Sample Paper 12

Class IX 2022-23

Mathematics

Time: 3 Hours **Max. Marks: 80**

General Instructions:

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

SECTION - A

(Section A consists of 20 questions of 1 mark each.)

1. The quadrants, where the ordinate and abscissa have different signs are:

(a) I and II (b) II and III

(c) I and III (d) II and IV 1

2. Which of the following conclusions is false if t is the semiperimeter and x, y and z are the sides of a triangle?

(a) $t > z$ (b) $t < x + z$

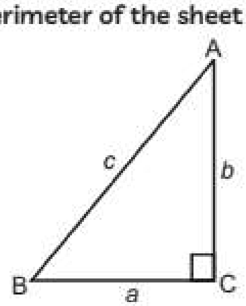
(c) $t < x + y$ (d) $t < x + y + z$ 1

3. In an exhibition, the cost of tickets for an adult is ₹5 more than thrice the cost of a ticket for a child. Which equation relates the cost y, of adult tickets in terms of the cost x, of child tickets?

(a) $y = 5 + 3x$ (b) $y + 5 = 3x$

(c) $y = 3 + 5x$ (d) $y + 3 = 5x$ 1

4. Tinku has a triangular cardboard sheet in his hand, having one angle 90^o. One side of the triangular cardboard sheet is 5 cm and the difference between other two sides is 1 cm. The semi-perimeter of the sheet will be:



(a) 15 cm (b) 16 cm

(c) 30 cm (d) 32 cm 1

5. Deep gave a challenge to her brother to solve exponent in simplest form. The simplest form of $\sqrt{3^2 5^2} \times \sqrt[8]{3^4 5^2} \times \sqrt[3]{3^6 5^6}$ is:

(a) $3^{3.5}5^{-\frac{13}{4}}$ (b) $3^{-3.5}5^{-\frac{12}{4}}$

(c) $\frac{3^{-3.5}}{5^{-\frac{12}{4}}}$ (d) $\frac{3^{3.5}}{5^{-\frac{13}{4}}}$ 1

6. Radhika has an elastic ball having a spherical shape. Now, she stretched it in order to triple its radius, then the ratio of the volume of the original ball to the stretched ball is:

(a) 1 : 4 (b) 1 : 2

(c) 1 : 27 (d) 1 : 4 1

7. According to the Euclid's geometry, which of the following statement is false?

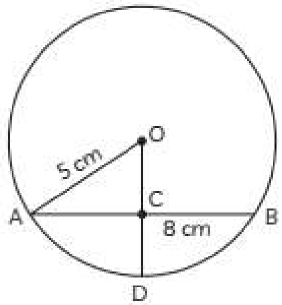
(a) A straight line may be drawn from any one point to any other point.

(b) A terminated line cannot be produced indefinitely.

(c) A circle can be drawn with any center and any radius.

(d) All right angles are equals to one another. 1

8. In the given figure, if OA = 5 cm, AB = 8 cm and OD is perpendicular to AB, then CD is equal to:



(a) 2 cm (b) 3 cm
(c) 4 cm (d) 5 cm 1

9. The width of each of five continuous classes in a frequency distribution is 5 and the lower class-limit of the lowest class is 10. The upper class-limit of the highest class is:
(a) 15 (b) 25
(c) 35 (d) 40 1

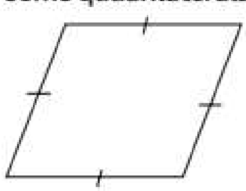
10. Consider the expression $x^{(m-1)} + 3$; where m is a constant. What is the least integer value of m for which the given expression is a polynomial in one variable?
(a) 0 (b) 1
(c) 2 (d) 3 1

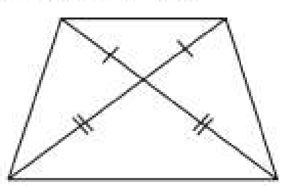
11. The total surface area of a cone of radius 7 cm and height 24 cm is: (Take $\pi = 22/7$)
(a) 710 cm^2 (b) 704 cm^2
(c) 700 cm^2 (d) 725 cm^2 1

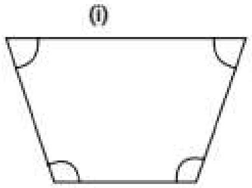
12. If the ratio of two allied angles on the same side of the transversal is 7 : 8. The bigger angle of the two angles is:
(a) 54° (b) 100°
(c) 96° (d) 84° 1

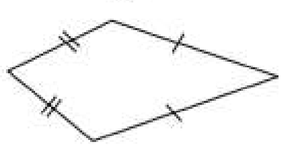
13. On plotting the points O(0,0), A(3, 0), B(3, 4), C(0, 4) on cartesian plane and joining OA, AB, BC and OC. Which of the following figures is obtained?
(a) Square (b) Rectangle
(c) Trapezium (d) Rhombus 1

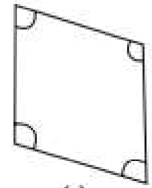
14. Some quadrilaterals are shown below.


(i)


(ii)


(iii)


(iv)


(v)

Which of the following quadrilateral are parallelograms?
(a) Only (i) and (v)
(b) Only (i), (ii) and (v)
(c) Only (ii), (iii), and (iv)
(d) Only (ii), (iv) and (v) 1

15. For drawing a frequency polygon of a continuous frequency distribution, we plot the points whose ordinates are the frequencies of the respective classes and abscissa are respectively:
(a) upper limits of the classes
(b) lower limits of the classes
(c) class marks of the classes
(d) upper limits of preceding classes 1

16. The value of p, if $y = p$ and $x = \frac{3}{2}$ is a solution of the linear equation $2x - y + 27 = 0$, is:
(a) –24 (b) –9
(c) 30 (d) 19 1

17. If angles with measures x and y form a complementary pair, then angles with which of the following measures will form a supplementary pair?
(a) $[x + 47°], [y + 43°]$
(b) $[x - 23°], [y + 23°]$
(c) $[x - 43°], [y - 47°]$
(d) No such pair is possible 1

18. The class mark of the class 90-130 is:
(a) 90 (b) 105
(c) 115 (d) 110 1

Direction: In the following questions, a statement of assertion (A) is followed by a statement of the 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. Statement A (Assertion): The factorization of $z^3 + 125$ is $(z + 5)(z^2 - 5z + 25)$.

