



Map

MEDIA SPOTLIGHT

For Teachers

Community Map

Oblique Birds'-Eye View

For the complete maps with media resources, visit:

<http://education.nationalgeographic.com/education/maps/community-map/>

Students in early elementary commonly draw their view of the world using the perspective seen in this map. Students can use maps with this perspective to begin to learn spatial concepts such as identity, location, and symbols. They should be given opportunities to practice with maps of familiar places, like a community. At this age, symbols should represent an object or place in the real world and be a recognizable icon to students. Abstract, unrelated symbols are not understood well at this age. Use the text and prompts below to explore the provided community map with students.

Try This!

A community is a place where people live, work, and have fun together. Look at this map of a community. It shows residential and business areas and some of the main streets and buildings in the community. It includes a map key with symbols.

Community buildings provide services for everyone who lives in the community. For example, everyone can borrow books from the library. Look at the map key to find the symbol for the library. Find the library on the map. What other places on the map provide services for the community?

Prompts:

- Name two streets that have a lot of houses.
- What does the paper bag symbol mean?
- This community has one bank. Find the bank on the map.
- Find the post office. Where is it located?
- Find the police station. Between what types of buildings is it located?
- In what direction would you travel to get from the post office to the farm?

FOR FURTHER EXPLORATION

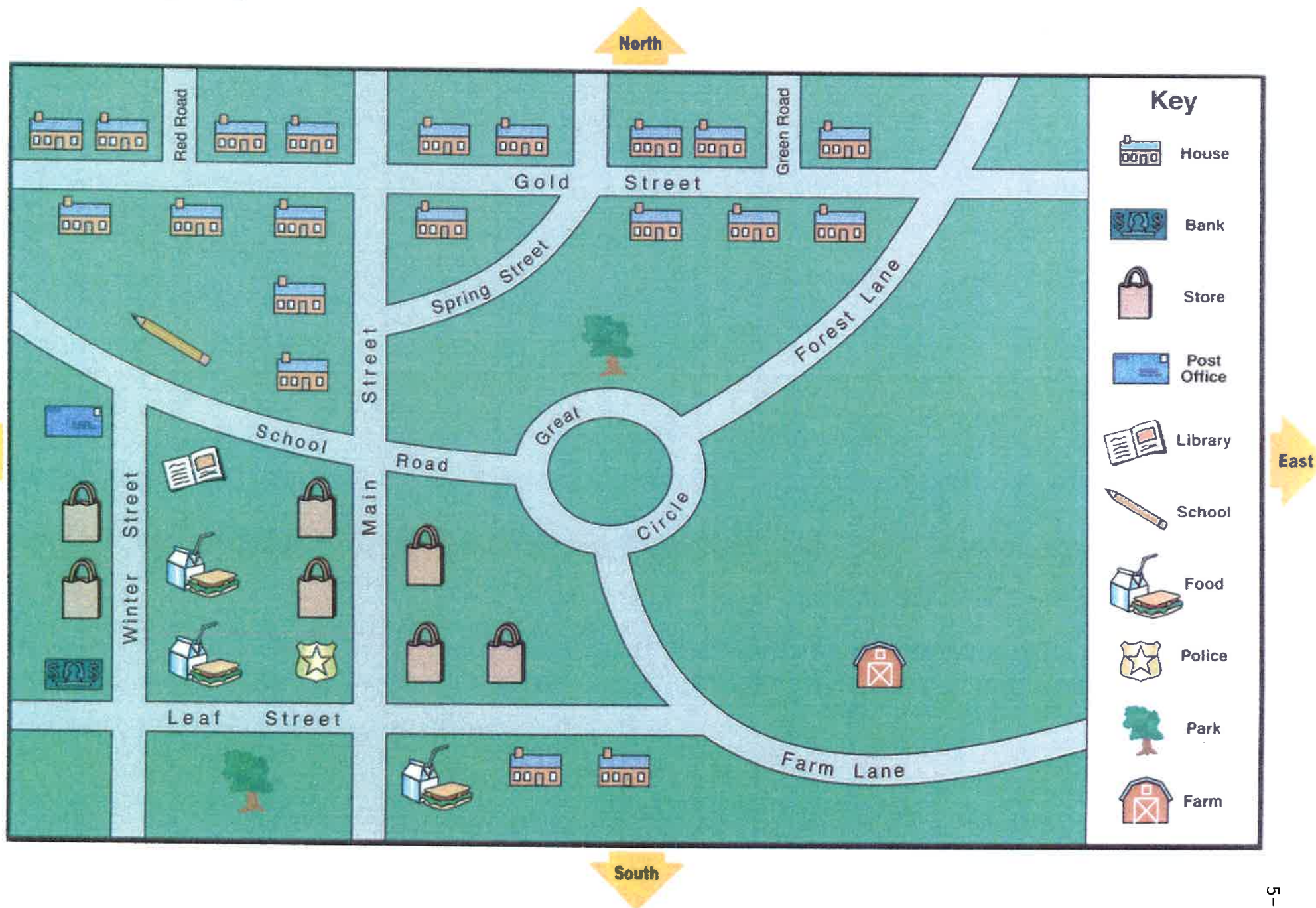
Books

- Sobel, David. *Mapmaking With Children: Sense of Place Education for the Elementary Years*. Portsmouth, NH: Heinemann, 1998.



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Community Map



**Map****MEDIA SPOTLIGHT**

For Teachers

Neighborhood Map

Oblique Birds'-Eye View

For the complete maps with media resources, visit:

<http://education.nationalgeographic.com/education/maps/neighborhood-map/>

Students in early elementary commonly draw their view of the world using the perspective seen in this map. Students can use maps with this perspective to begin to learn spatial concepts such as identity, location, and symbols. They should be given opportunities to practice with maps of familiar places, like a neighborhood. At this age, symbols should represent an object or place in the real world and be a recognizable icon to students. Abstract, unrelated symbols are not understood well at this age. Use the text and prompts below to explore the provided neighborhood map with students.

Try This!

A neighborhood is a section of a town or city. Look at this map of a neighborhood. It shows residential and business areas and some of the main streets and buildings in the neighborhood.

Symbols on a map are drawings that stand for real things. This map doesn't have a key. How can you tell what the drawings mean?

Prompts:

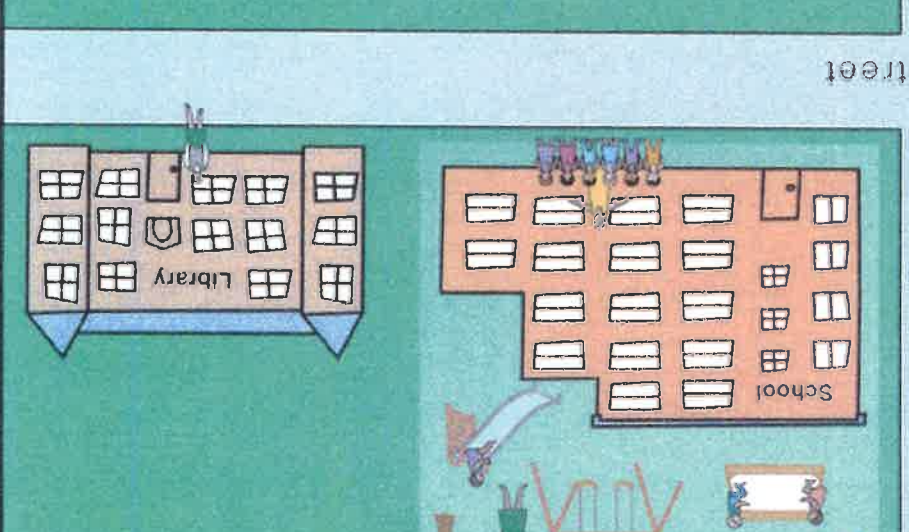
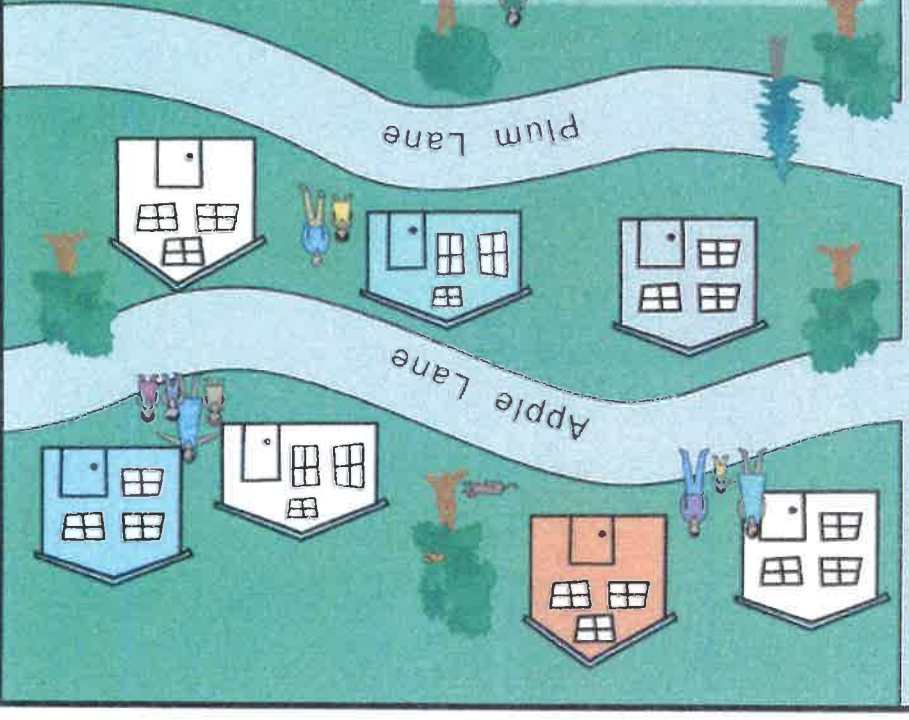
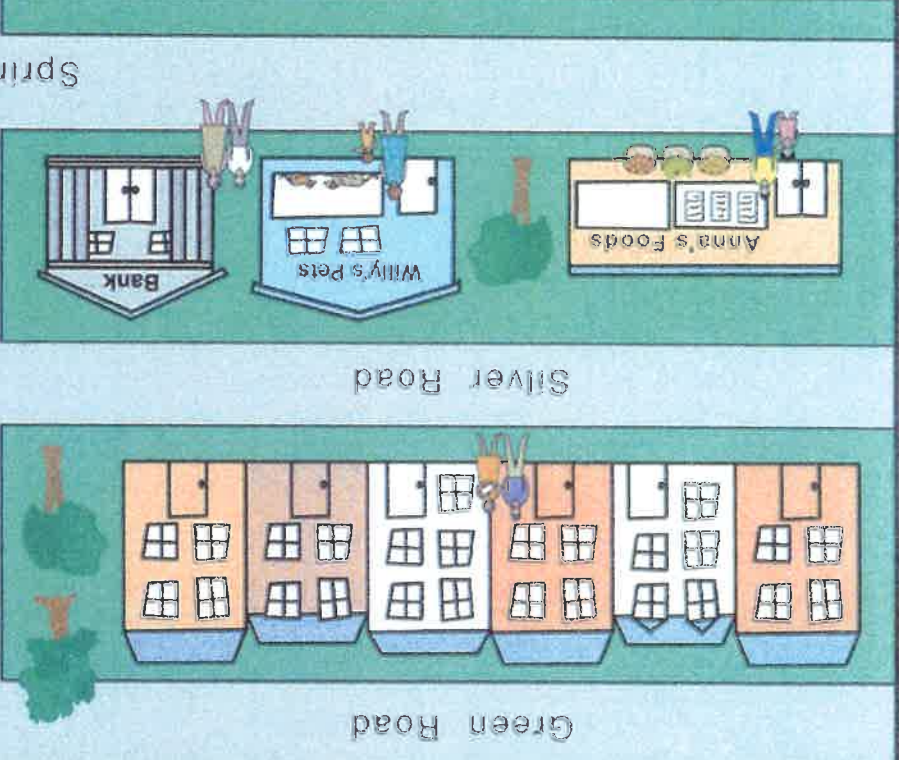
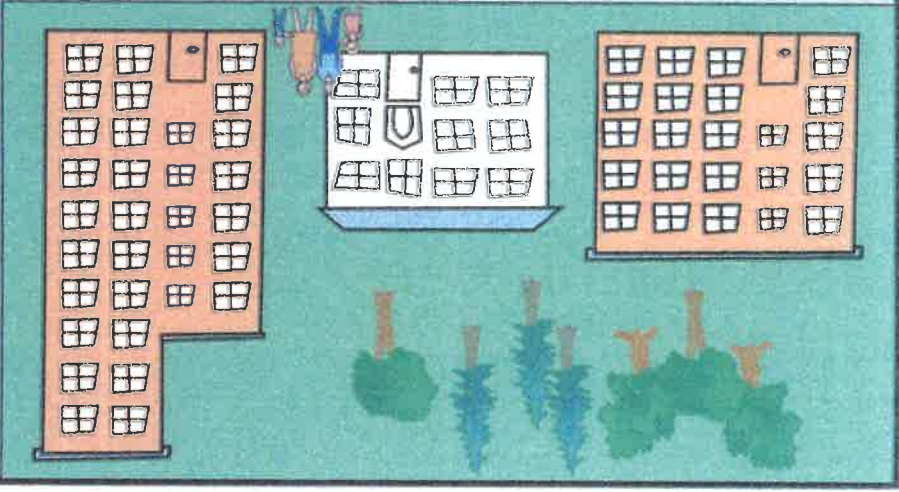
- Find the grocery store. Where is it located?
- What street has no houses on it?
- The school is at the corner of two streets. What streets are they?
- Find the pet store. Between what types of buildings is it located?
- This neighborhood has a tall apartment building. Find it on the map.

FOR FURTHER EXPLORATION**Books**

- Sobel, David. *Mapmaking With Children: Sense of Place Education for the Elementary Years*. Portsmouth, NH: Heinemann, 1998.



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Summer Street

Right

Left

Hopeville Map Questions

Grades 3-8

Time: 30 Minutes or more

This activity will help students with directions and reading maps. After practicing together through the first nine questions, challenge students with the remaining questions. Try pairing students up or in small groups to compete against each other.

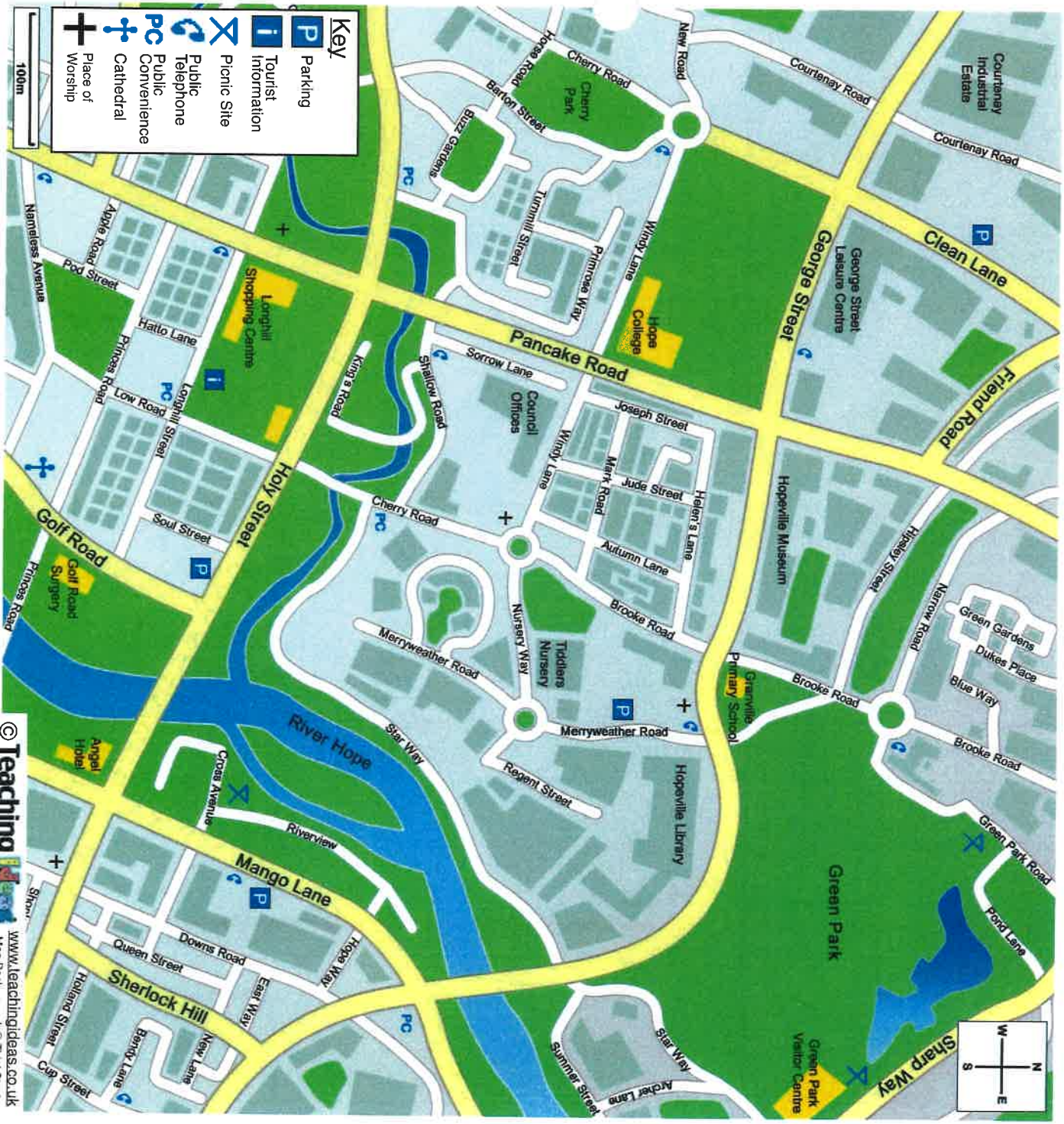
1. What direction is Hopeville Library from the Angel Hotel?
2. How many parking areas are in Hopeville?
3. Approximately how far would you have to walk from Granville Primary School to Hope College?
4. Peter is outside the Council Offices in Sorrow Lane. What is his quickest route to the Hopeville Library?
5. Mark is at the Longhill Shopping Centre. What direction is the Tiddlers Nursery from him?
6. Where is the tourist information centre in Hopeville?
7. Sally is at the picnic site near to Green Park Road. What direction should she go if she wants to go to Hope College?
8. What is the shortest route from Hopeville Museum to the cathedral?
9. Dave has lost his cell phone. How many public phones are there for him to use in Hopeville?

