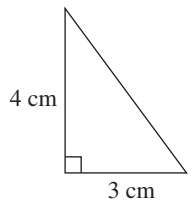
5 Geometry: Pythagoras and trigonometry

5.1 Pythagoras' theorem

HOMEWORK 5A

1 In each of the following triangles, find the hypotenuse, rounding off to a suitable degree of accuracy.

a



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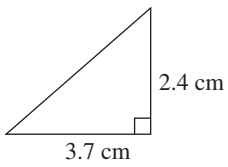

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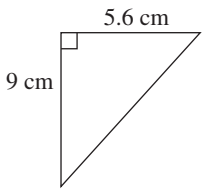

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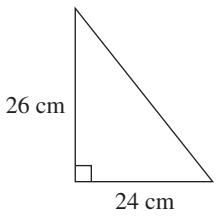

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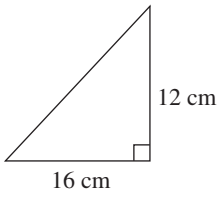

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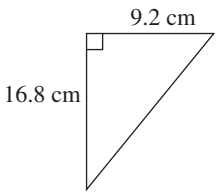
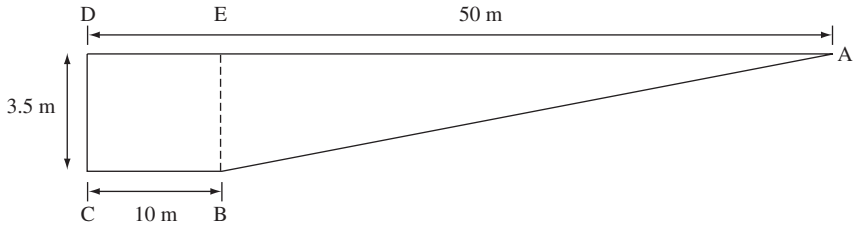


2 This diagram shows the cross-section of a swimming pool 50 m long. It is 3.5 m deep at the deep end. The deepest part of the pool is 10 m long. It is not drawn to scale.

a Calculate the length of the sloping bottom of the pool AB.

b The pool is 20 m wide. What is its volume?

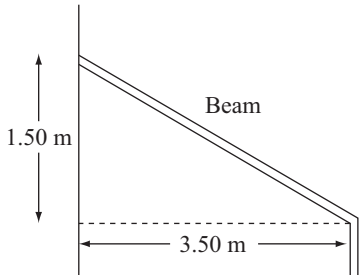


AU 3 Three of these lengths could form the sides of a right-angled triangle:

7.5 cm 10 cm 12.5 cm 15 cm

Which one would not be used? Give a reason for your answer.

FM 4 A beam of wood is needed to support a sloping roof, as shown. The beam spans a horizontal distance of 3.50 m and the difference between the bottom and the top is 1.50 m.



A builder has a beam that is 4 m long.

Is it long enough?

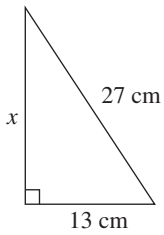
5.2 Finding a shorter side

HOMEWORK 5B

C

1 In each of the following triangles, find the length of x to a suitable degree of accuracy.

a



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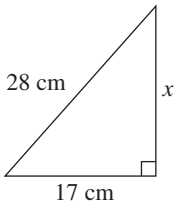

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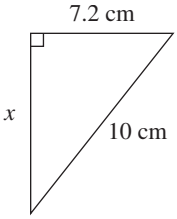

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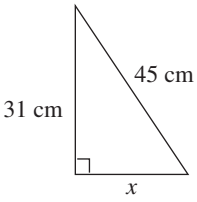

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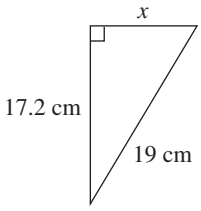

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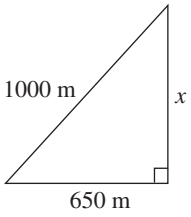

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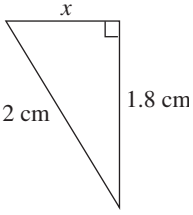

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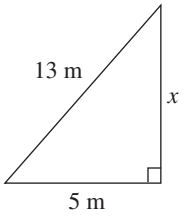
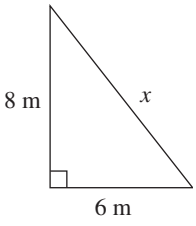
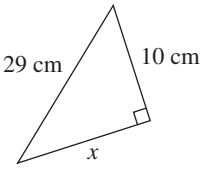


2 In each of the following triangles, find the length of x to a suitable degree of accuracy.

a



b



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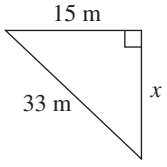

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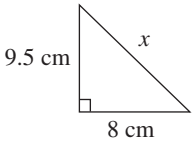
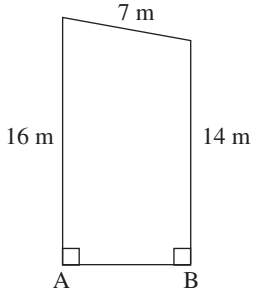
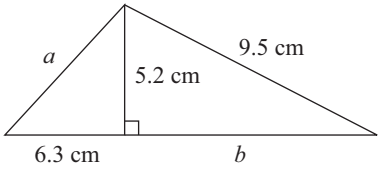


AU 3 The diagram shows the end view of the framework for a sports arena stand. Calculate the length AB.

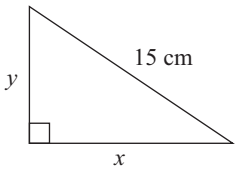


4 Calculate the lengths of a and b.



FM 5 A ladder 3.8 m long is placed against a wall. The foot of the ladder is 1.1 m from the wall.
A window cleaner can reach windows that are 1 m above the top of her ladder. Can she reach a window that is 4 m above the ground?

