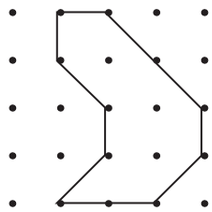
CHAPTER 8

1 Areas of Polygons

Goal **Estimate and measure the area of polygons.**

1. A hockey team chose this logo for their uniforms.



a) Estimate the area in square units.

Suggested answer: 8 square units

b) Measure the area in square units.

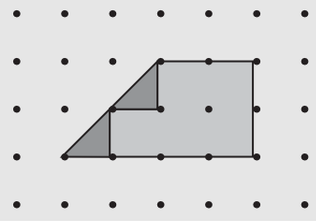
7.5 square units

2. For each polygon, estimate and then measure the area in square units.

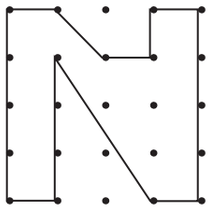
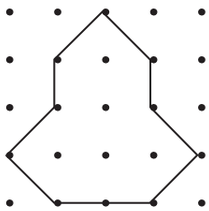
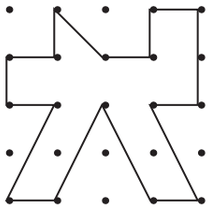
At-Home Help

A grid is like an area ruler. Each full square on the grid has an area of 1 square unit. Many shapes drawn on grids can be divided into squares and right-angled triangles.

For example:



In this shape, there are 5 full squares (lightly shaded) and 2 half squares (darkly shaded). So the total area is 6 square units.

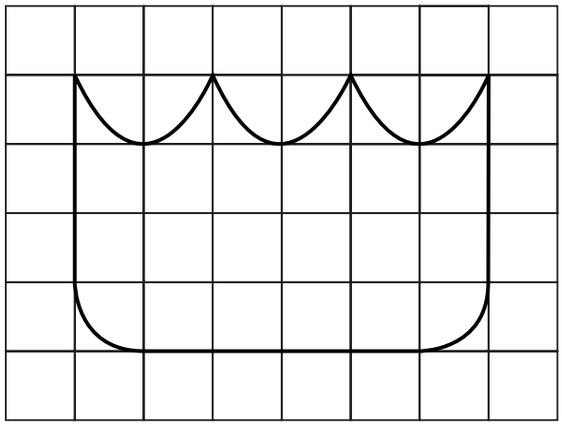
		Estimated area	Measured area
a)		Suggested answer: 11 square units	11.5 square units
b)		Suggested answer: 10 square units	9 square units
c)		Suggested answer: 10 square units	9.5 square units

CHAPTER 8
2

Areas of Irregular 2-D Shapes

Goal **Develop methods to measure the areas of irregular 2-D shapes.**

Find the area of this tulip shape to the nearest square unit using each of the methods below.



1. Count the full squares. For part squares, if less than half a square is covered, round down. If more than half a square is covered, round up.

Full squares	Part squares	Total area
16	2	18 square units

2. Count the full squares. For part squares, count how many squares you could make by putting together the part squares.

Full squares	Part squares	Total area
16	3	19 square units

3. Count the full squares. For part squares, count only those that are half or more.

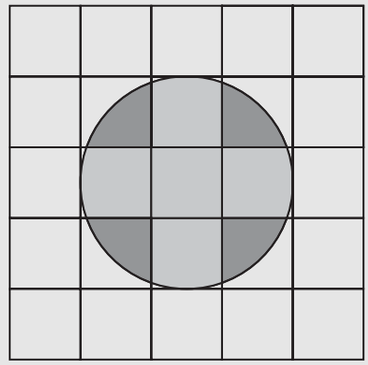
Full squares	Part squares	Total area
16	2	18 square units

At-Home Help

A grid is useful when measuring the area of an irregular 2-D shape to the nearest square unit.

On centimetre grid paper, each full square has an area of 1 square centimetre. Part squares that cover less than half a square can be rounded down. Part squares that cover more than half a square can be counted as 1 full square. Part squares can also be grouped to make up about 1 full square.

