Math Activities

Time: 2 days

Group Size: Whole Class

Where: Classroom, Gym, Sheldon Jackson Fish hatchery

Focus: Students learn how to do simple linear equations through guided practice, group activities, and the computer program, Compass Learning. Students will then apply what is learned in the classroom to real life situations provided by the Sheldon Jackson Hatchery.

Math Performance Standard M.A.6:
Students should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

Materials:

- Copies of pretest and posttest
- Sharpened pencils
- 4-5 large sheets of butcher paper (1 per CLG)
- 12 colored markers
- 3 stop watches
- 3 yard sticks or long tape measure
- Masking tape
- Copies of seal hop data sheet
- Clipboards (enough for the whole class)
- Calculators (1 per CLG)
- Graph paper
- Colored pencils for graphing
- Copies of hatchery field trip worksheet
- 8 Calculators (for hatchery calculations)
- Copies of reflection

Pretest: Give students the pretest prior to any instruction. The students are to take the pretest independently.

Activate Prior Knowledge: Pass around a big sheet of butcher paper and markers to each CLG. Ask students to write the word "equation" in the center of their paper. Give students 2-4 minutes to write words or draw pictures that come to mind when they hear the word, equation. Allow time for each group to briefly stand up and share what they came up with. Ask the group to look back at their paper and circle any commonly used equations they may have written down. Make a list of the equations on the board. Allow students to shout out additional example equations that pop into their minds as you are making the list. Ask the class what the letters in equations stand for (numbers) and what the letters are called (variables). Help students arrive at the correct answers.

Give each group 2-3 minutes to come up with a definition for the word equation based on what they already know about equations. Share and discuss the following definition for equation with the class: *a mathematical statement that shows the equality of two expressions.* Create a class

definition using student definitions and the dictionary version. Post on the word wall.

Explain that algebraic equations have been used for thousands of years, even by Alaska Natives. Use traditional kayak building as an example. Blue prints were never used to build kayaks long ago. In order to custom build a kayak to fit its owner perfectly, the measurements were based on body parts. The width of the kayak was determined by the two fists on either side of the hips of the person building the kayak, or W = 2F + H, where W is the width of the kayak, F is the size of a fist, and H is the size of the hips. The length of the kayak is determined by taking the arm span of the individual and multiplying it by three, or L = 3A, where L is the length of the kayak and A stands for one arm span.

Introducing Linear Equations with the Seal Hop: Using the list of equations made in the above activity, circle all the equations that are linear equations. Give students 1-2 minutes to discuss what all the circled equations have in common. Allow time for each group to share the similarities with the rest of the class. Write "linear equation" on the board. Explain that linear equations are *equations that represent a straight line when graphed.* Tell the students that they are going to use the Native Youth Olympic (NYO) event, the Seal Hop, to show how linear equations are a mathematical expression for things observed in real life.

Handout copies of the seal hop data sheet to each student. Briefly explain what the students will be doing in this experiment. With the class create a question and a hypothesis for the experiment prior to going to the gym. Take the students to the gym along with clipboards, pencils, copies of the NYO data sheet, stop watches, and yard sticks. Once at the gym demonstrate the seal hop. Show how it is like hopping forward in a push-up position, but your hands are shaped into fists. With every hop you land on your knuckles. Girls however, land on open hands. The following websites have good descriptions and images of NYO events, including the seal hop: http://library.thinkquest.org/3883/ and http://www.anchorage.net/764.cfm. Ask for three volunteers to race while doing the seal hop. Three students should measure and mark 25 feet with masking tape on the gym floor. Three other students will time the race, and assign three recorders to take down the times on their data sheets. Have

the students race three times (3 trials). The times will be averaged back in the classroom.

Once back in the classroom draw a large table on the board and have the recorders post the race times in the table. Ask the rest of the class to copy down the data on their individual data sheets. Have the students average the three trials so that you end up with three final average times, one for each person racing. Write Distance = Rate x Time (D= RT) on the board. Explain that D=RT is an example of a linear equation because when the data is plotted, it should make a straight line. Ask the students which pieces of the equation do they have? They should say distance and time. They will need to solve the equation to find the rate at which the racer was hopping. Plug in one of the racer's values in to the equation and ask students to tell you how you would go about solving this equation for rate. Most classes will have at least one or two students that will know something about solving simple equations to help facilitate this process. Once you have walked the class through solving the equation once, ask the students to solve the equation for the other two racers. Walk around the room and help students one on one. The rate for each racer should be recorded on the data sheet. Now hand out graph paper to each student. Remind the students that in order for D=RT to be a linear equation, the data has to make a straight line. Have the students plot the points for distance and time on the graph while plotting the points with them on the board. Draw a line through the x-y intercept to the time-distance point. Students can use a different colored pencil for each line. Ask the students which line represents which racer and why? Discuss with the students how the slope of the lines is equal to the rates of each racer.