Challenge Questions:

1. I am in Nursery Way facing west. If I go straight ahead at the roundabout, which road will I be on?
2. How many places of worship are there in Hopeville, including the cathedral?
3. Kate is in Cherry Park. What route should she take to get to the Council Offices?
4. What direction is the Green Park Visitor Centre from the parking area on Holy Street?
5. Approximately how far is Cherry Park from the Tiddlers Nursery?
6. Somebody stops you on Brooke Road asking how to get to Green Park Visitor Centre. What would you tell them?
7. The public telephone on Mango Lane is broken. What is the route to the closest public telephone?
8. Mark is on Joseph Street facing south. He turns right and then right at the next roundabout. Where is he now?
9. What route should Chris take to go from the Hopeville Library to the Angel Hotel?
10. Sally lives in Green Gardens. Approximately, how far is her house from the Longhill Shopping Centre?

11. Derek is in the Mango Lange Car Park. He wants to go to the Golf Road Surgery. Which roads should he walk along to get there?
12. How many roundabouts are shown on this map of Hopeville?
13. Approximately how long is Windy Lane?
14. Steve is on Summer Street and he wants to go to the Leisure Centre. However, there is an accident on George Street outside the Primary School. What route should he take?
15. What direction is the Clean Lange parking area from Tiddlers Nursery?
16. What can be found on the corner of Cherry Road and Star Way?
17. Sam is at the Longhill Shopping Centre. Where is the nearest picnic area? What route will take him there?
18. What direction is the cathedral from Hopeville Museum?
19. What directions should the tourist information office give to people who want to go to Hopeville Museum?
20. Approximately how long is Merryweather Road?
21. Kerry is outside the public telephone on Merryweather Road. She goes south, turns right and then turns left. What road is she on now?
22. Paul has taken a wrong turn and is at the end of Regent Street. What directions should he take to the George Street Leisure Centre?
23. There are roadworks along Windy Lane. How can Matthew get from Jude Street to Cherry Park?
24. Kevin has to walk from Cherry Park to Hopeville Library and back. How far is his journey approximately?

Hopeville

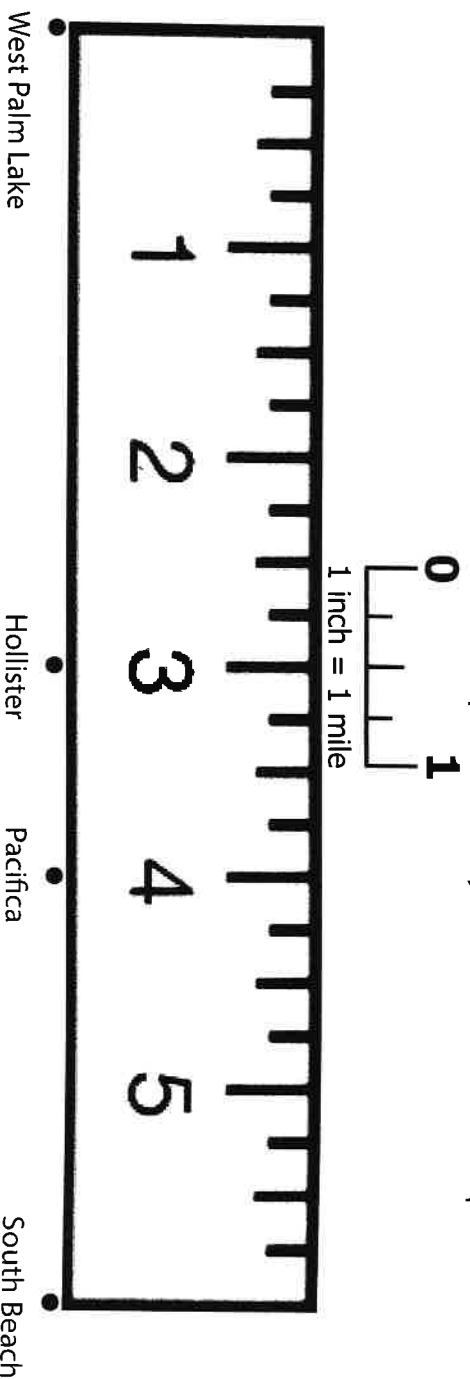


Using a Map Scale

Maps use a scale to show sizes and distances in a way that people can understand.

A scale compares actual distance on the ground to distance on the map.

On the scale below, one actual mile is represented by one inch on the map.

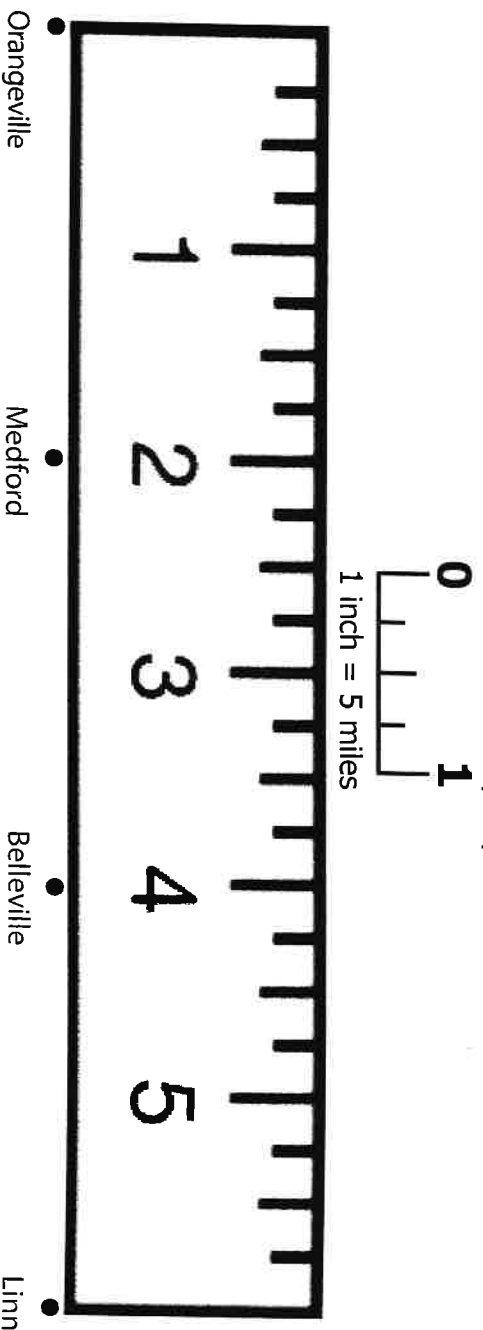


1. How many miles is it between West Palm Lake and South Beach?

2. How many miles is it between Hollister and South Beach?

3. How many miles is it between Pacifica and West Palm Lake?

On this scale, one inch on the map represents five miles.



4. How many miles is it between Medford and Belleville?

5. How many miles is it between Orangeville and Linn?

6. How many miles is it between Belleville and Orangeville?



Name: _____

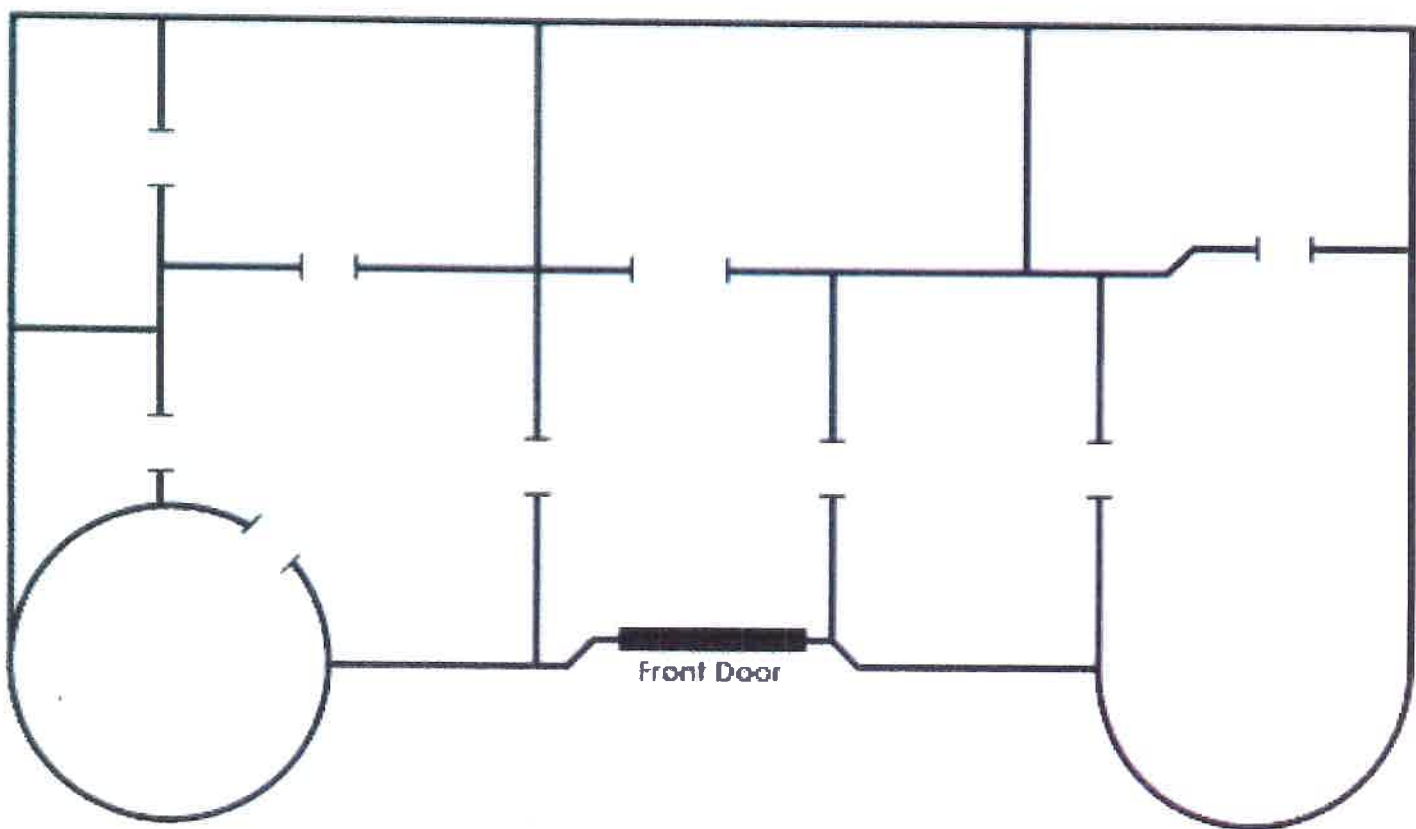
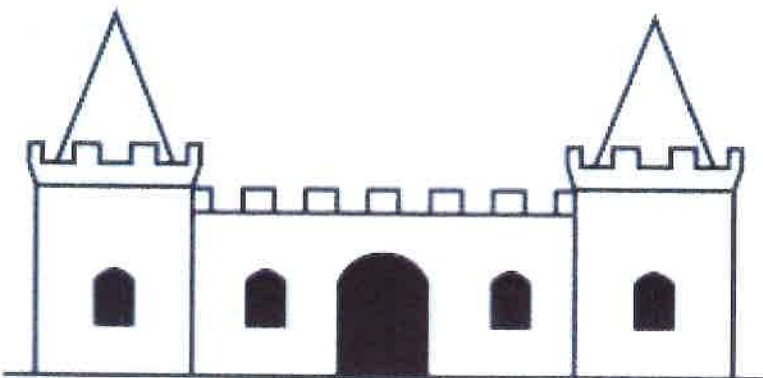
Royal Castle Floor Plan

Write your name at the top of the Royal Castle Floor Plan map and follow the directions below.

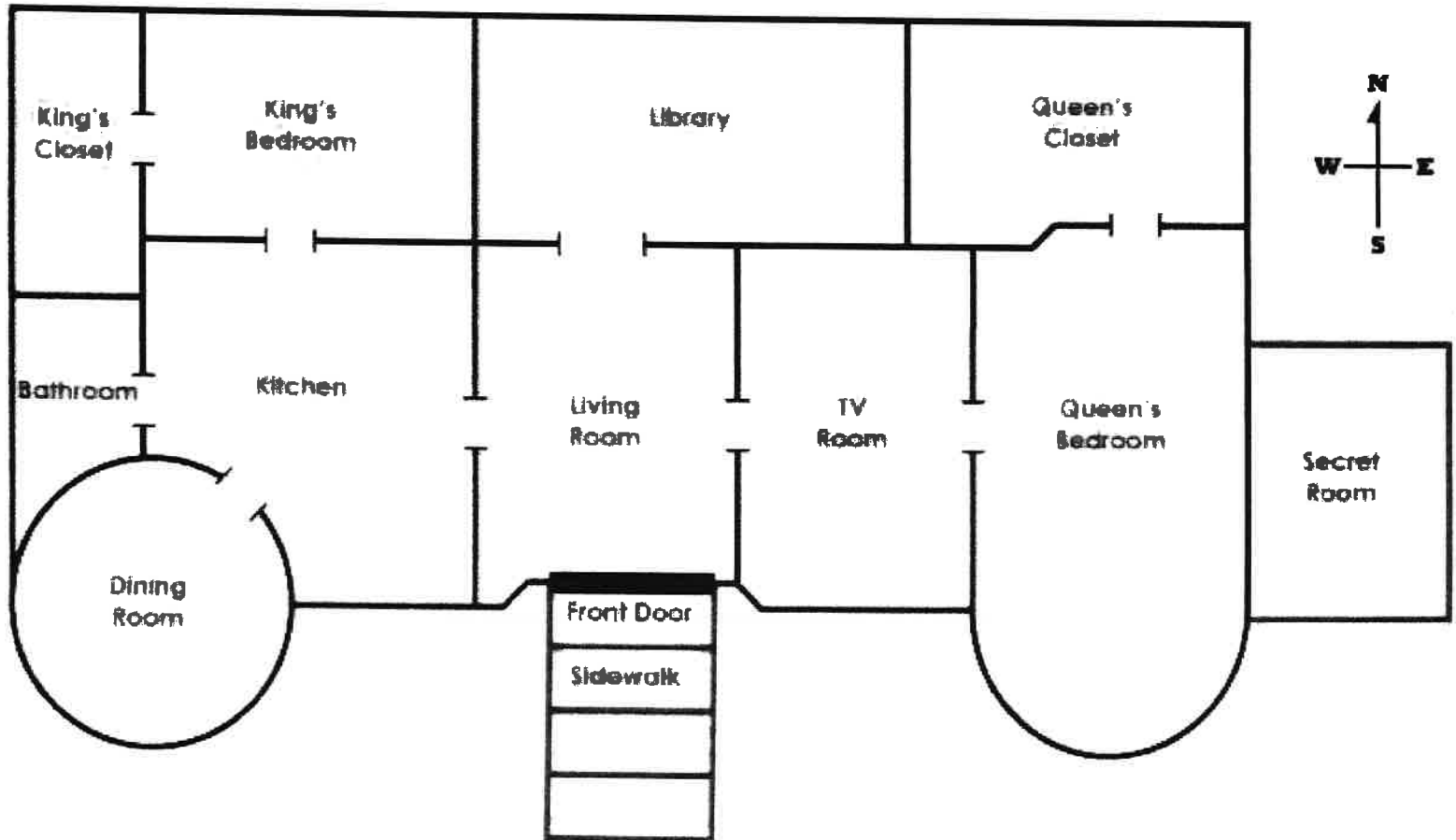
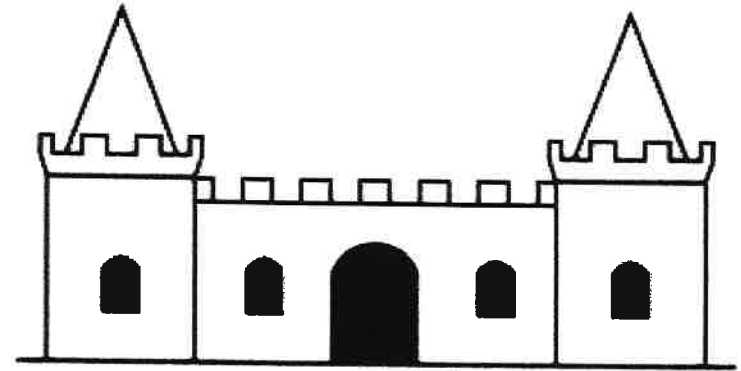
1. When you enter the castle through the front door, you are in the living room. Label this room LIVING ROOM and draw a sofa in it.
2. As you walk to the east from the living room, you enter the royal TV room. Label this room TV ROOM and draw a television in it.
3. The largest room in the castle is the Queen's bedroom. Label this room QUEEN'S BEDROOM and draw a bed in it.
4. Directly north of the Queen's bedroom is the queen's closet. Label this room QUEEN'S CLOSET and draw a dress in it.
5. Directly west of the Queen's closet is the library. Label this room LIBRARY and draw a book in it.
6. The smallest room in the castle is the bathroom. Label this room BATHROOM and draw a bathtub in it.
7. Directly east of the bathroom is the kitchen. Label this room KITCHEN and draw a stove and refrigerator.
8. The dining room is shaped like a circle. Label this room DINING ROOM and draw a table in it.
9. If you walk north from the kitchen, you enter the King's bedroom. Label this room KING'S BEDROOM and draw a bed in it.
10. If you're in the King's bedroom and look to the west, you'll see the King's closet. Label this room KING'S CLOSET and draw a shirt in it.
11. Outside the castle, just south of the front door, is a sidewalk. Draw the sidewalk leading up to the front door.
12. The King and Queen decide to build a secret room in their castle. They will hide their jewels in this room. It will be a small room that is directly east of the queen's bedroom. Draw the secret room and label it SECRET ROOM. Draw a crown in this room.



