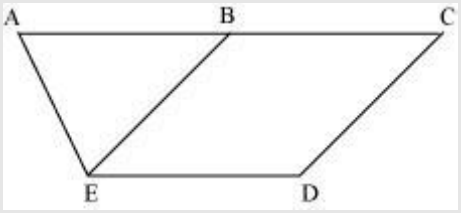
Q1) *Use the following information to answer the next question.*

The given figure shows rhombus BCDE. Side CB is extended to point A. The area of parallelogram ABDE, thus formed, is 144 cm^2. Diagonal BD is then drawn and points P and Q are marked on it such that they are 1 cm away from vertices B and D respectively. Points P and Q are joined to C and E to obtain quadrilateral PCQE. It is also known that CE measures 24 cm.	

What is the perimeter of quadrilateral PQCE?

A) 24 cm

B) 52 cm

C) 66 cm

D) 84 cm

Answer:

B

Solution:

From the given figure, it can be seen that rhombus BCDE and parallelogram ABDE lie on the same base (DE) and between the same parallels (DE and AC).

∴ ar (ABDE) = ar (BCDE)

It is given that ar (ABDE) = 144 cm^2

⇒ ar (BCDE) = 144 cm^2

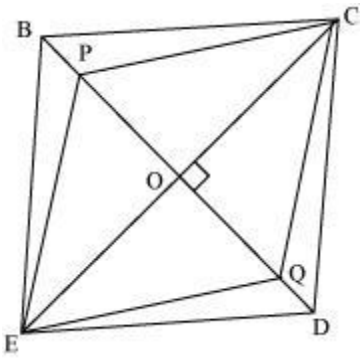
Now, the area of a rhombus is one-half the product of its diagonals.

∴ ar (BCDE) = $\frac{1}{2} \times BD \times CE = 144 \text{ cm}^2$

$\Rightarrow \frac{1}{2} \times BD \times 24 \text{ cm} = 144 \text{ cm}^2$ (CE = 24 cm)

⇒ BD = 12 cm

Now, quadrilateral PQCE can be drawn as:



Here, BP = QD = 1 cm

It is known that the diagonals of a rhombus bisect each other at 90°.

Thus, in rhombus BCDE, BO = OD = $\frac{1}{2}$ BD = $\frac{1}{2}$ × 12 = 6 cm

Similarly, CO = OE = $\frac{1}{2}$ CE = $\frac{1}{2}$ × 24 = 12 cm

Now, PO = BO − BP = (6 − 1) cm = 5 cm

Similarly, QO = DO − QD = (6 − 1) cm = 5 cm

∴ PO = QO = 5 cm and CO = OE = 12 cm

Also, ∠COQ = 90°

Thus, in quadrilateral PCQE, diagonals PQ and CE bisect each other at 90°.

This implies that quadrilateral PCQE is a rhombus.

Applying Pythagoras Theorem in right ΔCQO:

$CQ^2 = CO^2 + OQ^2 = 12^2 + 5^2 = 144 + 25 = 169$

⇒ CQ = 13 cm

∴ Perimeter of rhombus PCQE = 4 × CQ = 4 × 13 cm = 52 cm

The correct answer is B.

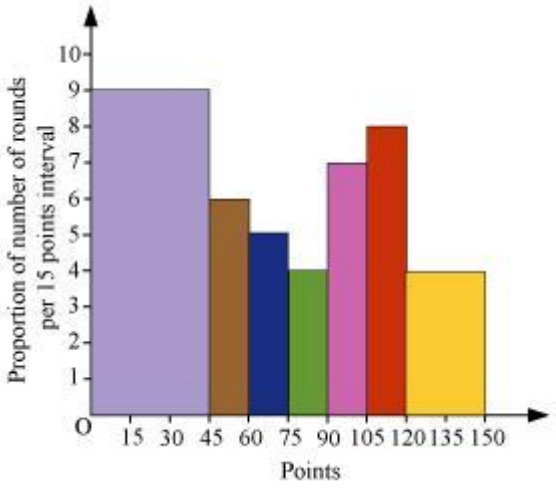
Q2) *Use the following information to answer the next question.*

In a game of golf, 45 rounds are played by each player. Each round is of 150 points. The given table shows the score of one of the players.