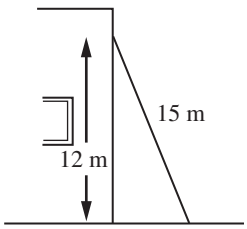
6 The lengths of the three sides of a right-angled triangle are all a whole number of centimetres. The hypotenuse is 15 cm. How long are the two other sides?



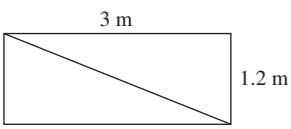
5.3 Applying Pythagoras' theorem in real situations

HOMEWORK 5C

1 A ladder, 15 m long, leans against a wall. The ladder needs to reach a height of 12 m. How far should the foot of the ladder be placed from the wall?



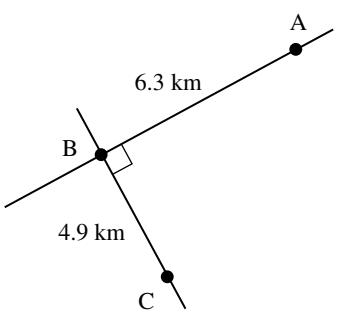
2 A rectangle is 3 m long and 1.2 m wide. How long is the diagonal?



3 How long is the diagonal of a square with a side of 10 m?

4 A ship going from a port to a lighthouse steams 8 km east and 6 km north. How far is the lighthouse from the port?

5 At the moment, three towns, A, B and C, are joined by two roads, as in the diagram. The council wants to make a road that runs directly from A to C. How much distance will the new road save compared to the two existing roads?



6 An 8 m ladder is put up against a wall.

a How far up the wall will it reach when the foot of the ladder is 1 m away from the wall?

b When it reaches 7 m up the wall, how far is the foot of the ladder away from the wall?

C

7 How long is the line that joins the two points A(1, 3) and B(2, 2)?

8 A rectangle is 4 cm long. The length of its diagonal is 5 cm. What is the area of the rectangle?

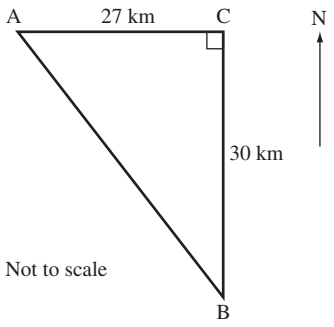
9 Is the triangle with sides 11 cm, 60 cm and 61 cm a right-angled triangle?

10 How long is the line that joins the two points A(–3, –7) and B(4, 6)?

AU 11 The diagram shows a voyage from position A to position B. The boat sails due east from A for 27 km to position C. The boat then changes course and sails for 30 km due south to position B. On a map, the distance between A and C is 10.8 cm.

a What is the scale of the map?

b What is the distance from A to B in kilometres?



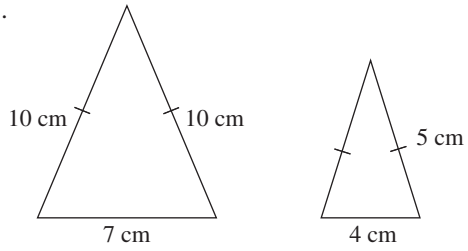
AU 12 A mobile phone mast is supported by a cable that stretches from the top of the mast down to the ground. The mast is 12.5 m high and the cable is 17.8 m long.
How far from the bottom of the mast is the end of the cable that is attached to the ground?

FM 13 A rolling pin is 45 cm long.
Will it fit inside a kitchen drawer which is internally 40 cm long and 33 cm wide?
Justify your answer.

HOMEWORK 5D

B

1 Calculate the area of these isosceles triangles.



2 Calculate the area of an isosceles triangle with sides of 10 cm, 10 cm and 8 cm.

3 Calculate the area of an equilateral triangle with sides of 10 cm each.

4 **a** Calculate the area of an equilateral triangle with sides of 20 cm each.

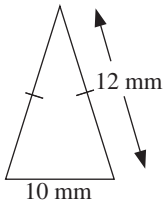
b Explain why the answer to **4a** is not twice that of Question **3**.

5 An isosceles triangle has sides of 6 cm and 8 cm.

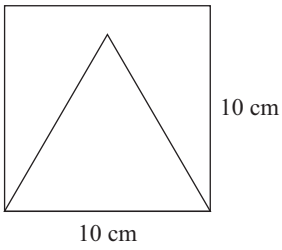
a Sketch the two isosceles triangles that fit this data.

b Which of the two triangles has the greater area?

6 The diagram shows an isosceles triangle of base 10 mm and side 12 mm. Calculate the area of the triangle.

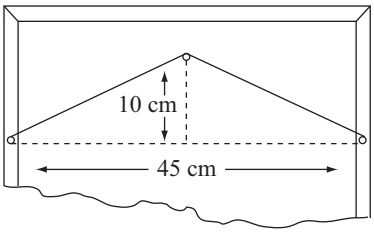


AU 7 The diagram shows an equilateral triangle drawn inside a square with sides of 10 cm each.



What percentage of the square is outside the triangle?

FM 8 A picture is hanging on a string secured to two points at the side of the frame.

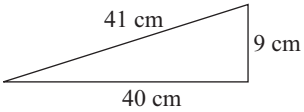


The string is initially 45 cm long.
When the picture is hung the string stretches as shown.
By how much does the string stretch?

5.4 Pythagoras' theorem in three dimensions

HOMEWORK 5E

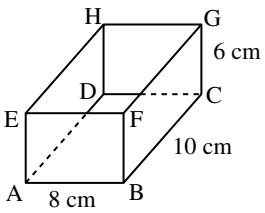
1 Is the triangle with sides of 9 cm, 40 cm and 41 cm a right-angled triangle?



