Build Your Wagon

Intended for Grade: Third

Subject: Math

Description: Using the pioneers as a theme, this activity uses manipulatives to teach students measurement concepts using both the English and the metric systems. A gridded paper sketch of a pioneer farm is provided for exploration of lines and angles.

Objective: The student will be able to measure length using the English and metric systems. Also, the student will be able to identify parallel and perpendicular lines as well as right, acute, and obtuse angles.

Mississippi Frameworks addressed:

- <u>Science Framework 7e</u>: Compare metric measurements to English measurements.
- <u>Science Framework 7f</u>: Using various types of instruments measure:
 Length in millimeters, meters, kilometers
- <u>Math Framework 2a</u>: Identify and distinguish between parallel, intersecting, and perpendicular lines.
- <u>Math Framework 2b</u>: Identify right angles and compare them to acute and obtuse angles.
- <u>Math Framework 3e</u>: Compare metric measurements to English measurements.
- <u>Math Framework 3f</u>: Using various types of instruments measure:
 Length in millimeters, meters, kilometers
- <u>Math Framework 3g:</u> Use manipulatives and gridded regions to determine area of shapes.

National Standards addressed:

- <u>Math Standard</u>: Geometry
- <u>Math Standard</u>: Measurement
- <u>Content Standard A</u>: Science as Inquiry

• <u>Content Standard B</u>: Physical Science

Materials:

Activity One: Build Your Wagon Each student will need:

- One small rectangular box (Kleenex boxes work well)
- 4 pipe cleaners
- Two straws
- White tissue paper
- $\frac{1}{2}$ cylinder of florist's styrofoam cut into fourths
- Glue
- Masking tape
- Scotch tape
- Ruler
- Meter stick or tape measure
- Scissors

Activity Two: A Pioneer Plot

- Transparencies containing examples of right, acute, and obtuse angles
- Transparencies containing examples of parallel, intersecting, and perpendicular lines
- Transparency of the gridded paper example of a boat and townhouses
- Overhead projector
- One "A Pioneer Plot" sketch on gridded paper per student
- Colored pencils (crayons will also work)

Background:

This project is a way to integrate math into a social studies unit on the Pioneers. Covered wagons were the major mode of transportation on the Oregon Trail. The size and shape of the covered wagon played a large part in determining the quality of life of a Pioneer family as they moved west. River crossings were one of the most dangerous elements of the journey west for a wagon train. If the river was shallow, the oxen would simply pull the wagon across. The pioneers would float the wagon across while the animals swam across if the water was deep but fairly calm. In deeper waters like the Mississippi River, the pioneers would build a flat boat called a scow for their wagon. The scow would be used to float the wagon across. The pioneers might also trade with the Indians to be ferried across a river.

Each flat side of a three dimensional shape is called a **face**. **Edges** connect the faces (the lines where the faces intersect). **Corners** connect the edges (the points where the lines intersect). These concepts are very important in geometry. In the future, the students will hear that two planes (faces) intersect in a line (edge) and two lines (edges) intersect in a point (corner).

Two systems of measurement exist: English and metric. The English system is the dominant method used in the United States. The English system uses inches, feet, miles, ounces, pounds, etc. The English system has no unit upon which all others are based. There is no standard conversion factor between the units in the English system. For example:

1 foot = 12 inches 1 yard = 3 feet 1 pound = 16 ounces

The United States has been reluctant to change over to the metric system because Americans are already familiar with the English. The metric system is the method used in most every other country. The big advantage of the metric system is that it is **standardized**. Every length measurement is based on the meter and uses some factor (or multiple) of 10 to convert to other units. Every weight measurement is based on the kilogram and uses some factor (or multiple) of 10 to convert to other units. For example:

1 meter = 100 centimeters 1 meter = 0.001 kilometers 1 kilogram = 1000 grams

Converting between the two systems requires a calculator and is often inexact. A few conversion factors (from English to metric) are listed below.

1 inch = 2.54 centimeters 1 foot = 0.3048 meters 1 mile = 1.6 kilometers* 1 kilogram = 2.2 pounds* *conversions are inexact

Parallel lines have exactly the same slope. Two parallel lines will never

intersect.