For example:



This circle covers 5 full or almost full squares (lightly shaded). There are 4 remaining part squares (darkly shaded), which can be grouped to give about 2 more full squares. So the total area of the circle is about 7 square units.

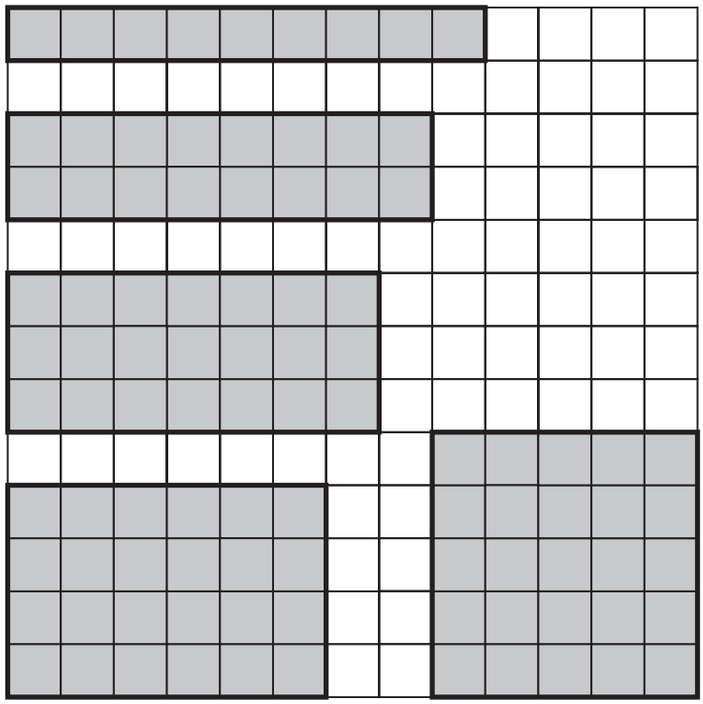
CHAPTER 8

3 Relating Perimeter and Area of Rectangles

Goal **Explore relationships among side lengths, perimeter, and area of rectangles.**

Camille has 20 cm of decorative tape to put around the perimeter of a bookmark.

1. Sketch all possible rectangles she can design with a perimeter of 20 cm.



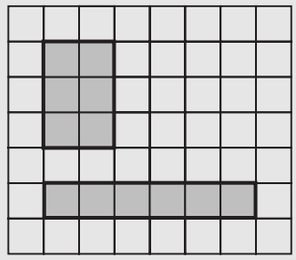
2. Calculate the area of each rectangle in Question 1. Record your answers in the table.

Length of side 1 (cm)	Length of side 2 (cm)	Area (cm^2)
1 cm	9 cm	9 cm^2
2 cm	8 cm	16 cm^2
3 cm	7 cm	21 cm^2
4 cm	6 cm	24 cm^2
5 cm	5 cm	25 cm^2

At-Home Help

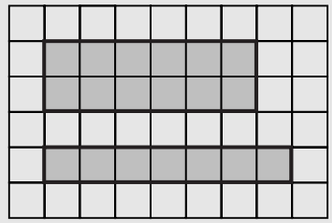
Perimeter is the distance around a shape. Rectangles with the same area may have different perimeters.

For example:



Both rectangles have an area of 6 cm^2, but the perimeter of both rectangles is not the same. The top rectangle has a perimeter of 10 cm while the bottom rectangle has a perimeter of 14 cm.

Rectangles with the same perimeter may have different areas.



Both rectangles have a perimeter of 16 cm, but the area of both rectangles is not the same. The top rectangle has an area of 12 cm^2 while the bottom rectangle has an area of 7 cm^2.

Perimeter is an outside measurement while area is an inside measurement.

3. How are the areas and the shapes of the rectangles related?

The areas of the rectangles increase as side length 1 gets close to side length 2. This means that the areas increase as the rectangles get close to becoming a square.