Statement R (Reason): We know $x^3 + y^3 = (x + y)^3 - 3xy(x + y)$ 1

20. Statement A (Assertion): The chord, which divides the circle into two equal parts, passes through the centre.

Statement R (Reason): The chord of a circle always, divides the circle into two equal parts. 1

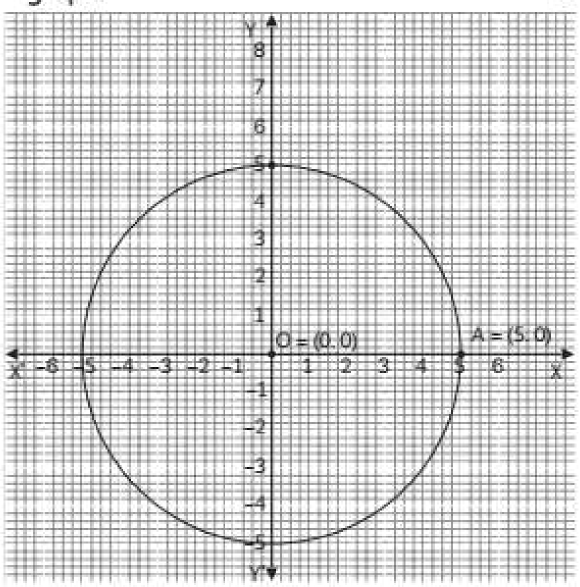
SECTION - B

(Section B consists of 5 questions of 2 marks each.)

21. Factorise the equation $64(x + y)^3 - 125(x - y)^3$. 2

22. Check whether $\left(\sqrt{2}, 4\sqrt{2}\right)$ is a solution of the equation $x - 2y = 4$ or not. 2

23. Find the area of circle which given in the graph. 2



24. The slant height and base diameter of a conical tomb are 25 m and 14 m respectively. Find the cost of white washing to its curved surface at the rate of ₹210 per 100 sq. m.

OR

A hemispherical dome of a tomb needs to be painted. The circumference of the base of the dome is 17.6 cm. If the cost of painting is ₹7 per cm^2. What is the cost, rounded to the nearest rupees, to paint the dome? 2

25. Romi was given an expression $\sqrt{\frac{768}{4}} - \frac{256}{512}\sqrt{48} - \sqrt{\frac{225}{3}}$, where $\sqrt{3} = 1.7321$.

He has to express it into decimals correct up to 3 decimal. What decimal number will obtain?

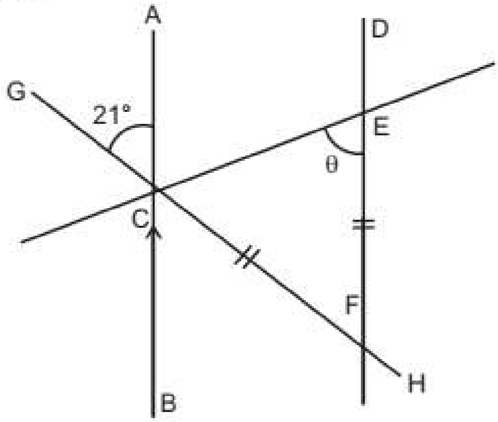
OR

On a number line, $\frac{2}{\sqrt{8}}$ is halfway located between 0 and $\sqrt{a}$. What is the value of a? 2

SECTION - C

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

26. Find the value of angle θ in the figure given below.



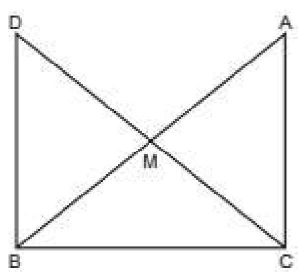
3

27. In the right angle triangle ABC, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. Point D is joined to point B. Show that:

(A) $\Delta AMC \cong \Delta BMD$

(B) $\angle DBC$ is a right angle.

(C) $\Delta DBC \cong \Delta ACB$



3

28. An expression is given: $2\left(\sqrt{k}-1\right)+\sqrt{8}$. If we add $-8\sqrt{2}$ to the expression, the result so obtain is a rational number, then what is the value of *k*? 3

29. 100 surnames were randomly picked up from a local telephone directory and a frequency distribution of the number of letters in the English alphabet in the surnames was found as follows:

Number of Letter	Number of Surnames
1 – 4	6
4 – 6	30
6 – 8	44
8 – 12	16
12 – 20	4

(A) Draw a histogram to depict the given information.

(B) Write the class interval in which the maximum number of surnames lie.

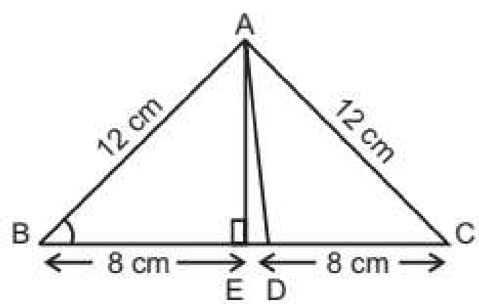
OR

The following table gives the distribution of students of two sections according to the marks obtained by them:

Section A		Section B	
Marks	Frequency	Marks	Frequency
0 – 10	3	0 – 10	5
10 – 20	9	10 – 20	19
20 – 30	17	20 – 30	15
30 – 40	12	30 – 40	10
40 – 50	9	40 – 50	1

Represent the marks of the students of both the sections on the same graph by two frequency polygons. From the two polygons compare the performance of the two sections. 3

30. Sahil drawn a triangle ABC with sides 12 cm, 12 cm, 16 cm on the blackboard as shown in the figure below. He also drawn a median AD of the triangle that bisects the largest side of the triangle. Find the area of the triangle ABD.



3

31. In a school, 25% of the students are girls. If the number of girls and boys are respectively *x* and *y*, then form an equation for the above statement.

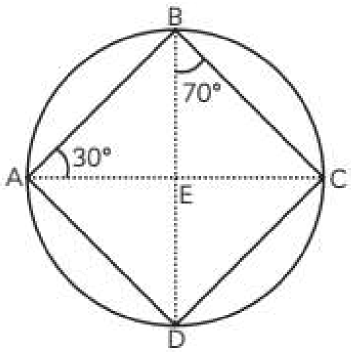
OR

In the equation $-(k + 1)x + ky - 5k = 1 - 2ky$, where $k > 0$ when this equation expressed in the form $ax + by + c = 0$, gives $c = 6$. What are the values of *a* and *b*? 3

SECTION - D

(Section D consists of 4 questions of 5 marks each.)

