Gizmos

Name: _____ Date: _____

Student Exploration: Introduction to Functions

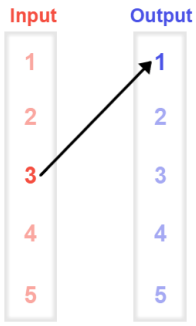
Vocabulary: domain, function, input, mapping diagram, ordered pair, output, range, relation

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
Matt wants a snack. He finds a vending machine with 25 different snacks. Each one is labeled with a letter (A to E), and then a number (1 to 5). He decides he wants the chips in slot A5.

1. Matt puts in his money and pushes the A button.
   A. Does the vending machine know what he wants yet? _____
   B. Explain. _____

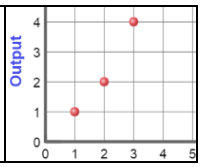
2. Then Matt pushes the 5 button. What does that tell the machine to do? _____
   _____

Gizmo Warm-up
In the *Introduction to Functions* Gizmo, you can create and analyze relations. A **relation** is a set of (input, output) or (*x*, *y*) **ordered pairs**. The Gizmo gives you three ways to link **input** values to **output** values, to form these pairs.



1. In the Gizmo, turn on **Show mapping diagram** and **Show ordered pairs**. In the **mapping diagram**, click-and-drag an arrow from the red 3 to blue 1, as shown to the right. This means, "For an input of 3, the output is 1."
   A. How is this expressed as an ordered pair? (_____, _____)
   B. Turn on **Show graph**. How is this relationship shown on the graph? _____
   _____

2. Drag another point onto the graph.
   A. What ordered pair did you graph? (_____, _____)
   B. How is this ordered pair shown on the mapping diagram? _____
   _____
   C. Express this relationship as a sentence: For an input of _____, the output is _____.

Activity A: **Relations**	Get the Gizmo ready: • Click **Clear all**. • Be sure **Show mapping diagram**, **Show ordered pairs**, and **Show graph** are selected.	

1. Consider this relation: (1, 5), (4, 2), (3, 1), and (2, 4).

   A. First, click inside the **Show ordered pairs** box, type (1, 5), and hit **Enter**. According to this ordered pair, what is the output of this relation when the input is 1? _____

   B. In the Gizmo, type in the other three ordered pairs. The set of all input (*x*) values form the **domain** of a relation. The set of all output (*y*) values form the **range**. How can you determine the domain and range from the mapping diagram?

   _____

   C. What are the domain and range of this relation, from smallest to largest?

   Domain: {_____, _____, _____, _____} Range: {_____, _____, _____,_____}

2. Click **Clear all**. Create a graph with 5 points whose domain is {2, 4, 5}.

   A. Record the coordinates of your points in the table to the right.

   B. What is the range of your relation? _____

   C. Look at the mapping diagram in the Gizmo. If a relation has more numbers in its range than in its domain, like this one does, what has to be true?

   _____

Input	Output

3. Consider this relation: If the input is 3, the output is 5. If the input is 2, the output is 2. If the input is 1, the output is 4. If the input is 4, the output is 5. First, sketch the relation's mapping diagram, ordered pairs, and graph below. Then create it in the Gizmo to check your answer.

Activity B: **Functions**	Get the Gizmo ready: • Click **Clear all**. • Turn on **Show mapping diagram** and **Show ordered pairs**.	**Ordered pairs (*x*, *y*)** (1, 4) (5, 5) (3, 2) (3, 3)

1. In the Gizmo, create the mapping diagram for this relation: {(1, 4), (5, 5), (3, 2), (3, 3)}.

   A. Fill in the blanks with the output for each of the following inputs.

   input 1, output _____ input 5, output _____ input 3, output _____

   B. Select **Show function test** under the mapping diagram. Why is this relation not a **function**? _____

   C. Which input is the "problem case" for this relation? _____

   D. How do you think you can spot a "problem case" on the graph? _____

   _____ Turn on **Show graph** to check.

   E. In the Gizmo, drag the point at (3, 3) to (4, 3). Look at **Show function test** under the mapping diagram. Why is this new relation a function? _____

   _____

   F. Select **Show function test** under the graph. Why does a "vertical line test" tell you if a relation is a function?

   _____

2. Click **Clear all**. Create a graph with 4 points whose domain is {1, 2, 3}.

   A. Record the coordinates of your points in the table to the right.

   B. Is this relation a function? _____ Explain. _____

   _____

Input	Output

   C. How can you turn this relation into a function? _____

   _____ Check your answer in the Gizmo.

3. In general, what makes a relation a function? _____

   _____