

Student Name

## Mathematics Stage 4

# AREA

**Book 3**      Develop and use the formula to find the area of trapeziums, rhombuses, and kites to solve problems

Version: 260207

Report mistakes & suggest improvements:  
<https://MrDingMaths.com>

## CONTENTS

|                                                         |    |
|---------------------------------------------------------|----|
| Overview .....                                          | 2  |
| Area of Kites and Rhombuses.....                        | 4  |
| Area of a Trapezium.....                                | 9  |
| Area of Composite Figures Involving Special Quads ..... | 15 |
| Check Your Understanding .....                          | 23 |

# OVERVIEW

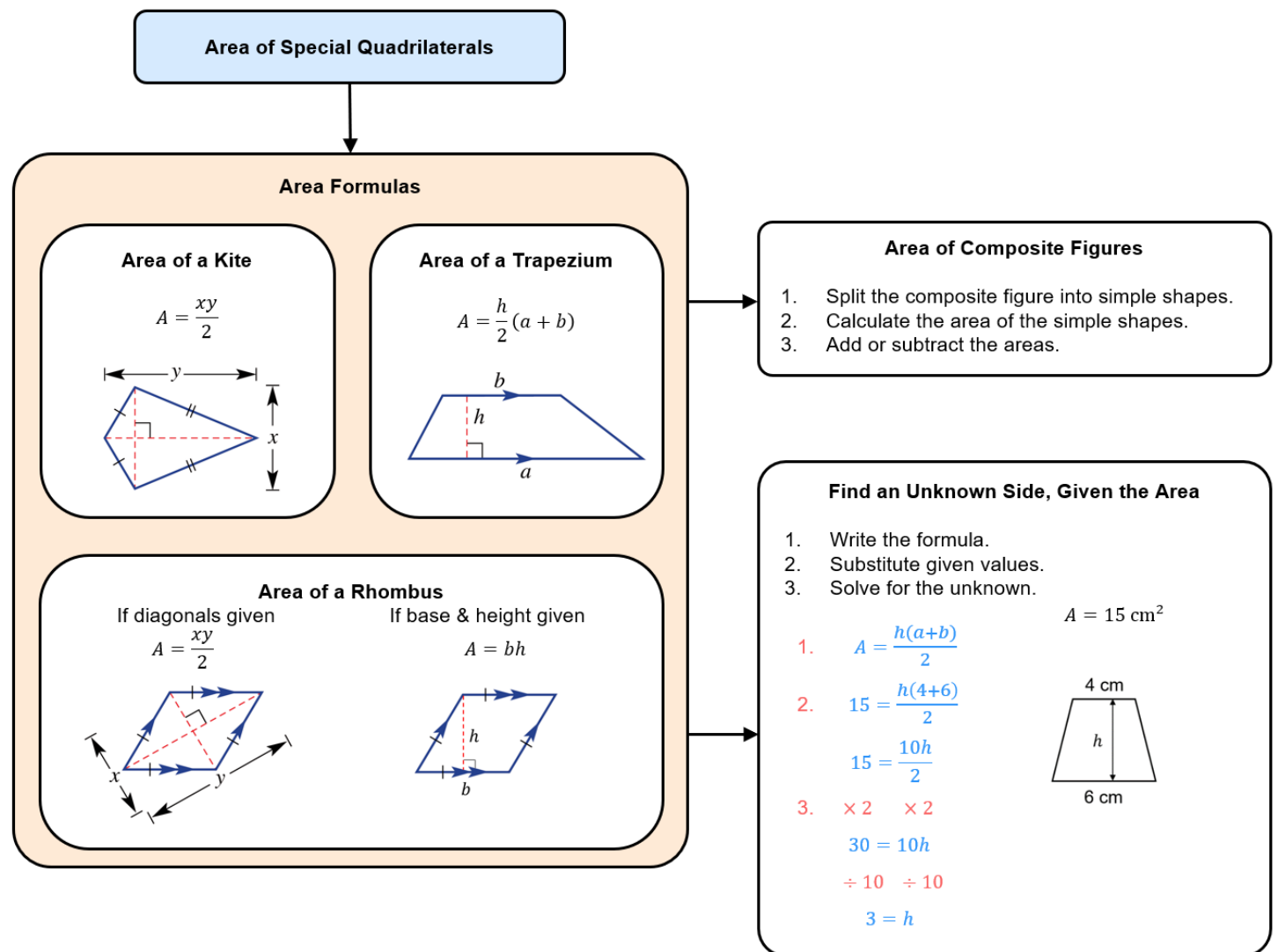
## SYLLABUS CONTENT

**MA4-ARE-C-01** applies knowledge of area and composite area involving triangles, quadrilaterals and circles to solve problems

**Develop and use the formulas to find the area of trapeziums, rhombuses and kites to solve problems**

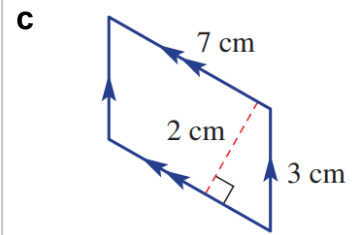
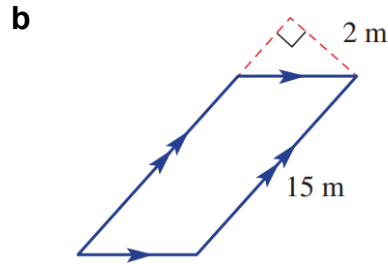
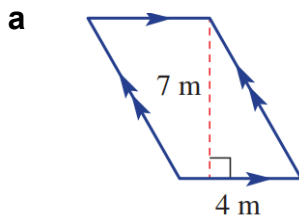
- Develop and apply the formula to find the area of a kite or rhombus:  $A = \frac{1}{2}xy$ , where  $x$  and  $y$  are the lengths of the diagonals
- Develop and apply the formula to find the area of a trapezium:  $A = \frac{h}{2}(a + b)$ , where  $h$  is the perpendicular height and  $a$  and  $b$  are the lengths of parallel sides
- Calculate the area of composite shapes involving trapeziums, kites and rhombuses to solve problems

## SUMMARY



## REVIEW OF PRIOR KNOWLEDGE

1 Calculate the area of these parallelograms.



2 A square is also a rectangle. Explain why this is true.

.....

.....