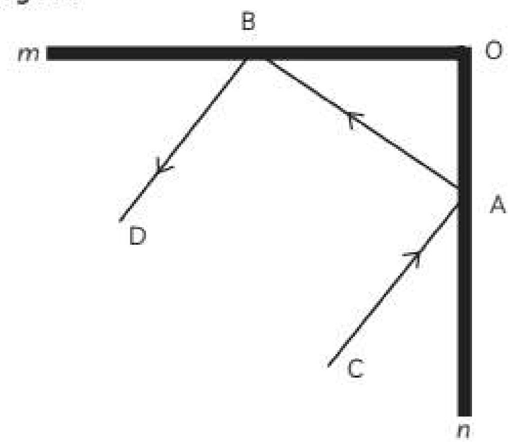
32. ABCD is a cyclic quadrilateral whose diagonals intersect at a point E. If $\angle DBC = 70°$, $\angle BAC = 30°$. Find $\angle BCD$ further, if AB = BC, find $\angle ECD$.



5

OR

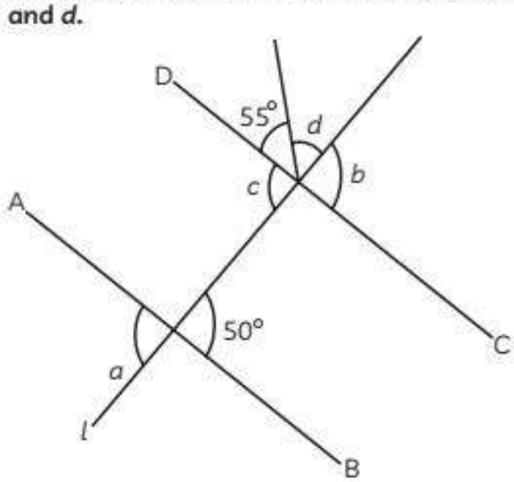
In the given figure, *m* and *n* are two plane mirrors perpendicular to each other. Show that incident ray CA is parallel to reflected ray BD.



5

33. $2x^3 + 4x^2 - 7ax - 5$ and $2x^3 + ax^2 - 6x + 3$ are polynomials which on dividing by $(x + 1)$ and $(x - 1)$ leaves remainders y and z, respectively, if $y - 3z = 16$, then find a. 5

34. In the given figure, find the value of all *a, b, c* and *d*.



35. Mona has a metallic hemispherical bowl that is made up of steel. The total sheet used in making the bowl is $2736\ \pi\ cm^3$. In this bowl, she can hold $1152\ \pi\ cm^3$ kheer. Find the thickness (in cm^3) of bowl and also find the curved surface area (in cm^2) of the outer side.

OR

A right angled triangle with sides 3 cm and 4 cm is revolved around its hypotenuse. Find the volume of the double cone thus generated. 5

SECTION - E

(Case study based questions are compulsory.)

36. *A competitive exam consists of multiple-choice questions. Every correct answer will award you 1 mark and every incorrect answer will deduct $\frac{1}{4}$ marks. Priya knew some answers and she guessed the rest. Suppose Priya answered all 100 questions and only secured 50 marks.*

(A) Write the linear equation for the above given situation. 1

(B) How many questions did she answer correctly?

OR

Suppose Priya answered 64 questions correctly and the rest were guessed by her wrong. Find the total marks by Priya secured. 2

(C) How many questions did she guess wrong? 1

37. *As schools are closed due to the lockdown, children in Rural Jharkhand are unable to attend online classes due to a lack of access to mobile phones. So Mr. Rajesh Kumar started a mobile classroom and teaches Mathematics and Science to the students. One day while teaching "Number Systems" he discuss about the rational numbers and their decimal expansions. He reiterate the class that a number that can be written in numbers in the form of $\frac{p}{q}$, where p and q both are integers and $q \neq 0$ and can be expanded into terminating or non–terminating decimals depending upon the number. He writes two numbers $\frac{3}{11}$ and $0.\overline{58}$ on the whiteboard and ask some question to the students.*

(A) Find the decimal form of $\frac{3}{11}$: 1

(B) Write the $\frac{p}{q}$ form of $0.\overline{58}$ can be written in $\frac{p}{q}$ form, where p and q both are integers and $q \neq 0$.

OR

Find the product of $\frac{3}{11}$ and $0.\overline{58}$. 2

(C) Find the sum of $\frac{3}{11}$ and $0.\overline{58}$. 1

38. *At the end of the 18th century, students in Europe and America were still using individual states made of actual state or pieces of wood coated with paint and grit and framed with wood. Teachers had no way to present a lesson or a problem to the class as a whole. So, in 1801, James Pillans made its debut by hanging a large plate of state on the classroom walls. The dimension of the blackboard were 30 m × 48 m.*

(A) What can be the shape of blackboard as shown in figure? 1

(B) Find the perimeter of the blackboard as shown in figure. 1

(C) If the perimeter of the given figure is same as of the square, then find the area of square formed.

OR

Find the length of diagonal of the shape (as shown in diagram). 2

SOLUTION

SAMPLE PAPER - 2

SECTION - A

1. *(d) II and IV*

Explanation: The points whose abscissa and ordinate have different signs will lie in II and IV in form of $(-x, y)$ or $(x, -y)$ respectively.

2. *(d)* $t < x + y + z$

Explanation: Let $x = 3$ cm

$y = 4$ cm

$z = 5$ cm

$x + y = 3$ cm $+ 4$ cm $= 7$ cm

$x + z = 3$ cm $+ 5$ cm $= 8$ cm

$x + y + z = 3$ cm $+ 4$ cm $+ 5$ cm

$= 12$ cm

So, semiperimeter of the triangle,

$$t = \frac{x+y+z}{2} = \frac{3+4+5}{2}$$

$= 6$ cm

Clearly, $t > z$

$t < x + y$

$t < x + z$

$t < x + y + z$

3. *(a)* $y = 5 + 3x$

Explanation: Here, the cost of a ticket for an adult = ₹y and the cost of a ticket for a child = ₹x

According to question,

Cost of an adult ticket = 3× cost of a child ticket + ₹5

$\Rightarrow$ $y = 3x + 5$

$\Rightarrow$ $y = 5 + 3x$

4. *(a) 15 cm*

Explanation: Let ABC be a piece of triangular cardboard sheet, having a right angle at C.

