

# **Perimeter and Area**

#### 14.1 Consider about following situations.

- 1. Neeta wants to put a lace border all around a rectangular picture.
- 2. An athlete is running on a circular track. He starts from a point A, completes one round and reaches back at the starting point A. What is the distance covered by him?
- 3. A farmer wants to fence his field. What is the total length of wire he must use?



In situations like this, we need to measure the length of the boundary of the closed figures. Perimeter is the measure of a closed figure when you go round the figure once.

In this chapter, we will learn about the concepts of perimeter and area.

#### 14.2 Perimeter

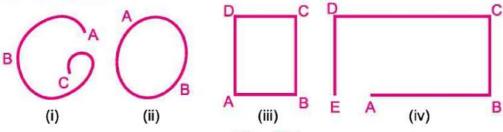


Fig. 14.1

Madhav and Ishan formed some figures as shown in figure 14.1. They observed that figures (i) and (iv) are open figures but figures (ii) and (iii) are closed figures. We can't measure perimeter of open figures. Hence, perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.

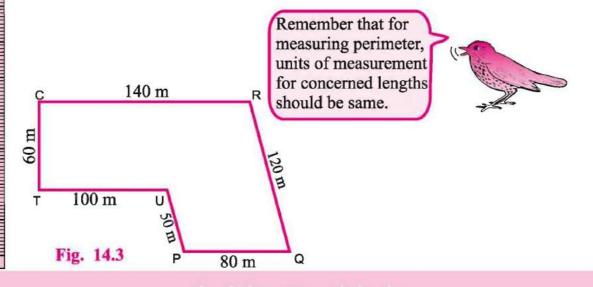
We measure perimeter and area only for closed figures. Think why?

## 14.2.1 Unit of measuring perimeter

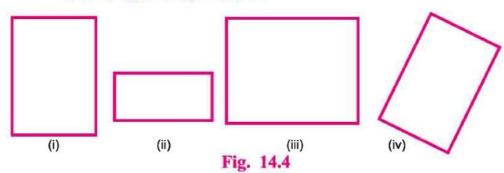
Let's try to solve following problems-

- 1. Measure in centimeters and write the lengths of the four sides of a page of your notebook. Also find the sum of the lengths of the four sides.
- 2. Rashmi went to a park 120 m long and 80 m wide. She took one complete round on its boundary. What is the distance covered by her?
- 3. Figure 14.2 is a closed figure made of various line segments. Find the perimeter of the figure by adding the lengths of the line segments. Perimeter = AB + BC + CD + DE + EF + FG + GH + HI + IJ+ JK + KL+ LA

2 cm E 2 cm E 2 cm D C 2 cm Fig. 14.2



# 14.2.2 Find the perimeter of the following rectangles. Which rectangle has the greatest perimeter?



Remember that opposite sides of a rectangle are equal. Perimeter of the rectangle = Sum of the lengths of its four sides = length + breadth + length + breadth

How many times length is added? Two times

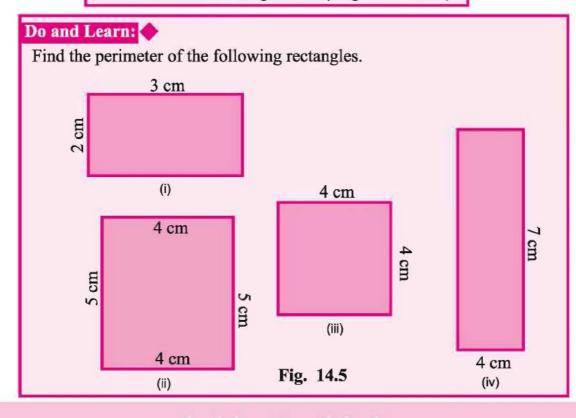
How many times breadth is added? Two times

Therefore, Perimeter of the rectangle = Twice of length + Twice of breadth

$$= 2 \times length + 2 \times breadth$$

$$=2 \times (length + breadth)$$

Perimeter of the rectangle  $=2 \times (length + breadth)$ 



Example 1

Find the perimeter of a rectangular mirror whose length is 25 cm

and breadth is 14 cm

Solution

Length of the rectangular mirror  $=25 \,\mathrm{cm}$ Breadth of the rectangular mirror  $=14 \,\mathrm{cm}$ 

Therefore, Perimeter of the rectangle =  $2 \times (length + breadth)$ 

 $=2 \times (25 \text{ cm} + 14 \text{ cm})$ 

 $=2\times(39\,\mathrm{cm})$ 

 $=78 \, \mathrm{cm}$ 

**Example 2** Find the perimeter of a rectangle whose length and breadth are 250

cm and 1 m respectively.