2 A box measures 6 cm by 8 cm by 10 cm.

a Calculate the lengths of
i AC **ii** BG **iii** BE

b Calculate the diagonal distance BH.

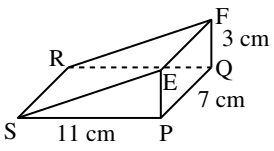


3 A garage is 5 m long, 5 m wide and 2 m high. Can a 7 m long pole be stored in it?

4 Spike, a spider, is at the corner S of the wedge shown in the diagram. Fred, a fly, is at the corner F of the same wedge.

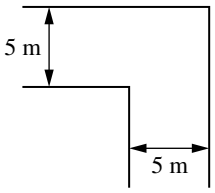
a Calculate the two distances Spike would have to travel to get to Fred if she used the edges of the wedge.

b Calculate the distance Spike would have to travel across the face of the wedge to get directly to Fred.



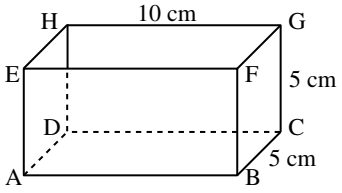
A

5 A corridor is 5 m wide and turns through a right angle, as in the diagram. What is the longest pole that can be carried along the corridor horizontally? If the corridor is 3 m high, what is the longest pole that can be carried along in any direction?



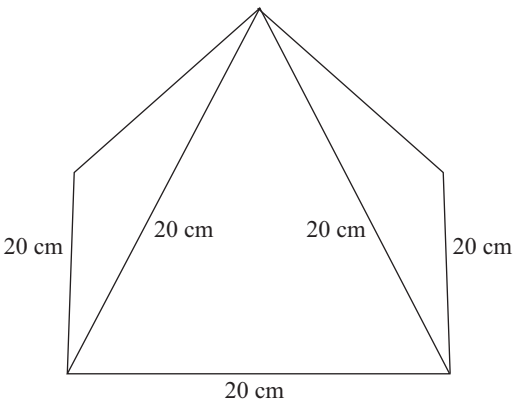
6 For the box shown on the right, find the lengths of:

a DG
b HA
c DB
d AG



AU 7 A cube has a side of 15 cm.
Calculate the distance between two vertically opposite corners.

FM 8 A small sculpture is made from four equilateral triangles of copper sheet stuck together to make a pyramid.

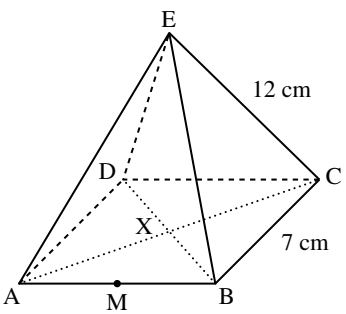


The triangles have a side of 20 cm. How high is the pyramid?

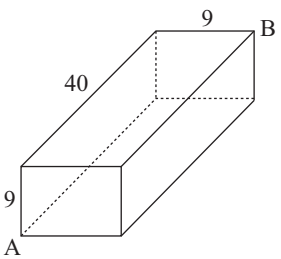
A*

9 The diagram shows a square-based pyramid with base length 7 cm and sloping edges 12 cm. M is the mid-point of the side AB, X is the mid-point of the base, and E is directly above X.

a Calculate the length of the diagonal AC.
b Calculate EX, the height of the pyramid.
c Using triangle ABE, calculate the length EM.



10 Use the answer to Question **1** to find the length of the diagonal AB of the cuboid 9 cm by 9 cm by 40 cm.



5.5 Trigonometric ratios

HOMEWORK 5F

In these questions, give any answers involving angles to the nearest degree.

1 Find these values, rounding off your answers to 3 significant figures.
a sin 52° **b** sin 46° **c** sin 76.3° **d** sin 90°

2 Find these values, rounding off your answers to 3 significant figures.
a cos 52° **b** cos 46° **c** cos 76.3° **d** cos 90°

3 **a** Calculate $(\sin 52°)^2 + (\cos 52°)^2$ **b** Calculate $(\sin 46°)^2 + (\cos 46°)^2$
c Calculate $(\sin 76.3°)^2 + (\cos 76.3°)^2$ **d** Calculate $(\sin 90°)^2 + (\cos 90°)^2$
e What do you notice about your answers?

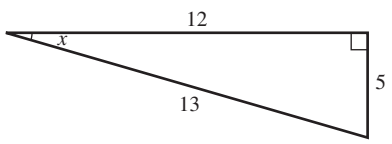
4 Use your calculator to work out the value of:
a tan 52° **b** tan 46° **c** tan 76.3° **d** tan 0°

5 Use your calculator to work out the value of:
a sin 52° ÷ cos 52° **b** sin 46° ÷ cos 46° **c** sin 76.3° ÷ cos 76.3°
d sin 0° ÷ cos 0°
e What connects your answers with the answers to Question **4**?

6 Use your calculator to work out the value of:
a 6 sin 55° **b** 7 cos 45° **c** 13 sin 67° **d** 20 tan 38°

7 Use your calculator to work out the value of:
a $\frac{6}{\sin 55°}$ **b** $\frac{7}{\cos 45°}$ **c** $\frac{13}{\sin 67°}$ **d** $\frac{20}{\tan 38°}$

8 Using the following triangle, calculate sin, cos, and tan for the angle marked x.
Leave your answers as fractions.



AU 9 You are given that $\sin x = \frac{5}{\sqrt{34}}$. Work out the value of tan x.

5.6 Calculating angles

HOMEWORK 5G

Use your calculator to find the answers to the following to one decimal place.

