

# 10

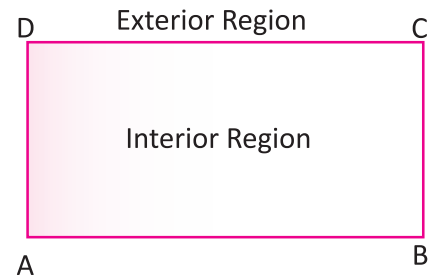
# Area and Perimeter



## Area

The amount of surface of the plane enclosed by a plane figure is known as **area**. We have studied about the closed plane figures. A rectangle, a square, a triangle and a circle, are all examples of closed plane figures.

The inner part of the plane enclosed by the rectangle ABCD is called the **interior region** of the rectangle ABCD. The outer part of the rectangle ABCD is called the **exterior region** of the rectangle ABCD.



The interior regions of four closed figures are shown below :



## Measuring Regions

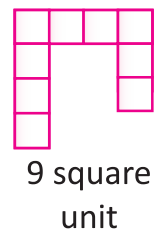
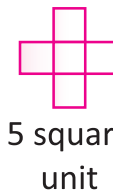
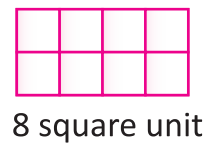
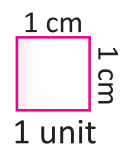
We measure a given region by a unit region and find how many such unit regions are contained in the given region.

The measure of a region is called its **area**.

An area is always expressed in square units. The area of a square with side 1 cm by 1 cm is equal to 1 square cm.

It is also written as  $1 \text{ cm}^2$ . A square is taken as the unit of area.

We can measure the areas of given regions in terms of a square unit.

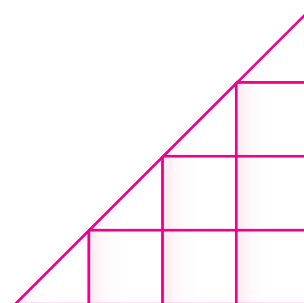




## Finding Area by Counting Squares

To find the area of a region of a closed plane figure, we draw the figure on a centimeter squared paper and then count the number of squares enclosed by the figure. Two possibilities arise :

1. All the square are completely enclosed.
2. Some squares are completely enclosed and some are partly enclosed. In the following figure, there are 6 whole squares and 4 half squares. In total, they make 8 whole squares.



Therefore, the area of the given figure is 8 square unit.

Area of certain regular figures like a rectangle or a square is measured by indirect method.



## Area of Rectangle

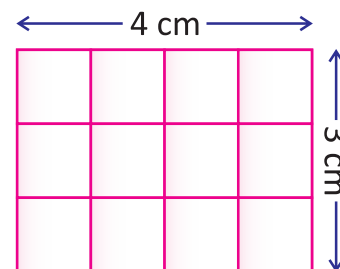
The internal region of the rectangle has been divided into squares of side 1 cm.

Number of squares in each row = 4

Number of squares in each column = 3

Then total number of squares in the rectangle = 12

But  $12 = 4 \times 3$



Therefore, total squares in rectangle = number of squares in a row  $\times$  number of squares in a column.

Now, length of rectangle = 4 cm

And breadth of the rectangle = 3 cm

Then, the area of rectangle =  $4 \text{ cm} \times 3 \text{ cm} = 12 \text{ sq. cm (cm}^2)$

= length  $\times$  breadth

Therefore, the area of rectangle = Length  $\times$  Breadth





## Area of a Square

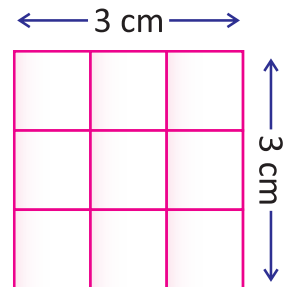
The internal region of the square is divided into small square of side 1 cm.

Number of squares in each row = 3 cm

Number of squares in each column = 3 cm

Then total number of squares =  $3 \times 3 = 9$  sq. cm

Then, the area of square = length of side  $\times$  length of side  
= side  $\times$  side.