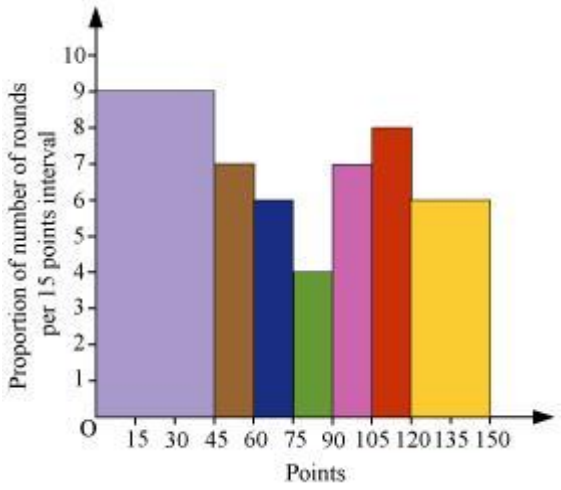
Scores	Number of rounds
Less than 45	9
45 – 60	6
60 – 75	5
75 – 90	4
90 – 105	7
105 – 120	8
More than 120	6

Which histogram correctly represents the given data?

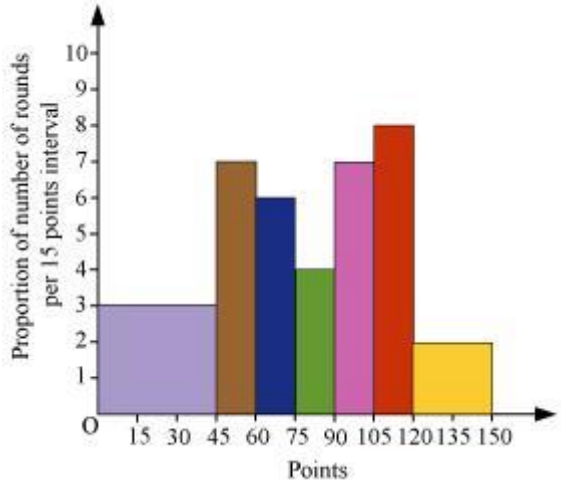
- A)



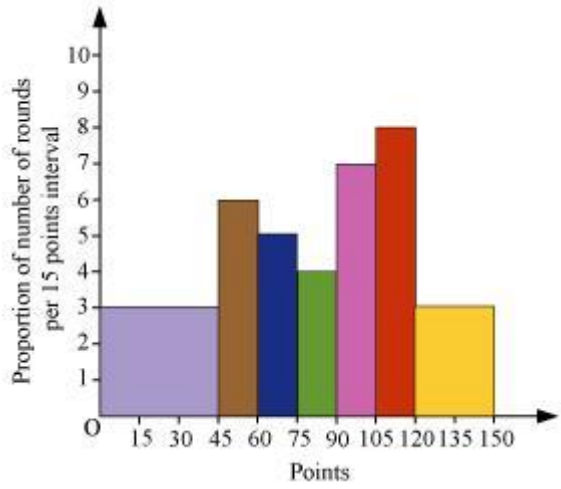
- B)


Proportion of number of rounds per 15 points interval
10
9
8
7
6
5
4
3
2
1
O
15 30 45 60 75 90 105 120 135 150
Points

- C)


Proportion of number of rounds per 15 points interval
10
9
8
7
6
5
4
3
2
1
O
15 30 45 60 75 90 105 120 135 150
Points

- D)


Proportion of number of rounds per 15 points interval
10
9
8
7
6
5
4
3
2
1
O
15 30 45 60 75 90 105 120 135 150
Points

Answer:

D

Solution:

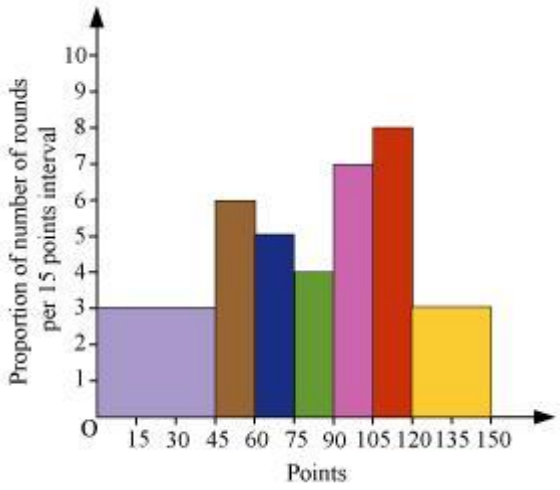
It can be seen that in the given data, intervals are not equally spaced. It is known that areas of rectangles in a histogram are proportional to their frequencies. Here, since the intervals are not equally spaced, the widths of the rectangles will be varying and the graph will not be correct.

To draw the correct graph, the new length of the rectangle proportional to the minimum class size, which is 15, has to be found.

The table shows the proportion of number of rounds per 15 points.