Royal Castle Floor Plan



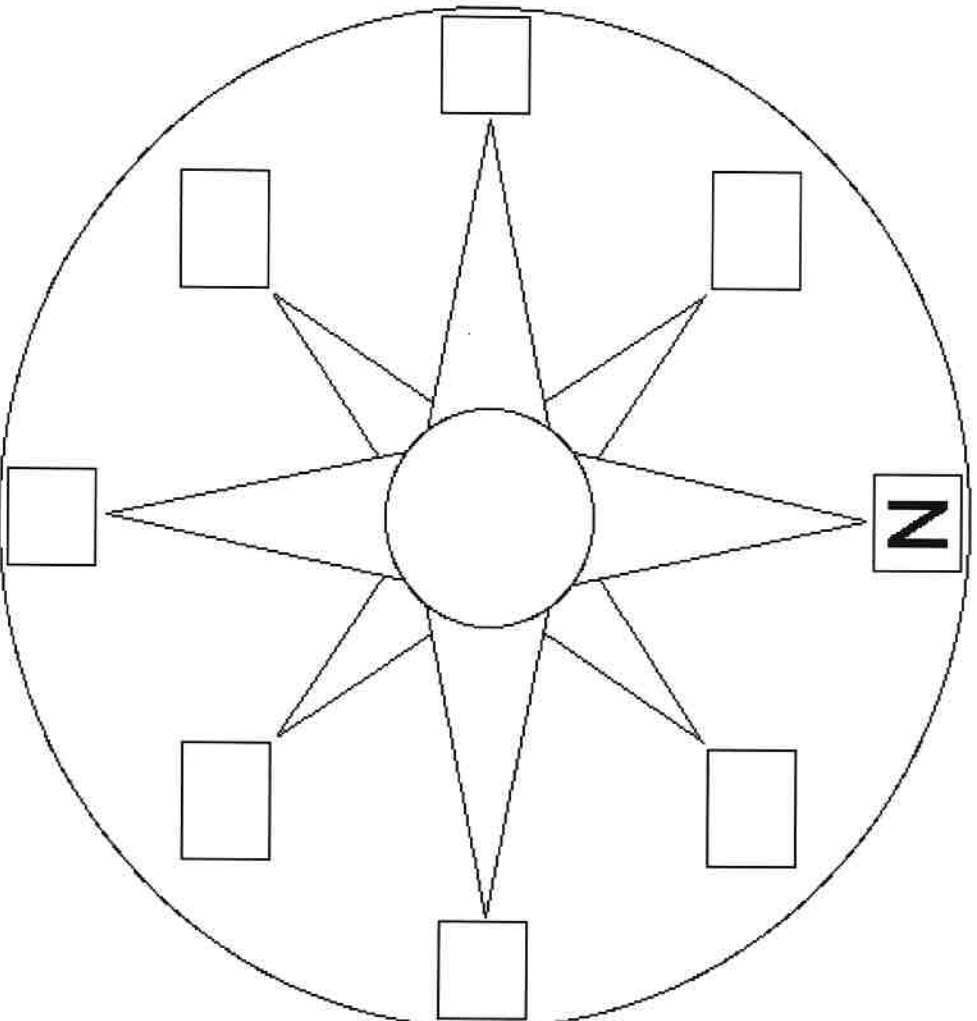
Royal Castle Floor Plan



ANSWER KEY

Compass Rose

A compass rose is a design on a map that shows directions. It shows north, south, east, west, northeast, northwest, southeast, and southwest.



On the compass rose above, only north is filled in.

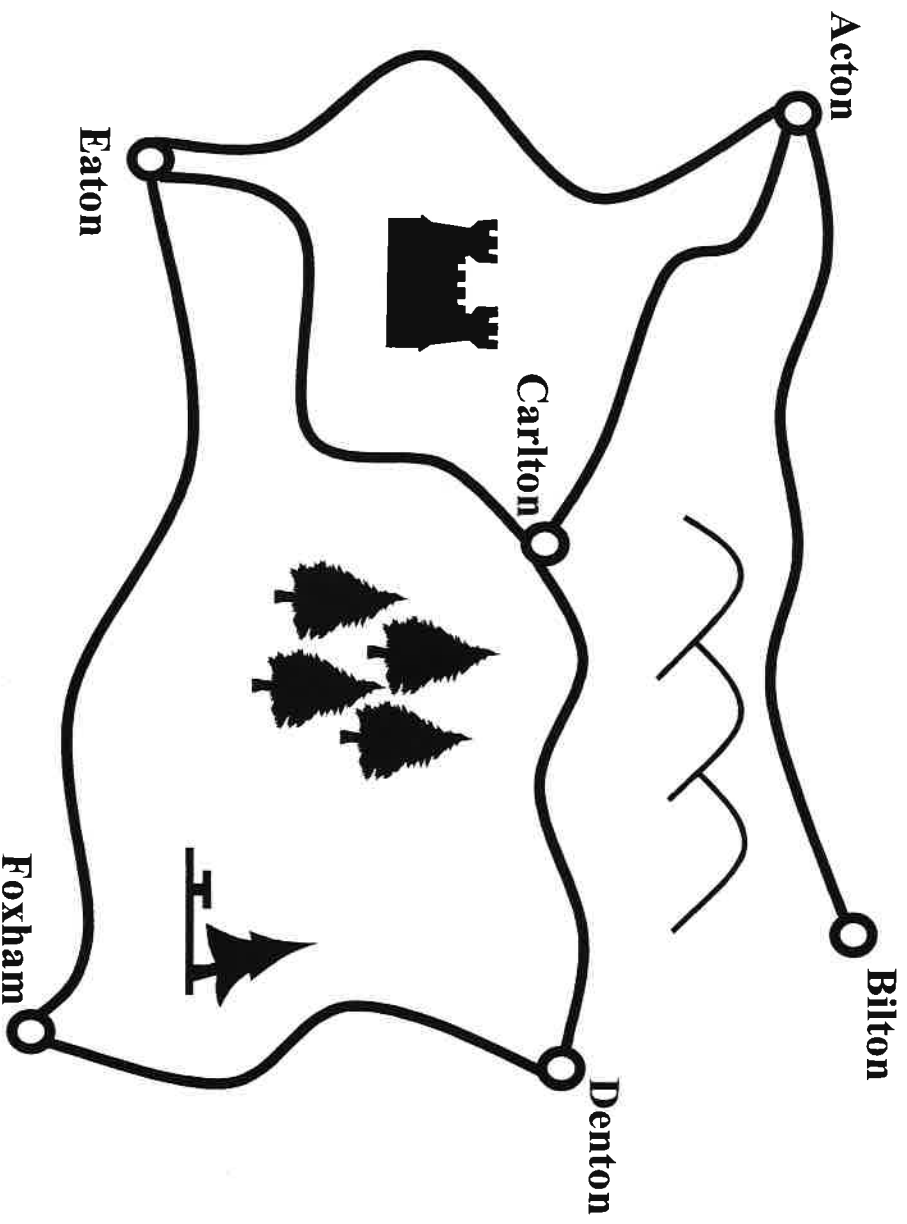
Fill in the rest of the directions on the compass rose, using the standard abbreviations:

N=North, S=South, E=East, W=West, NE=Northeast, NW=Northwest, SE=Southeast, SW=Southwest.

HINTS: When north is at the top of the compass rose (as it often is), south is at the bottom, east is on the right, and west is on the left. Northeast is between north and east, northwest is between north and west, southeast is between south and east, and southwest is between south and west.

HOW FAR?

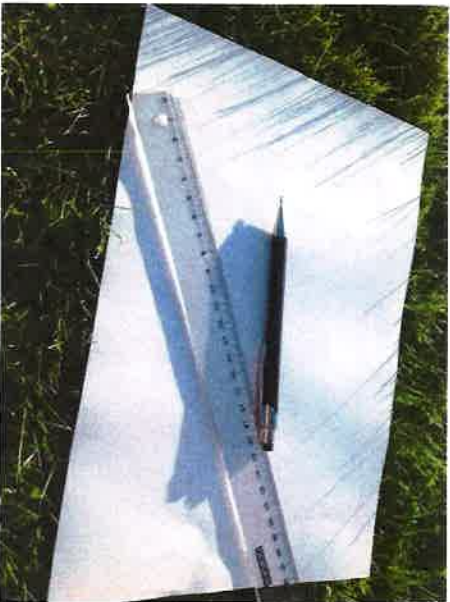
Scale: 1cm = 1km



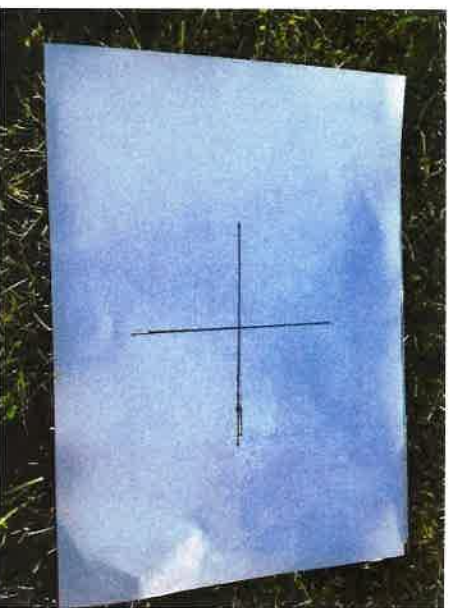
1. How far is it from Acton to Bilton? _____
2. What is the distance between Denton and Foxham? _____
3. How far is it from Eaton to Bilton? _____
4. What is the distance between Eaton and Foxham? _____
5. Which is the shortest distance between Carlton and Foxham?

6. What is the difference between the distance from Carlton to Denton, and the distance from Acton to Eaton? _____

How to Draw a Beautiful Compass Rose



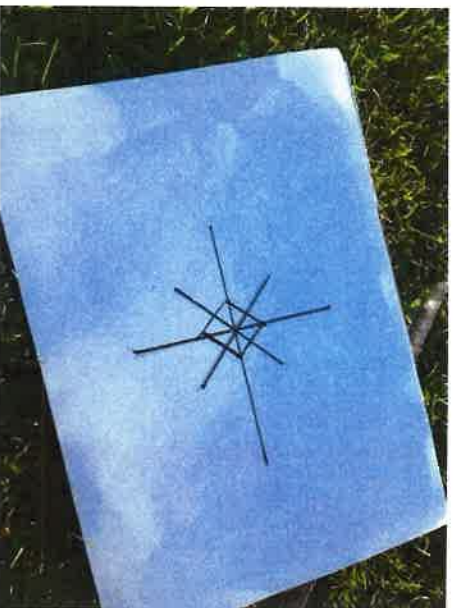
1. Supplies: Paper, eraser, color pencils, pencil, ruler, black pen



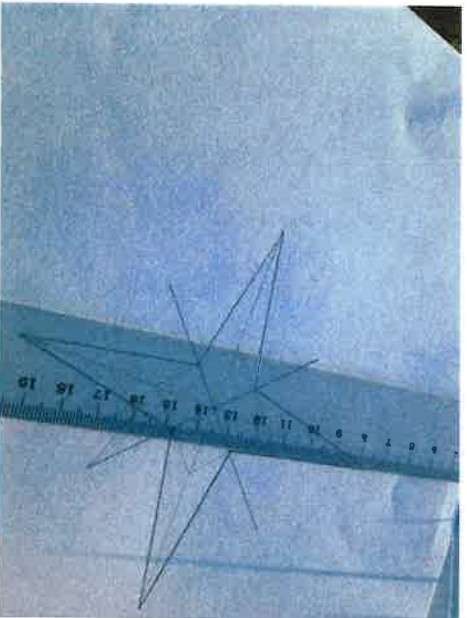
2. Draw a cross in the middle of the paper, use a ruler to make the lines straight and to measure the cross correctly. Each line is 6 centimeters from the middle.



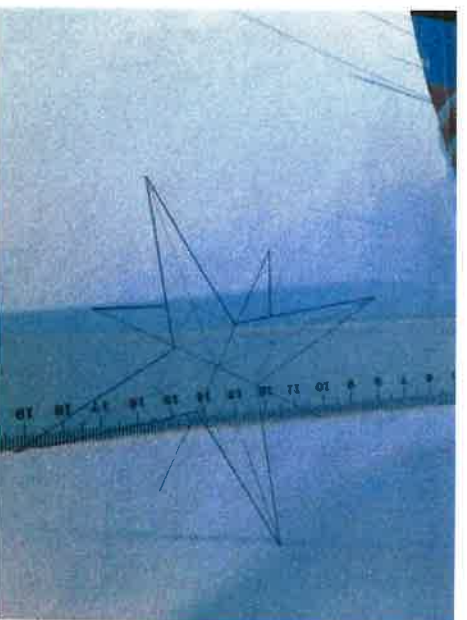
3. Make a perfect square using the ruler- measure 2 centimeters from the middle.



4. Measure the exact middle of each side of the square and mark it. Draw a straight line through the marks using the ruler. Each line should be about 4 centimeters from the middle.



5. Next, make the big star. Use the ruler and make a straight line from the tip of the star to the middle of the square.



6. Now, the little star "behind" the big star. Make a straight line from the tip of the star to the corner of the square.



7. A very straight and nice compass rose, maybe some color ???



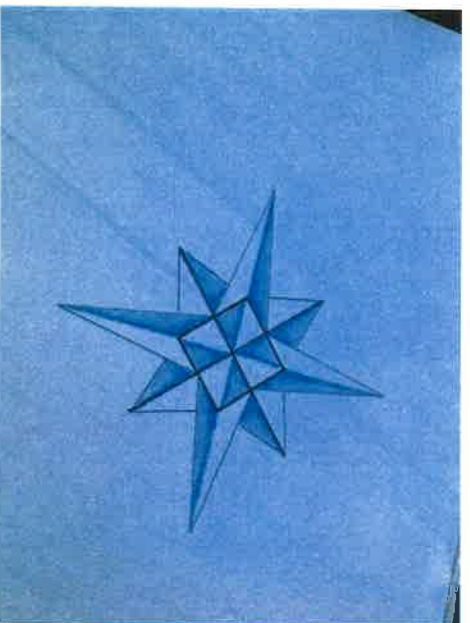
8. Markers are okay, but color pencils are best.



