



Where am I? Where are you?



**Welcome to a mapping adventure,
where YOU are the cartographer!**

In these activities, you will explore maps – what is important to map making, how do you read maps, and how do you make them? And learn how to be a cartographer.

Cartographers are incredible artists and engineers that have made maps for hundreds of years. It was those old maps of the globe that allowed humans to travel the oceans, the land, and even in the air and space. While the oldest maps were probably temporary and written in the sand with a finger or stick, many maps today are very detailed and made with computers and satellite data. But sometimes maps are still temporary (sometimes even written on napkins) and these maps help us find the grocery store or the park to meet friends.

We're going to spend some time using basic tools that will help us understand how to read a map and make them.

- 1 In the first activity, you will draw two maps and explore some of the parts of a map.
- 2 In the second activity, you get to go outside and determine which direction is North, just by using your arms and the sun! You then make another map and learn about the four cardinal directions.
- 3 In the third activity, you get to put your new skills to the test and interpret two maps – one of a park and one of a community!
- 4 Next, you will design your own map using the same techniques cartographers used 300 years ago!! Your map will have a road and a river, but the rest you get to draw in yourself and be creative!
- 5 And finally, you will have the opportunity to find geographic north and make your own magnetic compass to find magnetic north! This activity will require an adult for safety but you will get to observe a feature of the natural world that you can't see with your eyes – Earth's magnetic field!

*Questions? Write us at Shelby.Jones@dca.nm.gov



Where am I? Where are you?

Activity 1a: You can make a map!

Maps are incredibly useful drawings that allow you to know where you are, where your friends are, and where objects or places are in the world around you.

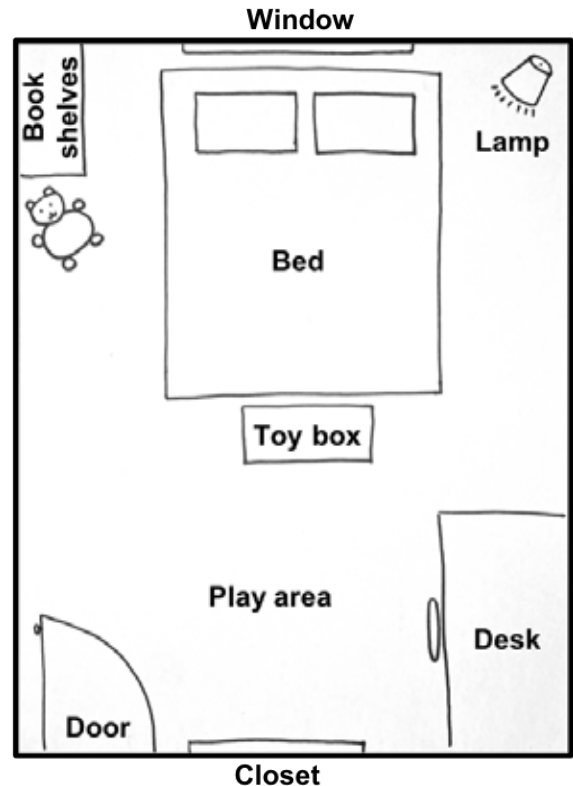
Let's make some maps!

Map #1: A map of your table place setting

1. With an adult, find a piece of paper, a plate/bowl, a cup, and a fork or spoon.
2. Put your three dishes on your piece of paper.
3. Trace (draw a line) around your dishes with a pencil.
4. You just made a map of your dishes!!

Map #2: A map of your room

1. Find a piece of paper (or use the back of your Map #1)
2. Draw your room on your piece of paper.
 - Where do you sleep?
 - Where do you put your clothes?
 - Where do you play?
 - Where is the door?
 - Do you have a window?

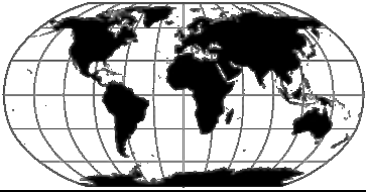
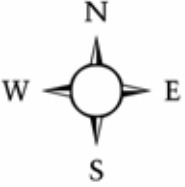
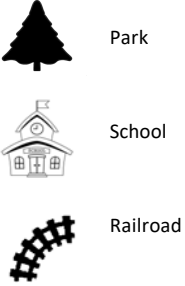





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Activity 1b: Parts of a Map

In the two maps you just made, would your friends know they were of your room and of your dishes? Would they know the different pieces in your room? To answer those questions, all maps have a few parts that are always shown. These parts make it easier for you to read different maps and help you learn from the maps.

<p>Title</p> <p>The title tells us what the map is about.</p> <p>Earth's Continents</p> 	<p>Compass Rose</p> <p>A compass rose tells us the directions of a map – north, south, east, and west.</p> 
<p>Map Key</p> <p>The key gives the meaning of the symbols used on the map.</p> <p>Sometimes the key is called a legend.</p> 	<p>Scale Bar</p> <p>The scale shows us the ratio of map distance to real life distance.</p> 

1. What is the title of the map above? _____


2. What does the tree mean in the map key above? _____

3. Using the scale above, if something was two inches away on a map, what would the distance be in miles in real life?

2 inches = _____ miles

4. Sometimes maps have grids that help you find things. On the gridded map to the right, what grid is the school in?

_____ Letter _____ Number

	A	B	C
1			
2			
3			



Where am I? Where are you?

