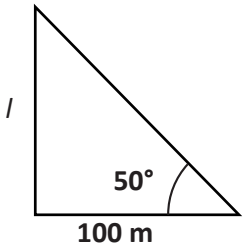
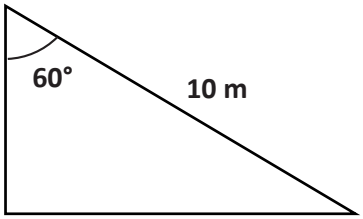
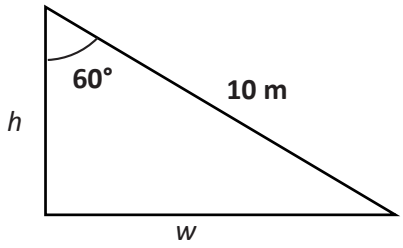
Set One: Matching steps cards

Rongopai, a surveyor, is designing a new bypass. This diagram shows a rough sketch from her notebook. Rongopai needs to find the length of the bypass, *l* in metres.	
From the sketch Rongopai knows that the side adjacent to the 50° angle is 100m long. The opposite side (*l*) is the length she wants to find out.	Adjacent side = 100m Opposite side = *l* Angle = 50°
Rongopai knows to use the trigonometric ratio called 'tangent'.	$\tan 50° = \frac{l}{100}$
Rongopai needs to rearrange the equation to make, *l* , the subject. She multiplies both sides by 100.	$100 \times \tan 50° = \frac{l}{100} \times 100$
Therefore, the length of *l* equals the tangent of 50° multiplied by 100.	$\therefore 100 \times \tan 50° = l$
Rongopai finds the value of the tan 50° on her calculator then multiplies that by 100.She gets the answer *l* = 119.175.	$\therefore 119.175 = l$
Rongopai knows that the length of the bypass rounds to 119.18 metres which is enough precision.	$l = 119.18m\ (2dp)$

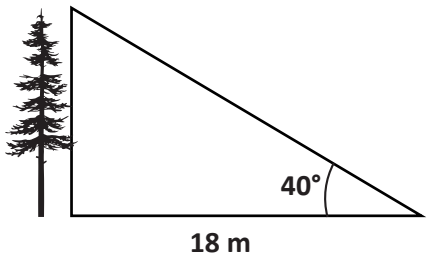
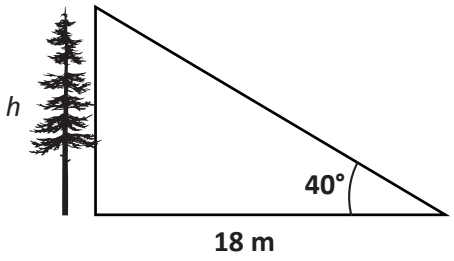
Set Two: Matching steps cards

Tom, a landscaper, is working out the perimeter of a triangular garden. From his plans, he knows the triangle has a right angle, an angle of sixty degrees, and a fence boundary of ten metres.	
Tom labels the missing side lengths, *w* for width, and *h* for height.	
Tom knows to use the trigonometric ratios called 'sine' and 'cosine' since he must find the sides that are opposite and adjacent to the 60° angle. He knows the hypotenuse equals 10m.	$\sin 60° = \frac{w}{10}$ ***and*** $\cos 60° = \frac{l}{10}$
He multiplies both sides of each equation by 10 so he can make *w* and *h* the subjects.	$10 \times \sin 60° = \frac{w}{10} \times 10$ ***and*** $10 \times \cos 60° = \frac{h}{10} \times 10$
Therefore, the length of *w* equals the sine of 60° multiplied by 10. The length of *h* equals the cosine of 60° multiplied by 10.	$10 \times \sin 60° = w$ ***and*** $10 \times \cos 60° = h$
Tom finds the values of the sin 60° and cos 60° on his calculator then multiplies those numbers by 10. He gets the answers *w* = 8.860254 and *h* = 5.	$\therefore 8.860254 = w$ ***and*** $5 = h$

Set Two: Matching steps cards

Tom rounds the length of each garden edge to the nearest millimetre which is enough precision.	$w = 8.860m\ (3dp)$ ***and*** $\mathrm{h} = 5\ (3dp)$
Tom adds all three edge lengths to get the total perimeter of the garden.	$10 + 8.860 + 5 = 23.860$ m