Let $a = 5$ cm, $b = x$ and $c = x + 1$

In ΔABC,

$c^2 = a^2 + b^2$

[By Pythagoras Theorem]

$(x + 1)^2 = (5)^2 + x^2$

$\Rightarrow$ $x^2 + 1 + 2x = 25 + x^2$

$\Rightarrow$ $x = \frac{25-1}{2}$

$x = 12$ cm

Therefore, $b = x = 12$ cm

$c = x + 1 = 13$ cm

Semi-perimeter(s) $= \frac{a+b+c}{2}$

$= \frac{5+12+13}{2}$ cm

$= \frac{30}{2}$ cm $= 15$ cm

5. *(d)* $\frac{3^{3.5}}{5^{-\frac{13}{4}}}$

Explanation: Given: $\sqrt{3^2 5^2} \times \sqrt[8]{3^4 5^2} \times \sqrt[3]{3^6 5^6}$

$\left(3^2 5^2\right)^{\frac{1}{2}} \times \left(3^4 5^2\right)^{\frac{1}{8}} \times \left(3^6 5^6\right)^{\frac{1}{3}}$ $\quad [(a^m)^n = a^{mn}]$

$= 3 \times 5 \times 3^{\frac{1}{2}} 5^{\frac{1}{4}} \times 3^2 5^2$ $\quad [a^m \times a^n = a^{(m+n)}]$

$= 3^{1+\frac{1}{2}+2} 5^{1+\frac{1}{4}+2} = 3^{\frac{2+1+4}{2}} 5^{\frac{4+1+8}{4}}$

$= 3^{\frac{7}{2}} 5^{\frac{13}{4}} = \frac{3^{3.5}}{5^{-\frac{13}{4}}}$

6. *(c) 1 : 27*

Explanation: Let the radius of original spherical ball is r_1 cm

Now stretched ball radius $(r_2) = 3r_1$

We know,

Volume of sphere $= \frac{4}{3} \pi r^3$

$$\frac{\text{Volume of original spherical ball}}{\text{Volume of stretched ball}} = \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3}$$

$$\frac{\text{Volume of original spherical ball}}{\text{Volume of stretched ball}} = \frac{r_1^3}{27 r_1^3}$$

Hence, the ratio of the volume of the originial ball to the stretched ball = 1 : 27.

7. *(b) A terminated line cannot be produced indefinitely.*

Explanation: According to Euclid's second postulate, a terminated line can be produced indefinitely.

8. *(a) 2 cm*

Explanation: As we know, perpendicular from the centre to a chord, bisects the chord.

$AC = BC = \frac{1}{2} AB = BC = \frac{1}{2} \times 8 \text{ cm} = 4 \text{ cm}$

Now, In ΔAOC

$$AO^2 = OC^2 + AC^2$$

[By using Pythagorus Theorem]

$$OC^2 = AO^2 - AC^2$$
$$OC^2 = 5^2 - 4^2$$
$$= 25 - 16$$
$$OC^2 = 9$$
$$OC = 3 \text{ cm}$$

Now,

$$OA = OD$$

[Same radius of a circle]

$$OD = 5 \text{ cm}$$

Hence, $CD = OD - OC = (5 - 3) \text{ cm}$

$$= 2 \text{ cm}$$

9. *(c) 35*

Explanation: Given: Lower class limit is 10.

Width of each of five continuous classes is 5.

Total width till upper class limit

$$= 5 \times 5$$
$$= 25$$

Therefore, the upper class limit of the highest class

$$= 10 + 25 = 35$$

10. *(c) 2*

Explanation: We know the degree of a linear polynomial should always be 1.

So, $m > 1$. Hence, options *a* and *b* are eliminated.

If we put $m = 3$, $x^{(3-1)} + 3 = x^2 + 3$

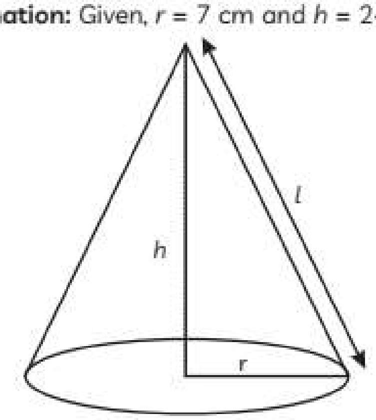
Which is not the required linear polynomial.

To make $x^{(m-1)} + 3$ is linear polynomial, put $m = 2$.

Hence, $x^{(2-1)} + 3 = x + 3$

11. *(b) 704 cm²*

Explanation: Given, $r = 7$ cm and $h = 24$ cm



From the figure,

We can say that according to the Pythagoras theorem,

$\because \quad l^2 = r^2 + h^2$

$\Rightarrow \quad = (7)^2 + (24)^2$

$\Rightarrow \quad l^2 = 49 + 576$

$\Rightarrow \quad l^2 = 625$

Therefore, $l = 25$ cm

We know that total surface area of a cone

$$= \pi rl + \pi r^2$$
$$= \pi r (l + r)$$
$$= \frac{22}{7} \times 7 (25+7)$$
$$= 704 \text{ cm}^2.$$

12. *(c) 96°*

Explanation: Allied angles are also known as interior angles.

Let the angles be $7x$ and $8x$

$\because$ Sum of allied angles is 180°

$$7x + 8x = 180°$$

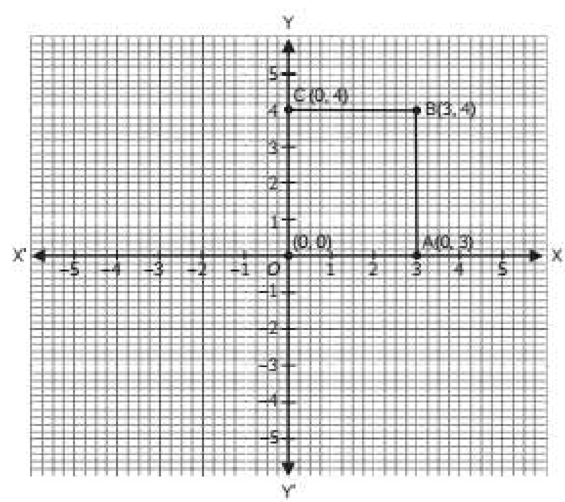
$\Rightarrow \quad 15x = 180°$

$\Rightarrow \quad x = 12°$

Bigger angle is $8x = 8 \times 12° = 96°$

13. *(b) Rectangle*

Explanation: On plotting the given point on the cartesian plane.



It is clear that, OA = BC and OC = AB

And, the distance of opposite sides are equal and form a right angle when plotted on a cartesian plane. Hence, the figure obtained is a rectangle.

14. *(a) Only (i) and (v)*

Explanation: We know, opposite sides of parallelograms are equal and parallel, and also, opposite angles of parallelograms are equal.

15. *(c) class marks of the classes*

Explanation: For drawing a frequency polygon of a continuous frequency distribution, we plot the frequencies of the classes on the ordinates and the class marks of the classes on the abscissae.

