GPS Pathfinders Pre-visit

Classroom Activity

Brief Synopsis:

Technology is constantly changing our lives. GPS units have grown in popularity, yet few fully understand how they work. Learning about the basics of latitude and longitude, along with basic geometry can provide insight into this amazing technology.

Ages: Designed for 4th—7th grades

Activity Lengths:
Activity 1: 50 minutes
Activity 2: 30 minutes

Materials:
Activity 1:
- Photocopies
- Scissors
- Pencils
- Overhead projector and transparencies (optional)

Activity 2:
- Worksheets
- Pencils

Vocabulary:
Triangulation, Trilateration, GPS Unit, Latitude, Longitude

Outcomes:
1. Students will gain a basic understanding of triangulation.
2. Students will become familiar with the layout of Eagle Bluff ELC before arriving.
3. Students will practice using latitude and longitude to determine a location on a map.

Minnesota Academic Standards:
Math: 5.V.B; 6.V.A; 6.V.B; 7.V.A; 7.V.B; 8.V.A; 8.V.B; 9-12.V.A; 9-12.V.B

Activity 1: Triangulation Worksheet

Background:

GPS (Global Positioning Systems) units are able to determine their location on Earth by communicating with various orbiting satellites in a process is called triangulation. Triangulation is defined as the method for finding the intersection of three spheres, while trilateration is using the angles of a triangle to determine a location. Both concepts are complicated mathematical processes that we will simplify for the sake of classroom ease and understanding. Using two-dimensional circles to determine distance from various known points will allow students to gain a basic understanding of the complex way GPS units work.

Procedures:

1. Make copies of Worksheets 1-3 and pass them out to the students. Have students cut out the circles on worksheet one. Once the circles are cut, have the students fold them in half twice thus making a pie shaped piece. Using a scissors, the students should snip off a small section of the pointed tip of the pie piece. Unfolding the paper should reveal a circle with a square in the center.
2. Handout worksheet three, which is an actual map of the campus, to determine where the lost children are at Eagle Bluff. The square in the middle of the circle should be placed over the location noted on worksheet two. When all three circles are placed on the map the point at which they all meet is where the lost child is. Have the students mark this point according to the sheet.
3. Check the students' work according to the key provided.

Activity 2: Latitude Longitude Look-up

Background:

GPS units identify location by using coordinates based upon latitude and longitude. While it may seem these coordinates, also known as waypoints, are made up at random, they are actually based upon the shape of the Earth and its division into equal segments (latitude and longitude). Students will become more familiar with latitude and longitude by plotting cities on a world map.

Procedures:

1. Print out Worksheet 4 and distribute to students.
2. Using the coordinates on the page, have students plot cities on the world map. It is up to the discretion of the teacher as to which categories (Easy, Medium, and Hard) students will complete.
3. The longitudinal lines on the map arch to compensate for the spherical shape of the earth. Remind students not to look straight above or below the number indicated on the map, rather to follow the curve of the line.
4. Have students compare results.

Discussion:

When students participate in the GPS Pathfinders class at Eagle Bluff, they will notice that the coordinates used have additional numbers than those in this activity. In order to be exact, the latitudinal and longitudinal grids are broken down further. Each degree is 60 minutes apart, so location is show in terms of minutes and seconds. Numbers can be shown in two different ways: in minutes (') and seconds (") or decimal notation with fraction (of a minute).

Example:

Eagle Bluff Environmental Learning Center Coordinates

Pre-vist Activity 2:	43° N	92° W
Minutes & Seconds:	43° 45'31.17" N	92° 0'18.63" W
Decimal Notation:	43° 45.520 N	92° 0.311 W

Teacher Tips

- Triangulation and trilateration are very complex mathematical problems. While the first activity doesn't fully explain these concepts, it will give students a basic understanding.
- Cut out examples of the circles used in Activity 1. These visuals will help students correctly cut the circles and center square without mishaps. Cut the circles out of clear plastic if available.
- Feel free to include additional cities in Activity 2! If you want to include your hometown, coordinate information can be found on http://www.wikipedia.org
- Remind students that the vertical lines on the World Map arch due to the shape of the Earth!