1 What angles have sines of:
a 0.4 **b** 0.707 **c** 0.879 **d** 0.666666666666666…

2 What angles have cosines of:
a 0.4 **b** 0.707 **c** 0.879 **d** 0.333333333333333…

3 What angles have the following tangents?
a 0.4 **b** 1.24 **c** 0.875 **d** 2.625

4 What angles have the following sines?
a 3 ÷ 8 **b** 1 ÷ 3 **c** 3 ÷ 10 **d** 5 ÷ 8

B

5 What angles have the following cosines?

a $3 \div 8$ **b** $1 \div 3$ **c** $3 \div 10$ **d** $5 \div 8$

6 What angles have the following tangents?

a $3 \div 8$ **b** $3 \div 2$ **c** $5 \div 7$ **d** $19 \div 5$

7 If $\sin 54° = 0.809$ to 3 decimal places, what angle has a cosine of 0.809?

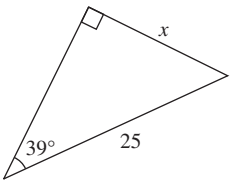
5.7 Using the sine and cosine functions

HOMEWORK 5H

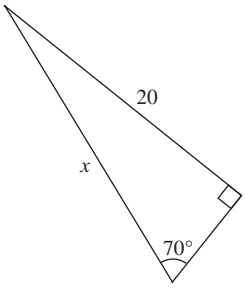
B

1 Find the value marked x in each of these diagrams.

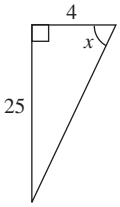
a



b



c



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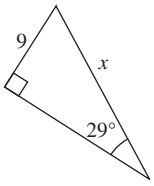

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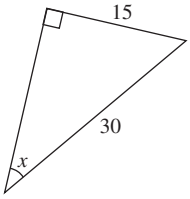

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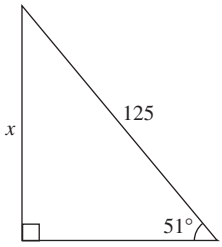
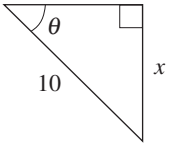


2 Angle θ has a sine of $\frac{7}{20}$. Calculate the missing lengths of these triangles.

a



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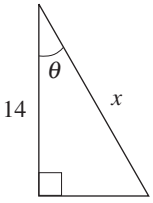

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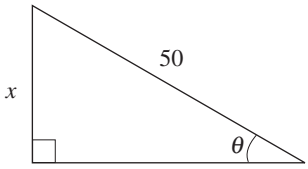
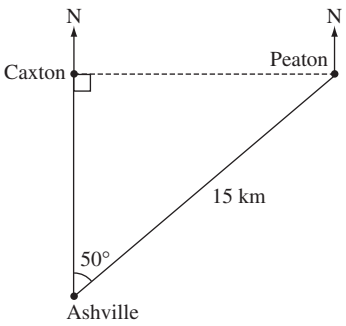


AU 3 Caxton is due north of Ashville and due west of Peaton. A pilot flies directly from Ashville to Peaton, a distance of 15 km, on a bearing of 050°.

a Calculate the direct distance from Caxton to Peaton.

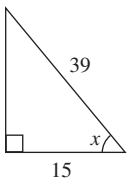
b Work out the bearing of Ashville from Peaton.



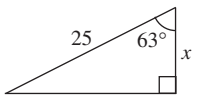
HOMEWORK 5I

1 Find the value marked x in each of these triangles.

a



b



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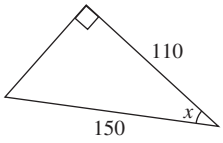

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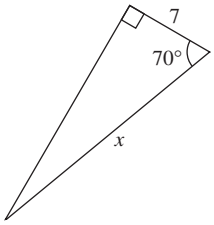

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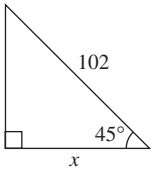

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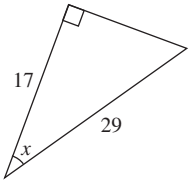
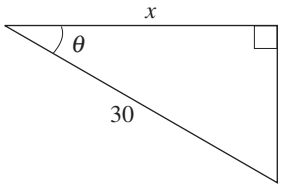


2 Angle θ has a cosine of $\frac{7}{15}$. Calculate the missing lengths of these triangles.

a



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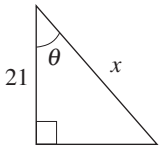

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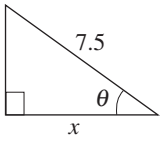
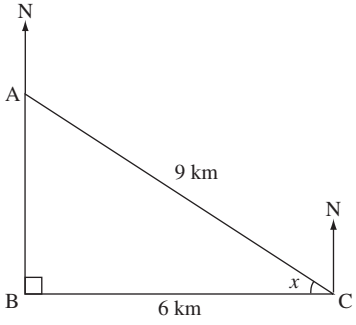


AU 3 The diagram shows the positions of three telephone masts A, B and C.
Mast C is 6 kilometres due east of Mast B.
Mast A is due north of Mast B, and 9 km from Mast C.

a Calculate the distance of A from B.
Give your answer in kilometres, correct to 3 significant figures.

b Calculate the size of the angle marked x.
Give your angle correct to one decimal place.