9. Press the pencil harder in the middle and then soften it up as you get to the edge of the star. This creates the illusion of depth, make it more vivid.



10. Continue the procedure in every other part of the star.



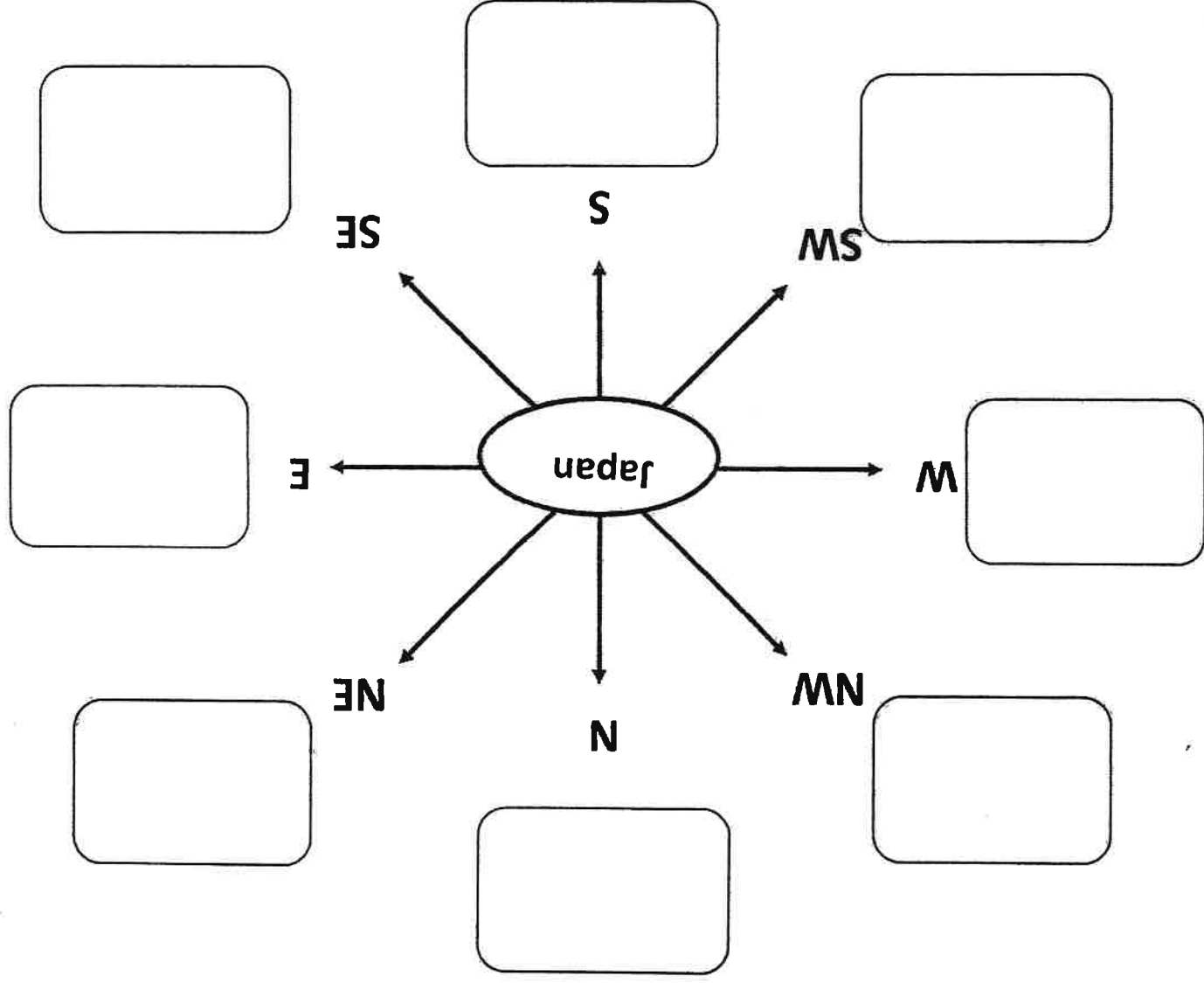
11. Last step, use a narrow black pen. Use a ruler to make line as straight as possible. Be careful not to smudge the black lines with your fingers.



12. Now, add N, NE, NW, W, E, S, SE and SW.

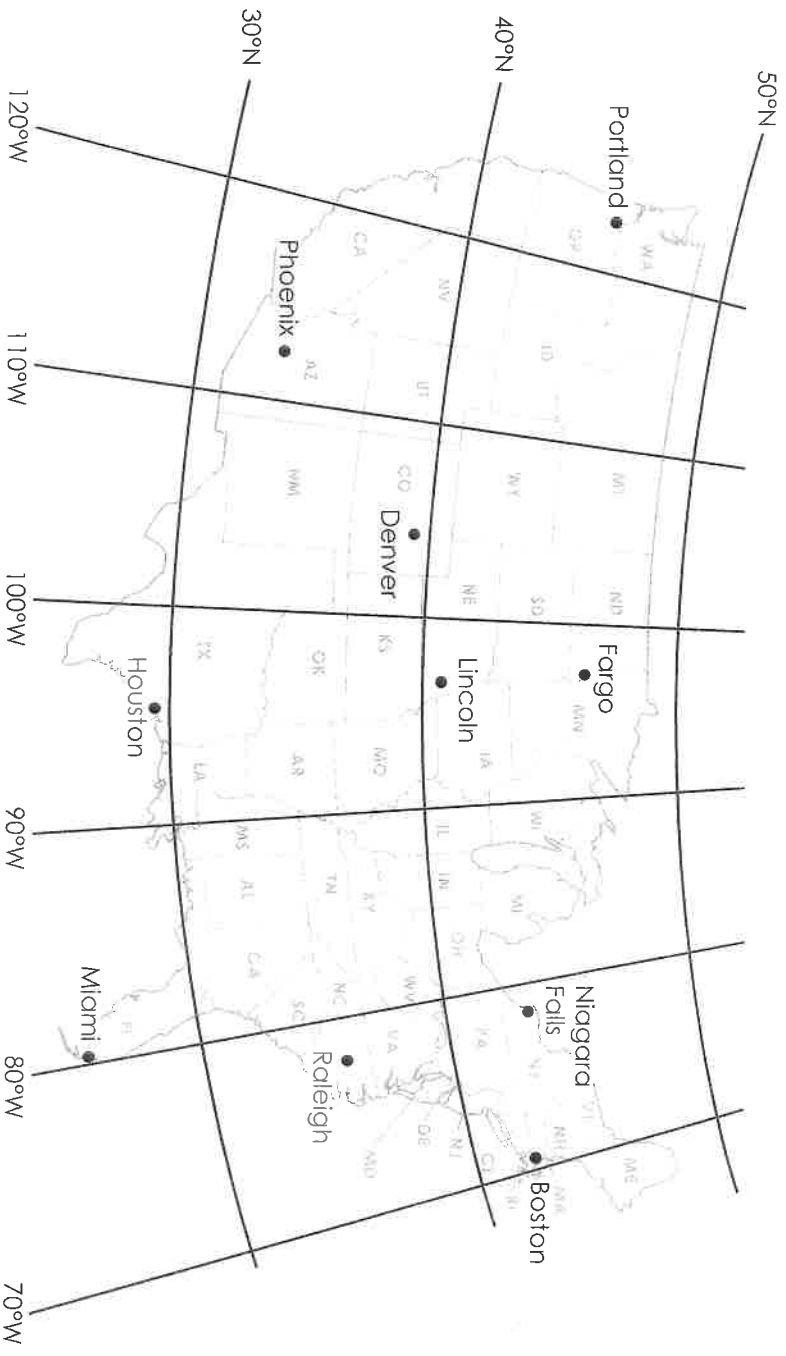
Compass Rose Map: Japan

For each direction on the compass rose, list geographical features that are located that direction from Japan.



Name: _____

Latitude and Longitude

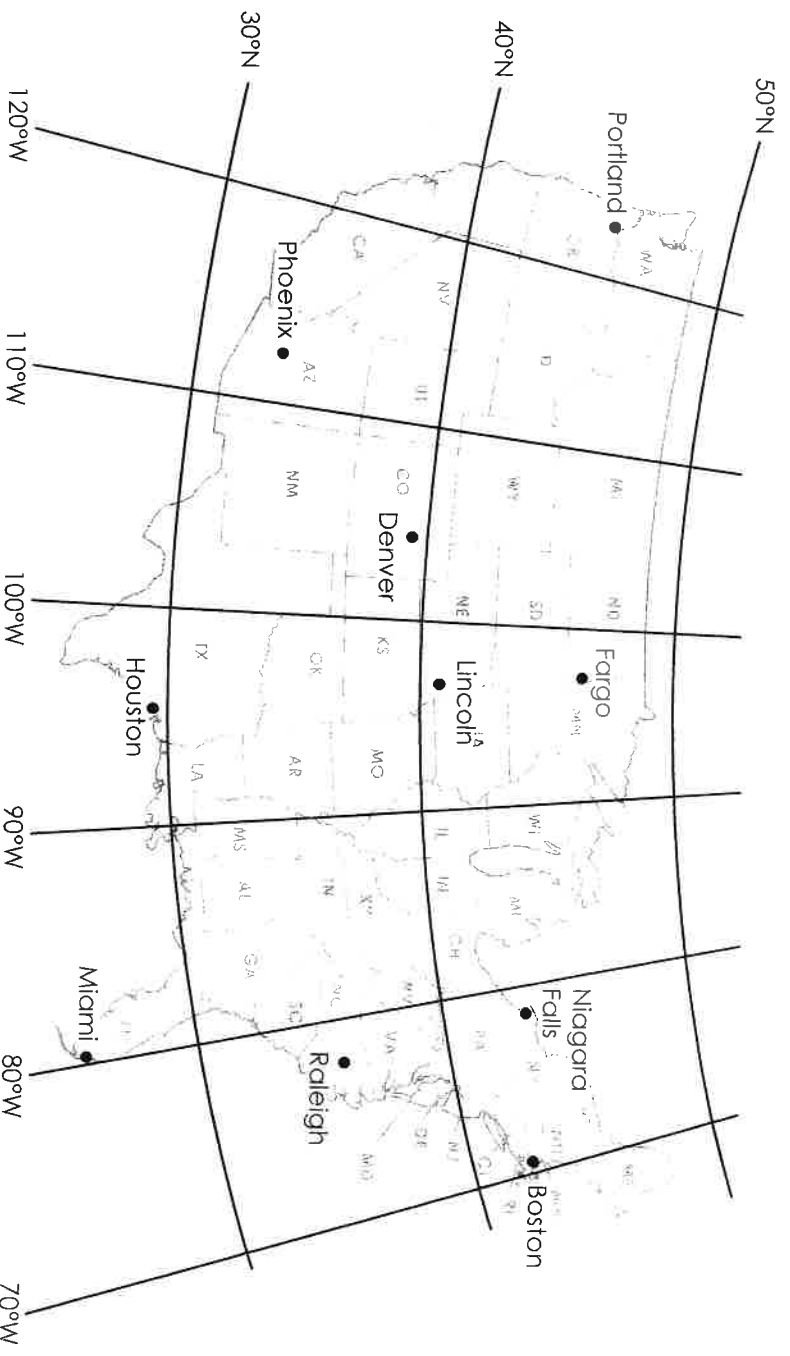


Write the name of the city and state found at the given latitude and longitude coordinates.

1. 33°N latitude, 112°W longitude _____
2. 35°N latitude, 78°W longitude _____
3. 46°N latitude, 96°W longitude _____
4. 45°N latitude, 122°W longitude _____
5. 29°N latitude, 95°W longitude _____
6. 43°N latitude, 79°W longitude _____
7. 25°N latitude, 80°W longitude _____

ANSWER KEY

Latitude and Longitude



Write the name of the city and state found at the given latitude and longitude coordinates.

- 33°N latitude, 112°W longitude Phoenix, Arizona
- 35°N latitude, 78°W longitude Raleigh, North Carolina
- 46°N latitude, 96°W longitude Fargo, North Dakota
- 45°N latitude, 122°W longitude Portland, Oregon
- 29°N latitude, 95°W longitude Houston, Texas
- 43°N latitude, 79°W longitude Niagara Falls, New York
- 25°N latitude, 80°W longitude Miami, Florida

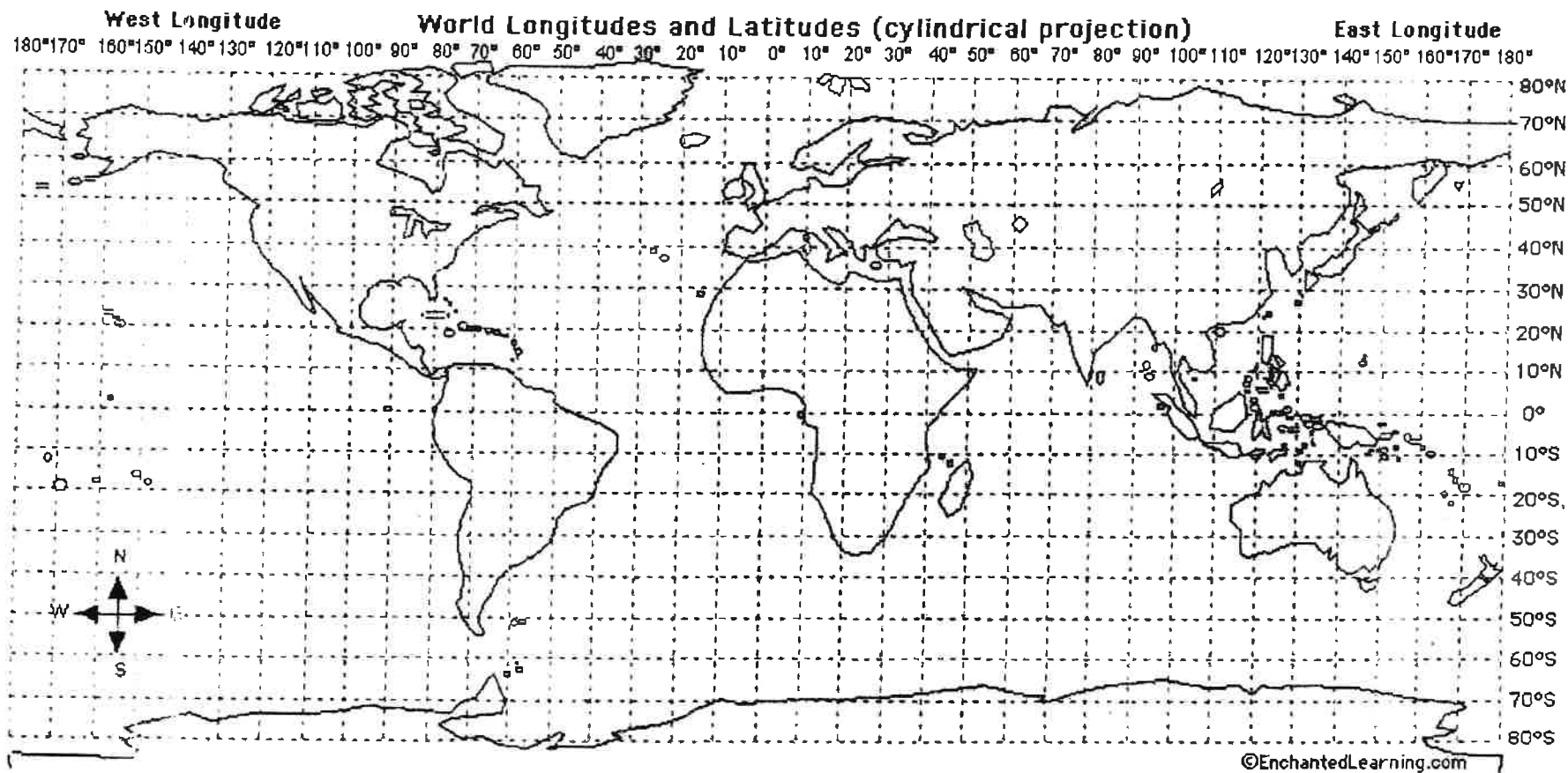
World Latitude and Longitude Activity

NAME _____

Using the world longitude and latitude map printout, answer the following questions and mark the locations.