Class mark is the mid value or the central value of a class

It is calculated as follows:

$$\frac{\text{Upper limit} + \text{Lower limit}}{2}$$

16. *(c) 30*

Explanation: Given linear equation,

$$2x - y + 27 = 0$$

Put the value $y = p$ and $x = \frac{3}{2}$ in the given equation,

we get

$$\Rightarrow \quad 2\left(\frac{3}{2}\right) - p + 27 = 0$$

$$\Rightarrow \quad 3 - p + 27 = 0$$

$$\Rightarrow \quad p = 30$$

17. *(a) [x + 47°], [y + 43°]*

Explanation: x and y form complementary pair.

$$x + y = 90°$$

$$x + 47° + y + 43° = x + y + 47° + 43°$$

$$= x + y + 90°$$

$$= 90° + 90° = 180°$$

[Sum of two supplementary angles is 180°]

Hence, $[x + 47°]$ and $[y + 43°]$ form a supplementary pair.

18. *(d) 110*

Explanation: Class mark is the mid value of a class.

$$\text{Class mark} = \frac{\text{upper limit} + \text{lower limit}}{2}$$

$$\Rightarrow \quad = \frac{130 + 90}{2}$$

$$\Rightarrow \quad = \frac{220}{2}$$

Class mark = 110

19. *(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).*

Explanation: We know,

$$x^3 + y^3 = (x + y)(x^2 + y^2 - xy)$$

$$z^3 + (5)^3 = (z + 5)(z^2 + 25 - 5z)$$

20. *(c) Assertion (A) is true but reason (R) is false.*

Explanation: Diameter is the longest chord of the circle which divides the circle into two equal parts. Only the longest chord of the circle divides the circle into two equal parts.

SECTION - B

21. $64(x + y)^3 - 125(x - y)^3 = [\{4(x + y)\}^3 - \{5(x - y)\}^3]$

we know, $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$

$= \{4(x + y) - 5(x - y)\}[16(x + y)^2 + 20(x + y)(x - y) + 25(x - y)^2]$

$= (9y - x)[16(x + y)^2 + 20(x + y)(x - y) + 25(x - y)^2]$

$= (9y - x)[16x^2 + 16y^2 + 32xy + 20x^2 - 20y^2 + 25x^2 + 25y^2 - 50xy]$

$= (9y - x)(61x^2 + 21y^2 - 18xy)$

22. Given equation is $x - 2y = 4$

Put $x = \sqrt{2}$, $y = 4\sqrt{2}$, in the given equation, we get

$$\Rightarrow \quad \sqrt{2} - 2(4\sqrt{2}) = 4$$

$$\Rightarrow \quad \sqrt{2} - 8\sqrt{2} = 4$$

$$\Rightarrow \quad -7\sqrt{2} \neq 4$$

$$\Rightarrow \quad \text{LHS} \neq \text{RHS}$$

Clearly, the given solution does not satisfy the given equation.

Hence, $(\sqrt{2}, 4\sqrt{2})$ is not a solution of the equation $x - 2y = 4$.

23. Area of circle $= \pi r^2$

Where r = radius

OA = Radius

Distance OA = (5 – 0) = 5 units

Area $= \pi r^2$

$= \pi(5)^2$

$= 25\pi$ sq. units.

24. Slant height of cone (l) = 25 m

Diameter of base of conical tomb = $2r$ = 14 m

Radius = r = 7 m

Curved surface area = πrl

$$\Rightarrow \quad = \frac{22}{7} \times 7 \times 25$$

$= 550$ sq. m

Also, given that the cost of white washing

$= 100$ sq. m

$= ₹201$

Hence, the total cost of white washing for

$$550 \text{ sq. m} = \frac{(₹210 \times 550)}{100}$$

$$= ₹1155$$

OR

Since, only the rounded surface of the dome is to be painted

∴ The curved surface area of the hemispherical dome needs to be painted.

Circumference of the base of the dome $= 17.6$

$\therefore \quad 17.6 = 2\pi r$

$$\Rightarrow \quad r = \frac{17.6}{2 \times \frac{22}{7}}$$

$\Rightarrow \quad r = 2.8$ cm

The curved surface area of the dome $= 2\pi r^2$

$$= 2 \times \frac{22}{7} \times 2.8 \times 2.8$$

$$= 49.28 \text{ cm}^2$$

Now, the cost of painting 1 cm^2 $= ₹7$

So, the cost of painting 49.28 cm^2 $= ₹7 \times 49.28$

$= ₹345$

25. Given, $\sqrt{\frac{768}{4}} - \frac{256}{512}\sqrt{48} - \sqrt{\frac{225}{3}}$

$$= \sqrt{192} - \frac{1}{2}\sqrt{48} - \sqrt{\frac{225}{3}}$$

$$= \sqrt{64 \times 3} - \frac{1}{2}\sqrt{48} - \sqrt{\frac{225}{3}}$$

$$= 8\sqrt{3} - \frac{1}{2}\sqrt{16 \times 3} - \sqrt{25 \times 3}$$

$$= 8\sqrt{3} - \frac{1}{2} \times 4\sqrt{3} - 5\sqrt{3}$$

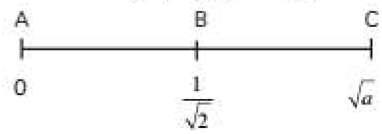
$$= 3\sqrt{3} - 2\sqrt{3}$$

$$= \sqrt{3}$$

$$= 1.732$$

OR

Given, $\frac{2}{\sqrt{8}} = \frac{2}{2\sqrt{2}} = \frac{1}{\sqrt{2}}$



Since, $\frac{1}{\sqrt{2}}$ is halfway located, *i.e.*,

AB = BC (on number line)

Thus, $\quad \frac{1}{\sqrt{2}} - 0 = \sqrt{a} - \frac{1}{\sqrt{2}}$

$$\Rightarrow \quad \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \sqrt{a}$$

$$\Rightarrow \quad \frac{2}{\sqrt{2}} = \sqrt{a}$$

$$\Rightarrow \quad \sqrt{2} = \sqrt{a}$$

$$a = 2$$

SECTION - C

26. AB is parallel to DF. [Given]

GH is transversal.

$\angle GCA = \angle BCF = 21°$, [Vertical opposite angles]

Also, $\quad CF = EF$ [Given]

So, $\quad \angle CEF = \angle ECF = \theta$

[Angles opposite to equal sides are equal]

Now, $\quad \angle BCF = \angle CFE = 21°$ [Alternate angles]

Now, In ΔCEF

$\angle CEF + \angle ECF + \angle CFE = 180°$

$\theta + \theta + 21° = 180°$

$\Rightarrow \quad 2\theta = 180° - 21°$

$$\Rightarrow \quad \theta = \frac{159°}{2}$$

$\Rightarrow \quad \theta = 79.5°$

27. Given: M is the mid-point of AB, so, AM = BM

$\angle ACB = 90°$

DM = CM

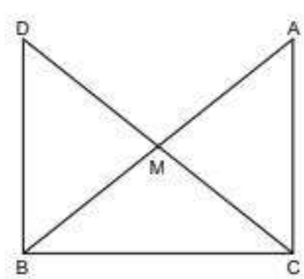
To Prove:

(A) $\Delta AMC \cong \Delta BMD$

(B) $\angle DBC$ is a right angle.

