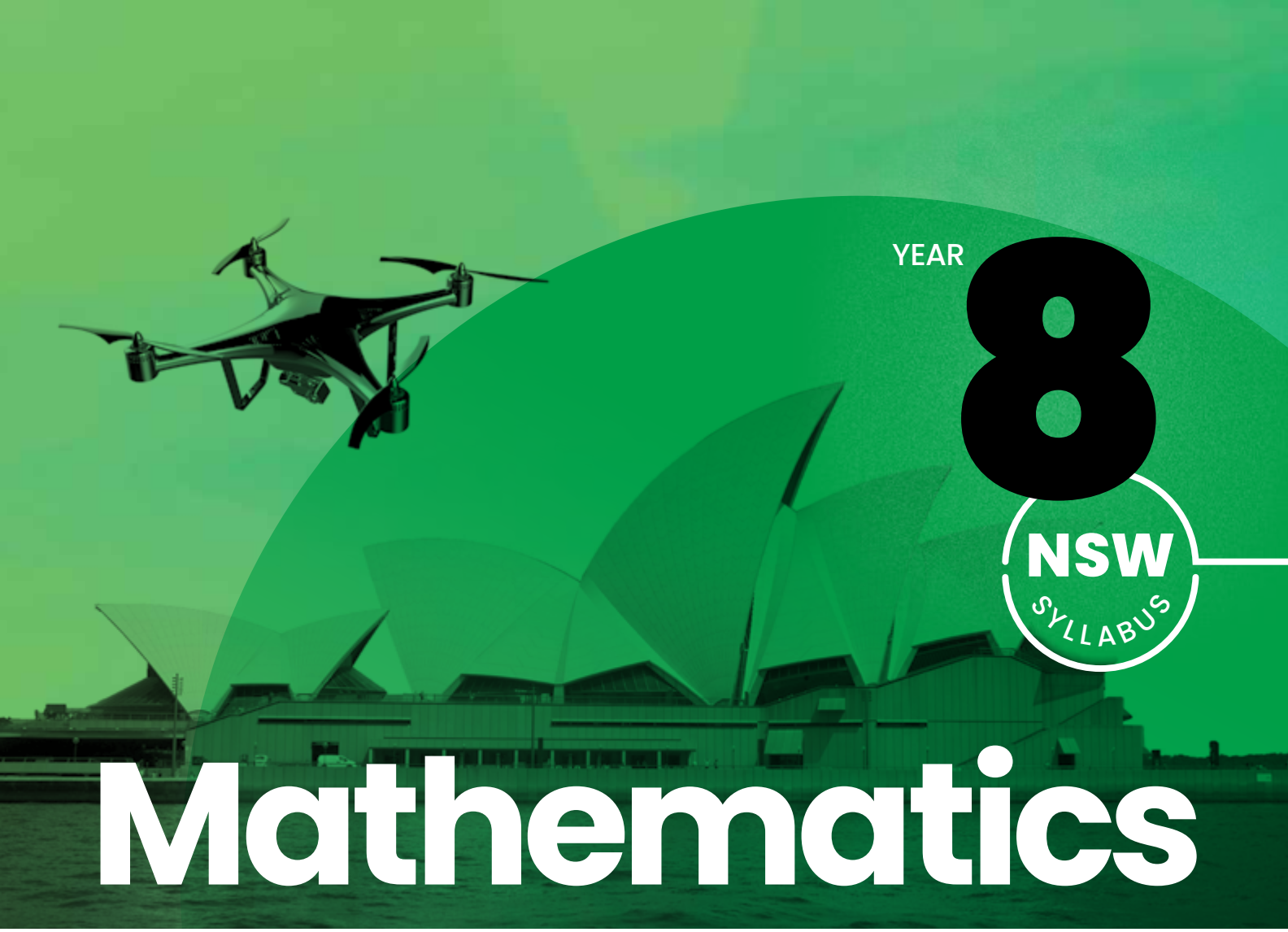

YEAR 8

NSW SYLLABUS

Mathematics

STUDENT COMPANION **NSW**

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Pearson Secondary Teaching Hub Maths 8 NSW

Student Companion

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We respect the living cultures of Aboriginal and Torres Strait Islander peoples and their ongoing connection to Country across lands, sky, seas, waterways and communities. We celebrate the richness of Indigenous Knowledge systems, shared with us and with schools Australia-wide.

We pay our respects to Elders, past and present.

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How to use this Student Companion

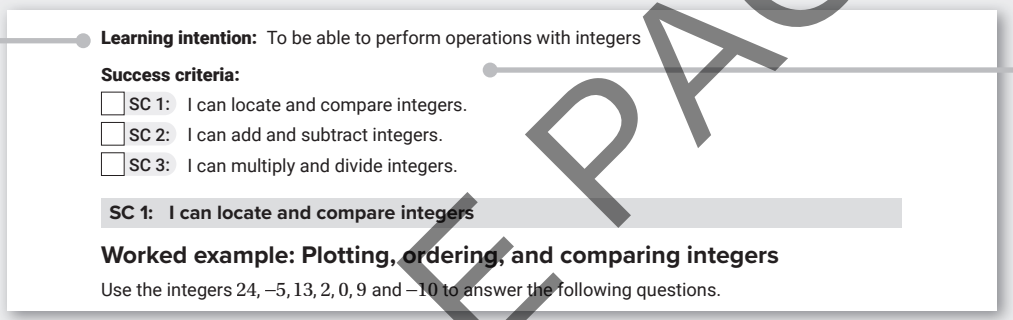
The *Student Companion* is a complementary resource that offers a print medium for corresponding lessons in *Pearson Secondary Teaching Hub*. It is designed to support teaching and learning by providing learners with a place to create a portfolio of learning to suit their individual needs, whether you are:

- supporting a blended classroom using the strengths of print and digital
- preparing for exams by creating a study guide or bound reference
- needing a tool to differentiate learning or
- looking for meaningful homework tasks.