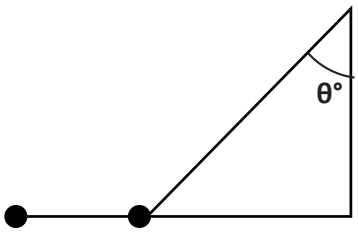
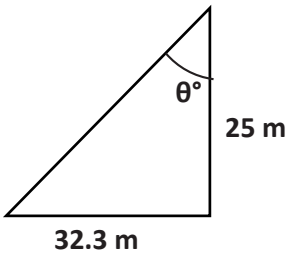
Set Three: Matching steps cards

Mere, the forestry worker, needs to check the height of a tree she is about to fell. She walks 18m back from the base of the tree. From that spot the angle of elevation to the top of the tree is 40°.	
Mere knows that the missing height, *h* , is the side opposite the angle of 40°.	
Since the opposite and adjacent sides are involved, and the angle is known, Mere writes an equation for the tangent of 40°.	$\tan 40° = \frac{h}{18}$
She multiplies both sides of the equation by 18 so she can make *h* the subject.	$18 \times \tan 40° = \frac{h}{18} \times 18$
Therefore, Mere knows that the height of the tree, *h* , equals the tangent of 40° multiplied by 18.	$18 \times \tan 40° = h$
She finds the value of the tan 40° then multiplies that number by 18. Mere gets the answer *h* = 15.1037933.	$\therefore 15.1037933 = h$

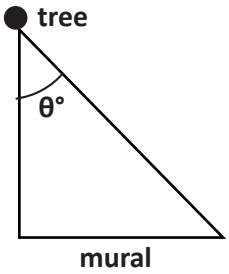
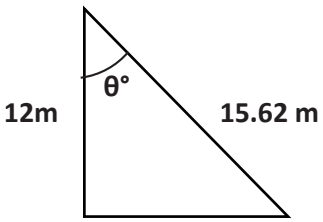
Set Three: Matching steps cards

Mere rounds the height to the nearest millimetre, which is enough precision, and puts in the unit of measure.	$h = 15.104m\ (3dp)$
Mere adds on the distance of her eyes from the ground to get the total height of the tree.	$total\ height = 15.104m + 1.65m$ $= 16.754m\ (3dp)$

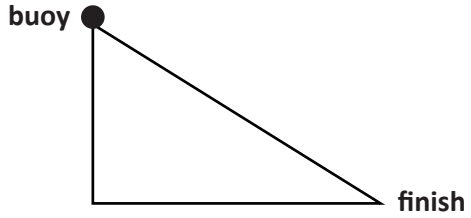
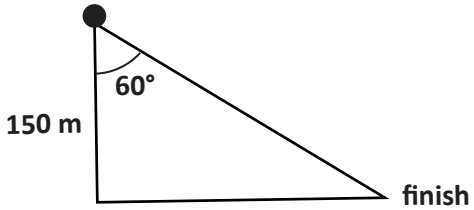
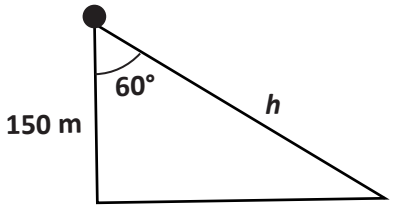
Set Four: Matching steps cards

Beauden is kicking for goal after Reiko scored in the corner. He wants the angle of shot to the near goal post so names the unknown as 'theta'.	
Beauden take the ball back 3m past the 22m line. He knows the distance from sideline to the near post is 32.2m. Therefore, he knows the lengths of the sides that are adjacent to and opposite theta.	
Since the opposite and adjacent sides are known, but the angle is known, Beauden writes an equation for the tangent of theta.	$\tan\theta = \frac{32.2}{25}$
He divides 32.2 by 25 to find the value of the tangent of theta.	$\tan\theta = 1.288$
Therefore, Beauden knows that theta equals the angle with a tangent of 1.288.	$\theta = \tan^{-1} 1.288$
He finds the value of $\tan^{-1} 1.288$ using his calculator.	$\therefore\ \theta = 52.17432$
Beauden rounds the angle to the nearest degree as that is precise enough.	$\theta = 52°$