Activity 1c: Scale Bars

All maps have a scale that shows us how to measure distance on the map. Different maps need different scales. The scale used to map something big (like Earth) will be different from the scale used to map something small (like your bedroom).

Below is a list of different types of maps and different scales. Draw a line from the type of map (on the left) to the best scale to make that map (on the right). Some scales may be used more than once.



1. A map of your classroom.



1 inch = 2 inches



2. A map of your local park.



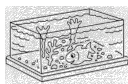
3. A map of New Mexico.



1 inch = 1 foot



4. A map of your school.



5. A map of a fish tank.



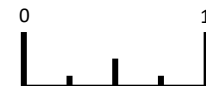
1 inch = 100 miles



6. A map of your city.



7. A map of Earth.



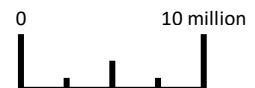
1 inch = 1 miles



8. A map of a dog house.



9. A map of the United States.



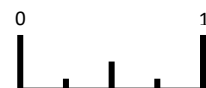
1 inch = 10 million miles



10. A map of the Pacific Ocean.



11. A map of all the planets and sun.



1 inch = 3 feet = 1 yard



12. A map of your bathroom.



13. A map of the inside of a car.



1 inch = 1000 miles



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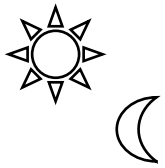
Activity 1d: How far away is it?

All maps have a scale that shows us how to measure distance on the map.
Use the scale bar and ruler to help you answer the questions.



1. How many miles is 1 inch on this map equal to in real life? _____ miles
2. How far (in miles) is Las Cruces from the city of Carlsbad?
Hint: Use your ruler (on the straight side of your protractor) to measure how far Las Cruces is from the city of Carlsbad. Then multiply the number of inches by 100 to convert to miles.
_____ inches x 100 miles = _____ miles
3. How far (in miles) is Albuquerque from Santa Fe?
_____ inches x 100 miles = _____ miles
4. How far (in miles) is Gallup from Las Cruces?
_____ inches x 100 miles = _____ miles

Challenge:
How much further
is it to drive to
Gallup from Las
Cruces than to fly?



Where am I? Where are you?

Activity 2a: Finding your way on a map

One of the most important things maps help us with is finding our way and giving directions to locations. But how do you give directions to someone? Most of us use words like “Up” and “down”, or “In front of you” and “Behind you”, but these don’t always work. When you turn around, what was in front of you is now behind you, and that can be confusing. “Turn right at the sleeping dog” works but only until the dog wakes up and moves. We need a way to give directions that everyone around the world can use and understand. Maps and compass roses are the solution. They can be used as a way of orientating ourselves. Orienting means finding ourselves and objects on a map.

What we all share is the natural world, both visible and invisible (as you will explore in the last activity in this kit), and features of the natural world are the foundation of our ability to orient ourselves in the world and on maps. Historically (and even today) the sun, stars, and Earth’s magnetic field were used to help orient ourselves. Let’s explore using the sun as a way to orient ourselves.

***Ask an adult to go outside.** Stretch your arms out and turn around until your right arm points in the direction of the sunrise. Your right arm is now pointing east, you are now looking north, your left arm is pointing west, and south is behind you. The sun will set in the direction your left hand is pointing. North, south, east, and west are called cardinal directions, and identifying them is the first step toward knowing where you are.

You can use these same cardinal directions inside, even if you can’t see the sunrise or sunset. But if you are inside sometimes it’s hard to figure out where north is when you can’t imagine where the sunrise would be. However, if you are in a building, and if you can remember which direction the door was facing when you entered, you can usually figure out where north is from inside.

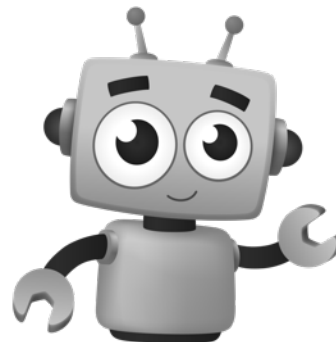
Want to try?

Take a look at the map of your room, and try to label north, south, east, and west walls.

