




19

Stretch lesson: Problem solving with trigonometry

Stretch objectives

Before you start this chapter, mark how confident you feel about each of the statements below:

I can apply Pythagoras' theorem, bearings and trigonometry to more complex problems.

19.1 Problem solving

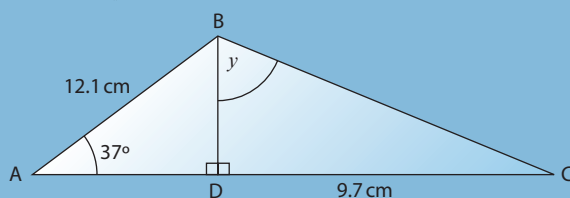
There will usually be a question on one of the exam papers which involves you applying **trigonometry**, **Pythagoras' theorem**, or both.

The problems often require you to complete a number of steps before you reach the final answer.

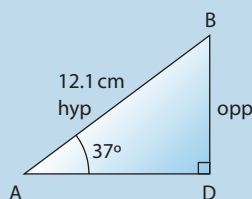
Example 1 **Q** The diagram shows a triangle ABC.

$AB = 12.1$ cm, $CD = 9.7$ cm, $\hat{B}AD = 37^\circ$.

Calculate the size of the angle marked y . Give your answer correct to one decimal place.



A First find the length of BD.

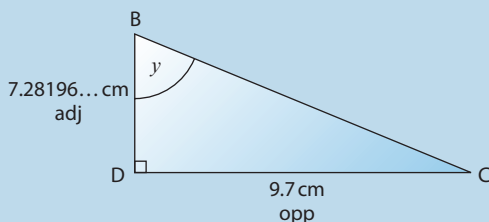


$$\sin 37^\circ = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 37^\circ = \frac{BD}{12.1}$$

$$\begin{aligned} BD &= 12.1 \times \sin 37^\circ \\ &= 7.28196\dots \text{ cm} \end{aligned}$$

Then find the size of angle y .



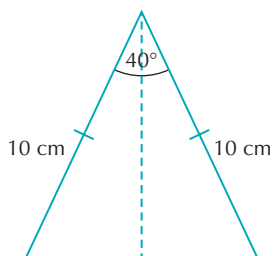
$$\begin{aligned}\tan y &= \frac{\text{opp}}{\text{adj}} \\ &= \frac{9.7}{7.28196\dots} \\ y &= \tan^{-1}(1.33205\dots) \\ &= 53.103\dots \\ &= 53.1^\circ \text{ (1 d.p.)}\end{aligned}$$

Exam tips Remember not to round numbers until the last line of your working.

Practice questions

- 1 A ship leaves port A and sails on a bearing of 025° for 50 km.
How far east of port A is the ship?

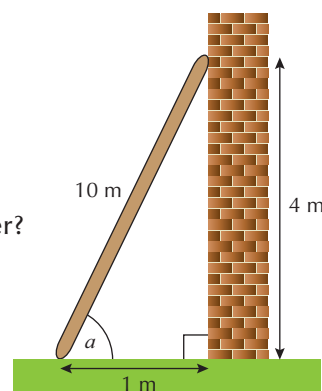
- 2 Calculate the area of the triangle.



Hint

Remember, area of a triangle = $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$, so start by working out the perpendicular height.

- 3 In order to use a ladder safely, the rule is: '1 unit out for every 4 units up'.
Eva has a 10 m ladder. She places the ladder against a wall following the safety rule.
- How far up the wall does the ladder reach?
 - How far from the base of the wall is the bottom of the ladder?

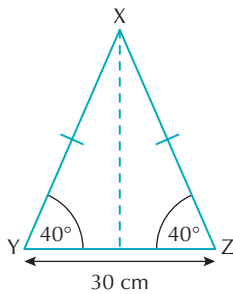


- 4 Martin walks 40 metres due north. He then walks on a bearing of 150° until he is directly east of his starting point.
What is the shortest distance back to his starting point?
Give your answer correct to one decimal place.

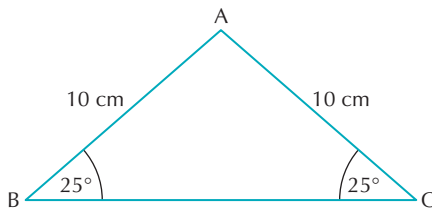
Exam-style questions

- 1 A boat sails 400 metres in a straight line from a jetty.
The position of the boat is then 300 metres east in relation to the position of the jetty.
Work out the two possible bearings the boat could have sailed on.

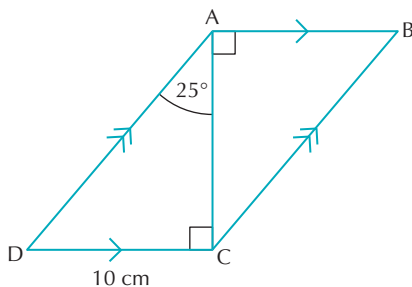
- 2 XYZ is an isosceles triangle.
Work out the area of the triangle.
Remember: area of a triangle = $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$



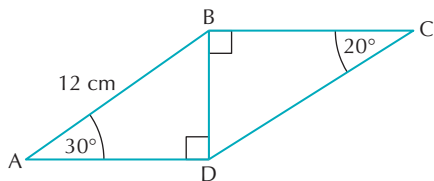
- 3 ABC is an isosceles triangle.
Work out the area of the triangle.



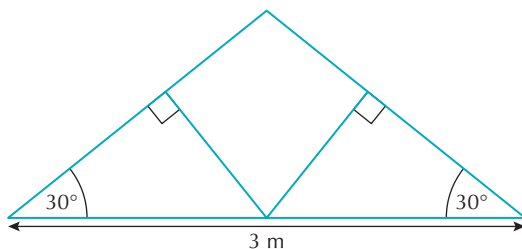
- 4 ABCD is a parallelogram as shown.
DC = 10 cm and angle DAC = 25°.
Calculate the length of BC.
Give your answer correct to one decimal place.



- 5 ABCD is a quadrilateral as shown.
 AB = 12 cm, angle A = 30° and angle C = 20° .
 Calculate the length CD.
 Give your answer correct to one decimal place.



- 6 Alex designs a symmetrical timber frame for a shed roof she is building.
 The diagram shows one piece of the frame.
 Calculate the total length of wood needed for this piece.



- 7 Rafiq walks on a bearing of 040° for 55 metres.
 He then turns and walks on a bearing of 060° for 70 metres.
- In relation to his starting point, work out:
 - how far north he is
 - how far east he is.
 - On what bearing should he walk to return directly to his starting point?
- 8 Sandya stands 50 metres from the base of a house which has a chimney.
 She measures the angle of elevation to the top and bottom of the chimney as 54° and 52° respectively.
 Work out the height of the chimney.

Chapter 19 Stretch lesson: Answers

19.1 Problem solving

- 1 21.1 km
- 2 32.14 cm^2
- 3 **a** 9.7 m **b** 2.4 m
- 4 23.1 m

Exam-style questions

- 1 049° and 131°
- 2 188.8 cm^2
- 3 38.3 cm^2
- 4 23.7 cm
- 5 17.5 cm
- 6 7.96 m
- 7 **a** 77.1 m **b** 96.0 m **c** 231°
- 8 4.82 m