

Finding Directions using a Compass

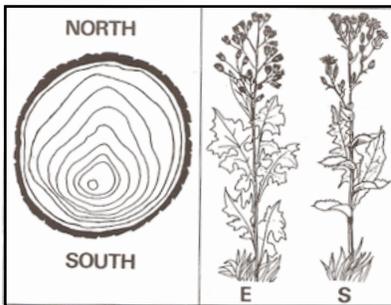
Objectives:

- Understand that a compass consists essentially of a moving magnetic needle and a compass housing labeled with directions
- Learn to use a compass to take a directional sighting and accurately follow it

I. Introduction to Navigation

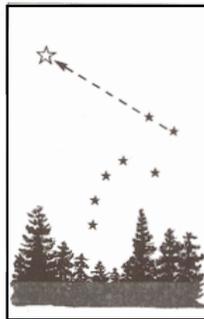
A. Class brainstorm

As a class, brainstorm ways that students use to find their way around Brookline. Then expand the discussion to include farther points, such as Boston, family trips, camping, and such. List all responses on the board. Then, ask them to imagine that they are farther back in time, without signs, maps, GPS, google earth, and all the rest. What might have helped then?



Bark and growth rings are thicker on the North side of tree section.

Some plants grow their leaves in a compass direction, e.g. the wild lettuce and pilot weed.



The Pole Star.



Trees shaped by prevailing wind – short branches towards the wind.

Flower plumes on reeds grow away from prevailing wind.

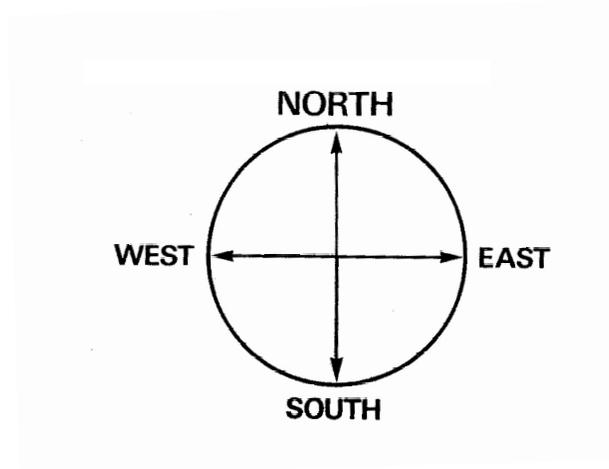
B. Orientation without a compass

1. Now it is time for some directional challenge activities. Ask how someone might find his/her way from the back of the classroom to the front blindfolded. If you have a brave person, and others who will keep that person from getting hurt, let someone try. What might help them? (sound, touch, memory). Some students might bring up Hansel and Gretel or Theseus and suggest laying a trail with a string.
2. Next, have a student stand up and, again with spotters, spin around a few times and point to the front of the room. How did that person decide where the front of the room was? What clues did he/she use?
3. Go outside, to a flat area such as the playground. Have the class make a circle with their backs to the center, and walk forward in as straight a line as possible for about 20 paces, or if you haven't done pacing, about 40 steps. Have them return to the circle and discuss how they kept themselves in a straight line instead of curving to one side or the other. Most will have picked a landmark and headed for it.
4. Now, do the same exercise, but blindfolded. For this, have half the students walk, and the other half spot. The spotter is not to help them go in a straight line, just to keep them from hurting themselves. Have the students trade places for the return. Most will be unable to do so, but ask what they used to try.

II. Introduction to Compass Rose and Standard Directions

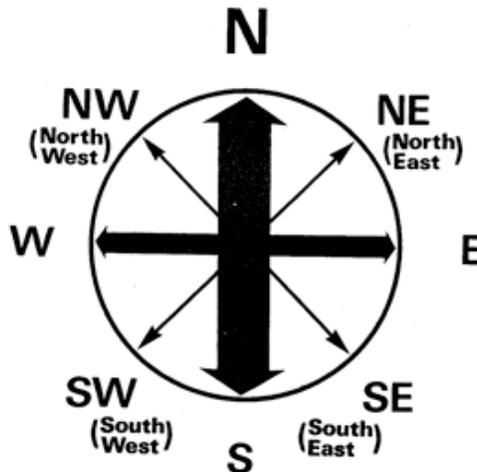
A. Learning the Basic Directions

Arrange the class so they are facing north. Feel free to use a compass. Tell them they are facing north. Ask them what direction is at their backs? (south) On their right side? (east) and on their left (west). Have them draw or give them already made a simple compass rose that they can put underneath them to have them actually be the central point of the compass and to reinforce that north not “up” or somehow over their heads. If you are outside at this point, go back inside.



