UNIT 6

MENSURATION

(A) Main Concepts and Results

- **Perimeter** of a closed figure is the distance covered in one round along the boundary of the figure.
- A closed figure in which all sides and angles are equal is called a **regular polygon**.
- Perimeter of a rectangle = 2 × (length + breadth)
- Perimeter of a square = 4 × length of its side
- Perimeter of an equilateral triangle = 3 × length of a side
- The amount of region enclosed by a plane closed figure is called its **area**.
- Area of a rectangle = length × breadth
- Area of a square = side × side

(B) Solved Examples

Example 1: Choose the correct answer from the given four options:

In Fig. 6.1, a square of side 1 cm is joined to a square of side 3 cm. The perimeter of the new figure is

(A) 13cm (B) 14cm

(C) 15cm (D) 16cm

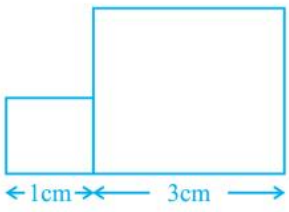


Fig. 6.1

Solution: Correct answer is (B)

Example 2: Which of the following statements are true or false?

(a) Geeta wants to raise a boundary wall around her house. For this, she must find the area of the land of her house.

(b) A person preparing a track to conduct sports must find the perimeter of the sports ground.

Solution: (a) False – Boundry wall is around her house, so she must know the perimeter of the land and not the area.

(b) True – Track is prepared along the boundary of the sports ground.

Example 3: Fill in the blanks to make the statements true:

(a) Perimeter of a triangle with sides 4.5cm, 6.02cm and 5.38cm is _____ .

(b) Area of a square of side 5cm is _____ .

Solution: (a) 15.9cm.

(b) 25sqcm.

Example 4: Bhavna runs 10 times around a square field of side 80m. Her sister Sushmita runs 8 times around a rectangular field with length 150m and breadth 60m. Who covers more distance? By how much?

Solution: Distance covered by Bhavana in one round = Perimeter of the square field

= 4 × side of square field = 4 × 80m = 320m

Distance covered in 10 rounds = (320 × 10)m = 3200m

Distance covered by Sushmita in one round

= Perimeter of the rectangular field

= 2 × (length + breadth)

= 2 × (150 + 60)m = 2 × 210 = 420m

Distance covered in 8 rounds = 420 × 8 = 3360m

Hence, Sushmita has covered 160m more than the distance coverd by Bhavna.

Example 5: The length of a rectangular field is thrice its breadth. If the perimeter of this field is 800m, what is the length of the field?

Solution:

Perimeter of a rectangle = 2 (length + breadth)

Length of the rectangular field = 3 × breadth

Therefore perimeter of field = 2 (3 × breadth + breadth)

= 2 (4 × breadth)

= 8 × breadth

The given perimeter = 800m

Therefore 8 × breadth = 800

Or, breadth = 800 ÷ 8 = 100m

So, length = 3 × 100m = 300m

Example 6: Cost of fencing around a square field is Rs. 12000. If the cost of fencing per metre is Rs. 30, find the area of the square field.

Solution:

Cost of fencing per metre = Rs 30

Total cost of fencing = Rs 12000

$$\text{So, the length of fencing (perimeter)} = \frac{\text{Total cost}}{\text{Cost per metre}}$$

$$= \frac{1200}{30} = 400\text{m}$$

Now, length of fencing = Perimeter of the square field

= 4 × side of the field

Therefore, 4 × side of the field = 400m

$$\text{or, side of the field} = \frac{400}{4}\text{ m} = 100\text{m}$$

So, area of the field = 100m × 100m

= 10000sq m.

Example 7: Sabina wants to cover the floor of her room whose length is 4 m and breadth is 3m by square tiles. If each square tile is of side 20cm, then find the number of tiles required to cover the floor of her room.