Sunset



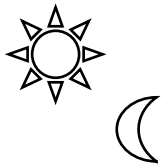
West



Sunrise



East

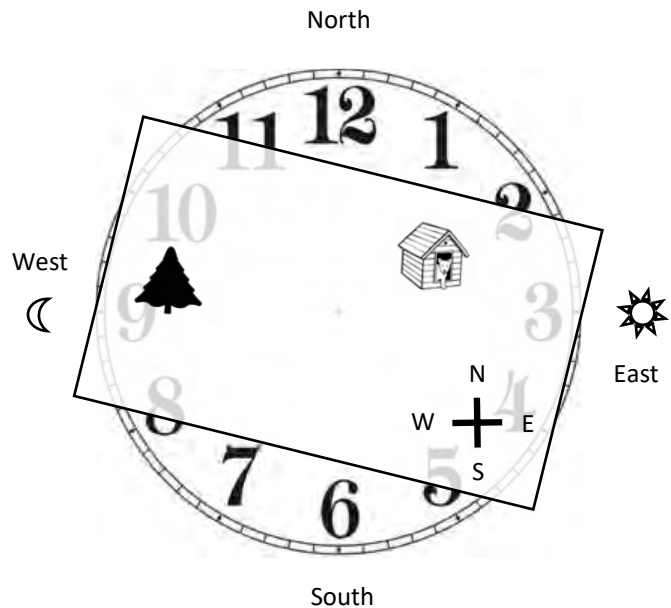


Where am I? Where are you?

Activity 2b: Map Sunrise and Sunset

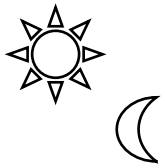
Let's try out your new skills as a cartographer (map maker) and make a map of an outside space. We will include some of the important parts of a map – a title, labels, and a compass rose. This compass rose will help you tell your friends which way to hold the map you make and allow you give them directions, using the cardinal directions. Setting up a map is just as important as filling it in and reading it. ***Ask an adult to go outside.**

1. You will need a piece of paper, a pencil, and a place to sit outside. Maybe a yard, a park, a patio.
2. Pretend you are flying bird looking down and draw a map from that perspective.
3. On which side of your map does the sun appear to rise?
Draw a sun on that side of your map and write the word "East".
4. On which side of your map does the sun appear to set?
Draw a moon on that side of your map and write the word "West".
5. Now pretend your map is a clock and turn your piece of paper, so that the sun is at 3 o'clock and the moon at 9 o'clock. This might not line up with the edges of your paper.
6. Where the 6 o'clock should be, write the word "South"
7. Where the 12 o'clock should be, write the word "North"
8. In a corner of your map, draw a small line in the 3 & 9 o'clock direction, and one in the 6 & 12 o'clock direction. It will look like a plus sign "+". Write N, E, S, W.



You just made a map and compass rose!

Last step is to draw and label some of the things you see, and give your map a title.

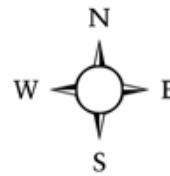


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Activity 2c: Compass Rose

Now that you made your own map with a compass rose, let's explore them a little more. A compass rose is a figure on a map that shows directions. Sometimes they are fancy, sometimes they are simple. Most show the "cardinal directions": North, South, East, and West. But fancier compass rose figures can have points for Northeast, Northwest, Southeast, and Southwest. Use the questions below to practice reading a compass rose.

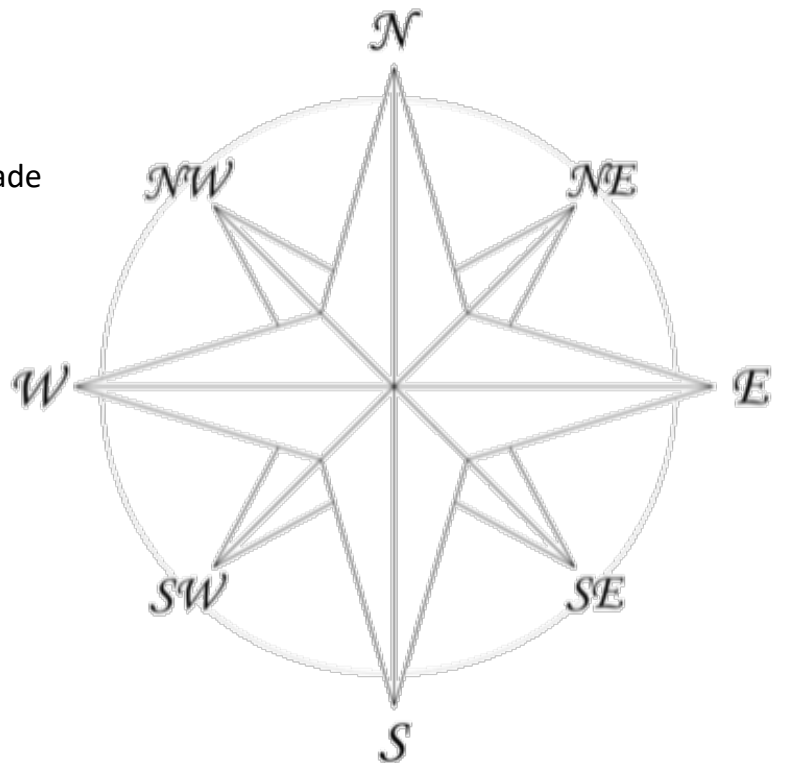
1. Circle the simplest compass rose
2. Square the one that shares the most information
3. Match the words on the left with their shortened name on the right



