



Using Pythagoras' theorem to solve problems

Year 8 About 70 minutes Calculator allowed 45 marks

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark]

Work out $17^2 - 8^2$.

A2 Needed today [1 mark]

Write $\sqrt{90}$ to 1 decimal place.

Answer

Answer

- A3** Last lesson [1 mark]

A right-angled triangle has shorter sides 9 cm and 40 cm. How long is the hypotenuse?

A4 Year 7 [1 mark]

Change 2.4 km into metres.

Answer

Answer

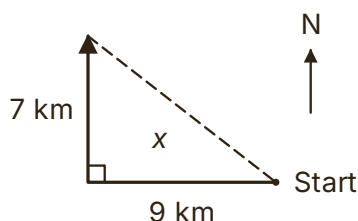
B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it. First find the right angle, then decide: is the side you want the hypotenuse, or a shorter side?

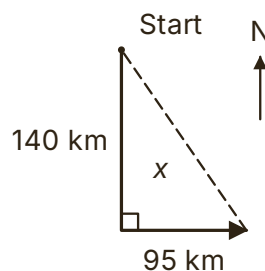
EXAMPLE 1

A ship sails 9 km due west, then 7 km due north. How far is it now from where it started? Give your answer to 1 decimal place.



Hint The two legs meet at a right angle. The direct distance is the hypotenuse.

- B1** A plane flies 140 km due south, then 95 km due east. How far is it from where it started? Give your answer to 1 decimal place. [2 marks]

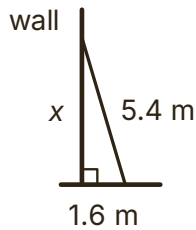


Not drawn accurately

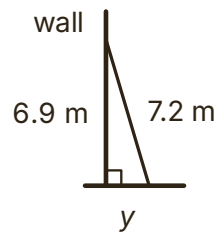
Answer ... km

EXAMPLE 2

A 5.4 m ladder leans against a wall. Its foot is 1.6 m from the wall. How far up the wall does it reach? Give your answer to 1 decimal place.



Hint The ladder is the hypotenuse. The height is a shorter side, so subtract.

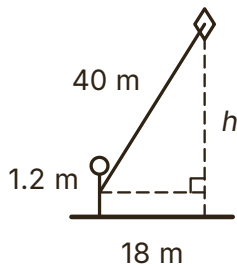
B2 A 7.2 m ladder reaches 6.9 m up a wall. How far is its foot from the wall? Give your answer to 1 decimal place. [2 marks]

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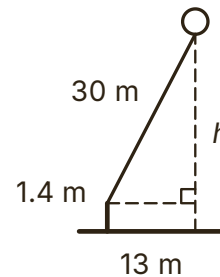
Answer $y = \dots$ m

EXAMPLE 3

Ana flies a kite on a 40 m string. The kite is directly above a point 18 m from Ana. She holds the string 1.2 m above the ground. How high is the kite above the ground? Give your answer to 1 decimal place.



Hint The right-angled triangle starts at Ana's hand, not at the ground. Find its height, then add 1.2 m.

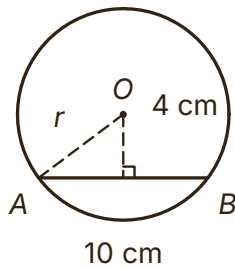
B3 A balloon is tied to the top of a 1.4 m post by a 30 m rope. The balloon is directly above a point 13 m from the post. How high is the balloon above the ground? Give your answer to 1 decimal place. [3 marks]

Not drawn accurately

Answer $h = \dots$ m

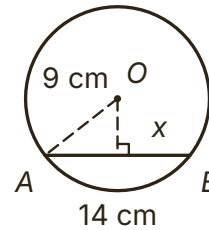
EXAMPLE 4

AB is a chord of a circle, centre O . $AB = 10$ cm and $OM = 4$ cm, where M is the mid-point of AB . Work out the radius and the diameter, to 1 decimal place.



Hint OM meets AB at a right angle, and AM is half of AB . The radius OA is the hypotenuse.