Solution:

Length of the room = 4m = 400cm

Breadth of the room = 3m = 300cm

Area of the floor of the room = Length × Breadth

= 400 × 300sqcm = 120000sqcm

Side of the square tile = 20cm

Area of the square tile = Side × Side = 20 × 20sqcm

= 400sqcm

So, number of tiles required = =

Example 8: By splitting the figure into rectangles, find its area. (see Fig. 6.2)

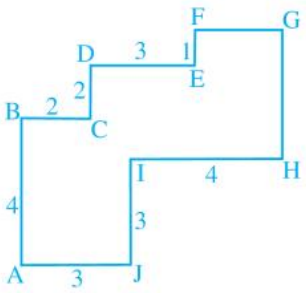


Fig. 6.2

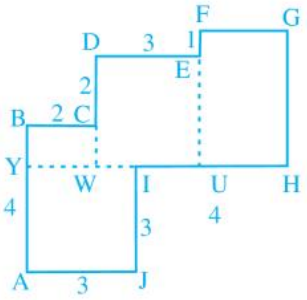


Fig. 6.3

Solution: By splitting the figure into four rectangles, we get Fig. 6.3

Area of the figure = Area AJIY + Area YWCB
+ Area DWUE + Area FUHG.

Area A J I Y = A J × J I = 3 × 3 = 9

Now, B Y = A B – Y A = 4 – 3 = 1

So, Area Y W C B = B Y × B C = 1 × 2 = 2

Next, D W = D C + C W = 2 + 1 = 3

Therefore, area D W U E = D W × D E = 3 × 3 = 9

Similarly, U H = I H – I U = 4 – 2 = 2

G H = F U and F U = E U + F E

= D W + F E = 3 + 1= 4

Area F U H G = U H × G H = 2 × 4 = 8

Therefore, the area of the figure = 9 + 2 + 9 + 8

= 28sq units

(C) Exercise

In questions 1 to 6, out of the four options only one is correct. Write the correct answer.

1. Following figures are formed by joining six unit squares. Which figure has the smallest perimeter in Fig. 6.4?



(i) (ii) (iii) (iv)

Fig. 6.4

(A) (ii) (B) (iii) (C) (iv) (D) (i)

2. A square shaped park ABCD of side 100m has two equal rectangular flower beds each of size 10m × 5m (Fig. 6.5). Length of the boundary of the remaining park is

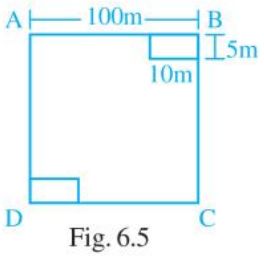


Fig. 6.5

(A) 360m (B) 400m

(C) 340m (D) 460m

3. The side of a square is 10cm. How many times will the new perimeter become if the side of the square is doubled?

(A) 2 times (B) 4 times (C) 6 times (D) 8 times

4. Length and breadth of a rectangular sheet of paper are 20cm and 10cm, respectively. A rectangular piece is cut from the sheet as shown in Fig. 6.6. Which of the following statements is correct for the remaining sheet?

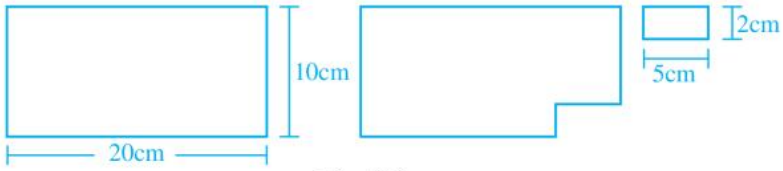


Fig. 6.6

(A) Perimeter remains same but area changes.

(B) Area remains the same but perimeter changes.

(C) Both area and perimeter are changing.

(D) Both area and perimeter remain the same.

5. Two regular Hexagons of perimeter 30cm each are joined as shown in Fig. 6.7. The perimeter of the new figure is



Fig. 6.7

(A) 65cm (B) 60cm

(C) 55cm (D) 50cm

6. In Fig. 6.8 which of the following is a regular polygon? All have equal side except (i)



(i) (ii) (iii) (iv)

Fig. 6.8

(A) (i) (B) (ii)

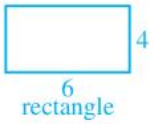
(C) (iii) (D) (iv)

7. Match the shapes (each sides measures 2cm) in column I with the corresponding perimeters in column II:

Column I	Column II
(A) 	(i) 16cm
(B) 	(ii) 20cm
(C) 	(iii) 24cm
(D) 	(iv) 28cm
	(v) 32cm

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8. Match the following

Shapes	Perimeter
(A)  rectangle	(i) 10
(B)  square	(ii) 18
(C)  equilateral triangle	(iii) 20
(D)  isosceles triangle	(iv) 25

In questions 9 to 13, fill in the blanks to make the statements true.

