RAFT IDEAS

Topics: Operations with Negative & Positive Numbers, Number Lines, Word Problems

Materials List
- ✓ Adding machine tape or equal, at least 10 cm (4") wide by 1.5 m (4 ft), 1 per student or team
- ✓ Meter stick/yard stick, tape measure, and/or rulers
- ✓ Pencils and/or markers
- ✓ Optional: Stickers, stamps

This activity can be used to teach:
Common Core Math Standards:
- Word problems with distances (Grade 4, Measurement/Data, 2)
- Positive and Negative Numbers (Grade 6, Number System, 5, Grade 7, Expressions and Equations, 3)
- Rational numbers & ordering (Grade 6, Number System, 6, 7)
- Addition & subtraction of rational numbers; number lines (Grade 7, Number System, 1)
- Problem Solving and Reasoning (Math Practices Grades 4-8)

Hi-Ho, Hi-Low!
Discover properties of number lines while sailing the high seas!

Construct your own high sea adventure math word problems along a vertical number line! Become the captain of positive and negative numbers in this maritime setting!

Assembly
Students work individually or in teams.
1. Draw or fold a straight line down the center length of paper roll.
2. Draw or fold a line perpendicular to the center of this line.
3. Lay the paper vertically; mark the intersection of the lines as zero.
4. Draw a small wave on the horizontal line at zero to represent the ocean "surface".
5. Mark the scale along the number line. This can be done in either centimeters, if using metric units, or inches. Above and below the zero at the ocean surface, draw small tic marks along each centimeter or inch of the vertical line. [The scales used will differ: 1 cm = 1 meter or 1 inch = 10 feet.]
6. Starting at zero, above the surface, write positive numbers next to every tic mark starting at +1 meter or +10 feet to +65 meters or +200 feet or more.
7. Below the surface, write negative numbers next to every tic mark starting at -1 meter or -10 feet to -65 meters or -200 feet or more.

To Do and Notice
The teacher may guide the student or allow students/teams to create individualized vertical number lines.)
1. Choose stamps, stickers, draw pictures or any combination of these to represent an "object" to be located along the vertical line in the activity.
2. Place different objects on, above and below zero along the vertical number line. Objects may be placed to the right, left, or on the vertical line
3. Write next to each object the distance it is located from zero.
4. On separate paper, create math word problems based on the locations object are from another. Pose the questions to another student or team.

For example, say the following objects appear on the line:
- A ship on the surface of the water
- A shark at 15 meters (50 feet) below sea level.
- Superman flying at 55 meters (180 feet) above the ocean.
- A bird at 27 meters (90 feet).
- A scuba diver at 50 meters (165 feet) below the ocean surface.
- A red fish swimming 9 meters (30 feet) above the scuba diver
- An octopus swimming next to the diver

With this example, the following math word problems could be created and then solved by creating and evaluating appropriate algebraic equations:
- If the octopus tugs the diver down 3.5 meters (11.5 feet), and then lets the diver go, how far up does the diver need to swim to reach the surface?
- If the shark swims to the red fish and eats him, how far (in meters or feet) will the shark be below the water level?
- How far up (meters or feet) would the bird need to fly to reach Superman?

The Math Behind the Activity

In a scenario that engages students' visual senses and is creatively fun, this activity gives students practice in locating positions along a number line, in understanding the relationship between positive and negative numbers, and in creating interesting word problems for others to solve. A number line is a straight line, usually horizontal or vertical, on which every point is assumed to correspond to a real number and every real number to a point. Number lines are divided into two symmetric halves by the origin, i.e., the number zero. In this activity, numbers above the ocean surface are positive (greater than zero), where numbers below are negative(less than zero). A change from one direction to another results in moving up or down along the number line, and may result in adding positive and negative numbers. Be careful to use correct terminology when referring to the (-) sign. This sign has more than one meaning in mathematics; it stands for "minus", which means to take away from; for "negative" which means the opposite sign of; and for moving in the opposite "direction."

Taking it Further

- For younger students only use positive numbers.
- Draw arrows on both ends of a number line to show it goes on forever in both positive and negative directions.
- A vertical number line could be illustrated as an elevator (positive direction above the main floor; negative direction means below the main floor, as in parking levels) or as a thermometer
- Illustrate other types of vertical or horizontal number lines (e.g., timelines, gaining and losing yards in a football game, traveling from one location to another along a road) and create related word problems.
- Include rates (e.g., if a fish starts at the surface of the ocean and swims downward 2 feet per minute, how long will it take for him to reach the shark if the shark is at 56 feet below sea level?)
- Incorporate different terms, concepts, and operations into the number line word problems. Suggestions: Include multiplication and division problems, absolute value, <, >, less than or equal to, greater than or equal to.
- Include proper fractions, improper fractions, mixed numbers, and decimals

Web Resources (Visit www.raft.net/raft-idea?isid=629 for more resources!)

- Positive and negative numbers - http://www.mathleague.com/help/posandneg/posandneg.htm#thenumberline
- Other types of number lines - http://www.mathsteacher.com.au/year7/ch15_linear/01_number/line.htm and http://illuminations.nctm.org/LessonDetail.aspx?id=L784
- Teacher designed math courses from the New Jersey Center for Teaching & Learning – https://njctl.org/courses/math