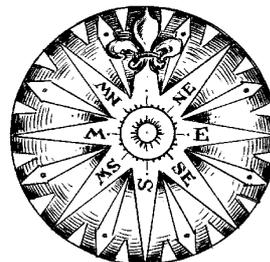


Do you know where you are going?



UNIT 19

This unit uses the context of the history of navigation to cover different ways of describing direction. It also encourages students to consider whom or what they trust when making decisions about the direction of their lives.

Using this unit

This unit could be used with all GCSE students and provides work on the different ways used to describe direction. The material is all found in the Foundation Tier but is suitable for Intermediate and Higher Tier students as well. Knowledge of angles is assumed, particularly that one revolution is 360° , that a straight line is 180° and that a right angle is 90° . The unit lasts for about 2 to 3 hours, depending on how many of the optional activities are used.

The students are introduced to three ways of describing direction that have been used in navigation. These are the 32 compass points, the quadrantal method and three figure bearings. There is a further section using scale drawing.

There are other activities, which encourage students to think about the experience of the early navigators and the trust that these people demonstrated in the compass. This is used as an analogy for finding our way in life. These tasks involve some discussion. This could be organised through a whole class discussion or small group work overseen by the teacher. It helps students to prepare for discussion if they are encouraged to write down their thoughts on the questions.



Students will need a copy of a local map.
All students require a ruler and protractor.

Mathematical content

- Shape, space and measure (AT3)
- ◆ Understand and use the standard 32 compass points
 - ◆ Understand and use the quadrantal methods
 - ◆ Understand and use 3 figure bearings
 - ◆ Use scale drawing to solve problems

Spiritual and moral development

The aim of the unit is to encourage students to reflect on how they trust in things, which they can not necessarily see or fully understand. It is hoped that by doing so they will deepen their understanding about the nature of faith.

Background

The history of navigation is full of examples of people who have travelled into the unknown with little to guide them. Sailors down the ages have chosen to trust the compass even when it was not fully understood.

Our lives are full of examples where we choose to trust in situations where we can not see. For some people, faith in God is related to this. A Christian understanding of faith is “being sure of what we hope for and certain of what we do not see” (Hebrews 11:1).

Notes on the Activities

Task 1:

This task should be done in pairs and will involve giving clear instructions and listening carefully. Students should then be encouraged to note down the directions of their partners.

Class discussion

Following the pair work, the class could discuss the following issues:

- ◆ The routes they chose,
- ◆ What sort of directions were used?
- ◆ How much did they rely on landmarks as fixed points?
- ◆ How would their sort of directions work at sea?



Task 3:

If angle work is weak then some preliminary revision may be required here, including the use of the protractor.

Losing your way

Students should first be encouraged to produce a written response, which can then inform a later whole class or group discussion.

Task 6:

Before beginning this task some students may need further explanation on how to interpret scales.

Tasks 2, 4, and 5:

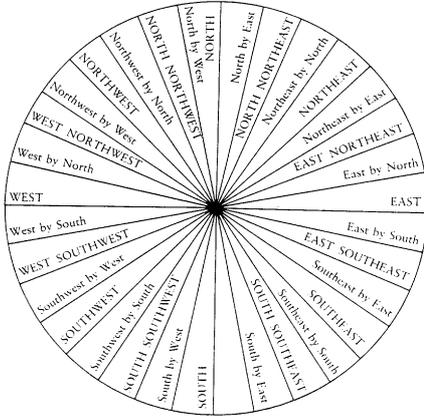
Before beginning these tasks students may need more explanation on compass points, the quadrantal method and three figure bearings respectively. The tasks all rely on students having access to a map. Ideally, this should be a local map or a copy of a relevant part of it.

Having faith in the compass

The final activity encourages students to reflect on broader issues again. There are two key questions which students are asked to consider, both related to trust. They should be given time to consider these questions and to produce a written response before having a final class discussion.