Conclude this activity by asking the students if anyone can give you the definition of a linear equation. Briefly review the seal hop experiment. Ask the students to tell you what the equation was for the experiment (D=RT). Then ask if it was a linear equation and why? They should be able to say that D=RT was in fact a linear equation because it produced a graph with a straight line. Once the students have created their definition for linear equation, post it on the word wall.

Compass Learning – Solve One-Step Linear Equations:

Note: This activity may be done prior to the seal hop activity.

Log on to Compass Learning and open the lesson, Solve One-Step Linear Equations. It is a good idea to do the sections in the lesson prior to doing them with the students. Project the lesson using the SMART Board. Do the third section, Reteach, together as a class. This section explains how to solve all the types of one-step linear equations. Pause the program as you see fit to elaborate on the explanations or to allow for students to ask questions. Do the second section, Let Me Try, together as a class. This section gives the students example equations to solve. Have the students solve each example equation with you using scratch paper and make them show all their work. In the computer lab allow students to do the fifth section, Let Me Practice, independently. This section gives students a chance to work on their own. Walk around the room and offer help to those who need it. Offer an incentive for students that get the 3 highest scores on this last section.

Hatchery Field Trip: The Sheldon Jackson Hatchery has been a fascinating place to visit for ANSWER Campers since Sitka has been a site for camp. They have a touch tank of intertidal invertebrates, a series of saltwater tanks full of sea life, and a hatchery that enhances the local economy by augmenting Sitka's salmon stock. The hatchery is a perfect example of where algebra is being used daily. For example, they use algebraic equations to monitor changes in size of the fish, determine feed rates, and to assist in treating water borne fungus. ANSWER Campers will be taking what they have learned about solving simple linear equations and observe firsthand how it applies to keeping salmon healthy at the hatchery.

In order to prepare the students for the trip to the hatchery they must be familiar with a few new vocabulary words and the equations that they will be working with. Briefly go over the following vocabulary words and then reinforce the words with one of the vocabulary activities listed in the fish curriculum:

Biomass: total mass of an unknown quantity of fish

Population: total number of fish

Size: average mass per fish (grams)

Concentration: the amount or proportion of a substance in a mixture or solution

During the visit to the hatchery students will be working with the following equations:

1) Biomass = Population x Size

Once a week, the hatchery gathers samples of fish in order to determine how much the fish have grown. They use the biomass equation in order to calculate the average size of each individual fish. A sample of fish is collected with a dip nets from the live tanks. Biomass is defined in this situation as the total mass of the unknown quantity of fish in the sample. Population is the total number of fish counted in the sample. Size is the average mass of an individual fish in the sample.

2) Amount to Feed Fish = Biomass x Feed Rate

The fish are fed at different feed rates in order to insure that all the fish in the tank are able to eat during a particular feeding. Feed rates are predetermined values based on the time of year and water temperature. Using the above equation determines how much feed to give the fish.

3) Treatment per Minute = Rate of Water Flow x Concentration

Formalin is a mixture of formaldehyde and water that is used to treat the eggs for fungus in the fall. The formalin is added to the water at a controlled rate for a given period of time in order for the correct concentration to be applied to the salmon eggs. The hatchery uses a bag similar to an IV bag that drips the formalin into the incoming water flowing through the incubators. The rate of the water flow and concentration are predetermined values. Using this equation determines the amount of formalin per minute to be applied to the eggs.

The students will bring clipboards, pencils, calculators and copies of the hatchery field trip worksheet. Dan Goodness the hatchery manager will do a short lecture explaining the above equations. He will then lead the students through the hatchery demonstrating how some of the variables in the equations are determined. The students will be able to gather a small example of live fish use the biomass equation in order to calculate their average individual masses.

Reflection and Post Test:

Allow students to reflect over the last couple of days and their investigations of linear equations. Hand out the reflections sheets and encourage students to write about any ah-has they may have had during the Seal Hop activity, Compass Learning, or at the Hatchery.

Give students the posttest after they are finished with the reflection. The students are to take the posttest independently.