

OUTBREAK: INFECTION DETECTION

These activities are designed for 60-minute lessons. You may need to adapt the materials for use in longer or shorter lessons.

INTRODUCTION

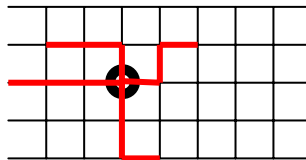
In this activity, pupils are required to locate people infected with a deadly virus. Field scouts have a number of infection detectors they can use, which provide the clues for the pupils.

This activity is mainly ICT based. It has been designed for use with pupils in an ICT suite although it could be adapted for use in a maths classroom equipped with a data projector and whiteboard. It is suggested that pupils work together in pairs or small groups to encourage appropriate levels of participation and discussion.

The activity contains 3 options offering varying degrees of challenge. Different pupil pairs or groups within a class can work at the different options. Alternatively, you may prefer to ensure each group has a mix of pupils. This will help to create appropriate conditions for peer support.

Completing an option unlocks a code which can be used in the map room to reflect the progress individuals or groups have made. **Please note that these codes are not automatically saved if the user logs out.** Remind users to make a note of any codes they receive as they progress.

Option 1: Pupils are presented with a map overlaid with a grid. The grid lines represent streets. Pupils are able to drag scouts on to the grid one at a time. Clues at the bottom of the screen tell them the distance of an infected person from the scout. The diagram below shows 4 possible positions for an infected person located 3 km from a scout.



Pupils can drag on 'markers' to indicate all possible locations of the infected person from scout A. Pupils can then drag a second or third scout onto the grid and get other clues to help them narrow down the correct location of the infected person. They are then required to enter the appropriate coordinates. This option is for pupils working at **level 4 of the National Curriculum**.

Option 2: Again pupils are presented with a map overlaid with a grid. The scout is in a fixed position at the centre of the grid. The locations of the infected people are given as bearings and distances. Pupils will need copies of the grid on which to draw the bearing and distance, using the scale given. Once an infected person is located, their coordinates are entered on the screen. This option is for pupils working at **level 5 of the National Curriculum**.

Option 3: This time two scouts are available and the clues just give a bearing to the infected person from each scout. Pupils draw the bearings on their copies of the grid and find the point of intersection. Once an infected person is located, their coordinates are entered on the screen. They are then asked to find the distance from a scout to the infected person. This option is for pupils working at **level 6 of the National Curriculum**.

LEARNING OBJECTIVES

Option 1

By the end of the lesson, pupils will:

- explore patterns on a grid;
- use coordinates.

Option 2

By the end of the lesson, pupils will:

- use a protractor to draw bearings;
- work to a given scale.

Option 3

By the end of the lesson, pupils will:

- use a protractor to draw bearings;
- work to a given scale;
- use Pythagoras' Theorem.

LEARNING OUTCOMES**Option 1**

Most pupils will:

- Use given information to solve a problem. Use patterns on a grid to determine a fixed point and describe the point by its coordinates.

Option 2

Most pupils will:

- Use given information to solve a problem. Use bearings and scale drawings to determine the location of an infected person

Option 3

Most pupils will:

- Use given information to solve a problem. Use bearings and scale drawings to determine the location of an infected person. Use Pythagoras' Theorem and/or scale drawing to find the distance from the Scout to the infected person.

NATIONAL CURRICULUM OBJECTIVES**Ma2 Number and Algebra****Using and applying number and algebra**

- 1) Pupils should be taught to:
 - j) show step-by-step deduction in solving a problem; explain and justify how they arrived at a conclusion.

Ma3 Shape, Space and Measures**Geometrical Reasoning**

- 2) Pupils should be taught to:
 - b) distinguish between acute, obtuse, reflex and right angles; estimate the size of an angle in degrees.
 - h) understand, recall and use Pythagoras' theorem.

Coordinates

- 3) Pupils should be taught to:
- e) use axes and coordinates to specify points in all four quadrants; find the coordinates of points specified by geometrical information.