(C) $\Delta DBC \cong \Delta ACB$

Proof:



(A) In ΔAMC and ΔBMD,

AM = BM [Given]

∠CMA = ∠DMB

[Vertically opposite angles]

CM = DM [Given]

Thus, ΔAMC ≅ ΔBMD

[By SAS congruence rule]

(B) From ΔAMC and ΔBMD,

∠ACD = ∠BDC

Also alternate interior angles of two parallel lines AC and DB. Therefore, the sum of two co-interiors angles is 180°.

So, ∠ACB + ∠DBC = 180°

⇒ ∠DBC = 180° – ∠ACB

∠ DBC = 90° [∠ACB = 90°]

(C) From ΔDBC and ΔACB,

BC = CB [Common]

∠DBC = ∠ACB

[As both are right angles]

DB = AC [By CPCT]

Thus, ΔDBC ≅ ΔACB

[By SAS congruence rule]

28. Given expression is $2\left(\sqrt{k}-1\right) + \sqrt{8}$

Now, add $-8\sqrt{2}$ to the given expression, we get

$$= 2\left(\sqrt{k}-1\right) + \sqrt{8} - 8\sqrt{2}$$

$$= 2\left(\sqrt{k}-1\right) + 2\sqrt{2} - 8\sqrt{2}$$

$$= 2\left(\sqrt{k}-1\right) - 6\sqrt{2}$$

$$= 2\sqrt{k} - 2 - 6\sqrt{2}$$

Since, the result obtain will be a rational number. We have to eliminate $6\sqrt{2}$ from the expression,

Thus, $2\sqrt{k} = 6\sqrt{2}$

or $\sqrt{k} = 3\sqrt{2}$

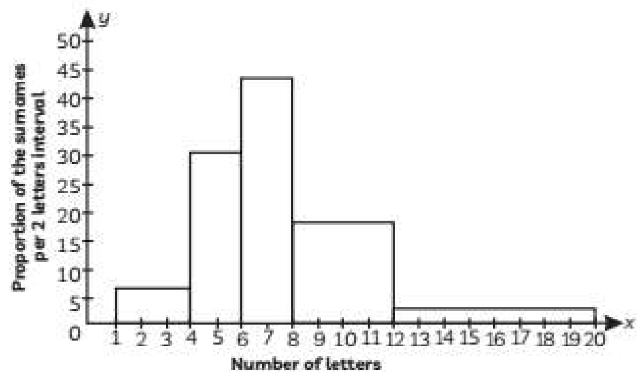
or $k = 3^2 \times 2$

or $k = 18$

Thus, the value of k will be 18.

29. (A) The width of the class intervals in the given data is varying in nature. Also, the area of a rectangle is proportional to the frequencies in the histogram. Now, the proportion of surnames can be calculated as shown in the table below.

Number of Letters	Frequency	Width of Interval	Length of Rectangles
1 – 4	6	3	$\frac{6}{3}\times 2 = 4$
4 – 6	30	2	$\frac{30}{2}\times 2 = 30$
6 – 8	44	2	$\frac{44}{2}\times 2 = 44$
8 – 12	16	4	$\frac{16}{4}\times 2 = 8$
12 – 20	4	8	$\frac{4}{8}\times 2 = 1$



(B) From the above histogram, it is clear that 6–8 is the class interval in which the maximum number of surnames lie.

OR

To make frequency polygon, we plot class marks and frequency.

Class mark = $\frac{159^{\circ}}{2}$

Marks	Class Marks	Section A Frequency	Section B Frequency
0 – 10	$\frac{10+0}{2} = 5$	3	5
10 – 20	$\frac{20+10}{2} = 15$	9	19
20 – 30	$\frac{30+20}{2} = 25$	17	15
30 – 40	$\frac{40+30}{2} = 35$	12	10
40 – 50	$\frac{50+40}{2} = 45$	9	1

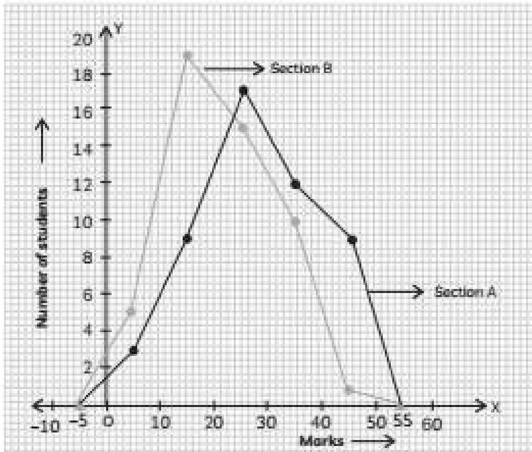
Calculating points where frequency = 0

Difference = 15 − 5 = 10

First point = 5 − 10 = −5

Last point = 45 + 10 = 55

So, we plot points (−5, 0) and (55, 0)



30. In the given figure, ABC is a triangle with sides 12 cm, 12 cm, 16 cm.

$a = 12$ cm, $b = 12$ cm, $c = 16$ cm

Semi-perimeter of Δ ABC, $s = \frac{a+b+c}{2}$

$= \frac{12+12+16}{2} = \frac{40}{2} = 20$ cm

Area of Δ ABC $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{20(20-12)(20-12)(20-16)}$

$= \sqrt{20\times8\times8\times4}$

$= 4\times8\sqrt{5} = 32\sqrt{5}$ cm^2

Let AE is the height of triangle. Therefore,

area of Δ ABC $= \frac{1}{2}$ base × height

So, $32\sqrt{5} = \frac{1}{2} \times 16 \times AE$

$AE = 4\sqrt{5}$ cm

Now, area of triangle ABD $= \frac{1}{2}$ × base × height

$= \frac{1}{2} \times BD \times AE$

$= \frac{1}{2} \times 8 \times 4\sqrt{5}$ [BD = 8 cm]

$= 16\sqrt{5}$ cm^2

Area of triangle ABD $= 16\sqrt{5}$ cm^2

31. Given that:

The number of girls = x

The number of boys = y

So, total number of students

$= x + y$

According to question,

The number of girls = 25% of the students

⇒ $x = 25\%$ of $(x + y)$

⇒ $x = \frac{25}{100} \times (x + y)$

⇒ $x = \frac{x+y}{4}$

⇒ $4x - x - y = 0$

⇒ $3x - y = 0$

Hence, the required equation is $3x - y = 0$.

