



Name: _____

Date: _____

Student Exploration: Linear Functions

Vocabulary: coordinate plane, coordinates, equation, function, input, linear function, mapping diagram, ordered pair, output, relation

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
In Musical Chairs six players circle five chairs as music plays. When the music stops, players rush to sit in a chair. The player left standing is eliminated. A chair is removed and play continues until only two players and one chair are left. The winner is the last seated player.

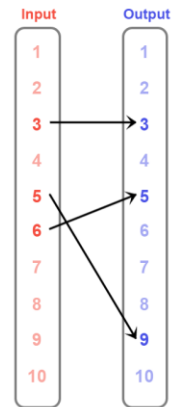


- How many chairs are needed for 8 people to play? _____
- In general, if x people want to play, how many chairs are needed? Explain. _____

Gizmo Warm-up

In the *Linear Functions* Gizmo, you can create relations. A **relation** is a set of $(input, output)$ or (x, y) **ordered pairs**. To make a relation in the Gizmo, either drag points onto the graph to create (x, y) points, or click-and-drag arrows from **input** values to **output** values in the **mapping diagram**.

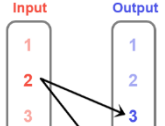
A sample mapping diagram is shown to the right. The relation mapped here contains the ordered pairs $(3, 3)$, $(5, 9)$, and $(6, 5)$.



- Click-and-drag an arrow in the Gizmo's mapping diagram to map any input value to any output value.
 - What $(input, output)$ ordered pair did you create? _____
 - What happened in the graph? _____

- Click **Clear**. Now, in the Gizmo, drag a point onto the graph.
 - What ordered pair did you create? _____
 - What happened in the mapping diagram? _____



Activity A: Identifying functions	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Click Clear. 	
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1. In the Gizmo's mapping diagram, click and drag arrows to map 4 to 3, 5 to 4, and 6 to 6.

A. Select **Show linear function test**. Describe the analysis of this relation you created. Does the Gizmo say this is a function?

B. Slowly drag one of the points around the graph. As you do, watch the numbers under **Input** in the mapping diagram. You should see a number being circled occasionally. What seems to cause an **Input** value to be circled?

C. Be sure that there are still at least 3 points on the graph. Again, slowly drag one of the points around the graph. This time, watch the Gizmo's analysis under **Show linear function test**. When is a relation NOT a function, according to the Gizmo?

2. Click **Clear**. Using the mapping diagram or points on the graph, create the relation shown to the right: (2, 7), (1, 3), (3, 1), and (2, 1).

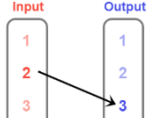
Input	Output
2	7
1	3
3	1
2	1

A. Why is this relation not a function? _____

B. What could you change to turn this relation into a function? _____

3. In general, when is a relation a function and when is it not? _____



Activity B: Test for functions	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Click Clear. 	
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1. In the Gizmo's mapping diagram, click and drag arrows to map 2 to 3, 4 to 5, and 6 to 7.

A. Explain why this relation is a function. _____

B. Select **Show linear function test**. Why is this a **linear function**? _____

C. Drag three more points onto the grid that lie on the same line segment. How are the *(input, output)* or *(x, y)* values related for every point in this linear function?

D. Write an **equation** in terms of *input (x)* and *output (y)* values to describe this relation.

2. Click **Clear**. Use the mapping diagram to plot (1, 3), (3, 7), and (4, 9).

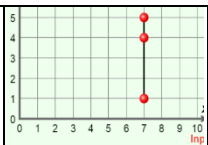
A. Why do these points determine a function? _____

B. Select **Show linear function test** to see why this is a linear function. Write an equation in terms of input (*x*) and output (*y*) to describe the relationship.

C. Drag one of the points to a different location so that the relation no longer represents a function. What are the new coordinates of the point? _____

D. Explain why this set of points is not a function now. _____



Activity C: Horizontal and vertical lines	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Click Clear. 	
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- In the Gizmo's graph, plot a set of points that all have the same input (x) value.
 - What are the coordinates of the points you plotted? _____ and _____
 - Examine the mapping diagram and tell why these points do not represent a function.

 - Select **Show linear function test**. Describe the properties of the graph in the grid.

 - Click the **Table** tab. Describe the relationship between the ordered pairs in the table and the graph of the segment. _____

 - What equation describes all points on this segment? _____

- Click **Clear**. Plot two points that have the same output (y) value.
 - What are the coordinates of the points you plotted? _____ and _____
 - Explain why the relation above is or is not a function. _____

 - Click the **Table** tab. What equation describes the ordered pairs in the table and all points on this segment? _____

- Use words or equations and describe the difference between points on a horizontal segment and points on a vertical segment. _____

