1.2

A Sort of Sorts

Analyzing and Sorting Graphs

LEARNING GOALS

In this lesson, you will:

- Review and analyze graphs.
- Determine similarities and differences among various graphs.
- Sort graphs by their similarities and rationalize the differences between the groups of graphs.
- Use the Vertical Line Test to determine if the graph of a relation is a function.

KEY TERMS

- relation
- domain
- range
- function
- Vertical Line Test
- discrete graph
- continuous graph

Are you getting the urge to start driving? Chances are that you'll be studying for your driving test before you know it. But how much will driving cost you? For all states in the U.S., auto insurance is a must before any driving can take place. For most teens and their families, this more than likely means an increase in auto insurance costs.

So how do insurance companies determine how much you will pay? The fact of the matter is that auto insurance companies sort drivers into different groups to determine their costs. For example, they sort drivers by gender, age, marital status, and driving experience. The type of car is also a factor. A sports vehicle or a luxury car is generally more expensive to insure than an economical car or a family sedan. Even the color of a car can affect the cost to insure it!

Do you think it is good business practice to group drivers to determine auto insurance costs? Or do you feel that each individual should be reviewed solely on the merit of the driver based on driving record? Do you think auto insurance companies factor in where a driver lives when computing insurance costs?

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PROBLEM 1 Let's Sort Some Graphs

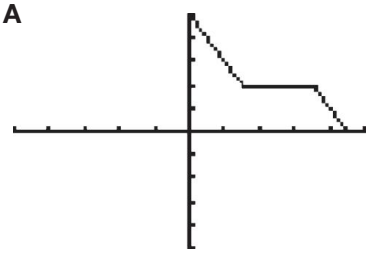
Mathematics is the science of patterns and relationships. Looking for patterns and sorting objects into different groups can provide valuable insights. In this lesson, you will analyze many different graphs and sort them into various groups.

1. Cut out the twenty-two graphs on the following pages. Then analyze and sort the graphs into different groups. You may group the graphs in any way you feel is appropriate. However, you must sort the graphs into more than one group!

In the space provided, record the following information for each of your groups.

- Name each group of graphs.
- List the letters of the graphs in each group.
- Provide a rationale why you created each group.

A



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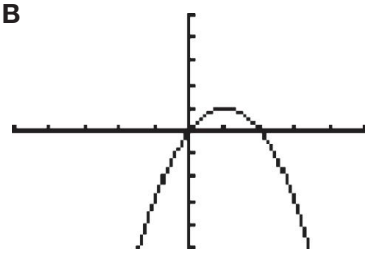

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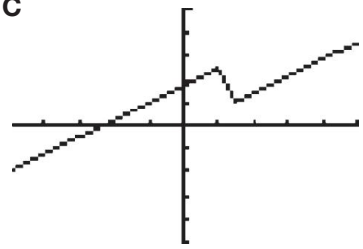

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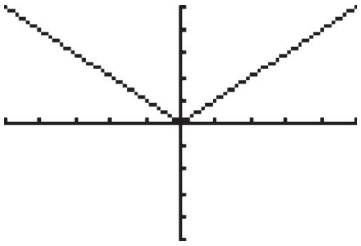

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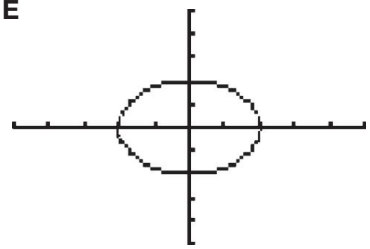

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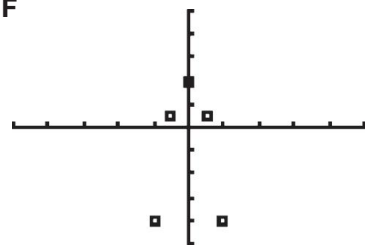

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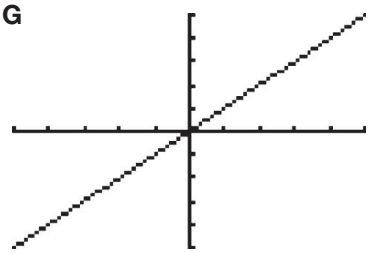

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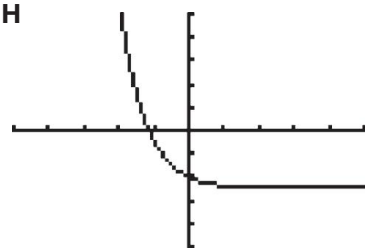

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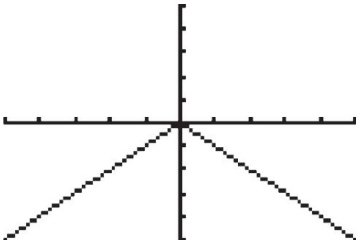