Therefore, the area of square = side  $\times$  side.



## Area of Irregular Figures

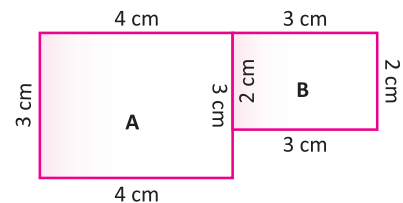
Every figure will not have a regular shape like rectangle or square. To find the area of irregular figure, we divide it into regular figures like rectangles or squares. To find the area of each regular figure, we add them together.

**For Example :** The area of figure given below can be calculated as :

The area of part 'A' =  $3 \times 4 = 12 \text{ cm}^2$

The area of part 'B' =  $2 \times 3 = 6 \text{ cm}^2$

Therefore, area of whole figure = area of 'A' + area of 'B'  
=  $12 \text{ cm}^2 + 6 \text{ cm}^2$   
=  $18 \text{ cm}^2$



**Example I :** The length and breadth of a rectangle are respectively 17 cm and 9 cm. Find the area of rectangle.

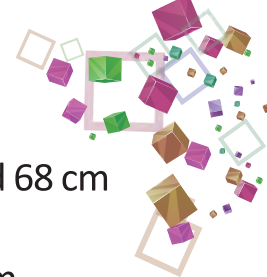
**Solution :** Length of the rectangle = 17 cm

Breadth of the rectangle = 9 cm

Area of rectangle = length  $\times$  breadth =  $17 \text{ cm} \times 9 \text{ cm}$

Therefore, the area of rectangle = 153 sq. cm





**Example II :** Find the area of a rectangle whose length and breadth are 3 m and 68 cm respectively.

**Solution :** Length of the rectangle = 3 m or 300 cm  
 Breadth of the rectangle = 68 cm  
 Area of the rectangle =  $300 \times 68$  sq. cm  
 = 20400 sq. cm  
 Therefore, area of the rectangle = 20400 sq. cm  
 In another way, we can also find this area :  
 Length of the rectangle = 3 m  
 Breadth of the rectangle = 68 cm or 0.68 m  
 Then, area of the rectangle =  $3 \times 0.68$  sq. m = 2.04 sq. m  
 Therefore, the area of the rectangle = 2.04 sq. m



### Facts to Know

- While finding the area of a rectangular figure, we first find whether length and breadth are expressed in the same unit. If not, we express them first in the same unit and then find the area of the rectangular figure.

**Example III :** The area of a rectangle is  $42 \text{ cm}^2$ . If its breadth is 6 cm then find its length.

**Solution :** Area of rectangle =  $42 \text{ cm}^2$   
 Breadth of rectangle = 6 cm  
 Area of rectangle = length  $\times$  breadth  
 $42 \text{ cm}^2$  = length  $\times$  6 cm  
 or length =  $\frac{42 \text{ cm}^2}{6 \text{ cm}} = 7 \text{ cm}$

Therefore, the length of the rectangle is 7 cm.

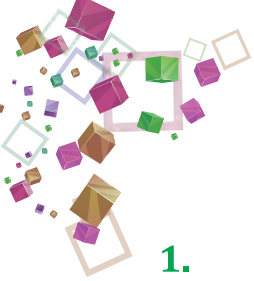
**Example IV :** Find the breadth of a rectangle whose area is 112 sq. cm and length is 14 cm.

**Solution :** Area of rectangle = 112 sq. cm  
 Length of rectangle = 14 cm  
 Area of rectangle = length  $\times$  breadth  
 $112 \text{ cm}^2$  = 14 cm  $\times$  breadth  
 or, breadth =  $\frac{112 \text{ cm}^2}{14 \text{ cm}} = 8 \text{ cm}$

Therefore, breadth of rectangle is 8 cm.







# Exercise 10.1

## 1. Fill in the blanks.

	Length	Breadth	Area
a.	11 cm	11 cm	.....
b.	13 cm	9 cm	.....
c.	23 cm	17 cm	.....
d.	15 cm	9 cm	.....