B. Learning a Basic Compass Rose

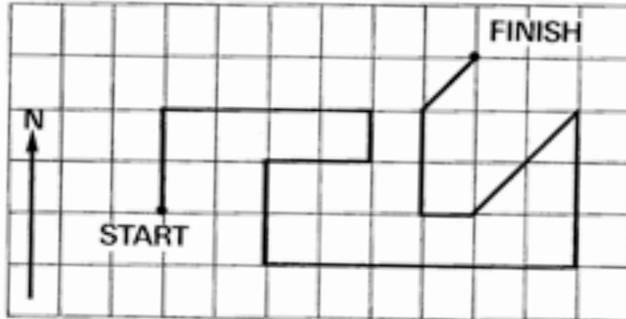
Introduce a more complex compass that includes NW, NE, SE and SW. If necessary, explain that the north and south are given first because they are considered the primary directions, closely followed by east and west.



C. Practicing Using a Basic Compass Rose

Using the compass rose as a reference, do this simple compass point trip. Give each student a piece of graph paper, and have them draw an arrow to indicate north, as indicated below. Have them choose a starting point in the center of the paper, make a dot and label it Start, again, as below. Each student begins at start and tries to reach finish by following the directions below. Put them on the board.

- 2 squares N
- 4 squares E
- 1 square S
- 2 squares W
- 2 squares S
- 6 squares E
- 3 squares N
- 2 squares SW
- 1 square W
- 2 squares N
- 1 square NE



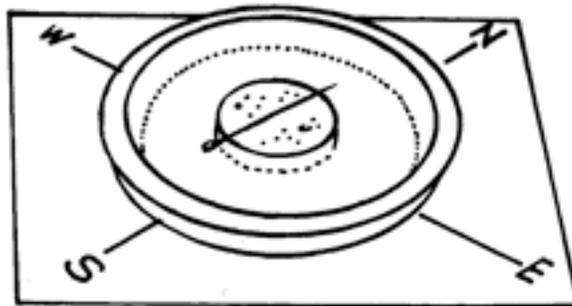
III. Meet the Compass!

A. Making a Compass

The materials needed per student or pair of students are:

- large needle, such as a sewing needle
- magnet
- small saucer or petri dish
- small piece of cork

Magnetize the needle by gently rubbing it with one end of the magnet, always moving in the same direction. Put the needle gently on a small piece of cork and float it in the petri dish, or just float the needle in the petri dish. Make a simple NSEW compass rose around the dish.



B. Using a Compass

The time has come to introduce the compass. Give one compass to each pair of students. Ask them what they recognize. They will probably identify the orienting arrow and parts of the compass rose. Explain that rather than just using north or southeast, that more accuracy was needed, so that the compass rose has been divided into 360 degrees. Make the connection to 360 degrees in a circle.

