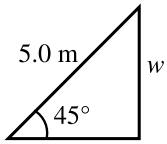
STEM SMART Phase One, 2022

Physics Week 5 – Vectors

https://isaacphysics.org/gameboards#smart_p_1_5

Essential Pre-Uni Physics B1.1

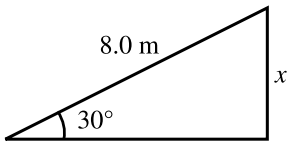
GCSE - Practice (P3)
A Level - Practice (P1)



What is the length marked w to 2 significant figures?

Essential Pre-Uni Physics B1.2

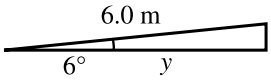
GCSE - Practice (P3)
A Level - Practice (P1)



What is the length marked x to 2 significant figures?

Essential Pre-Uni Physics B1.3

GCSE - Practice (P3)
A Level - Practice (P1)



What is the length marked y to 2 significant figures?

Essential Pre-Uni Physics B1.5

GCSE - Practice (P3)
A Level - Practice (P1)

Where bearings are given, they are in degrees East of North (so North is 000°, East is 090°, South is 180° and West is 270°). For the purposes of this exercise, assume that the Earth is flat.

Eric the Explorer walks $35\,\mathrm{km}$ on a bearing of 075°. How far East is he compared to his original position? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B1.6

GCSE - Challenge (C3)
A Level - Challenge (C1)

A trolley has a weight of $11\,\mathrm{N}$ and sits on a ramp inclined at 33° to the horizontal. How big is the component of the weight which is trying to pull the trolley along the ramp? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B1.8

GCSE - Challenge (C3)
A Level - Practice (P1)

When you walk up Amersham Hill, you walk at an angle of about 6.0° to the horizontal. How far do you travel vertically when you walk $500\,\mathrm{m}$ along the road? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B1.10

GCSE - Practice (P3)
A Level - Challenge (C2)

Where bearings are given, they are in degrees East of North (so North is 000°, East is 090°, South is 180° and West is 270°). For the purposes of this exercise, assume that the Earth is flat.

A fly in a room is flying on a bearing of 204° at a speed of $0.36\,\mathrm{m\,s^{-1}}$. Sunlight streams horizontally westward across a room, forming a shadow of the fly on the west wall. How fast does the shadow move? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B2.3

GCSE - Challenge (C3)
A Level - Challenge (C1)

Where bearings are given, they are in degrees East of North (so North is 000°, East is 090°, South is 180° and West 270°). For the purposes of this exercise, assume the Earth is flat.

Part A Swimming in a river

a) In which direction would I have to travel in order to travel North (relative to a stationary observer) if I am swimming in a river with a current running $0.40\,\mathrm{m\,s^{-1}}$ to the East, and I can swim at $1.5\,\mathrm{m\,s^{-1}}$ relative to the water? Give your answer as a bearing (degrees clockwise from North) to 3 significant figures.

Part B Flying in the wind

b) In which direction would I have to travel in order to travel North (relative to a stationary observer) if I am flying in a $15\,\mathrm{km\,h^{-1}}$ wind coming from the West and can fly at $90\,\mathrm{km\,h^{-1}}$ relative to the air? Give your answer as a bearing (degrees clockwise from North) to 3 significant figures.

Part C Speed Northwards

c) How fast do I move Northwards over the ground in part (b)?

Swimming to a Boat

A boat is travelling on a bearing of $\alpha = 60^\circ$ at a constant speed $u = 3.0\,\mathrm{m\,s^{-1}}$. A man is swimming at a constant speed v in order to reach the boat from a point a distance $l = 100\,\mathrm{m}$ due east of the boat.

Part A Direction of swimmer

Find, as a bearing, the direction in which the swimmer should head in order to reach the boat with the minimum speed.

Part B Speed of swimmer

What then is the minimum value of v which will enable the swimmer to reach the boat.

Part C Time taken

What is the time taken for the swimmer to reach the boat with this speed?

Adapted with permission from UCLES, A Level Further Maths, Syllabus C, June 1986, Paper II, Question 4