal expansion terminates. Then x can be expressed in the form $\frac{p}{q}$, where p and q are co-prime and the prime factorization of q is of the form 2^n5^m, where n, m are non-negative and vice-versa.

    Let $x = \frac{p}{q}$ be a rational number, such that the prime factorization of q is not of the form 2^n5^m, where n and m are non-negative integers. Then x has a non-terminating repeating decimal expansion.

    Base on the above information, answer the following questions.

    i. Check whether $\frac{81}{5^2 \times 2^3 \times 3}$ has terminating decimal expansion or not? [2]

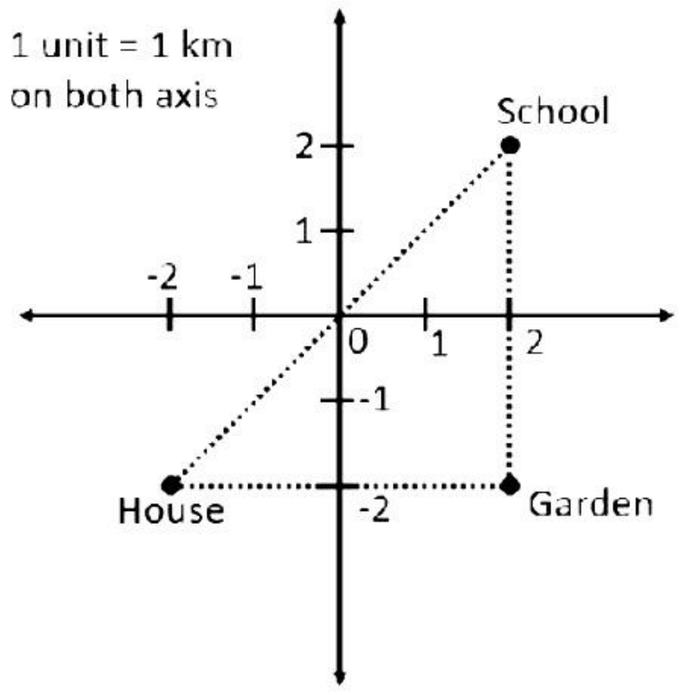
    OR

    Check whether $\frac{441}{2^2 \times 5^2 \times 7^2}$ has terminating decimal expansion or not? [2]

    ii. For which value(s) of b, a rational number $\frac{251}{2^3 \times b^2}$ has a terminating decimal expansion? [1]

    iii. Decimal expansion of a/an _____ number is non-terminating and non-repeating. [1]

37. Raj, studying in class 9, goes to his school every day by walking. There are two routes from his house to the school. One of the routes connects his house to the school directly, while the other takes a sharp left-turn around a garden. Both routes are shown in the graph below.



i. Find the distance from Raj's house to the garden. [1]

ii. Find the distance from garden to Raj's school. [1]

iii. Find the shortest distance from Raj's house to his school. [2]

OR

If Raj decides to travel by Auto rickshaw at the fare of Rs. 10/km, then how much will it cost to travel from his house to the garden? [2]

38. Meera bought some apples at the rate of Rs. 100 per kg and some avocados at the rate of Rs. 200 per kg. If she bought 'x' kg of apples and 'y' kg of avocado, then answer the following questions.

i. If the total cost incurred to Meera after buying 'x' kg of apples and 'y' kg of avocado is Rs. 1000, then write the equation representing this situation? [1]

ii. If Meera bought 3 kg of apples and 'y' kg of avocados for Rs. 500, find the value of 'y'. [2]

OR

If Meera bought 'x' kg of apples and 2 kg of avocados for Rs. 800, find the value of 'x'. [2]

iii. At what point the graph of $x + 2y = 10$ cuts the Y-axis? [1]

Solution

Section A

1. Correct option: D
Explanation:
$\frac{13}{20} = \frac{13 \times 5}{20 \times 5} = \frac{65}{100} = 0.65$

2. Correct option: A
Explanation:
Let x = 0.7777... (i)
10x = 7.7777... (ii)
Subtracting (i) from (ii),
9x = 7
$x = \frac{7}{9}$

3. Correct option: A
Explanation:
Total surface area of a sphere = $4\pi r^2$
$= 4 \times \frac{22}{7} \times 7^2$
$= 616\ cm^2$