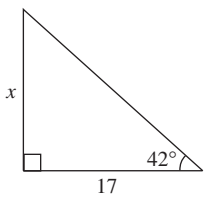
5.8 Using the tangent function

HOMEWORK 5J

B

1 Find the value marked x in each of these triangles.

a



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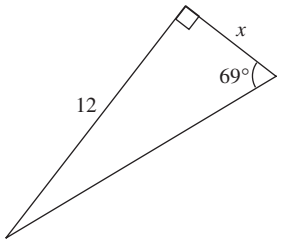

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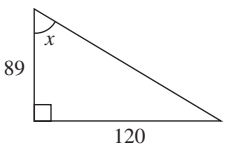

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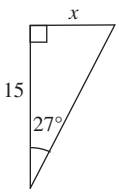

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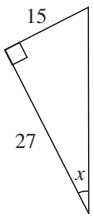

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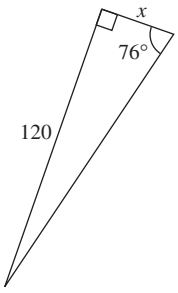
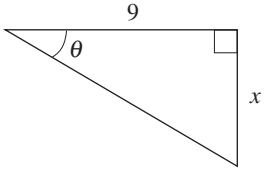


2 Angle θ has a tangent of $\frac{2}{3}$. Calculate the missing lengths of these triangles.

a



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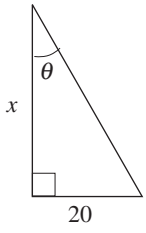

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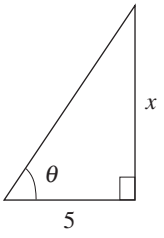
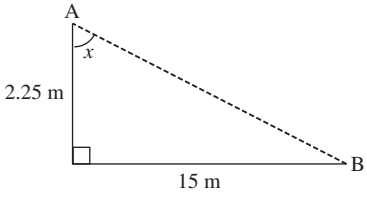


AU 3 The sensor for a security light is fixed to a house wall 2.25 m above the ground. It can detect movement on the ground up to 15 m away from the house. B is the furthest point where the sensor, A, can detect movement.
Calculate the size of angle x.

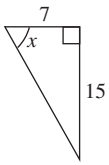


5.9 Which ratio to use

HOMEWORK 5K

1 Find the angle or length marked x in each of these triangles.

a



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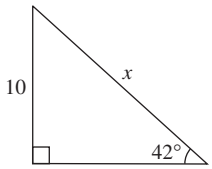

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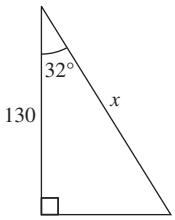

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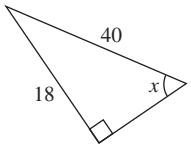

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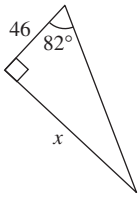

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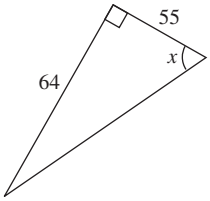
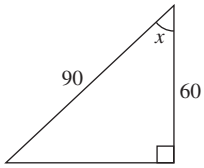


g



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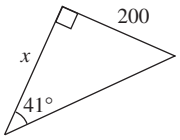
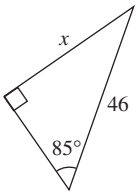
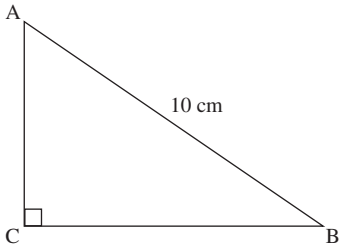


i



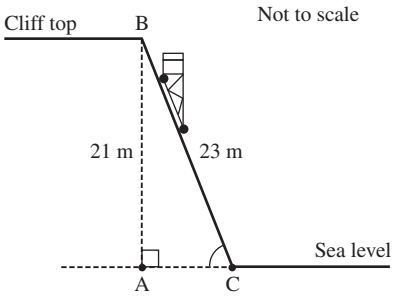
2 The diagram shows a right-angled triangle, ABC.
Angle C = 90° and AB = 10 cm
Given that cos B = 0.8, sin B = 0.6 and tan B = 0.75, calculate the length of AC.



3 A lift at the seaside takes people from sea level to the top of a cliff, as shown.
From sea level to the top of the cliff, the lift travels 23 m, to a height of 21 m.

a Calculate the distance AC. Give your answer to an appropriate degree of accuracy.

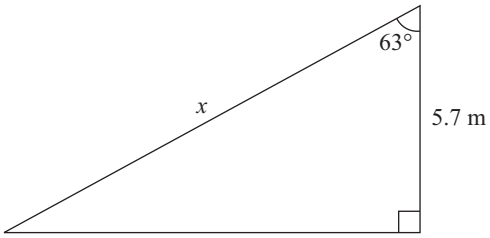
b Calculate angle BCA.



B

B

4 Look at this triangle.



Find the length of side x.

5.10 Solving problems using trigonometry 1

HOMEWORK 5L

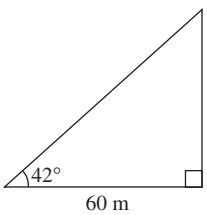
In these questions, give any answers involving angles to the nearest degree.

B

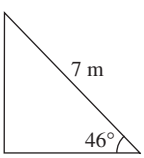
1 A ladder, 8 m long, rests against a wall. The foot of the ladder is 2.7 m from the base of the wall. What angle does the ladder make with the ground?

FM 2 The ladder in Question **1** has a 'safe angle' with the ground of between 70° and 80°. What are the safe limits for the distance of the foot of the ladder from the wall?

3 Angela walks 60 m from the base of a block of flats and then measures the angle from the ground to the top of the flats to be 42° as shown in the diagram. How high is the block of flats?