Learners can develop their portfolio of learning as part of classroom learning or at home as an additional opportunity to engage and re-engage with the knowledge and skills from the lesson.

This could be done as prior learning in a flipped classroom environment or as an additional revision or homework task.

Learning intention and success criteria



Learning intention: To be able to perform operations with integers

Success criteria:

- ☐ SC 1: I can locate and compare integers.
- ☐ SC 2: I can add and subtract integers.
- ☐ SC 3: I can multiply and divide integers.

SC 1: I can locate and compare integers

Worked example: Plotting, ordering, and comparing integers

Use the integers $24, -5, 13, 2, 0, 9$ and -10 to answer the following questions.

Learning intentions are provided for every lesson. The learning intentions are goals or objectives that align to the corresponding digital lesson. They describe what learners should know, understand or be able to do by the end of the lesson.

Success criteria clarify expectations and describe what success looks like. The success criteria are specific, concrete and measurable so learners can actively engage with and reflect on their evidence of learning within each lesson.

Worked examples

Worked examples provide learners with a step-by-step solution to a problem. The worked examples in the *Student Companion* correspond to those in the digital lesson and are provided for each skill to:

- scaffold learning
- support skill acquisition
- reduce the cognitive load.

The **worked examples** are an effective tool to demonstrate what success looks like. The 'try yourself' format of the worked examples in the *Student Companion* support the gradual release of responsibility. Learners can view a completed worked example and a video walkthrough of the worked example in the corresponding digital lesson and then apply the scaffolded steps themselves to practise independently.

Practice questions are provided in the *Student Companion* so that learners can apply the knowledge and skills obtained in the worked example given. These questions are designed to ensure learners build confidence and demonstrate efficiency. They follow on from the Check your understanding questions beside the corresponding worked example in the digital lesson.

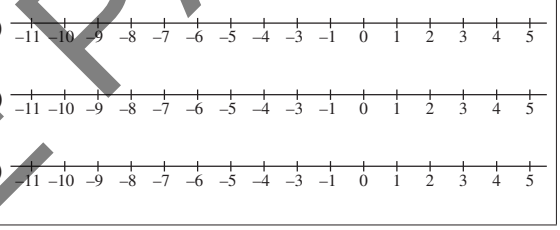
Each lesson in the *Student Companion* contains a space for students to reflect on their understanding. The simple and intuitive design of the **lesson reflection tool** allows students to scale their confidence, reflect on their learning and identify areas in which they need support.

SC 2: I can add and subtract integers

Worked example: Adding integers

Use the number lines to show the calculations:

(a) $0+(-8)$ **(b)** $(-8)+1$ **(c)** $(-8)+(-1)$

Thinking	Working
To add a positive number, face right and step forward. To add a negative number, face right and step backward.	

1 Calculate:

(a) $20+(-4)$

(b) $(-8)+11$

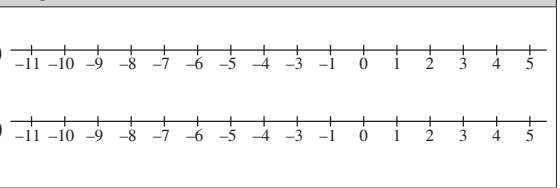
(c) $(-6)+(-5)$

(d) $12+(-5)+2$

Worked example: Subtracting integers

Use the number lines to show the calculations:

(a) $(-6)-4$ **(b)** $(-6)-(-4)$

Thinking	Working
To subtract a positive number, face left and step forward. To subtract a negative number, face left and step backward.	

1 Calculate:

(a) $22-(-15)$

(b) $(-16)-8$

(c) $(-6)-(-5)$

(d) $14-(-5)-9$

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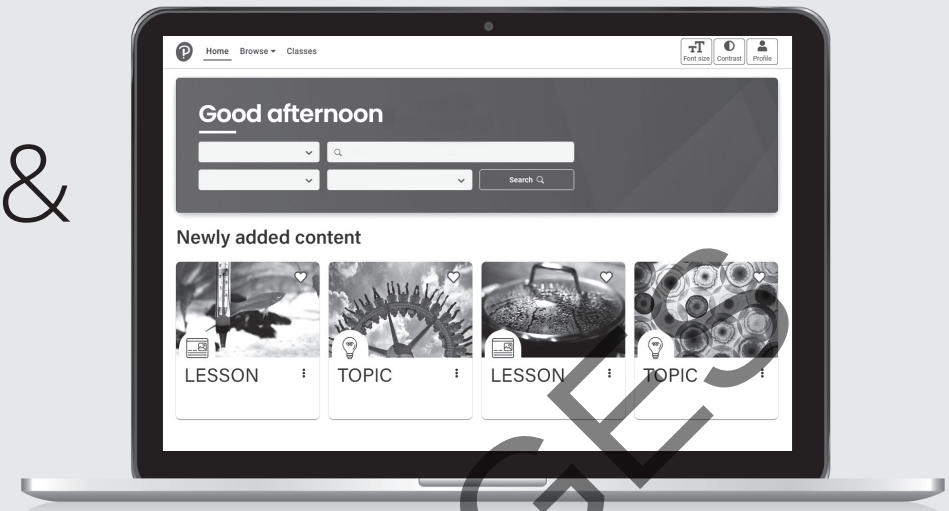
Simplify teaching & energise learning



