

Pace and Compass

Overview:

Scientists use maps to record and monitor many geologic features, including lava flows, calderas, and volcano vents. The boundaries of these features can be mapped with a handheld GPS (Global Positioning System) receiver. This information is compiled by computer GIS (Geographic Information System) software into a digital map.

Since ancient times, Hawaiians also have observed volcanic features and events. These observations were recorded in a variety of forms, including *lono* and *mele*. *Lono* are ancient oral reports containing detailed observations. A *mele* is a song, anthem or chant, often accompanied by musical instruments.

Before GPS receivers and GIS software were invented scientists used other methods to convert their observations into maps. The “Pace and Compass” is one such technique. In this activity, students will learn how to draw a map using the “Pace and Compass” technique.

Objectives:

The student will:

- find their pace;
- use a compass;
- use their pace to find the distance between two points; and
- draw a map using the pace and compass method.

Materials:

- Compass
- Clipboard
- Small protractor or ruler
- Measuring tape
- Calculator
- Student Worksheet: “Sample Pace and Compass”
- Student Worksheet: “Finding your Pace”
- Student Worksheet: “Search for Waypoints”

Pace and Compass

Answers to Student Worksheets:

Sample Pace and Compass:

Waypoint Name & Number	Compass Bearing	Pace		Meters Per Pace		Distance (Meters)
#1 Picnic Table	-----	-----	x	-----	=	-----
#2 Basketball Hoop	90° (E)	44	x	1.6	=	70.4 m
#3 Slide	225° (SW)	22	x	1.6	=	35.2 m
1. #4 Swings	270° (W)	29	x	1.6	=	46.4 m
2. #5 Jungle Gym	135° (SE)	21	x	1.6	=	33.6 m

3. True

Finding your Pace:

Answers will vary

Search for Waypoints:

1. Maps
- 2-3. Chart and map will vary depending on the area. Map should include a scale.

Pace and Compass

Activity Preparation:

1. Choose a location for this activity that is large enough to accommodate the whole class.
2. Measure off a 100-meter line in the area (it can be 50 meters if students pace it off two times).
3. Familiarize yourself with your classroom compasses. Practice finding compass bearings from one waypoint to another.
4. Place 5 pieces of colored cardboard (cover with construction paper if needed) or cones on an open field to use as waypoints. Number the waypoints 1-5. Make Waypoint 1 the starting point. Students will locate waypoints in numerical order. Stand at Waypoint 1 and use a compass to determine which direction students will need to walk to get to Waypoint 2. Write this direction in degrees under the “Compass Bearing” column on the Student Worksheet: “Part 2: Search for Waypoints.” Record compass bearings from Waypoints 2 to 3, 3 to 4, and 4 to 5 before copying the worksheet for students.

Activity Procedure:

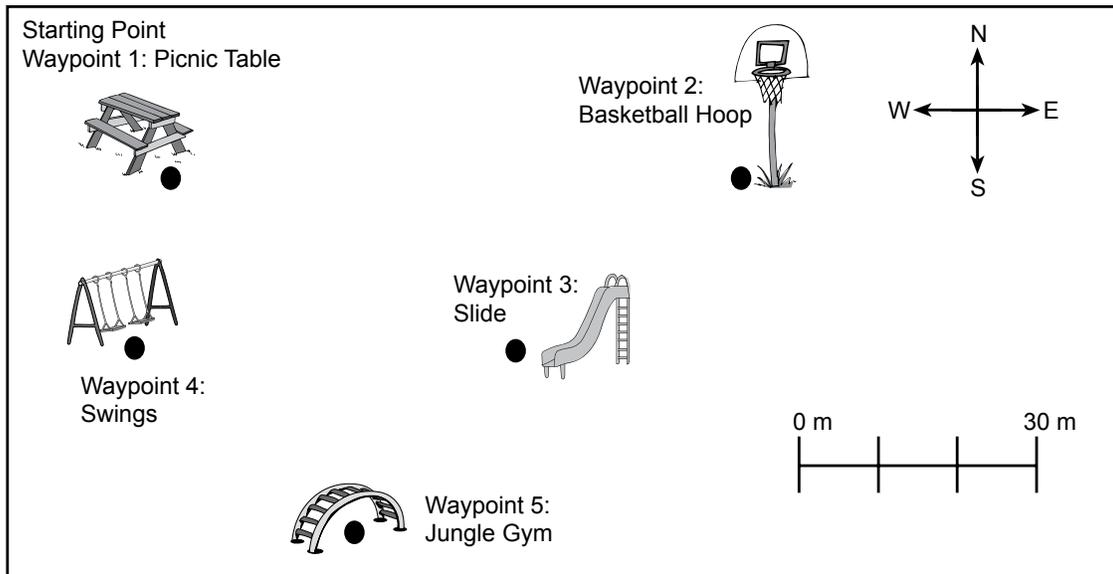
1. Ask students to describe how to get to the gym, the office, and the gas station nearest the school. Ask what their responses have in common (direction and distance). Explain that in this activity students will locate waypoints (objects) on the school grounds. They will be given compass bearings but will need to find the distance (pace) to each waypoint. Students will use the information they collect to create a map of the area.
2. Distribute the Student Worksheet: “Finding your Pace.” Help students follow the directions to determine their average paces.
3. Distribute calculators and the Student Information Sheet: “Sample Pace and Compass,” which provides an example of a map created using pace and compass data. Show students (1) how to determine compass bearings by looking at the map and (2) how to determine distance using pace. Ask students to fill in the two empty boxes on the chart.
4. Distribute compasses, clipboards, and the Student Worksheet: “Search for Waypoints” on which you previously filled in the compass bearings. Review how to use a compass. Lead students to the starting point (Waypoint 1). Ask them fill in the waypoint and the pace for each compass direction on their Student Worksheet: “ Search for Waypoints.”
5. Return to the classroom and ask students to fill in the “Meters Per Pace” column on their charts. The number in this column will be the same for every waypoint (their “Meters Per Pace” calculation on the Student Worksheet: “Finding Your Pace”). Ask students to calculate the distance to each waypoint.
6. Distribute protractors and rulers. Show students how to draw a map of their school grounds using these instruments and the data collected. Include a scale on the map.