4. Correct option: C
Explanation:
Curved surface area of the cone = πrl

5. Correct option: A
Explanation:
$p(x) = x^4 + x^2 - 8x + 6$
$p(1) = 1^4 + 1^2 - 8(1) + 6 = 1 + 1 - 8 + 6 = 0$

6. Correct option: C
Explanation:
$203 \times 205 = (200 + 3)(200 + 5)$
$= 200^2 + (3 + 5)200 + 3 \times 5$ $[(x + a)(x + b) = x^2 + (a + b)x + ab]$

7. Correct option: B
Explanation:
If $\Delta ABC \cong \Delta XYZ$, then $\angle A = \angle X \neq \angle Y$ ...(c.p.c.t)

8. Correct option: A
Explanation:
Lines which are parallel to a given line are parallel to each other.

9. Correct option: A
Explanation:
In a parallelogram, diagonals bisect each other.

10. Correct option: D
Explanation:
In a parallelogram, opposite angles are equal.
$\therefore \angle C = \angle A = 70°$

11. Correct option: B
Explanation:
AE = 7 cm and since diagonals bisect at E.
$\therefore$ AC = 2AE = 2 × 7 = 14 cm

12. Correct option: B
Explanation:
Equal chords of a circle are equidistant from the centre.

13. Correct option: C
Explanation:
ABCD is a cyclic quadrilateral and opposite angles of a cyclic quadrilateral are supplementary.
$\therefore \angle A + \angle C = 180°$
$\Rightarrow 120° + \angle C = 180°$
$\Rightarrow \angle C = 60^{\circ}$

14. Correct option: B
Explanation:
The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

15. Correct option: C
Explanation:
Opposite angles of a parallelogram are equal in measures.

16. Correct option: D
Explanation:
Given, $\angle ROQ = 90°$ and $\angle SOP = \angle ROS$
$\Rightarrow \angle ROQ + \angle ROP = 180°$ (linear pair of angles)
$\Rightarrow \angle ROQ + \angle SOP + \angle ROS = 180°$
$\Rightarrow 90° + 2\angle SOP = 180°$
$\Rightarrow 2\angle SOP = 90°$
$\Rightarrow \angle SOP = 45°$

17. Correct option: A

Explanation:

Pair of vertically opposite angles are equal.

$\therefore x = 3x - 20$

$\Rightarrow 2x = 20$

$\Rightarrow x = 10$

18. Correct option: D

Explanation:

Let the smaller angle = x

$\Rightarrow$ Greater angle = 2x

Now,

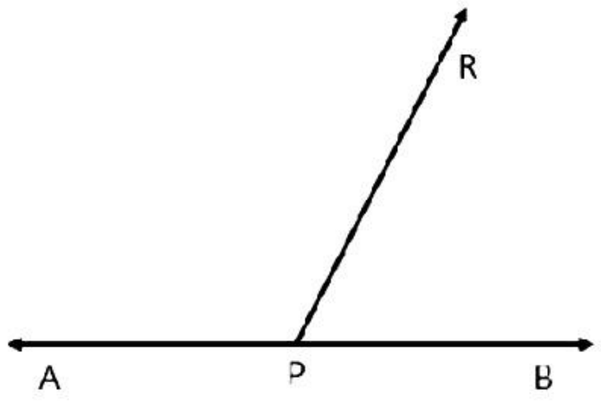
$x + 2x = 180°$

$\Rightarrow 3x = 180°$

$\Rightarrow x = 60°$

19. Correct option: A

Explanation:



Here,

$\angle APR + \angle RPB = 180°$

Because, if a ray stands on a line, then the sum of the two adjacent angles so formed is 180°.

Hence, the statements given in assertion and reason are correct and reason is the correct explanation for assertion.

20. Correct option: D

Explanation:

In the given right-angled triangles, only the hypotenuses of ΔABC and ΔDEF are congruent, but not one of the corresponding sides. Hence, they are not congruent.

Hence, assertion is false.

Now, the statement given in reason is correct and hence, reason is true.

Hence, assertion is false but reason is true.