Measurements and Construction

- 4) Pupils should be taught to:
- b) understand angle measure using the associated language (for example, use bearings to specify direction).

Links to the revised Programme of Study for introduction in 2008 include:

1 Key concepts**Competence**

- a) Applying suitable mathematics accurately within the classroom and beyond.
- b) Communicating mathematics effectively.

Creativity

- a) Combining understanding, experiences, imagination and reasoning to construct new knowledge.
- b) Using existing mathematical knowledge to create solutions to unfamiliar problems.

2 Key processes**Representing**

Pupils should be able to:

- a) identify the mathematical aspects of a situation or problem.

Analysing

Pupils should be able to:

- c) visualise and work with dynamic images
- d) identify and classify patterns
- g) take account of feedback and learn from mistakes
- k) make accurate mathematical diagrams, graphs and constructions on paper and on screen.

3 Range and content**Geometry and measures**

The study of mathematics should include:

- b) constructions, loci and bearings
- c) Pythagoras' theorem
- e) similarity, including the use of scale
- f) points, lines and shapes in 2D coordinate systems.

4 Curriculum opportunities

The curriculum should provide opportunities for pupils to:

- a) develop confidence in an increasing range of methods and techniques
- b) work on sequences of tasks that involve using the same mathematics in increasingly difficult or unfamiliar contexts, or increasingly demanding mathematics in similar contexts
- f) work collaboratively as well as independently in a range of contexts.

LESSON PREPARATION

- Familiarise yourself with the on-screen task in order to identify the key points that your pupils will need to address before they attempt the task.
- Print sufficient copies of paper grids (see **Materials required** section below) and homework activities.
- Arrange for access to computers for the main part of the lesson.
- Create a wall display identifying key vocabulary and include pictorial representations of fractions, decimals and percentages.
- You may wish to create a certificate of achievement to award to pupils that perform well in the activity.

Vocabulary

Coordinates, bearing, distance, Pythagoras' Theorem.

Materials required

Option 1

- Centimetre-squared paper
- Whiteboard or projector and screen
- Computer access: either one per pair or one per small group.

Option 2 and Option 3

- A copy of the relevant grid for each pupil
- Protractors, preferably 360°
- Rulers
- Sharp pencils
- Whiteboard or projector and screen
- Pupils should be able to work in pairs or small groups at a computer, although this is not essential. The activity can be delivered from a single computer projected onto a screen
- Polar graph paper (a single sheet to show as an example in the plenary session)

Prior knowledge and skills

Option 1

- Pupils should have some experience of working on a grid and using coordinates.

Option 2 and Option 3

- Pupils should have some experience of working with bearings, although Option 2 could be used to first introduce bearings.

Option 3

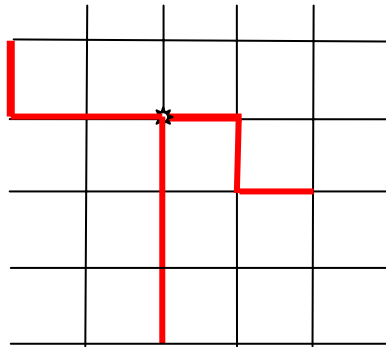
- Pupils should have some knowledge of Pythagoras, although the activity can be completed using scale.