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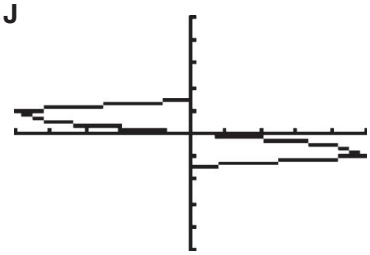

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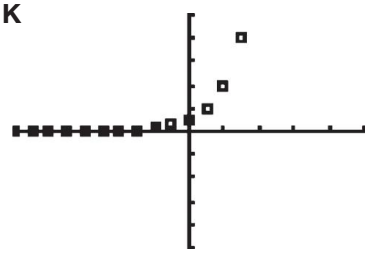

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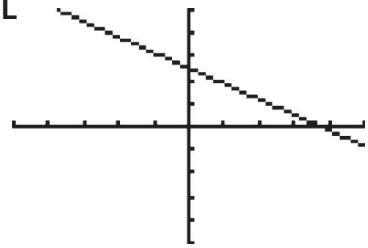

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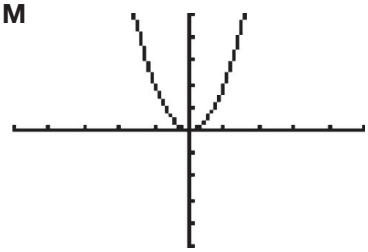

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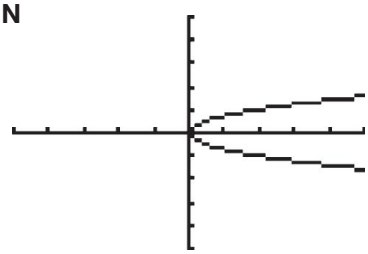

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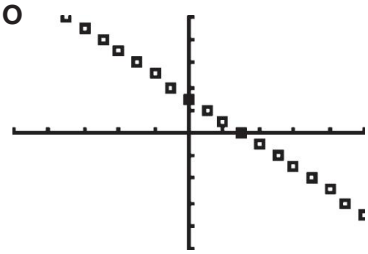

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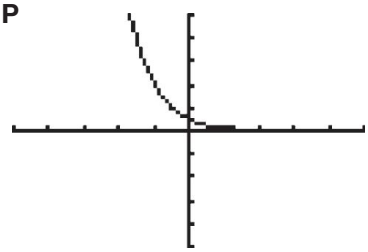

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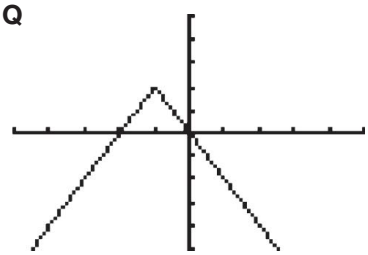

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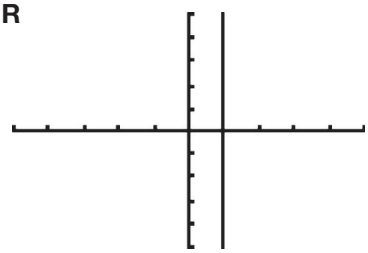

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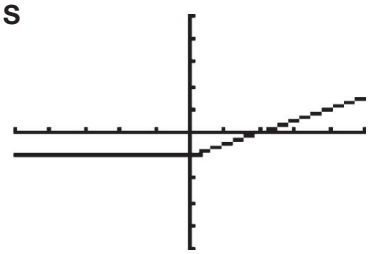

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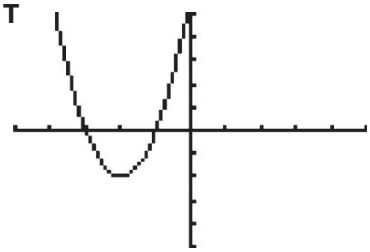

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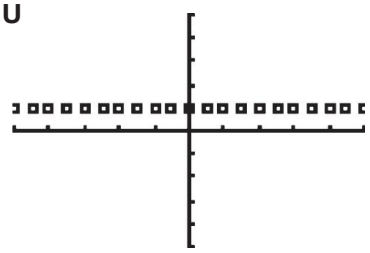

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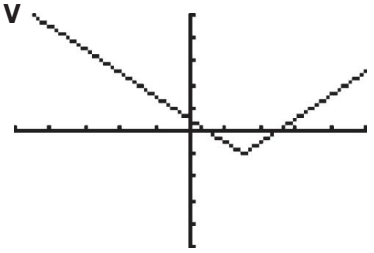

