

Area of a parallelogram

WALT Investigate and learn about the formula of a parallelogram

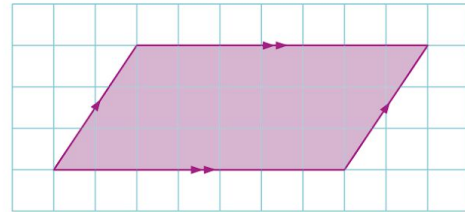
Success Criteria I know from the investigation parallelogram is a stretched rectangle. I use height instead of a width of this shape.

You have tried two investigations in triangle area now its time for the third one

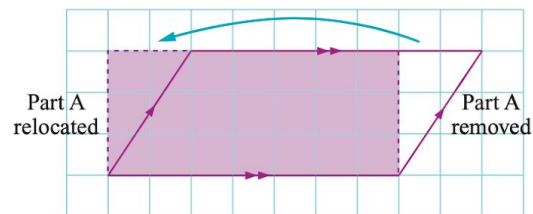
Investigation 3 Area of a parallelogram

One way to find the area of a shape is to divide the shape into a number of unit squares and count the squares.

- 1 Consider the parallelogram shown. By counting the squares determine the area of the parallelogram.



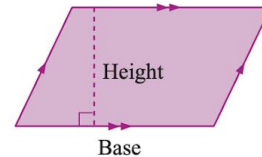
- 2 Now consider this diagram.
 - a What shape is formed when part A is removed and relocated?
 - b What do you now notice about the area of the new shape and the original shape?
- 3 Using the terms 'base' and 'height', develop a formula to determine the area of a parallelogram.



In Investigation 3 you developed a rule to find the area of a parallelogram. The area of a parallelogram is:

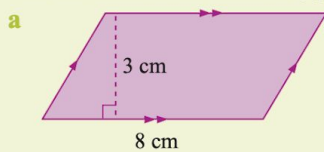
$$\text{Area} = \text{base} \times \text{height}$$

$$A = bh$$

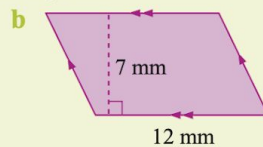


EXAMPLE 1

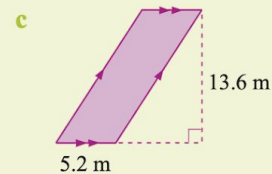
Find the areas of the following parallelograms.



a $A = bh$
 $= 8 \times 3 = 24 \text{ cm}^2$



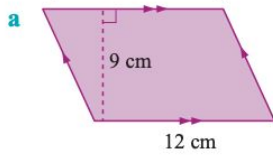
b $A = bh$
 $= 12 \times 7 = 84 \text{ mm}^2$



c $A = bh$
 $= 5.2 \times 13.6 = 70.72 \text{ m}^2$

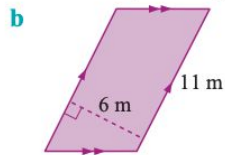
Time to work on the area of a parallelogram

1 Complete the following to find the areas of these parallelograms.



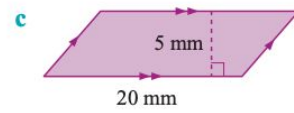
$$A = bh$$

$$= 12 \times \underline{\quad} = \underline{\quad} \text{ cm}^2$$



$$A = bh$$

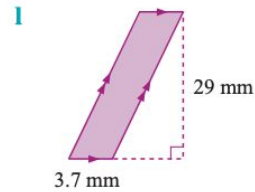
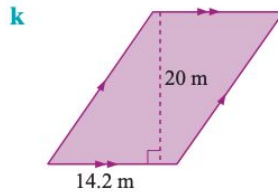
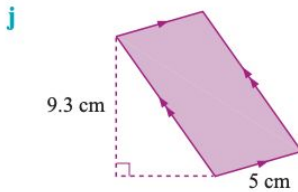
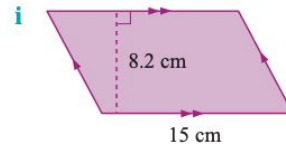
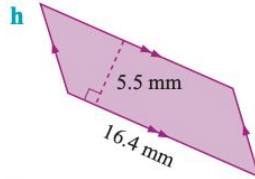
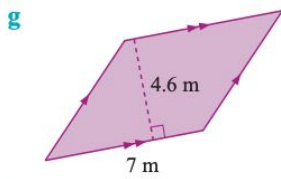
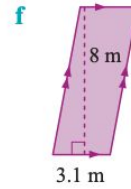
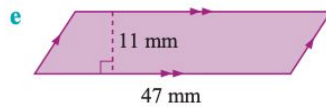
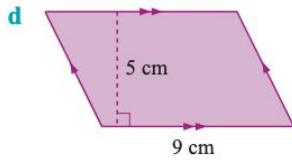
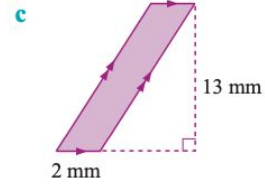
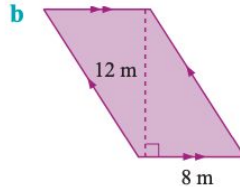
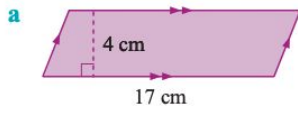
$$= \underline{\quad} \times 6 = \underline{\quad} \text{ m}^2$$