Northeast
Northwest
Southeast
Southwest

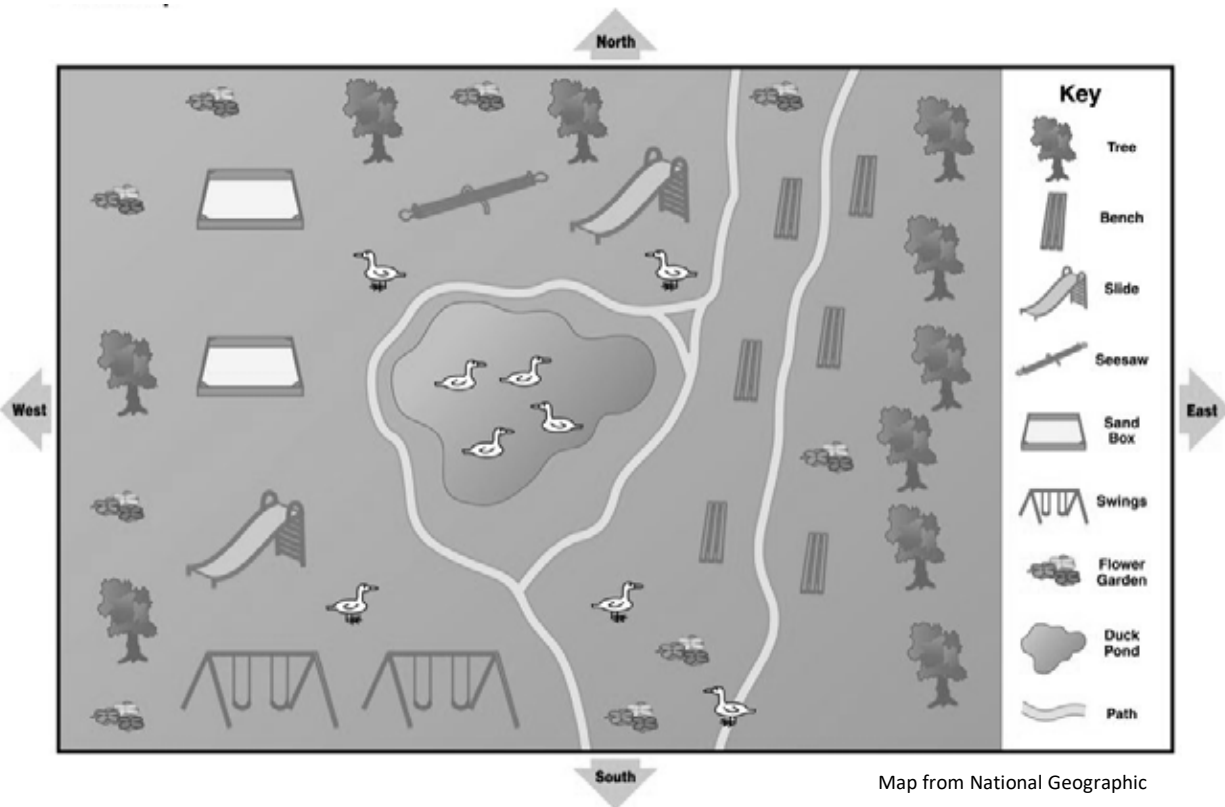
SE
 NW
 SW
 NE

4. On the compass rose, color the "cardinal directions" in red.
5. If you were walking North, then made a left turn, what would your new direction be?
6. If you were walking in the Northwest direction, then turned around to walk the opposite direction, what would your new direction be?
7. Finish coloring the compass rose!



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Activity 3a: Around the Park