9. Perimeter of the shaded portion in Fig. 6.9 is

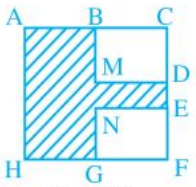


Fig. 6.9

AB + _ + _ + _ + _ + _ + _ + HA

10. The amount of region enclosed by a plane closed figure is called its _____.

11. Area of a rectangle with length 5cm and breadth 3cm is _____.

12. A rectangle and a square have the same perimeter (Fig. 6.10).

(a) The area of the rectangle is _____.

(b) The area of the square is _____.



Fig. 6.10

13. (a) 1m = _____ cm.

(b) 1sqcm = _____ cm × 1cm.

(c) 1sqm = 1m × _____ m = 100cm × _____ cm.

(d) 1sqm = _____ sqcm.

In questions 14 to 20, state which of the statements are true and which are false.

14. If length of a rectangle is halved and breadth is doubled then the area of the rectangle obtained remains same.

15. Area of a square is doubled if the side of the square is doubled.

16. Perimeter of a regular octagon of side 6cm is 36cm.

17. A farmer who wants to fence his field, must find the perimeter of the field.

18. An engineer who plans to build a compound wall on all sides of a house must find the area of the compound.

19. To find the cost of painting a wall we need to find the perimeter of the wall.

20. To find the cost of a frame of a picture, we need to find the perimeter of the picture.

21. Four regular hexagons are drawn so as to form the design as shown in Fig. 6.11. If the perimeter of the design is 28cm, find the length of each side of the hexagon.

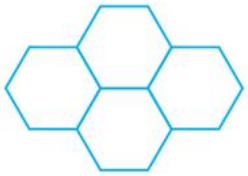


Fig. 6.11

22. Perimeter of an isosceles triangle is 50cm. If one of the two equal sides is 18cm, find the third side.

23. Length of a rectangle is three times its breadth. Perimeter of the rectangle is 40cm. Find its length and width.

24. There is a rectangular lawn 10m long and 4m wide in front of Meena's house (Fig. 6.12). It is fenced along the two smaller sides and one longer side leaving a gap of 1m for the entrance. Find the length of fencing.

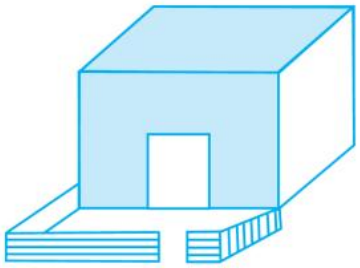


Fig. 6.12

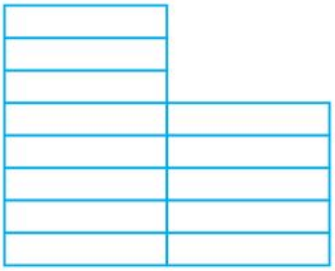


Fig. 6.13

25. The region given in Fig. 6.13 is measured by taking  as a unit. What is the area of the region?

26. Tahir measured the distance around a square field as 200 rods (*lathi*). Later he found that the length of this rod was 140cm. Find the side of this field in metres.

27. The length of a rectangular field is twice its breadth. Jamal jogged around it four times and covered a distance of 6km. What is the length of the field?

28. Three squares are joined together as shown in Fig. 6.14. Their sides are 4cm, 10cm and 3cm. Find the perimeter of the figure.

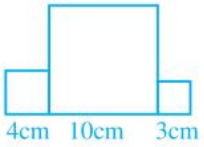


Fig. 6.14

29. In Fig. 6.15 all triangles are equilateral and AB = 8 units. Other triangles have been formed by taking the mid points of the sides. What is the perimeter of the figure?

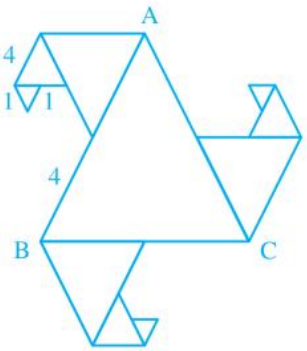


Fig. 6.15

30. Length of a rectangular field is 250m and width is 150m. Anuradha runs around this field 3 times. How far did she run? How many times she should run around the field to cover a distance of 4km?