Solution

Length of the rectangle =  $250 \, \text{cm}$ Breadth of the rectangle = 1 m

 $= 100 \,\mathrm{cm} \,(1 \,\mathrm{m} = 100 \,\mathrm{cm})$ 

Therefore, Perimeter of the rectangle =2 x (length + breadth)

 $=2\times(250\,\mathrm{cm}+100\,\mathrm{cm})$ 

 $=2 \times (350 \, \text{cm})$ 

 $=700 \, \text{cm} = 7 \, \text{m}$ 

250 cm

1<sub>m</sub>

**Example 3** A farmer has a rectangular field of length and breadth 415 m and 280 m respectively. He wants to fence it. Find the cost of fencing at

the rate of Rs 10 per metre.

Solution

Length of the rectangular field = 415 m Breadth of the rectangular field = 280 m

Therefore, Perimeter of the rectangular field  $=2\times(length + breadth)$ 

 $=2\times(415\,\mathrm{m}+280\,\mathrm{m})$ 

 $=2\times(695 \,\mathrm{m})$ 

 $= 1390 \, \text{m}$ 

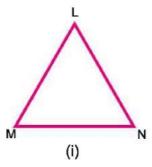
Cost of fencing per meter = Rs 10

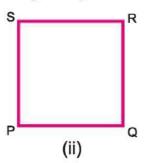
Therefore, cost of fencing for  $1390 \,\mathrm{m} = \mathrm{Rs} \, 10 \times 1390$ 

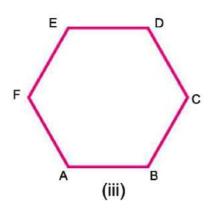
= Rs 13900

### 14.2.3 Perimeter of Regular Polygons

Madhav and Ishaan are making different polygns with the help of similar straws. Following are a few of the shapes they made:







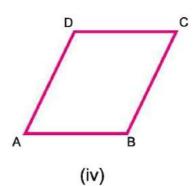


Fig. 14.6

Measure the lengths of the sides of these figures and fill in the table.

S.No. of the figure	Number of sides	Measure of length of one side	Sum of measure of lengths of all the sides	Product of number of sides and measure of length of one side
(i)				
(ii)				
(iii)				
(iv)				

**Table 14.1** 

Observing table 14.1, you will find that in each figure, sum of measure of lengths of all the sides of that figure is equal to the product of number of sides of that figure and measure of length of one side of that figure.

Perimeter of a regular polygon = Number of sides × Length of one side

Since a square is also a regular polygon, therefore,

Perimeter of a square =  $4 \times length$  of side

**Example 4** Find the distance travelled by Jyoti if she takes two rounds of a square park of side 90 m.

Solution Perimeter of the square park = 4 × length of side = 4 × 90 m = 360 m

Distance travelled by Jyoti in two rounds  $= 2 \times 360 \,\mathrm{m}$ = 720 m

Example 5 Find the side of the square whose perimeter is 18 cm.

Perimeter of the square = 18 cm

We know that Perimeter of a square =  $4 \times \text{side}$ Therefore,  $18 \text{ cm} = 4 \times \text{side}$ Hence,  $\text{side} = \frac{18}{4}$ = 4.5 cm

Find the perimeter of a equilateral triangle whose side is 8.5 cm.