$$A = bh$$

$$= \underline{\quad} \times \underline{\quad} = 100 \text{ mm}^2$$

2 Find the areas of the following parallelograms.



Challenge

3 Find the area of each parallelogram with the dimensions given.

a $b = 14 \text{ cm}, h = 10 \text{ cm}$

c $b = 7 \text{ cm}, h = 13 \text{ cm}$

e $b = 9 \text{ m}, h = 30 \text{ m}$

g $b = 9 \text{ cm}, h = 2.1 \text{ cm}$

i $b = 2.7 \text{ m}, h = 9.3 \text{ m}$

b $b = 15 \text{ m}, h = 8 \text{ m}$

d $b = 21 \text{ mm}, h = 12 \text{ mm}$

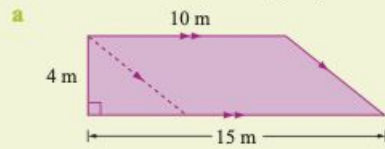
f $b = 4.1 \text{ cm}, h = 5 \text{ cm}$

h $b = 8.5 \text{ m}, h = 7.2 \text{ m}$

j $b = 12.4 \text{ m}, h = 8.6 \text{ m}$

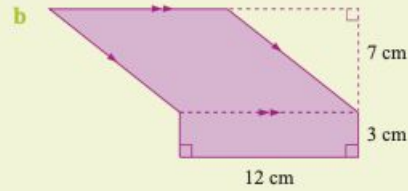
EXAMPLE 2

Find the areas of the following shapes.



a This shape is made up of a triangle and a parallelogram.

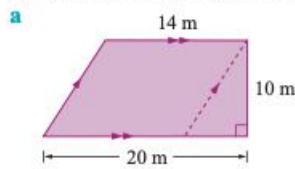
$$\begin{aligned} A &= A_1 + A_2 \\ &= \frac{1}{2}bh + bh \\ &= \frac{1}{2}(5 \times 4) + (10 \times 4) \\ &= 10 + 40 \\ &= 50 \text{ m}^2 \end{aligned}$$



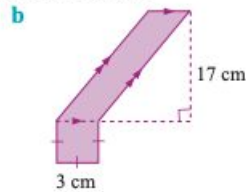
b The shape is made up of a rectangle and a parallelogram.

$$\begin{aligned} A &= A_1 + A_2 \\ &= lb + bh \\ &= (12 \times 3) + (12 \times 7) \\ &= 36 + 84 \\ &= 120 \text{ cm}^2 \end{aligned}$$

4 Complete the following to find the area of these composite shapes.

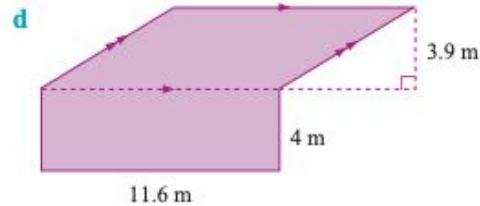
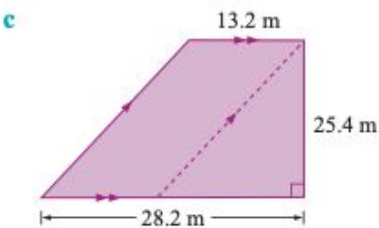
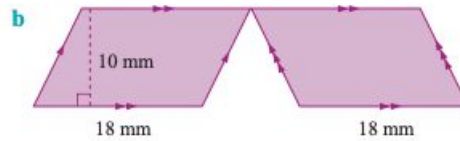
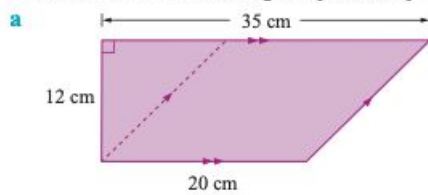