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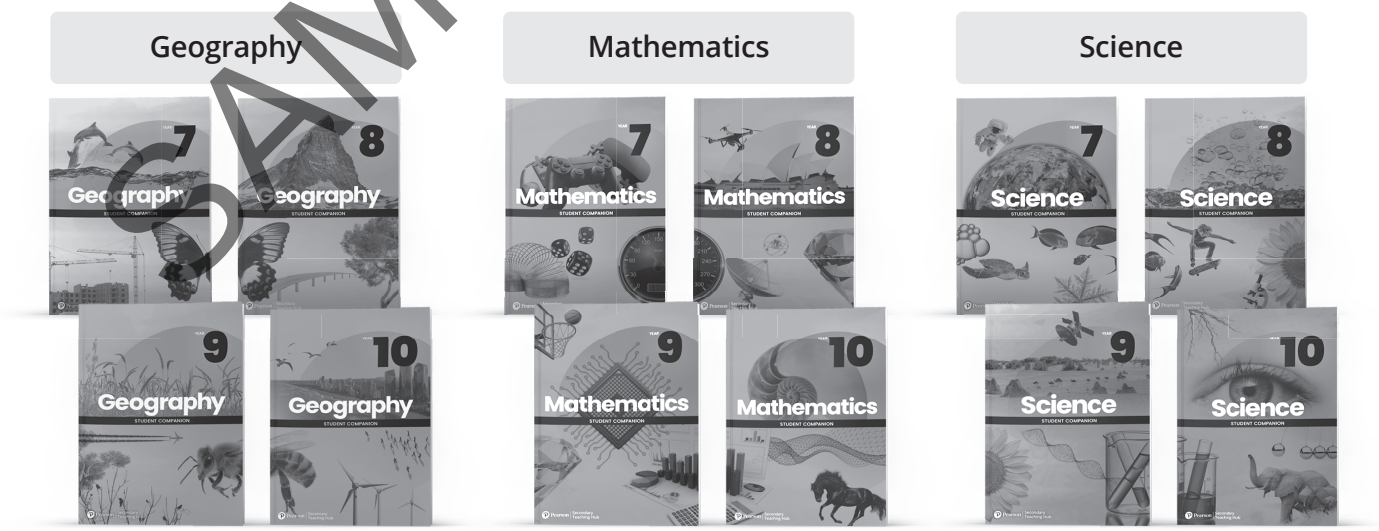
Pearson Secondary Teaching Hub has been designed to simplify teaching and energise learning across multiple subjects. Every *Secondary Teaching Hub* subject offers best-practice learning design delivered in flexible formats for the modern classroom, plus uniquely developed content structures and features for each subject.

This solution provides continuity for students from one class to the next and a rare whole-school view for school leadership while still delivering the rigour and support teachers need to help students meet the specific outcomes of their curriculum area.



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Measure the side lengths of a right-angled triangle

Learning intention: To be able to measure the sides of right-angled triangles

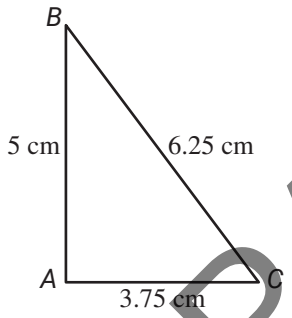
Success criteria:

- ☐ SC 1: I can identify the hypotenuse in a right-angled triangle.
- ☐ SC 2: I can construct and measure the side lengths of a right-angled triangle.

SC 1: I can identify the hypotenuse in a right-angled triangle

Worked example: Identifying the right angle and the hypotenuse

Identify and name the right angle and hypotenuse in this right-angled triangle.



Thinking	Working
Identify the known information.	
Locate the hypotenuse. Name the hypotenuse using the vertex labels at either end of the side. The vertices are usually written in alphabetical order.	
Locate the right angle. Name the angle.	

1 Given the lengths of sides in each of the following right-angled triangles, identify the length of the hypotenuse.

(a) 5 mm, 12 mm, 15 mm _____

(b) 12 mm, 20 mm, 16 mm _____

(c) 7.5 cm, 6 cm, 2.5 cm _____

(d) Explain how you determined which side length represented the hypotenuse.

_____

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SC 2: I can construct and measure the side lengths of a right-angled triangle

Worked example: Constructing right-angled triangles given the lengths of two sides

Use a ruler, a protractor and a compass to construct a right-angled triangle as directed. Measure the length of the other side to the nearest millimetre.

(a) The lengths of the two shorter sides are $5.6\,\text{cm}$ and $4.2\,\text{cm}$.

Thinking	Working
Draw a horizontal line using the first given length. Form a right angle at one end and extend the vertical line to the second given length.	
Join the ends of the horizontal and vertical lines to form the hypotenuse. Measure the length of the hypotenuse to the nearest millimetre and write it on the diagram.	

(b) The hypotenuse is $8.5\,\text{cm}$ and a shorter side is $7.5\,\text{cm}$.

Thinking	Working
Draw a horizontal line using the given shorter side length. Form a right angle at one end and draw an extended vertical line.	
From the other end of the horizontal line, draw the hypotenuse the required length to just meet the vertical line (extended, if necessary).	
Measure the length of the vertical side and write it on the diagram.	