All three sides in a equilateral triangle are equal

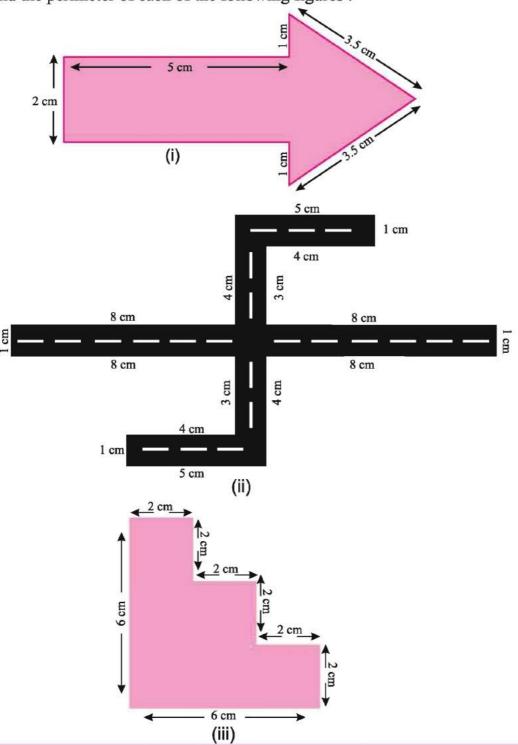
So perimeter of triangle  $= 3 \times \text{side}$   $= 3 \times 8.5$  = 25.5 cm

## Do and Learn.

- 1. Find the perimeter of a regular polygon with each side equal to 3.5 cm and number of sides equal to 3.
- 2. The perimeter of a regular polygon is 28 cm and its each side equal to 7 cm Find the number of sides of the polygon.
- 3. Find the perimeter of a square with each side equal to 4.5 cm.

## Exercise 14.1

1. Find the perimeter of each of the following figures:



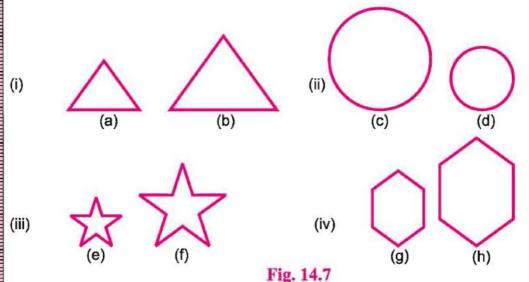
- 2. Find the perimeter of a regular pentagon with each side equal to 4 cm.
- 3. A piece of string is 36 cm long. What will be the length of each side if the string is used to form:

A piece of string is 36 cm long. What will be the length of each side if the string is used to form:

- (i) a square?
- (ii) an equilateral triangle?
- (iii) a regular hexagon?
- 4. Geeta runs around a square field of side 50 m. Puja runs around a rectangular field with length 65 m and breadth 25 m. Who covers less distance?
- 5. Find the side of the regular pentagon whose perimeter is 30 cm.
- 6. Madhu has a rectangular field of length and breadth 23.5 m and 15.5 m respectively. He wants to fence his field with steel wire. What is the total length of steel wire he must use?
- 7. Perimeter of a football ground is 270 m. Find the breadth of the ground if the length of the ground is 90 m.

#### 14.3 Area

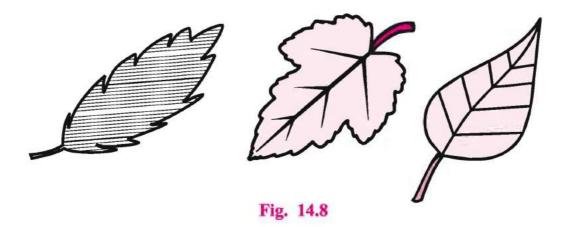
Look at the closed figures (Fig 14.7) given below. All of them occupy some space of a flat surface. Can you tell which one occupies more space?



Kusum-Smaller figures occupy less space and larger figures occupy more space.

The amount of surface enclosed by a closed figure is called its area.

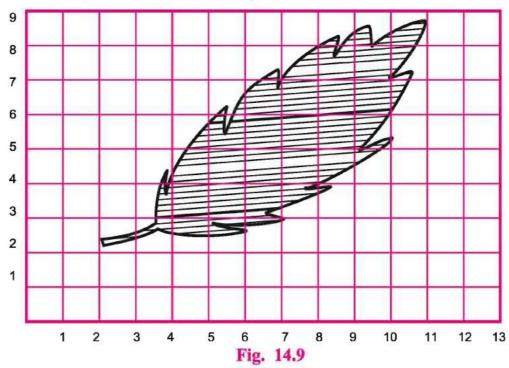
**Teacher -** Now, look at the below figures of Fig 14.8. Which one of these has larger area?