Points	Frequency	Width of class	Length of rectangle
Less than 45 (0 – 45)	9	45	$\frac{9\times15}{45}=3$
45 – 60	6	15	$\frac{6\times15}{15}=6$
60 – 75	5	15	$\frac{5\times15}{15}=5$
75 – 90	4	15	$\frac{4\times15}{15}=4$
90 – 105	7	15	$\frac{7\times15}{15}=7$
105 – 120	8	15	$\frac{8\times15}{15}=8$
More than 120 (120 – 150)	6	30	$\frac{6\times15}{30}=3$

Thus, the correct histogram can be drawn as



The correct answer is D.

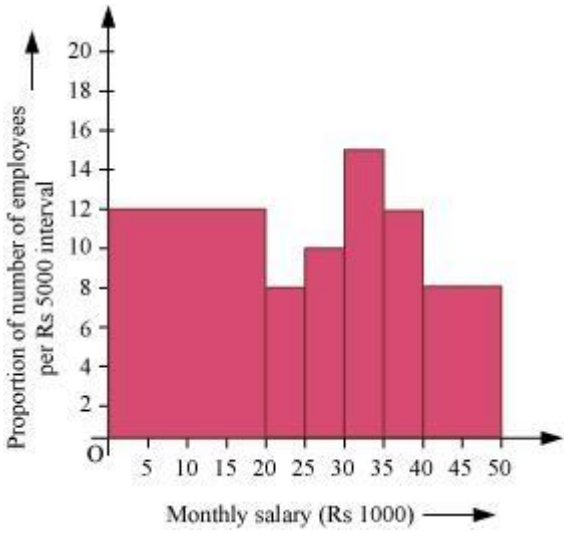
Q3) *Use the following information to answer the next question.*

The given table shows the monthly salaries of a group of employees of a certain company.

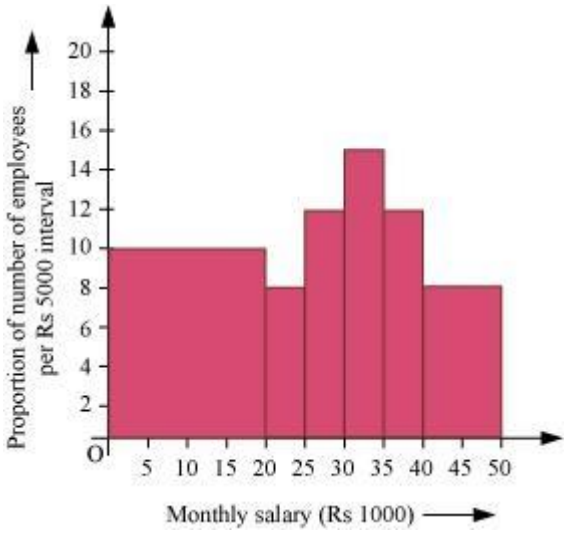
Monthly salary (Rs)	Number of employees
0 – 20000	12
20000 – 25000	8
25000 – 30000	10
30000 – 35000	15
35000 – 40000	12
40000 – 50000	8

Which histogram correctly represents the given data?

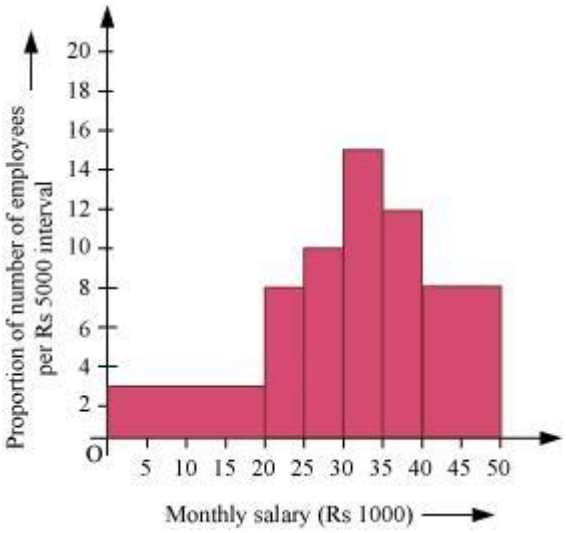
- A)


Proportion of number of employees per Rs 5000 interval
20
18
16
14
12
10
8
6
4
2
O
5 10 15 20 25 30 35 40 45 50
Monthly salary (Rs 1000)

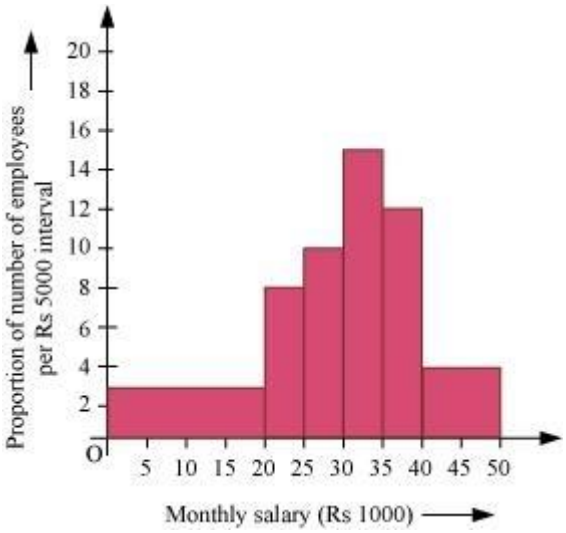
- B)