$$\begin{aligned} A &= A_1 + A_2 \\ &= \text{parallelogram} + \underline{\hspace{2cm}} \\ &= bh + \underline{\hspace{2cm}} \\ &= (14 \times \underline{\hspace{1cm}}) + \frac{1}{2}(\underline{\hspace{1cm}} \times 10) \\ &= \underline{\hspace{1cm}} + \underline{\hspace{1cm}} \\ &= \underline{\hspace{1cm}} \text{ m}^2 \end{aligned}$$



$$\begin{aligned} A &= A_1 + A_2 \\ &= \text{square} + \underline{\hspace{2cm}} \\ &= s^2 + \underline{\hspace{2cm}} \\ &= \underline{\hspace{1cm}}^2 + (\underline{\hspace{1cm}} \times \underline{\hspace{1cm}}) \\ &= \underline{\hspace{1cm}} + \underline{\hspace{1cm}} \\ &= \underline{\hspace{1cm}} \text{ cm}^2 \end{aligned}$$

5 Find the area of the following composite shapes.



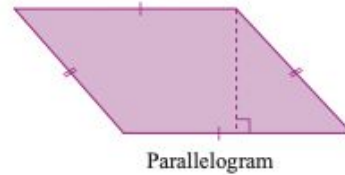
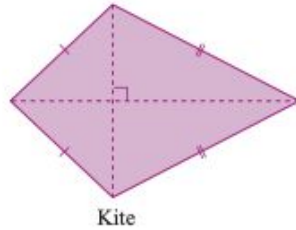
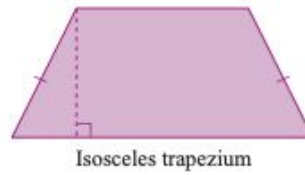
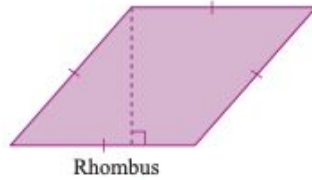
Extension

Investigation 4 Making rectangles

Many plane shapes can be made into rectangles. This gives a method of finding their areas.

An isosceles trapezium has both non-parallel sides equal in length. !.....

1 Step 1: Copy and cut out each of the following shapes.



Step 2: Cut along the dotted line(s) and arrange the pieces to make each shape into a rectangle.

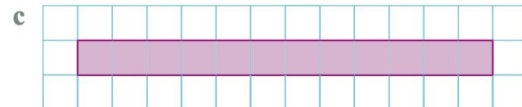
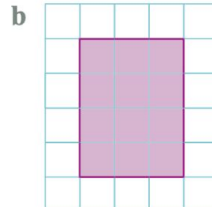
Step 3: Find the area of each rectangle and hence the area of each original shape.

2 Draw your own rhombus, isosceles trapezium, kite and parallelogram and find their areas.

Investigation 5 How many possibilities are there?

Consider the examples shown below.

1 Determine the area of each shape. What do you notice?



2 On grid paper, show the number of ways you could make shapes of the following area.

a 18 units²

b 20 units²

c 36 units²

Check your answers

- 1** **a** $12 \times 9 = 108 \text{ cm}^2$ **b** $6 \times 11 = 66 \text{ m}^2$
c $20 \times 5 = 100 \text{ mm}^2$
- 2** **a** 68 cm^2 **b** 96 m^2 **c** 26 mm^2
d 45 cm^2 **e** 517 mm^2 **f** 24.8 m^2
g 32.2 m^2 **h** 90.2 mm^2 **i** 123 cm^2
j 46.5 cm^2 **k** 284 m^2 **l** 107.3 mm^2
- 3** **a** 140 cm^2 **b** 120 m^2 **c** 91 cm^2
d 252 mm^2 **e** 270 m^2 **f** 20.5 cm^2
g 18.9 cm^2 **h** 61.2 m^2 **i** 25.11 m^2
j 106.64 m^2
- 4** **a** triangle, $bh + \frac{1}{2}bh$
 $= 14 \times 10 + \frac{1}{2} \times 6 \times 10$
 $= 140 + 30 = 170 \text{ m}^2$
b parallelogram, $s^2 + bh$
 $= 3^2 + 3 \times 17$
 $= 9 + 51 = 60 \text{ cm}^2$
- 5** **a** 330 cm^2 **b** 360 mm^2
c 525.78 m^2 **d** 91.64 m^2