1. Draw a red line along the equator (0 degrees latitude).
2. Draw a purple line along the Prime Meridian (0 degrees longitude).
3. In which ocean is the location 10 degrees S latitude, 75 degrees E longitude located? Mark it on the map with a blue "X" and write the name of the ocean.
4. In which ocean is the location 30 degrees N latitude, 60 degrees W longitude located? Mark it on the map with a blue "Y" and write the name of the ocean.
5. Mark the following cities on the map in red:

B. Beijing: 40°N, 116°E
 C. Cairo: 30°N, 31°E
 CT. Cape Town: 34°S, 18°E
 H. Hong Kong: 22°N, 114°E
 J. Jakarta: 6°S, 106°E
 LA. Los Angeles: 34°N, 118°W
 LI. Lima: 12°S, 77°W
 LO. London: 51°N, 0°W
 MC. Mexico City: 19°N, 99°W
 MO. Moscow: 55°N, 37°E
 MU. Mumbai: 19°N, 72°E
 NA. Nairobi: 1°S, 37°E
 NO. New Orleans: 30°N, 90°W
 NY. New York: 40°N, 74°W
 R, Rio de Janeiro: 23°S, 43°W
 SE. Seattle: 47°N, 122°W
 SY. Sydney: 34°S, 151°E
 TK. Tokyo: 35°N, 139°E
 T. Toronto: 43°N, 79°W



Getting Geographic

Understanding Time Zones

Grade: 4th through 8th

Time: 30 minutes

Materials: Atlas or internet access

Is it really tomorrow in Tokyo? Understanding time zones is an important, but challenging concept for many students.

The need for standard time zones emerged with the spread of high speed transportation systems – first trains and later airplanes. In 1884, delegates from twenty seven countries met in Washington, DC at the Meridian Conference and agreed on a system of time zones that is essentially the one we still use today.

Time zones are based on the fact that Earth moves through 15 degrees of longitude each hour. Therefore, there are 24 standard time zones (24 hours x 15°=360°). Time zones are counted from the Prime Meridian (0° longitude), which runs through Greenwich, England. Each time zone is based on a central meridian, counted at 15° intervals from the Prime Meridian, and extends 7½° to either side of the central meridian. For example, New York City lies in the zone of the 75°W central meridian, and the time zone includes all locations between 67½°W and 82½°W.

Constructing a Time Zone Model

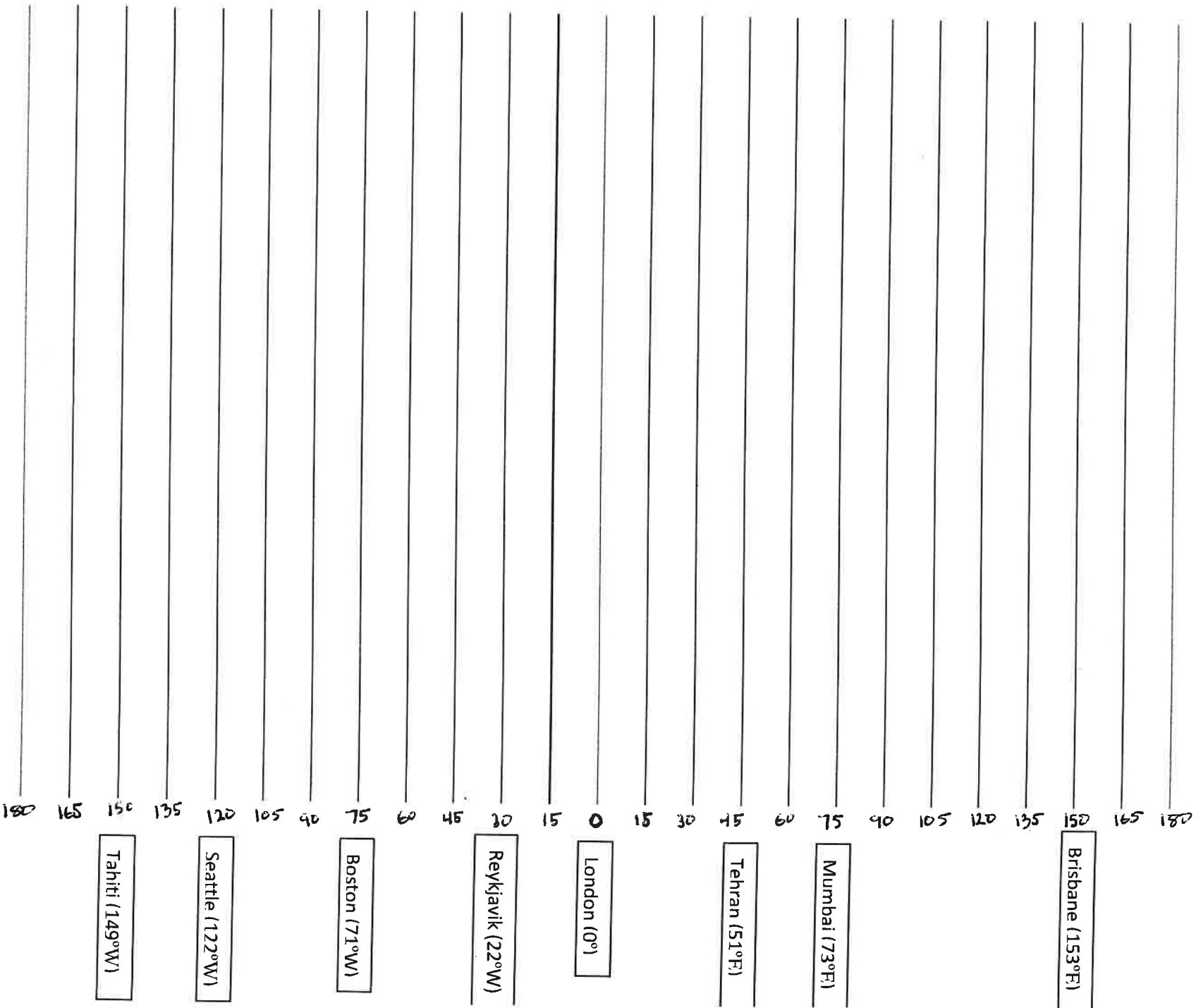
Distribute copies of the Activity #10 Handout to each student and instruct, as follows:

- Turn the paper sideways so that the “holes” are at the top.
- Use a colored pencil to trace over the line at the center of the paper and label this line “Prime Meridian.”
- Label the lines to the right (East) at 15° intervals up to 180°. Repeat to the left (West). Point out that each line represents one hour. Students should count hours plus to the east and minus to the west on their charts.
- Use an atlas to determine the longitude of Stockton, CA and have students place a dot in the correct time zone on the chart.
- Use an atlas to determine the longitude of Nairobi Kenya, Rome Italy, San Juan Puerto Rico and Tokyo Japan and have students place a dot in the correct time zone on the chart.
- Use the chart (i.e., count the lines) to determine the time in each location labeled on the chart. Remind students that the new day begins when they pass midnight.
- If it is 2pm on Monday in Stockton, CA what time will it be in Tokyo Japan? (7am Tuesday in Tokyo) So it really is tomorrow in Tokyo!

Extending the Activity

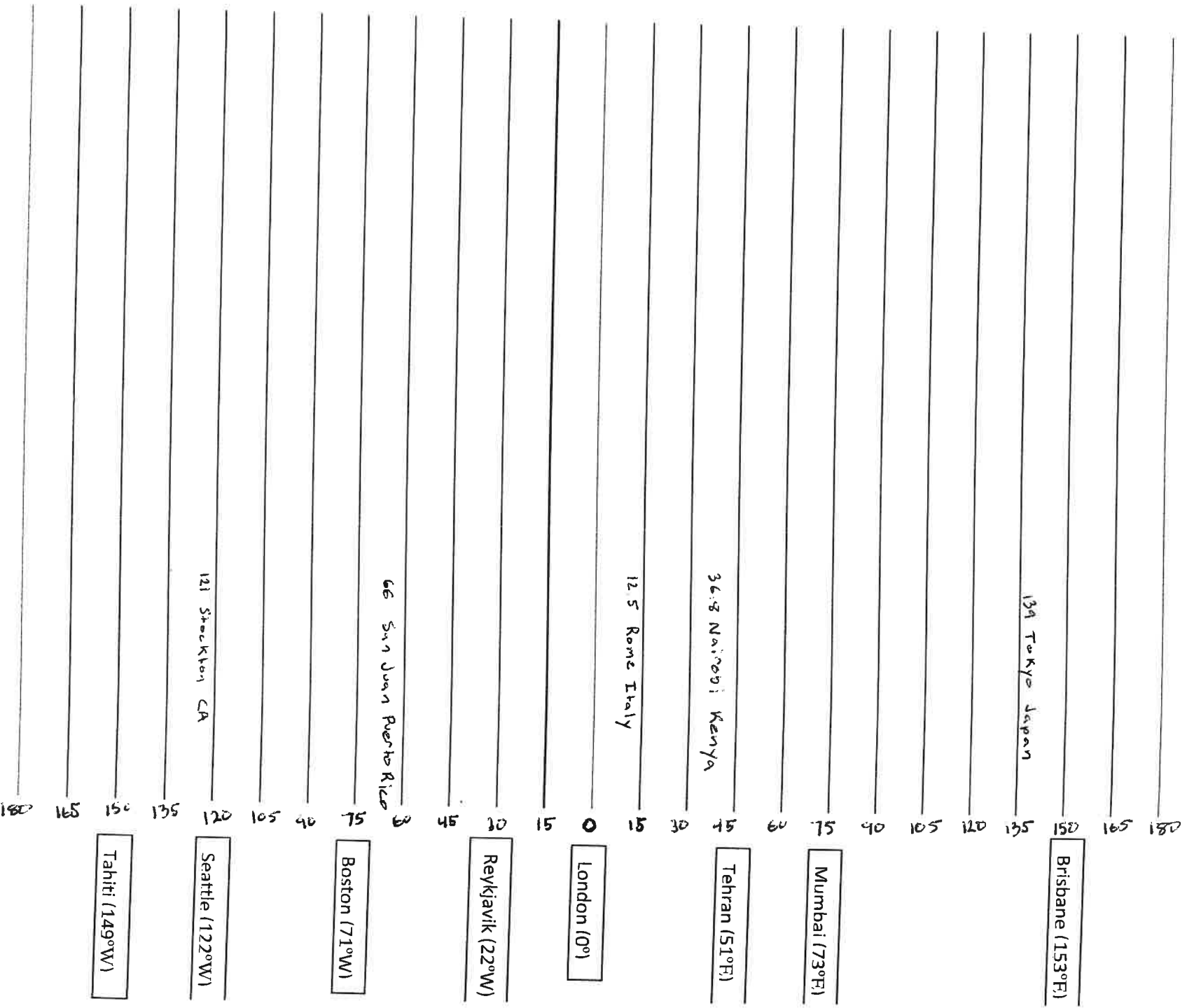
- Explain that some countries adjust time zones for political reasons. Have students research actual time zones that vary from the model they have made (e.g., Australia, China, India, Liberia).
- Have students research “daylight saving time.”

Activity #10-HANDOUT



Key

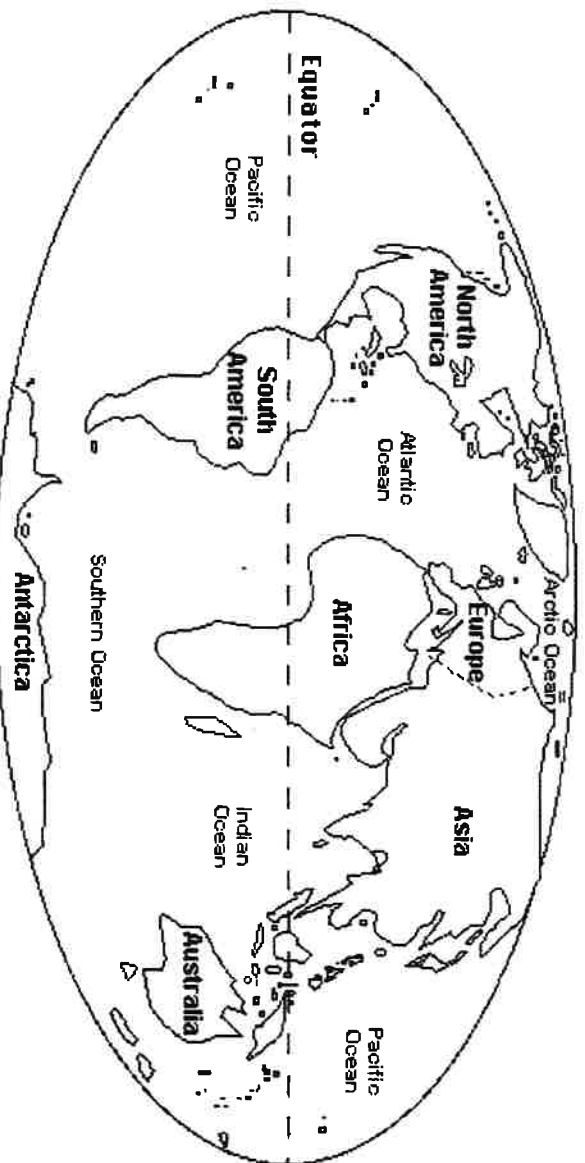
Activity #10-HANDOUT



Continents

Follow the instructions below.

Name _____



1. Color the continent of Africa green.
2. Color the continent of Antarctica white.
3. Color the continent of Asia yellow.
4. Color the continent of Europe red.
5. Color the continent of Australia brown.
6. Color the continent of North America orange.
7. Color the continent of South America pink.
8. How many continents are there? _____
9. Color the equator (a line) black.
10. Color the oceans blue.
11. I live on the continent of _____

Label the Continents

Work with a partner

Read the definitions, and then label the map

☐ **Africa**

A continent that crosses the equator. It is south of Europe and is bordered by the Atlantic and Indian Oceans.

☐ **Antarctica**

The continent that surrounds the South Pole of the Earth.

☐ **Asia**

A continent in the Northern Hemisphere. Asia is attached to Europe (and east of it).

☐ **Australia**

A continent, an island, and a country in the Southern Hemisphere.

☐ **Equator**

An imaginary line that divides the Earth into Northern and Southern Hemispheres.

☐ **Europe**

A continent in the Northern Hemisphere. Europe is attached to Asia (and west of it).

☐ **North America**

A continent in the Northern Hemisphere; it is north of South America. It is bordered by the Atlantic and Pacific Oceans.

☐ **North Pole**

The point that is the farthest north on Earth.

