Area of a parallelogram

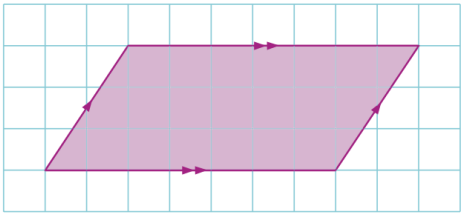
WALT Investigate and learn about the formula of a parallelogram
Success Criteria I know from the investigation parallelogram is a stretched rectangle. I use height instead of the width of this shape.

You have tried two investigations in the 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.

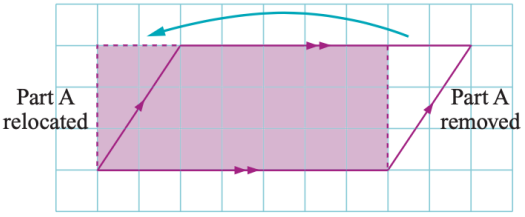
1 Consider the parallelogram shown. By counting the squares determine the area of the parallelogram.



2 Now consider this diagram.

a What shape is formed when part A is removed and relocated?

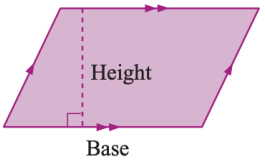
b What do you now notice about the area of the new shape and the original shape?



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:

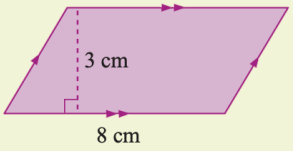
$$\text{Area} = \text{base} \times \text{height}$$
$$A = bh$$



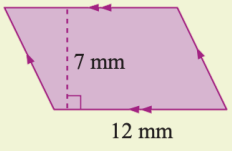
EXAMPLE 1

Find the areas of the following parallelograms.

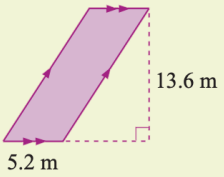
a



b



c



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

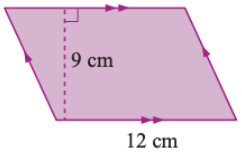
b $A = bh$
$= 12 \times 7 = 84 \text{ mm}^2$

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.

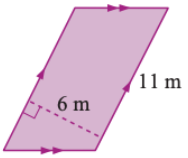
a



$A = bh$

$= 12 \times \_\_\_ = \_\_\_ \text{ cm}^2$

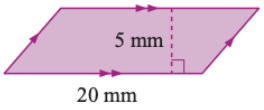
b



$A = bh$

$= \_\_\_ \times 6 = \_\_\_ \text{ m}^2$

c

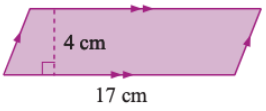


$A = bh$

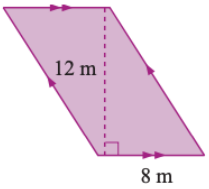
$= \_\_\_ \times \_\_\_ = 100 \text{ mm}^2$

2 Find the areas of the following parallelograms.

a



b



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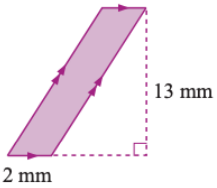

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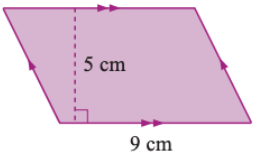
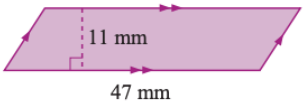
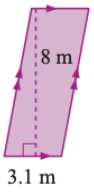


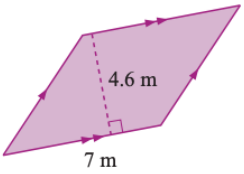
e



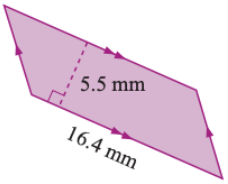
f



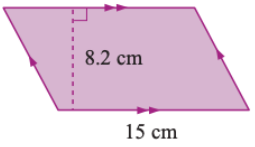
g



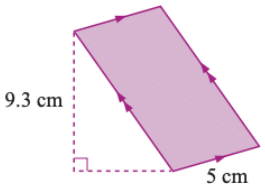
h



i



j



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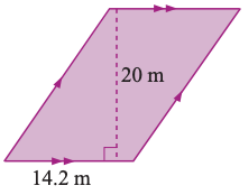

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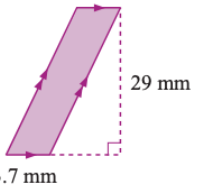


Challenge

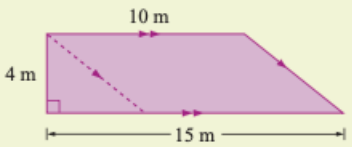
3 Find the area of each parallelogram with the dimensions given.

a $b = 14$ cm, $h = 10$ cm
b $b = 15$ m, $h = 8$ m
c $b = 7$ cm, $h = 13$ cm
d $b = 21$ mm, $h = 12$ mm
e $b = 9$ m, $h = 30$ m
f $b = 4.1$ cm, $h = 5$ cm
g $b = 9$ cm, $h = 2.1$ cm
h $b = 8.5$ m, $h = 7.2$ m
i $b = 2.7$ m, $h = 9.3$ m
j $b = 12.4$ m, $h = 8.6$ m

