

## Trigonometry Problems

- 1 A ladder is placed against a wall. The foot of the ladder is 1.4m away from the wall. The wall is 8m high. Seventy-five centimetres of the ladder is above the height of the wall.
  - a. At what angle is the ladder leaning against the wall?
  - b. How long is the ladder?
  
- 2 A ladder is placed against a wall. The foot of the ladder is 1.25m away from the wall. The wall is 7m high. One metre of the ladder is above the height of the wall.
  - a. At what angle is the ladder leaning against the wall?
  - b. How long is the ladder?
  
- 3 A golfer is approaching the green. In front of the green, there are some trees that are 12m high. The ball is 30m from the trees.
  - a. At what angle must the golfer hit the ball to clear the trees?
  - b. How far must the ball travel before being over the trees?
  
- 4 A footballer kicks the ball towards the opponents' goal mouth. The player is 14 m away from the goal line. He kicks the ball at an angle of  $14^\circ$ . Assume that the ball travels in a straight trajectory, ie is not affected by gravity. The height of the goal posts are 2m.
  - a. Does the player score?
  - b. If the goal keeper covers all the space up to 1.42m in the goal, what is the minimum angle that the ball needs kicking to get a goal?
  
- 5 A ship leaves Dover and sails on a heading of  $240^\circ$  for 45km. The ship turns to a new heading of  $150^\circ$  and sails 20km.
  - a. How far from Dover does the ship end up?
  - b. If the ship was to sail directly back to Dover, at what angle should it sail?
  
- 6 An aircraft takes off from Leeds Bradford airport and flies on a heading of  $200^\circ$  for 150km. The aircraft is told to turn  $90^\circ$  port and fly for 70km.
  - a. On what heading is the aircraft flying for the second leg of its journey?
  - b. On what heading would the aircraft need to fly to return directly to Leeds Bradford airport?
  - c. How far would the aircraft need to fly to return to the airport?
  
- 7 A glider takes off from an aerodrome. It takes off using a winch. When the winch is released, it is at an angle of  $62^\circ$ . The winch is 1200m long.
  - a. What is the altitude of the glider when the winch releases?
  - b. If the glider falls at an average angle of  $3^\circ$ , how far will the flight be?

**Tips for answering the questions overleaf:**

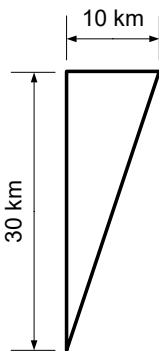
1. Draw a diagram.
2. All the questions involve right angled triangles and trigonometry.
3. Choose whether you are finding an angle or a length. Remember that if you are finding a length, you need to use Sin, Cos or Tan. If you are finding an angle, you use  $\text{Sin}^{-1}$ ,  $\text{Cos}^{-1}$  or  $\text{Tan}^{-1}$ .
4. Make sure you write a sentence giving the answer to the question in the context that the question was asked.

**Example Question**

A farmer drove his Land Rover along a straight road for 30km. At that point, the farmer made a right turn and drove through moorland for another 10km.

- a How far was the driver from his original starting position?
- b At what angle should the driver travel to return to his original starting point?

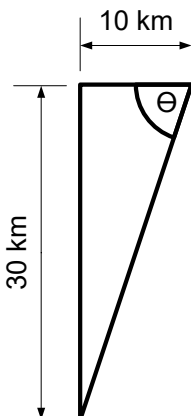
a.



By Pythagoras Theorem: In a right angled triangle, the square of the hypotenuse is equal to sum of the squares of the other two sides.

$$\begin{aligned}c^2 &= a^2 + b^2 \\&= 30^2 + 10^2 \\&= 900 + 100 \\&= 1000 \\ \therefore c &= \sqrt{1000} \\ &\approx 31.623 \text{ km}\end{aligned}$$

b.  $\sin \theta = \frac{\textit{Opposite}}{\textit{Hypotenuse}}$        $\cos \theta = \frac{\textit{Adjacent}}{\textit{Hypotenuse}}$        $\tan \theta = \frac{\textit{Opposite}}{\textit{Adjacent}}$



I have the opposite and the adjacent sides in relation to the angle marked on the triangle as  $\theta$ .

Therefore, I need to use Tangent.

$$\begin{aligned}\tan \theta &= \frac{\textit{Opposite}}{\textit{Adjacent}} \\&= \frac{30}{10} \\&= 3 \\ \therefore \theta &= \tan^{-1} 3 \\&= 71.5650118^\circ \\&= 71^\circ 33' 54.184''\end{aligned}$$

To find the heading the farmer would need to follow with a compass, you would need to take account that the angle is in relation to  $270^\circ$ , due West and so:

$$270 - 71^\circ 33' 54.184'' = 198^\circ 26' 5.816''$$