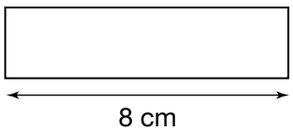
CHAPTER 8

4 Area Rule for Rectangles

Goal **Develop and explain a rule for calculating the area of a rectangle.**

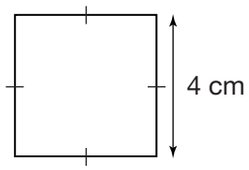
1. Jasmine is choosing address labels. Calculate each area. Use the rule for area of a rectangle. Show your work.

a)



8 cm x 2 cm = 16 cm^2

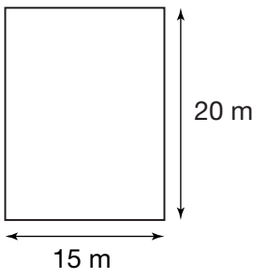
b)



4 cm x 4 cm = 16 cm^2

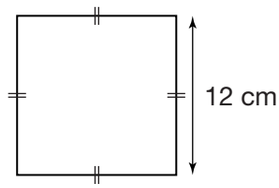
2. Calculate the area of each rectangle. Use the rule for area of a rectangle. Show your work.

a)



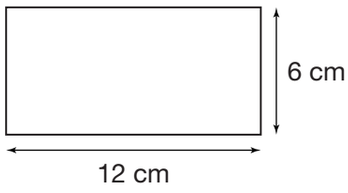
20 m x 15 m = 300 m^2

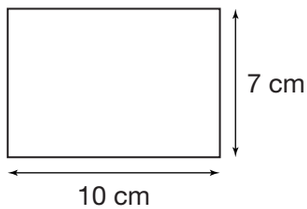
b)

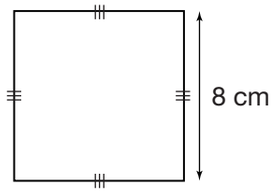


12 cm x 12 cm = 144 cm^2

3. Nancy is using 1 cm^2 tiles to make rectangular coasters. Each tile costs $0.15. Which coaster will cost the most? Explain.



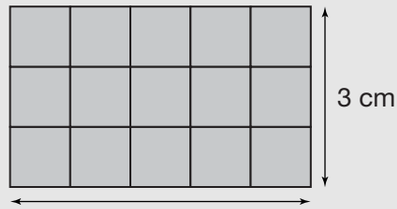




6 cm by 12 cm rectangle. This shape has the greatest area (72 cm^2).

At-Home Help

The area of a rectangle, when viewed on a grid, is like a multiplication array.



For example, this rectangle has a width of 3 cm and a length of 5 cm. The area of the rectangle can be found by multiplying the length by the width.

5 cm $\times$ 3 cm $=$ 15 cm^2

The general rule for the area of a rectangle is

area $=$ length $\times$ width

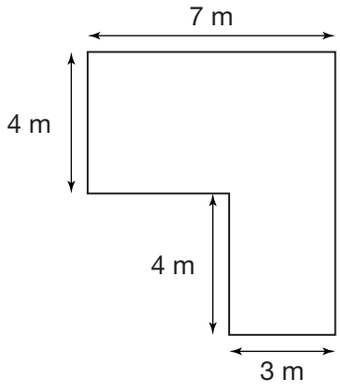
CHAPTER 8

5 Solve Problems by Solving Simpler Problems

Goal **Solve problems by breaking them into smaller parts.**

1. Alain's parents are purchasing new flooring for their living room. The flooring costs \$20/m^2.

How much will the flooring cost before taxes?



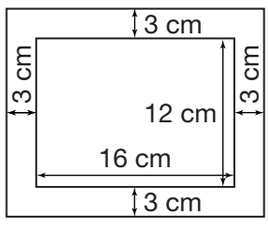
Scale 1 cm = 4 m

a) Calculate the area by dividing the shape into two parts. Use 2 different sets of rectangles. Did you get the same answer? Explain why or why not.

40 m^2. The area was the same for both sets of rectangles because the overall shape of the room did not change, only the way it was divided.

b) Calculate the cost of the flooring. \$800

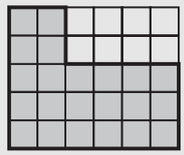
2. A photograph is 12 cm by 16 cm. It has a mount that is 3 cm wide all around it. What is the area of the mount? Show your work.