All the students in the class are quiet.

Naresh - It is difficult to tell just by looking at these figures.

Teacher - So, what do we do? Let's try to estimate the area.



If more than half of a square is enclosed by the figure, just count it as one square. Ignore portions of the figure that are less than half a square. If exactly half the square is enclosed, take its area as 1/2 sq unit.



Fully-filled squares = 10

More than half-filled squares = 14

Less than half-filled squares = 06

If we ignore 'less than half-filled squares' and count 'more than half-filled squares' just as one square, then, Number of squares enclosed by the figure of the

$$leaf = (10 + 14) = 24$$
 squares

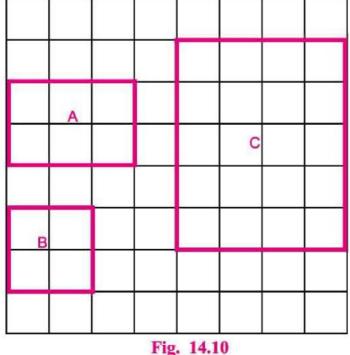
Therefore, Estimated area of the leaf = 24 squares.

### Do and Learn.

Put a leaf of a china rose plant and a leaf of a pepal tree on grid papers. Find the estimated areas of both. Compare and tell which leaf has greater area?

#### 14.4 Area of Rectangle

Place any one figure on a squared grid paper or graph paper where every square measures 1 cm × 1 cm (i.e. 1 sq. unit). Make an outline of the figure. Look at the squares enclosed by the figure. Some of them are completely enclosed, some half, some less than half and some more than half.



Make some more rectangles on the grid paper and fill in the following table.

Rect- angle	Length	Breadth	Number of squares enclosed by the rectangle	Length × Breadth
Α	cm	cm		
В	cm	cm		
С	cm	cm		
D	cm	cm		

#### **Table 14.2**

From the table 14.2, we can infer that for each rectangle, number of squares enclosed by the rectangle is equal to the product of length and breadth of that rectangle.

Hence, Area of a rectangle = Length x Breadth

#### 14.5 Area of Square

We know that square is a rectangle whose length and breadth are equal. So, think, what should be the area of a square?

Area of the square =  $side \times side$ 

#### 14.6 Unit of Area

To find the area, two similar units are multiplied. Hence, the unit of area is written as square units or sq. units.

For e.g.,  $cm \times cm = sq. cm (cm^2)$ 

$$m \times m = sq. m (m^2)$$

**Example 7** Find the area of the surface of a rectangular mobile phone whose length and breadth are 14 cm and 7 cm respectively.

Solution Length of mobile phone = 14 cm

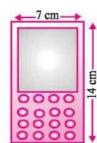
Breadth of mobile phone  $= 7 \, \text{cm}$ 

Therefore, the area of the surface of the mobile phone

=Length  $\times$  Breadth

 $=14 \,\mathrm{cm} \times 7 \,\mathrm{cm}$ 

 $=98 \, \mathrm{sq.\,cm}$ 



**Example 8** Find the area of a square field with each side equal to 15 m.

Solution Length of one side of the square field = 15 m

Therefore, the area of the square field = side ×side

 $= 15 \,\mathrm{m} \,\mathrm{x} \,15 \,\mathrm{m}$ 

 $= 225 \, \text{sq. m}$ 

**Example 9** Area of a rectangular cardboard is 2.50 sq. m. Find the breadth of the cardboard if its length is 2 m.

Area of the rectangular cardboard = 2.50 sq. m. Solution

Length of the cardboard  $= 2 \,\mathrm{m}$ 

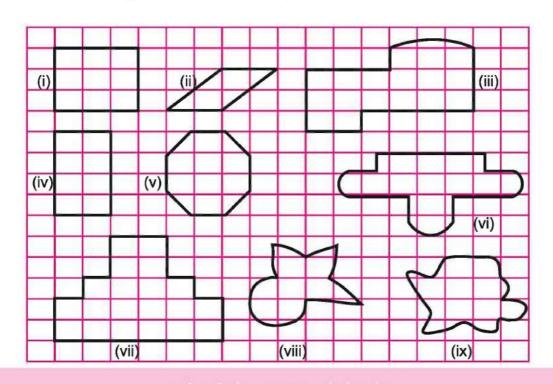
We know that, area of a rectangle = length × breadth

Therefore, breadth of the cardboard =  $\frac{\text{Area}}{\text{Length}} = \frac{2.50 \text{ sq. m}}{2 \text{ m}} = 1.25 \text{ m}$ 



By counting squares, estimate the areas of the figures. 1.