Section B

21. $27(x + y)^3 + 8(2x - y)^3$

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

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

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

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

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

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

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

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

$= (7x + y)(13x2 + 19y2 - 4xy)$

22. $3(2a - b)^2 - 17(2a - b) - 28$

Put $2a - b = m$

$3m^2 - 17m - 28$

$= 3m^2 - 21m + 4m - 28$

$= 3m(m - 7) + 4(m - 7)$

$= (m - 7)(3m + 4)$

$= (2a - b - 7)[3(2a - b) + 4]$

$= (2a - b - 7)(6a - 3b + 4)$

23.

$$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} = a + b\sqrt{6}$$

$$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} \times \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = a + b\sqrt{6}$$

$$\frac{\left(\sqrt{3}+\sqrt{2}\right)^2}{\left(\sqrt{3}\right)^2 - \left(\sqrt{2}\right)^2} = a + b\sqrt{6}$$

$$\frac{\left(\sqrt{3}\right)^2 + 2\sqrt{3}\sqrt{2} + \left(\sqrt{2}\right)^2}{3-2} = a + b\sqrt{6}$$

$$\therefore 3 + 2\sqrt{6} + 2 = a + b\sqrt{6}$$

$$\therefore 5 + 2\sqrt{6} = a + b\sqrt{6}$$

$$\therefore \text{ a = 5 and b = 2}$$

24.

$$\left(\frac{x^{-1}y^2}{x^3y^{-2}}\right)^{1/3} \div \left(\frac{x^6y^{-3}}{x^{-2}y^3}\right)^{1/2} = x^a y^b$$

$$\left(x^{-1-3}y^{2+2}\right)^{1/3} \div \left(x^{6+2}y^{-3-3}\right)^{1/2} = x^a y^b$$

$$\left(x^{-4}y^4\right)^{1/3} \div \left(x^8y^{-6}\right)^{1/2} = x^a y^b$$

$$\left(x^{-4/3}y^{4/3}\right) \div \left(x^{8/2}y^{-6/2}\right) = x^a y^b$$

$$\frac{x^{\frac{-4}{3}}y^{\frac{4}{3}}}{x^4y^{-3}} = x^a y^b$$

$$x^{-\frac{4}{3}-4}y^{\frac{4}{3}+3} = x^a y^b$$

$$x^{-\frac{16}{3}}y^{\frac{13}{3}} = x^a y^b$$

$$\therefore a = \frac{-16}{3},\ b = \frac{13}{3}$$

$$\therefore a + b = \frac{-16}{3} + \frac{13}{3} = -1$$

OR

If possible, let $\sqrt{5} + \sqrt{2}$ be a rational number equal to x.

$$x = \sqrt{5} + \sqrt{2}$$

$$x^2 = \left(\sqrt{5} + \sqrt{2}\right)^2 = 5 + 2\sqrt{5 \times 2} + 2$$

$$\Rightarrow x^2 = 7 + 2\sqrt{10}$$

$$\Rightarrow x^2 - 7 = 2\sqrt{10}$$

$$\Rightarrow \frac{x^2 - 7}{2} = \sqrt{10}$$

Since, x is rational.

$\Rightarrow x^2$ is rational

$\Rightarrow \frac{x^2 - 7}{2}$ is rational

$\Rightarrow \sqrt{10}$ is rational.

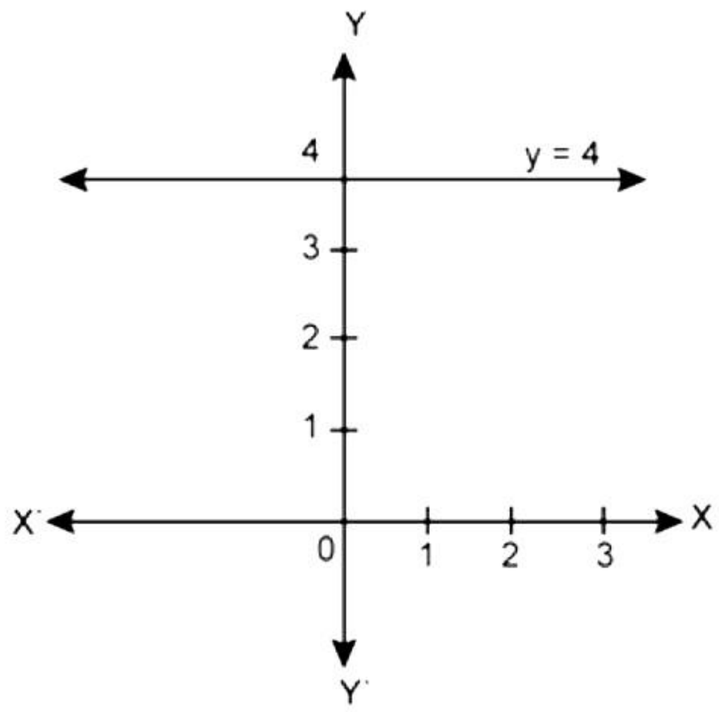
But $\sqrt{10}$ is irrational.