Proportion of number of employees per Rs 5000 interval
20
18
16
14
12
10
8
6
4
2
O
5 10 15 20 25 30 35 40 45 50
Monthly salary (Rs 1000)

- C)



- D)



Answer:

D

Solution:

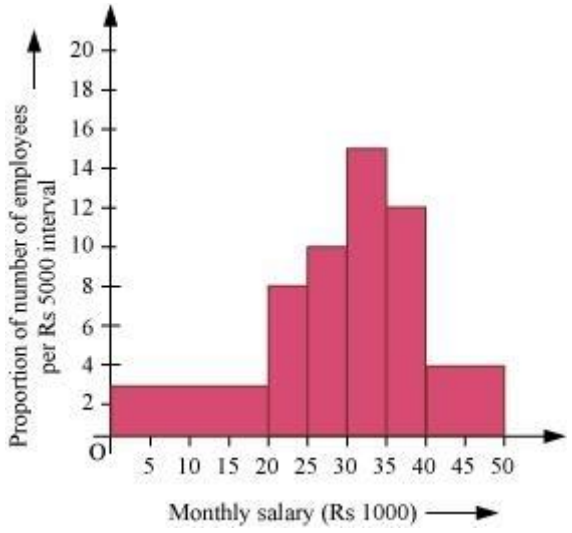
It can be seen that in the given data, the intervals are not equally spaced. It is known that the areas of rectangles in a histogram are proportional to their frequencies. Here, since the intervals are not equally spaced, the widths of rectangles will be varying and the obtained histogram will not be correct.

To draw the correct graph, the new length of the rectangle proportional to the minimum class size, which is 5000, has to be found.

The proportion of the number of employees per Rs 5000 interval can be shown by the following table as

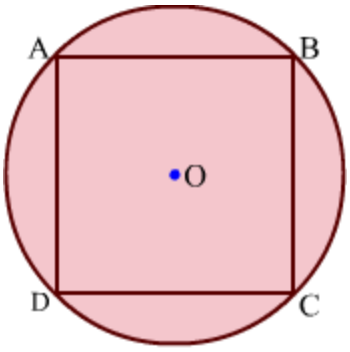
Daily salary (in Rs)	Frequency	Width of class	Proportional Length of rectangle
0 – 20000	12	20000	$\frac{12\times5000}{20000}=3$
20000 – 25000	8	5000	$\frac{8\times5000}{5000}=8$
25000 – 30000	10	5000	$\frac{10\times5000}{5000}=10$
30000 – 35000	15	5000	$\frac{15\times5000}{5000}=15$
35000 – 40000	12	5000	$\frac{12\times5000}{5000}=12$
40000 – 50000	8	10000	$\frac{8\times5000}{10000}=4$

Thus, the correct histogram can be drawn as



The correct answer is D.

Q4) A square, ABCD, is inscribed in a circle of radius 14 cm. What is the sum of the arcs AB and AD?



A) 40 cm

B) 42 cm

C) 43 cm

D) 44 cm

Answer:

D

Solution:

ABCD is a square.

∴ AB = BC = CD = DA

We know that if the chords of a circle are equal, then their corresponding arcs are also equal.

⇒ Arc AB = Arc BC = Arc CD = Arc DA

Length of the arc AB = $\frac{1}{4}$ × Circumference of circle

$$= \frac{1}{4} \times 2\pi r$$
$$= \frac{1}{4} \times 2 \times \frac{22}{7} \times 14\,\text{cm}$$
$$= 22\,\text{cm}$$

Sum of the arcs AB and AD = 2 × Length of the arc AB

= 2 × 22 cm = 44 cm

The correct answer is D.

Q5) If the equation $9x+8y=2\sqrt{3}$ is expressed in the form *ax* + *by* + *c* = 0, then what are the respective values of *a*, *b*, and *c*?

A) 9, 8, and $2\sqrt{3}$

B) 8, 9, and $2\sqrt{3}$

C) 9, 8, and $-2\sqrt{3}$

D) 8, 9, and $-2\sqrt{3}$

Answer:

C

Solution:

The equation $9x+8y=2\sqrt{3}$ can be written as $9x+8y-2\sqrt{3}=0$.