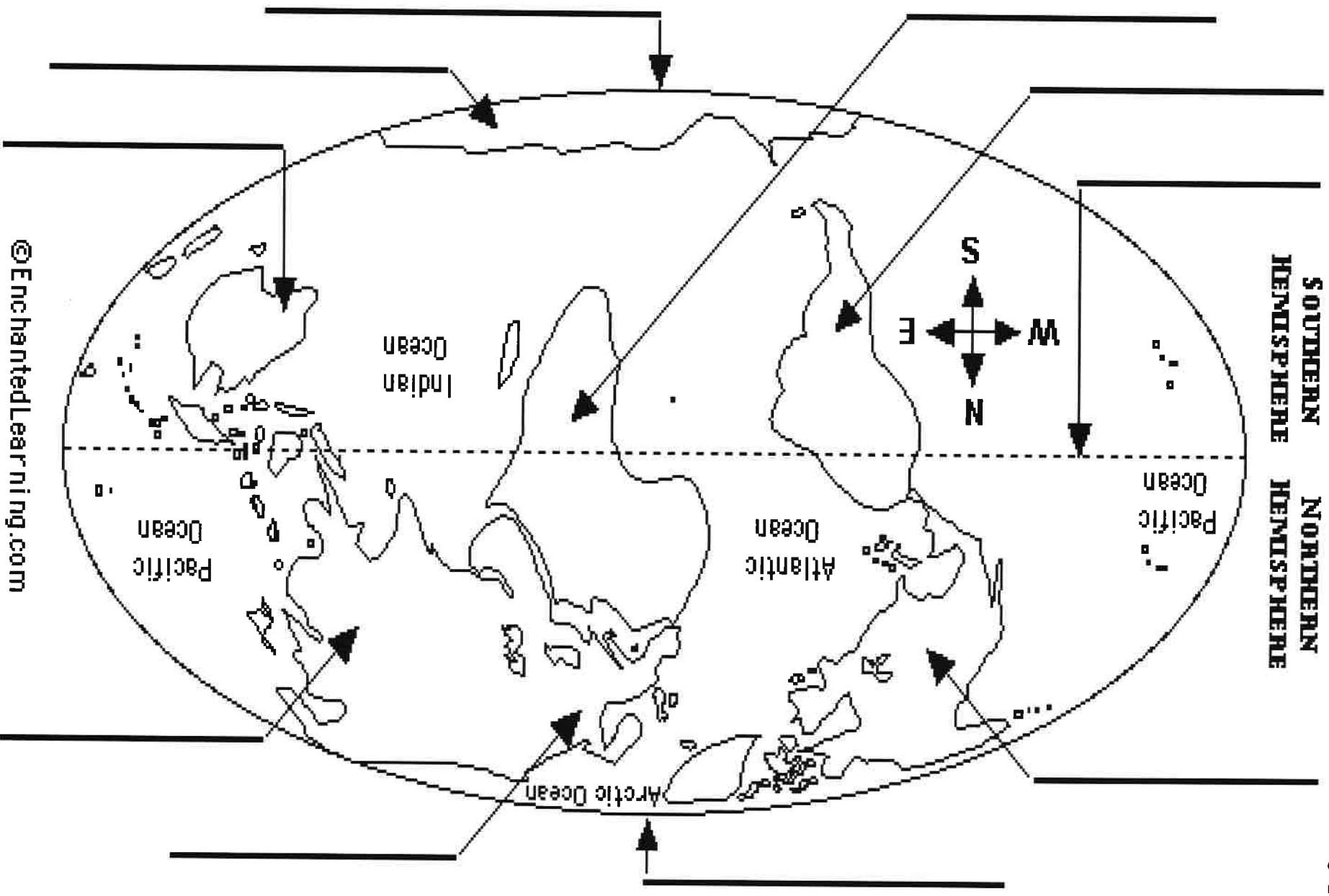
☐ **South America**

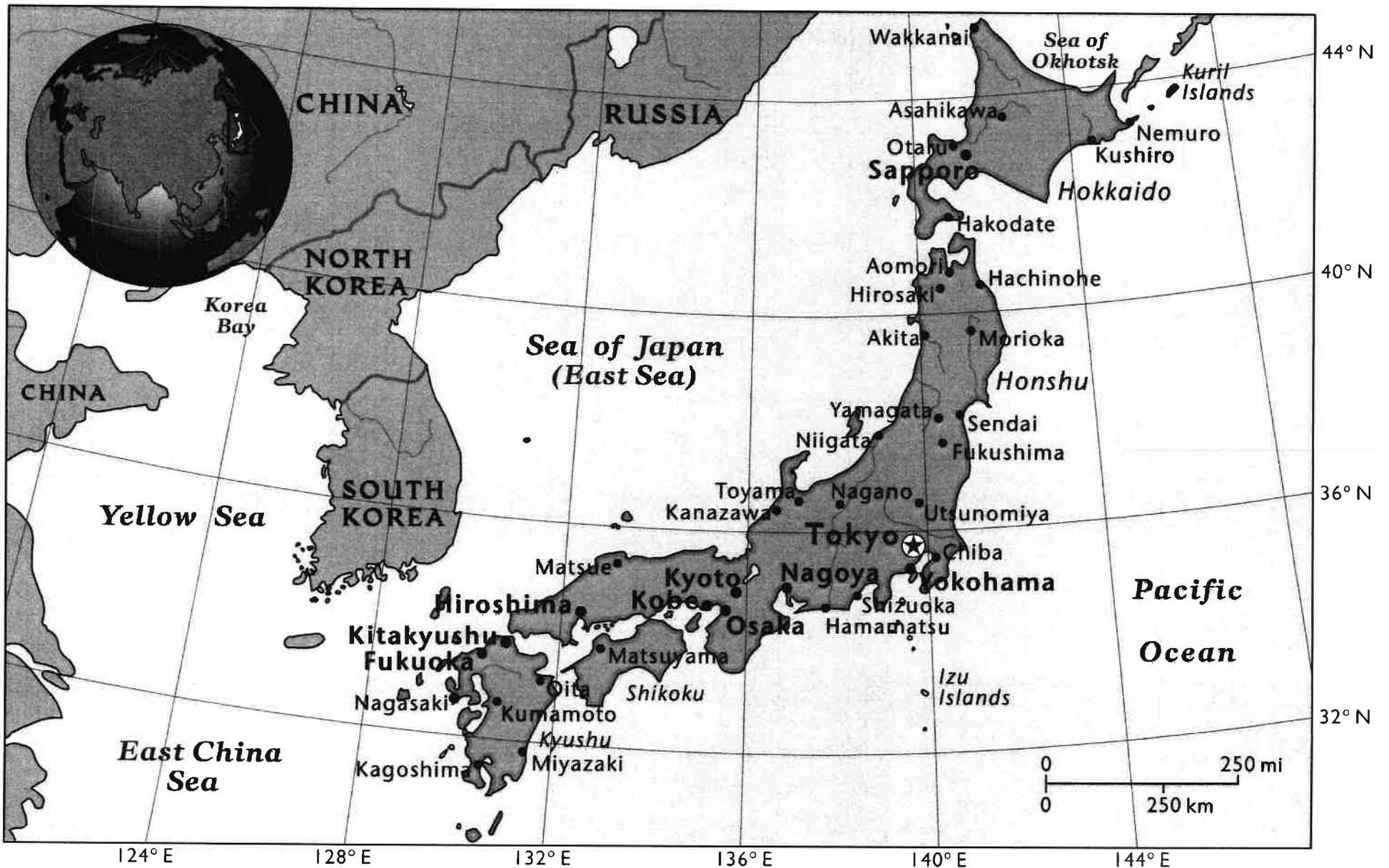
A continent that is mostly in the Southern Hemisphere. It is bordered by the Atlantic and Pacific Oceans.

☐ **South Pole**

The point that is the farthest south on Earth

Where are Italy, Japan, Kenya and Puerto Rico located? On the map, write an "I" for Italy, "J" for Japan and "K" for Kenya, and a "P" for Puerto Rico.





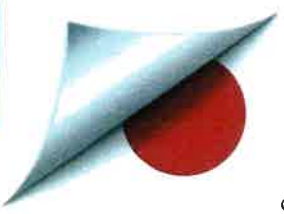
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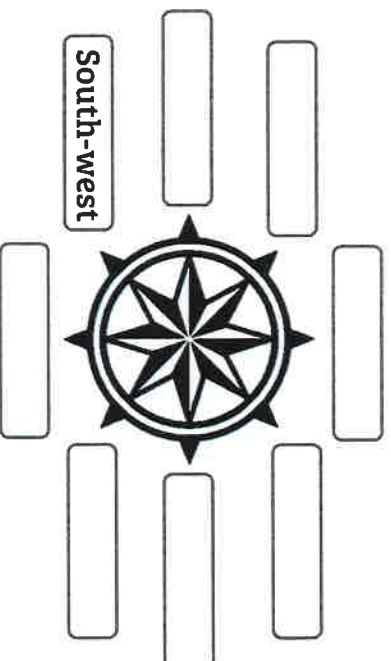
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Direction



In this activity, we will learn how to use the points of the compass to show direction on a map.

- 1 Look at the eight point compass below. Label each of the points. One has been done for you.



- 2 Using the map to help you, complete these sentences.

Kobe is _____ of Hamamatsu.

Hiroshima is _____ of Nara.

Kagoshima is _____ of Fukuoka.

Akita is _____ of Tokyo.

Niigata is _____ of Fukushima.

Miyazaki is _____ of Okayama.

Maebashi is _____ of Tokyo.

Chiba is _____ of Nagano.

_____ is NORTH of Tokyo.

_____ is WEST of Shizuoka.

_____ is SOUTH of Morioka.

_____ is EAST of Yamaguchi.

_____ is SOUTH-EAST of Fukui.

_____ is NORTH-EAST of Wakayama.

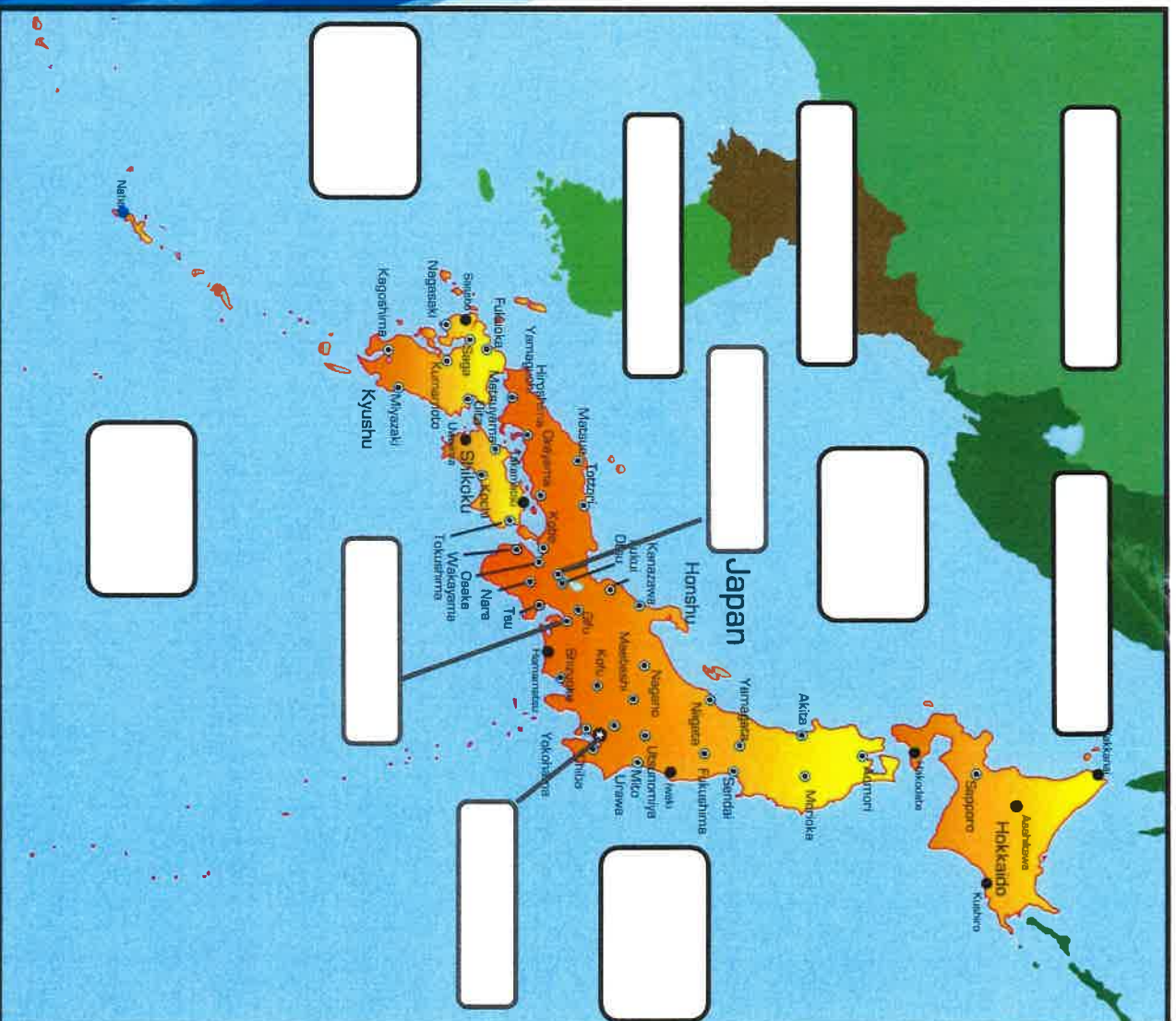
_____ is SOUTH-WEST of Sendai.

_____ is NORTH-WEST of Osaka.

- 3 Now make some direction sentences of your own.

JAPAN'S LOCATION

Where is Japan? Using an atlas to help you, write the names of the features in the correct spaces on the map below.



Water features

- Philippine Sea, Pacific Ocean
- East China Sea, Sea of Japan

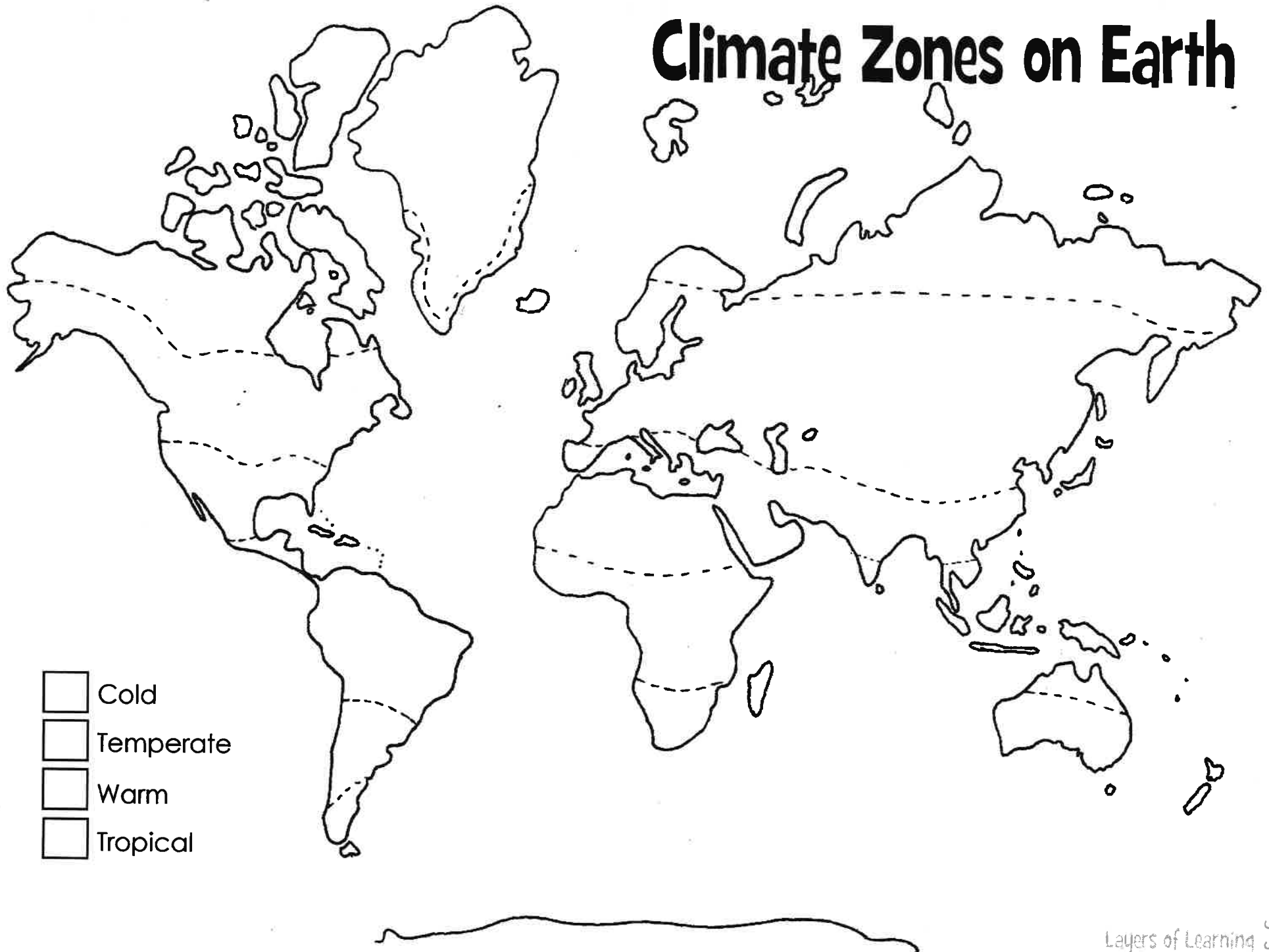
Neighbouring countries

- Russia, South Korea, China, North Korea

Cities

- Tokyo, Kyoto, Nagoya

Climate Zones on Earth



Biome Description

Biome Name

Locations Worldwide

Weather

(Temperature & Precipitation)

Plants and Animals

Plants:

Animals:

Examples of Food Chain:

Describe the Biome:

Climates: Charting the Statistics

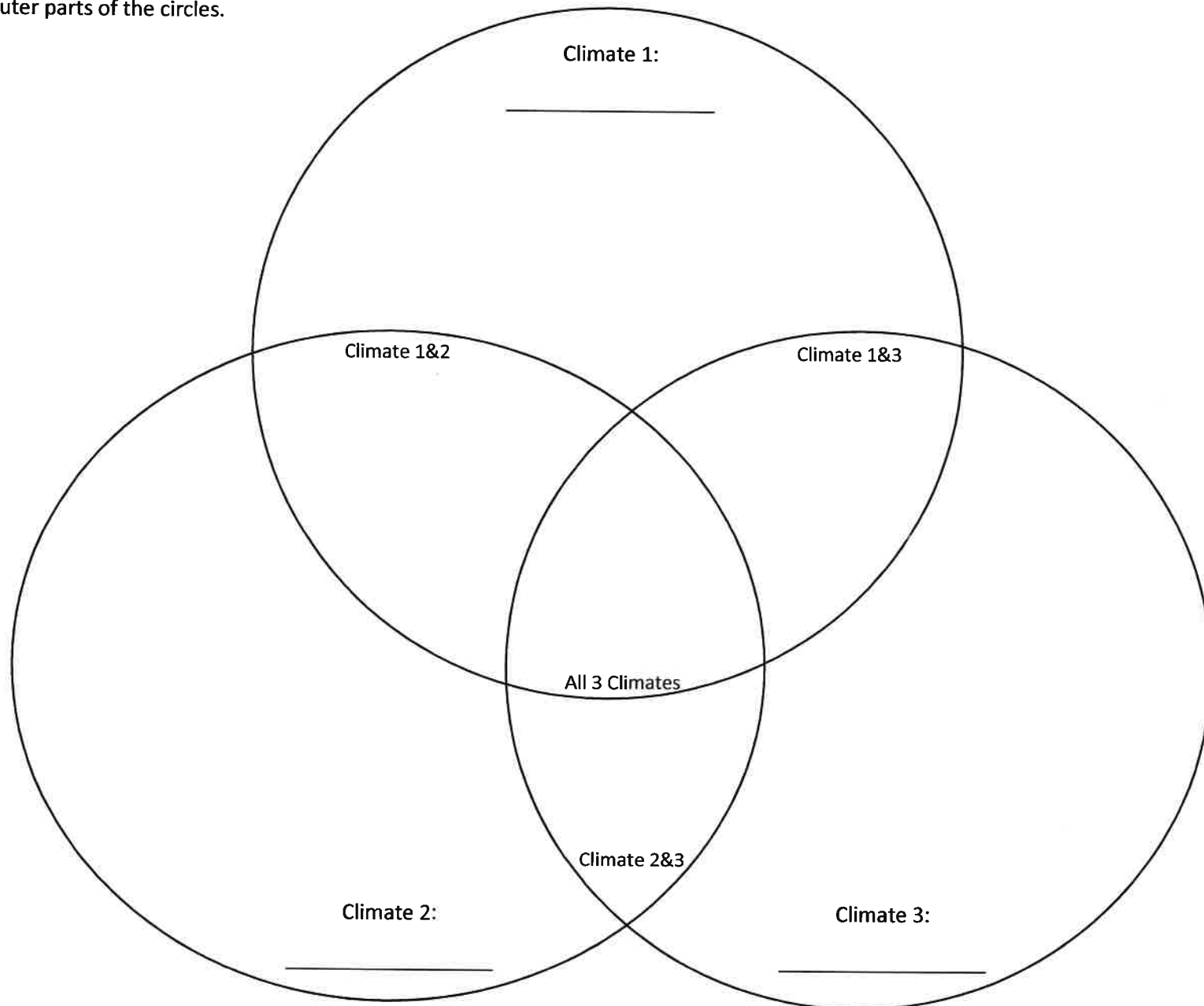
Directions: Choose 3 climates and write them in the first row of boxes below. Then, fill out each category with facts and details about these climates.