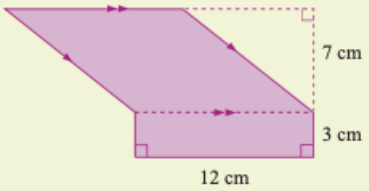
EXAMPLE 2

Find the areas of the following shapes.

a



b



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

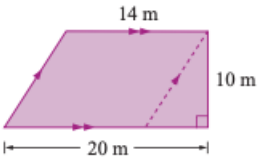
$A = A_1 + A_2$
$= \frac{1}{2}bh + bh$
$= \frac{1}{2}(5 \times 4) + (10 \times 4)$
$= 10 + 40$
$= 50 \text{ m}^2$

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

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

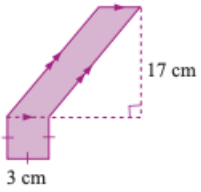
4 Complete the following to find the area of these composite shapes.

a



$A = A_1 + A_2$
$=$ parallelogram $+$ _____
$= bh +$ ____
$= (14 \times$ ___$) + \frac{1}{2}($___ $\times 10)$
$=$ ___ $+$ ___
$=$ ___ m^2

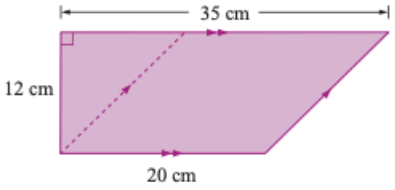
b



$A = A_1 + A_2$
$=$ square $+$ _____
$= s^2 +$ _____
$=$ ___$^2 + ($___ $\times$ ___$)$
$=$ ___ $+$ ___
$=$ ___ cm^2

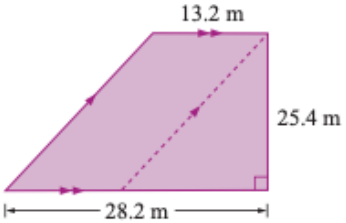
5 Find the area of the following composite shapes.

a

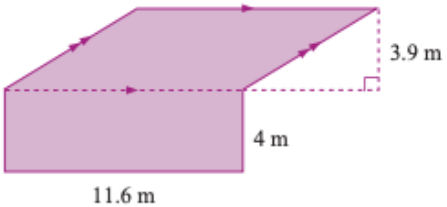


b

c



d



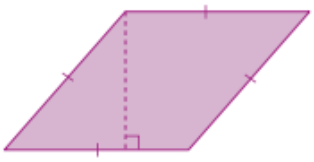
Extension

Investigation 4 Making rectangles

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

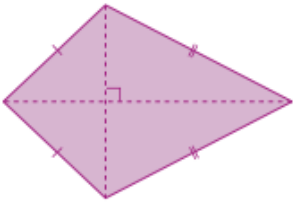
An isosceles trapezium has both non-parallel sides equal in length.

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

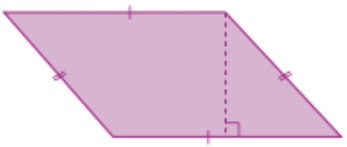


Rhombus

Isosceles trapezium



Kite



Parallelogram

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.

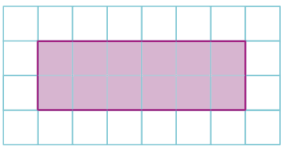
2 Draw your own rhombus, isosceles trapezium, kite and parallelogram and find their areas.

Investigation 5 How many possibilities are there?

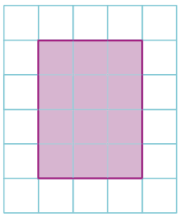
Consider the examples shown below.

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

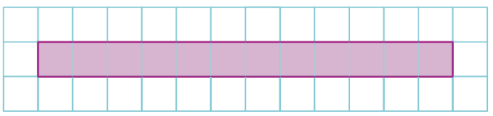
a



b



c



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

a 18 units^2 **b** 20 units^2 **c** 36 units^2

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** $68\ \text{cm}^2$ **b** $96\ \text{m}^2$ **c** $26\ \text{mm}^2$
d $45\ \text{cm}^2$ **e** $517\ \text{mm}^2$ **f** $24.8\ \text{m}^2$
g $32.2\ \text{m}^2$ **h** $90.2\ \text{mm}^2$ **i** $123\ \text{cm}^2$
j $46.5\ \text{cm}^2$ **k** $284\ \text{m}^2$ **l** $107.3\ \text{mm}^2$

3 **a** $140\ \text{cm}^2$ **b** $120\ \text{m}^2$ **c** $91\ \text{cm}^2$
d $252\ \text{mm}^2$ **e** $270\ \text{m}^2$ **f** $20.5\ \text{cm}^2$
g $18.9\ \text{cm}^2$ **h** $61.2\ \text{m}^2$ **i** $25.11\ \text{m}^2$
j $106.64\ \text{m}^2$

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** $330\ \text{cm}^2$ **b** $360\ \text{mm}^2$
c $525.78\ \text{m}^2$ **d** $91.64\ \text{m}^2$