1 Draw a right-angled triangle using the two shorter side lengths listed. In each case, label and measure the hypotenuse.

(a) $AB = 7\,\text{cm}$ and $AC = 5\,\text{cm}$

(b) $AB = 6\,\text{cm}$ and $BC = 5\,\text{cm}$

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Understand and use Pythagoras' theorem to identify right-angled triangles

Learning intention: To be able to understand and use Pythagoras' theorem to identify right-angled triangles

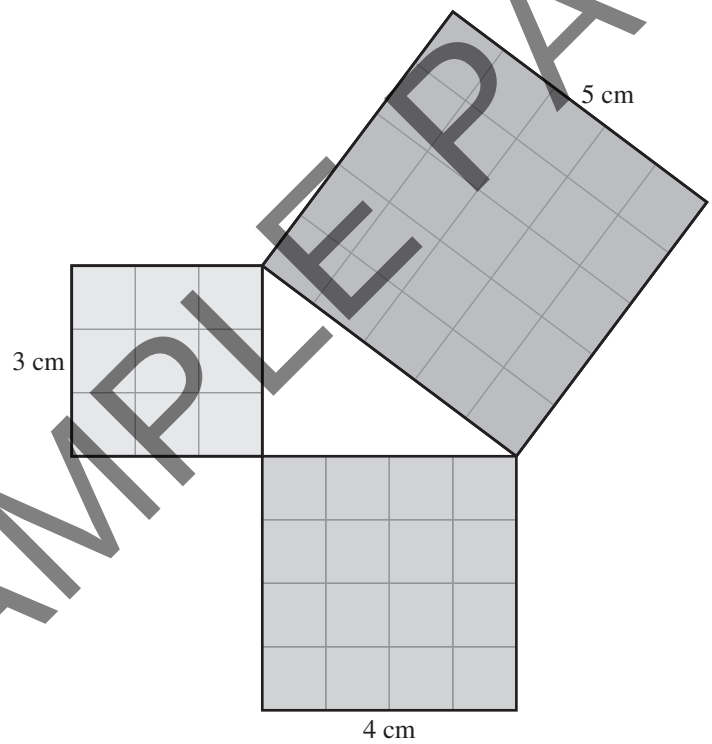
Success criteria:

- ☐ SC 1: I can establish the relationship between the side lengths in a right-angled triangle.
- ☐ SC 2: I can identify and use Pythagorean triples.
- ☐ SC 3: I can recognise the relationship between the squares of lengths of sides for different types of triangles.

SC 1: I can establish the relationship between the side lengths in a right-angled triangle

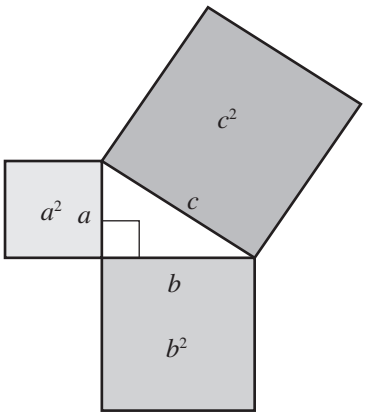
Worked example: The converse of Pythagoras' theorem

Determine whether or not this triangle is right-angled.



Thinking	Working
Recall Pythagoras' theorem.	
Identify the two shorter side lengths.	
Determine the sum of the squares of the two shorter side lengths.	
Identify the longest side length.	
Determine the square of the longest side length.	
Compare the sum of the squares of the two shorter sides with the square of the longest side length.	
Write a conclusion.	

1 Consider the right-angled triangle shown.



(a) Complete the table for the right-angled triangles with the side lengths given.

a	b	c	a^2	b^2	$a^2 + b^2$	c^2
15 mm	20 mm	25 mm				
9 cm	12 cm	15 cm				
50 mm	120 mm	130 mm				
8 cm	15 cm	17 cm				

(b) Which variable is used for the hypotenuse in each case? _____

(c) What sort of units do each of the values of a^2, b^2 and c^2 have?

_____

(d) What is the relationship between $a^2 + b^2$ and c^2?

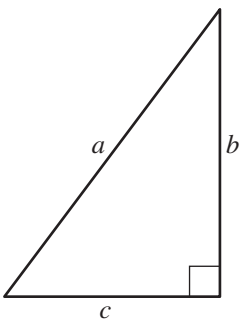
_____

2 Consider the triangle shown.

(a) Explain why Pythagoras' theorem written as $c^2 = a^2 + b^2$ does not describe the triangle.

_____

_____



(b) Using Pythagoras' theorem, write a true equation based on the triangle.

_____

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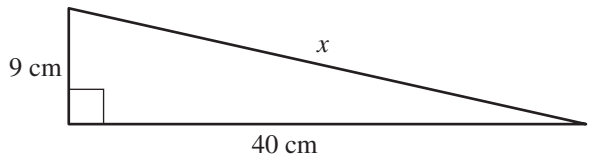
SC 2: I can identify and use Pythagorean triples

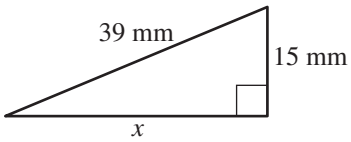
Worked example: Using Pythagorean triples to solve unknown sides

Use Pythagorean triples to determine the lengths of the unknown side in each right-angled triangle.