Resources:

http://www.pbs.org/wgbh/nova/shackletonexped/navigate/find.html
Different games help students to understand latitude and longitude. This website does require a plug-in which is available for download.

http://www.cyberbee.com/gps_sites.html
If you are looking for a look at GPS units and how they work and can be used, this is a great place to start.

http://www.bcca.org/misc/qiblih/latlong_us.html
This website includes the longitude and latitude of major cities in the United States.

http://www.confluence.org/index.php
This website has pictures an information on different locations where latitudinal and longitudinal lines intersect.

1600 meters

800 meters

1200 meters

400 meters

#1) MARK:
- -1600 meters from Beginning Orienteering
- -800 meters from Archery Range
- -1200 meters from Shiitake

#2) SUSIE
- -400 meters from Overlook
- -1200 meters from East Group Challenges site
- -1600 meters from South Tree Tops

#3 BEN
- -400 meters west from west-most Parking Lot
- -1200 meters from Archery
- -1600 meters from South Tree Tops

#4) JENNA
- -400 meters from South Tree Tops
- -800 meters from the southeastern most Pond
- -1600 meters from Archery Range

#5) SAMUEL
- -400 meters from River Monitoring
- -1200 meters from Competitive Orienteering
- -1600 meters from Susie (#2)

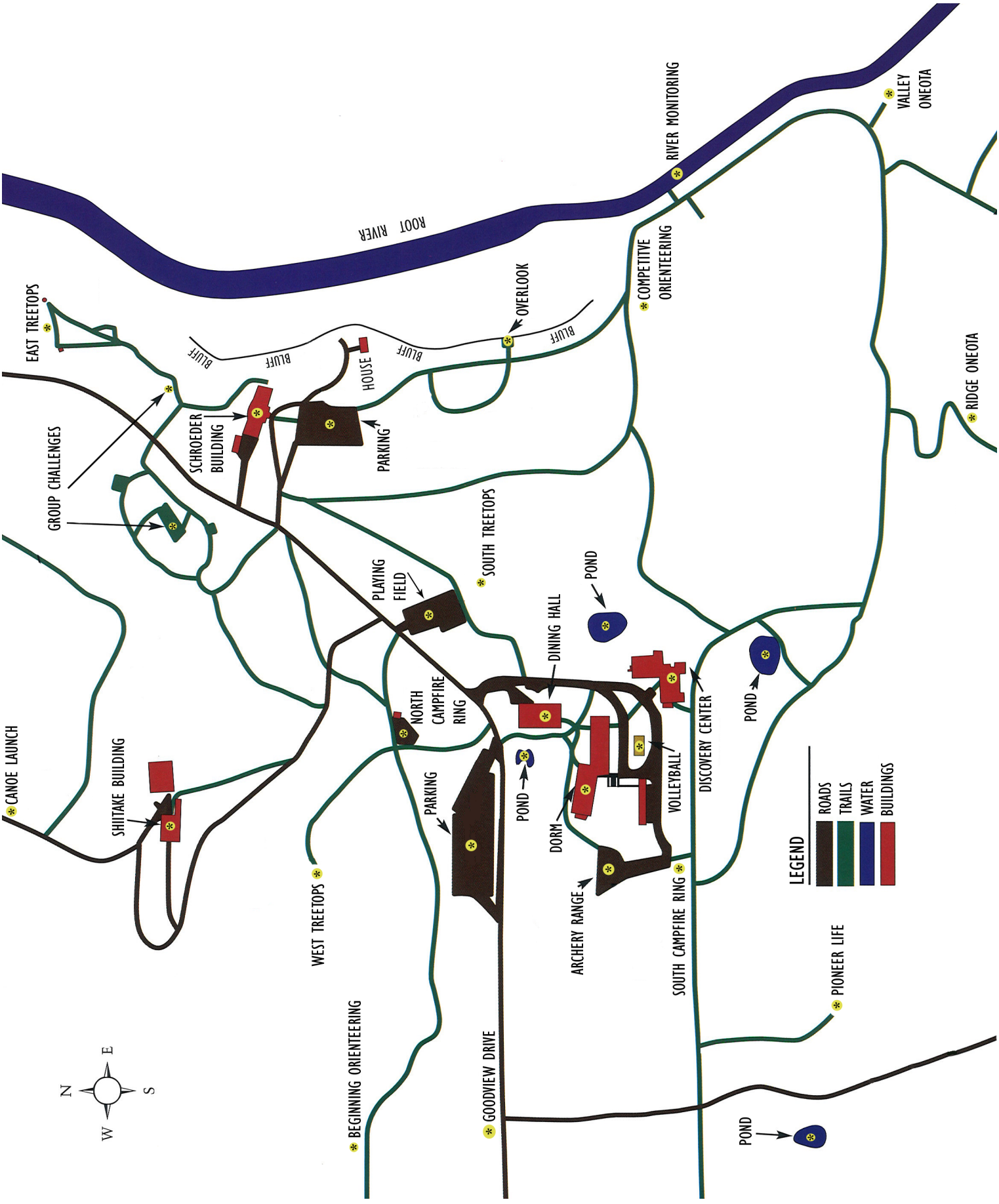
#6) CHLOE
- -1600 meters from Pioneer Life
- -1200 meters from Beginning Orienteering
- -800 meters from Dorm

