

Getting your bearings

Maths students at key stage 3 often find it difficult to work out the bearing of one position from another, whether by measuring or calculating the angles. **Colin Foster** offers some ideas



EVEN WHEN students have been told many times that they should always measure bearings clockwise from north, it is still easy to go wrong, and endless routine practice can be counterproductive and boring.

Here are some possible tasks you might offer to learners. Those who are already okay at finding bearings might explore links with trigonometry, Pythagoras' theorem, coordinates and transformations, depending on what they are already familiar with.

Bearings around the room

However learners are seated in the room, their positions can be exploited in the following way. Decide which direction is going to be our "north" for today (you can, of course, use the actual direction of north, but the direction of the front of the classroom might be simpler, or you could choose by voting).

- What is the bearing of Anupe from Ben? (Learners estimate an appropriate angle).
- What is the bearing of Ben from Anupe? (Asking the question both ways round highlights the relationship of a bearing and a back-bearing).

Questions along these lines involve learners in

putting themselves in another person's position – which may be easier to do in real life, with people you know, than on a piece of paper.

Learners can make up their own questions

Who is on a bearing of 270° from Harnam? (There may be more than one answer).

I am thinking of a person. They are on a bearing of 045° from Alana and a bearing of 300° from Pamelbir. Who is it? (If another pupil cannot decide from this between two pupils, say, then they could ask the questioner something like: "Is the person you're thinking of on a bearing of 180° from George?" to resolve their ambiguity).

Bearings and coordinates

On a coordinate grid there are lots of opportunities for learners to work on bearings without the need for pre-prepared photocopied sheets of drawn-out questions. It

is generally sensible to take the positive y-axis direction as north.

What is the bearing of (3, 5) from (4, 7)? Can you come up with any general rules for finding the bearing of one point from another?

Draw axes from 0 to 10 in both directions on centimetre-squared (or dotted) paper. Make up a route from the origin to (10, 10) that doesn't go through any lattice points (i.e. dots). (You could think of these dots as 'mines'.) Learners need to say a distance and a bearing for each leg of the route. You could specify a minimum/maximum number of legs for the journey.

Draw axes from 0 to 10 in both directions on centimetre-squared paper. In your head, 'bury treasure' at a particular pair of coordinates, but don't tell anyone. Make up instructions (distance, bearing for each step) for a roundabout route (not too easy, not too hard) that takes you there. See if someone else can follow it and find the treasure!

Draw axes from 0 to 6 in both directions on centimetre-squared paper and place letters at the lattice points.

Then use distance and bearings to spell out a message, starting from the origin. For example, the word MATHS would be:

- 037° , 5.0 cm (origin to M)
- 315° , 2.8 cm (M to A)
- 127° , 5.0 cm (A to T)
- 315° , 2.8 cm (T to H – note the same vector as M to A)
- 153° , 2.2 cm (H to S)

Learners will need to be quite accurate for it to work, and once you go wrong, you find you get gibberish from then on, and repeated letters can be awkward, so just say "stay" if you want the same letter again.

Without a protractor, you can still work out angles for routes based on 45° , 90° , 180° etc. So what words can you do without a protractor? For example, "COOL GAME".

Bearings on blank paper

Describe instructions (distance, bearing for each step) that draw a picture or a regular polygon or a capital letter.

If someone else is going to try to follow these instructions, it is kind to indicate roughly where on the page they should start – and give a recommended orientation of the paper – so that they do not end up going off the edge of the paper after they have done a lot of work!

How accurately can you predict the shape by visualising in your head before drawing anything out?

Bearings on maps

Google Earth is excellent for this and provides obvious cross-curricular links with geography.

• *Colin Foster teaches mathematics at King Henry VIII School in Coventry. Email him at c@foster77.co.uk*

Further information

Google Earth: <http://earth.google.com/>

Getting Your Bearings

Colin Foster

Pupils at Key Stage 3 often find it difficult to work out the bearing of one position from another, whether by measuring or calculating the angles. Even when they have been told many times that they should always measure clockwise from North, it is still easy to go wrong, and endless routine practice can be counterproductive and boring.