3 Work out the answer to the following:

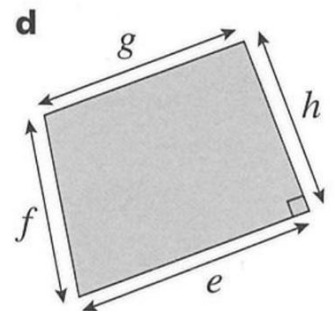
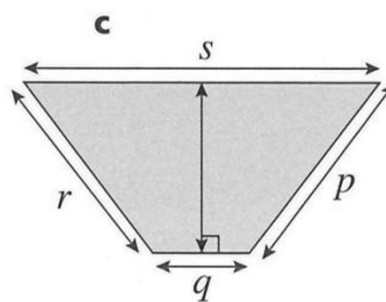
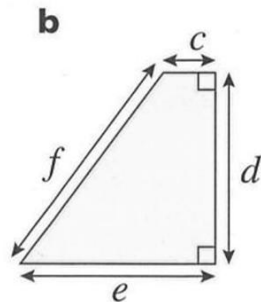
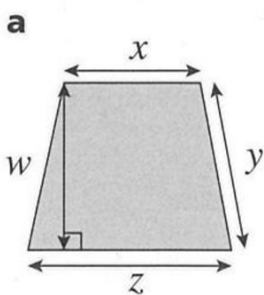
**a**  $\frac{3 \times 6}{2}$

**b**  $\frac{1}{2} \times 3 \times 6$

**c**  $\frac{6+14}{5}$

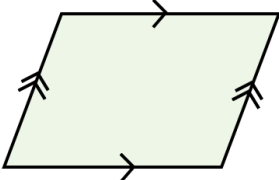
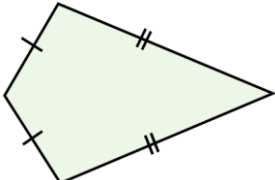
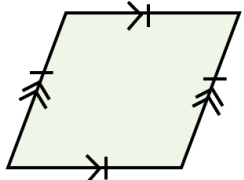
**d**  $\frac{5(2+6)}{2}$

4 Circle the two sides that are parallel in these shapes.



# AREA OF KITES AND RHOMBUSES

- **Quadrilaterals** are four-sided shapes.

| Parallelogram                                                                     | Kite                                                                              | Rhombus                                                                             |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| A quadrilateral with two pairs of parallel sides                                  | A quadrilateral with two pairs of equal adjacent sides.                           | A quadrilateral with all sides equal. A rhombus is a parallelogram and a kite.      |
|  |  |  |

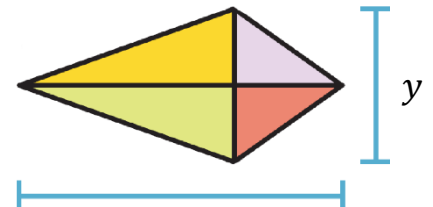
## Investigation Area of a kite and rhombus.

- Area of a Kite: <https://www.geogebra.org/m/dhdwbyzf>
- Area of a Rhombus: <https://www.geogebra.org/m/upgv3cut>

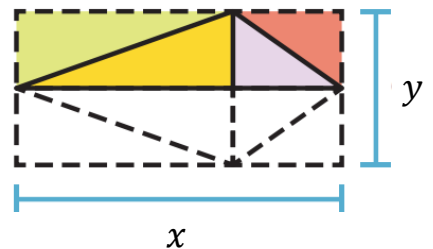
A kite is shown below. The length of the diagonals is given by  $x$  and  $y$ .

What is a diagonal?

*A diagonal is a line that connects two ..... of a shape that are not already joined by an edge.*



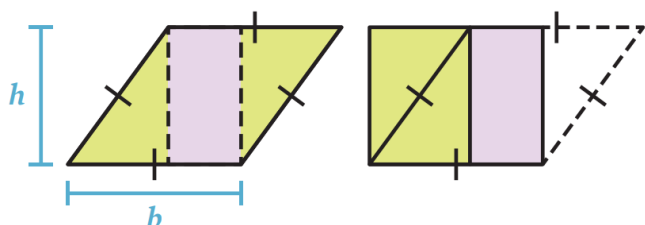
Consider the shape below. What has happened between the two shapes?  $x$



Using the area of a rectangle, calculate the area of a kite.

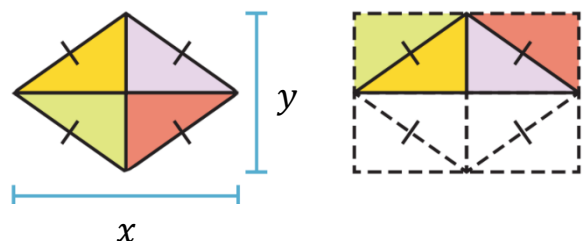
A rhombus is a kite and a parallelogram.

The area of a rhombus can be found using either formula, depending on what is given.



If base and height are given:

$$A = bh$$



If diagonals are given:

$$A = \frac{xy}{2}$$

Why is a rhombus also a kite?

*A rhombus has four equal sides, meaning its ..... sides are equal. So, it's a kite.*

Why is a rhombus also a parallelogram?

*A rhombus has two pairs of ..... sides, meaning it's a parallelogram.*

# AREA OF A KITE AND RHOMBUS

| Area of a Kite and Rhombus                     |  |
|------------------------------------------------|--|
| <p>Diagonals</p> <p>↓ ↓</p> $A = \frac{xy}{2}$ |  |

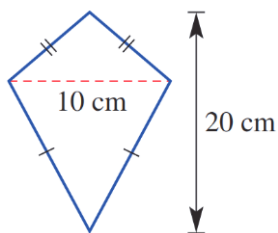
**Example** Distinguish between a parallelogram, rhombus, and kite

For each quadrilateral, decide which formula you would use to calculate the area.

|                                                                                                                                    |                                                                                                                                    |                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>a</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>b</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>c</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> |
| <p><b>d</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>e</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>f</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> |
| <p><b>g</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>h</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> | <p><b>i</b></p> <p><input type="checkbox"/> <math>A = bh</math></p> <p><input type="checkbox"/> <math>A = \frac{1}{2}xy</math></p> |

## Example Calculate the area of a kite or rhombus.

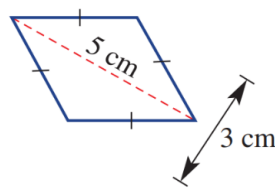
Find the area of these shapes.



$$A = \frac{xy}{2}$$

$$= \frac{10 \times 20}{2}$$

$$= 100 \text{ cm}^2$$



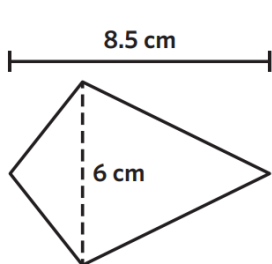
$$A = \frac{xy}{2}$$

$$= \frac{5 \times 3}{2}$$

$$= 7.5 \text{ cm}^2$$

Calculate the area of these shapes.

a



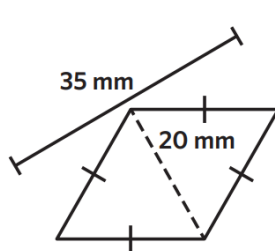
$$A = \frac{xy}{2}$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

25.5 cm<sup>2</sup>

b



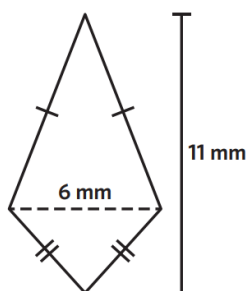
$$A = \frac{xy}{2}$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

350 mm<sup>2</sup>

c



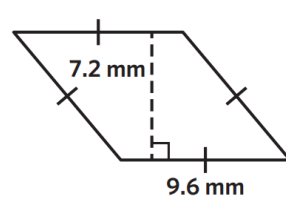
$$A = \dots\dots\dots$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

33 mm<sup>2</sup>

d



$$A = \dots\dots\dots$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

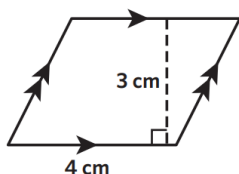
69.12 mm<sup>2</sup>

## Key ideas

1. Diagonals are lines that connect two ..... of a shape that are not already joined by an edge.
2. The area of a kite is half the product of the .....
3. A rhombus is also a ....., so we use the formula  $A = bh$  if the base and height are given, and the formula ..... if the diagonals are given.

