Name: Date:

**Student Exploration:** **Linear Functions**

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

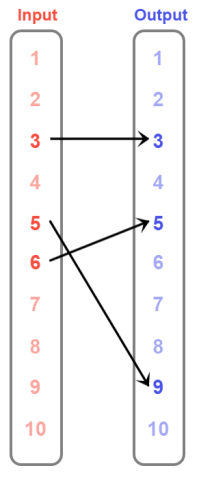


**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

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.

1. How many chairs are needed for 8 people to play? \_\_\_\_\_\_\_\_\_\_
2. In general, if *x* people want to play, how many chairs are needed? Explain. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**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).

1. Click-and-drag an arrow in the Gizmo’s mapping diagram to map any input value to any output value.
   1. What (*input*, *output*) ordered pair did you create? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. What happened in the graph? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Click **Clear**. Now, in the Gizmo, drag a point onto the graph.
2. What ordered pair did you create? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What happened in the mapping diagram? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Activity A:**  **Identifying functions** | Get the Gizmo ready:   * Click **Clear**. | 216SE2 |

1. In the Gizmo’s mapping diagram, click and drag arrows to map 4 to 3, 5 to 4, and 6 to 6.
   1. Select **Show linear function test**. Describe the analysis of this relation you created. Does the Gizmo say this is a function?

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* 1. 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?

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* 1. 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?

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| **Input** | **Output** |
| 2 | 7 |
| 1 | 3 |
| 3 | 1 |
| 2 | 1 |

1. 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).
2. Why is this relation not a function?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What could you change to turn this relation into a function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. In general, when is a relation a function and when is it not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Activity B:**  **Test for functions** | Get the Gizmo ready:   * Click **Clear**. | 216SE3 |

1. In the Gizmo’s mapping diagram, click and drag arrows to map 2 to 3, 4 to 5, and 6 to 7.
   1. Explain why this relation is a function. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. Select **Show linear function test**. Why is this a **linear function**? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. 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?

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

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1. Click **Clear**. Use the mapping diagram to plot (1, 3), (3, 7), and (4, 9).
2. Why do these points determine a function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. 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.

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1. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Explain why this set of points is not a function now. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Activity C:**  **Horizontal and vertical lines** | Get the Gizmo ready:   * Click **Clear**. | 216SE4 |

1. In the Gizmo’s graph, plot a set of points that all have the same input (*x*) value.
   1. What are the coordinates of the points you plotted? \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_
   2. Examine the mapping diagram and tell why these points do not represent a function.

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

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* 1. Click the **Table** tab. Describe the relationship between the ordered pairs in the table and the graph of the segment. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. What equation describes all points on this segment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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1. Click the **Table** tab. What equation describes the ordered pairs in the table and all points on this segment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Use words or equations and describe the difference between points on a horizontal segment and points on a vertical segment. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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