Answers

Task 2:

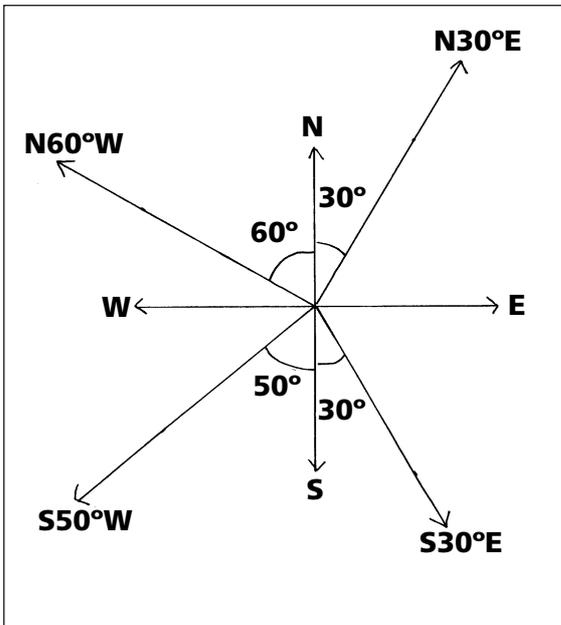


Task 3:

1. 90° , 2. 45° , 3. 22.5° , 4. 11.25° , 5. 90° , 6. 180° ,
 7. 123.75° , 8. 90° , 9. 135° , 10. 146.25° .

Task 4:

1. a) $S45^\circ E$, b) $N45^\circ W$, c) $S45^\circ W$, d) $N45^\circ E$,
 e) $S11.25^\circ W$, f) $N22.5^\circ W$, g) $N33.75^\circ E$.
- 2.



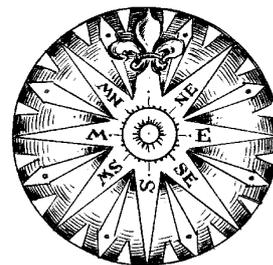
Task 5:

1. Because the compass needle points to north and so provides a fixed point.
2. a) 135° , b) 225° , c) 270° , d) 067.5° .
3. a) 030° , b) 130° , c) 280° , d) 195° .

Task 6:

1. a) 062° , b) 115° , c) 165° , d) 345° .
2. Distance: 5.76 miles; bearing: 101° .
3. Distance: 1.6 km; bearing: 332° .

Do you know where you are going?



UNIT 19

Throughout history people have been exploring more and more of our world. This means that they have always tried to improve their ways of navigating. In this unit, you are going to learn about some of the different ways which have been used in the past and which are still being used today for navigation. You will also spend some time thinking about what it is like to trust in something which you cannot see and do not fully understand.

1

This is a task for pairs. Choose two places in different parts of the school. Make up directions to take you from one place to the other. Then take it in turns to describe your routes to each other. You will need to give clear directions.

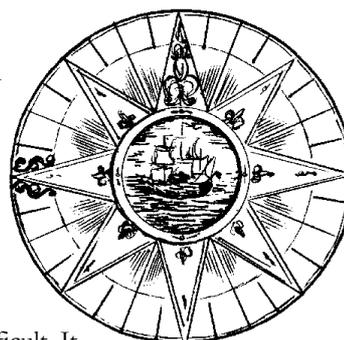
While you are listening to your partner's description, write down the following:

- ◆ where the journey starts and ends,
- ◆ the type of directions your partner uses,
- ◆ any fixed points that your partner refers to (e.g. the staff room).

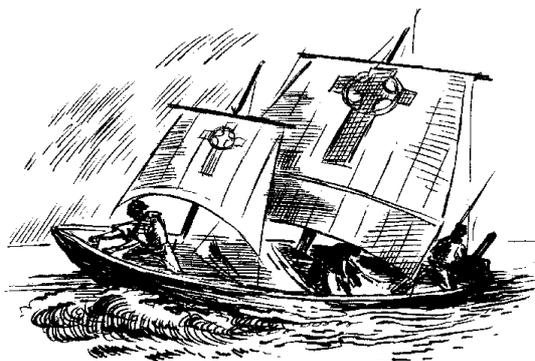
The cardinal points

Early sailors used the stars as a navigation aid. They realised that certain stars appeared to stay in the same place in the sky. In the Northern Hemisphere, they used the North Star (also known as the Pole Star) as a fixed point to guide them in their navigation.