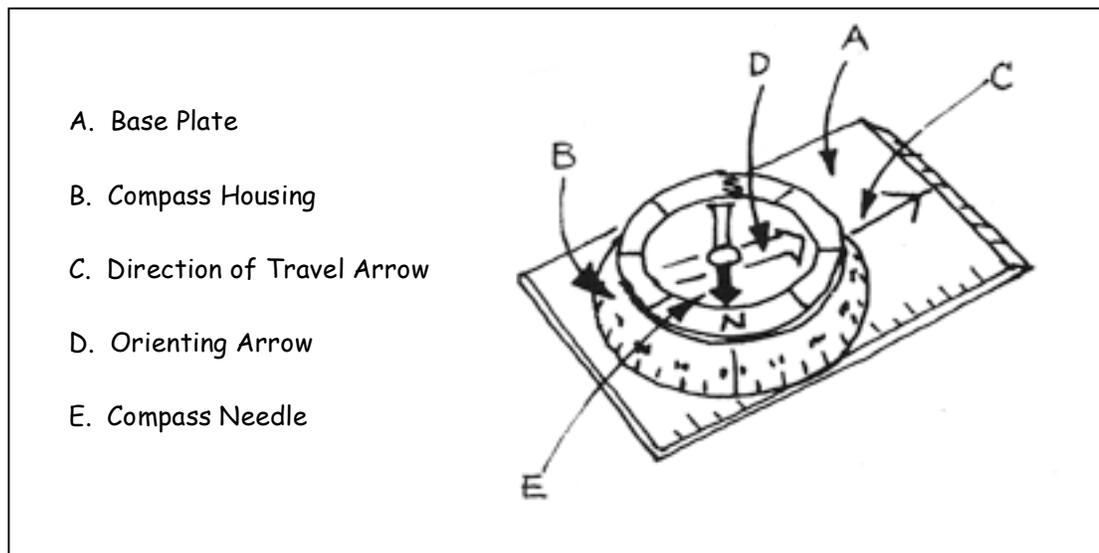
Ask them to find the number of degrees for each of the 8 directions they have been using on the compass rose: N, NE, E, SE, S, SW, W, NW. After they have done this, explain that 0 and 360 degrees are the same, and so are both north.

Show them how to turn the compass housing so that north on the housing lines up with north on the compass needle. Ask the students to stand up and face north, using the compass. Ask them to point east, or west, again using the compass. Make sure no one is near something metal that might be interfering, or go outside.

Next, demonstrate how to use the direction of travel arrow. Make sure the students can do the following:

- Find the direction given on the compass housing (for example, 26 degrees)
- Line up the direction of travel arrow on the base plate with the direction (again, in this case, 26 degrees).
- Line up the compass needle correctly with north, and face the direction of travel (26 degrees).
- Face 26 degrees (not North)

The students will need practice with this. With them standing, call out a direction and have them face that direction. Have them help each other until you are satisfied they can face the correct direction each time.

