Trigonometry
Bearings Problems

Learning Objective

To apply trigonometry to bearings problems.

Success Criteria

- To sketch diagrams from given bearings problems.
- To calculate missing sides in bearings problems with acute angles.
- To calculate missing sides in bearings problems with non-acute angles.

Starter: Bearings

A bearing is how we measure the direction of travel from one place to another.

The unit of measure for bearings is degrees.

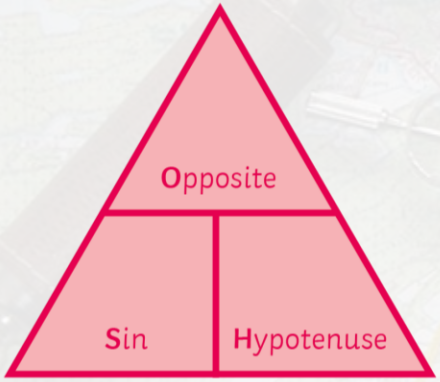
We can use a compass to measure bearings.

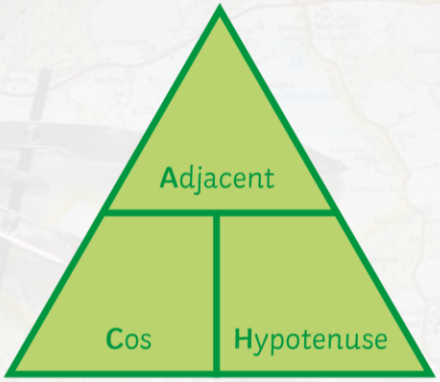
What are the **three rules to remember** when working with bearings?

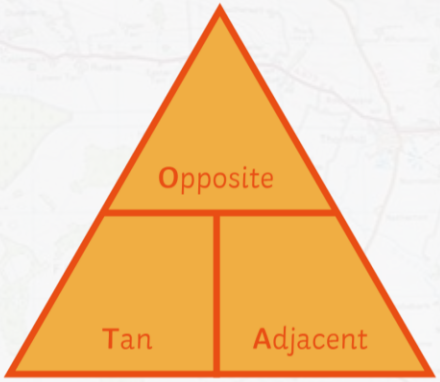
- Always measure a bearing from the **north** line.
- Always measure in a **clockwise** direction.
- Bearings are given in **3 figures**, e.g. 270° or 085°.

SOHCAHTOA

Cover the letter of the part that you want to find.
This tells you which calculation needs to be done.





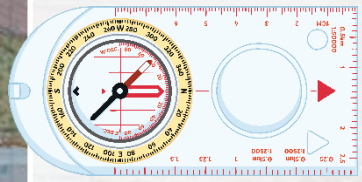


$$\text{Sin } \theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

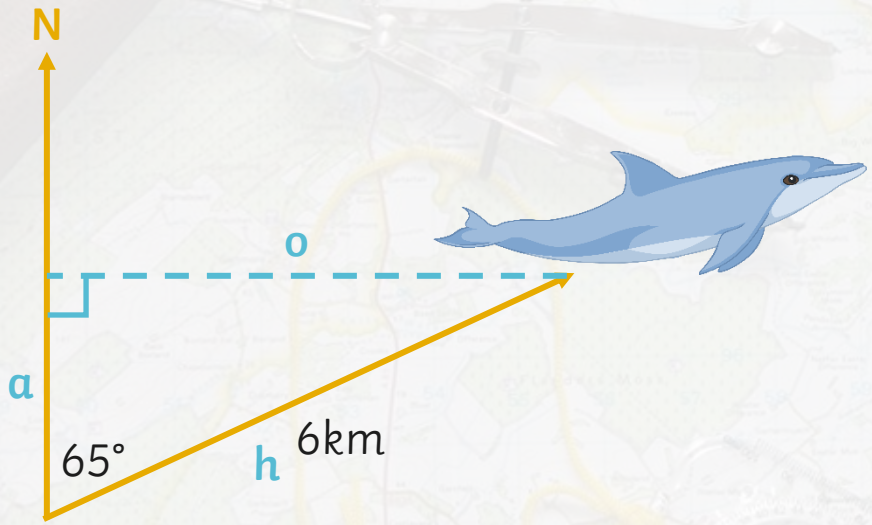
$$\text{Cos } \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Tan } \theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