(area of photo and mount) 22 cm x 18 cm = 396 cm^2
(area of photo) 16 cm x 12 cm = 192 cm^2
(area of mount) 396 cm^2 - 192 cm^2 = 204 cm^2

At-Home Help

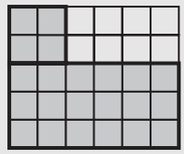
The area of a complex shape can sometimes be found by dividing it into several smaller parts. The total area is then equal to the sum of the areas of the smaller parts.



For example, the area of this shape can be calculated two ways.

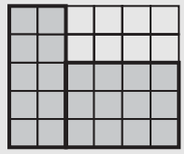
area = area of 2 cm by 2 cm square + area of 6 cm by 3 cm rectangle

$= 2 \times 2 + 6 \times 3$
$= 4 + 18$
$= 22$ cm^2



or area = area of 5 cm by 2 cm rectangle + area of 4 cm by 3 cm rectangle

$= 5 \times 2 + 4 \times 3$
$= 10 + 12$
$= 22$ cm^2



CHAPTER 8

6 Modelling Area

Goal **Model area using an appropriate scale.**

1. Jasleen's parents are planning a community garden. The dimensions are 20 m by 16 m. They want to make a scale model of the garden on centimetre grid paper.

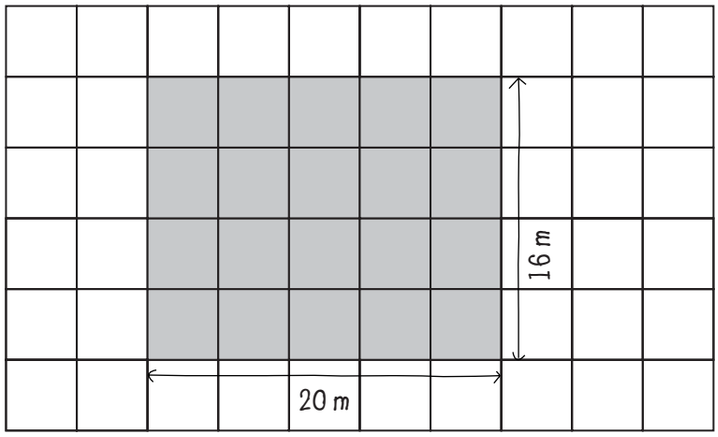
a) Choose an appropriate scale. Explain your choice.

Suggested scale: 1 cm = 4 m

Using this scale, the garden can easily fit on the grid. The model of the garden will be 5 cm by 4 cm.

b) Model the garden. Include the scale.

Suggested model:



Scale 1 cm = 4 m

c) What is the area of the garden? Include the units.

320 m^2

d) What is the area of the model? Include the units.

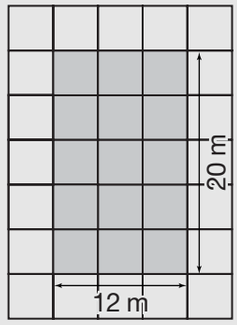
(using suggested model) 20 cm^2

At-Home Help

Large objects, such as floor plans, towns, and buildings, can be modelled using a scale. A **scale model** may be larger or smaller than the real object but must be the same shape. A scale model is similar to the real object.

When choosing a scale, consider the size of the object and the space you have available for the model.

For example, to draw a model of a 20 m by 12 m patio on the grid below, an appropriate scale would be 1 cm = 4 m. The model will then be 5 cm (20 ÷ 4) by 3 cm (12 ÷ 4).



Scale 1 cm = 4 m

Remember to always include the scale on your model.