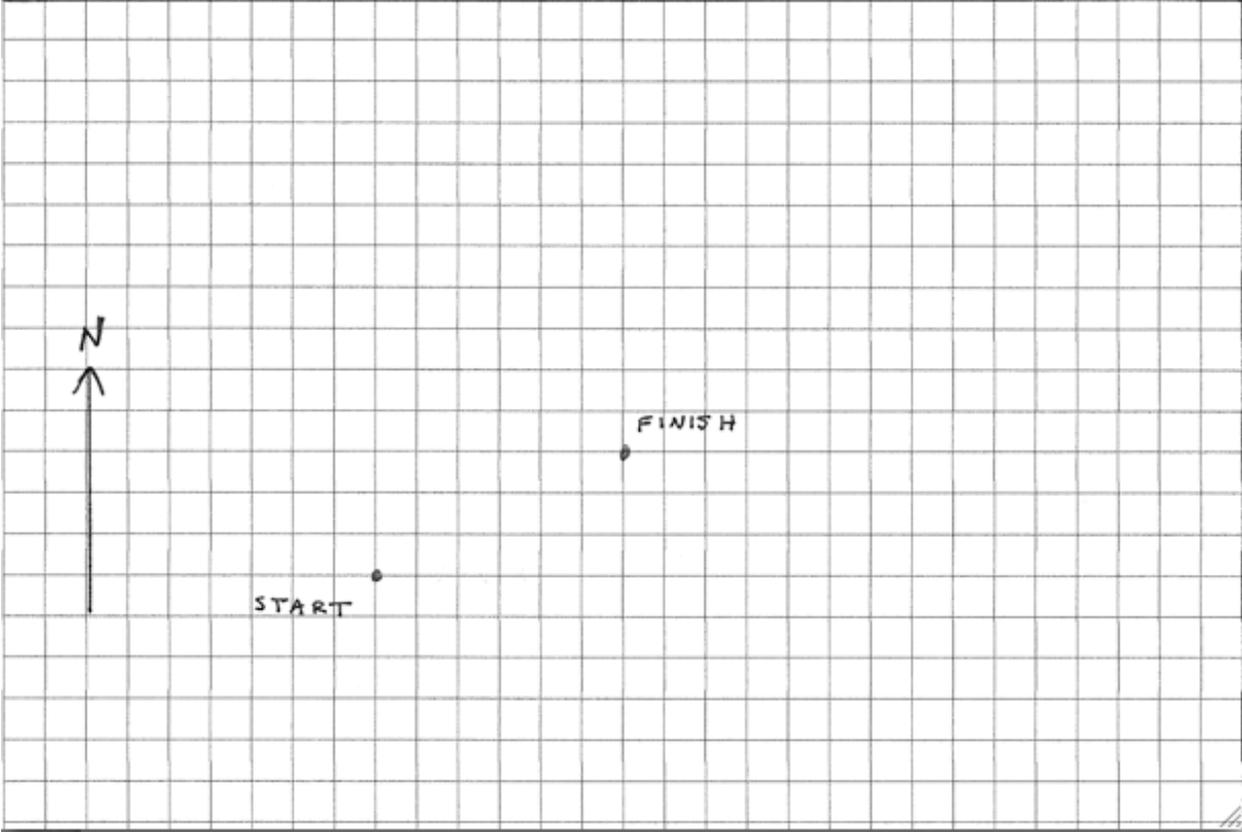
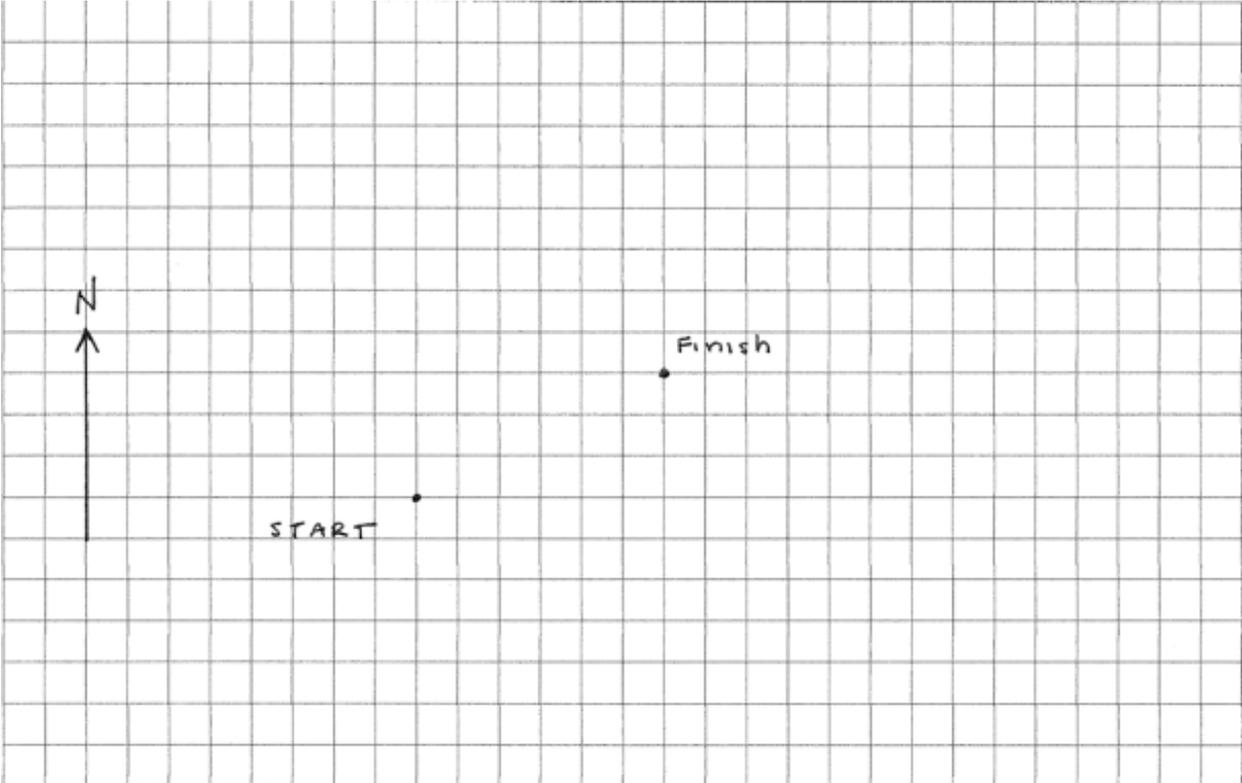


C. Cool Reinforcement Games!

There are three attached activities that can be used for fun practice. In order of increasing difficulty, they are:

1. Hunt the Coin
2. Schoolyard Compass Game
3. The Quicksand

Student worksheet for Compass Rose Direction Activity



Hunt the Coin Activity

Objective:

- To practice using a baseplate (orienteeing) compass correctly and to follow a simple course given the bearings and distances.