The Dolphin



A dolphin swims on a bearing of 065° for 6km.
How far **east** is it from its starting position?
Give your answer correct to 1 decimal place.



not to scale

Answer:

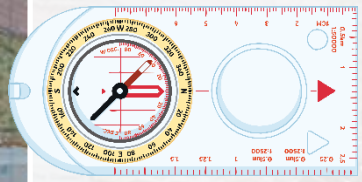
$\sin\theta = \frac{\text{opp}}{\text{hyp}}$

$\sin(65°) = \frac{x}{6}$

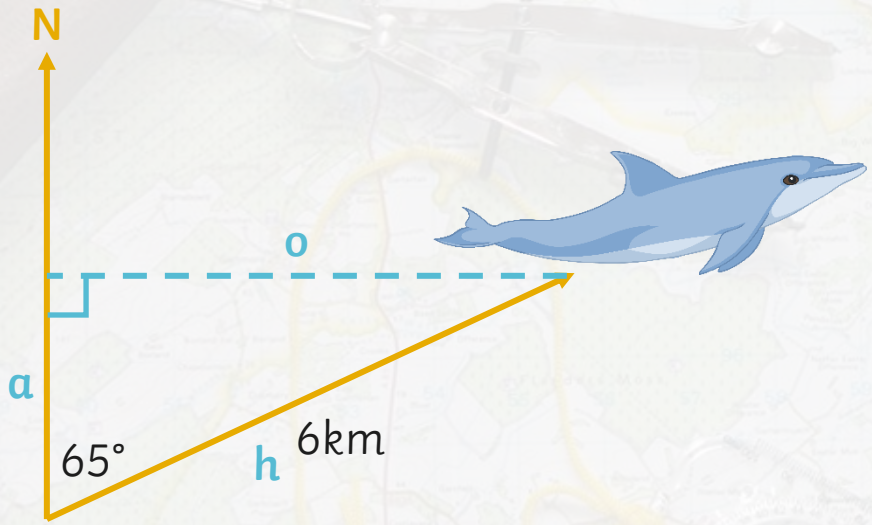
$\sin(65°) \times 6 = x$

$x = 5.4\text{km}$ to 1d.p.

The Dolphin



A dolphin swims on a bearing of 065° for 6km.
How far **north** has it travelled?
Give your answer correct to 1 decimal place.



not to scale

Answer:

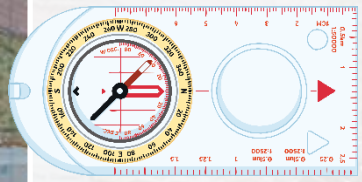
$\cos\theta = \frac{\text{adj}}{\text{hyp}}$