LESSON DETAILS

Starter

Option 1

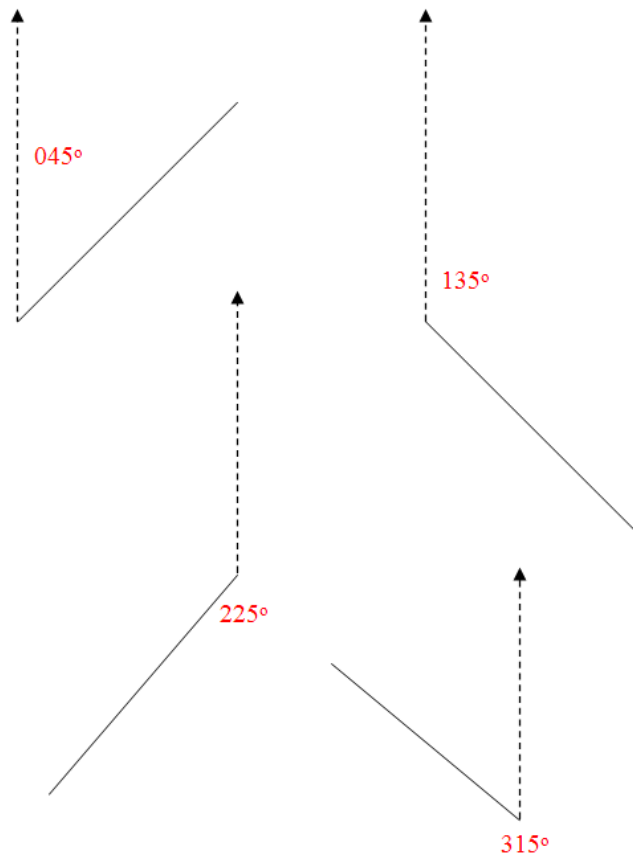
- As a whole class ask pupils to draw a grid on squared paper, with axes numbered from 0 to 10. Ask them to plot the point (4, 6)
- Ask them to plot another point that is 3 units from (4, 6) if they are only allowed to move along grid lines as shown in the diagram below.



- Ask pupils for the coordinates of the new point. How many different points have been found by the class?
- Ask pupils to find all the possible points that are 3 units from (4, 6).

Option 2 and Option 3

- Ask pupils what name is given to an angle measured clockwise from North (a bearing).
- Draw some diagrams on the board as below and ask them to estimate the bearing.
- Remind pupils that bearings are always written with 3 digits.



Main**Option 1**

- Pupils should work in pairs or small groups at a computer, if possible.
- Set the scene by telling pupils that there has been an outbreak of a highly infectious disease. Their task is to find the location of four infected people.
- Pupils are presented with a map overlaid with a grid. This represents a town laid out in a similar fashion to New York, with streets in a grid pattern.
- Pupils can drag a scout onto the grid. A clue at the bottom of the screen will tell them the distance from the scout to the infected person. These distances are along grid lines, as in the starter activity.
- Pupils should drag marker(s) to all the possible locations given the distance information.
- Once a marker has been added, pupils can drag a second and then a third scout onto the grid and get further clues to help them narrow down the location possibilities and find the correct location.
- Allow pupils to devise their own strategies in the first place.
- Should any pupils be having difficulties, suggest that one possible strategy is to remove markers from scout 1 that do not fit the criteria when the second scout has been dragged onto the grid.
- Once the infected person is located, pupils should enter the coordinates on the screen.
- Pupils should be discouraged from using trial and error to complete the activity. You should remind them that they are penalised for having a high number of attempts. This penalty is specified in the code that is awarded to them at the end of the activity.

Option 2

- Pupils should work in pairs or small groups at a computer, if possible. The activity can be delivered via a single computer projected onto a whiteboard or screen. However this will be less flexible and more able pupils will not be able to progress to Option 3.
- Set the scene by telling pupils that there has been an outbreak of a highly infectious disease. Their task is to find the location of six infected people.
- The scout is in a fixed position at the centre of the grid. Clues are given in the form of a bearing and a distance. The scale is shown on screen.
- Pupils draw the bearing and distance onto their own copies of the grid, but enter the coordinates of the infected person onto the screen. This gives them instant feedback so they can redraw the diagram if they are wrong.
- Pupils should be discouraged from using trial and error to complete the activity. You could remind them that they are penalised for having a high number of attempts.