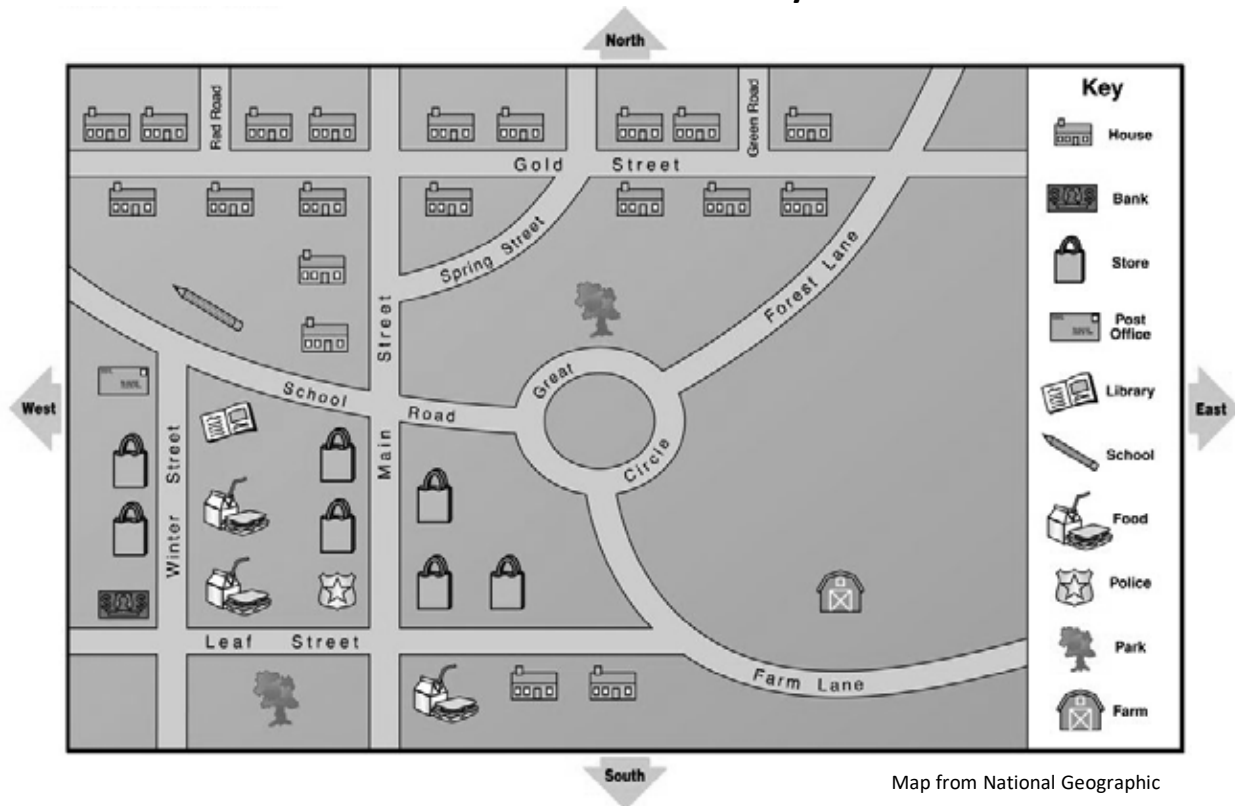


Use the map of the community to answer the questions

1. How many flower gardens are in the park? _____
2. What is the line that circles the duck pond? _____
3. What toys are next to the seesaw? _____ and _____
4. Circle the toy that is West of the seesaw.
5. How many slides are North of the duck pond? _____
6. The benches are _____ of the duck pond. (North, South, East, or West)
7. If you walked South along the path, what animal will you run into? _____

Where am I? Where are you?

Activity 3b: Around the Community



Use the map of the community to answer the questions

1. The library is _____ of the school. (North, South, East, or West)
2. A _____ is south of the police station.
3. To get from the post office to the library, you must cross _____ Street.
4. The bank is _____ of the farm. (North, South, East, or West)
5. What road would you take to get from the school to the bank? _____
6. The school is _____ and _____ of the farm.
(Choose two: North, South, East or West)
7. How many roads do you need to take to get to the school from the farm? ____



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Activity 4:

Making maps – Introduction

Making and reading a map is surprisingly easy and doesn't involve a lot of fancy tools. In fact, you really only need a piece of paper, some measurements, a protractor, a ruler, a pencil, and a little creativity. That's it! The same tools that have been used by cartographers for hundreds of years!

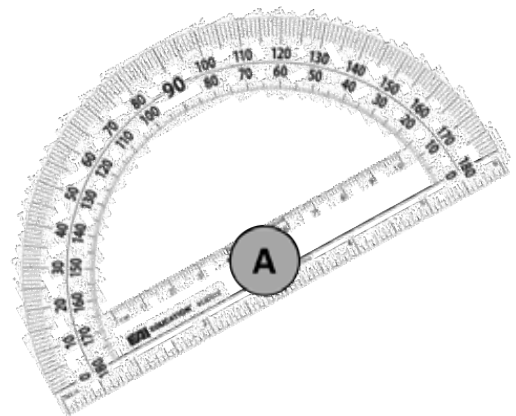
Cartographers (map makers) of the past (and today) would use measurements of angles from North and distances to connect the dots and make maps of all sorts of things. Usually, these maps were made of the oceans or of land, but the same skills can be used to make smaller maps of your community or your room.

In your activity kit, you have a protractor, it will help you measure the angles from North and allow you to make nicer maps, that look more like real life. A protractor is a measuring tool for angles rather than distance (like a ruler). A circle can be divided into 360 equal degrees. Some protractors are round and have 360 degrees marked off like lines radiating from the center of the circle. Most protractors, like the one in your kit, are half circles (180 degrees), with a tiny circle or point in the middle of the straight side to show the center of the circle, where the degrees are measured from.

The angle between East and North is 90 degrees and can also be written as 90° .

How to use your protractor:

1. First, know which way North is on your piece of paper. In these activities North will be towards the top of your paper.
2. Place the protractor on top of your starting point (in this example, the grey circle – point A), so the starting point is in the tiny circle in the middle of the ruler part of your protractor.



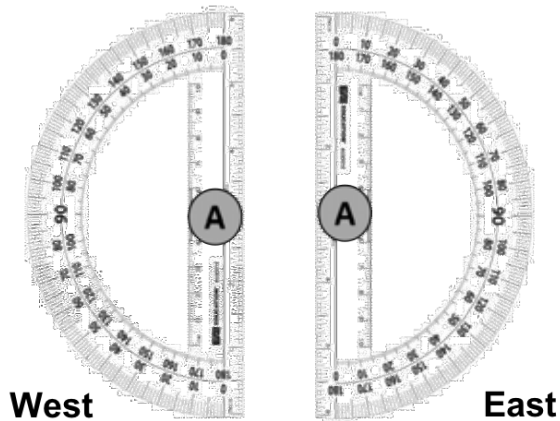


Where am I? Where are you?