Thus, we arrive at a contradiction.

So, our assumption that $\sqrt{5} + \sqrt{2}$ is rational is wrong.

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

25. The equation of the line which is parallel to the x-axis is given by y = k.
As it passes through the point (3, 4), we have, 4 = k.
So, the required equation of line is y = 4.



OR

Given linear equation is 3x – 4y + 6 = 0.

Substituting x = 2 and y = 3 in given equation,

LHS = 3x – 4y + 6

= 3 × 2 – 4 × 3 + 6

= 6 – 12 + 6

= 0

= RHS

Hence, x = 2, y = 3 satisfies the linear equation 3x – 4y + 6 = 0.

Section C

26.

(i) Radius of a sphere = 10.5 cm

Surface area of a sphere = $4\pi r^2 = \left[4 \times \frac{22}{7} \times (10.5)^2\right]$ cm^2 = 1386 cm^2

(ii) Radius of a sphere = 5.6 cm

Surface area of a sphere = $4\pi r^2 = \left[4 \times \frac{22}{7} \times (5.6)^2\right]$ cm^2 = 394.24 cm^2

(iii) Radius of a sphere = 14 cm

Surface area of a sphere = $4\pi r^2 = \left[4 \times \frac{22}{7} \times (14)^2\right]$ cm^2 = 2464 cm^2

27.

(i) $12x^2 - 7x + 1 = 12x^2 - 4x - 3x + 1$

$= 4x(3x - 1) - 1(3x - 1)$

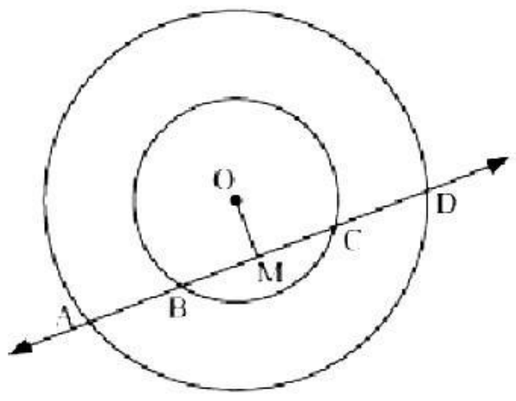
$= (3x - 1)(4x - 1)$

(ii) $2x^2 + 7x + 3 = 2x^2 + 6x + x + 3$

$= 2x(x + 3) + 1(x + 3)$

$= (x + 3)(2x + 1)$

28. Let us draw a perpendicular OM on line AD.



Here, BC is a chord of smaller circle and AD is a chord of bigger circle.

We know that the perpendicular drawn from the centre of a circle bisects the chord.

Then, BM = MC ... (1)

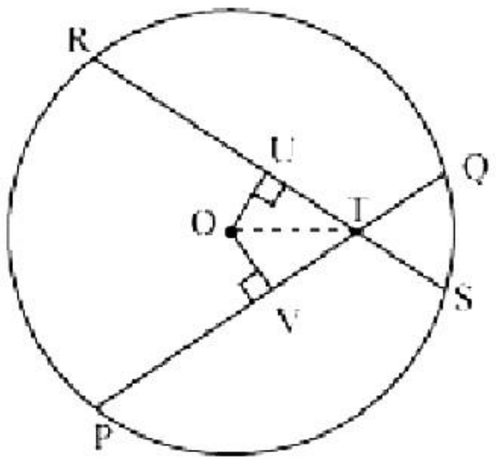
And AM = MD ... (2)

Subtracting equation (1) from equation (2), we have

AM – BM = MD – MC

$\Rightarrow$ AB = CD

OR



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)
$\Rightarrow \angle OTV = \angle OTU$	(CPCT)