- B4** A circle, centre O , has radius 9 cm. [3 marks]
A chord AB is 14 cm long.
How far is the chord from O ?
Give your answer to 1 decimal place.



Not drawn accurately

Answer $x = \dots$ cm

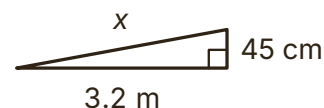
c Practice

Year 8

- C1** Two sides of a right-angled triangle are 9 cm and 14 cm. [3 marks]
Work out the two possible lengths of the third side. Give your answers to 1 decimal place.
- C2** In triangle XYZ , angle $Y = 90^\circ$, [2 marks]
 $XZ = 7.25$ m and $XY = 4.18$ m.
Work out the length of YZ . Give your answer to 2 decimal places.

Answer $YZ = \dots$ m

- C3** (a) Show that 12, 35, 37 is a Pythagorean triple. (b) Write [3 marks]
down a Pythagorean triple whose largest number is 74.
- C4** A ramp rises 45 cm over a level [3 marks]
distance of 3.2 m. Work out the length, x , of the ramp in metres. Give your answer to 2 decimal places.



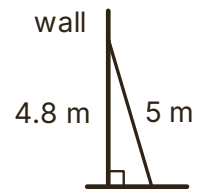
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Answer $x = \dots$ m

- D1** A 5 m ladder reaches 4.8 m up a wall. Tom says, "If I move the foot of the ladder 0.5 m closer to the wall, the top will go 0.5 m higher."

[3 marks]

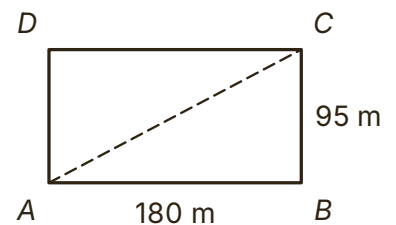
Is Tom right? You must show your working.



Not drawn accurately

- D2** $ABCD$ is a rectangular field. Kai walks from A to C along the edges, through B . Mia walks straight across the field from A to C . How much further does Kai walk than Mia? Give your answer to 1 decimal place.

[4 marks]



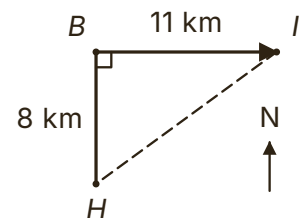
Answer ... m

Not drawn accurately

- D3** A boat sails from a harbour H 8 km due north to a buoy B . It then sails 11 km due east to an island I . It then sails straight back to H .

- (a) Work out the distance from I to H . Give your answer to 1 decimal place.

[2 marks]



Answer ... km

Not drawn accurately

- (b) The boat sails at 12 km/h for the whole trip. How long does the trip take? Give your answer in hours and minutes, to the nearest minute.

[3 marks]

Answer ... hours ... minutes

Total for D3: 5 marks

D4 A circle has its centre at $C(-4, 3)$. It passes through the point $P(5, -2)$.

(a) Work out the radius of the circle. Give your answer to 1 decimal place.

[2 marks]

Answer ... units

(b) Does the circle pass through the point $Q(1, 9)$? You must show your working.

[2 marks]

Total for D4: 4 marks

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 Two boats leave a harbour at the same time. One sails due north at 10 km/h. The other sails due east at 24 km/h. How long is it until they are 39 km apart? [4 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** After 1 hour, how far has each boat sailed? How far apart are they then?
- Hint 2** After 1 hour they are 10 km and 24 km from the harbour, so $\sqrt{10^2 + 24^2} = 26$ km apart. Every hour they get 26 km further apart.
- Hint 3** $39 \div 26 = 1.5$ hours, which is 1 hour 30 minutes.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can draw the right-angled triangle in a problem. ☐ ☐ ☐
- I can decide whether I need the hypotenuse or a shorter side. ☐ ☐ ☐
- I can solve problems with ladders, journeys, kites and chords of circles. ☐ ☐ ☐
- I can give an answer to a sensible degree of accuracy. ☐ ☐ ☐