Activity 4: Making maps – Introduction

How to use your protractor continued:

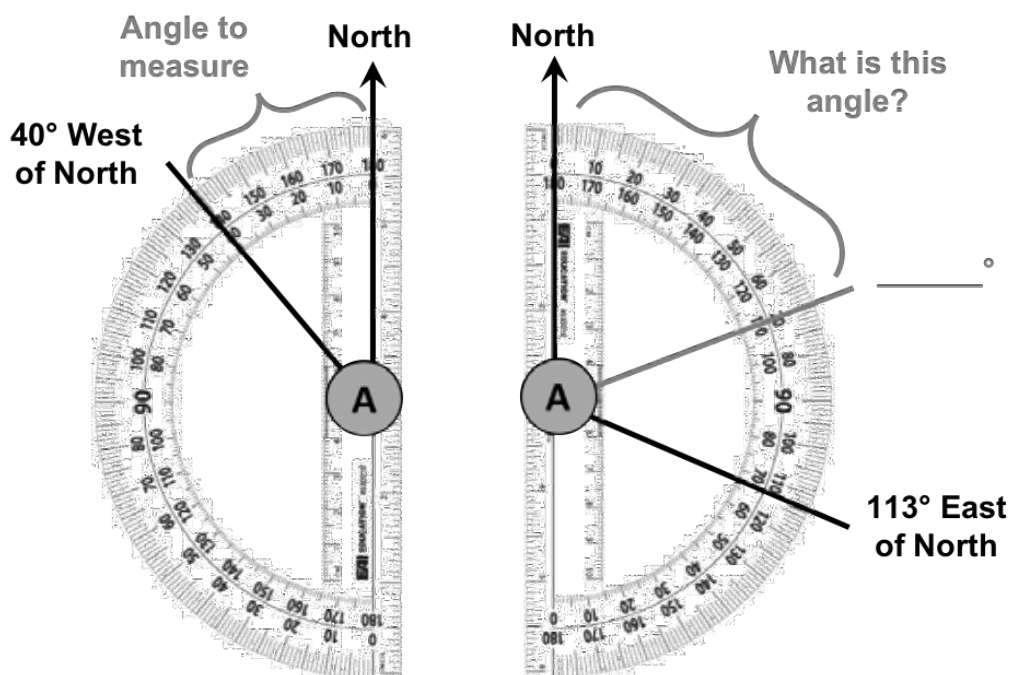
- Turn your protractor so that zero line is pointed North. This will allow you to make measurements from North using the numbers 0-180° (degrees). You will need to know if you are measuring degrees to the West or East of North. This will tell you how to place your protractor.



- Last, you use the numbers 0-180° that are written on your protractor, to count how many degrees from North a point is or measure how many degrees from north you are making a new point.

Let's practice!

Below you have two examples of angles (in black). One is 40° West of North and the other is 113° East of North. There is also a grey line and the angle is left blank. What is the angle of the grey line? Is it East or West of North.



Answer: 70° East of North



Where am I? Where are you?

Activity 4a:

Making maps – Mystery shape

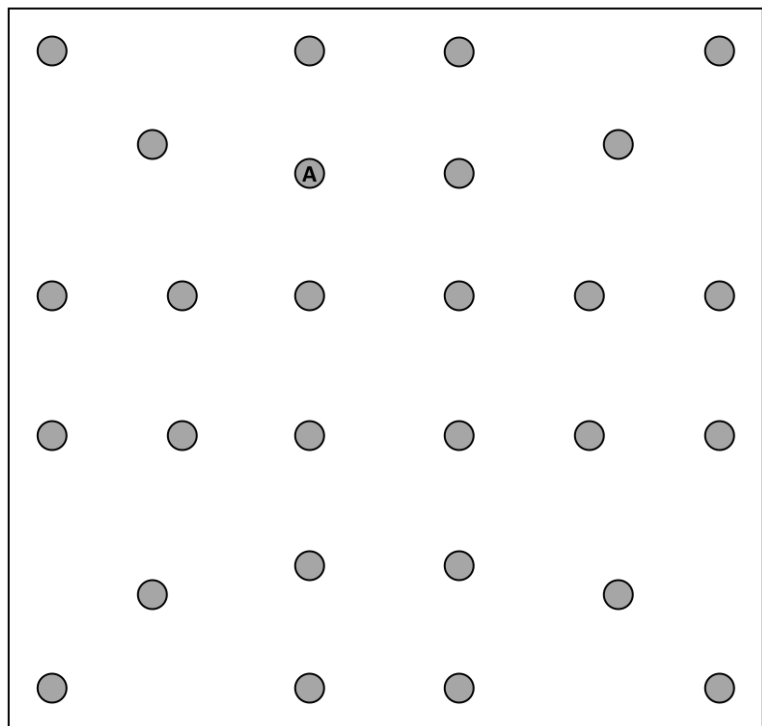
Hidden in the cloud of dots is a shape, your goal is to use the measurements below and your protractor to identify the mystery shape.