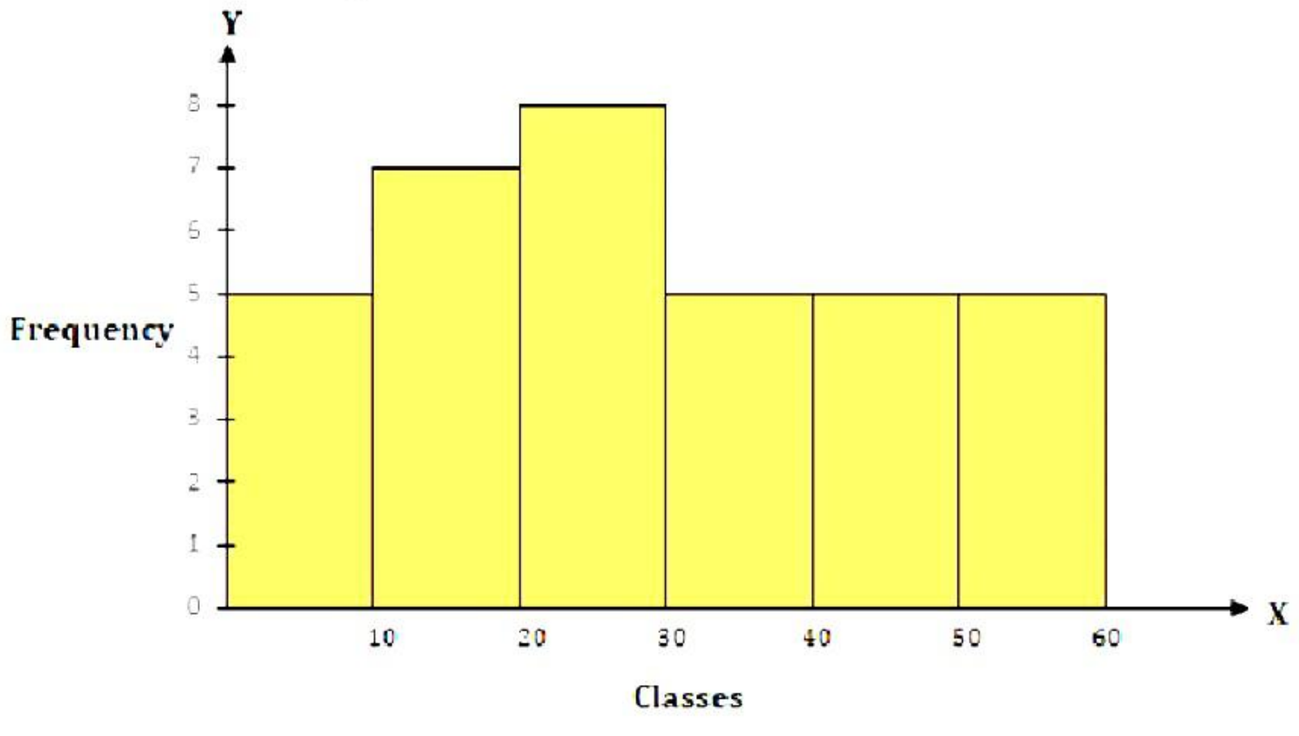
Hence, the line joining the point of intersection to the centre makes equal angles with the chords.

29. We find that the class width of classes 0-10, 10-20, 20-30 is 10 each. But the class width of class 30-60 is 30. So, here, we need to adjust frequency of this class. And,

$$\text{Adjusted frequency of a class} = \frac{\text{Minimum class-width}}{\text{Class-width}} \times \text{Frequency of the class}$$

Classes	Frequency	Adjusted Frequency
0-10	5	$\frac{10}{10} \times 5 = 5$
10-20	7	$\frac{10}{10} \times 7 = 7$
20-30	8	$\frac{10}{10} \times 8 = 8$
30-60	15	$\frac{10}{30} \times 15 = 5$

Then, the histogram is as follows:



30. Inner radius (r) of hemispherical bowl $= \left(\frac{10.5}{2}\right)$ cm $= 5.25$ cm

Curved surface area of hemispherical bowl $= 2\pi r^2$

$= \left[2 \times \frac{22}{7} \times (5.25)^2\right]$ cm^2

$= 173.25$ cm^2

Cost of tin-plating 100 cm^2 area = Rs. 16

Then, cost of tin-plating 173.25 cm^2 area = Rs. $\left(\frac{16 \times 173.25}{100}\right)$ = Rs. 27.72

Thus, the cost of tin-plating the inner side of hemispherical bowl is Rs. 27.72.