Perpendicular lines have opposite - negative reciprocal slopes (if the slope of one line is 2 then the slope to a line perpendicular to it is $-\frac{1}{2}$). Perpendicular lines form a perfect "t" at their point of intersection.

Intersecting lines are two lines that cross. Any two lines with different slopes will eventually intersect. Perpendicular lines are a special type of intersecting lines. All lines are intersecting **except** parallel lines.

There are three types of angles: right angles, acute angles, and obtuse

angles. **Right** angles occur when two perpendicular lines intersect. The size of a right angle is 90°.

An **acute** angle is any angle smaller than a right angle.

An **obtuse** angle is any angle bigger than a right angle.

Finding the **area of a gridded region** is fairly simple. Let each square of the grid indicate one unit. Count the whole units that make up the area you want to find. Then count the half units included in the region. Every two half units make up one whole unit. Figure out how many more whole units you have and add that to the original number. For example, the image below has 5 whole units and 4 half units. Therefore, its area is 5 + 2 = 7 units.



Procedure:

Activity One: Build Your Wagon

- 1. At least two weeks before you intend to do the activity, ask the students to bring a small rectangular box to class.
- 2. Teach the students about the pioneers.
- **3.** Introduce the metric and English systems of measurement. Also, teach the students how to use the meter stick and ruler.
- **4.** Introduce the concepts of faces, edges and corners.
- 5. Introduce the concepts of length, width, depth, and diameter.

- **6.** Pass out one box, one piece of tissue paper, four pipe cleaners, two straws, and four slices of styrofoam to each student.
- Have the students count the faces, edges, and corners of their box and record the results on the provided worksheet.
- 8. If you have any other 3-dimensional shapes around the classroom (like a pyramid or prism), have the students count the faces edges and corners of those and compare with their box.
- **9.** At this point you will no longer need the top (one of the sides with the biggest area) of the box. The students should discard the top of the box or cut the top off if necessary.
- **10.** Measure the length, width and depth of their box in centimeters and record the results.
- **11**. Measure the length and width of their piece of tissue paper in inches and record their results.
- **12.** Measure the diameter of their wheel (styrofoam) in millimeters and record the results.
- **13.** Have the students measure the length of their pipe cleaners in inches and record the results.
- **14.** Trim two centimeters off the end of two of the pipe cleaners.
- 15. Put two wheels flat on their desk and stab the center with a straw. Turn the straw over and stab the other wheel in the center.
- Repeat step 14 with the other two wheels and the other straw.
- 17. Have the students masking tape each straw underneath the box (one near the front and one near the back) so that the wheels do not extend past the front (or back) of the box.
- **18.** Form arcs with the pipe cleaners and masking tape the ends to the inside of the box equidistant from one another. Tell them to put the shorter pipe cleaners in the middle and the longer ones on each end.

- **19.** Have the students fold the tissue paper in half (match short end to short end).
- **20.** Have the students trim 15 cm off the length of the folded tissue paper.
- **21**. Glue along the top of each pipe cleaner.
- **22.** Have the students place the tissue paper on top of the pipe cleaners. The tissue paper should completely cover all pipe cleaners and hang slightly over the box on either side.
- **23.** Scotch tape the tissue paper to the sides of the box.
- **24.** While the glue is drying, proceed to Activity 2.
- **25.** After the glue dries, tuck the excess tissue paper into each end into the wagon.

Activity Two: A Pioneer Plot

- **1**. Copy the examples of lines and angles, and the gridded paper drawing of a boat and townhouses (p. 18) onto transparencies.
- 2. Using the transparencies and the overhead projector, introduce the students to:
 - right, acute, and obtuse angles
 - parallel, intersecting, and perpendicular lines
- **3.** Using the gridded transparency of the boat and townhouses show the students how to*:

In the boat:

• find and indicate right, acute, and obtuse angles

In the townhouses:

- find and label parallel and perpendicular lines
- determine the area of a gridded region

- **4.** Pass out a copy of the pioneer sketch on gridded paper and corresponding "A Pioneer Plot" handout to each student.
- **5.** Have the students use their colored pencils to follow the instructions.

