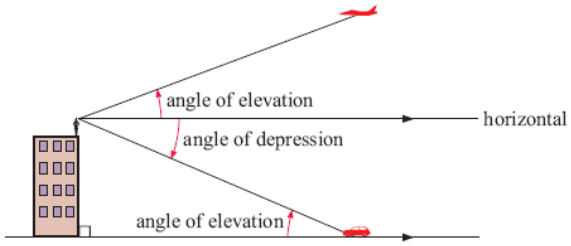
D PROBLEM SOLVING USING TRIGONOMETRY

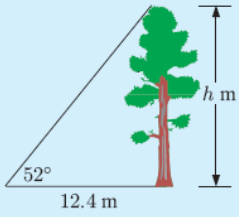
Trigonometry is a very useful branch of mathematics. **Heights** and **distances** which are very difficult or even impossible to measure can often be found using trigonometry.

ANGLES OF ELEVATION AND DEPRESSION

The angle between the horizontal and your line of sight to an object is called the **angle of elevation** if you are looking upwards, or the **angle of depression** if you are looking downwards.



When measured from a point 12.4 m from its base, the angle of elevation to the top of a tree is 52°. Find the height of the tree.



Let h be the tree's height in metres.

For the 52° angle, OPP $= h$ and ADJ $= 12.4$

$$\therefore \tan 52^\circ = \frac{h}{12.4}$$

$$\therefore 12.4 \times \tan 52^\circ = h$$

$$\therefore h \approx 15.9$$

So, the tree is 15.9 m high.

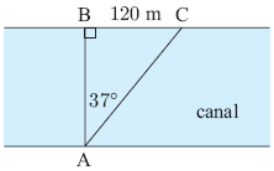
EXERCISE 15D

1 When measured from a point 9.32 m from its base, the angle of elevation to the top of a flagpole is 63°. Find the height of the flagpole.

2 A hill is inclined at 18° to the horizontal. It runs down to the beach with constant gradient so its base is at sea level.

a If I walk 1.2 km up the hill, what is my height above sea level?

b If I am 500 metres above sea level, how far have I walked up the hill?

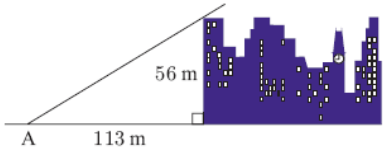
3 

A surveyor standing at A notices two posts B and C on the opposite side of a canal. The posts are 120 m apart. If the angle of sight between the posts is 37°, how wide is the canal?

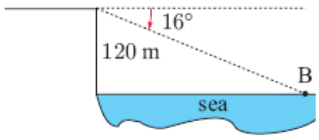
4 A train must climb a constant gradient of 5.5 m for every 200 m of track. Find the angle of incline.

5 a Find the angle of elevation to the top of a 56 m high building from point A, which is 113 m from its base.

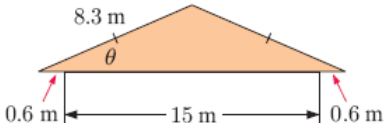
b What is the angle of depression from the top of the building to A?



6 The angle of depression from the top of a 120 m high vertical cliff to a boat B is 16°.
How far is the boat from the base of the cliff?



7 Find θ, the pitch of the roof.



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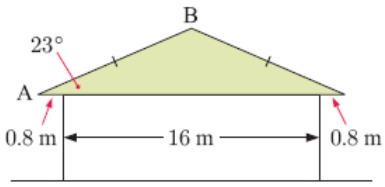
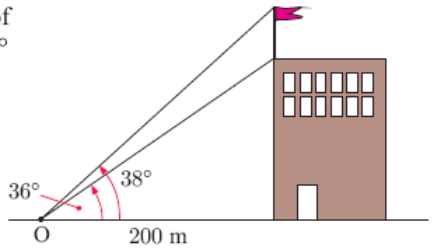


The pitch of the given roof is 23°. Find the length of the timber beam AB.

9 From an observer O, 200 m from a building, the angles of elevation to the bottom and the top of a flagpole are 36° and 38° respectively. Find the height of the flagpole.



10 Kylie measures a 32° angle of elevation from a point on level ground to the top of a building 120 metres high. She walks towards the building until the angle of elevation is 45°. How far does she walk?

11 The angle of depression from the top of a 150 m high cliff to a boat at sea is 7°. How much closer to the cliff must the boat move for the angle of depression to become 19°?