

What is area? 2

The area of a shape is the amount of surface that is enclosed by the shape. We can measure and compare the areas of different shapes.

Example 1

Four shapes, A, B, C and D are shown.

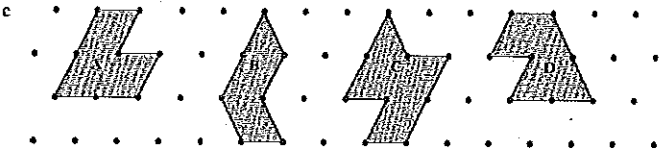
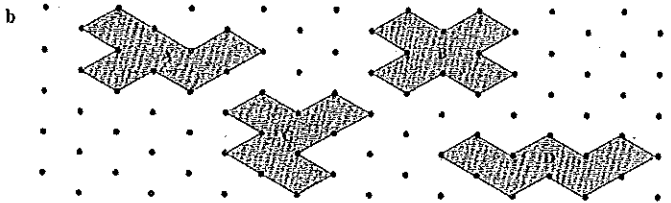
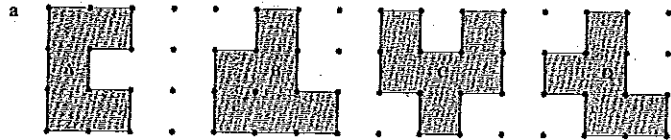


Shape A is four tiles, B is three tiles, C is four tiles and D is five tiles.

- Shape A encloses more surface than B, so the area of A is more than the area of B.
- Shape A encloses the same amount of surface as C, so A is equal to C in area.
- Shape A encloses less surface than D, so the area of A is less than the area of D.

Exercise

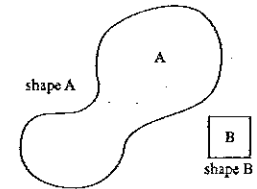
1 For each of the following, state whether the area of A is greater than, equal to, or less than, the area of each of the other shapes.



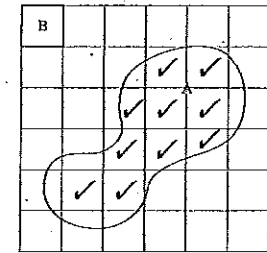
Skillsheet 11-01 What is area? 2 continued

Using a grid to find area

The area of some shapes cannot be found as easily as those in the previous exercise. For example, suppose we wish to find the area of shape A as a number of units of B, where B is a square.

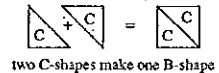


- A grid made of repetitions of shape B is placed over curved shape A.
- Count the number of B-shapes enclosed by A. Only count the B-shapes which have half or more of their area inside A. (These are ticked off in the diagram as shown.)
- Since there are 10 ticks, the area of the shape is approximately 10 units. We can write: area of curved shape A \approx 10 B-shapes.



Changing the grid to find a better approximation

Each square B-shape used in the previous section is made up of two identical triangles. We can call these triangles C-shapes.

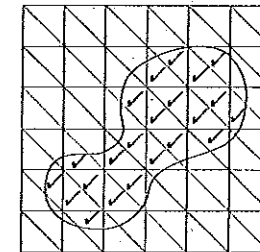


Drawing diagonal lines on the original grid of B-shapes gives a grid of C-shapes like the one shown.

Counting the C-shapes that have half or more of their area inside shape A gives the area of the shape as approximately 22 units. As we need two C-shapes to make one B-shape we can write:

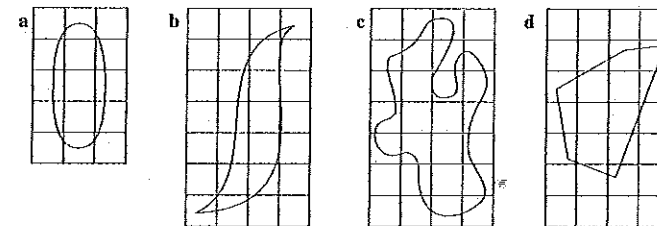
$$\text{Area of curved shape A} \approx (22 \div 2) \text{ B-shapes} \\ \approx 11 \text{ B-shapes}$$

This answer, in B units, is a better approximation than the one found at the top of this page.



Exercises

2 Using one *tile* as the area unit, find the approximate area of each of the following shapes.



3 Use a piece of graph paper and trace around your hand. Use 1 centimetre squares as the area unit. What is the area of your hand in square centimetre units?

Skillsheet 11-01 What is area? 2 continued

Standard units of area

Obviously it would be more convenient if everyone used the same standard units to measure area. Two commonly used standard units are the square millimetre (mm^2) and the square centimetre (cm^2).

A square millimetre is a square with each side 1 mm.