## 2. Fill in the blanks.

	Length	Breadth	Area
a.	24 cm	.....	216 cm <sup>2</sup>
b.	.....	15 cm	135 cm <sup>2</sup>
c.	13 cm	13 cm	.....
d.	14 m	.....	196 m <sup>2</sup>

## 3. Find the area of a rectangle whose length and breadth respectively are.....

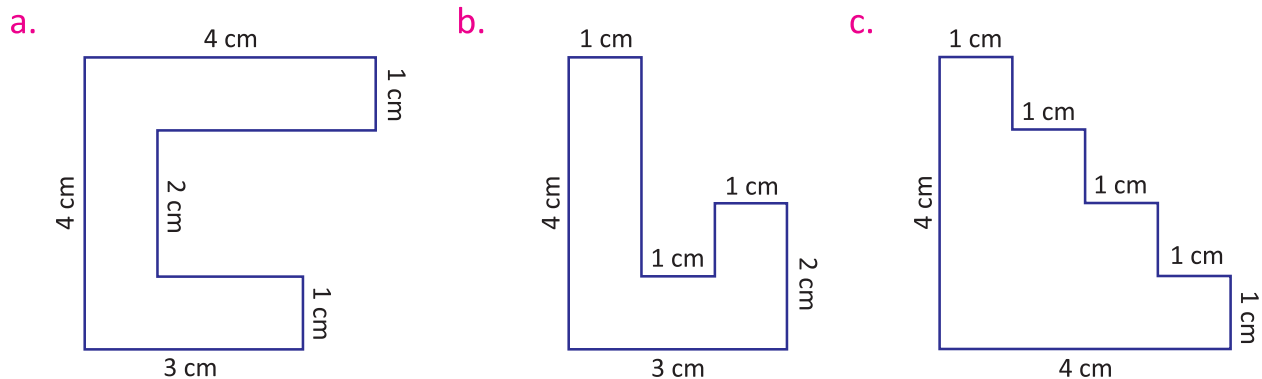
- a. 7.5 cm and 7 cm      b. 6 cm and 3.5 cm      c. 14 cm and 6 cm

## 4. Find the area of a square whose side is....

- a. 9 cm      b. 6.7 cm      c. 13.7 cm      d. 1.2 cm

5. What is the area of a rectangular field whose length is 40 m and breadth is 20.5 m?  
 6. The side of a square tile is 10 cm. How many tiles can be fixed on the floor of a room of 2.5 m long and 2 m wide?  
 7. How many carpets, each 4 m long and 2.5 m wide, will be required to cover completely the floor of a hall 20 m long 13 m wide?  
 8. A courtyard 25 m long and 12 m broad, is to be laid with brick of length 20 cm and breadth 10 cm. How many number of bricks are required?

## 9. Find the area of the following figures.





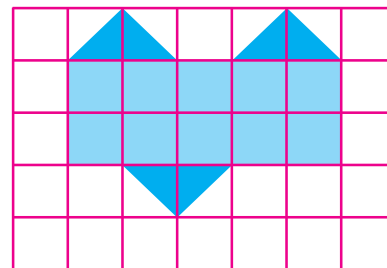
## Area of Figures not Covering Whole Squares

There are some shapes which do not cover the whole squares or complete squares. To find the area of such figures we have to consider half-squares besides complete squares.

The figure given alongside is covering 10 complete (whole) squares and 6 half-squares.

We can treat 6 half-squares as 3 whole squares.

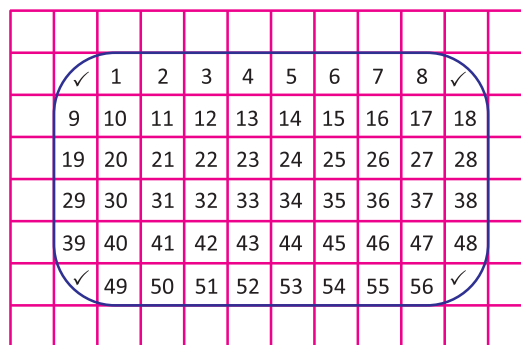
So, area of the figure =  $10 + 3 = 13$  sq. units.