1 Calculate the area of these parallelograms, kites, and rhombuses. Round to 2 d.p. if needed.

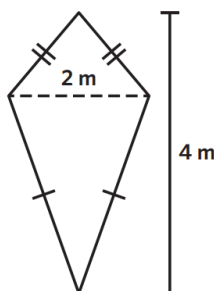
a Parallelogram



$$\begin{aligned} A &= bh \\ &= ( \quad )( \quad ) \\ &= \dots\dots\dots \end{aligned}$$

12 cm<sup>2</sup>

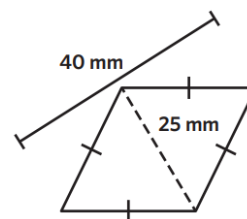
b Kite



$$\begin{aligned} A &= \frac{bh}{2} \\ &= \frac{( \quad )( \quad )}{2} \\ &= \dots\dots\dots \end{aligned}$$

4 m<sup>2</sup>

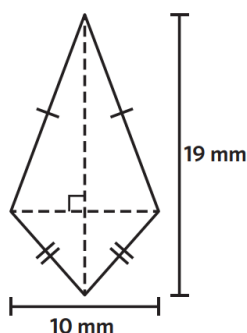
c Rhombus



$$\begin{aligned} A &= \frac{bh}{2} \\ &= \frac{( \quad )( \quad )}{2} \\ &= \dots\dots\dots \end{aligned}$$

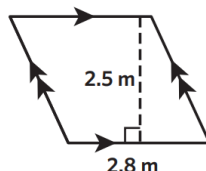
500 mm<sup>2</sup>

d



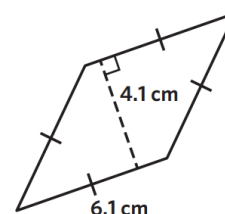
95 mm<sup>2</sup>

e



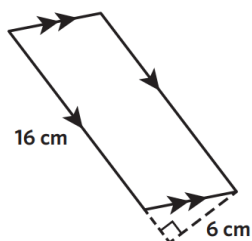
7 m<sup>2</sup>

f



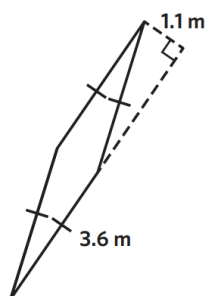
25.01 cm<sup>2</sup>

g



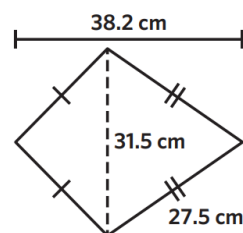
96 cm<sup>2</sup>

h



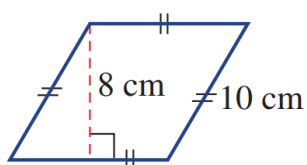
3.96 m<sup>2</sup>

i



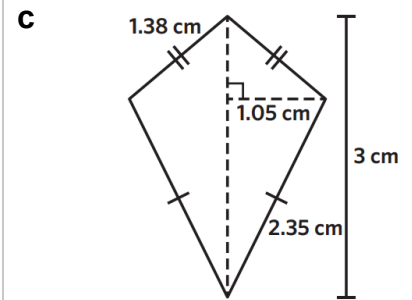
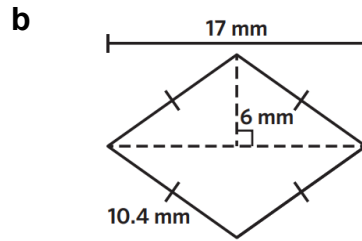
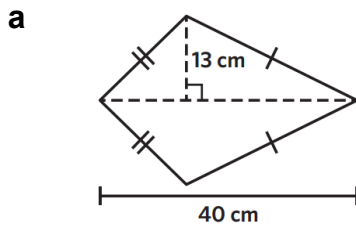
601.65 cm<sup>2</sup>

2 Explain why the area of this rhombus is NOT  $\frac{8 \times 10}{2}$



The diagonals are not 8 and 10. For this rhombus, we should consider it a parallelogram and use  $A = bh$

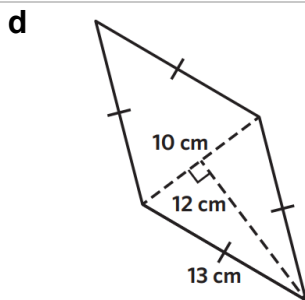
3 Calculate the area of these shapes.



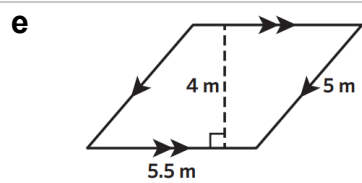
520 cm<sup>2</sup>

102 cm<sup>2</sup>

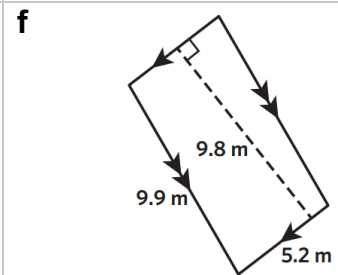
3.15 cm<sup>2</sup>



120 cm<sup>2</sup>

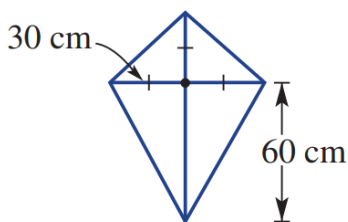


22 m<sup>2</sup>



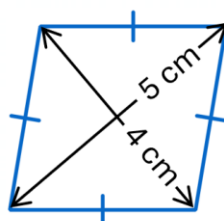
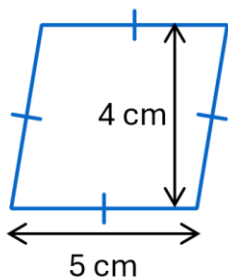
50.96 m<sup>2</sup>

4 A flying kite is made from four centre rods all connected near the middle of the kite, as shown. What area of plastic, in square centimetres, is needed to cover the kite?



2700 cm<sup>2</sup>

5 Explain why these two rhombuses have different areas.



The first shape gives you the base and height, the second gives you the diagonals.

AREA OF A TRAPEZIUM

Trapezium

A quadrilateral with one pair of parallel sides.

**Example** Identify parallel sides of a trapezium.

| Identify the sides of the trapezium |                |              |           |                |              |
|-------------------------------------|----------------|--------------|-----------|----------------|--------------|
| Trapezium                           | Parallel sides | Perp. height | Trapezium | Parallel sides | Perp. height |
|                                     |                |              |           |                |              |
|                                     |                |              |           |                |              |
|                                     |                |              |           |                |              |

**Investigation** Area of a trapezium.

A trapezium is shown below. We'll copy the trapezium and put two of them together.