#7) JACK
- -800 meters from West Tree Tops
- -400 meters from the east-most Parking Lot
- -1200 meters from Jenna (#4)

#8) MAUREEN
- -800 meters from Volleyball Court
- -1600 meters from Ridge Oneota
- -1600 meters from Pioneer Life

#9) EDWARD
- -800 meters from Pioneer Life
- -1600 meters from Maureen (#8)
- -1600 meters from Ben (#3)

#10) DEE
- -800 meters from Dining Hall
- -1200 meters from West Group Challenges site
- -1600 meters from East Group Challenges site


ROOT RIVER
EAST TREETOPS
BLUFF
BLUFF
HOUSE
BLUFF
BLUFF
OVERLOOK
RIVER MONITORING
COMPETITIVE ORIENTEERING
VALLEY ONEOTA
RIDGE ONEOTA
GROUP CHALLENGES
SCHROEDER BUILDING
PARKING
PLAYING FIELD
SOUTH TREETOPS
POND
DINING HALL
NORTH CAMPFIRE RING
CANOE LAUNCH
SHITAKE BUILDING
PARKING
POND
DORM
VOLLEYBALL
DISCOVERY CENTER
POND
WEST TREETOPS
ARCHERY RANGE
SOUTH CAMPFIRE RING
LEGEND
ROADS
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BUILDINGS
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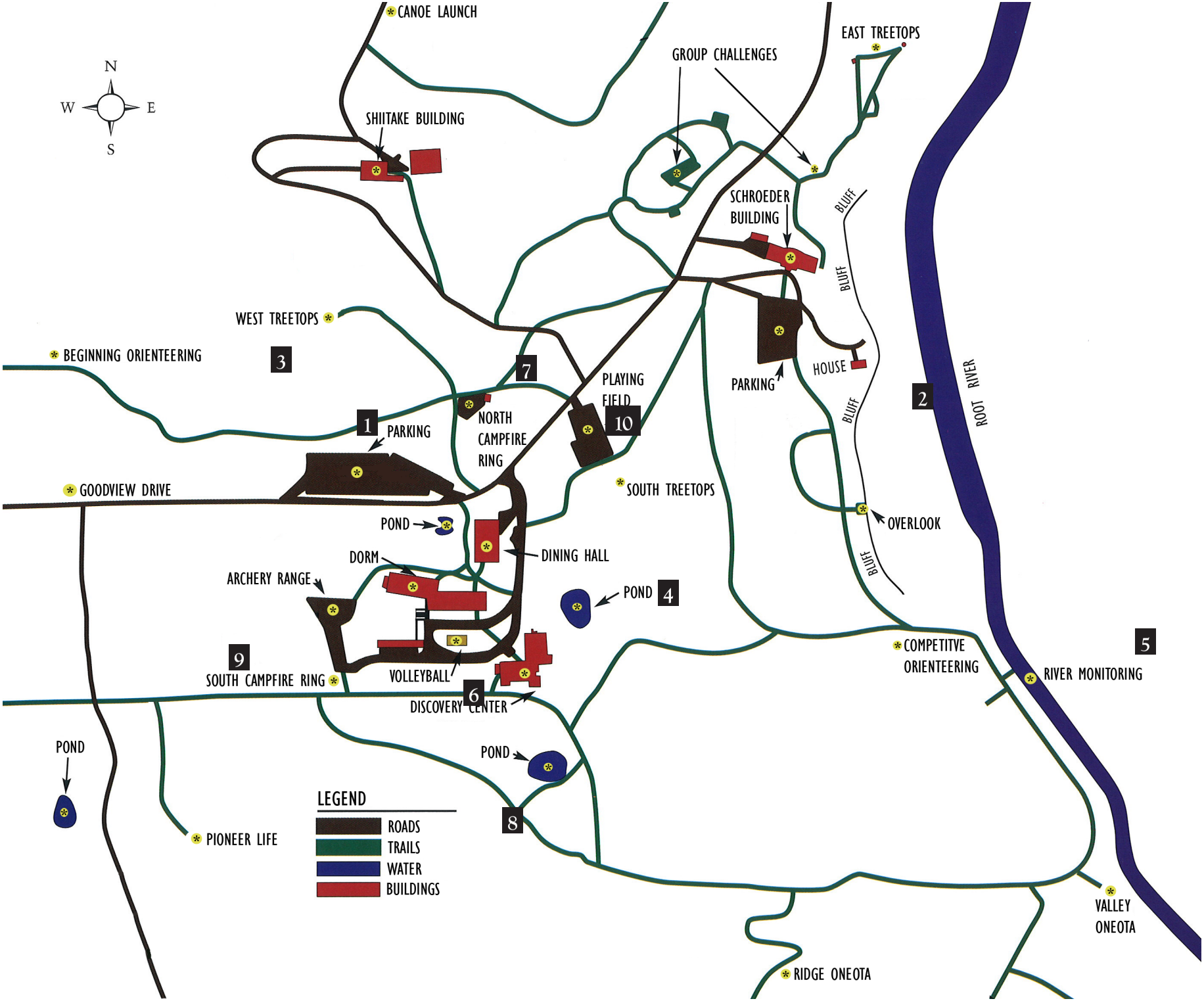
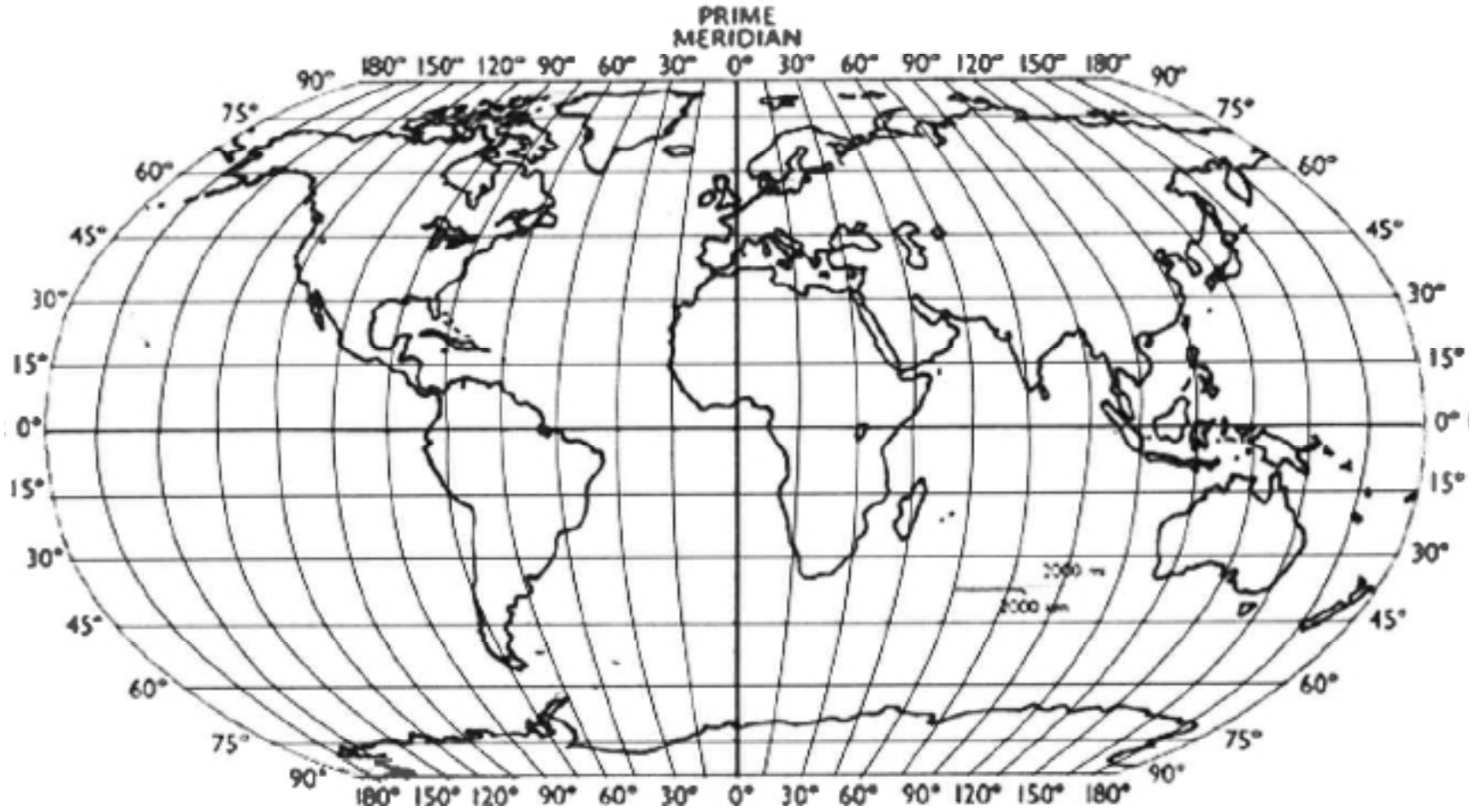