## Estimation of Area of Irregular Shapes

A school wants to make a new playground. The shape of the playground is oval, as shown in the figure. How can the area be calculated?

We can calculate the approximate area of the playground. To estimate the area, we use a grid and follow the steps given below :



**Step 1** : Count the complete (whole) squares.

**Step 2** : Count the half-squares.

**Step 3** : Estimate the partial squares to calculate the number of complete squares that can be made.

**Step 4** : Add all the three. The sum is the required approximate area.

**For the playground :**

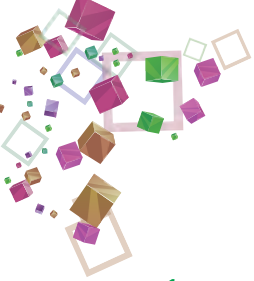
Number of whole squares = 56

Number of half squares = 4 = 2 whole squares

Total area =  $56 + 2 = 58$  squares

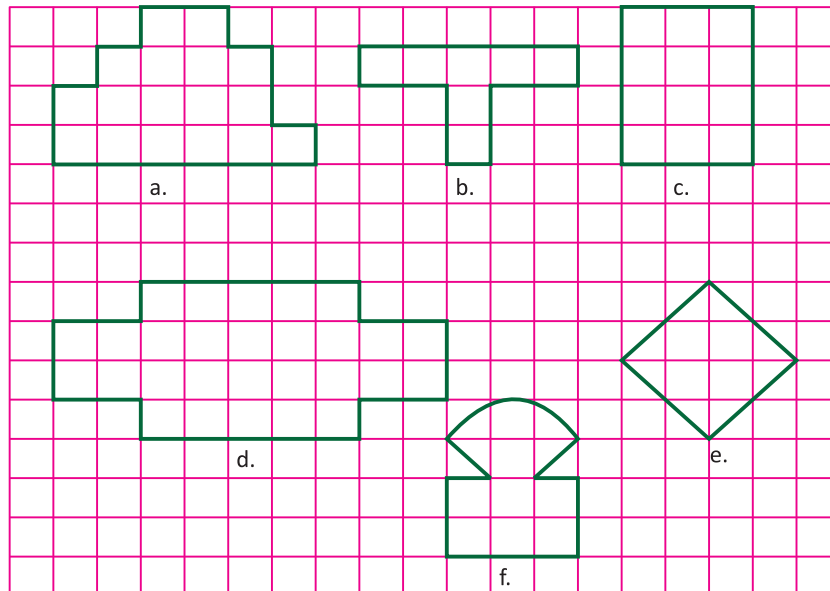
As the area of each square is  $1 \text{ m}^2$ , the area of the playground is  $58 \text{ m}^2$ .





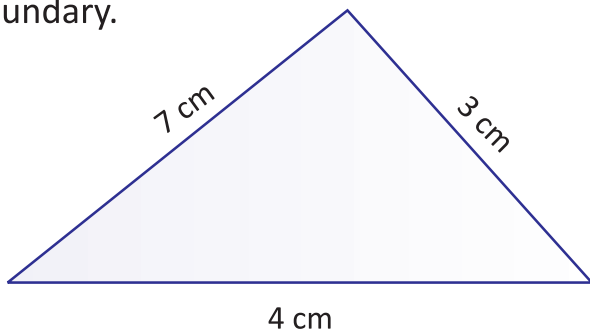
## Exercise 10.2

1. Find the area of the figures given below. (each square = 1sq. cm)

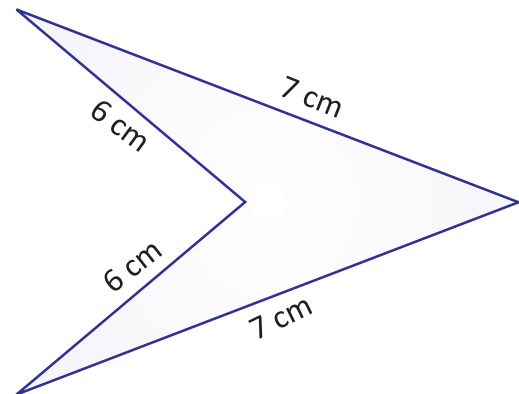


### Perimeter

The length of the boundary of a shape is called its perimeter. The distance around a figure is called the perimeter of the figure. The perimeter of a closed figure is the total length of its boundary.