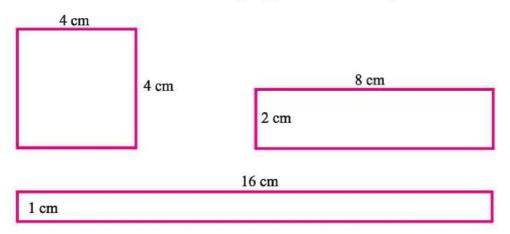
Given: 1 square cell =  $1 \text{ cm} \times 1 \text{ cm}$ )



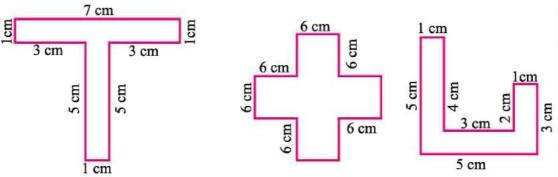
cm

N.

2. Find the areas of the following figures. What do you infer from this?



3. By splitting the following figures into rectangles, find their areas (The measures are given in centimeters).



- 4. A room is 10 m long and 8 m wide. How many square meters of carpet is required to cover the floor of the room?
- 5. Find the area of a square frame of side  $9 \, \mathrm{cm}$ .
- 6. Find the areas of the following rectangles. Which rectangle has least area and which one has greatest area?

(i) 
$$l = 2 \text{ m}$$
  
b = 80 cm

(ii) 
$$l = 180 \text{ m}$$
  
b = 70 cm

(iii) 
$$l = 200 \text{ cm}$$
$$b = 1 \text{ m}$$

(iv) 
$$l = 190 \text{ cm}$$
  
  $b = 1 \text{ m}$ 

- 7. The area of a rectangular garden 50 m long is 300 sq m. Find the width of the garden.
- 8. Six square flower beds each of sides 1 m are dug on a piece of land 8 m long and 6 m wide. What is the area of the remaining part of the land?
- 9. What will be the change in the area of a rectangle if its-
  - (i) Length and breadth are both doubled?
  - (ii) Length is tripled and breadth is doubled twice?
- 10. What will be the change in the area of a square if its side is
  - (i) Halved?
  - (ii) Doubled?

#### 14.7 Relation between Perimeter and Area of a Rectangle

#### 1. When perimeter is equal:

Take a grid paper with every square measures  $1 \text{ cm} \times 1 \text{ cm}$ . Take 22 pieces of thin strings each 1 cm long. Place these strings on the grid paper and make different rectangles each with perimeter equal to 22 cm (as shown in the figure 14.11).

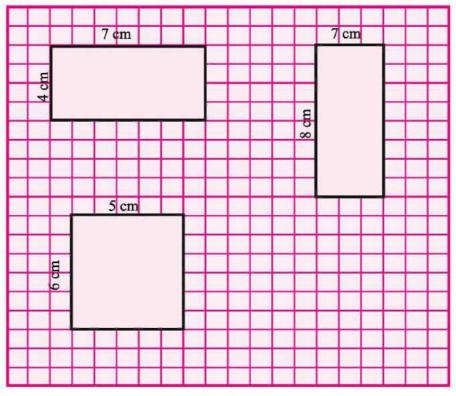


Fig. 14.11

Fill the details in the given table. For each figure, count the number of squares enclosed and fill in the table.

Length	Breadth	Length x Breadth	Area ( sq. units)
cm	cm		

**Table 14.3** 

On similar grid papers, make some more rectangles with the same perimeter, and continue filling the above table with the details of those rectangles. What do you infer from Table 14.3?

- 1. Areas of rectangles with same perimeter may not be always equal.
- 2. Among the rectangles with same perimeter, the rectangle with smallest difference between its length and breadth, will have greatest area.