What shape do two trapeziums make? .....

By labelling the base and height of parallelogram, calculate the area of two trapeziums.

.....

Therefore, what is the area of a trapezium?

.....

# AREA OF A TRAPEZIUM

🔗 Area of a Trapezium: <https://www.geogebra.org/m/bkhppeux>

| Area of a Trapezium                                                                             |  |
|-------------------------------------------------------------------------------------------------|--|
| <p>Perpendicular height    Parallel sides</p> <p>↓       ↓       ↓</p> $A = \frac{h(a + b)}{2}$ |  |

**Example** Calculate the area of a trapezium.

|                                                                                                                                              |                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Calculate the area of these trapeziums to two decimal places.</p> $A = \frac{h(a + b)}{2}$ $= \frac{5(4.5 + 9.5)}{2}$ $= 35 \text{ cm}^2$ | <p>What is <math>a</math> and <math>b</math> in the trapezium formula?<br/> <math>a</math> and <math>b</math> are the ..... sides of a trapezium.</p> <p>What is <math>h</math> in the trapezium formula?<br/> <math>h</math> is the ..... distance between the parallel sides.</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Calculate the area of these trapeziums to two decimal places.

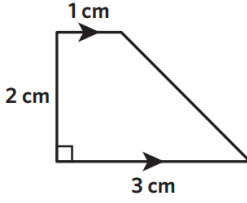
|                                                                                                                            |                                                                                                                            |                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <p><b>a</b></p> $A = \frac{h(a + b)}{2}$ <p>= .....</p> <p>= .....</p> <p style="text-align: right;">36 cm<sup>2</sup></p> | <p><b>b</b></p> $A = \frac{h(a + b)}{2}$ <p>= .....</p> <p>= .....</p> <p style="text-align: right;">25 cm<sup>2</sup></p> | <p><b>c</b></p> $A = \frac{h(a + b)}{2}$ <p>= .....</p> <p>= .....</p> <p style="text-align: right;">31.5 cm<sup>2</sup></p> |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|

## Key ideas

1. A trapezium is a q..... with one pair of ..... sides.
2. The area of a trapezium is calculated using  $A = \frac{h(a+b)}{2}$ , where  $a$  and  $b$  are the ..... sides, and  $h$  is the ..... distance between them.

1 Calculate the area of these trapeziums.

**a**



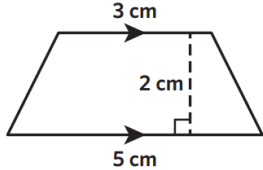
$A = \frac{h(a + b)}{2}$

= .....

= .....

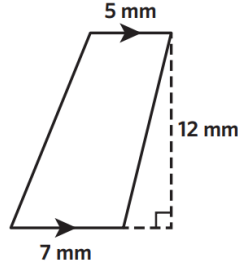
4 cm<sup>2</sup>

**b**



8 cm<sup>2</sup>

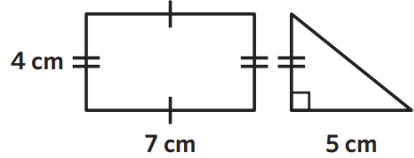
**c**



72 cm<sup>2</sup>

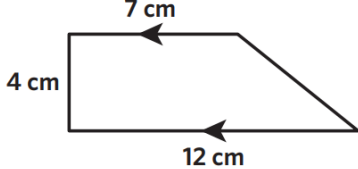
2

**a** Calculate the area of the rectangle and triangle.



$4 \times 7 + \frac{1}{2}(4)(5) = 38 \text{ cm}^2$

**b** Calculate the area of the trapezium using the formula.



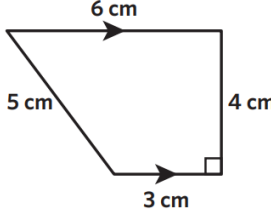
$\frac{4}{2}(7 + 12) = 38 \text{ cm}^2$

**c** What do you notice?

They are the same.

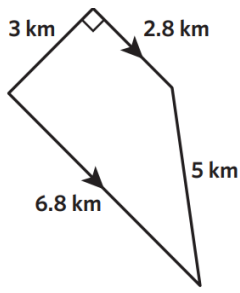
3 Calculate the area of these trapeziums.