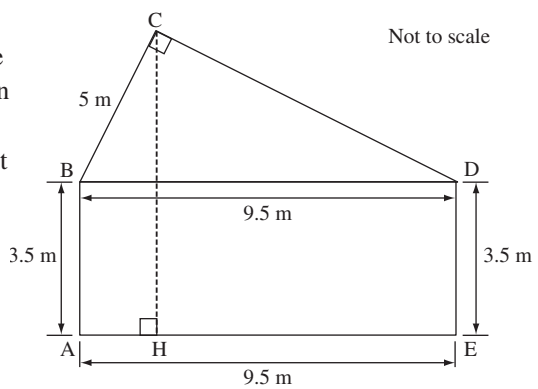


4 A slide is at an angle of 46° to the horizontal. The slide is 7 m long. How high is the top of the slide above the ground?



5 Use trigonometry to calculate the angle that the diagonal makes with the long side of a rectangle 9 cm by 5 cm.

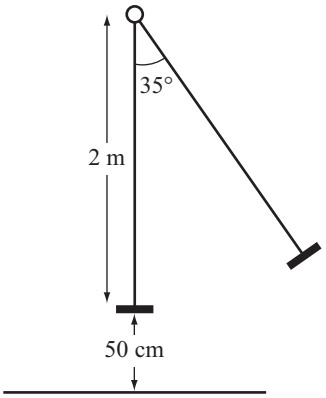
FM 6 Drumsbury Town Council wants to put up a flag pole outside the town hall. The diagram shows the end view of the town hall building.
Regulations state that the flag pole must not be more than half the height of the building.
What is the maximum height that the flag pole can be?



AU 7 A road rises steadily at an angle of 6°. A lorry travels 300 m along the road. What is the increase in height?

B

FM 8 A swing at rest is 50 cm above the ground and 2 m below the point of suspension. When a child is on the swing, the angle with the vertical can be as large as 35°.



The child's father thinks that she might then be dangerously far from the ground. Can you tell him exactly how far his daughter will be above the ground?

HOMEWORK 5M

In these questions, give any answers involving angles to the nearest degree.

B

1 Eric sees an aircraft in the sky. The aircraft is at a horizontal distance of 15 km from Eric. The angle of elevation is 42°. How high is the aircraft?

2 A man standing 100 m from the base of a block of flats, looks at the top of the block and notices that the angle of elevation is 49°. How high is the block of flats?

3 A man stands 15 m from a tree. The angle of elevation of the top of the tree from his eye is 25°. If his eye is 1.5 m above the ground, how tall is the tree?

4 A bird, sitting at the very top of the tree in Question **3**, sees a worm next to the foot of the man. What is the angle of depression from the bird's eye to the worm?

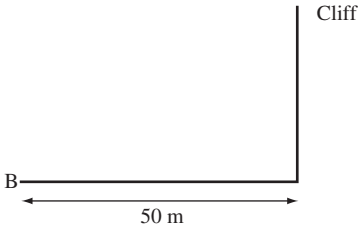
5 I walk 200 m away from a chimney that is 120 m high. What is the angle of elevation from my eye to the top of the chimney? (Ignore the height of my eye above the ground.)

6 If you are now told that the height of my eye in Question **5** is 1.8 m above ground, how much different is the angle of elevation?

AU 7 Boat B is moored 50 m from the foot of a vertical cliff. The angle of depression of the boat from the top of the cliff is 52°.

a Calculate the height of the cliff.

b The boat is released from its mooring and it drifts 350 m further away from the cliff. Calculate the angle of elevation of the top of the cliff from the boat.



8 A boat is 450 m from the base of a cliff. The angle of elevation of the top of the cliff is 8°. How high is the cliff?

B

FM 9 To find the height of a tree, Sacha tries to measure the angle of elevation of the top from a point 40 m away.
He finds it difficult to measure the angle accurately, but thinks it is between 30° and 35°.
What can you tell him about the height of the tree?

5.11 Solving problems using trigonometry 2

HOMEWORK 5N

B

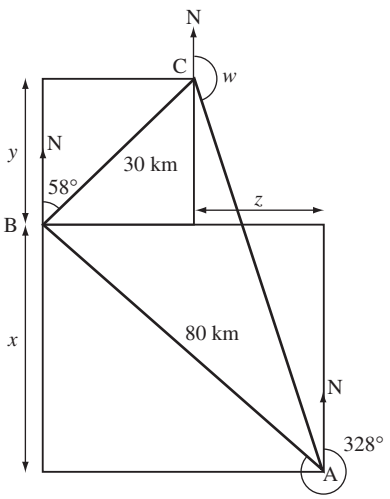
1 A ship sails for 85 km on a bearing of 067°.
- **a** How far east has it travelled?
- **b** How far north has the ship sailed?

2 Rotherham is 11 miles south of Barnsley and 2 miles west of Barnsley.
What is the bearing of:
- **a** Barnsley from Rotherham
- **b** Rotherham from Barnsley?

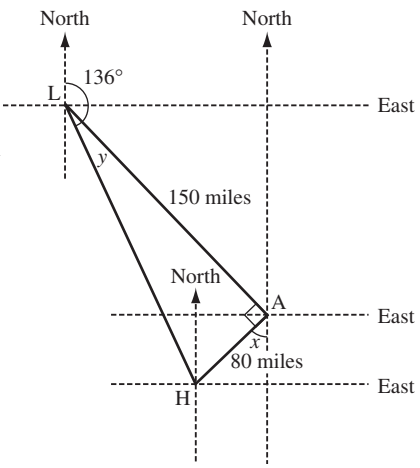
3 A plane sets off from airport A and flies due east for 100 km, then turns to fly due south for 80 km before landing at an airport B. What is the bearing of airport B from airport A?

FM 4 Mountain A is due east of a walker. Mountain B is due south of the walker.
The guidebook says that mountain A is 5 km from mountain B, on a bearing of 038°.
How far is the walker from mountain B?

