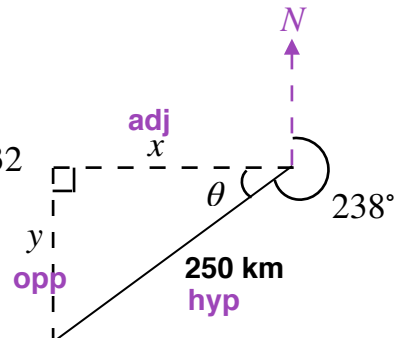


Angles of elevation and depression

Starter

1. **(Review of last lesson)** A ship sails 250 km on a bearing of 238° . How far has it travelled (a) west (b) south? Give your answers to the nearest kilometre.

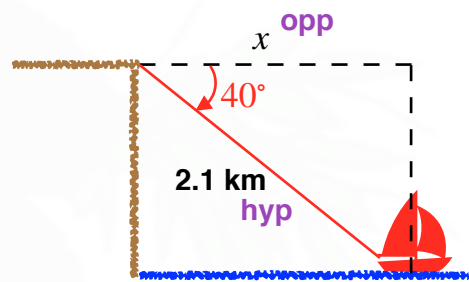
Working: (a) $\theta = 270 - 238 = 32^\circ$
 adj and hyp \Rightarrow cos
 $\cos \theta = \frac{\text{adj}}{\text{hyp}}$: $\cos 32 = \frac{x}{250}$
 $x = 250 \cos 32$
 $x \approx 212.0$
 Distance travelled west is 212 km



(b) opp and hyp \Rightarrow sin
 $\sin \theta = \frac{\text{opp}}{\text{hyp}}$: $\sin 32 = \frac{y}{250}$
 $250 \sin 32 = y$
 $y \approx 132.48$
 Distance travelled south is 132 km

- E.g. 1** A man stands on top of a cliff and spies a sailing boat on the sea. The direct distance from the man to the boat is 2.1 km. The angle of depression is 40° . Find the distance of the boat from the foot of the cliff.

Working: adj and hyp \Rightarrow cos
 $\cos \theta = \frac{\text{adj}}{\text{hyp}}$: $\cos 40 = \frac{x}{2.1}$
 $2.1 \cos 40 = x$
 $x \approx 1.609$

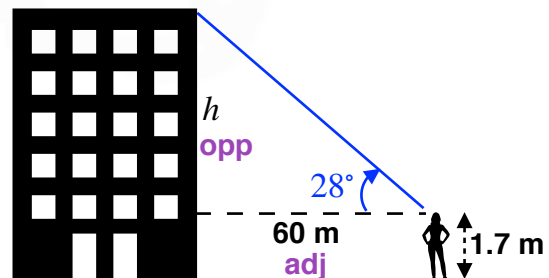


The distance of the boat from the foot of the cliff is 1.61 km (3 s.f.).

- E.g. 2** A woman looks up towards the top of a building. The angle of elevation is 28° . Her distance from the base of the building is 70 m. If her eye is 1.7 m above the ground, find the height of the building.

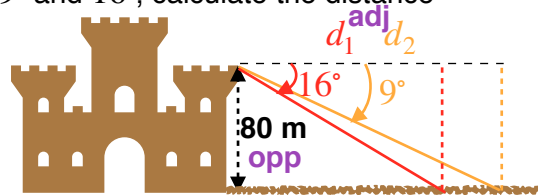
Working: opp and adj \Rightarrow tan
 $\tan \theta = \frac{\text{opp}}{\text{adj}}$: $\tan 28 = \frac{h}{70}$
 $h = 70 \tan 28$

N.B. Do not round half-way through the calculation.



Height = $70 \tan 28 + 1.7 \approx 38.92$
 The height of the building is 38.9 m (3 s.f.).

E.g. 3 From the top of a tower of height 80 m, a guard sees two prisoners both due east of him. If the angles of depression of the two prisoners are 9° and 16° , calculate the distance between them.



Working: Let d_1 and d_2 be the distance of the two prisoners to the tower
opp and adj $\Rightarrow \tan$

$$\tan \theta = \frac{\text{opp}}{\text{adj}}: \quad \tan 9 = \frac{80}{d_1}$$

$$d_1 = \frac{80}{\tan 9}$$

N.B. Do not round half-way through the calculation.

$$\tan \theta = \frac{\text{opp}}{\text{adj}}: \quad \tan 16 = \frac{80}{d_2}$$

$$d_2 = \frac{80}{\tan 16}$$

N.B. Do not round half-way through the calculation.

$$\text{Required distance is } d_1 - d_2 = \frac{80}{\tan 9} - \frac{80}{\tan 16} \approx 226.1$$

The distance between the prisoners is 226 m (nearest metre).

Video 1:

[Angles of elevation and depression](#)

Video 2:

[Angles of elevation and depression](#)

[Solutions to Starter and E.g.s](#)

Exercise

9-1 class textbook:

p572 M18.3 Qu 1-8 Draw a diagram for each question

A*-G class textbook:

p532 M18.3 Qu 1-9 Draw a diagram for each question

9-1 homework book:

p192 M18.3 Qu 1-8 Draw a diagram for each question

A*-G homework book:

p147 M18.3 Qu 1-7 Draw a diagram for each question