**a**



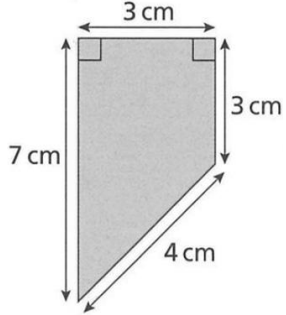
18 cm<sup>2</sup>

**b**



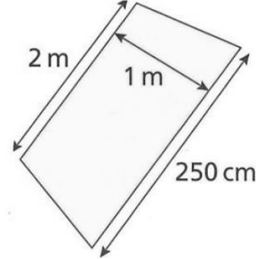
14.4 km<sup>2</sup>

**c**



15 cm<sup>2</sup>

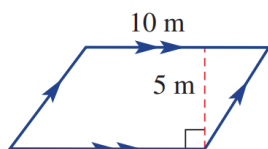
**d**



2.25 cm<sup>2</sup>

4 Identify the special quadrilateral then calculate the area of each special quadrilateral.

a



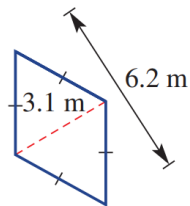
Parallelogram

$$A = bh$$

=

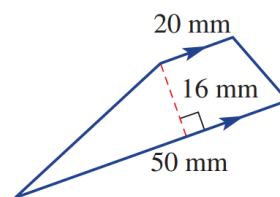
50 cm<sup>2</sup>

b



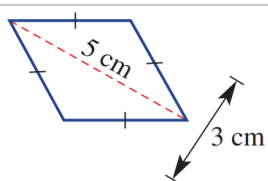
9.61 m<sup>2</sup>

c



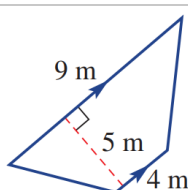
560 mm<sup>2</sup>

d



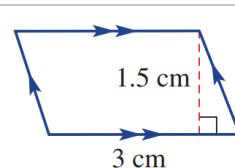
7.5 cm<sup>2</sup>

e



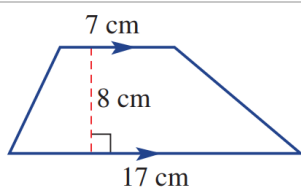
32.5 m<sup>2</sup>

f



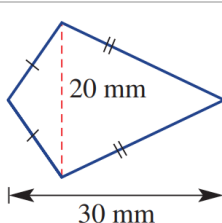
4.5 cm<sup>2</sup>

g



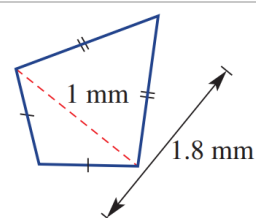
96 cm<sup>2</sup>

h



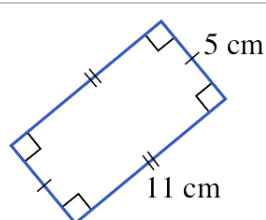
300 mm<sup>2</sup>

i



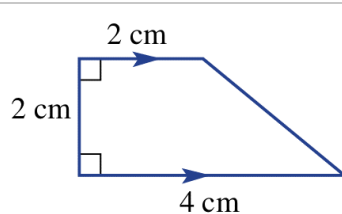
0.9 mm<sup>2</sup>

j



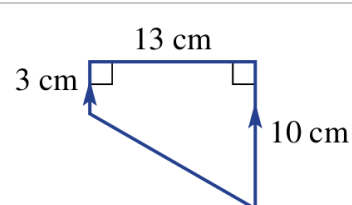
55 cm<sup>2</sup>

k



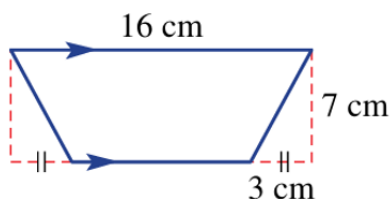
6 cm<sup>2</sup>

l



84.5 cm<sup>2</sup>

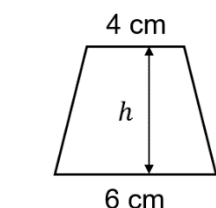
- 5 Find the area of this trapezium.



91 cm<sup>2</sup>

- 6 Read the worked example and answer the questions.

- a The area of the trapezium is 15 cm<sup>2</sup>. Find the height.



$$A = \frac{h(a + b)}{2}$$

$$15 = \frac{h(4 + 6)}{2}$$

$$15 = \frac{10h}{2}$$

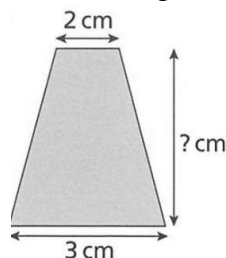
$$\times 2 \quad \times 2$$

$$30 = 10h$$

$$\div 10 \quad \div 10$$

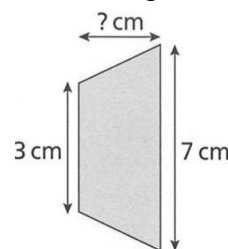
$$3 = h$$

- b The area of the trapezium is 30 cm<sup>2</sup>. Find the height.



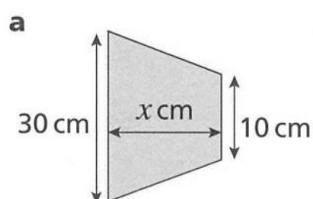
12 cm

- c The area of the trapezium is 45 cm<sup>2</sup>. Find the height.

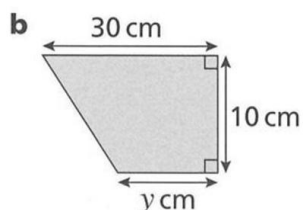


9 cm

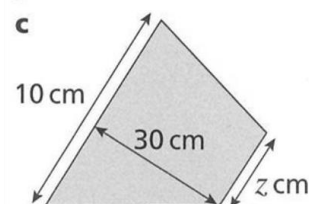
- 7 Work out the length of each unknown side, if the area is 210 cm<sup>2</sup>.



10.5 cm



11 cm



4 cm

8

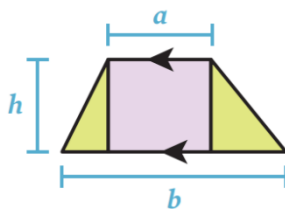
- a** A trapezium has area  $40 \text{ cm}^2$ .  
Its parallel sides are  $7 \text{ cm}$  and  $3 \text{ cm}$  long.  
Find the height of the trapezium.

- b** A trapezium with area  $40 \text{ cm}^2$  has one  
parallel side  $10 \text{ cm}$  long and height  $5 \text{ cm}$ .  
Find the length of the other parallel side.

8 cm

6 cm

- 9** Using the diagram and your knowledge of the area of composite figures,  
derive the area of a trapezium by splitting a trapezium up into a rectangle and triangles.



$$A_1 = \dots\dots\dots$$

$ah$

$$A_2 = \dots\dots\dots$$

$\frac{h}{2}(b-a)$

$$A = A_1 + A_2$$

$$=$$

$$= ah + \frac{h}{2}(b-a)$$

$$= ah + \frac{bh}{2} - \frac{ah}{2}$$

$$= \frac{ah}{2} + \frac{bh}{2}$$

$$= \frac{h}{2}(a+b)$$

- 10** Consider a 'trapezium' with  $a = 0$ ,  $b = 5$  and  $h = 3$ . With all measurements in centimetres.

- a** Calculate the area using the formula.

$$A = \frac{3(0+5)}{2} = 7.5 \text{ cm}^2$$

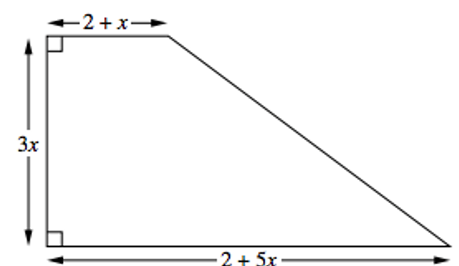
- b** Sketch a diagram of this 'trapezium', what shape is it?

A triangle

- c** Does this result match if you use the area formula for a triangle?

$$\text{Yes, } A = \frac{bh}{2} = \frac{3(5)}{2}$$

- 11** A lawn is to be made in the shape shown.  
Show that the area of the lawn is  $A = 9x^2 + 6x$



$$A = \frac{3x}{2}(2+x+2+5x)$$

$$= \frac{3x}{2}(4+6x)$$

$$= 6x + 9x^2$$

# AREA OF COMPOSITE FIGURES INVOLVING SPECIAL QUADS

**Example** Calculate the area of composite figures involving special quadrilaterals

$$A_1 = \frac{5(8 + 11)}{2}$$

$$= 47.5 \text{ m}^2$$

$$A_2 = 8 \times 11$$

$$= 88 \text{ m}^2$$

$$A_{\text{Total}} = 47.5 + 88$$

$$= 135.5 \text{ m}^2$$

What two shapes did we split the composite figure into?

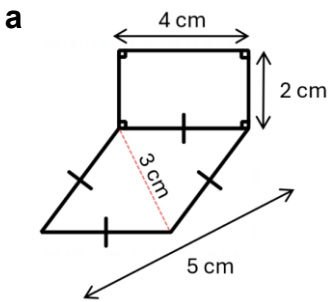
We split the composite figure into

a ..... and a .....

For the area of the rectangle, where did the 8 come from?

..... - ..... = 5

Calculate the area of these composite figures. Round your answer to 2 d.p.