OR

Let the diameter of the earth = d

Then, the diameter of the moon $= \frac{d}{4}$

Now, radius of the earth = $\frac{d}{2}$ and radius of the moon $= \frac{d}{8}$

Then, surface area of the earth = $4\pi\left(\frac{d}{2}\right)^2$

And, surface area of the moon = $4\pi\left(\frac{d}{8}\right)^2$

Required ratio $= \frac{4\pi\left(\frac{d}{8}\right)^2}{4\pi\left(\frac{d}{2}\right)^2} = \frac{4}{64} = \frac{1}{16} = 1:16$

Thus, the required ratio of their surface areas is 1:16.

31.

(i) Class 30-40 has the highest frequency.

(ii) Number of students who secured marks above 30 = 20 + 10 = 30

Number of students who secured marks less than 10 = 5

Required difference = 30 – 5 = 25

Section D

32. We know that

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

and $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

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

$= 8x^3 + 1 + 6x(2x+1)$

$= 8x^3 + 1 + 12x^2 + 6x$

$= 8x^3 + 12x^2 + 6x + 1$

(ii) $(2a-3b)^3 = (2a)^3 - (3b)^3 - 3(2a)(3b)(2a-3b)$

$= 8a^3 - 27b^3 - 18ab(2a-3b)$

$= 8a^3 - 27b^3 - 36a^2b + 54ab^2$

(iii) $\left[\frac{3}{2}x+1\right]^3 = \left[\frac{3}{2}x\right]^3 + (1)^3 + 3\left(\frac{3}{2}x\right)(1)\left(\frac{3}{2}x+1\right)$

$= \frac{27}{8}x^3 + 1 + \frac{9}{2}x\left(\frac{3}{2}x+1\right)$

$= \frac{27}{8}x^3 + 1 + \frac{27}{4}x^2 + \frac{9}{2}x$

$= \frac{27}{8}x^3 + \frac{27}{4}x^2 + \frac{9}{2}x + 1$

(iv) $\left[x - \frac{2}{3}y\right]^3 = x^3 - \left(\frac{2}{3}y\right)^3 - 3(x)\left(\frac{2}{3}y\right)\left(x - \frac{2}{3}y\right)$

$= x^3 - \frac{8}{27}y^3 - 2xy\left(x - \frac{2}{3}y\right)$

$= x^3 - \frac{8}{27}y^3 - 2x^2y + \frac{4}{3}xy^2$

OR

We know that

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

(i) $4x^2 + 9y^2 + 16z^2 + 12xy - 24yz - 16xz$

$= (2x)^2 + (3y)^2 + (-4z)^2 + 2(2x)(3y) + 2(3y)(-4z) + 2(2x)(-4z)$

$= (2x + 3y - 4z)^2$

$= (2x + 3y - 4z)(2x + 3y - 4z)$

(ii) $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8xz$

$= \left(-\sqrt{2}x\right)^2 + (y)^2 + \left(2\sqrt{2}z\right)^2 + 2\left(-\sqrt{2}x\right)(y) + 2(y)\left(2\sqrt{2}z\right) + 2\left(-\sqrt{2}x\right)\left(2\sqrt{2}z\right)$

$= \left(-\sqrt{2}x + y + 2\sqrt{2}z\right)^2$

$= \left(-\sqrt{2}x + y + 2\sqrt{2}z\right)\left(-\sqrt{2}x + y + 2\sqrt{2}z\right)$

33. Height (h) of conical tent = 8 m

Radius (r) of base of tent = 6 m

Slant height (l) of tent = $\sqrt{r^2 + h^2} = \left(\sqrt{6^2 + 8^2}\right)$ m $= \left(\sqrt{100}\right)$ m $= 10$ m

CSA of conical tent = $\pi rl = (3.14 \times 6 \times 10)\ m^2 = 188.4\ m^2$

Let the length of tarpaulin sheet required be L.

As 20 cm will be wasted so, effective length will be (L – 0.2 m)

Breadth of tarpaulin = 3 m

Area of the tarpaulin sheet = CSA of tent

$[(L - 0.2\ m) \times 3]\ m = 188.4\ m^2$

$L - 0.2\ m = 62.8\ m$

$L = 63\ m$

Thus, the length of the tarpaulin sheet will be 63 m.