Sample Pace and Compass

Directions: Use the information below to fill in the empty boxes on the chart.

Waypoint Name & Number	Compass Bearing	Pace		Meters Per Pace		Distance (Meters)
#1 Picnic Table	-----	-----	x	-----	=	-----
#2 Basketball Hoop	90° (E)	44	x	1.6	=	70.4 m
#3 Slide	225° (SW)	22	x	1.6	=	35.2 m
1. #4 Swings		29	x	1.6	=	46.4 m
2. #5 Jungle Gym	135° (SE)	21	x	1.6	=	

*Please note that the numbers in the Meters Per Pace column should be the same for every waypoint. You found your own Meters Per Pace on the Student Worksheet: "Finding your Pace."



- True or False: Lono and GPS are methods that have been used to record information about volcanic features.

Finding Your Pace

Scientists use maps to record and monitor many geologic features, including lava flows, calderas and volcano vents. In this activity, use the “Pace and Compass” technique to collect data and draw a map.

Pace is the distance of two steps. To find your pace, walk a 100-meter-long line. Start with your left foot and count how many times your right foot hits the ground. Do this two times, and record each number in the box below.

To find your average pace, add the number of paces it took the first and second time you walked 100 meters, then divide by two. For example, if your right foot hit the ground 60 times the first time you walked the 100 meters and your right foot hit the ground 64 times the second time, then your average pace would be 62 paces per 100 meters. $(60 + 64) \div 2 = 62$

Find your average pace:

$$\begin{array}{r}
 \text{1st 100 meters: } \underline{\hspace{2cm}} \\
 + \\
 \text{2nd 100 meters: } \underline{\hspace{2cm}} \\
 = \\
 \underline{\hspace{2cm}} \div 2 = \\
 \underline{\hspace{2cm}} \\
 \text{(your average pace per 100 meters)}
 \end{array}$$

To find your distance per pace, divide 100 meters by your average pace. In the example, the distance per pace is 1.6 meters (100 meters \div 62 paces = 1.6 meters/pace). Use the formula below to find your distance per pace, then record this number on the Student Worksheet: “Part 2: Search for Waypoints.”

You will use this information to create a map.

Find your meters per pace:

$$100 \div \frac{\underline{\hspace{2cm}}}{\text{(your average pace per 100 meters)}} = \frac{\underline{\hspace{2cm}}}{\text{(distance per pace in meters)}}$$

Search for Waypoints

Record your pace here: _____ per 100 meters

1. The pace and compass method and GIS (the Geographic Information System) are both methods that have been used to create _____.

2. Fill in the chart below (compass bearings have been provided by your teacher).

Waypoint Color & Number	Compass Bearing	Pace		Meters Per Pace		Distance (Meters)
	-----	-----	x	-----	=	-----
			x		=	
			x		=	
			x		=	
			x		=	

3. In the box below, draw a map showing the following:
 - a) a starting point;
 - b) the location of each waypoint;
 - c) the pace to each waypoint (distance);
 - d) the compass bearing to each waypoint (direction); and
 - e) a scale.