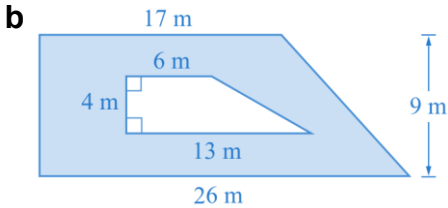


$A_1 =$

$A_2 =$

$A_{\text{Total}} =$

$15.5 \text{ cm}^2$

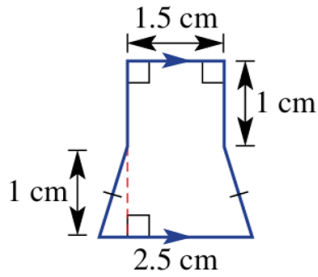


$155.5 \text{ m}^2$

# FOUNDATION

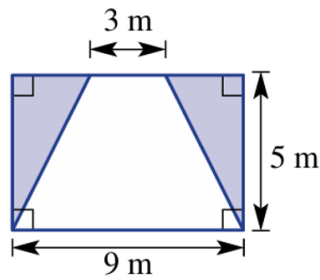
1 Calculate the area of these composite figures. Round your answer to 2 d.p. where appropriate.

a

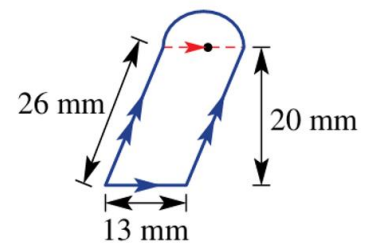


b

Find the shaded area

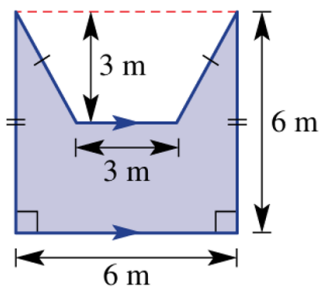


c

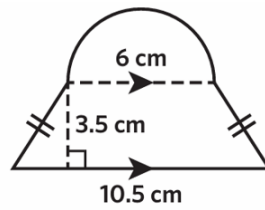


d

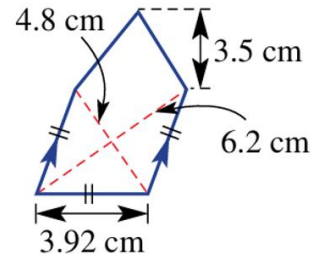
Find the shaded area



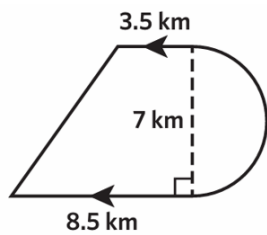
e



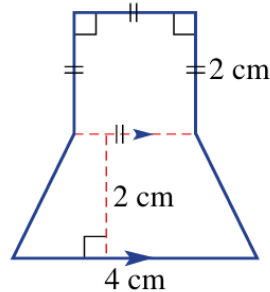
f



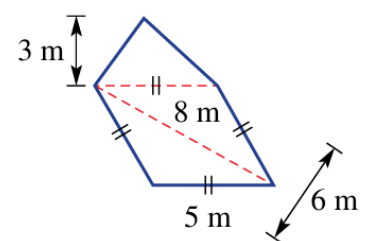
g



h

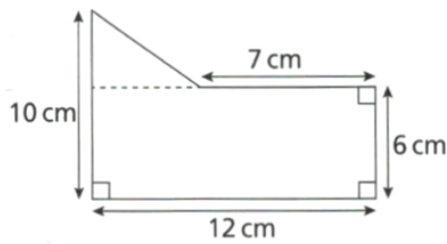


i

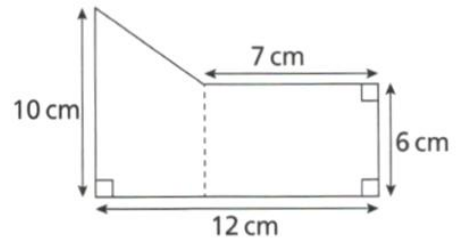


2 Jakub and Marta are discussing how they found the area of the shape.

a They have drawn how they plan to split up the shape. Use their methods to find the area.



$$6 \times 12 + \frac{4 \times 5}{2} = 82 \text{ cm}^2$$



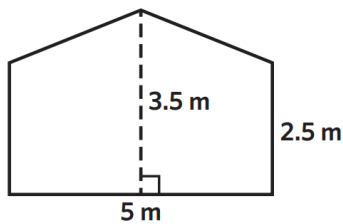
$$7 \times 6 + \frac{5}{2}(10 + 6) = 82 \text{ cm}^2$$

b Which method do you prefer?

3 Mark is planning to paint the side of his barn. He has measured it to be 5 m wide, while the right and left sides are both 2.5 m high.

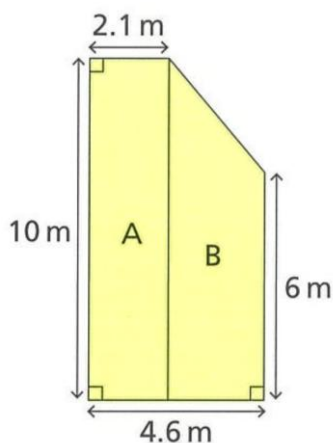
The barn reaches 3.5 m at its highest point perpendicular to the ground.

How many square metres does he need to paint?



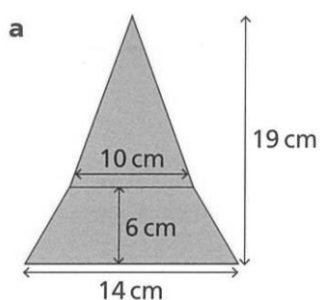
$$15 \text{ m}^2$$

4 The diagram shows the cross-section of a squash court. Find the area of the cross-section.

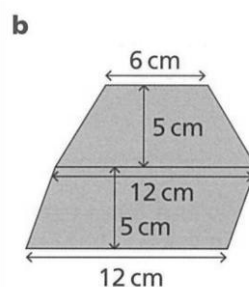


$$10 \times 2.1 + \frac{2.5}{2}(10 + 6) = 41 \text{ m}^2$$

- 5 Find the area of the composite shapes.

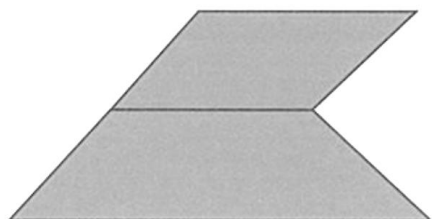


137 cm<sup>2</sup>



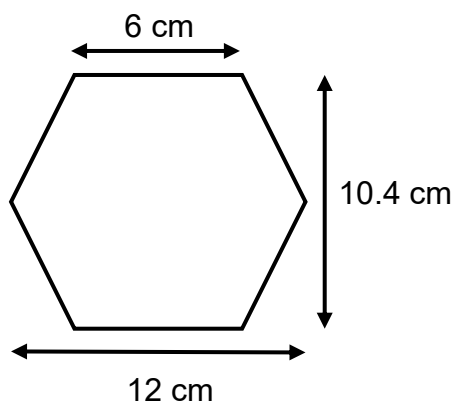
105 cm<sup>2</sup>

- 6 A logo consists of a parallelogram on top of a trapezium, as shown. The parallelogram has height 16 mm and base 32 mm. The trapezium is the same height as the parallelogram and its base is twice the length of its top. Find the area of the logo, in square millimetres.