Materials:

- Large grassy area
- A coin, or similar small flat object not easily seen from a distance
- Orienteering compass for each pair of students

Student Instructions:

Place the coin on the ground at your feet. Set the compass at 60° and turn your body to face this bearing. Walk 10 paces forward along this bearing and stop. It is important to keep your paces regular in size.

Now add 120° to your present bearing so that the compass reads 180° on the dial. Turn your body to face this bearing and walk another 10 paces in the new direction. Stop.

Again add 120° to your last bearing so that the compass dial now reads 300° . Walk 10 paces at this new bearing.

You have now walked in a triangle and if you have been really accurate the coin will be at your feet when you completed the last leg... Is the coin there?

If you didn't do too well, try again and remember your paces should be regular and in a straight line along the bearings. Check to see that you are reading the bearings on the compass dial correctly and that you are using the compass correctly.

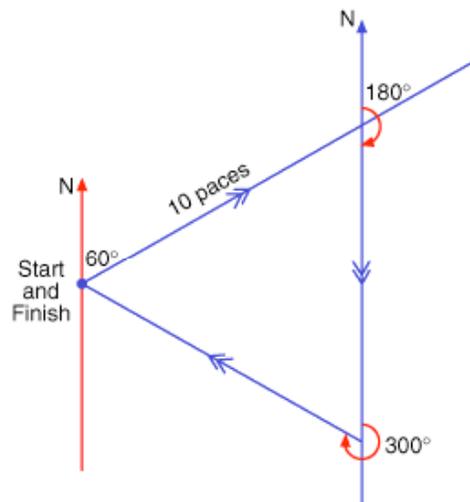
Teacher Notes:

This exercise is excellent for determining whether students understand how to use the compass to follow directions. If they don't do it correctly they won't end up back at the coin, or even near it.

It requires little preparation and is really effective. You will soon see that students are turning the compass to the bearing instead of turning their whole body to face the direction of the compass bearing.

The other interesting thing that puzzles students is that they used 60° , plus 120° , plus 120° which adds up to 300° . Why not a full 360° to get back to where they started from? Why not only 180° because they walked in a triangle?

To answer these sorts of questions it is useful for students to draw a scale diagram of the course they followed and then look at the angle relationships. It will help them to visualize and understand the bearings they took.



SCHOOLYARD COMPASS GAME OUTDOOR PRACTICE

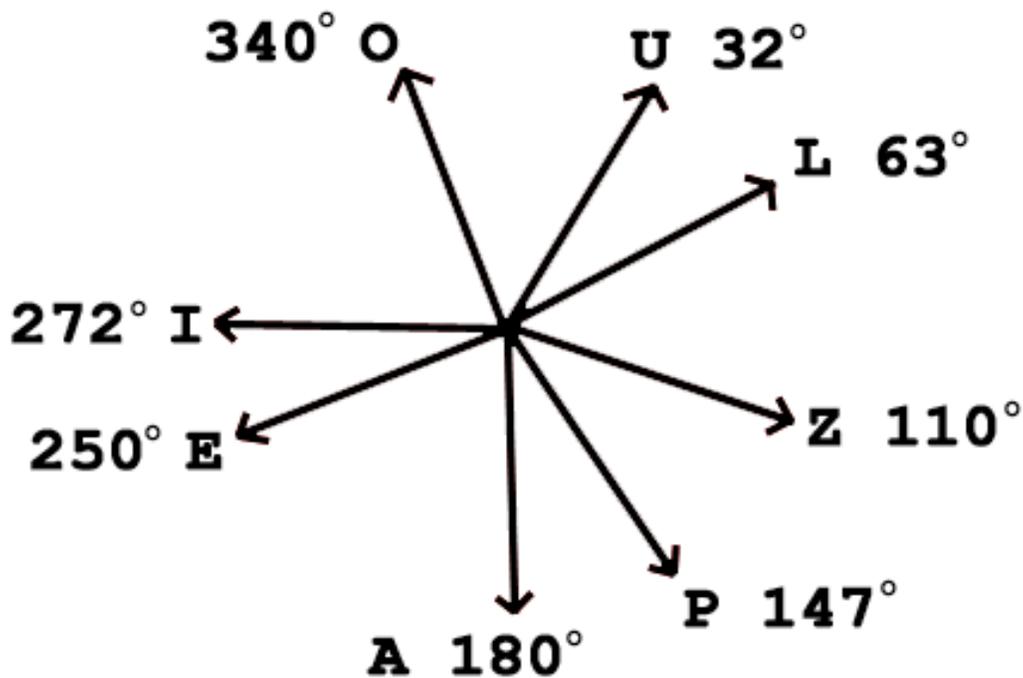
Objective:

Practice in setting the compass for degree bearings and following them with precision. (Designed by Allen Foster)

Group Project: The course for this game can be set up in a schoolyard, in a park, or in a camp. The course consists of eight marked stakes set up in a large circle. The stakes are marked I, O, U, L, Z, E, A, and P. For laying out the course you also need an unmarked center stake, a string or rope 50 feet long or longer, and an Orienteering compass. An alternative to using stakes is to use bright-colored spray paint. This prevents participants from fixating on the stakes.

To lay out the course, place the unmarked stake in the center of the area you have chosen for the game. Attach the measuring string (rope) to the center stake. Starting at the center stake each time, set the compass bearing as indicated below for each lettered stake; stretch out the measuring string (rope) along this bearing and place the respective marked stake at the end of the string (rope). The success of the game depends on the careful positioning of the marked stakes.

U – 32°	Z – 110°	A – 180°	I – 272°
L – 63°	P – 147°	E – 250°	O – 340°



To play the game each participant or group is provided with an Orienteering compass, a pencil, and an instruction card. The card tells him at what marked stake to start and directs him to follow five compass bearings from marker to marker around the course. The player copies down on his card the letter on each marker along his route.

Schoolyard Compass Game Answers:

- Course #1 EOUZP
- Course #2 IULPA
- Course #3 OLZAE
- Course #4 UZPEI
- Course #5 LPAIO
- Course #6 ZAEOU
- Course #7 PEIUL
- Course #8 AIOLZ
- Course #9 IUZAE
- Course #10 OLPEI

Course #1

Start at stake or point marked A

- Proceed at 305°. Marker reached _____
- Proceed at 25°. Marker reached _____
- Proceed at 96°. Marker reached _____
- Proceed at 161°. Marker reached _____
- Proceed at 219°. Marker reached _____

Course #2

Start at stake or point marked E

- Proceed at 351°. Marker reached _____
- Proceed at 68°. Marker reached _____
- Proceed at 138°. Marker reached _____
- Proceed at 195°. Marker reached _____
- Proceed at 254°. Marker reached _____

Course #3

Start at stake or point marked I

- Proceed at 36°. Marker reached _____
- Proceed at 112°. Marker reached _____
- Proceed at 177°. Marker reached _____
- Proceed at 235°. Marker reached _____
- Proceed at 305°. Marker reached _____

Course #4

Start at stake or point marked O

- Proceed at 96°. Marker reached _____
- Proceed at 161°. Marker reached _____
- Proceed at 219°. Marker reached _____
- Proceed at 289°. Marker reached _____
- Proceed at 351°. Marker reached _____

Course #5

Start at stake or point marked U

- Proceed at 138°. Marker reached _____
- Proceed at 195°. Marker reached _____
- Proceed at 254°. Marker reached _____
- Proceed at 316°. Marker reached _____
- Proceed at 36°. Marker reached _____

Course #6

Start at stake or point marked L

- Proceed at 177°. Marker reached _____
- Proceed at 235°. Marker reached _____
- Proceed at 305°. Marker reached _____
- Proceed at 25°. Marker reached _____
- Proceed at 96°. Marker reached _____

Course #7

Start at stake or point marked Z

Proceed at 219°. Marker reached _____
Proceed at 289°. Marker reached _____
Proceed at 351°. Marker reached _____
Proceed at 62°. Marker reached _____
Proceed at 138°. Marker reached _____