OR

Given:

$-(k + 1)x + ky - 5k = 1 - 2ky$ [$k > 0$]

⇒ $-(k + 1)x + ky + 2ky - 5k - 1 = 0$

⇒ $-(k + 1)x + 3ky - (5k + 1) = 0$

Multiply the equation with −1, we get

⇒ $(k + 1)x - 3ky + (5k + 1) = 0$

Now, compare it with $ax + by + c = 0$, we get

$a = k + 1$, ... (i)

$b = -3k$ ... (ii)

$c = (5k + 1)$, ... (iii)

Since, $c = 6$ [Given]

∴ $5k + 1 = 6$ [From (iii)]

⇒ $5k = 5$

∴ $k = 1$

Now, $a = k + 1$ [From (i)]

⇒ $a = 1 + 1$

∴ $a = 2$

Now, $b = -3k$ [From (ii)]

⇒ $b = -3 \times 1$

∴ $b = -3$

Hence, $a = 2$, and $b = -3$

SECTION - D

32. $\angle DBC = 70^\circ$

$\angle BAC = 30^\circ$

∠DBC and ∠DAC are in the same segment

Thus, $\angle DAC = \angle DBC$ [Angles in the same segment are equal]

$\angle DAC = 70^\circ$

Also, $\angle BAD = \angle BAC + \angle DAC$.

$\angle BAD = 30^\circ + 70^\circ$

$\angle BAD = 100^o$

Now, ABCD is a cyclic quadrilateral.

$\angle BAD + \angle BCD = 180^o$

[Opposite angles of a cyclic quadrilateral are supplementary]

$\Rightarrow \quad 100^o + \angle BCD = 180^o$

$\Rightarrow \quad \angle BCD = 180^o - 100^o$

$\Rightarrow \quad \angle BCD = 80^o$

Now, for AB = BC

$\angle BAC = \angle BCA$

[Angles opposite to equal sides are equal]

$\Rightarrow \quad 30^o = \angle BCA$

Also, $\angle BCD = \angle BCA + \angle ECD$

$\Rightarrow \quad 80^o = 30^o + \angle ECD$

$\Rightarrow \quad \angle ECD = 80^o - 30^o$

$\Rightarrow \quad \angle ECD = 50^o$

33. Let, $p(x) = 2x^3 + 4x^2 - 7ax - 5$ and

$q(x) = 2x^3 + ax^2 - 6x + 3$ be the given polynomials.

Now,

When $p(x)$ is divided by $(x + 1)$, remainder = y

$y = p(-1)$

$y = 2(-1)^3+4(-1)^2-7a(-1)-5$

$\Rightarrow \quad y = -2 + 4 + 7a - 5$

$\Rightarrow \quad y = -3 + 7a$

And, when $q(x)$ is divided by $(x - 1)$, remainder = z

$z = q(1)$

$z = 2(1)^3 + a(1)^2 - 6(1) + 3$

$z = 2 + a - 6 + 3$

$\Rightarrow \quad z = a - 1$

Substituting the values of y and z, we have

$y - 3z = 16$

$\Rightarrow -3 + 7a - 3(a - 1) = 16$

$\Rightarrow \quad -3 + 7a - 3a + 3 = 16$

$\Rightarrow \quad 4a = 16$

$a = 4$

34. AB || CD, l is transversal

$a = 50°$

[Vertically opposite angles]

$c = 50°$ [Alternate angles]

On line l,

$c + 55° + d = 180°$ [Linear pair]

$\Rightarrow \quad 50° + 55° + d = 180°$

$\Rightarrow \quad d = 180° - 105°$

$d = 75°$

On line DC,

$55° + d + b = 180°$ [Linear pair]

$55° + 75° + b = 180°$

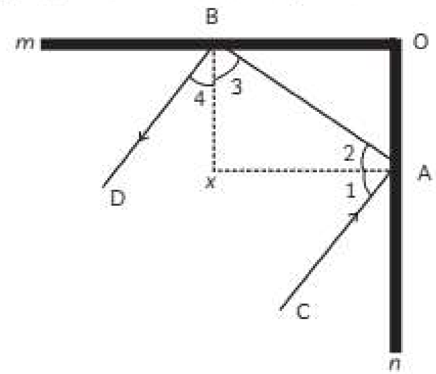
$b = 180° - 130°$

$b = 50°$

We have, $a = 50°, b = 50°, c = 50°$ and $d = 75°$

OR

BD || AC, AX is normal to the plane OA



BX is normal to the plane OB.

It is given that two plane mirrors are perpendicular to each other.

$\therefore$ BX ⊥ OX and AX ⊥ OB.

So, BX ⊥ AX,

i.e., $\angle BXA = 90°$

In ΔAXB,

$\angle 2 + \angle 3 + \angle BXA = 180°$

$\Rightarrow \quad \angle 2 + \angle 3 + 90° = 180°$

$\Rightarrow \quad \angle 2 + \angle 3 = 90°$ ... (i)

Multiply (i) by 2

$2\angle 2 + 2\angle 3 = 180°$

So, by law of reflection

$\angle 1 = \angle 2$ and $\angle 3 = \angle 4$ ... (ii)

[Angle of incidence = Angle of reflection]

From equation (i) and (ii), we get

$\angle 1 + \angle 4 = 90°$ ... (iii)

Adding (i) and (iii), we get

$\angle 2 + \angle 3 + \angle 1 + \angle 4 = 90° + 90°$

$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$

$\angle CAB + \angle DBA = 180°$

Hence, CA || BD.