$\cos(65°) = \frac{x}{6}$

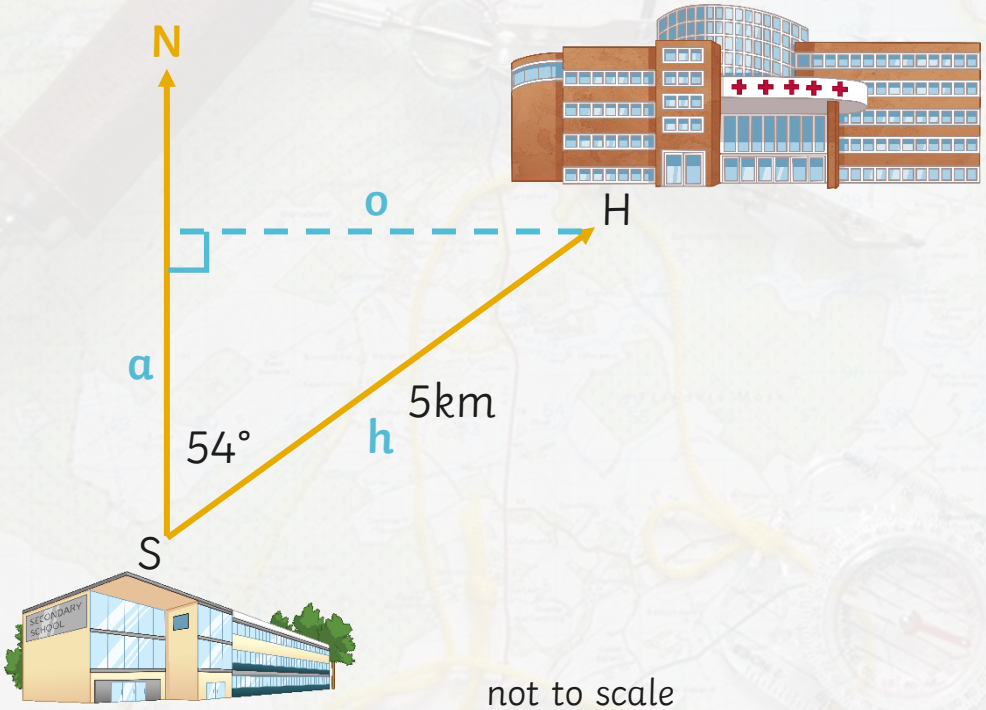
$\cos(65°) \times 6 = x$

$x = 2.5\text{km}$ to 1d.p.

The Hospital



A hospital (H) is 5km away from a school (S) on a bearing of 054°.
How far east of the school is the hospital?
Give your answer correct to 1 decimal place.



not to scale

Answer:

$\sin\theta = \frac{\text{opp}}{\text{hyp}}$

$\sin(54°) = \frac{x}{5}$

$\sin(54°) \times 5 = x$

$x = 4.0\text{km}$ to 1d.p.

Your Turn: Acute Angles

Give your answers correct to 1d.p. where appropriate.

1. A ship sails for 85km on a bearing of 082°.
   a. How far north has it travelled from its starting position?
   b. How far east has it travelled from its starting position?

Remember to sketch a diagram first and label the sides.

a. $\cos(82°) = \frac{x}{85}$

$\cos(82°) \times 85 = 11.8\text{km}$

b. $\cos(82°) = \frac{x}{85}$

$\cos(82°) \times 85 = 84.2\text{km}$

Your Turn: Acute Angles

Give your answers correct to 1d.p. where appropriate.

2. The entrance to a park is on a bearing of 062° from a shop at a distance of 2km. How far east of the shop is the park entrance?

$$\sin(62°) = \frac{x}{2}$$

$$\sin(62°) \times 2 = 1.8\text{km}$$

Your Turn: Acute Angles

Give your answers correct to 1d.p. where appropriate.

3. A seal swims on a bearing of 034° for 12km.
How far north has it travelled?

$$\cos(34°) = \frac{x}{12}$$

$$\cos(34°) \times 12 = 9.9\text{km}$$

Your Turn: Acute Angles

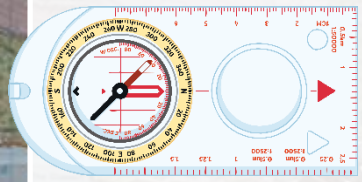
Give your answers correct to 1d.p. where appropriate.