31. Bajinder runs ten times around a square track and covers 4km. Find the length of the track.

32. The lawn in front of Molly's house is 12m× 8m, whereas the lawn in front of Dolly's house is 15m×5m. A bamboo fencing is built around both the lawns. How much fencing is required for both?

33. The perimeter of a regular pentagon is 1540cm. How long is its each side?

34. The perimeter of a triangle is 28cm. One of it's sides is 8cm. Write all the sides of the possible isosceles triangles with these measurements.

35. The length of an aluminium strip is 40cm. If the lengths in cm are measured in natural numbers, write the measurement of all the possible rectangular frames which can be made out of it. (For example, a rectangular frame with 15cm length and 5cm breadth can be made from this strip.)

36. Base of a tent is a regular hexagon of perimeter 60cm. What is the length of each side of the base?

37. In an exhibition hall, there are 24 display boards each of length 1m 50cm and breadth 1m. There is a 100m long aluminium strip, which is used to frame these boards. How many boards will be framed using this strip? Find also the length of the aluminium strip required for the remaining boards.

38. In the above question, how many square metres of cloth is required to cover all the display boards? What will be the length in m of the cloth used, if its breadth is 120cm?

39. What is the length of outer boundary of the park shown in Fig. 6.16? What will be the total cost of fencing it at the rate of Rs 20 per metre? There is a rectangular flower bed in the center of the park. Find the cost of manuring the flower bed at the rate of Rs 50 per square metre.

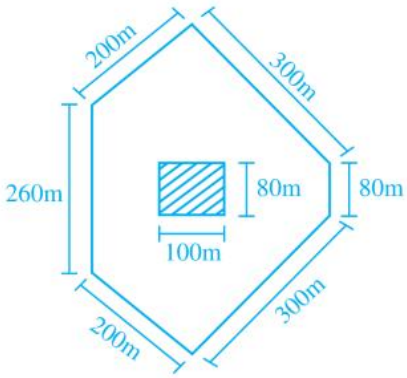


Fig. 6.16

40. Total cost of fencing the park shown in Fig. 6.17 is Rs 55000. Find the cost of fencing per metre.

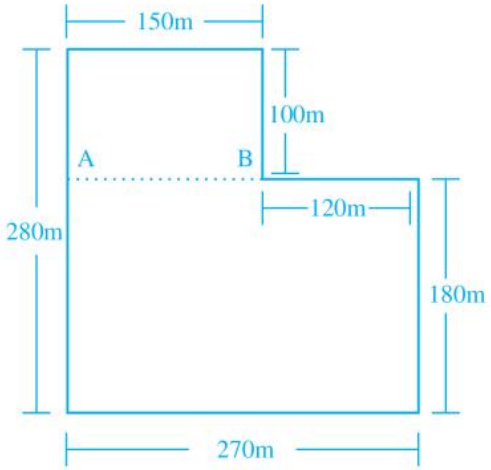


Fig. 6.17

41. In Fig. 6.18 each square is of unit length

(a) What is the perimeter of the rectangle ABCD?

(b) What is the area of the rectangle ABCD?

(c) Divide this rectangle into ten parts of equal area by shading squares.

(Two parts of equal area are shown here)

(d) Find the perimeter of each part which you have divided. Are they all equal?

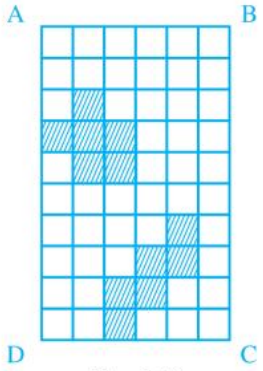


Fig. 6.18

42. Rectangular wall MNOP of a kitchen is covered with square tiles of 15cm length (Fig. 6.19). Find the area of the wall.

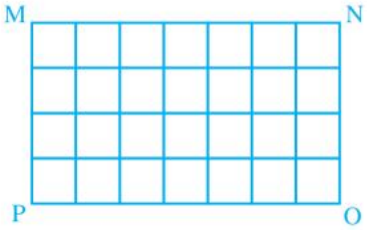


Fig. 6.19

43. Length of a rectangular field is 6 times its breadth. If the length of the field is 120cm, find the breadth and perimeter of the field.