The problem with using stars for navigation was that they were only visible on clear nights. An alternative method was found when it was discovered that a particular kind of metal, when suspended freely, always pointed in the same direction and this direction was towards the North Star! This led to the invention of the compass. Once the direction north was defined, the directions east, south and west were easy to mark on the compass. These four directions are called the cardinal points of the compass.



Steering a sailing boat is difficult. It is easiest to sail in the direction of a cardinal point. This is because it is easier to keep the needle of the compass on a well-defined point.



This meant, for example, that sailors navigating to the West Indies from England would sail southwards along the coasts of France and Spain until they reached the right distance north of the equator and then sail due west. (They knew how far south to go by the position of the sun.)

Going where no man has gone before

Put yourself in the position of the early explorers.

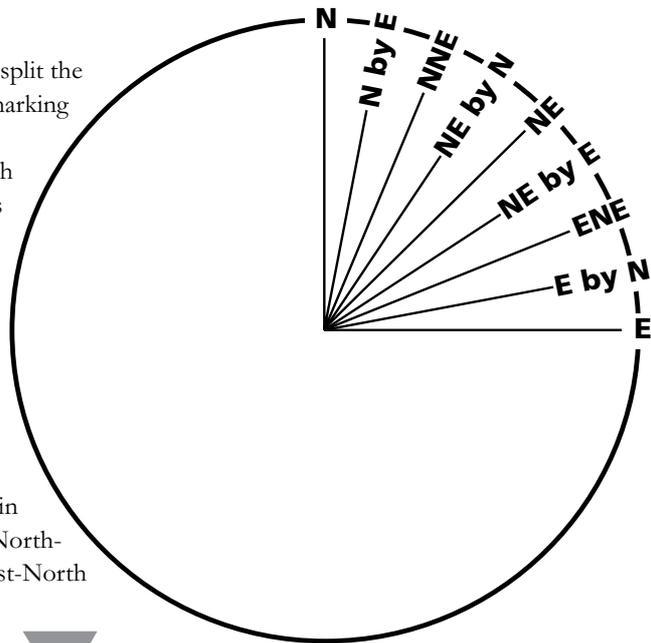
How would you feel going somewhere you had never been before and possibly where no one else had been either?

How would you feel depending on a compass that you did not really understand?

Boxing the compass

The first real development of the compass was to split the circle into 32 directions, all equally spaced. After marking the cardinal points on the circumference, each quadrant was split into half. Halfway between north and east was called north-east. Then these sections were split into half again. Halfway between north-east and north was defined as north-north-east. Halfway between north-north-east and north was defined as north by east. Finally, these new sections were split in half again. Naming the points round the compass is called “boxing the compass”.

The full list of points for the first “quadrant” are, in order, North, North by East, North-North East, North-east by North, North-east, North-east by East, East-North East, East by North, East.



2

1. Copy the diagram and then box the compass for all 32 points.
2. Find a map of your local area including your school. Use compass points to write down the directions of five places from your school or from each other. (You might write, for instance, that the station is north-east of the school.)

The journey of life

Life is sometimes thought of as a journey. We need guidance and reference points in order to complete our journey of life satisfactorily.

Do you know where you are going in life?

How do you make decisions about the direction of your life?

Who guides you in your life journey? Parents, friends, God, teachers, ...?

360 degrees!

Boxing the compass was a relatively crude method of defining direction but in the earliest days of sailing it was not necessary to be more accurate because a boat could not be sailed to that degree of accuracy! As abilities increased, however, a more accurate method was necessary and the degree was defined. Rather than have just 32 divisions, the compass circle was split into 360 divisions.