2. Would you measure each area in square kilometres, square metres, square centimetres, or square millimetres?

a) a restaurant — square metres

b) a function key on a calculator — square millimetres or square centimetres

c) a country — square kilometres

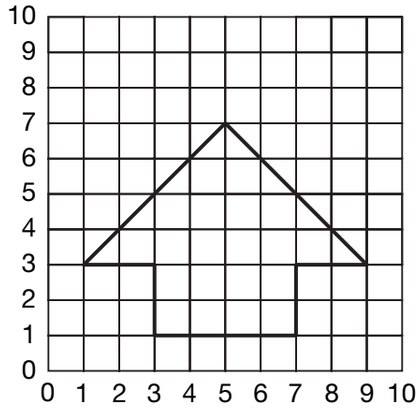
d) a postcard — square centimetres

CHAPTER 8

7 Coordinate Grids

Goal **Use coordinate pairs to identify and describe locations on a grid.**

1. Ari drew this logo on a coordinate grid.



a) What points on the grid could you use to describe the logo? Write the coordinates for each point.

(1, 3), (3, 1), (3, 3), (7, 1), (7, 3), (5, 7), and (9, 3)

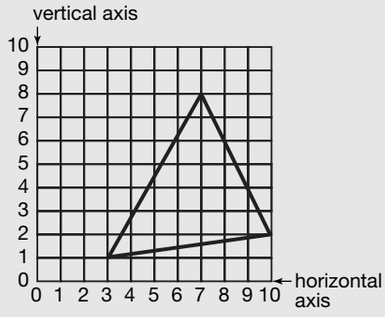
b) Write instructions for drawing the logo from these points.

Plot the points in Part a), then join the points with straight lines to form a closed polygon.

At-Home Help

A **coordinate grid** is a grid with each horizontal and vertical line numbered in order. **Coordinates** identify locations on a coordinate grid, and are sets of numbers that describe where a vertical and a horizontal line meet. The coordinate from the horizontal axis is always written first.

For example, the vertices of the triangle below have coordinates (3, 1), (7, 8), and (10, 2).



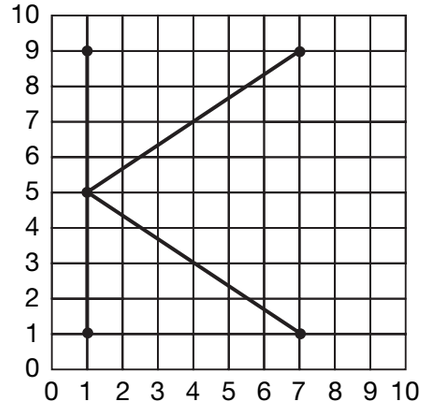
2. Ken started drawing the initial of his first name on a coordinate grid.

a) Name the coordinates he has used so far.

(1, 1), (1, 9), and (7, 9)

b) Write the coordinates he would need to finish the letter K. Mark these points on the grid and finish the initial.

Suggested answer: (1, 5) and (7, 1)

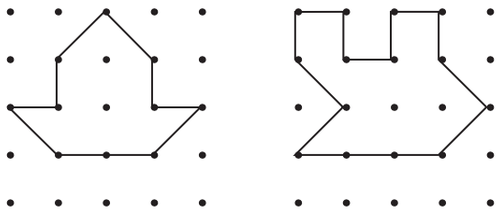


CHAPTER 8

Test Yourself

Circle the correct answer.

1. What is the area of each shape in square units?



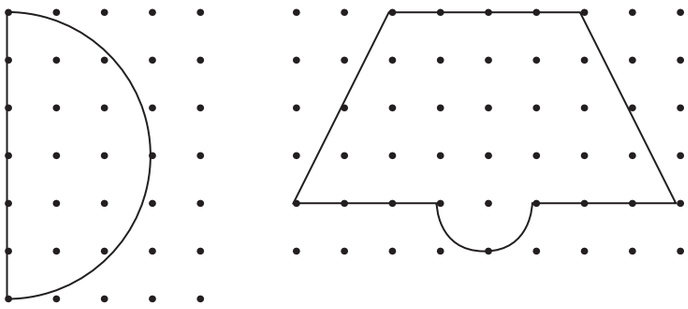
A. 6 square units, 8 square units

B. 7 square units, 7 square units

C. 8 square units, 6 square units

D. 9 square units, 8.5 square units

2. What is the area of each shape to the nearest square centimetre?



A. 11 cm^2, 24 cm^2

B. 14 cm^2, 26 cm^2

C. 17 cm^2, 24 cm^2

D. 18 cm^2, 28 cm^2

3. Pat made a rectangle using square stickers. The stickers are 1 cm^2. The perimeter of the rectangle is 22 cm. Of all the rectangles Pat could have made, what are the dimensions of the rectangle with the smallest area and the rectangle with the largest area?

