**Area:** The amount of space inside the boundary of a 2-dimensional shape.

1 **Shapes made out of rectangles.**

1. Find the area for the following shapes.
2. The width of the rectangle below is 5cm, the length of the rectangle is 9cm, and the gaps are 3cm by 2cm. Calculate the area of the shaded region.

\[
\text{Area} = 45 - 2(6) = 33
\]

3. Three squares of side length 4cm are cut out from a rectangle of size 6cm by 9cm. What is the area of the shaded region? Start by labeling the lengths of all the sides to show your work.

\[
\text{Area} = 6(9) - (4)(4)(3) = 6
\]
4. The figure below shows a large rectangle that has a length of 20m and a width of 16m. Six identical shaded rectangles are placed into the large rectangle.

(a) What is the width and length of each shaded rectangle?
Length = 8
Width = 4

(b) What is the perimeter of each shaded rectangle?
Perimeter = 8(2) + 4(2) = 24

(c) What is the area of each shaded rectangle?
Area = 8(4) = 32

(d) What is the area of the big rectangle?
Area = 20(16) = 320
(e) If you laid the shaded rectangles next to each other with no spaces, what is the maximum number of shaded rectangles you could fit in the big white rectangle? Draw a picture:

10 rectangles can fit into the big rectangle (each will be 8x4)

f) What is the maximum number of squares with sides of 4cm that could fit into the large rectangle?

20

g) What is the maximum number of squares with sides of 2cm that could fit into the large rectangle?

80

h) What is the maximum number of squares with sides of 8cm that could fit into the large rectangle?

4
2 Finding the area of parallelograms

A parallelogram is a shape with two pairs of parallel sides. A rectangle is a special case of a parallelogram.

You can find the area of a rectangle by the following familiar formula: $A = width \times length$. However, you can also consider the vertical side the height of the rectangle. Thus, modifying the formula to $A = width \times height$.

The following shape is an example of a parallelogram that is not a rectangle. How can we find the area of this parallelogram? Write down some ideas you have.

$A = width \times height$
Finding the area of a parallelogram is very similar to finding the area of a rectangle as long as you are given the **height** of the parallelogram. This height is NOT represented by the length of parallel sides at an angle. The height is the distance between the two parallel horizontal sides, as seen below:

Why do we need the height? If you cut off the triangle shaded and move it to the other side of the parallelogram, you now have made a rectangle:

1. Look at the parallelogram on the grid below:

   ![Parallelogram](image)

   (a) What is the height of the parallelogram?

   **5 units**
(b) What is the length of the base?

**11 units**

(c) What is the area?

**55 units**

2. On the grid below, draw several possible rectangles with an area of 12 square units. How many different rectangles with an area of 12 can you draw? (Assume that the sides of the rectangles are parallel to the grid lines and that the side lengths are whole numbers.) **3 different (4x3, 6x2, 12x1)**
3. On the grid below, draw several possible parallelograms with an area of 12 square units. How many different parallelograms with an area of 12 can you possibly draw?

Many more are possible since there are many different ways to slant the lines. Above is an example that shows possible ways of drawing a 3x4 parallelogram.

Possible schemes are 3x4, 4x3, 2x6, 6x2, 1x12, 12x1.

Total parallelograms = 

$$3(2) + 4(2) + 2(2) + 6(2) + 1(2) + 12(2) = 56.$$
The following information is given:
1. The height of one parallelogram is 3 inches.
2. The width of one parallelogram is 4 inches.

(a) What is the area of the one parallelogram?

\[ 4(3) = 12 \]
(b) How many small parallelograms make up the flower?

\[32\]

(c) What is the area of the entire flower?

\[32(12) = 384\]

d) What is the perimeter of the flower?

\[32(4) = 128\]

e) What is the area of the box the flower is in?

\[8 + 12 + 8 = 28\]