$$\begin{aligned} \text{Perimeter} &= 7 \text{ cm} + 3 \text{ cm} + 4 \text{ cm} \\ &= 14 \text{ cm} \end{aligned}$$



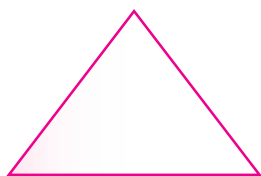
$$\begin{aligned} \text{Perimeter} &= 7 \text{ cm} + 7 \text{ cm} + 6 \text{ cm} + 6 \text{ cm} \\ &= 26 \text{ cm} \end{aligned}$$

Perimeter = sum of the lengths of the line segments forming a figure





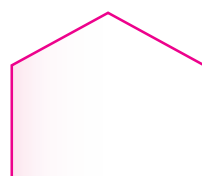
Polygons having number of sides 3,4,5 and 6 are called triangle, quadrilateral, pentagon and hexagon.



Triangle



Quadrilateral



Pentagon



Hexagon

**Rectilinear Figure** : A plane figure bounded by the segments is called rectilinear figure.

**For Example** : Triangle, quadrilateral, pentagon and hexagon are rectilinear figures. A circle is not a rectilinear figure.

**Perimeter of a Triangle** : Sum of all the three sides of a triangle is called the perimeter of the triangle.



### Perimeter of a Rectangle

Three different methods can be used for finding the perimeter of the rectangle.

**First Method** : Perimeter of the rectangle = length + breadth + length + breadth

**Second Method** : Perimeter of the rectangle =  $2 \times \text{length} + 2 \times \text{breadth}$

**Third Method** : Perimeter of the rectangle =  $2 \times (\text{length} + \text{breadth})$

The third method is more simple and takes less time in calculation. Therefore, perimeter of the rectangle =  $2 \times (\text{length} + \text{breadth})$ .



### Perimeter of a Square

Two different methods can be used to find the perimeter of the square.

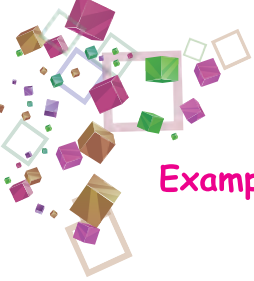
**First Method** : Add the length of all four sides.

$$\text{Perimeter of the square} = \text{side} + \text{side} + \text{side} + \text{side}$$

**Second Method** : Perimeter of square =  $4 \times \text{side}$

Second method is simpler and take less time for calculation, so we always use it.

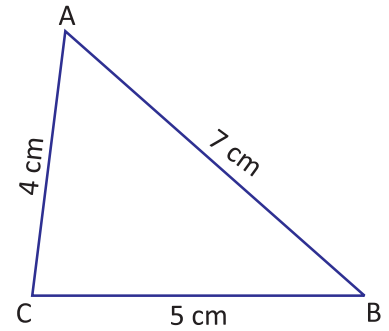




**Example V** : Find the perimeter of a triangle ABC whose side are AB= 7 cm, BC= 5 cm and CA= 4 cm.

**Solution** : Perimeter of  $\triangle ABC = AB + BC + CA$   
 $= 7 \text{ cm} + 5 \text{ cm} + 4 \text{ cm}$

Perimeter of  $\triangle ABC = 16 \text{ cm}$

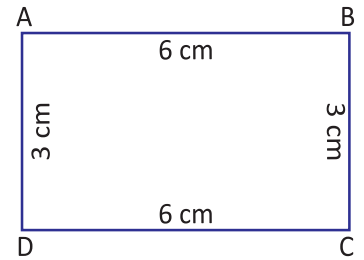


**Example VI** : Find the perimeter of rectangle ABCD whose sides AB= 6 cm, BC= 3 cm.

**Solution** : Since, in a rectangle, opposite sides are parallel and equal.

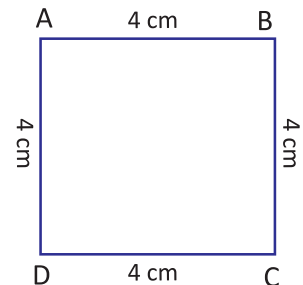
Therefore,  $AB = CD = 6 \text{ cm}$  and  $BC = AD = 3 \text{ cm}$