3

For each of the following work out the angle between:

- | | |
|-------------------------------------|-------------------------------------|
| 1. north and east, | 6. east by south and west by north, |
| 2. north and north-east, | 7. north-east and south by east, |
| 3. north and north-north-east, | 8. west by north and north by east, |
| 4. north and north by east, | 9. north-west and east, |
| 5. north by east and east by south, | 10. south-west and east by north. |

The quadrantal method

When degrees were first used to describe direction, sailors were not keen to give up the cardinal points and so a mixture was used. In this method the angle turned from north or south was given towards east or west.

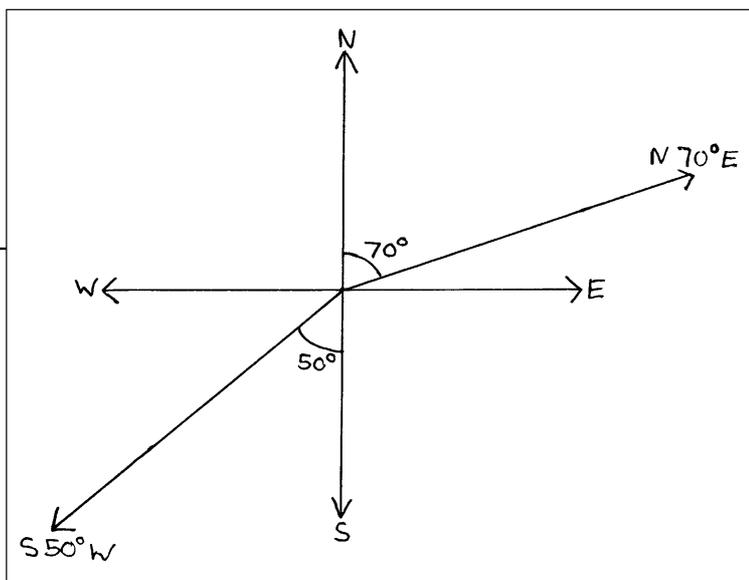
For example:

70° east of north would be given as N70°E. (Note, this is not written E20°N)

50° west of south would be given as S50°W

4

- Write the following directions using the quadrantal method
 - south-east
 - north-west
 - south-west
 - north-east
 - south by west
 - north-north-west
 - north-east by north



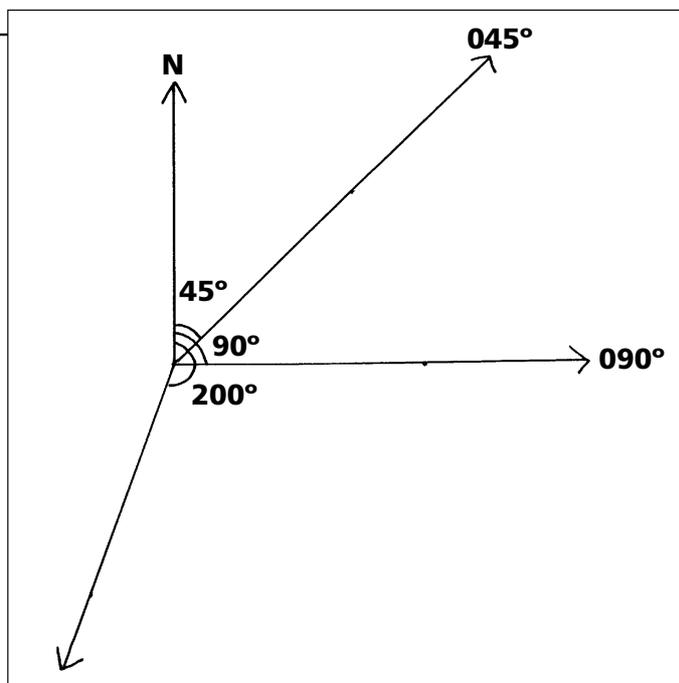
- On a page draw some lines representing north-south and east-west, as shown here. Using your protractor and ruler draw lines representing the following directions.
 - N30°E
 - S30°E
 - N60°W
 - S50°W
- Look again at the five directions you wrote for the places on your local map. Rewrite the statements using the quadrantal form. Are any of them more accurate using this method?