(a)



(b)



Thinking	Working
Interpret the information given in the right-angled triangle as a Pythagorean triple.	
Recall the relationship between the three values in a Pythagorean triple.	
Determine the relationship between the values in the Pythagorean triple.	
Determine the value of the variable.	
Interpret the answer.	

Thinking	Working
Interpret the information given in the right-angled triangle as a Pythagorean triple.	
Recall the relationship between the three values in a Pythagorean triple.	
Determine the relationship between the values in the Pythagorean triple.	
Determine the value of the variable.	
Interpret the answer.	

This list of Pythagorean triples will be helpful for the following questions.

$(3,4,5), (5,12,13), (7,24,25), (8,15,17), (9,40,41), (12,35,37), (20,21,29)$

1 Use the Pythagorean triples from the list to determine the length of the hypotenuse, given the lengths of the two shorter sides.

(a) 15 cm, 20 cm

(b) 21 m, 72 m

(c) 16 km, 30 km

2 Use the Pythagorean triple (12, 35, 37) to determine the unknown side length, given the length of the hypotenuse and another side.

(a) 24 m, 74 m

(b) 70 m, 74 m

(c) 36 m, 111 m

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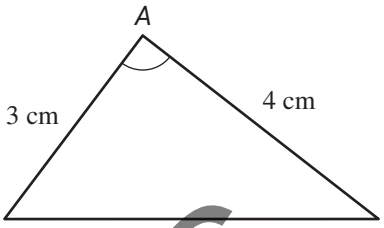
SC 3: I can recognise the relationship between the squares of lengths of sides for different types of triangles

Worked example: Classifying triangles with angle names

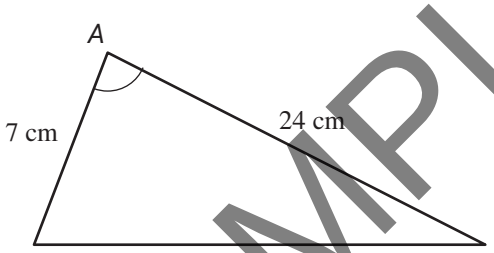
Two shorter sides of a triangle are 3 cm and 4 cm.

Match the length of the longest side $(4.5\text{ cm}, 5\text{ cm}, 5.5\text{ cm})$ to the triangle it represents (acute, right-angled, obtuse).



Thinking	Working
Determine the sum of the squares of the two shorter sides.	
Determine the length of the hypotenuse of a right-angled triangle.	
Use the length of the hypotenuse to classify the other side lengths.	
Draw a conclusion.	

1 The two shorter sides of a triangle are 7 cm and 24 cm. Give a third possible side length that would form:



(a) an acute-angled triangle

_____

(b) a right-angled triangle

_____

(c) an obtuse-angled triangle.

_____

2 Use the Pythagorean triple (5, 12, 13) to classify the triangles with the side lengths listed as either acute-angled or obtuse-angled triangles.

(a) $(5, 12, 12)$ _____

(b) $(5, 12, 14)$ _____

(c) $(10, 23, 26)$ _____

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Compare different applications, demonstrations and proofs of Pythagoras' theorem

Learning intention: To be able to compare different applications, demonstrations and proofs of Pythagoras' theorem

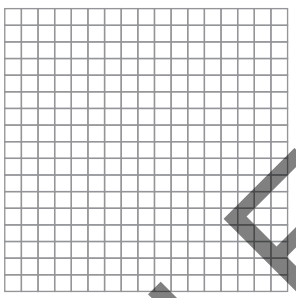
Success criteria:

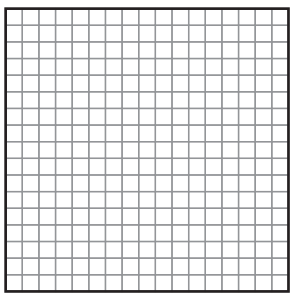
- ☐ SC 1: I can demonstrate and prove Pythagoras' theorem using a square shape.
- ☐ SC 2: I can use Pythagoras' theorem for similar shapes on the sides of right-angled triangles.

SC 1: I can demonstrate and prove Pythagoras' theorem using a square shape

Worked example: Illustrating the geometric proof using a grid

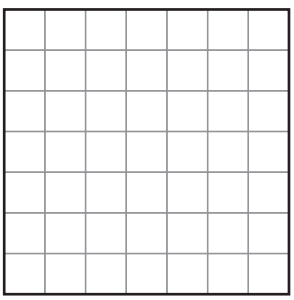
Demonstrate Pythagoras' theorem using squares on grid paper using the Pythagorean triple $(5,12,13)$.

Thinking	Working
On grid paper, draw the large square to the required size. Draw the right-angled triangle at each corner so that a square is left in the middle.	
Determine the dimensions of the large square.	
Determine the area of the inside square.	

Thinking	Working
Draw four copies of the right-angled triangle arranged as two pairs of rectangles so that two squares are left at opposite corners.	
Determine the areas of the remaining squares.	
Show that the area of the square of the hypotenuse is equal to the sum of the squares on the other two sides.	

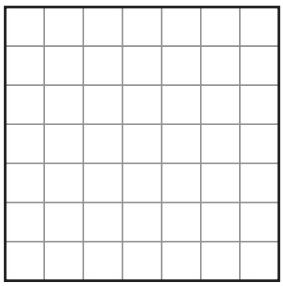
1 Use a square with side lengths of 7 units drawn on grid paper to complete the proof of Pythagoras' theorem with a $(3,4,5)$ triangle.

(a) Use grid paper to draw right-angled triangles with side lengths $(3,4,5)$.



