Experiment 1

The Wave

Teaching Notes

In this experiment, the duration of a wave is a linear function of the number of students performing it. The number of students is the *independent variable*, and the time needed to complete the wave is the *dependent variable*. This whole-class experiment provides an opportunity to model the procedures that students will use as they complete the three sections of all the experiments: Collect the Data, Find the Equation, and Interpret the Data.

Equipment

overhead projector and markers

piece of linguini (flat spaghetti)

stopwatch, or a watch that displays seconds, 1 per group

Appoint one student as the "timer."

graph paper, 1 sheet per student

rulers, 1 per student

Procedure

Start with a group of 5 students. The timer says, "Go!" and students make a wave. To do this, the first student stands up and sits down, the second student does the same, and so on. The last student says, "Stop!" as she or he sits. The timer records the elapsed time. Repeat this experiment with 8, 10, 15, and 18 students. (Continue to increase the number of students each time, until everyone in the class has been part of at least one wave.)

Plot the points on the overhead projector as students plot them at their desks. Draw a line through two of the points using a piece of spaghetti; students should use rulers. Use the graph to predict how long it would take 26 students (or some other number you didn't use) to make a wave. Have students make a 26-student wave and compare the resultant time with the prediction.

Ask: What would happen to the graph of the line if, when the timer says "Go," we all clap four times and say, "Let's go team!" before the wave begins? (The line would move up.)

Display a flatter line than the original. *Ask:* What does this graph mean? (Everyone in the class stood up and sat down faster.)

Ask: How could we change the experiment so the line would be steeper? (Each student could shout "Let's go team!")

Extension

A similar experiment can be done with dominoes. You will need a stopwatch and plenty of dominoes for this extension. Line up the dominoes about 1 inch apart. The *independent variable* is the number of dominoes, and the *dependent variable* is the amount of time it takes the dominoes to fall. Forty dominoes set 1 inch apart fall in less than 2 seconds. Varying the distance between dominoes will change the slope of the line.

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Name _____

Partner _____

Collect the Data

Draw a diagram of the experiment, indicating variables.

Describe the procedure for the experiment.

The independent variable, x, is _____ Units _____

The dependent variable, y, is _____ Units _____

Data Collection

Independent	Dependent

Points to Be Graphed

x	y

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Find the Equation

After plotting your data on graph paper, draw a straight line through two of your points. Choose the line that best fits your data. Circle the points on your graph and copy their coordinates below.

Your points: (____, _____) and (____, _____)

Use these points to find the equation of your line. Show your work.

Find the slope of the line.

Find the y-intercept of the line.

Write the equation of the line.

$y =$ _____ $x +$ _____ $y =$ _____ $x +$ _____

rational form *decimal form*

Rewrite the decimal form of the equation, using the names of the variables instead of x and y.

_____ = _____ _____ + _____

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Interpret the Data

Write the decimal form of your equation here. $y =$ _____ $x +$ _____

Use this equation to answer Questions 1 through 5. Show your work.

1. How long would it take 40 students to make a wave? _____

2. How many students are needed for a 25-second wave? _____

3. Was your answer to Question 2 a whole number? _____

   Does a non-whole number make sense for this answer? _____

4. How many students must get up and sit down for a 3-minute wave? _____

5. With a group of 33 students, how long would it take to make a complete wave? _____

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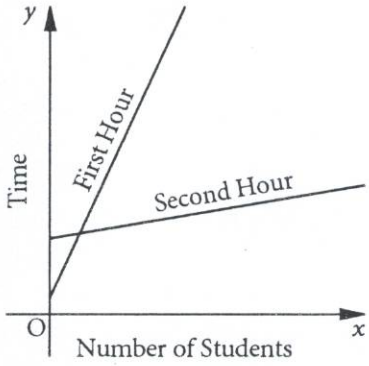
6. How would your graph be different if every student stood up and turned around twice before sitting down?

_____

_____

First- and second-hour classes did the Wave experiment. The graphs are recorded here.



7. Give a possible explanation of why the slopes are different.

_____

_____

8. Give a possible explanation of why the y-intercepts are different.

_____

_____