Perimeter of rectangle ABCD  $= 2 \times (AB + BC)$   
 $= 2 \times (6 \text{ cm} + 3 \text{ cm})$   
 $= 2 \times 9 \text{ cm} = 18 \text{ cm}$



**Example VII** : Find the perimeter of the square ABCD whose each side is 4 cm.

**Solution** : Perimeter of a square ABCD  
 $= 4 \times \text{side}$   
 $= 4 \times 4 = 16 \text{ cm}$



**Example VIII** : A public meeting is conducted in a rectangular field of 40 m length and 30 m breadth.

A fence of rope is made around the field to control the gathering. What will be the length of the rope?

**Solution** : The length of the rope equal to the perimeter of field  
 $= 2 \times (\text{length} + \text{breadth})$   
 $= 2 \times (40 \text{ m} + 30 \text{ m})$   
 $= 2 \times 70 \text{ m} = 140 \text{ m}$

Therefore, length of the rope will be 140 m.

**Example IX** : An athlete runs a race of 200 m around a rectangular field whose length is 30 m and breadth is 20 m. How many times does the athlete run around the field ?







**Solution** : The distance covered by an athlete in one round is equal to the perimeter of the field.

$$\begin{aligned} &\text{Therefore, distance the athlete covers in one round} \\ &= 2 \times (30 \text{ m} + 20 \text{ m}) \\ &= 2 \times 50 \text{ m} = 100 \text{ m} \end{aligned}$$

The athlete covers 100 m in one round.

Therefore, the athlete covers 200 m in 2 rounds.

Thus, the athlete, runs 2 times around the field.



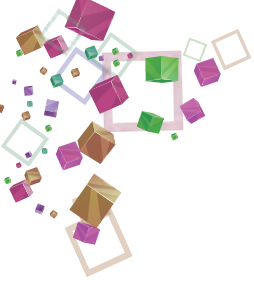
### Exercise 10.3

- Find the perimeter of the rectangle whose length is 8 m and breadth is 4 m.
- Find the perimeter of a square whose side is 6 m.
- Find the perimeter of the following rectangles whose dimensions are...**
  - Length = 7 cm, Breadth = 5 cm
  - Length = 5 cm, Breadth = 3 cm
  - Length = 6 cm, Breadth = 4 cm
- Find the perimeter of the following squares whose sides are...**
  - 3 cm
  - 6 cm
  - 8 cm
- Find the perimeter of the following triangles whose sides are...**
  - 7 cm, 8 cm, 3 cm
  - 6 m, 5 m, 4 m,
  - 8 cm, 7 cm, 6 cm
- A rectangular field has a perimeter of 34 cm. If its breadth is 8 cm. What is its length?
- A square has a perimeter of 36 m. What is the length of each side?
- A triangle has a perimeter of 60 cm. If its two sides are of lengths 18 cm and 22 cm. Find the length of the third side.

### Points to Remember

- ❖ Perimeter is the distance around a figure.
- ❖ Area is the number of square units needed to cover a surface.
- ❖ Area of a rectangle = length  $\times$  breadth
- ❖ Area of a square = side  $\times$  side
- ❖ Perimeter of a rectangle =  $2(\text{length} + \text{breadth})$
- ❖ Perimeter of a square =  $4 \times \text{side}$
- ❖ All measurements should have the same unit for calculation.