35. The volume of a hemisphere = $\frac{2}{3}\pi r^3$

The inner volume of the hemispherical bowl

$= 1152\ \pi\ cm^3$

$\frac{2}{3}\pi r^3 = 1152\ \pi$

$r^3 = \frac{(1152\times 3)}{2} = 1728$

$r = 12$ cm

Where, r = inner radius of the hemisphere

The sheet used for the hemispherical bowl

$$= 2736\,\pi$$

$$\Rightarrow \quad \frac{2}{3}\pi R^3 - \frac{2}{3}\pi r^3 = 2736\,\pi$$

Where, R = outer radius of the hemisphere

$$\frac{2}{3}\pi[R^3 - r^3] = 2736\,\pi$$

$$[R^3 - r^3] = 4104$$

$$R^3 = 4104 + r^3$$

$$R^3 = 4104 + 1728$$

$$R^3 = 5832$$

$$R = 18 \text{ cm}$$

The thickness of the bowl $R - r = 18 - 12 = 6$ cm

The curved surface area of the outer side $2\pi R^2$

$$2 \times \frac{22}{7} = (18)^2$$

$$= 648\,\pi \text{ cm}^2$$

OR

In right angled ΔABC, $\angle B = 90°$

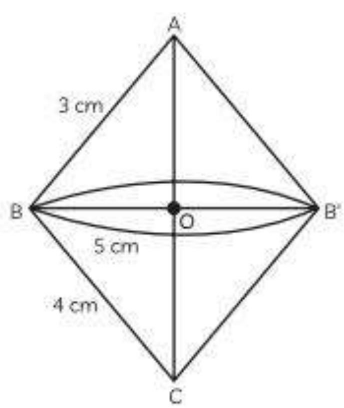
AB = 3 cm and BC = 4 cm

Diagonal CA = $\sqrt{AB^2 + BC^2}$ [By Pythagoras theorem]

$$= \sqrt{(3)^2 + (4)^2}$$

$$= \sqrt{9+16} = \sqrt{25}$$

$$= 5 \text{ cm}$$



Now, revolving the triangle along CA, we get double cons as shown in th figure BB' is joined which bisected by AC at O at right angles.

In ΔABC, $\angle B = 90°$

$$\therefore \quad \text{area } (\Delta ABC) = \frac{3\times 4}{2} = 6 \text{ cm}^2$$

$$\text{and area } (\Delta ABC) = \frac{1}{2}\times AC \times BO$$

$$\Rightarrow \quad 6 = \frac{1}{2}\times 5 \times BO$$

$$\Rightarrow \quad BO = \frac{6\times 2}{5} = \frac{12}{5} = 2.4 \text{ cm}$$

$\therefore$ Radius of cone along AO is BO which is 2.4 cm and also along CO is BO which is 2.4 cm.

Now volumes of two cones, so formed

$$= \frac{1}{3}\pi r^2 \times AO + \frac{1}{3}\pi r^2 \times CO$$

$$= \frac{1}{3}\pi r^2 (AO + CO)$$

$$= \frac{1}{3}\pi r^2 \times AC$$

$$= \frac{1}{3}\times\frac{22}{7}\times(2.4)^2\times 5$$

$$= \frac{22}{21}\times 5.76 \times 5$$

$$= \frac{211.20}{7} \text{cm}^3$$

$$= \frac{21120}{7\times 100} = \frac{1056}{35} \text{ cm}^3$$

$$= 30\frac{6}{35} \text{ cm}^3$$

SECTION - E

36. (A) Let, the number of correct answers be x and the number of wrong answers be y.

marks secured for answering correctly

$= x \times 1 = x$ marks

And, marks secured for answering incorrectly

$$= y \times -\frac{1}{4} \text{ marks}$$

$$= -\frac{y}{4}$$

Therefore, $x + \left(-\frac{y}{4}\right) = 50$

$\Rightarrow \quad x - \frac{y}{4} = 50$

(B) Let the number of correct answers be x and the number of wrong answers be y. So,

$x + y = 100$

$\Rightarrow \quad y = 100 - x$ ...(i)

Also, Marks secured for answering correctly

$= x \times 1$

$= x$ marks

Marks secured for answering incorrectly

$= y \times \frac{-1}{4} = \frac{-y}{4}$ marks

Since, she secured total 50 marks. Therefore,

$x - \frac{1}{4}y = 50$ ...(ii)

Putting the value of y from (i) to (ii), we get

$x - \frac{1}{4}(100 - x) = 50$

$\Rightarrow \quad x - \frac{100}{4} + \frac{x}{4} = 50$

$\Rightarrow \quad x + \frac{x}{4} = 50 + \frac{100}{4}$

$\Rightarrow \quad \frac{5x}{4} = \frac{300}{4}$

$\Rightarrow \quad 5x = 300$

$x = 60$

Thus, Priya answered 60 questions correctly.

OR

Let, the number of correct answers be x and the number of wrong answers be y. Therefore, $x + y = 100$

Since, Priya answered 64 questions correctly.

Then, $64 + y = 100$

$y = 100 - 64 = 36$

Therefore, she answered 36 questions incorrectly.

Now, marks secured for answering correctly $= 64 \times 1 = 64$ marks

And, the marks secured for answering incorrectly $= 36 \times -\frac{1}{4} = -9$ marks

$\therefore$ Total marks secured by Priya = 64 – 9

= 55 marks

Thus, Priya secured 55 marks.

(C) The number of questions answering correctly,

$x = 60$ [From (B)]

Since, $x + y = 100$

$\Rightarrow \quad 60 + y = 100$

$\Rightarrow \quad y = 100 - 60 = 40$

Thus, Priya answered 40 questions incorrectly.

37. (A) 11) 3000 (0.2727

```
 22
 80
 77
 30
 22
 80
 77
  3
```

$\therefore \frac{3}{11} = 0.272727.... = 0.\overline{27}$

(B) Let $x = 0.\overline{58} = 0.5858...$ ... (i)

Multiply both sides by 100, we get

$100x = 58.5858$ ... (ii)

Subtract (i) from (ii), we get

$\Rightarrow \quad 99x = (58.5858...) - (0.5858...)$

$= 58.000...$

$\Rightarrow \quad 99x = 58$

$x = \frac{58}{99}$

OR

Here, $0.\overline{58} = \frac{58}{99}$

Therefore, $\frac{3}{11} \times \frac{58}{99} = \frac{174}{1089}$

$= \frac{58}{363}$

(C) Here, $0.\overline{58} = \frac{58}{99}$

Therefore, $\frac{3}{11} + \frac{58}{99} = \frac{27+58}{99} = \frac{85}{99}$, it is a rational number.

38. (A) The shape of blackboard is rectangle as opposite sides have different dimension.

(B) Perimeter of rectangle = $2(l + b)$

where length $(l) = 30$ m

Breadth $(b) = 48$ m

So, Perimeter $= 2(30 + 48)$

$= 2 \times 78$

$= 156$ m

(C) Perimeter of square = Perimeter of rectangle

$$4 \times \text{side} = 2(l + b)$$

$$4 \times \text{side} = 2(30 + 48)$$

$$\text{side} = \frac{156}{4} \text{ m}$$

$$\text{side} = 39 \text{ m}$$

Now,

$$\text{Area of square} = (\text{side})^2$$

$$= (39)^2$$

$$= 1521 \text{ m}^2$$

OR

Diagonal of rectangle

$$= \sqrt{l^2 + b^2}$$

$$= \sqrt{(30)^2 + (48)^2}$$

$$= \sqrt{3204}$$

$$= 6\sqrt{89}$$