4. Eshal swims on a bearing of 075° for 150m.
How far east is she from her starting position?

$$\sin(75°) = \frac{x}{150}$$

$$\sin(75°) \times 150 = 144.9\text{m}$$

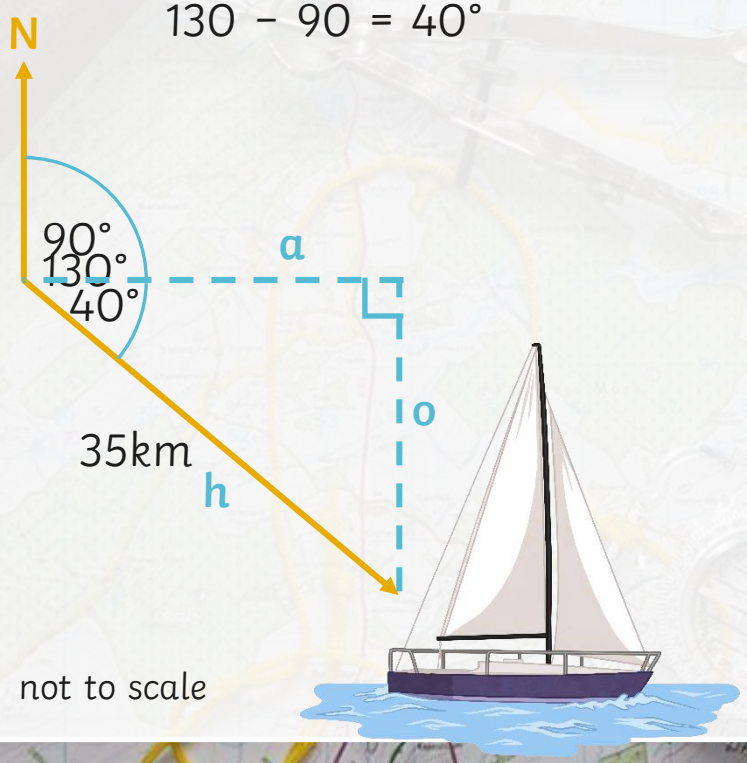
Obtuse Bearings



A boat sails on a bearing of 130° for 35km.
How far east has it travelled from its starting point?

If the angle in a bearing question is not acute we need to find its 'partner' acute angle.

130 – 90 = 40°



Answer:

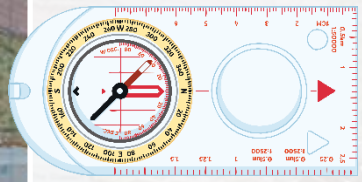
$\cos\theta = \frac{\text{adj}}{\text{hyp}}$

$\cos(40°) = \frac{x}{35}$

$\cos(40°) \times 35 = x$

$x = 26.8\text{km}$ to 1d.p.

Obtuse Bearings



A boat (B) is due south of a lighthouse (L) and sails on a bearing of 340° for 35km until it is due west of the lighthouse.
How far away is it now from the lighthouse?
Give your answer correct to 2d.p.

If the angle in a bearing question is not acute we need to find its 'partner' acute angle.

360 − 340 = 20°

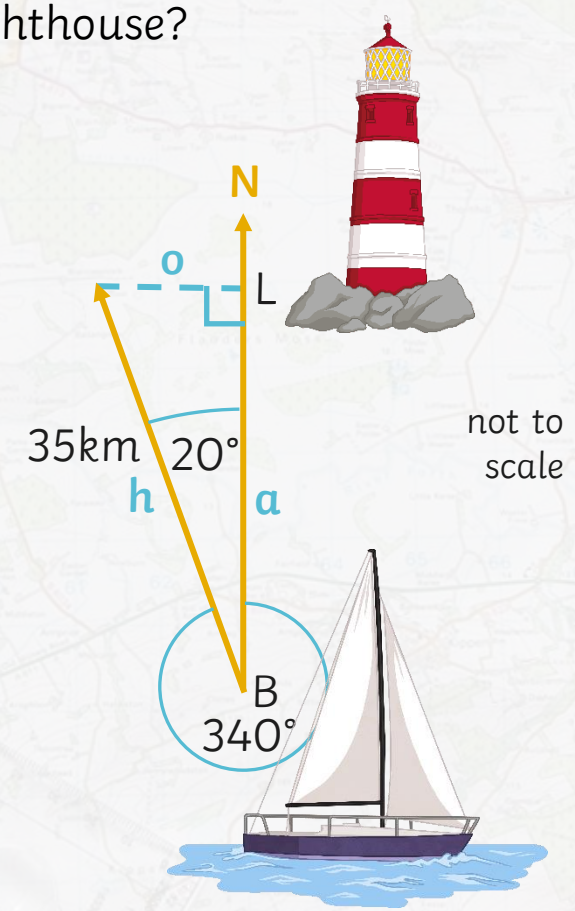
Answer:

$\sin\theta = \frac{\text{opp}}{\text{hyp}}$

$\sin(20°) = \frac{x}{35}$

$\sin(20°) \times 35 = x$

$x = 11.97\text{km}$ to 2d.p.



Your Turn: Non-Acute Angles

Give your answers correct to 1d.p. where appropriate.

1. Bangor is 6 miles from Caernarfon on a bearing of 230°.
   How far south of Bangor is Caernarfon?

$230° - 180° = 50°$

$\cos(50°) = \frac{x}{6}$

$\cos(50°) \times 6 = 3.9$ miles

Remember to sketch a diagram first and label the sides.

Don't forget to work out the angle's 'acute partner'.

Your Turn: Non-Acute Angles

Give your answers correct to 1d.p. where appropriate.

2. Canterbury is 20.8km from Margate on a bearing of 315°.
How far west of Margate is Canterbury?

$360° - 315° = 45°$

$$\sin(45°) = \frac{x}{20.8}$$

$$\sin(45°) \times 20.8 = 14.7\text{km}$$

Remember to sketch a diagram first and label the sides.