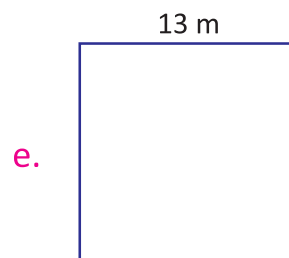
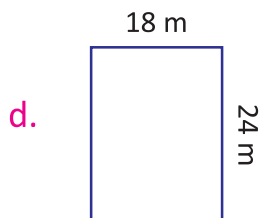
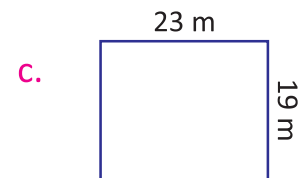
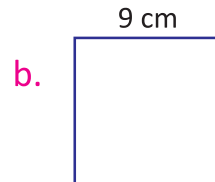
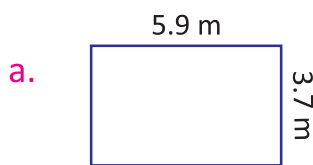
# EXERCISE

## 1. Multiple Choice Questions (MCQs)

Tick (✓) the correct option:

- a. The area of a rectangle with length 15 cm and breadth 7 cm is .....
- (i)  $95 \text{ cm}^2$   (ii)  $105 \text{ cm}^2$   (iii)  $205 \text{ cm}^2$   (iv)  $108 \text{ cm}^2$
- b. The area of a square with side 9 m is .....
- (i)  $36 \text{ m}^2$   (ii)  $80 \text{ m}^2$   (iii)  $81 \text{ m}$   (iv)  $81 \text{ m}^2$
- c. The perimeter of a square with side 18 cm is .....
- (i)  $36 \text{ cm}$   (ii)  $324 \text{ cm}$   (iii)  $72 \text{ cm}^2$   (iv)  $72 \text{ cm}$
- d. The perimeter of a rectangle is given by .....
- (i)  $3(\ell + b)$   (ii)  $2(\ell - b)$   (iii)  $3(\ell - b)$   (iv)  $2(\ell + b)$
- e. A rectangle whose area is  $153 \text{ sq. cm}$  and length is  $17 \text{ cm}$ , the breadth is .....
- (i)  $7 \text{ cm}$   (ii)  $8 \text{ cm}$   (iii)  $9 \text{ cm}$   (iv) none of these

## 2. Find the perimeter and area of the following figures.



## 3. Find the area of the following.

	Length	Breadth	Area		Length	Breadth	Area
a.	8 cm	7 cm	.....	b.	12 cm	5 cm	.....
c.	26 cm	17 cm	.....	d.	9 cm	6 cm	.....
e.	28 cm	32 cm	.....	f.	19 cm	25 cm	.....

4. The length of a room is 6 m and its breadth is 4 m. Find the area of floor of the room.





5. Find the area of a square whose side is 17 cm.
6. Find the perimeter of the following rectangles whose dimensions are...
  - a. Length = 6 cm, Breadth = 3 cm
  - b. Length = 19 cm, Breadth = 13 cm
  - c. Length = 18 cm, Breadth = 11 cm
  - d. Length = 21 cm, Breadth = 20 cm
7. Find the perimeter of the following squares whose sides are...
  - a. 7 cm
  - b. 12 cm
  - c. 9 cm
  - d. 22 cm
8. Find the perimeter of the following triangles whose sides are...
  - a. 9 cm, 5 cm, 3 cm
  - b. 11 cm, 9 cm, 8 cm
  - c. 6 cm, 6 cm, 6 cm
9. An athlete runs 3 times around a field whose length is 150 m and breadth is 75 m. Find the distance covered by him.



A 15 cm by 10 cm picture is put in a frame of 18 cm by 12 cm. Does the picture take up less or more of the area than the frame?



### Lab Activity

#### Objective

: Working with perimeter and area.

#### Materials Required

: Sheet of drawing paper, scale, pencil, a pair of scissors and tape to hold the folds together

#### Activities :

- ❖ Draw the figure shown alongside, having 6 equal square surfaces of side 5 cm on a thick sheet of paper.
- ❖ Cut along the bold lines and fold on the dotted lines to make a cube.
- ❖ Use tape to hold the cube.
- ❖ Now make an observation table.

Perimeter = .....

Area of all the surfaces = .....

The cube can be coloured and numbered to make it look like a dice to play.