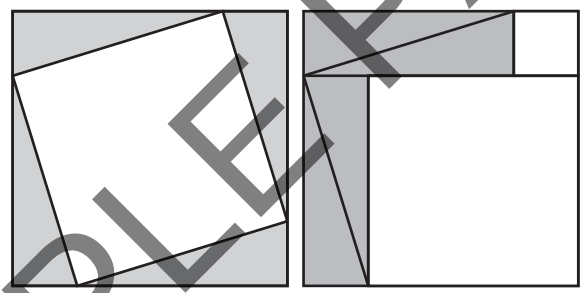
(b) Calculate the area of the centre square.

(c) Rearrange the right-angled triangles to form two squares.



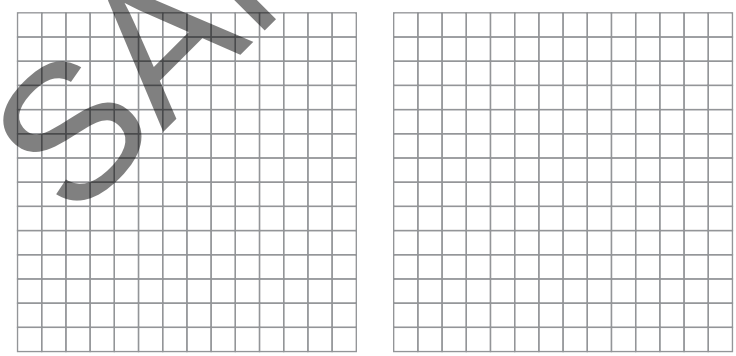
(d) Use your answer to part **(c)** to demonstrate that the sum of the squares of the two shorter sides is equal to the square of the hypotenuse.

2 Another pair of square diagrams that illustrate Pythagoras' theorem are given below.



(a) For a right-angled triangle with hypotenuse c and shorter sides a and b, what is the side length in both of the two larger squares?

(b) On grid paper, illustrate this method of proof using the Pythagorean triple $(6,8,10)$.



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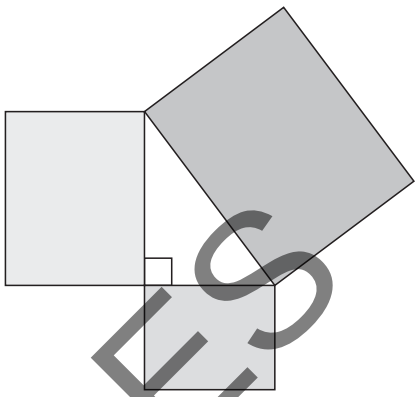
SC 2: I can use Pythagoras' theorem for similar shapes on the sides of right-angled triangles

Worked example: Using Pythagoras' theorem with similar shapes built on the sides of right-angled triangles

The right-angled triangle shown has a shape based on the $(3,4,5)$ Pythagorean triple.

The hypotenuse is $10\,\text{cm}$ long, and the rectangle on the hypotenuse has an area of $80\,\text{cm}^2$.



Given that the three rectangles are similar, and all have a longer side along the side of the triangle, determine:

(a) the value of k in $kc^2 = ka^2 + kb^2$

Thinking	Working
Use the length of the hypotenuse as c and the area of the rectangle on the hypotenuse as kc^2.	
Explain the meaning of the value of k.	

(b) the lengths of the shorter sides of the triangle

Thinking	Working
Use the ratio $3:4:5$ to determine the scale factor.	
Interpret the answer.	

(c) the areas of the smaller two rectangles

Thinking	Working
Use ka^2, kb^2 and kc^2 as the areas.	

(d) the width of each rectangle.

Thinking	Working
Use $A = lw$ for each rectangle.	

1 A right-angled triangle has shorter side lengths of 30 mm and 40 mm.
Rectangles with lengths of double their widths are built onto each side, with the width along the side of the triangle in each case. Determine:

(a) the length of the hypotenuse _____

(b) the length of each rectangle _____

(c) the area of each rectangle _____

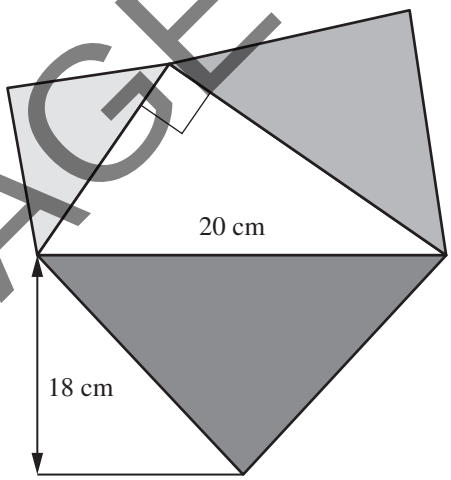
(d) the value of k in $kc^2 = ka^2 + kb^2$. _____

_____

_____

2 A right-angled triangle's shape is based on the $(3,4,5)$ Pythagorean triple, with a hypotenuse of 20 cm.

Three similar triangles are built onto the sides with the longest side of each triangle attached to the right-angled triangle in each case. The height of the triangle on the hypotenuse is 18 cm.



Determine:

(a) the lengths of the two shorter sides of the right-angled triangle

_____

(b) the height of the other similar triangles

_____

(c) the area of each similar triangle

_____

_____

_____

(d) the value of k in $kc^2 = ka^2 + kb^2$. _____

_____

_____

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Use Pythagoras' theorem to determine the length of the hypotenuse

Learning intention: To be able to use Pythagoras' theorem to determine the length of the hypotenuse

Success criteria:

- ☐ SC 1: I can use Pythagoras' theorem to determine the length of a hypotenuse.
- ☐ SC 2: I can solve problems involving determining the length of a hypotenuse.