The obtained equation is of the form *ax* + *by* + *c* = 0, where *a* = 9, *b* = 8, and *c*

= $-2\sqrt{3}$.

Thus, the respective values of *a*, *b*, and *c* are 9, 8, and $-2\sqrt{3}$.

The correct answer is C.

Q6) *Use the following information to answer the next question.*

A rectangle and a rhombus lie on the same base. The remaining vertices of the rectangle and the rhombus are collinear.

Which quadrilateral has greater area and which quadrilateral has greater perimeter respectively?

A) Rectangle, rectangle

B) Rectangle, rhombus

C) Both have same area, rectangle

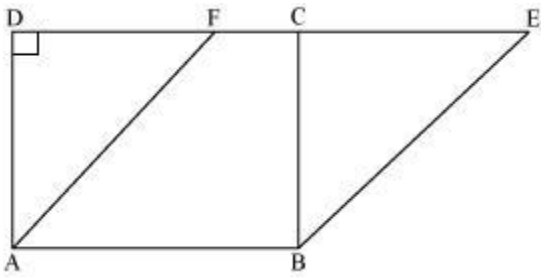
D) Both have same area, rhombus

Answer:

D

Solution:

According to the given information, rectangle ABCD and rhombus ABEF can be drawn as:



As seen in the figure, the two quadrilaterals lie on the same base AB.

Also, vertices C and D of the rectangle and vertices E and F of the rhombus are collinear i.e., they lie on a straight line.

Now, the two quadrilaterals lie on the same base (AB) and between the same parallels (AB and DE). Thus, they have the same area.

Since ABEF is a rhombus, AB = BE

In ΔBCE, BC is the altitude and BE is the hypotenuse.

∴ BC < BE

⇒ BC < AB (AB = BE)

Perimeter (ABCD) = 2 (AB + BC)

Perimeter (ABEF) = 4 × AB

Since BC < AB, 2 (AB + BC) < 4 × AB

This implies that the perimeter of rhombus ABEF is more than that of rectangle ABCD.

Hence, the two quadrilaterals have the same area. However, the rhombus has greater perimeter.

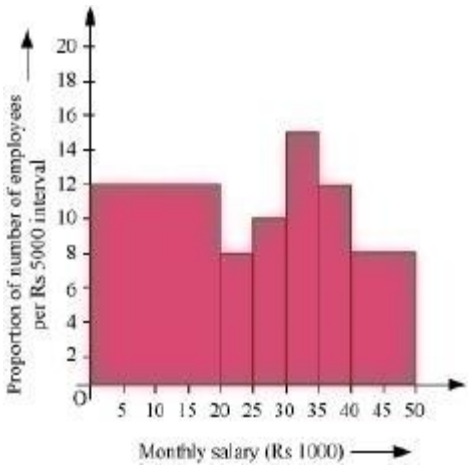
The correct answer is D.

Q7) *Use the following information to answer the next question.*

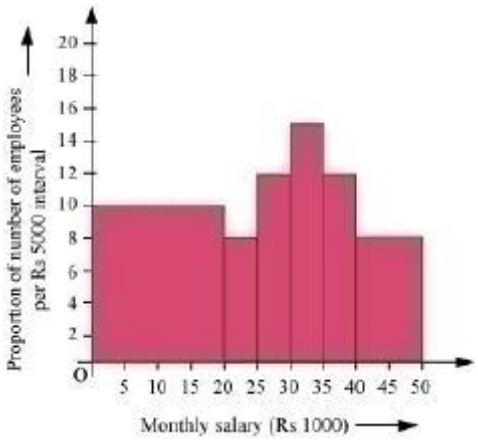
The given table shows the monthly salaries of a group of employees of a certain company.	
Monthly salary (Rs)	**Number of employees**
0 − 20000	12
20000 − 25000	8
25000 − 30000	10
30000 − 35000	15
35000 − 40000	12
40000 − 50000	8

Which histogram correctly represents the given data?

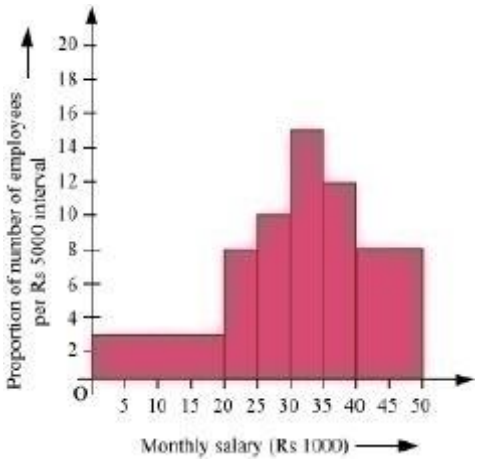
- A)