*There is more than one correct way to label the drawings (i.e. there is more than one acute angle, right angle, and obtuse angle in the boat.) Two examples of an acute angle, obtuse angle, and right angle are labeled on the key (p. 19) as well as two examples of parallel lines and perpendicular lines.

Evaluation:

The "Measure Your Wagon" worksheet, the "A Pioneer Plot" worksheet and the gridded paper sketch can be used for assessment.

Extended Activities:

A few good pioneer websites for children:

http://www.nationalgeographic.com/west/main.html

This interactive National Geographic Kids site tells the story of Lewis and Clark while giving the children a chance to make their own decisions when faced with the same situations. The children can read excerpts from Lewis's journal. They can even see a map of the path they traveled based on their decisions.

<u>http://www.thinkquest.org/library/site_sum.html?tname=6400&cid=2</u> <u>&url=6400/default.htm</u>

This ThinkQuest site includes information about toys, first aid, river crossings, and cooking on the trail. Recipes can be found here for doughnuts and a drink called a "Raspberry Quencher." There are also photos of tools the pioneers used and their functions.

http://204.234.22.1/SDGI/Newell/Immigration.html

This site lists interesting facts including: sizes and weights of covered wagons, what each person should pack, the cost and weight of supplies in 1849 dollars, and the number of pioneers moving west to Oregon, Utah and California for the years 1840-1860. It also shows pictures of two common types of covered wagon.

Sources:

http://gpn.unl.edu/guides/rr/pa018.pdf

http://www.lhf.org/cgi-bin/gygactivity.pl?31

http://www.watersheds.org/farm/hagriculture.htm

http://www.pbs.org/teachersource/thismonth/apr02/index3.shtm

http://www.tech.purdue.edu/It/Courses/IT278/Presentations/Math/ Math%20Concepts.doc

http://www.sciencemadesimple.com/conversions.html

http://www.illuminations.nctm.org/index_d.aspx?id=407

http://library.thinkquest.org

Prepared by:

Emlee Nicholson NSF NMGK-8 University of Mississippi November 2004

Name:_____

Measure Your Wagon

Directions: Answer the following questions using a ruler, meter stick (or tape measure), and the materials you will use to build your covered wagon.

1.	How many faces does your box have?			
2.	How many corners does your box have?			
3.	How many edges does your box have?			
4.	What two dimensional shape is one side of your box?			
5.	What is the length of your box (inches)?			
6.	What is the length of your box (centimeters)?			
7.	Which is bigg a. 1 inch	er? b. 1 ce	entimeter	
8.	What is the width of your box (centimeters)?			
9.	What is the depth of your box (centimeters)?			
10. What is the length of your pipe cleaner (inches)?				
11.	11. What is the diameter of your wheel (millimeters)?			
12. What is the diameter of your wheel (centimeters)?				
13. How many millimeters are in 1 centimeter? a. 1 b. 10 c. 100				

Name:

A Pioneer Plot

A pioneer family who completed their journey west in a covered wagon needed to settle their land. So they built a log cabin to live in and planted corn and wheat. They needed to keep their livestock from eating the crops so they built a fence around them. The pioneers built split rail fences using logs they split in half for the rails.

Directions:

In the log cabin,

- 1. Find a right angle and label it with a red \neg
- 2. Find an acute angle and label it with a blue
- 3. Find an obtuse angle and label it with a green

In the fields,

- 4. Trace the ---- lines yellow. These represent the corn the family planted.
- 5. Trace the _____ lines brown. These represent the wheat the family planted.
- 6. Find two parallel lines and color them both purple.
- 7. Find two perpendicular lines and color them both red.
- 8. If 1 square = 1 unit what is the area of the fenced in corn field in units?





Right Angle

Obtuse Angle



Parallel Lines

Perpendicular Lines



Intersecting Lines







The area of the tall townhouse is 36 units. The area of the other three townhouses is 32 units.