Categories	Climate #1	Climate #2	Climate #3
What is the average temperature?			
What kinds of plants are there?			
Where in the world is this climate found?			
How do living things adapt to this climate?			

My favorite climate is _____ because _____

Comparing Climates

Directions: A venn diagram helps you compare (find things that are the same) and contrast (find things that are different) two or more items. Write the name of each climate in the three circles below. Fill out the intersections of the circle with facts and details that are the same; write the facts that are different for each animal on the outer parts of the circles.



Habitats/Biomes

The Earth has many different environments, varying in temperature, moisture, light, and many other factors. Each of these habitats has distinct life forms living in it, forming complex communities of interdependent organisms. A complex community of plants and animals in a region and a climate is called a **biome**.

Tundra

LOCATION: The tundra biome is the coldest of all biomes. It is also quite big. The tundra covers about one fifth of the land on earth. The word tundra comes from a Finnish word that means treeless plain, which is a good description of the biome. Tundra biome is located in the arctic circle, which is a circle that surrounds the north pole, but this is not the only place we can find freezing cold temperatures and a few animals. In Antarctica, and other cold environments, there are areas that can be described as part of a tundra biome as well.

WEATHER: The tundra is the coldest and the driest of all the biomes on Earth. There is very little rainfall in the tundra, it rains less than ten inches a year. Winters here are long, and summers short, sometimes they last for only 6 - 10 weeks. In the winter the temperature can reach -50°F (-45.5°C). And we think our winters are bad! Because the tundra is so close to the north pole, summer days are 24 hours long! Summer temperatures rarely get above 50°F (10°C), just enough to thaw the surface of the ground. What a place for a summer vacation! In the summer the soil becomes very soggy from melted snow and rain. The moisture sinks into the ground, which is called permafrost. The permafrost lies six inches below the ground, and is frozen for most of the year. The top layer of the permafrost thaws, but the bottom layer of gravel and finer material stays frozen all year which keeps moisture from rain on the surface of the ground.



Charles Webber @ California Academy of Sciences

PLANTS: You would think that plants would never live or survive in this biome, but the answer is quite a surprise. There is low diversity in organisms that live here, but many still flourish. Many lichens, mosses, and small shrubs flourish in the arctic tundra. The plants that live in the harsh permafrost soil usually adapt to the weather by being short and grouped together to resist winds and to be protected. The growing season in the tundra is short and lasts up to 60 days. Tundra plants get their energy from the sun through photosynthesis like all other plants, but have adapted to low temperatures and low light intensities. Compared to plants in other biomes they use a minimal amount of energy.



Dr. Lloyd Glenn Inghes @ California Academy of Sciences

ANIMALS: You may think that the tundra is too chilly for animals, but guess what - it's not. There are actually animals that live in this harsh biome! You might find lemmings, caribou, and arctic hares in the tundra. These animals seem pretty nice, but can you guess which the largest and most dangerous animal is that lives in the tundra? THE POLAR BEAR. Polar bears love to eat fresh, fatty meat. Fatty foods might not be good for humans, but polar bears need the energy from fat to survive the cold tundra. Seals, at times walrus, and sometimes even belugas trapped in open water pockets surrounded by ice are some of the polar bear's favorite meals. They will also eat berries and eggs in the summer. Polar bears hunt by the power of scent and can smell their food at 20 miles (32 km) away. The stomach of an adult polar bear is so big that it can hold more than 150 pounds (68 kilos) of food! Other predators of the tundra are arctic foxes and wolves. Some migratory birds also live in the tundra during part of the year.

Animals who live in the tundra have special adaptations to survive. Some animals in the tundra are adapted to the climate by breeding and raising their young in the summer. Many animals hibernate, or sleep during the worst part of winter to minimize

Habitats/Biomes

energy loss. Because animals of the tundra are generally migratory, this biome's population is constantly changing. Resident animals have to change what they are hunting and eating as the seasons change. The food chain in the Arctic Tundra consists of predators such as owls, foxes, wolves, and polar bears at the top of the chain. Predators hunt herbivores, plant eating animals, such as caribou, lemmings, and hares. Mosquitoes, flies, moths, grasshoppers, arctic bumblebees, and other insects are at the bottom of the arctic food chain. Many birds feed on these insects.

Rainforest

LOCATION: There are two types of rainforest biomes: temperate and tropical rainforests. Temperate rainforests are found along coasts in temperate regions. The largest temperate rainforests are on the Pacific coast in North America, stretching from Alaska to Oregon. Other temperate rainforests are found along the coast of Chile, the United Kingdom, Norway, Japan, New Zealand, and S. Australia. Tropical rainforests are generally found between 30°N and 30°S latitudes, covering 6 - 7% of the Earth's land surface. Tropical rainforests can be found around the world: in Central and South America; in Western Africa, eastern Madagascar, and the Zaire basin; and in Indo-Malaysia along the west coast of India, Assam, Southeast Asia, New Guinea, and Queensland, Australia.

WEATHER: Rainforests are important because they help maintain global weather patterns and rain. Water that evaporates from trees falls in other areas as rain.

Tropical rainforests are lush and warm all year long! Temperatures don't even change much between night and day. The average temperature in tropical rainforests ranges from 70 to 85°F (21 to 30°C). The environment is pretty wet in tropical rainforests, maintaining a high humidity of 77% to 88% year-round. The yearly rainfall ranges from 80 to 400 inches (200 to 1000 cm), and it can rain hard. It can downpour as much as 2 inches (5 cm) in an hour!

Temperate rainforests are also wet, but not as rainy as tropical rainforests. It rains about from 60 - 200 inches (150 - 500 cm) each year, while the other moisture comes from the coastal fog that lingers on the trees. The fog provides about 7 - 12 inches (18 - 30°C) of rain each year. Temperate rainforests are a lot cooler than tropical rainforests, but the temperatures are still mild. They often have two distinct seasons: one long wet winter, and a short drier summer.

PLANTS: One type of plant often found in a rainforest is an epiphyte. Epiphytes are plants that live on the surface of other plants, especially the trunks and branches. They often grow on trees to take advantage of sunlight in the canopy. In temperate rainforests common epiphytes are mosses and ferns, while in tropical rainforests there are many kinds of epiphytes, including orchids and bromeliads. There are more than 20,000 varieties of orchids found in the rainforest.

There are about 10 - 20 species of trees in temperate rainforests that are mostly coniferous, meaning they have needles.

Trees in temperate rainforests can live much longer than humans, some live for up to 1000 years! Tropical rainforests have a bigger variety of trees, hundreds of species in fact! These trees are mostly broadleaf trees and have a shorter lifespan. They usually live for 50 - 100 years.

Most trees in tropical rainforests have thin, smooth bark. They don't need thick bark to keep them from drying out because the rainforest is so wet. Also, smooth bark makes it difficult for other plants, such as epiphytes, to grow on the tree surface. Trees often have buttresses, large branching ridges near the base, for support because their roots are often shallow and they grow tall to reach the sunlight. Prop roots also help support trees in shallow soils. Many plants in the rainforests have adapted leaf shapes that help water drip off the plant to avoid too much moisture, which might make bacteria and fungus grow.

Tropical rainforests are so big that they are divided into four zones. The top layer of the rainforest is called the emergent layer. Giant trees grow here that are much taller than the trees below. The next layer is the



F. Albert Ellis © California Academy of Sciences

Habitats/Biomes

canopy. It contains trees standing 60 to 150 feet (18 to 45 meters) tall. Their branches form a canopy, like a big beach umbrella that shades the forest floor. Thick, woody vines are found in the canopy. Over 2,500 species of vines grow in the rainforest. Some vines, called lianas, are sometimes as big around as a person! They climb the trees in the canopy to reach for sunlight. The next layer, the understory, is a dark, cool area below the canopy, but above the ground. The understory is shaded from much of the sunlight by the canopy. The forest floor is the bottom layer of the rainforest. This is the area where fallen, decomposing plants and trees lay on the ground. Many insects live here. Temperate rainforests have all of these zones except the emergent layer. The tallest trees in the temperate rainforest canopy grow to be about 300 feet (90 meters) tall.

ANIMALS: Tropical rainforests are home to half the plant and animal species on Earth. Scientists believe that there is such a great diversity of animals in tropical rainforests because they are one of the oldest ecosystems on earth. Some forests in Southeast Asia have been around for at least 100 million years, ever since dinosaurs roamed the earth.

Animals in the tropical rainforest are specially adapted to live in this unique environment. A common characteristic found among mammals, birds, reptiles and amphibians, is an adaptation to living in trees. One example is New World monkeys that have prehensile tails that curl around branches allowing the monkey to hold onto the tree with its tail! Other animals are brightly colored, sharply patterned, have loud vocalizations, and like to eat lots of fruit. Most of the animals in the tropical rainforest live in the canopy. There is so much food available up there that some animals never go

down to explore the forest floor! Birds are important to rainforests because they like to eat seeds and fruit. Their droppings grow into new plants and help rainforests to survive. In turn, tropical rainforests are important to birds because they provide winter grounds as migratory destination. Parrots are not the only type of birds you will see in the rainforest. In fact, about 27% of the bird species in the world live in tropical rainforests. Insects make up the largest single group of animals that live in tropical forests. They include bright beautiful butterflies, menacing mosquitoes, camouflaged stick insects, and colossal colonies of ants.



In temperate rainforests you'll find a different set of amazing animals. Most of these animals live on, or near the forest floor where they are protected from the wind and rain by the trees above. Many birds and small mammals, such as chipmunks, like to eat seeds that fall on the forest floor. Lots of insects live in the temperate rainforest. Most of them live in tree bark, decomposing dead plant matter, or mossy areas. Birds and amphibians like to eat these insects. Some mammals in the temperate rainforest include deer and bobcats. Cougars and bobcats are the top predators in this biome.

Savanna

LOCATION: Savannas are comprised mostly of grasses and a few scattered trees. They cover half the surface of Africa, large areas of Australia, South America, and India. That is a lot of the earth's surface! Savannas can result from climate changes, soil conditions, animal behavior, or agricultural practices. Humans create savannas by burning grasslands and cutting down trees so they can plant crops. Large animals, like elephants, can turn a forest into a savanna by knocking trees down, stripping the bark from the trees, and trampling on tree seedlings.

WEATHER: An important factor in the savanna is climate. The climate is usually warm and temperatures range from 68° to 86°F (20 to 30°C). Savannas exist in areas where there is a 6 - 8 month wet summer season, and a 4 - 6 month dry winter season. The annual rainfall is from 10 - 30 inches (25 - 75 cm) per year. During the dry season, lightning often strikes the ground, igniting the dry grasses that cover the savanna.

PLANTS: The savanna is dominated by grasses such as Rhodes grass, red oats grass, star grass, lemon grass, and some shrubs. Most savanna grass is coarse and grows in patches with interspersed areas of bare ground. You won't see many trees in the savanna because of



Habitats/Biomes

little rainfall. Occasionally, you'll find individual trees or small groves of trees. These mostly live near streams and ponds. The Acacia tree is an interesting plant in the savanna. It has an umbrella shape, with branches and leaves high off the ground that giraffes like to eat. Baobab trees also live in the savanna. They deal with dry conditions by storing water between the bark and meat of the tree.

ANIMALS: There are many different types of animals that live in the savanna. The species found in savannas vary by the geographic location of the biome. Animals native to African savannas include African elephants, zebras, horses, and giraffes. Many animals in the savanna are herbivores, which means they eat plants, and there is plenty of grass in the savanna. During the rainy months animals thrive in the savanna, but the rainy season is only half the year. During the dry season, surface water from the rain is quickly absorbed into the ground by thirsty soils. The competition for water during the dry season is so intense that most birds and many of the large mammals migrate elsewhere in search of water. Depending on the severity of the drought, the migration may be to a place nearby, or far away. The dry season is often associated with fires. Many insects with short life spans die in these fires, but the birds and larger animals are usually able to fly or run to safety. Although small burrowing animals probably can't outrun the flames, they often survive the fire by digging deep into the ground and remaining there until the flames are gone. Some birds, such as the Fork-tailed Drongos, don't flee the fires; they actually fly to the fires. For these birds fire means dinner. They eat the fleeing or flame-roasted insects.

TAIGA

LOCATION: Taiga, also known as coniferous or boreal forest, is the largest terrestrial biome on earth. It extends in a broad band across North America, Europe, and Asia to the southern border of the arctic tundra. It is also found at cool, high elevations in the more temperate latitudes, for example, in much of the mountainous western region of North America. Much of the taiga in North America was once covered with glaciers. As the glaciers receded, cuts and depressions were left in the landscape that have since filled with rain creating lakes and bogs.

WEATHER: Long, cold winters, and short, mild, wet summers are typical of this region. In the winter, chilly winds from the arctic cause bitterly cold weather in the taiga. The length of day also varies with the seasons. Winter days are short, while summer days are long because of the tilt of the earth on its axis. Fire is not uncommon in the taiga during the summer. Fires may seem destructive, but they actually help this biome by removing old sick trees, making room for new growth. Precipitation is relatively high in the taiga and falls as snow during the winter and rain during the summer. The total yearly precipitation in the taiga biome is 10 - 30 inches (25 - 75 cm).



PLANTS: Compared to other biomes, the taiga has less diversity in plant life. The most common type of tree found in the taiga is the conifer, or cone-bearing tree. Conifers, also known as evergreens, include pines, spruces and firs. There may also occasionally be deciduous species present, such as oak, birch, willow, or alder, in a particularly wet or disturbed area. The soil in the taiga is thin, acidic and not very nutrient rich. It also is rocky. Due to these factors, plants in the taiga have different adaptations than the plants we find around Santa Barbara.

The name, evergreen, describes an important adaptation of conifers. Just like Kermit, they are always green! Because they don't drop their leaves in the winter, they don't have to regrow them in the spring. This is good for trees in a tough environment because growing new leaves takes a lot of energy. Another adaptation of conifers to live in the taiga has to do with their needles. Although the taiga has moderately high precipitation, the frozen winter ground makes it difficult for trees to get water. Having thin needles with a waxy coating limits water loss of the conifer through transpiration. The dark color of the pine needles is also important. What happens when you where a dark T-shirt on a sunny day? You get hot, right? This is because your dark shirt is absorbing energy from the sun. Well, the dark needles do the same thing for the evergreen. They help the tree absorb the maximum amount of energy from the sun for photosynthesis. Conifers also have that pointy shape for a good reason. The winter snow slides right off of their branches. Without this shape the heavy snow might break or damage the conifer branches.