Eagle Bluff

GPS Pathfinders Pre-visit Classroom Activity - KEY



EASY		
New Orleans, LA, USA	30°N	90°W
St. Petersburg, Russia	60°N	30°E
Shanghai, China	30°N	120°E
Magadan, Russia	60°N	150°E
N'Djamena, Chad	15°N	15°E
Vila Bela de Santissima Trindade, Brazil	15°S	60°W
Portland, OR, USA	45°N	120°W

MEDIUM		
New Dehli, India	28°N	75°E
Perth, Australia	30°S	115°E
Nairobi, Kenya	0°	36°E
Merida, Mexico	20°N	90°W
Oslo, Norway	60°N	10°E
Quito, Ecuador	0°	78°W
Montreal, QC, Canada	45°N	73°W
Santa Fe, NM, USA	35°N	105°W

HARD		
Casablanca, Morocco	33°N	7°W
Krasnoyarsk, Russia	56°N	92°W
Charleston, SC, USA	32°N	79°W
Buenos Aires, Argentina	34°S	58°W
Kupang, Indonesia	10°S	123°E
Cape Town, South Africa	33°S	18°W
Caracas, Venezuela	10°N	66°W
Calgary, AB, Canada	51°N	114°W
Eagle Bluff ELC	43°N	92°W