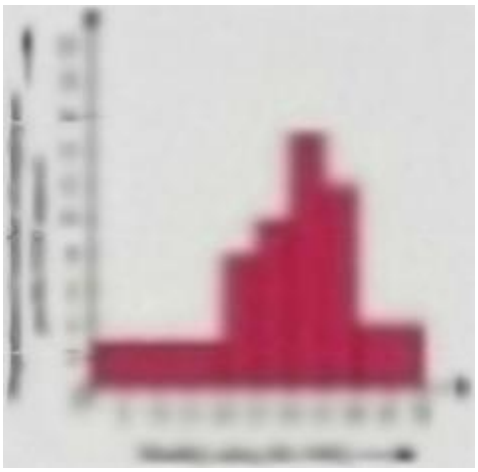
- B)



- C)



- D)



Answer:

D

Solution:

It can be seen that in the given data, the intervals are not equally spaced. It is known that the areas of rectangles in a histogram are proportional to their frequencies. Here, since the intervals are not equally spaced, the widths of rectangles will be varying and the obtained histogram will not be correct.

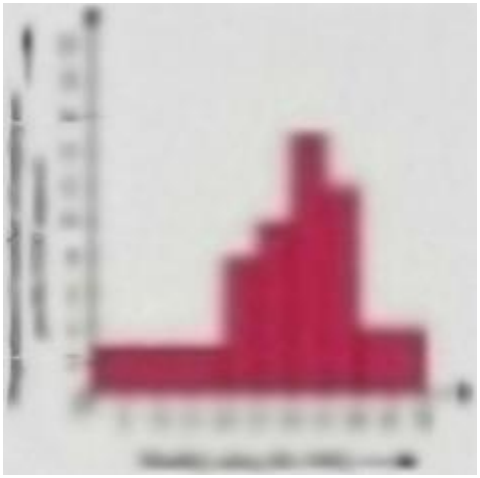
To draw the correct graph, the new length of the rectangle proportional to the minimum class size, which is 5000, has to be found.

The proportion of the number of employees per Rs 5000 interval can be shown by the following table as

Daily salary (in Rs)	Frequency	Width of class	Proportional Length of rectangle

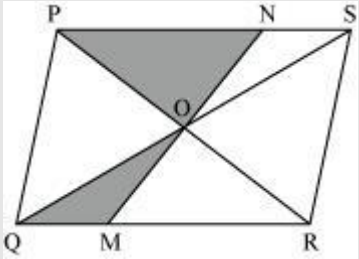
0 − 20000	12	20000	$\frac{12\times5000}{20000}=3$
20000 − 25000	8	5000	$\frac{8\times5000}{5000}=8$
25000 − 30000	10	5000	$\frac{10\times5000}{5000}=10$
30000 − 35000	15	5000	$\frac{15\times5000}{5000}=15$
35000 − 40000	12	5000	$\frac{12\times5000}{5000}=12$
40000 − 50000	8	10000	$\frac{8\times5000}{10000}=4$

Thus, the correct histogram can be drawn as



The correct answer is D.

Q8) *Use the following information to answer the next question.*

In the given figure, diagonals PR and QS of parallelogram PQRS intersect each other at O. Through O, a line is drawn intersecting the sides PS and QR at the points N and M respectively.	

If the area of the shaded region is 68 cm^2, then what is the area of the parallelogram PQRS?

A) 136 cm^2

B) 204 cm^2

C) 272 cm^2

D) 408 cm^2

Answer:

C

Solution:

In ΔOMQ and ΔONS,

∠OQM = ∠OSN [Pair of alternate interior angles and PS || QR]

∠QOM = ∠SON [Vertically opposite angles]

OQ = OS [Diagonals of a parallelogram bisect each other]

∴ΔOMQ ≅ ΔONS [By ASA congruency criterion]

⇒ ar (ΔOMQ) = ar (ΔONS)

Now, ar (ΔOPS) = ar (OPN) + ar (ΔONS) = ar (OPN) + ar (ΔOMQ)

= Area of the shaded region = 68 cm^2

SO is the median for ΔPSR corresponding to PR.

[Diagonals of a parallelogram bisect each other]

We know that a median of a triangle divides it into two triangles of equal areas.

∴ar (ΔPSR) = 2 ar (ΔOPS) = 2 × 68 cm^2 = 136 cm^2

We also know that a diagonal of a parallelogram divides it into two triangles of equal areas.

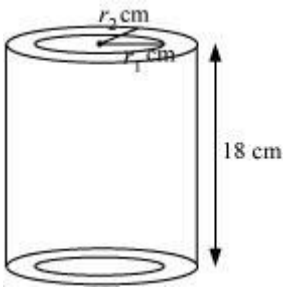
Thus, ar (PQRS) = 2 ar (ΔPSR) = 2 × 136 cm^2 = 272 cm^2

The correct answer is C.