44. Anmol has a chart paper of measure 90cm × 40cm, whereas Abhishek has one which measures 50cm × 70cm. Which will cover more area on the table and by how much?

45. A rectangular path of 60m length and 3m width is covered by square tiles of side 25cm. How many tiles will there be in one row along its width? How many such rows will be there? Find the number of tiles used to make this path?

46. How many square slabs each with side 90cm are needed to cover a floor of area 81sqm.

47. The length of a rectangular field is 8m and breadth is 2m. If a square field has the same perimeter as this rectangular field, find which field has the greater area.

48. Parmindar walks around a square park once and covers 800m. What will be the area of this park?

49. The side of a square is 5cm. How many times does the area increase, if the side of the square is doubled?

50. Amita wants to make rectangular cards measuring 8cm × 5cm. She has a square chart paper of side 60cm. How many complete cards can she make from this chart? What area of the chart paper will be left?

51. A magazine charges Rs 300 per 10sqcm area for advertising. A company decided to order a half page advertisment. If each page of the magazine is 15cm × 24cm, what amount will the company has to pay for it?

52. The perimeter of a square garden is 48m. A small flower bed covers 18sqm area inside this garden. What is the area of the garden that is not covered by the flower bed? What fractional part of the garden is covered by flower bed? Find the ratio of the area covered by the flower bed and the remaining area.

53. Perimeter of a square and a rectangle is same. If a side of the square is 15cm and one side of the rectangle is 18cm, find the area of the rectangle.

54. A wire is cut into several small pieces. Each of the small pieces is bent into a square of side 2cm. If the total area of the small squares is 28 square cm, what was the original length of the wire?

55. Divide the park shown in Fig. 6.17 of question 40 into two rectangles. Find the total area of this park. If one packet of fertilizer is used for 300sqm, how many packets of fertilizer are required for the whole park?

56. The area of a rectangular field is 1600sqm. If the length of the field is 80m, find the perimeter of the field.

57. The area of each square on a chess board is 4sqcm. Find the area of the board.

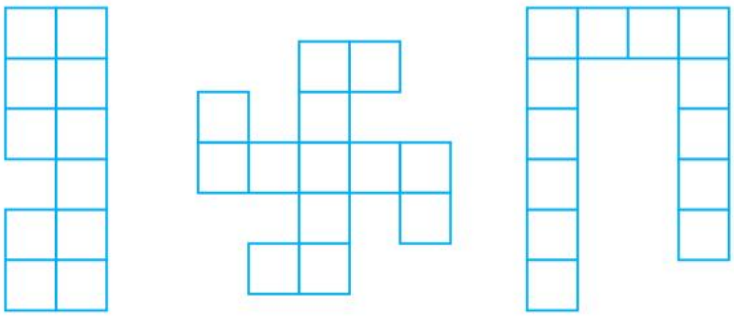
(a) At the beginning of game when all the chess men are put on the board, write area of the squares left unoccupied.

(b) Find the area of the squares occupied by chess men.

58. (a) Find all the possible dimensions (in natural numbers) of a rectangle with a perimeter 36cm and find their areas.

(b) Find all the possible dimensions (in natural numbers) of a rectangle with an area of 36sqcm, and find their perimeters.

59. Find the area and Perimeter of each of the following figures, if area of each small square is 1sqcm.



(i) (ii) (iii)

Fig. 6.20

60. What is the area of each small square in the Fig. 6.21 if the area of entire figure is 96sqcm. Find the perimeter of the figure.

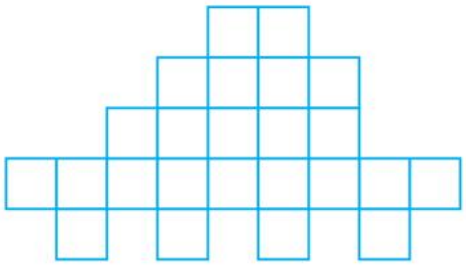


Fig. 6.21

(D) Activities

Activity 1: Take 36 square cards each of unit length. In how many ways can you put them together to form a rectangle? One is done for you (Fig. 6.22). Which arrangement will make a rectangle of greatest perimeter and which arrangement will make a rectangle of least perimeter?