SC 1: I can use Pythagoras' theorem to determine the length of a hypotenuse

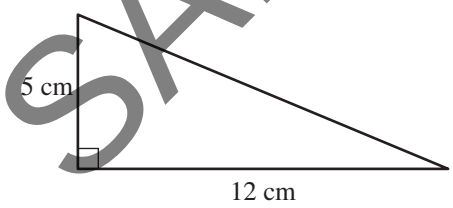
Worked example: Calculating the length of the hypotenuse

Calculate the length of the hypotenuse.

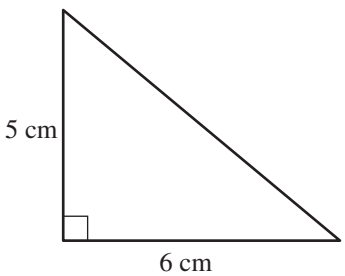
Thinking	Working
Use a pronumeral to represent the length of the unknown side.	
Write an equation for Pythagoras' theorem in terms of the given values.	
Solve for the unknown.	
Write the answer in words with appropriate units.	
Check that the answer is reasonable.	

1 Calculate the length of the hypotenuse in each right-angled triangle. Round your answers to 2 decimal places where necessary.

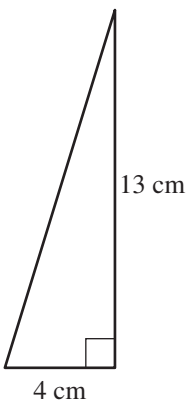
(a)



(b)



(c)



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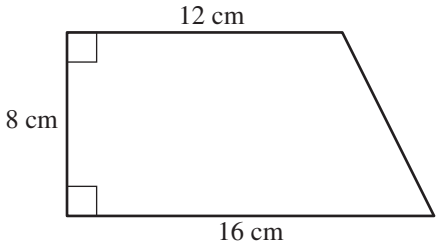
SC 2: I can solve problems involving determining the length of a hypotenuse

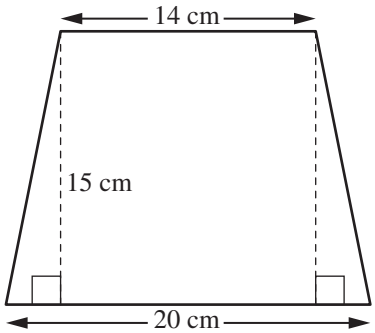
Worked example: Determining the length of the hypotenuse by first forming a right-angled triangle

Determine the unknown side length, correct to the nearest centimetre.



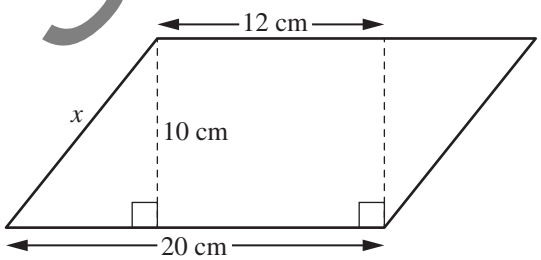
Thinking	Working
Draw a vertical line on the diagram given to form a right-angled triangle.	
Determine the length of the two shorter sides in the right-angled triangle by matching with known lengths, or by simple subtraction. Write the lengths on the diagram.	
Substitute the known lengths into Pythagoras' theorem, $c^2 = a^2 + b^2$.	
Solve for the unknown side length.	
Write the answer in words, with units, rounding as instructed.	

1 Determine the perimeter of the symmetrical shape shown, correct to the nearest millimetre.

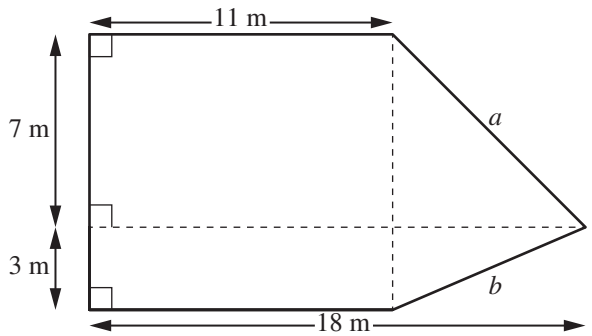


2 Determine the length of the sides marked with a pronumeral. Write your answers correct to 1 decimal place.

(a)



(b)



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Use Pythagoras' theorem to determine the length of a shorter side in a right-angled triangle

Learning intention: To be able to use Pythagoras' theorem to determine the length of a shorter side in a right-angled triangle

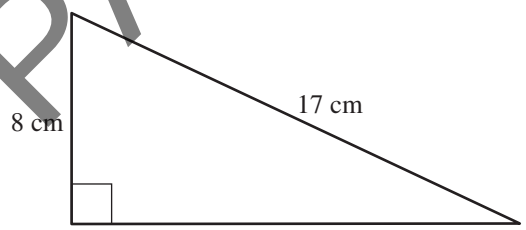
Success criteria:

- ☐ SC 1: I can rearrange Pythagoras' theorem to determine the length of a shorter side of a right-angled triangle.
- ☐ SC 2: I can solve problems using Pythagoras' theorem.