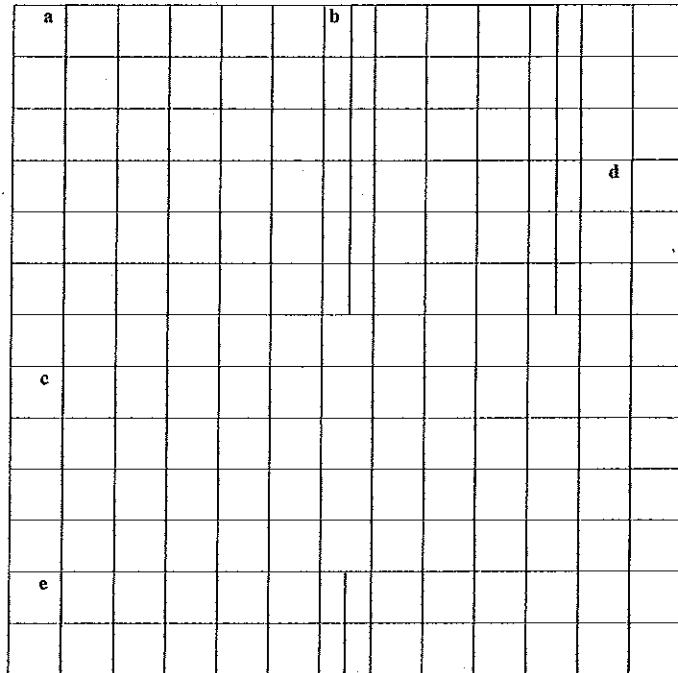


A square centimetre is a square with each side 1 cm.

A larger standard unit of area is the square metre (m^2). It is the area of a square with each side 1 metre.

Exercise

- 4 These rectangles are drawn on a grid of 1 cm squares. Find the area of each rectangle in square centimetres by counting the squares enclosed by the rectangle. Then copy and complete the table below.



Rectangle	a	b	c	d	e
Length (cm)	4				
Breadth (cm)	5	6			
Area (cm^2)					

Look at your results in the table. Write a rule for finding the area of a rectangle when you know its width and length.

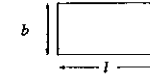
Skillsheet 11-01 What is area? 2 continued

Area of rectangles

In the previous exercise, you found that:

Area of rectangle = length multiplied by breadth

$$A = l \times b$$



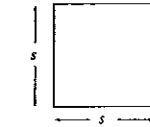
This is the rule for finding the area of a rectangle or square.

Since a square is a rectangle with length equal to width:

Area of square = side multiplied by side

$$A = s \times s$$

$$A = s^2$$

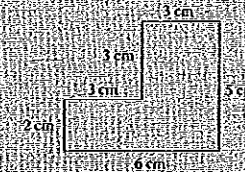


This is the rule for finding the area of a square.

You can use these rules to find the area of rectangles and squares, or of shapes which are made up of rectangles and squares.

Example 2

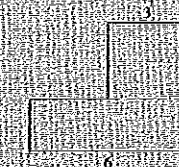
Find the area of this shape.



Solution

Find a way of dividing the shape into squares and rectangles.

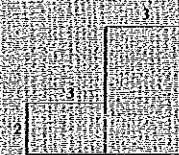
This is one way to do it.



$$\begin{aligned} \text{Area of shape} &= \text{area of rectangle} + \text{area of square} \\ &= 6 \times 2 + 3 \times 3 \\ &= 12 + 9 \\ &= 21 \end{aligned}$$

The area of the shape is 21 cm^2 .

You could also divide the shape into two rectangles like this.

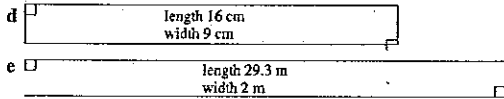
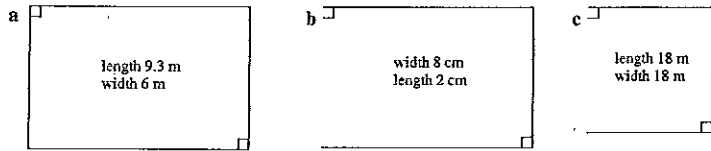


Check that the area also works out to be 21 cm^2 this way.

Skillsheet 11-01 What is area? 2 continued

Exercises

5 Find the areas of these rectangles and squares.



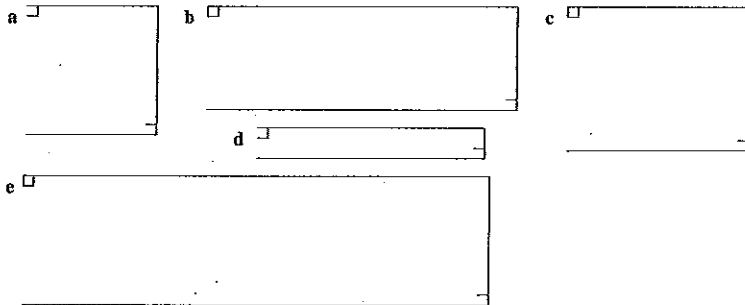
- 6 a Use the facts in the box below to help find:
- i the area in mm^2 of a square measuring 1 cm on each side
 - ii the area in cm^2 of a square measuring 1 m on each side
 - iii the area in mm^2 of a square measuring 1 m on each side.