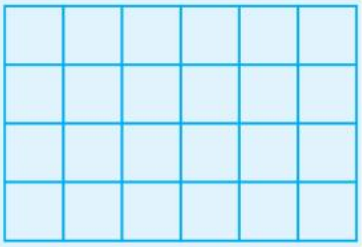
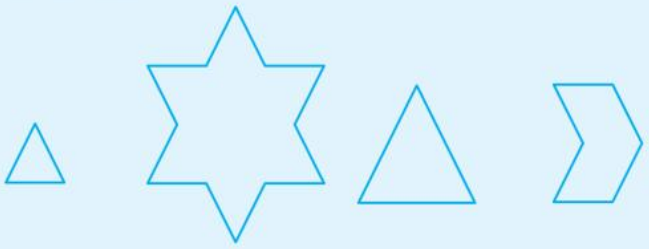


Fig. 6.22

Activity 2: Copy the triangular region in Fig. 6.23 (a). Use it as a unit to measure the area of each polygon in Fig. 6.23 (b), (c) and (d))



(a) (b) (c) (d)

Fig. 6.23

Activity 3: If  = 10sq units

Find how many such triangles will cover the following figures (Fig. 6.24)



(a) (b) (c) (d)

Fig. 6.24

Activity 4: Measure the following region in Fig. 6.25. Use the rectangular region of Q.25 as the unit of measure.

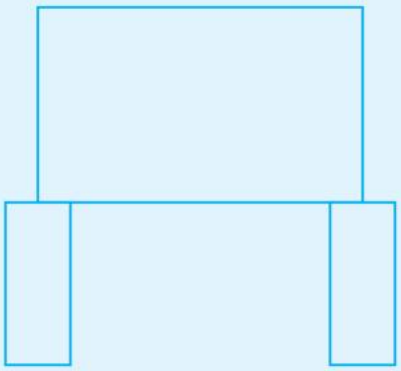
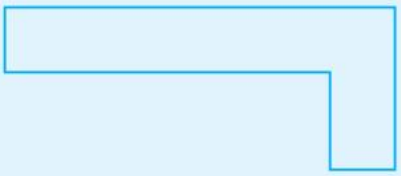


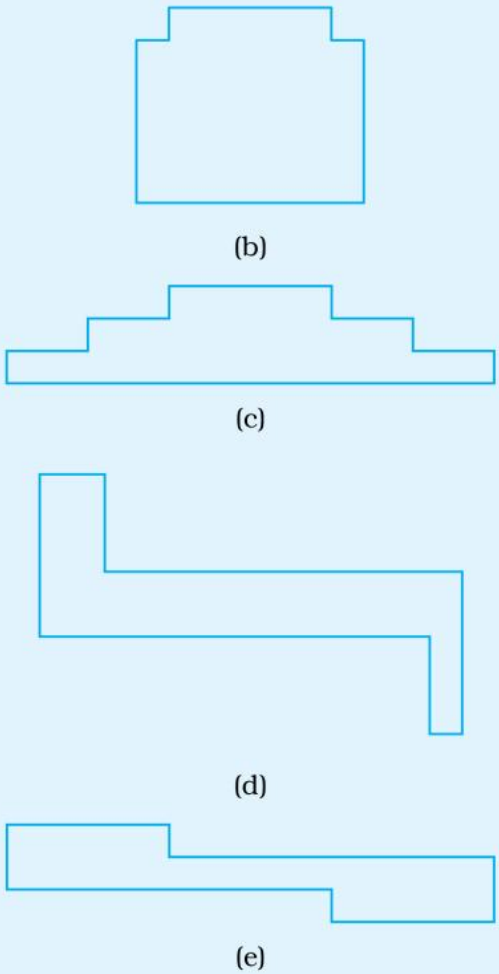
Fig. 6.25

Copy the rectangular unit on cardboard and cut it out, so that you can use it.

Activity 5: Using the same unit as in Q.25 measure these regions. (Fig. 6.26)



(a)



(b)

(c)

(d)

(e)

Fig. 6.26

Activity 6: Area of the rectangle shown in Activity 1 is 24sq units. Its length is 6 units and breadth is 4 units. We can also write $24 = 6 \times 4$ which means that 6 and 4 are factors of 24. Now write factors of 24 by observing the rectangles formed in Q9. Similarly take 48 unit squares and try to write all the factors of 48 using these squares.

Activity 7: On a squared paper, draw two rectangles with same perimeter but different areas. Draw two other rectangles which have same area but different perimeters.

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