Measurements:

1. Starting at point A, draw a line from point A to the point that is directly East (90° East of North).
2. Move your protractor to the new point. From that point, find the point that is 135° East of North. Draw a line to it.
3. Move your protractor to the new point. Now find the point that is directly South (180° from North). Draw a line to it.
4. Move your protractor. Find the point that is 135° West of North. Draw a line to it.
5. Move your protractor and draw a line to the point that is directly West (90° West of North).
6. Draw a line to the point that is 45° West of North.
7. Draw a line to the point directly North.
8. Draw a line to the point 45° East of North.

Title: Map of a Mystery Shape

North



What shape did you make?



Where am I? Where are you?

Activity 4b: Making maps – Old Roads

Historically, people would take measurements outside while walking along a road or creek. Those measurement would be an angle from North and a distance. They would then take notes on those measurements and make a map using those measurements, in much the same way you did in the Mystery Shape activity. Let's try it. Let's be a cartographer (map maker) from 300 years ago. They didn't have computers or Google Maps so they had to make their own maps. And fun fact! They often measured distance by simply counting their foot steps!

Measurements:

1. Start at point A (on the next page), draw a line to a new point (that you draw) that is 130° East of North, 1 inch away.
2. From that point draw a line to a new point that is directly South (180° from North), 1 inch away.
3. Now draw a line to a point that is 130° West of North, 1 inch away.
4. Go back to point A, draw a line to a point that is 40° West of North, 1 inch away
5. From that point draw a line to a new point that is directly North, 1 inch away
6. From that point draw a line to a new point that is 40° East of North, 1 inch away
7. If you have crayons or colored pencils, trace over this line you drew in blue. You just mapped a river!!

8. Go back to point A, draw a line to a new point 80° East of North, 3 inches away
9. Go back to point A, draw a line to a new point directly West (90° West of North), 3 inches away
10. Trace over this line in black. You just mapped a road!!

Now let's add some fun things to our map.

- North of the road and East of the river, draw a school
- South of the road and West of the river, draw a pond with ducks
- North of the road and West of the river, draw a forest
- South of the road and East of the river, draw a play ground

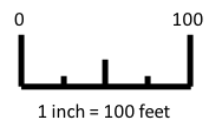
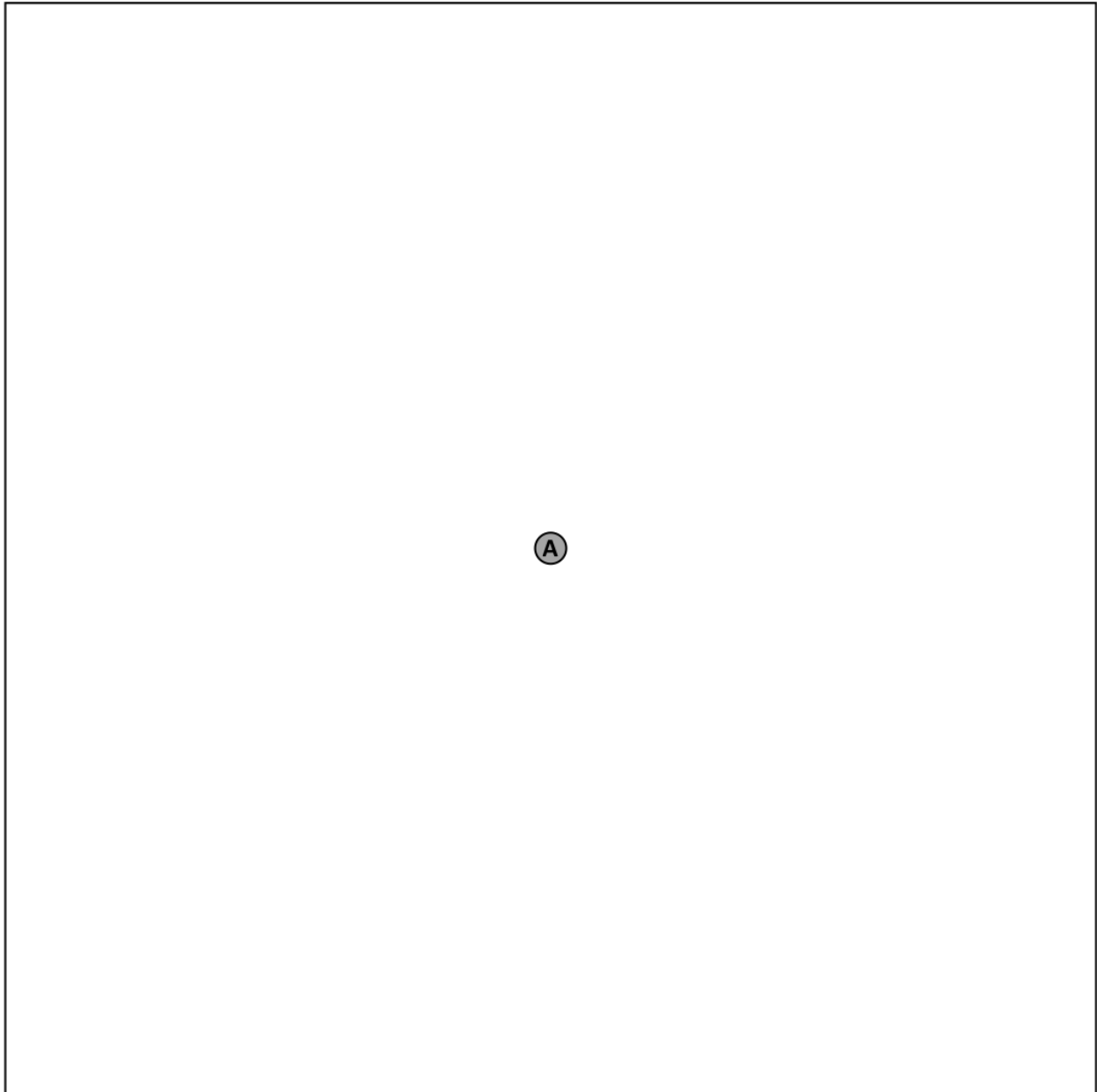