1 cm = 10 mm 1 m = 100 cm 1 m = 1000 mm

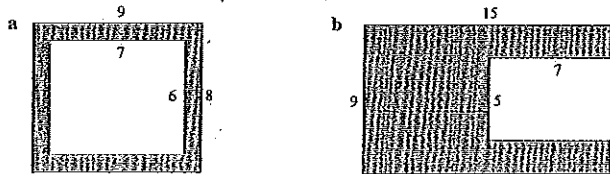
b Compare your answers to part a with the box below. Copy this into your book.

1 cm^2 = 100 mm^2 1 m^2 = 10 000 cm^2 1 m^2 = 1 000 000 mm^2

- 7 Find the area of a square bowling green of side length 5 m. Write your answer first in square metres, then in square centimetres, and finally in square millimetres.
- 8 Find the area of a desk top measuring 180 mm by 60 mm. Give your answer first in square millimetres, then in square centimetres, and finally in square metres.
- 9 Use a ruler to measure the lengths and widths of these rectangles in millimetres. Use the measurements to find the area of each rectangle. Give your answer first in square millimetres (mm^2), then in square centimetres (cm^2).



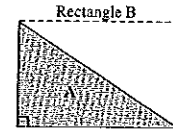
10 Find the area of each of these shaded shapes. All measurements are in centimetres.



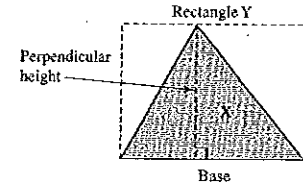
Skillsheet 11-01 What is area? 2 continued

Areas of triangles

The area of a triangle can be shown to be equal to the area of the rectangle that encloses it.



Area of triangle A is half of the area of rectangle B



Area of triangle X is half of the area of rectangle Y

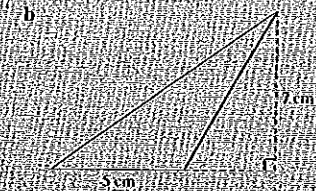
Area of triangle = $\frac{1}{2}$ times base multiplied by perpendicular height

$A = \frac{1}{2} \times b \times h$

This is the rule for finding the area of a triangle.

Example 3

Find the area of each of these triangles



Solution

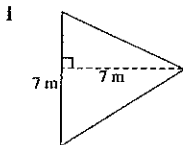
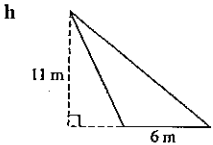
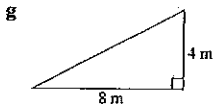
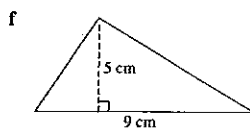
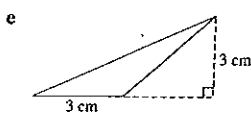
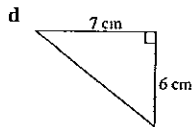
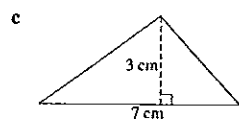
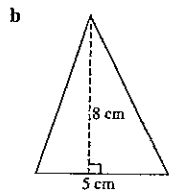
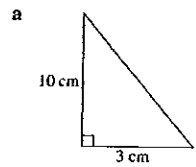
a $A = \frac{1}{2} \times 6 \times 4$
 $= 12 \text{ cm}^2$
 The area of the triangle is 12 cm^2

b $A = \frac{1}{2} \times 5 \times 7$
 $= 17.5 \text{ cm}^2$
 The area of the triangle is 17.5 cm^2

Skillsheet 11-01 What is area? 2 continued

Exercises

11 Find the area of each triangle.



Skillsheet 11-01 What is area? 2 continued

Answers

- 1 a $A < B, A < C, A = D$ b $A = B, A = C, A = D$ c $A > B, A < C, A = D$
 2 a 5 b 7 c 12 d 8

3 Various answers.

4 Rectangle	a	b	c	d	e
Length (cm)	4	4	8	1	$5\frac{1}{2}$
Breadth (cm)	5	6	3	10	2
Area (cm ²)	20	24	24	10	11

Area = length \times breadth

- 5 a 55.8 m^2 b 16 cm^2 c 324 m^2 d 144 cm^2 e 58.6 m^2
 6 a i 100 mm^2 ii $10\,000 \text{ cm}^2$ iii $1\,000\,000 \text{ mm}^2$
 7 $25 \text{ m}^2 = 250\,000 \text{ cm}^2 = 25\,000\,000 \text{ mm}^2$
 8 $10\,800 \text{ mm}^2 = 108 \text{ cm}^2 = 0.0108 \text{ m}^2$
 9 a $625 \text{ mm}^2 = 6.25 \text{ cm}^2$ b $1200 \text{ mm}^2 = 12 \text{ cm}^2$ c $980 \text{ mm}^2 = 9.8 \text{ cm}^2$
 d $264 \text{ mm}^2 = 2.64 \text{ cm}^2$ e $2250 \text{ mm}^2 = 22.5 \text{ cm}^2$
 10 a 30 cm^2 b 100 cm^2
 11 a 15 cm^2 b 20 cm^2 c 10.5 cm^2 d 21 cm^2 e 4.5 cm^2
 f 22.5 cm^2 g 16 m^2 h 33 m^2 i 24.5 m^2