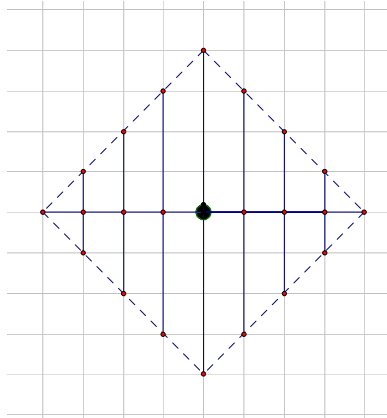
Option 3

- Pupils should work in pairs or small groups at a computer, if possible.
- Set the scene by telling pupils that there has been an outbreak of a highly infectious disease. Their task is to find the location of four infected people.
- This time two Scouts can be dragged onto the screen. The clues give the bearing from each one to the infected person. The scale is shown on screen.
- Pupils draw the bearings on their own copy of the grid and find the point of intersection. The coordinates of this point are entered on screen. This allows pupils to redraw the diagram if they have made an error.
- Pupils are then asked to find the distance from a Scout to the infected person.
- Allow pupils time to decide how they will do this before suggesting Pythagoras.
- Some pupils may decide to use scale drawing. They can then be encouraged to use Pythagoras as a check to their accuracy.
- Pupils should be discouraged from using trial and error to complete the activity. You could remind them that they are penalised for having a high number of attempts.

Plenary

Option 1

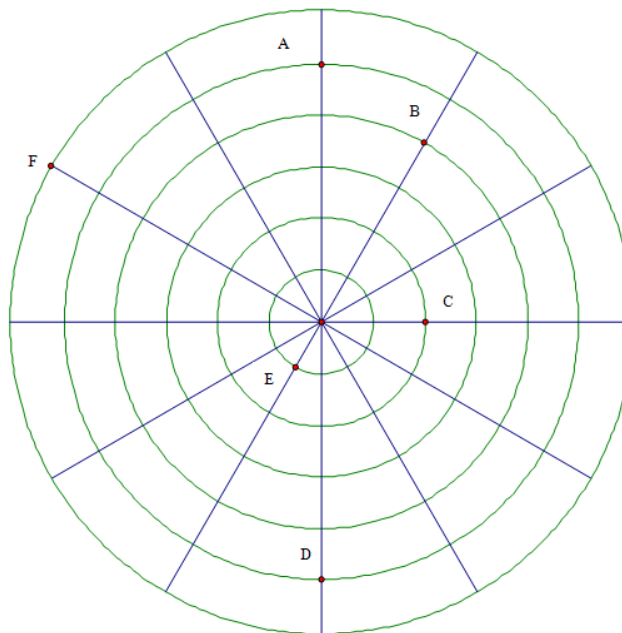
- Ask individual pupils to explain their strategies for finding the infected person.
- Compare strategies if there is more than one.
- Ask if they spotted any patterns in the positions from Scout 1.
- Show all the possible positions 4 units, say, from a fixed point.



What shape is made by the points?

Option 2 and Option 3

Compare their work to positions shown on a radar screen.



- Draw a diagram similar to this one on the board and ask pupils for the positions of given points, giving them as (distance, bearing). For example, which point is at (1, 210°)? **E**
- Explain that these are known as polar coordinates.

- If possible, show pupils a sheet of polar graph paper.

Homework

Separate homework sheets have been provided for each option. Download and print off sufficient copies for your pupils.

TECHNICAL SUPPORT

Throughout all the activities and support notes you will be asked to open various files in Flash or in Adobe PDF. To use these, you will need to have the minimum specification installed. This recommendations list can be found below.

The latest **Adobe Flash Player** (previously know as the Macromedia Flash Player) can be downloaded free from the Adobe website. Support and Help can also be found on this site.

http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash

You will be using a version of **Adobe Reader** or Distiller to view these Teacher Notes. If you would like help or to download a newer version, you can find information at Adobe's website:

<http://www.adobe.com/products/reader/>

Minimum Machine and Software Specifications

PC

P3 800MHz; 128MB RAM; Windows 2000

Screen resolution 1024x768

Browser: Microsoft Internet Explorer 5.5; Firefox 1; Netscape 7; or Opera 7

Macromedia Flash Player 7

Adobe Reader 7

Mac

G3 500MHz; 128MB RAM; OS X 10.2

Browser: Safari 1; Firefox 1; Netscape 7; or Opera 6.2

Screen resolution 1024x768

Macromedia Flash Player 7

Adobe Reader 7