A. 2 cm by 9 cm, 4 cm by 7 cm

B. 3 cm by 8 cm, 4 cm by 7 cm

C. 4 cm by 7 cm, 5 cm by 6 cm

D. 1 cm by 10 cm, 5 cm by 6 cm

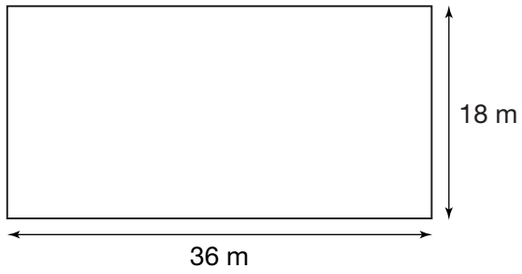
4. A rectangle has an area of 48 cm^2. What dimensions would give the shortest perimeter?

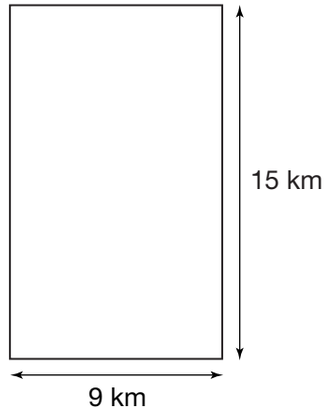
A. 6 cm by 6 cm **B.** 6 cm by 8 cm **C.** 4 cm by 12 cm **D.** 2 cm by 24 cm

CHAPTER 8

Test Yourself Page 2

5. What is the area of each rectangle?





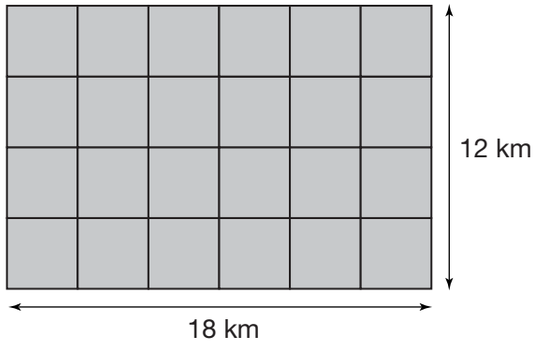
A. 648 cm^2, 24 cm^2

B. 648 m^2, 135 km^2

C. 108 cm^2, 135 cm^2

D. 108 m^2, 24 km^2

6. A zoo has the shape of an 18 km by 12 km rectangle. A scale model of the zoo is shown below. What are the areas of the zoo and the model?



Scale 1 cm = 3 km

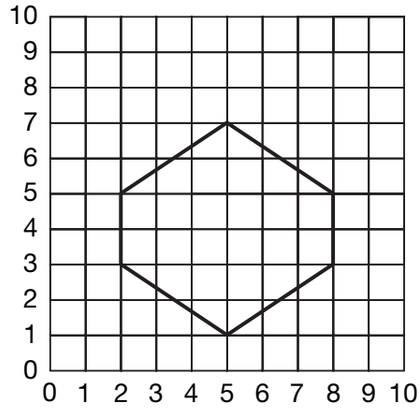
A. 60 km^2, 24 cm^2

B. 60 km^2, 20 cm^2

C. 216 km^2, 20 cm^2

D. 216 km^2, 24 cm^2

7. What coordinates would describe this shape?



A. (7, 5), (5, 8), (3, 8), (1, 5), (3, 2), and (5, 2)

B. (5, 7), (8, 5), (8, 3), (1, 5), (3, 2), and (5, 2)

C. (5, 7), (8, 5), (8, 3), (5, 1), (2, 3), and (2, 5)

D. (5, 7), (5, 8), (3, 8), (1, 5), (3, 2) and (5, 2)