Q9) The volume and total surface area of a hollow metallic cylinder, whose height is 18 cm, are 3564 $cm^3$and 2772 cm^2. Find the thickness of the metallic cylinder.

Solution:

Let $r_2$and $r_1$be the external and internal radii of the cylinder. Its height, h= 18 cm



Now, volume of the cylinder $= \left[\pi\left(r_2^2 - r_1^2\right)h\right]\ \text{cm}^3$

$$\Rightarrow 3564 = \pi\left(r_2^2 - r_1^2\right)h$$
$$\Rightarrow \pi\left(r_2 - r_1\right)\left(r_2 + r_1\right)h = 3564 \qquad ...(1)$$

It is given that total surface area of the metallic cylinder is 2772 cm^2.

$$\therefore 2\pi r_1 h + 2\pi r_2 h + 2\pi\left(r_2^2 - r_1^2\right) = 2772$$
$$\Rightarrow 2\pi\left(r_1 + r_2\right)h + 2\pi\left(r_2 + r_1\right)\left(r_2 - r_1\right) = 2772$$
$$\Rightarrow 2\pi\left(r_1 + r_2\right)\left(h + r_2 - r_1\right) = 2772 \qquad ...(2)$$

Dividing equation (1) by (2), we obtain

$$\frac{\pi\left(r_2 - r_1\right)\left(r_2 + r_1\right)h}{2\pi\left(r_1 + r_2\right)\left(h + r_2 - r_1\right)} = \frac{3564}{2772}$$
$$\Rightarrow \frac{\left(r_2 - r_1\right)\times 18}{2\left(18 + r_2 - r_1\right)} = \frac{9}{7}$$
$$\Rightarrow 7\left(r_2 - r_1\right) = 18 + \left(r_2 - r_1\right)$$
$$\Rightarrow 6\left(r_2 - r_1\right) = 18$$
$$\Rightarrow r_2 - r_1 = \frac{18}{6} = 3$$

Therefore, the thickness of the metallic cylinder is 3 cm.

Q10) A three digit number is twenty six times the sum of its digits. Its tens digit is 2 less than its units digit. Express the given situation mathematically.

Solution:

Let the hundreds digit of the number be x and the units digit be y.

$\therefore$ Tens digit = $y - 2$

Number = $100x + 10(y - 2) + y$

$= 100x + 10y - 20 + y$

$= 100x + 11y - 20$

According to the given information:

$100x + 11y - 20 = 26\,(x + y - 2 + y)$

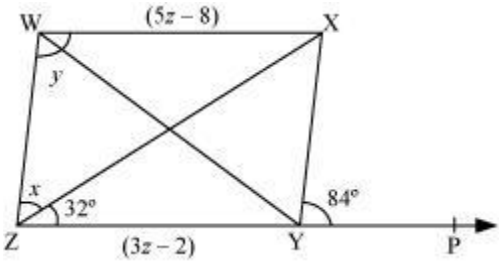
$100x + 11y - 20 = 26\,(x + 2y - 2)$

$100x + 11y - 20 = 26x + 52y - 52$

$\Rightarrow 74x - 41y + 32 = 0$

This equation represents the given situation mathematically.

Q11) In the given figure, WXYZ is a parallelogram. Find the values of x, y, and z.



Solution:

We know that in a parallelogram, the opposite sides are of equal lengths.

$\therefore$ WX = YZ

$\Rightarrow 5z - 8 = 3z - 2$

$\Rightarrow 5z - 3z = -2 + 8$

$\Rightarrow 2z = 6$

$\Rightarrow z = 3$

Now, ∠XYZ + ∠XYP = 180°(Linear pair angles)

⇒ ∠XYZ + 84°= 180°

⇒ ∠XYZ = 96°

Now, applying angle sum property in ΔXYZ, we obtain

∠XYZ + ∠YZX + ∠ZXY = 180°

⇒ 96°+ 32°+ ∠ZXY = 180°

⇒ ∠ZXY = 180°− 128°= 52°

Now, the parallel lines WX and YZ are cut by transversal XZ.

∴ ∠ZXY = ∠XZW (Alternate interior angles)

∴ x= 52°

Now, ∠ZWX = ∠XYZ (∵ opposite angles of a parallelogram are equal)

∴ y= 96°(∵ ∠XYZ = 96°)

Q12) The opposite angles of a parallelogram are (2x − 8)° and (3y + 22)°. Graphically represent the relation between x and y?