5 The diagram shows the relative distances and bearings of three ships A, B and C.
- **a** How far north of A is B?
(Distance x on diagram.)
- **b** How far north of B is C?
(Distance y on diagram.)
- **c** How far west of A is C?
(Distance z on diagram.)
- **d** What is the bearing of A from C?
(Angle w on diagram.)



AU 6 An aeroplane is flying from Leeds (L) to London Heathrow (H). It flies 150 miles on a bearing 136° to point A. It then turns through 90° and flies the final 80 miles to H.
- **a** **i** Show clearly why the angle marked x is equal to 46°.
ii Give the bearing of H from A.
- **b** Use Pythagoras' theorem to calculate the distance LH.
- **c** **i** Calculate the size of the angle marked y.
ii Work out the bearing of L from H.



B

AU 7 A plane flies 200 km on a bearing of 124° and then 150 km on a bearing of 053°.
How far east from its starting point has it travelled?

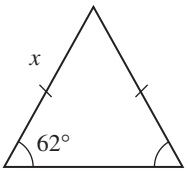
FM 8 Large boats are supposed to stay at least 300 m from the shore near a particular beach.
Don notices a large boat that is due north from where he is sitting on the beach.
He walks 100 m to the east and uses a compass to find that the bearing of the boat is 340°.
Is the boat breaking the rules?

HOMEWORK 5P

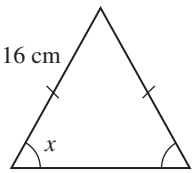
B

1 Find the side or angle marked x.

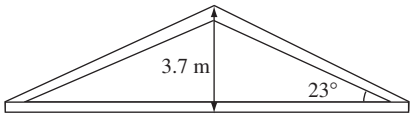
a



b

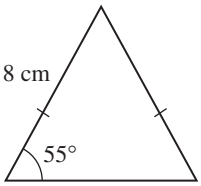


2 This diagram shows a roof truss.
How wide is the roof?

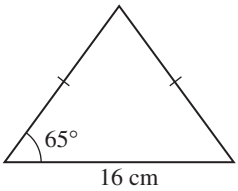


3 Calculate the area of each triangle.

a



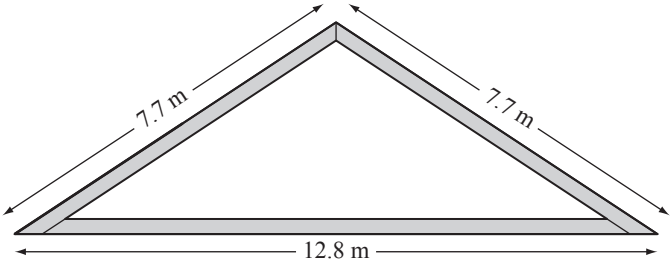
b



4 An isosceles triangle has two sides of 12 cm and an angle of 62°.
Calculate both possible areas.

AU 5 The largest angle of an isosceles triangle is 152° and the longest side is 60 cm.
Calculate the area of the triangle.

FM 6 Hugo is using roof trusses with the dimensions shown in this diagram.



What is the angle of slope of the roof?

Functional Maths Activity
Access ramps

Building regulations in the UK state how steep wheelchair ramps used to access buildings are allowed to be.

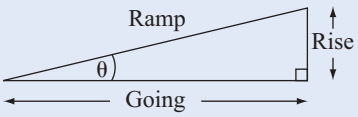
Going	Maximum gradient	Maximum rise
10 m	1:20	500 mm
5 m	1:15	333 mm
2 m	1:12	166 mm

Below are some definitions of the jargon used. The diagram that follows illustrates how they are used in practice.

Going: The horizontal length.

Gradient: The tangent of the angle the ramp makes with the horizontal. Here it is written as a ratio.

Rise: The change in height from one end of the ramp to the other.



Gradient = $\tan\theta$

You can add to the table, using different lengths for the going. Try adding the maximum gradient and maximum rise for goings of 4 m and 9 m, following the number patterns in the table.

A builder has asked you to explain a few things that are puzzling him.

a Is there a connection between the numbers in the three columns?

b What is the difference between the maximum angles for a 2 m going and a 10 m going?

c The builder has been asked to install an access ramp to an old building. The rise required is 400 mm. In order not to exceed the available space, he wants to build a ramp with a 7 m going. Is this permitted, according to the regulations? Explain how you would decide.

5 Geometry: Pythagoras' theorem and trigonometry

5.1 Pythagoras' theorem

HOMEWORK 5A

1 **a** 5 cm **b** 4.41 cm **c** 10.6 cm
d 35.4 cm **e** 20 cm **f** 19.2 cm

2 **a** 40.15 m **b** 2100 m^3

3 15 cm, because $7.5^2 + 10^2 = 12.5^2$

4 3.81 metres, so the beam is long enough

5.2 Finding a shorter side

HOMEWORK 5B

1 **a** 23.7 cm **b** 22.3 cm **c** 6.9 cm
d 32.6 cm **e** 8.1 cm **f** 760 m
g 0.87 cm **h** 12 m

2 **a** 10 m **b** 27.2 cm **c** 29.4 m
d 12.4 cm

3 6.7 m

4 a = 8.2 cm b = 8.0 cm

5 No, the ladder will only reach 3.6 metres

6 3 cm and 5 cm

5.3 Applying Pythagoras' theorem in real-life situations

HOMEWORK 5C

1 9 m

2 3.23 m

3 14.14 m

4 10 km

5 3.22 km

6 **a** 7.9 m **b** 3.9 m

7 $\sqrt{2}$

8 12 cm^2

9 Yes, $61^2 = 60^2 + 11^2$

10 14.76 units

11 **a** 1 cm represents 2.5 km **b** 40.4 km

12 12.7 metres

13 The diagonal of the drawer is $\sqrt{(40^2 + 33^2)}$ = 51.8 cm, so it will fit in the drawer if it is put in at an angle.