34.

i) In ΔABD and ΔACD,

AB = AC	(given)
BD = CD	(given)
AD = AD	(common)
$\therefore \Delta ABD \cong \Delta ACD$	(by SSS congruence rule)
$\Rightarrow \angle BAD = \angle CAD$	(CPCT)
$\Rightarrow \angle BAP = \angle CAP$	....(1)

ii) In ΔABP and ΔACP,

AB = AC	(given)
$\angle BAP = \angle CAP$	[from (1)]
AP = AP	(common)
$\therefore \Delta ABP \cong \Delta ACP$	(by SAS congruence rule)
$\Rightarrow$ BP = CP	(C.P.C.T.) ....(2)

iii) From equation (1),

$\angle BAP = \angle CAP$

Hence, AP bisects $\angle A$.

Now in ΔBDP and ΔCDP

BD = CD	(given)
DP = DP	(common)
BP = CP	[from (2)]
$\therefore \Delta BDP \cong \Delta CDP$	(by SSS Congruence rule)
$\Rightarrow \angle BDP = \angle CDP$	(C.P.C.T.) ....(3)

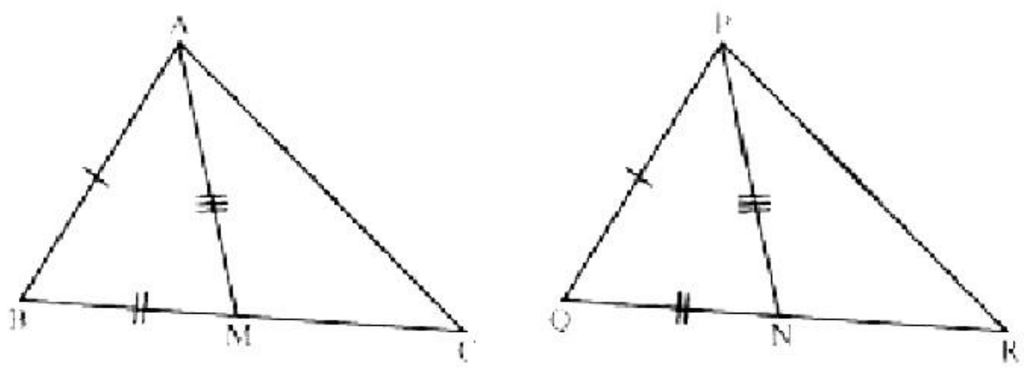
Hence, AP bisects $\angle D$.

iv) We have $\Delta BDP \cong \Delta CDP$

$\therefore \angle BPD = \angle CPD$	(C.P.C.T.) .... (4)
Now, $\angle BPD + \angle CPD = 180^\circ$	(linear pair angles)
$\angle BPD + \angle BPD = 180^\circ$	
$2\angle BPD = 180^\circ$	[from equation (4)]
$\angle BPD = 90^\circ$	

Hence, AP is the perpendicular bisector of BC.

OR



(i) In ΔABC, AM is the median to BC.

$$\Rightarrow BM = \frac{1}{2}BC$$

In ΔPQR, PN is the median to QR.

$$\Rightarrow QN = \frac{1}{2}QR$$

But BC = QR

$$\Rightarrow \frac{1}{2}BC = \frac{1}{2}QR$$

$\Rightarrow$ BM = QN ... (1)

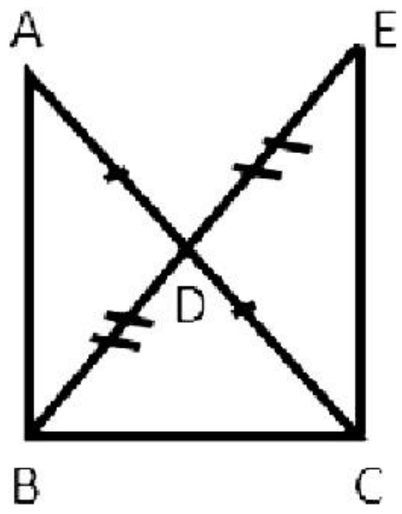
Now, in ΔABM and ΔPQN,

AB = PQ	(given)
BM = QN	[from (1)]
AM = PN	(given)
$\therefore \Delta ABM \cong \Delta PQN$	(SSS congruence rule)
$\angle ABM = \angle PQN$	(C.P.C.T.)
$\angle ABC = \angle PQR$	... (2)

(ii) Now in ΔABC and ΔPQR,

$AB = PQ$	(given)
$\angle ABC = \angle PQR$	[from equation (2)]
$BC = QR$	(given)
$\Rightarrow \Delta ABC \cong \Delta PQR$	(by SAS congruence rule)

35.