Set Five: Matching steps cards

Celeste is installing a spotlight to wash on a mural at night. The maximum angle the spotlight can be set to is 54°.	
Celeste measures the adjacent side to theta and the hypotenuse.	
Since the opposite side and hypotenuse are known, but the angle is unknown, Celeste writes an equation for the sine of theta.	$\sin\theta = \frac{12}{15.62}$
She divides 12 by 15.62 to find the value of the sine of theta.	$\sin\theta = 0.7682456$
Therefore, Celeste knows that theta equals the angle with a sine of 0.7682456.	$\therefore\ \theta = 50.196624$
She finds the value of $\sin^{-1}$ 0.7682456 using her calculator.	$\therefore \theta = sin^{-1}\,0.7682456$
Celeste rounds the angle to the nearest degree as that is precise enough. The spotlight can be attached to the tree.	$\theta = 50°$

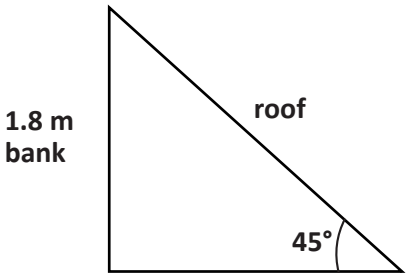
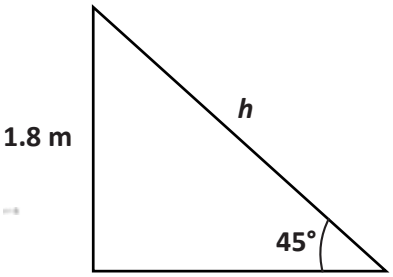
Set Six: Matching steps cards

Toni rounds the buoy on her swim to the finish point at the shore. How much further has she got to swim?	
She knows that the buoy is 150 metres directly off shore. The angle between the shore and finish is 60° when taken from the buoy.	
Toni swims the length of the hypotenuse, *h*, to finish the race.	
Since the adjacent side to the angle and hypotenuse are involved, she writes an equation about the cosine of 60°.	$\cos 60° = \frac{150}{h}$
Next, Toni multiplies both sides of the equation by *h*, to make *h* the subject.	$\cos 60° \times h = \frac{150}{h} \times h$
Therefore, Toni knows that the cosine of 60° multiplied by *h* equals 150.	$\therefore \cos 60° \times h = 150$

Set Six: Matching steps cards

Toni divides both sides of the equation by cos 60° without finding the value of it first.	$Cos\ 60° \times h \div Cos\ 60° = 150 \div Cos\ 60°$
Therefore, the hypotenuse equals 150 divided by the cosine of 60°.	$\therefore h = \frac{150}{\cos 60°}$
Celeste works out 150 divided by the cosine of 60°, using her calculator, then rounds the answer to the nearest metre.	$h = 300\text{m}$

Set Seven: Matching steps cards

Casey builds a shelter against a vertical bank while on his four-day survival training. The bank is 1.8m high and Casey thinks that an angle of 45° will give him enough room inside.	
She needs six branches to form the rafters of the roof. The hypotenuse is the length that the branches need to be.	
Since the side opposite to 45° and the hypotenuse are involved, Casey writes an equation involving the sine of 45° .	$\sin 45° = \frac{1.8}{h}$
Next, Casey multiplies both sides of the equation by *h*, to make *h* the subject.	$\sin 45° \times h = \frac{1.8}{h} \times h$
Therefore, Casey knows that the sine of 45° multiplied by *h* equals 1.8.	$\therefore \sin 45° \times h = 1.8$
Casey divides both sides of the equation by sine 45° without finding the value of it first.	$sin\,45° \times h \div sin\,45° = 1.8 \div sin\,45°$

Set Seven: Matching steps cards

Therefore, the hypotenuse equals 1.8 divided by the sine of 45°.	$\therefore h = \frac{1.8}{\sin 45°}$
Casey works out 1.8 divided by the sine of 45°, using her calculator, then rounds the answer to the nearest centimetre.	$h = 255\text{cm}$