Big Idea(s):

Functions can be represented verbally, graphically, symbolically, physically, and in a table.

Essential Question(s):

What do different shapes of graphed data tell us?

Content Standard(s):

Understand the connections between proportional relationships, lines, and linear equations.

Mathematical Practice or Process Standards:

Model with mathematics.

Look for and make use of structure.

Learning Intention(s): Mathematical Learning Intentions

We are learning to:

- Write an equation, table, and graph for a linear relationship
- Recognize a linear, nonlinear, and no relationship from a graph

Language Learning Intentions

We are learning to:

- Use the terms relationship, linear equation, and nonlinear relationship appropriately

Social Learning Intentions

We are learning to:

- Listen to the ideas of others
- Respectfully disagree with the mathematical arguments of others

Success Criteria (written in student voice):

I know that I am successful when I can:

- Write an equation, table, and graph for a linear relationship
- Look at a graph and tell if there is a linear, nonlinear, or no relationship
- Use the terms relationship, linear equation, and nonlinear relationship appropriately when I communicate with others in writing or speaking
- Listen to the ideas of others
- Respectfully disagree with the mathematical arguments of others

Purpose:

☑ Conceptual Understanding ☐ Procedural Fluency ☐ Transfer

Task:

Each pair of students graphs data from one of nine different situations (see situations in Figure A.5). Three situations are linear relationships, three are nonlinear, and three have no relationship. Pairs post the graphs of their situations. In pairs, students sort the graphs based on the shape of the data. After sorting, there is a class discussion about what the shape of the data means.

(*Continued*)

Materials (representations, manipulatives, other):

An assortment of pictures of faces that demonstrate emotions such as a baby crying, a woman smiling, a boy angry, etc.; chart-size graph paper; markers; inch or centimeter cubes; pennies; stopwatch; rugs worksheet; a soup can (or any can); and prepared exit slips (see Figure A.6).

Misconceptions or Common Errors:

- Students may try to connect the points on the scatterplot where there is no relationship.
- Some students confuse the x and y axes.

Format:

☐ Four-Part Lesson ☐ Game Format ☐ Small-Group Instruction

☑ Pairs ☐ Other_____

Formative Assessment:

Hinge question (after the sorting): How do each of these graphs reflect the information in the story?

Launch:

Introduce the phrase, "A picture is worth a thousand words." Ask students questions to facilitate a brief discussion. Questions may include the following:

- Have you ever seen a poster with no words? How do you know what it means?
- Holding up one face at a time, "What do you think this person is trying to tell you?"
- Can you think of any pictures you have looked at that had no words yet you knew exactly what it meant?

Lead the discussion in a mathematical direction by introducing the idea that graphs are like pictures that are worth a thousand words. In this lesson, we are going to look at many graphs and see what they tell us.

Facilitate:

Divide students into pairs and randomly assign one situation A-1 to each pair (alternatively, decide in advance which situation is appropriate for which pair of students). After making material available and answering questions, allow students to work. Walk around the classroom and be available to answer questions. Support pairs by asking questions such as, "Do you think there is a relationship? Does one of your variables depend on the other?"

Instruct students to hang the graphs around the room. Be sure to mix up scatterplots and linear and nonlinear graphs.

Ask pairs to sort the graphs in any way that makes sense to them. If any pair needs assistance, suggest three groupings.

Lead a discussion beginning with the scatterplots, asking students the following:

- Why is there no line to this graph?
- What do the three situations that these graphs represent have in common?
- Were you able to write an equation to model this situation?

Lead a discussion around the linear graphs:

- What is the same about all of these graphs?
- What do you think that means compared to the previous group we examined?
- How were the situations the same?
- Could you write equations for these graphs?

Lead a discussion around the nonlinear graphs:

- Is there a relationship here?
- How is this relationship different from the linear graphs? The scatterplots?
- How are the situations that led to these graphs similar to one another? How are they different from the linear stories?

Anticipating student responses:

Most pairs will sort the graphs by lines, scattered points, and curves. Some may try to sort them further by sorting the nonlinear graphs into smaller groups. Students will notice that they could predict the answers in the linear graphs. For the discussion questions, students may feel uncomfortable about the scatterplot since there is no relationship. However, when they revisit the situations, they will conclude that none of the scenarios really made sense and that there were no relationships within them.

Closure:

Use the 3 What's: What did I learn today about graphs?

Why do I need to know the difference between different shapes of data on a graph?

Now that I know, how can this information help me?