#### 2. When area is equal

On a centimeter squared paper, make as many rectangles as you can, such that enclosed area of each rectangle is 24 squares. Fill the details about their length and breadth in a table with format similar to table 14.3. What do you inferfrom the table?

# 14.8. Comparison between a square's area and a rectangle's area with same perimeter:

Given below are figures of the plots of Punam and Puja (Figure 14.12). Whose plot has greater area?

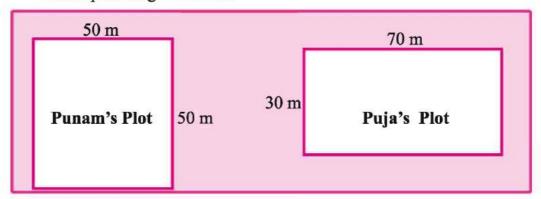


Fig. 14.12

Area of Punam's plot = ......sq. m

Area of Puja's plot = ......sq. m

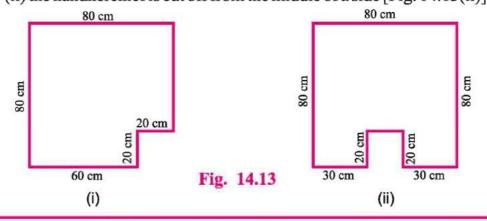
Square and rectangle with same perimeter

Square's area is greater than rectangle's area when the perimeter is the same for both.

#### 14.9 Change in perimeter when shape of the figure is reduced

A square handkerchief of width 20 cm is cut off from a piece of square cloth 80 cm wide. What will be the change in the perimeter of the cloth if(i) The handkerchief is cut off from a corner of the cloth [Fig. 14.13(i)]?
(ii) the handkerchief is cut off from the middle of a side [Fig. 14.13(ii)]?

**MATHEMATICS** 



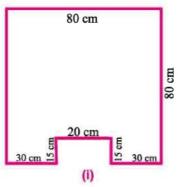
The changes in the perimeter of a figure may not be same when parts with equal area are removed from different places of the shape.

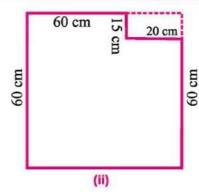
## Exercise 14.3

1. Find the areas and perimeters of the following rectangular figures. Which of them have same perimeter but different area?



- 2. Gopi has a square field of side 75 m. Narayan has a rectangular field of length 85 m. If the perimeters of both the fields are same, whose field has greater area and by how much?
- 3. Area of a square is 64 sq. cm. Perimeter of a rectangle is equal to the perimeter of this square. Find the length of the rectangle if its breadth is 6.5 cm. Which figure has greater area?
- 4. A rectangular piece of 20 cm x 15 cm is cut off from a bigger rectangle as shown in the figures below. In each case, find the difference in perimeter before and after the piece is cut off.





- 5. On a centimeter squared paper, make as many rectangles as you can, such that the area of the rectangle is 64 sq. cm (consider only natural number lengths).
  - (i) Which rectangle has the greatest perimeter?
  - (ii) Which rectangle has the least perimeter?
  - (iii) Find the change in width of rectangle with decreasing perimeter of the rectangle.
- 6. On a centimeter squared paper, make as many rectangles as you can, such that the perimeter of the rectangle is 16 cm (consider only natural number lengths).
  - (I) Which rectangle has the greatest area?
  - (ii) Which rectangle has the least area?
  - (iii) Find the change in length of rectangle with increasing area of the rectangle.

# We Learnt

- 1. Perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.
- 2. (i) Perimeter of a rectangle =  $2 \times (length + breadth)$ 
  - (ii) Perimeter of a square = 4 × length of its side
  - (iii) Perimeter of an equilateral triangle = 3 × length of a side
  - (iv) Perimeter of a regular polygon = Number of sides x Length of one side
- 3. The amount of surface enclosed by a closed figure is called its area.
- 4. To calculate the area of a figure using a squared paper, the following conventions are adopted:
- (I) Ignore portions of the area that are less than half a square.
- (ii) If more than half a square is in a region. Count it as one square.
- (iii) If exactly half the square is counted, take its area as  $\frac{1}{2}$  sq units.
- 5. (i) Area of a rectangle = length × breadth
  - (ii) Area of a square = side × side