Given: ΔABC is right angled at B, and D is the mid-point of AC.

To prove: BD = ½ AC

Construction: Produce BD to E such that BD = DE. Join EC.

Proof: In ΔADB and ΔCDE,

AD = CD	
DB = DE	(Construction)
$\angle ADB = \angle CDE$	(Vertically opposite angles)
$\therefore \Delta ADB \cong \Delta CDE$	(by SAS congruence rule)
$\therefore$ AB = CE	(C.P.C.T.)
And, $\angle ABD = \angle CED$	(C.P.C.T.)
$\therefore$ AB parallel to EC	(Converse of the alternate interior angle test)
$\therefore \angle ABC + \angle ECB = 180°$	(Sum of co-interior angles)
$\therefore \angle ECB = 90°$	($\angle ABC = 90°$)

In ΔABC and ΔECB,

AB = CE	
BC = CB	(Common)
$\angle ABC = \angle ECB = 90°$	
$\therefore \Delta ABC \cong \Delta ECB$	(by SAS congruence rule)
$\therefore$ AC = EB	(C.P.C.T.)
$\therefore$ ½ AC = ½ EB	
$\therefore$ ½ AC = BD	(BD = ½ EB Construction)
$\therefore$ BD = ½ AC	

Section E

Case study-based questions are compulsory.

36.

i. Given, $\frac{81}{5^2 \times 2^3 \times 3}$

Now, $\frac{81}{5^2 \times 2^3 \times 3} = \frac{27 \times 3}{5^2 \times 2^3 \times 3} = \frac{27}{5^2 \times 2^3} = \frac{27}{200}$

It is of the form $\frac{p}{q}$, where p and q are co-prime

We observe that prime factorixation of q is of the form 2^n5^m.
Hence, it has a terminating decimal expansion.

That is, $\frac{81}{5^2 \times 2^3 \times 3} = 0.135$

OR

Given, $\frac{441}{2^2 \times 5^2 \times 7^2}$

Now, $\frac{441}{2^2 \times 5^2 \times 7^2} = \frac{9 \times 7 \times 7}{2^2 \times 5^2 \times 7^2} = \frac{9}{2^2 \times 5^2}$

It is of the form $\frac{p}{q}$.

We observe that prime factorixation of q is of the form 2^n5^m.
Hence, it has a terminating decimal expansion.

That is, $\frac{441}{2^2 \times 5^2 \times 7^2} = 0.09$

ii. When rational number is of the form $\frac{p}{q}$, where p, q are coprime, it has terminating decimal expansion if q is of the form 2^n5^m.

In $\frac{251}{2^3 \times b^2}$, $q = 2^3 \times b^2 \Rightarrow b = 5$.

Hence, for b = 5, $\frac{251}{2^3 \times b^2}$ will be a terminating decimal.

iii. Decimal expansion of an irrational number is non-terminating and non-repeating.

37.

i. The distance from Raj's house to the garden is 4 km.
ii. The distance from garden to Raj's school is 4 km.
iii. By applying Pythagoras theorem, we get the shortest distance from Raj's house to his school = $\sqrt{4^2 + 4^2} = \sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$ km

OR

Distance from Raj's house to the garden = 4 km
Auto rickshaw fare = Rs. 10/km
Hence, travelling cost from his house to garden = Rs. (4 × 10) = Rs. 40

38.

i. Cost of 'x' kg of apples = Rs. 100x
Cost of 'y' kg of avocados = Rs. 200y
Total cost = Rs. 1000
⇒ Rs. (100x + 200y) = Rs. 1000
⇒ 100x + 200y = 1000
⇒ x + 2y = 10

ii. Cost of 3 kg of apples = Rs. (3 × 100) = Rs. 300
Cost of 'y' kg of avocados = Rs. 200y
Total cost = Rs. 500
⇒ 300 + 200y = 500
⇒ 200y = 200
⇒ y = 1

OR

Cost of 'x' kg of apples = Rs. 100x
Cost of 2 kg of avocados = Rs. (2 × 200) = Rs. 400
Total cost = Rs. 800
⇒ 100x + 400 = 800
⇒ 100x = 400
⇒ x = 4

iii. x + 2y = 10
Substituting x = 0 in x + 2y = 10, we get
0 + 2y = 10
⇒ y = 5
So, the graph of x + 2y = 10 cuts the Y-axis at point (0, 5).