SC 1: I can rearrange Pythagoras' theorem to determine the length of a shorter side of a right-angled triangle

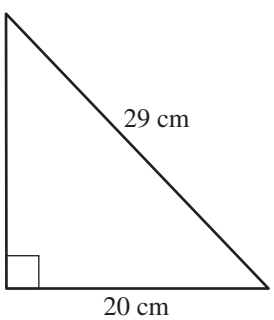
Worked example: Calculating the length of a shorter side in a right-angled triangle

Determine the length of the unknown side.

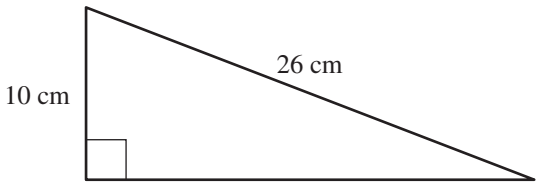
Thinking	Working
In the diagram given, label the unknown length with a pronumeral.	
Label the two shorter side lengths a and b. Label the hypotenuse c.	
Write an equation for Pythagoras' theorem in terms of the given values. Note: Subtraction is used since the unknown side must be shorter than the hypotenuse.	
Solve for the unknown.	
Write the answer in words with appropriate units.	

1 Calculate the lengths of the unknown sides. Round your answers to the nearest millimetre where required.

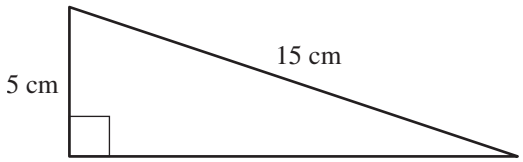
(a)



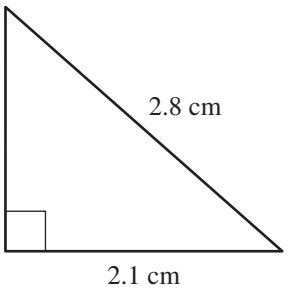
(b)



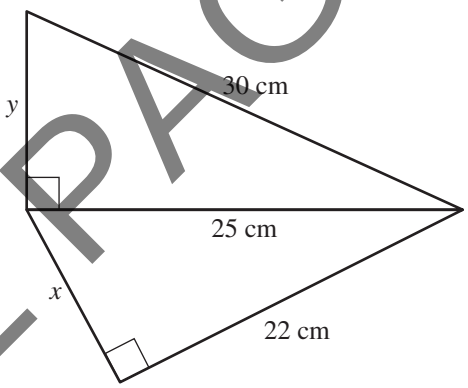
(c)



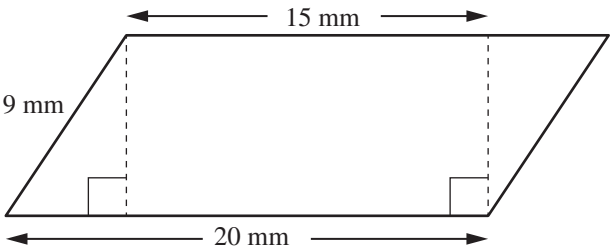
(d)



2 Determine the values of the pronumerals, correct to two decimal places.



3 Determine the height of the quadrilateral shown, correct to one decimal place.



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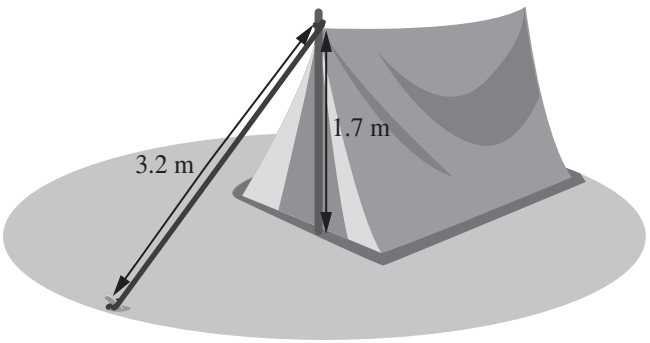
SC 2: I can solve problems using Pythagoras' theorem

Worked example: Solving a described problem by first drawing a right-angled triangle

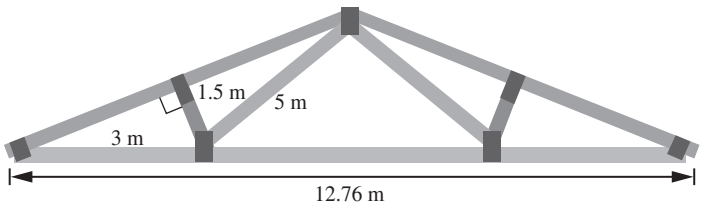
A ladder measuring 2.7 m is leaning against a wall with its base 110 cm from the wall. How high up the wall does the ladder reach? Give your answer in metres, correct to the nearest centimetre.

Thinking	Working
Draw a right-angled triangle using the wall and ground as the natural right angle. Ensure units are the same. Identify and mark the unknown length with a suitable pronumeral.	
Substitute the values into Pythagoras' theorem.	
Solve for the unknown.	
Interpret and present the answer in words with appropriate units, rounding as directed.	
Check that the answer is reasonable.	

1 A taut 3.2 m guy rope stretches from a peg on the ground to the top of a 1.7 m tall vertical tent pole.
How far is the peg from the base of the tent pole, to the nearest centimetre?



2 A symmetrical timber roof frame is constructed as shown.
Calculate the total length of timber used to construct this symmetrical roof frame, accurate to the nearest centimetre.



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