Don't forget to work out the angle's 'acute partner'.

Your Turn: Non-Acute Angles

Give your answers correct to 1d.p. where appropriate.

3. A statue is 130m from a church on a bearing of 095°.
How far east is the statue from the church?

$180° - 95° = 85°$

$\sin(85°) = \frac{x}{130}$

$\sin(85°) \times 130 = 129.5\text{m}$

Remember to sketch a diagram first and label the sides.

Don't forget to work out the angle's 'acute partner'.

Your Turn: Non-Acute Angles

Give your answers correct to 1d.p. where appropriate.

4. A tree is 22.7m from a house on a bearing of 350°.
How far north of the house is the tree?

$360° - 350° = 10°$

$\cos(10°) = \frac{x}{22.7}$

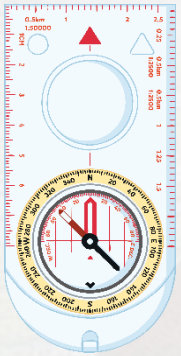
$\cos(10°) \times 22.7 = 22.4\text{m}$

Remember to sketch a diagram first and label the sides.

Don't forget to work out the angle's 'acute partner'.

Check MB's Tasks tab.

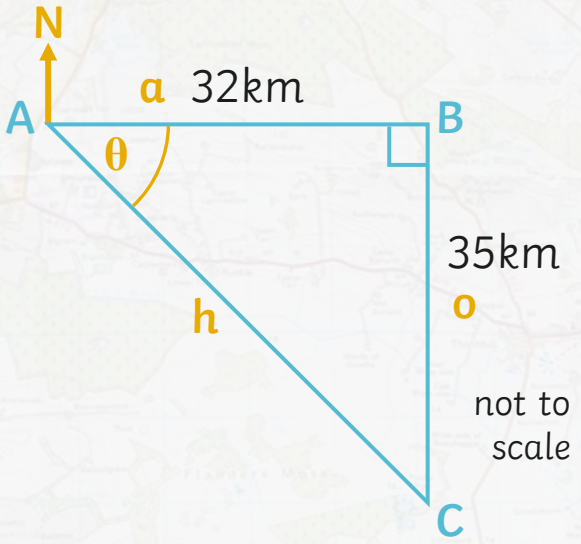
Plenary: Exam Question



Zack walks 32km due east from A to B.

From B, he then heads due south for 35km to position C.

Calculate the bearing of C from A.

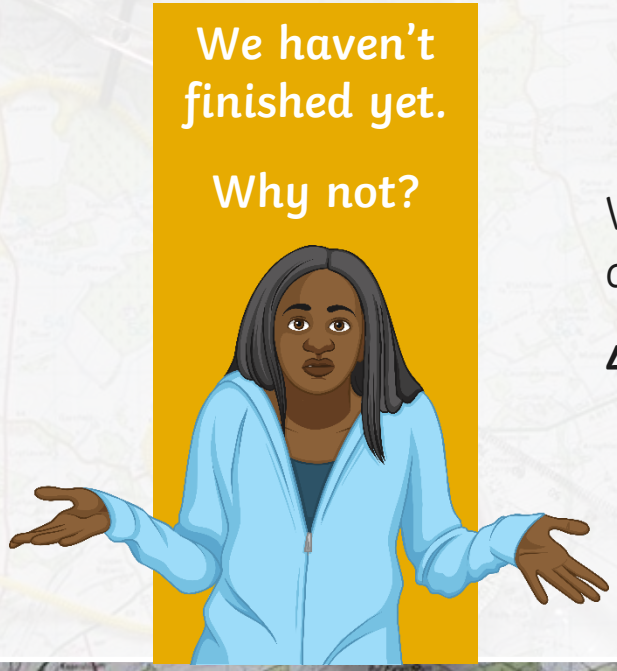


$\tan\theta = \frac{opp}{adj}$

$\tan\theta = \frac{35}{32}$

$\theta = \tan^{-1}(\frac{35}{32})$

$\theta = 48°$
(to the nearest whole number)



We need to add 90° to calculate the bearing:

48° + 90° = 138°

twinkl
twinkl
Quality Standard
Approved