HOMEWORK 5D

1 32.8 cm^2, 9.17 cm^2

2 36.7 cm^2

3 43.3 cm^2

4 **a** 173.2 cm^2

b Only the lengths have doubled; the area has quadrupled.

5 **a** Student's sketches

b 8, 8, 6 has area 22.25 cm^2 and 6, 6, 8 has 17.9 cm^2

6 54.5 mm^2

7 56.7%

8 49 cm or 49.2 cm

5.4 Pythagoras' theorem in three dimensions

HOMEWORK 5E

1 Yes

2 **a** **i** AC = 12.8 cm **ii** BG = 11.7 cm **iii** BE = 10.0 cm

b BH = 14.1 cm

3 Yes

4 **a** 21 cm and 18.4 cm **b** 13.4 cm

5 14.1 m and 14.5 m

6 **a** DG = 11.2 cm **b** HA = 7.1 cm **c** DB = 11.2 cm

d AG = 12.2 cm

7 26 cm

8 14.1 cm

9 **a** AC = 9.9 cm **b** EX = 10.9 cm **c** EM = 11.5 cm

10 42 cm

5.5 Trigonometric ratios

HOMEWORK 5F

1 **a** 0.788 **b** 0.719 **c** 0.972

d 1

2 **a** 0.616 **b** 0.695 **c** 0.237

d 0

3 **a** 1 **b** 1 **c** 1

d 1 **e** All 1

4 **a** 1.280 **b** 1.036 **c** 4.102

d 0

5 **a** 1.280 **b** 1.036 **c** 4.102

d 0 **e** same

6 **a** 4.915 **b** 4.950 **c** 11.967

d 15.626

7 **a** 7.325 **b** 9.899 **c** 14.123

d 25.60

8 Sin $x = \frac{5}{13}$, cos $x = \frac{12}{13}$, tan $x = \frac{5}{12}$

9 Tan $x = \frac{5}{3}$

5.6 Calculating angles

HOMEWORK 5G

1 **a** 23.6° **b** 45.0° **c** 61.5°
d 41.8°

2 **a** 66.4° **b** 45.0° **c** 28.5°
d 70.5°

3 **a** 21.8° **b** 51.1° **c** 41.2°
d 69.1°

4 **a** 22.0° **b** 19.5° **c** 17.5°
d 38.7°

5 **a** 68.0° **b** 70.5° **c** 72.5°
d 51.3

6 **a** 20.6° **b** 56.3° **c** 35.5°
d 75.3°

7 36.0°

5.7 Using the sine and cosine functions

HOMEWORK 5H

1 **a** 15.7 **b** 21.3 **c** 80.9°
d 18.6 **e** 30° **f** 97.1

2 **a** 3.5 **b** 14.95 **c** 17.5

3 **a** 11.5 km **b** 230°

HOMEWORK 5I

1 **a** 67.4° **b** 11.3 **c** 42.8°
d 20.5 **e** 72.1 **f** 54.1°

2 **a** 14 **b** 45 **c** 3.5

3 **a** 6.71 km **b** 48.2°

5.8 Using the tangent function

HOMEWORK 5J

1 **a** 15.3 **b** 4.6 **c** 53.4°
d 7.64 **e** 29.1° **f** 29.9

2 **a** 6 **b** 30 **c** $\frac{10}{3}$

3 81.5°

5.9 Which ratio to use

HOMEWORK 5K

1 **a** 65.0° **b** 14.9 **c** 153.3
d 26.7° **e** 327 **f** 49.3°
g 48.2° **h** 230 **i** 45.8

2 6 cm

3 **a** 9.4 m **b** 65.9°

4 12.6 cm

5.10 Solving problems using trigonometry 1

HOMEWORK 5L

1 70.3°
2 2.74 m to 1.39 m
3 54 m
4 5.04 m
5 29°
6 3.88 m
7 31 metres
8 The swing will rise to a maximum height of 86 cm, or 36 cm above its initial height.

HOMEWORK 5M

1 13.5 km
2 115 m
3 8.5 m
4 29.5° (30° to the nearest degree)
5 31°
6 0.4° (0° to the nearest degree)
7 **a** 64 m **b** 9.1° (9° to the nearest degree)
8 63 metres
9 It is probably between 23 and 28 metres high.

5.11 Solving problems using trigonometry 2

HOMEWORK 5N

1 **a** 78.2 km **b** 33.2 km
2 **a** 10.3° **b** 190.3°
3 128.7°
4 3.94 km
5 **a** 67.8 km **b** 15.9 km **c** 17.0 km
d 168.6°
6 **a** **i** Example of proof: Remaining angle at L between LA and the vertical is 180 – 136 = 44° (angles on a straight line). Therefore the angle at A between LA and the vertical (North) is 44° because LA is transversal between the two North parallel lines. Therefore x = 180 – 90 – 44 = 46° (angles on a straight line).
ii 226°
b 170 km
c **i** 28.1° **ii** 344.1°
7 286 kilometres
8 Yes: it is only 275 metres from the shore.

HOMEWORK 5P

1 **a** 9.59 cm **b** 20.4°

2 17.4 m

3 **a** 30.1 cm^2 **b** 137.2 cm^2

4 63.6 cm^2, 59.7 cm^2

5 224 cm^2

6 34°

Functional Maths Activity

Access ramps

a The ratio of the maximum rise to the going is equal to the gradient.

b The angles are 2.9 degrees and 4.7 degrees, a difference of 1.9 degrees.

c Yes. By interpolation, the maximum gradient is 1 : 17 and the corresponding maximum rise is 412 mm, which is greater than the 400 mm he wants.