1280 mm<sup>2</sup>

- 7 Calculate the area of this hexagon.



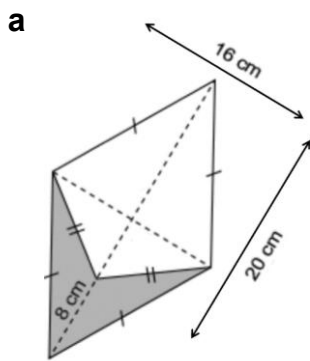
Consider as two trapeziums

$$\frac{5.2}{2}(6 + 12) \times 2 = 93.6 \text{ cm}^2$$

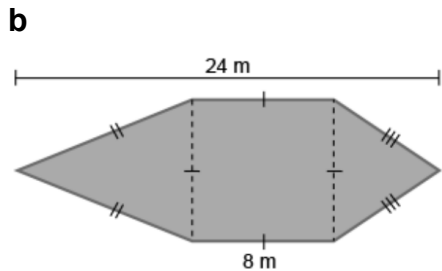
Check your answer by calculating the area in a different way.

Another possibility is rectangle + 2 triangles

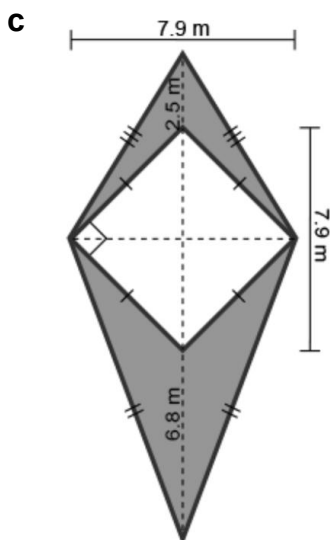
8 Calculate the shaded area of these shapes.



64 cm<sup>2</sup>

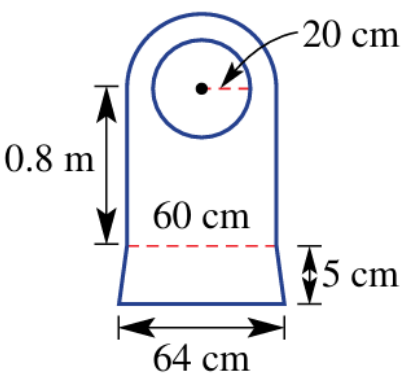


128 m<sup>2</sup>



36.735 m<sup>2</sup>

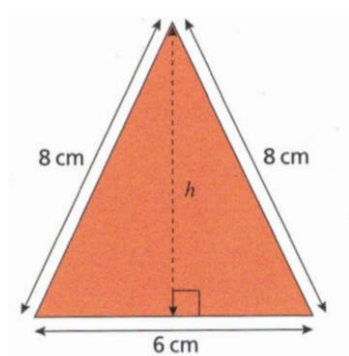
9 The front of a grandfather clock consists of a timber board with dimensions as shown. A circle of radius 20 cm is cut from the board to form the clock face. Find the remaining area of the timber board correct to one decimal place.



$$A_{\text{Bottom trapezium}} = \frac{5(64 + 60)}{2}$$
$$A_{\text{middle rectangle}} = 80 \times 60$$
$$A_{\text{Top semicircle}} = \frac{\pi(30)^2}{2}$$
$$A_{\text{hole}} = \pi(20)^2$$
$$\text{Total area} = 5267.1 \text{ cm}^2$$

## AREA PROBLEMS INVOLVING PYTHAGORAS' THEOREM

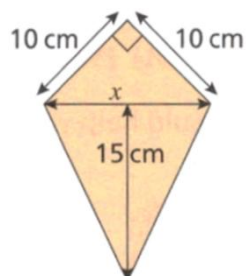
- 1 Find the perpendicular height,  $h$ , of this isosceles triangle, then calculate the area to 2 d.p.



$$h = \sqrt{8^2 - 3^2} = \sqrt{55}$$

$$A = \frac{6 \times \sqrt{55}}{2} = 22.25 \text{ cm}^2$$

- 2 Calculate  $x$  and hence find the area of the kite. Round your answer to 2 d.p.

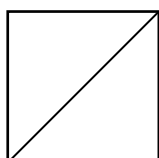


$$x = \sqrt{10^2 + 10^2} = \sqrt{200}$$

$$A = \frac{10 \times 10}{2} + \frac{15 \times \sqrt{200}}{2} = 156.07 \text{ cm}^2$$

- 3 A square has a diagonal of length 20 cm.

- a Determine its area using Pythagoras' Theorem



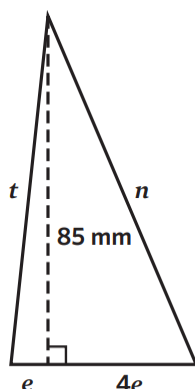
Let side length be  $x$   
 $x^2 + x^2 = 20^2$   
 $2x^2 = 400$   
 $x^2 = 200$   
 $\therefore$  Area is  $200 \text{ cm}^2$

- b This is Aiden's solution. Explain why it works.

$$\begin{aligned} A &= \frac{xy}{2} \\ &= \frac{20^2}{2} \\ &= 200 \text{ cm}^2 \end{aligned}$$

A square is also a rhombus.

- 4 Calculate the unknown values to 1 d.p., given the area of the triangle is  $2550 \text{ mm}^2$



$$2550 = \frac{85 \times 5e}{2}$$

$$2550 = \frac{425}{2}e$$

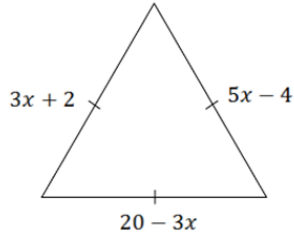
$$e = 12 \text{ mm}$$

$$t = \sqrt{12^2 + 85^2} = 85.84 \text{ cm}$$

$$n = 97.62 \text{ cm}$$

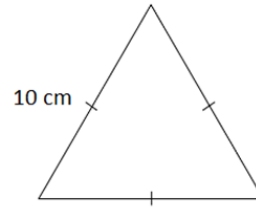
5

a Write an expression for the perimeter.



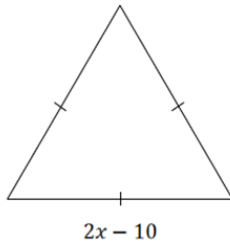
$$5x + 18$$

b Calculate the exact area of the triangle.