Course #8

Start at stake or point marked P

Proceed at 254°. Marker reached _____
Proceed at 316°. Marker reached _____
Proceed at 36°. Marker reached _____
Proceed at 112°. Marker reached _____
Proceed at 177°. Marker reached _____

Course #9

Start at stake or point marked A

Proceed at 320°. Marker reached _____
Proceed at 62°. Marker reached _____
Proceed at 161°. Marker reached _____
Proceed at 235°. Marker reached _____
Proceed at 305°. Marker reached _____

Course #10

Start at stake or point marked E

Proceed at 29°. Marker reached _____
Proceed at 112°. Marker reached _____
Proceed at 195°. Marker reached _____
Proceed at 289°. Marker reached _____
Proceed at 351°. Marker reached _____

TO MAKE ADDITIONAL INSTRUCTION CARDS

Pick any combination of 6 letters from the list: A, E, I, O, U, L, Z, P. The first letter is the marked stake that the participant will start at, the next five letters will be the answers.

Do not pick the same letter consecutively, example: Z, A, A, P, E, L. Because the participant would not move. But it is possible for the same letter to be used, example: Z, A, P, E, A, L. With a small group more than 6 letters could be picked, the first letter is still the starting stake and the remaining letters are the answers.

Use the provided charts to determine the compass bearings from one marked stake to the next marked stake. Example, I picked the six letters: Z, A, P, E, A, L.

The participant will start at Z, use the chart, **From Z**, first to find the bearing to A, bearing is 235° .

To find the bearing from A to the next stake P, use the chart, **From A**, bearing to P is 74° .

Next use the chart, **From P**, to find the bearing to E, bearing is 289° .

Next use the chart, **From E**, to find the bearing to A, bearing is 125° .

Next use the chart, **From A**, to find the bearing to L, bearing is 32° .

Start at stake marked Z.

Proceed at 235° . Marker reached _____
Proceed at 74° . Marker reached _____
Proceed at 289° . Marker reached _____
Proceed at 125° . Marker reached _____
Proceed at 32° . Marker reached _____

Answer to the example: A, P, E, A, L (not on the instruction card)

Note: By picking 6 letters and using the provided charts, you can make over 16,000 additional sets of instructions.

Compass Activity 4: “The Quicksand”

Aim:

To accurately plot and follow a safe course through ‘quicksand’, using your knowledge of bearings and locating position.

What you need:

Orienteering compass
Pen and paper

Tape measure (30m)
Markers, for example short sticks

Scenario:

A child is trapped on the far side of an area with quite a bit of quicksand. Bearings of the quicksand areas are known from two fixed points on the rescuers’ side of the field (the rescuers have talked local oldtimers into giving them this information!). The rescue involves finding a safe course across the field.

Instructions:

Using the list of bearings (these will be in pairs for each quicksand area) draw a rough sketch of the field and the estimated position of the quicksand pits. The field will be set out with one marker for the child on the far side and two fixed markers for you on the rescuers side. When reading the bearings, the first one given will be read from the left hand rescue marker and the second from the right hand rescue marker. You will notice that this means they always intersect at the location of a quicksand pit.

Now use the orienteering compass and any other equipment you have to travel to the nearest quicksand pit. Place a marker at its location. You will need to think about how you can best accomplish this.

Are the two bearings enough information?

Would it help to know some of the distances?

Can you calculate any of the distances?

Once all the quicksand pits have been located, you can plot a safe course to rescue the child with bearings and distances recorded accurately for later work

On the next page is a sample field. The bearings are listed in pairs on the right-hand side of the page.

	• Child		
	X	27° (31.8m)	349° (28.8m)
X	X	0° (22.9m)	319° (30.3m)
	X	31° (23.2m)	340° (21.8m)
X		17° (14.7m)	313° (20.9m)
	X	57° (10.6m)	298° (12.4m)
•	• Rescuers Fixed		
Assuming 20m	Markers		
Between markers			

Distances along the triangle sides will depend on the width between the two rescue markers. The figures given beside the angles are for a width of 20m between the markers and are approximate (to one decimal place). 'The child' will be a little over 35m away.

You may decide to find the perpendicular distances to the quicksand pits from the base line and proceed from there with Pythagoras Theorem, for a right triangle the sum of the square of the two sides is equal to the square of the hypotenuse, $X^2+Y^2=Z^2$.