Where am I? Where are you?

Activity 4b:
Making maps – Old Roads

Title: Map of a Old Roads

North





Where am I? Where are you?

Activity 5a: Find Geographic North

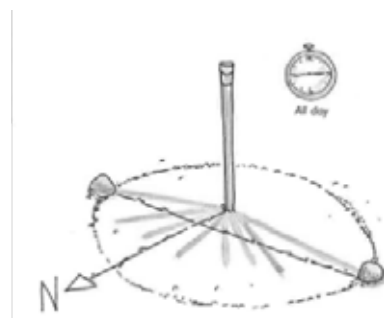
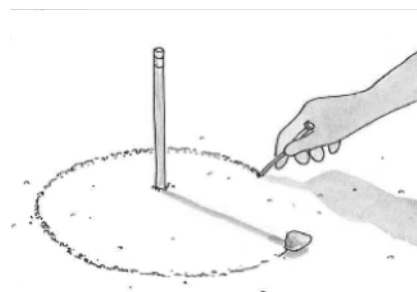
In Activity 2a, you had the opportunity to explore the natural world and estimate which direction North is by stretching out your arms towards sunrise and sunset. This gave you a really good understanding of how the sun can help us orient ourselves in the world and on maps. Let's expand on that activity and find geographic North (you have probably grown up calling it the North Pole) in a more accurate way, using shadows throughout the day. ***Ask an adult to go outside.**

Materials:

- A straight stick or pencil that is about 8 inches long
- 2 small rocks
- A strong stick for drawing in the sand
- A sunny day

Directions:

1. At about 9 o'clock in the morning, find a sunny location outside. You will want to try to find a spot that will be sunny all day long.
2. Once you find your sunny spot, stick your pencil/stick in the ground so it is standing straight up and casting a shadow.
3. Starting at the tip of the pencil's shadow, use your strong stick to draw a circle around pencil. The goal is to draw a circle that is as round as possible, with the pencil in the center.
4. Place one of your two rocks on the circle where the shadow of the pencil meets the circle.
5. Throughout the day, keep checking your shadow. The shadow will shorten as the progresses, until about lunch time. Then after lunch the shadow will lengthen. Once the shadow touches the circle you drew again, place the second rock there.
6. Draw a straight line between your two rocks.
7. Now draw a line from the pencil through the middle point of the line that connects the two rocks. And draw an arrow at the end of this line, and label it with an "N" for North. You just found geographic North!!



Adapted from Q.L. Pearce's Backyard Science Experiments



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Activity 5b: Magnetic North

Another feature of the natural world that is often used in orienting is Earth's magnetic field. It is invisible to humans but can be sensed using magnetic compasses. These compasses contain a little rod of magnetic material (similar to the magnets that you can put on a fridge). The little rod is allowed to rotate and will always rotate so it is pointing towards magnetic North.

The direction of magnetic North is almost parallel to geographic North not quite. Instead the direction magnetic North is usually a few degrees different from geographic North, and the difference in degrees can change over decades and centuries. But because magnetic North is so easy to measure with compass it has been used for over 300 years in map making and orienting. In this activity you will make your own compass!



In your kit, you have a red magnet and a metal sewing pin attached to a round piece of foam. You will need both of these for this activity plus a bowl of water. A bowl is better than a cup because it is wider.

Directions: *Ask for an adult's help with this activity

1. Fill the bowl half full of water.
2. Carefully, without poking yourself or others, rub the "N" side of the magnet against the sewing pin. It is best rub several times in the same direction (from the plastic head to the point) , but not back and forth. This rubbing will make the sewing pin a temporary magnet.
3. Gently place the sewing pin and foam into your bowl of water. Watch it turn! It will align with North!

Challenge!

If you were to rub the other side of the magnet (the "S" side) against the sewing pin, would it float and rotate the same direction? Try it.