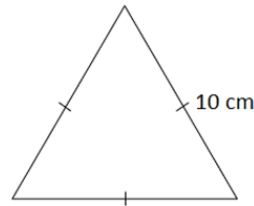
$$\begin{aligned} \text{Height} &= \sqrt{10^2 - 5^2} = \sqrt{75} \\ A &= \frac{1}{2} \times 10 \times \sqrt{75} = 5\sqrt{75} \text{ cm}^2 \\ &\text{or } 25\sqrt{3} \text{ cm}^2 \end{aligned}$$

c If the perimeter is 21 m, what is the value of  $x$ ?



$$\begin{aligned} 6x - 30 &= 21 \\ 6x &= 51 \\ x &= 8.5 \text{ m} \end{aligned}$$

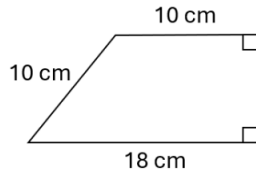
d A square has the same perimeter as the triangle. Find the area of the square.



$$\begin{aligned} \text{Perimeter of square} &= 30 \text{ cm} \\ \text{Side length} &= \frac{30}{4} = 7.5 \text{ cm} \\ \text{Area of square} &= 7.5^2 = 56.25 \text{ cm}^2 \end{aligned}$$

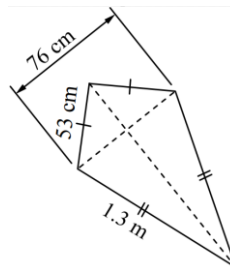
6 Find the missing sides, then find the area. Round your answer to 1 d.p.

a



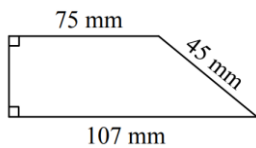
$$\begin{aligned} h &= \sqrt{10^2 - 8^2} = 6 \\ A &= \frac{6}{2}(10 + 18) = 84 \text{ cm}^2 \end{aligned}$$

b



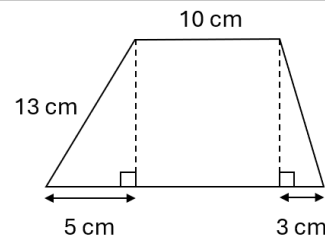
$$\begin{aligned} \text{Other diagonal} &= \sqrt{53^2 - 38^2} + \sqrt{130^2 - 38^2} = 161.268 \\ A &= \frac{161.268 \times 76}{2} = 6128.2 \text{ cm}^2 \end{aligned}$$

c



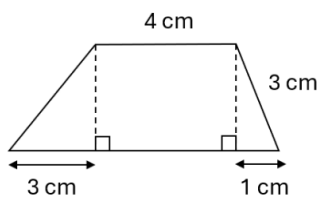
$$\begin{aligned} h &= \sqrt{45^2 - 32^2} \\ h &= \sqrt{1001} \\ A &= \frac{\sqrt{1001}}{2}(75 + 107) = 2879.1 \text{ mm}^2 \end{aligned}$$

d



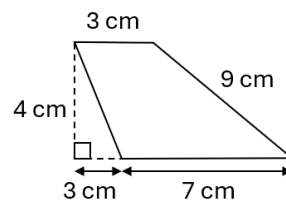
$$\begin{aligned} h &= \sqrt{13^2 - 5^2} = 12 \\ A &= \frac{12}{2}(10 + 18) = 168 \text{ cm}^2 \end{aligned}$$

e



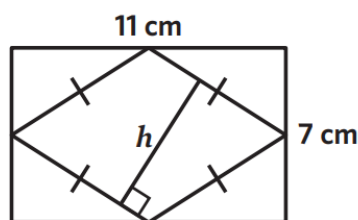
$$\begin{aligned} h &= \sqrt{3^2 - 1^2} \\ h &= \sqrt{8} \\ A &= \frac{\sqrt{8}}{2}(8 + 4) = 17.0 \text{ cm}^2 \end{aligned}$$

f



$$A = \frac{4}{2}(3 + 7) = 20 \text{ cm}^2$$

- 6 A rhombus with a perimeter of 26 cm sits inside a rectangle with side lengths 11 cm and 7 cm. The vertices of the rhombus are at the midpoints of the sides of the rectangle. Determine the length of  $h$ , rounded to 2 decimal places.



$$\text{Area of Rhombus} = \frac{11 \times 7}{2} = 38.5 \text{ cm}^2$$

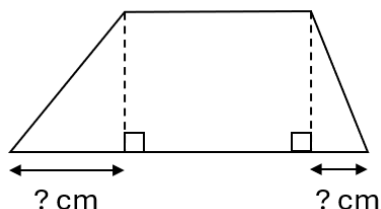
$$\text{Base} = \sqrt{3.5^2 + 5.5^2} = 6.519202405$$

$$A = bh$$

$$38.5 = 6.519202405h$$

$$h \approx 5.91 \text{ cm}$$

- 7 The area of the trapezium is  $294 \text{ cm}^2$ . The height of the trapezium is three-fifths of the left leg and 1 cm less than the right leg. If the parallel sides are 14 cm and 35 cm, find the missing sides.



$$294 = \frac{h}{2}(14 + 35)$$

$$\text{Height is } 12 \text{ cm}$$

$$\text{Left leg is } 20 \text{ cm, right leg is } 13 \text{ cm}$$

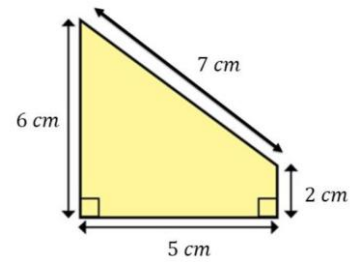
$$\text{Using Pythagoras, missing lengths are } 16 \text{ cm and } 5 \text{ cm}$$

# CHECK YOUR UNDERSTANDING

## Area of a trapezium

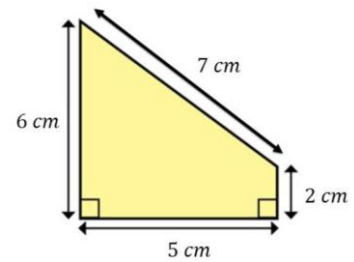
1 For this trapezium, what are the values of  $a$  and  $b$ ?

- a 5 cm and 7 cm
- b 6 cm and 2 cm
- c 5 cm and 2 cm
- d 6 cm and 5 cm



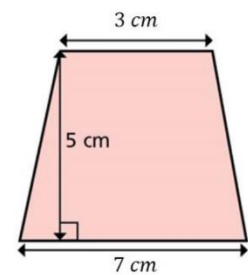
2 For this trapezium, what is the value of  $h$ ?

- a 6 cm
- b 5 cm
- c 7 cm
- d 2 cm



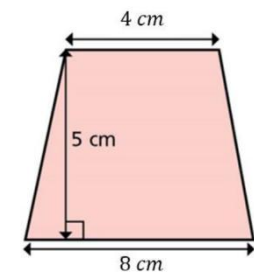
3 What is the area of this trapezium?

- a  $15 \text{ cm}^2$
- b  $50 \text{ cm}^2$
- c  $25 \text{ cm}^2$
- d  $28 \text{ cm}^2$



4 What is the area of this trapezium?

- a  $17 \text{ cm}^2$
- b  $60 \text{ cm}^2$
- c  $36 \text{ cm}^2$
- d  $30 \text{ cm}^2$



5 What is the area of this trapezium?

- a  $25 \text{ cm}^2$
- b  $50 \text{ cm}^2$
- c  $60 \text{ cm}^2$
- d  $84 \text{ cm}^2$