Three figure bearings

The main way now used to navigate is by using bearings. Like the quadrantal method, bearings are also given in degrees. The bearing is the clockwise angle between direction north and the direction you are describing. For example, for east the angle is 90° and for north-east it is 45° . So the angle can be anything from 0° to 360° . To avoid confusion the angle is always given as three digits, even if its size is less than 100° . So north will be given as 000° and north-east will be 045° . The sailor would read this as “zero four five degrees”.

5

- Why do you think north was chosen as the starting direction to measure bearings from?
- Describe the following compass directions using three figure bearings:
 - south-east
 - south-west
 - west
 - east-north-east
- Describe the following quadrantal method directions using three figure bearings:
 - $N30^\circ E$
 - $S50^\circ E$
 - $N80^\circ W$
 - $S15^\circ W$
- Look again at the five directions you wrote for the places on your local map. Write each of these using bearings.



Losing your way

Have you ever been lost?

What was the situation when you were lost?

How did it feel?

What did you do to “find yourself” again?

Write a few lines to answer these questions.

Scale Drawings

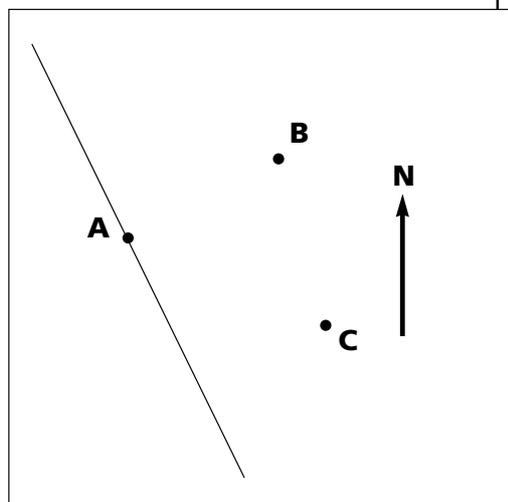
If you want to know the distance and bearing of places from other places you can measure them over the ground, or you can measure them on a map. A scale drawing is really just a simple map.

Scales are often written like this, 1: 5000. This means that one unit on paper represents 5000 units on the earth, whatever the unit. For example 1 cm represents 5000 cm or 50 metres.

Another way of writing the scale is 1 cm = 50 metres.

6

- In the diagram find:
 - the bearing of point B from point A,
 - the bearing of point C from point A,
 - the bearing of point C from point B,
 - the bearing of point B from point C.
- A ship leaves a port A and sails on a bearing of 060° for three miles. The captain then alters course so that the ship is sailing on a bearing of 130° for four miles. How far and on what bearing is the ship now from the port?



- An orienteering course on a moor has these instructions:

Stage 1: From the start travel 2 km on a bearing of 050° to point W.

Stage 2: From point W travel 3 km on a bearing of 140° to point X.

Stage 3: From point X travel 1 km on a bearing of 170° to point Y.

Stage 4: From point Y travel 3 km on a bearing of 280° to point Z.

Stage 5: From point Z return to the start.

- Mark the starting point (S) in the middle of a sheet of paper and indicate the direction north up the page
- Using a scale of 2 cm to represent 1 km, draw the orienteering course
- Give the bearing and distance for stage 5 so that the orienteer can get back from point D back to the starting point.

Having faith in the compass

A navigator on the seas or an orienteer on a moor both depend on the compass. The compass needle responds to the earth's invisible magnetic field. Although people can not see this field, they are prepared to trust in it as reliable.

Can you think of any other situation in which you are prepared to trust in something without seeing it?

As the compass responds to something unseen some people put their trust in an unseen God as they try to make sense of problems and attempt to make right decisions.

Who do you put your trust in when making your life decisions?