Solution:

The opposite angles of the parallelogram are (2x − 8)° and (3y + 22)°.

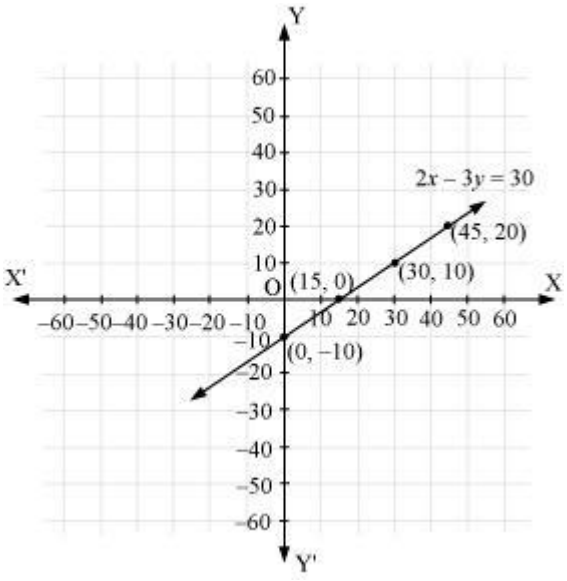
It is known that the measures of opposite angles of a parallelogram are equal.

$$\therefore (2x-8)^\circ = (3y+22)^\circ$$
$$\Rightarrow 2x-3y = 22+8$$
$$\Rightarrow 2x-3y = 30 \qquad \ldots(1)$$
$$\Rightarrow 3y = 2x-30$$
$$\Rightarrow y = \frac{2x-30}{3}$$

Four different solutions of equation (1) are given in the table.

x	0	15	30	45
$y=\frac{2x-30}{3}$	−10	0	10	20

On plotting and joining points (0, −10), (15, 0), (30, 10) and (45, 20), a straight line representing the relation between *x* and *y* is obtained. This can be done as:



Q13) After 10 years, Roshni's mother's age will be 2 times the age of Roshni. If her mother is 24 years old now, then determine the present age of Roshni graphically.

Solution:

Let the present ages of Roshni and her mother be *x* and *y* respectively.

After 10 years:

Roshni's age = (*x* + 10)

Her mother's age = (*y* + 10)

According to the given situation,

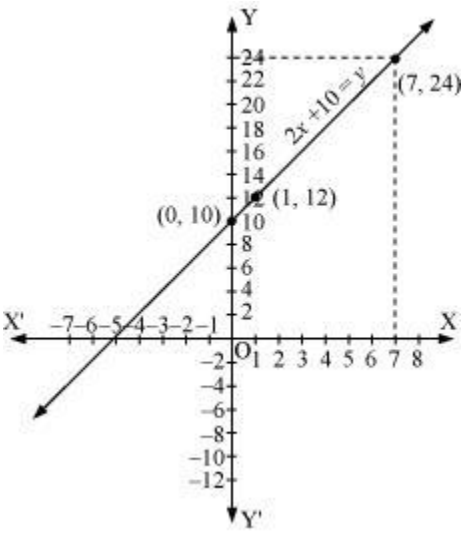
2 (*x* + 10) = *y* + 10

2*x* + 10 = *y* … (1)

The two solutions of equation (1) are as follows.

x	0	1
y	10	12

Plotting the points, (0, 10) and (1, 12), we obtain the following graph.

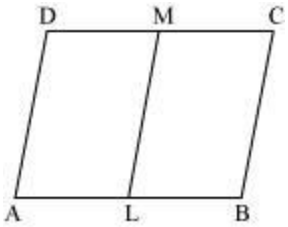


It can be seen from the graph that the value of *x*, corresponding to *y* = 24, is 7.

Thus, the present age of Roshni is 7 years.

Q14) Show that the line joining the mid points of two opposite sides of a parallelogram is parallel to the other pair of sides.

Solution:



Let ABCD be a parallelogram.

Let L and M be the mid points of sides AD and CD respectively.

$\therefore AL = BL = \frac{AB}{2}$

$DM = MC = \frac{CD}{2}$

It is known that, the opposite sides of a parallelogram are equal and parallel.

$\therefore AB = CD$

$$\Rightarrow \frac{AB}{2} = \frac{CD}{2}$$
$$\Rightarrow AL = MD$$

If a pair of opposite sides of a quadrilateral is equal and parallel, then the quadrilateral is a parallelogram.

In quadrilateral ALMD,

AL = DM and AL || DM.

∴ ALMD is a parallelogram.

⇒ AD || LM

It is known that, the lines parallel to the same line are parallel to each other.

∴ AD || LM || BC

Thus, the line joining the mid points of two opposite sides of a parallelogram is parallel to the other pair of opposite sides