Habitats/Biomes

ANIMALS: The cold climate of the taiga makes it a difficult place for many animals to live. Many have thick coats of fur to insulate against the cold, and some hibernate. Others migrate to warmer areas in the chilly winters. Animal populations are mainly seed-eating squirrels and jays; small mammals like ermine and moles; and larger browsing animals such as deer, moose, elk, and snowshoe hare. The bogs and ponds in the taiga provide a great summertime breeding place for many different insects. Migratory birds often come to the taiga to nest and feed on all these insects. The typical predators for this area are grizzly bears, wolves, lynxes and wolverines. These are pretty ferocious, so their prey must adapt to flourish. Some animals hide from predators by changing color to blend into the different summer and winter habitats. For example, the ermine is dark brown in the summer, but in the winter it turns white. What excellent camouflage!



Garold and Buff Corsi
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TEMPERATE FOREST

parts of Russia. Deciduous zones. The first zone is the tree zone and trees here range from tall. Maple, elm, and oak trees trees found in this zone. The and sapling zone. Younger, zone. The shrub zone is the mountain laurel, huckleberries, zone is the herb zone, and like ferns. The Ground zone is grow directly near the ground. lichens and mosses.



Dr. G. Dallas and Margaret Hanna
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forests are located in the eastern United States, Canada, Europe, China, Japan, and forests are broken up into five stratum zone. It is the tallest 60 to 100 feet (18 to 30 meters) are just some examples of second zone is the small tree shorter trees characterize this third zone. Shrubs include and many others. The fourth contains short herbal plants, the final zone where plants Some plants that grow here are

WEATHER: This biome has

including winter, spring, summer, and fall. These seasons happen because of the tilt of the Earth's axis. Throughout the year, rays from the sun hit different parts of the world more directly than others, causing varying temperatures, or seasons. If the Earth were not tilted on an axis, temperatures around the globe would always be the same. Temperate deciduous forests also have quite a wet environment. Following rainforests, temperate deciduous forests are the second-rainiest biome. The average yearly precipitation is 30 - 60 inches (75 - 150 cm). This precipitation falls throughout the year, but in the winter it falls as snow. The average temperature in temperate deciduous forests is 50°F (10°C). Summers are mild, and average about 70°F (21°C), while winter temperatures are often well below freezing.

PLANTS: Trees and plants in deciduous forests have special adaptations to survive in this biome. Deciduous trees are trees with leaves rather than pine needles, and they dominate temperate forests. As the seasons change each year, so do the leaves. Each year deciduous trees lose their leaves, and grow them back. In the summer their broad green leaves capture sunlight and help the trees make food through photosynthesis. As temperatures cool in the fall, the chlorophyll (green pigment in leaves) breaks down, causing the beautiful red, yellow and orange leaf colors of fall. In the cold winter, deciduous trees and plants go into dormancy, kind of like sleep. It is too cold for them to protect their leaves from the damage of freezing in the winter, so they simply loose them and seal up the places where the leaves attach to the branch. The warmer spring days signal to the trees that they can grow new leaves again, and restart the cycle.

Habitats/Biomes



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ANIMALS: Animals in temperate deciduous forests have to adapt to changing seasons. They must be able to cope with cold winters and hot summers. Some animals hibernate or migrate during the winter to escape the cold. Animals who do not hibernate or migrate must have special adaptations to deal with higher exposure to predators in the winter. When leaves fall, there is less cover for animals in this biome to hide from predators.



Dr. Lloyd Glenn Ingles © California Academy of Sciences

The black bear is an animal that is well adapted for the temperate deciduous forest biome. It has a heavy coat made of many layers of fur to deal with the winter cold. Black bears have long claws that help them to climb trees. This is an essential adaptation because black bears often live in hollowed trees. Black bears are omnivores, so they eat plants and animals. Most of their diet is composed of plant material, so their long claws are useful to get their food from trees and shrubs. They also hibernate to avoid having to find food in the snowy, frozen winter.

GRASSLAND

LOCATION: The name for this biome, temperate grasslands, is a great description for what it is like here. The most important plants in this biome are grasses! Temperate grasslands have some of the darkest, richest soils in the world (not in wealth, but in nutrients). People who live in grassland regions often use these soils for farming. In North America we call temperate grasslands prairies. Major grasslands in North America are the Great Plains of the Midwest, The Palouse Prairie of eastern Washington State, and other grasslands in the southwest. In Eurasia temperate grasslands are known as steppes and they are found between the Ukraine and Russia. In South America they are called pampas, and are located in Argentina and Uruguay. In South Africa temperate grasslands are known as velds.



Helen H. Johnston © California Academy of Sciences

WEATHER: Temperatures in this biome vary greatly between summer and winter. The summers are hot and the winters are cold - much colder than Santa Barbara! With cold winters, it's surprising how hot the grassland summers can get! Sometimes the temperature is more than 100°F (37.8°C). Rain in the temperate grasslands usually occurs in the late spring and early summer. The yearly average is about 20 - 35 inches (55 - 95 cm), but much of this falls as snow in the winter. Fire is not

foreign in temperate grasslands. They are often set by lightning or human activity. Fire regularly swept the plains in earlier times, and to some extent still does today.

PLANTS: Grasses dominate temperate grasslands. Trees and large shrubs are rarely found in grassland areas. There are many species of grasses that live in this biome, including, purple needlegrass, wild oats, foxtail, ryegrass, and buffalo grass. Many animals munch on these grasses, but they survive because the growth point on the grasses is very close to the ground. Also, with underground stems and buds, grasses are not easily destroyed by fire. Shrubs and trees that live in temperate



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Habitats/Biomes

grasslands are not as good as grasses at coping with the flames, and often are destroyed by fire. Wildflowers also grow well in temperate grasslands. Popular flowers that you might find growing on grasslands are asters, blazing stars, goldenrods, sunflowers, clovers, and wild indigos.

ANIMALS: All grasslands share a lack of shelter from predators, and an abundance of grass for food; therefore, grassland animal populations are similar throughout the world. The dominant vertebrates in grasslands are herbivorous or plant-eating grazers called ungulates. Ungulates are mammals with hoofs, like horses and deer. Their long legs help them run fast to escape grassland predators. The temperate grassland does not have much animal diversity, especially compared to the Savannah. Some animals that inhabit temperate grasslands in North America are bison, antelope, birds, gophers, prairie dogs, coyotes, and insects. On the steppes you'll find similar animals to the Great Plains including lynx, antelopes, falcons, and fox.



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ALPINE

LOCATION: What do you think of when you hear mountains or skiing? Well, you are right. Alpine regions worldwide, including the Andes, Alps, and biome usually lies between an altitude of about the place where the snow line of a mountain and Arctic biomes cover 16% of the earth's surface

WEATHER: In the summer average temperatures 15.5°C). In the winter the temperatures are well altitude increases, the temperature gets colder. are dynamic and can also change from warm to season lasts from around October to May. The June to September. The alpine biome is fairly dry 12 inches (30 cm) each year.



Glenn & Martha Vargas @ California Academy of Sciences

PLANTS: The alpine biome is a tough place for the sunlight at these high altitudes is very strong. of alpine plants. At the high altitudes where these carbon dioxide, which is necessary for plants to Because of the blustery weather, most plants are small groundcover plants, which grow and reproduce slowly. They protect themselves from the cold and wind by hugging close to the ground. When plants die the cold weather makes it hard for them to decompose quickly. This makes for poor soil conditions. Most alpine plants are adapted to grow in sandy and rocky soil. Plants have also adapted to the dry conditions of the alpine biome. Some of the plants found here are tussock grasses, small-leaved shrubs, and dwarf trees. The bristlecone pine is an amazing plant of the alpine biome. It lives in scattered, and mountain regions of six western states of America ranging from Colorado to California. Many are found in the Ancient Bristlecone Pine Forest in the White Mountains of California. These trees only grow to about 60 feet (18 meters). That may seem tall, but for its age 60 feet (18 meters) is short! Bristlecone pines can live to be over 4,000 years old. That is almost old as the Great Sphinx of Ancient Egypt!

the word "alpine"? Perhaps biomes are found in mountain Rocky Mountains. The alpine 10,000 feet (3,000 meters), and begins. Combined, the Alpine area.

range from 40 to 60°F (4.5 to below freezing. Generally, as the Temperatures in the alpine biome freezing in one day. The winter summer season may last from with an average precipitation of

plants to live. It's windy, cold, and There are only about 200 species plants live, there is very little carry on photosynthesis.

Habitats/Biomes

ANIMALS: Can you imagine living in a cold, windy place without much shelter? Animals that live in the alpine biome must have special adaptations to survive the cold, snowy conditions. They also have to deal with high UV light exposure from the sun and thin atmosphere. Mostly warm-blooded animals live here, but a few types of insects also make the alpine biome home. Alpine animals adapt to the cold by hibernating, migrating to warmer areas, or insulating their bodies with layers of fat and fur. Their bodies tend to have shorter legs, tails, and ears, in order to reduce heat loss. Alpine animals also have larger lungs, more blood cells, and blood that can deal with the lower levels of oxygen at higher altitudes. Some animals in the alpine biome are mountain goats, sheep, elk, beetles, grasshoppers and butterflies. Which of these animals do you think leaves the alpine biome in the winter?



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One interesting alpine animal is the chinchilla. Maybe you've seen one of these small, gray, furry creatures in a nature center or zoo. In the wild, chinchillas live in the Andes alpine regions, but they are not easily found. Chinchillas are herbivores. Their diet in the wild consists of plants, roots, and grasses. As altitude increases, the temperature decreases, so in these regions the chinchilla has even denser fur. Chinchillas used to be hunted for their soft, beautiful fur. People used their pelts to make coats until they became nearly extinct in the 1940s. It takes over 100 pelts to make one chinchilla coat! Now they are on the endangered species list, and protected by law from hunting and people. The snowshoe rabbit and ptarmigan bird are also alpine animals. They are adapted to be less visible when snow covers the ground through camouflage. The snowshoe rabbit has brown fur in the summer, but in the winter it turns white. What do you think the ptarmigan does to camouflage? It's like the snowshoe hare! In the summer the ptarmigan has brown feathers and in the winter its feathers are white to hide in the snowy environment.

CHAPARRAL

LOCATION: The chaparral biome is found in small sections of most continents, including the west coast of the United States, the west coast of South America, the Cape Town area of South Africa, the



Jo Ann Ordono
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western tip of Australia and the coastal areas of the Mediterranean. In Europe it is called the maquis, Australia has the mallee, Chile the matorral, and South Africa calls it fynbos. It is also called the Mediterranean Forest, Woodland, and Scrub biome. The chaparral biome has many different types of terrain. Some examples are flat plains, rocky hills and mountain slopes.



Gerald and Buff Corsi
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WEATHER: The chaparral is characterized as being very hot and dry. The winter is very mild and is usually about 50°F (10°C). Most of the rain in this biome comes in the winter. The summer is hot and dry at up to 100°F (37.5°C). This makes fires and droughts very common.

Habitats/Biomes

PLANTS: Most chaparral plants have large, hard leaves, which hold moisture. The plants are also very well adapted to fires. Plants in the chaparral often have root systems designed to get as much water as possible. Shallow roots extend horizontally under the surface of the soils and are good at catching water when it falls as rain; taproots extend deep into the soil to capture groundwater. Some examples of plants in the chaparral are toyon, chamise, poison oak, scrub oak, Yucca and other shrubs, trees and cacti. The maquis contains plants such as myrtle, hawthorn, and broom. The Australian mallee is more open than these other types of chaparral and consists mainly of dwarf eucalyptus trees. The fynbos is also composed mainly of scrub and shrubs, such as heathers and protea plants.

ANIMALS: The animals are all mainly grassland and desert types adapted to hot, dry weather. A few examples from California are: coyotes, jack rabbits, mule deer, alligator lizards, horned toads, praying mantis, honey bees and ladybugs. In Europe one might find wild goats, sheep, cattle, mouflon, horses, lynx, wild boar, rabbits, vultures and eagles. There are also many small mammals, reptiles and insects, just like in California. The fynbos of South Africa also has many butterfly species that rely on this habitat.



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DESERT

LOCATION: Although few animals and plants are adapted to the extremely dry desert life, the desert is a vital biome. The desert is important because it covers about a fifth of the earth's surface! There are both hot and cold deserts. Antarctica is the largest desert in the world, while the Sahara in Africa is the largest of the hot deserts. There are also deserts close to Santa Barbara, such as the Mojave the Colorado Desert which encompass parts of Southern California. In North America, there are four major hot, dry deserts, including the Mojave and the Great Basin. Outside the U.S. hot, dry deserts are found in the Southern Asian realm, South and Central America, Ethiopia and Australia.

Another type of desert is the coastal desert, for example, the Atacama Desert in Chile of South America. And then there are cold deserts. That sounds pretty silly! If deserts are supposed to be hot, how can there possibly be a cold desert? Well these deserts are in places like Antarctica and Greenland where vegetation is sparse, just like the more commonly known hot, dry deserts.



Robert Potts
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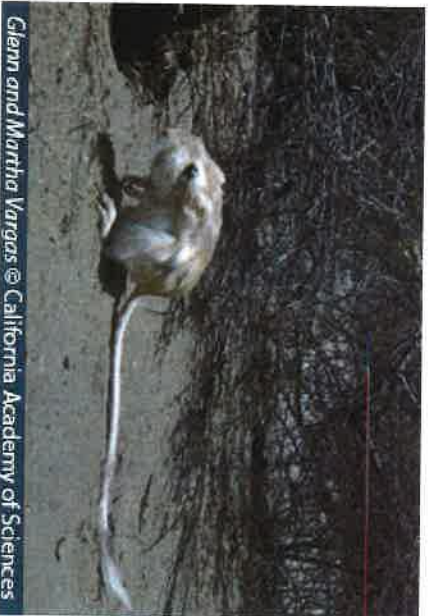
WEATHER: Weather is not the same in all deserts. The seasons in hot and dry deserts are usually very hot during the summer and warm during the rest of the year. During winter these deserts get little rainfall. Rain is often light, or in short concentrated bursts. Most of the time evaporation rates are faster than rainfall rates. Sometimes the rain evaporates before even hitting the ground. This is the reason for the dry characteristic of this type of desert. Coastal deserts are in moderately cool to warm areas. Coastal deserts usually have cool winters followed by fairly long, warm summers. The temperature in the winters is generally 41°F (5°C) or below. In the summer the weather heats up to between 55° and 75°F (12 and 24°C). Average rainfall is usually 3 - 5 inches (8 - 13 cm). The Atacama is the Earth's driest desert. In the Atacama 1 millimeter or more of rain falls every 5-20 years. Cold deserts have short, moist and moderately warm summers, and long cold winters like one could expect in Antarctica. The winter temperature ranges from -5°F to -110°F (-20.5 to -79°C), and in the summer it can be a nice, balmy, 32°F (0°C). The coldest day recorded in Antarctica was -113°F (-80.5°C)!

Habitats/Biomes



Gerald and Buffy Casti @ California Academy of Sciences

PLANTS: Deserts plants have many adaptations to survive in such a dry environment. They are good at storing and finding water. Some plants have seeds that can stay dormant in the sand for a long time, until there is enough rain for them to grow. In hot deserts, you'll often find Cacti. Cacti are great at storing water. With their waxy coating, water can't escape and their spines protect them from being desert dinner. Their roots are shallow, and widely spread so that any rain can be absorbed immediately! Some other plants you might find in the hot desert are creosote bush, sagebrush, and ocotillo. Coastal deserts house a variety of plants. These plants must adapt to minimal rainfall by having extensive root systems that come up to the surface to absorb any possible rainfall, and go far down to absorb any water saturated in the ground. These plants also have very thick leaves that can absorb and store water whenever it is available. The plants that live in coastal deserts include salt bush, rice grass, black sage and chrysothamnus. Plants can even live in cold deserts, but you won't find as many here as in other types of deserts. Plants in cold deserts include algae, grasses, and plants with spiny thin leaves. Usually these plants grow only in the summer.



Glenn and Martha Vargas @ California Academy of Sciences

ANIMALS: Deserts are a very important biome. No, not because of all the sand! Mostly because of all the plants and animals that call the desert "home". Some animals that live in the hot desert are cold-blooded, like snakes, insects, and lizards. Mammals that live in the desert are usually small, such as the kangaroo rat and kit fox. Sometimes it's hard to survive in the desert. Some mice build their home out of fallen cactus spines to protect themselves from predators like coyotes and hawks. In the Eritrean coastal desert in Djibouti, Africa, animals like gazelles, skinks, geckos and dikdiks roam the desert. Fewer animals live in the cold desert. In Antarctica, most of the animals live near the ocean shore. Because of their ice home, seals, penguins, and other birds rely on fish, squid and other sea creatures for their food.