Here are some possible tasks you might offer to learners. Those who are already OK at finding bearings might explore links with trigonometry, Pythagoras' Theorem, coordinates and transformations, depending on what they are already familiar with.

1. Bearings around the room

However learners are seated in the room, their positions can be exploited in the following way. Decide which direction is going to be our 'North' for today. (You can, of course, use the actual direction of North, but the direction of the front of the classroom might be simpler, or you could choose by voting.)

- What is the bearing of Anupe from Ben? (Learners estimate an appropriate angle.)
- What is the bearing of Ben from Anupe? (Asking the question both ways round highlights the relationship of a bearing and a back-bearing.)

Questions along these lines involve learners in putting themselves in another person's position – which may be easier to do in real life, with people you know, than on a piece of paper.

Learners can make up their own questions:

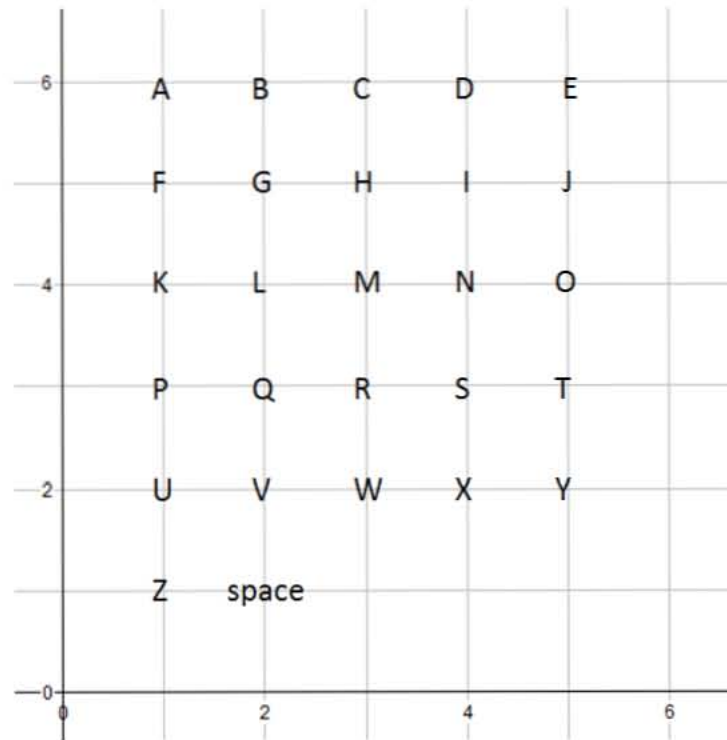
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On a coordinate grid there are lots of opportunities for learners to work on bearings without the need for pre-prepared photocopied sheets of drawn-out questions. It is generally sensible to take the positive y-axis direction as North.

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- Draw axes from 0 to 10 in both directions on centimetre-squared (or dotted) paper. Make up a route from the origin to (10, 10) that *doesn't* go through any lattice points (i.e., dots). (You could think of these dots as 'mines'.) Learners need to say a distance and a bearing for each leg of the route. You could specify a minimum/maximum number of legs for the journey.
- Draw axes from 0 to 10 in both directions on centimetre-squared paper. In your head, 'bury treasure' at a particular pair of coordinates, but don't tell anyone. Make up instructions (distance, bearing for each step) for a roundabout route (not too easy, not too hard) that takes you there. See if someone else can follow it and find the treasure!
- Draw axes from 0 to 6 in both directions on centimetre-squared paper and place letters at the lattice points, as below:



Then use distance and bearings to spell out a message, starting from the origin; e.g., the word MATHS would be:

037°, 5.0 cm (origin to M)

315°, 2.8 cm (M to A)

127°, 5.0 cm (A to T)

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