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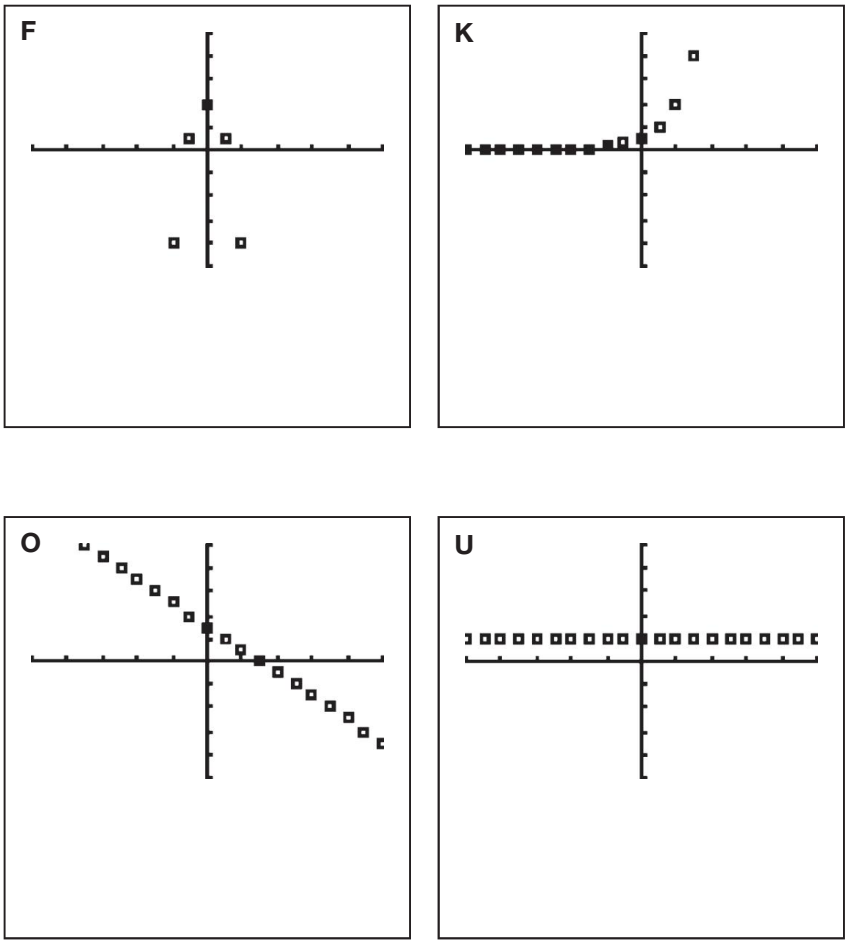
2. Compare your groupings with your classmates' groupings. Create a list of the different graphical behaviors you noticed.

PROBLEM 2 I Like the Way You Think

1. Matthew grouped these graphs together.

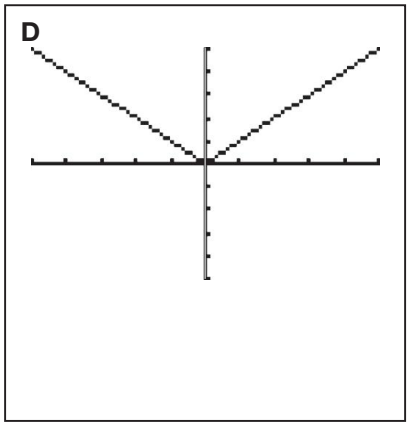


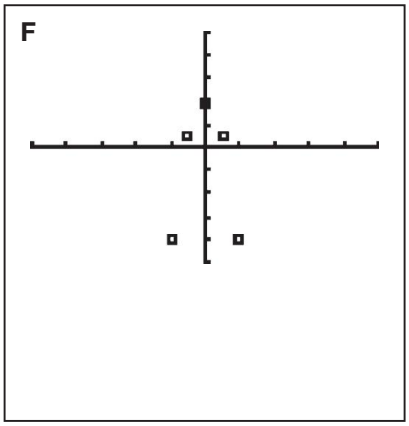
Why do you think Matthew put these graphs in the same group?

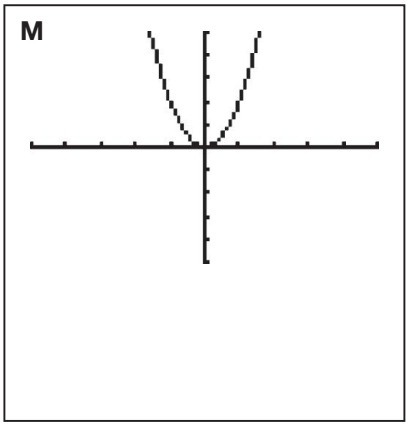
2.

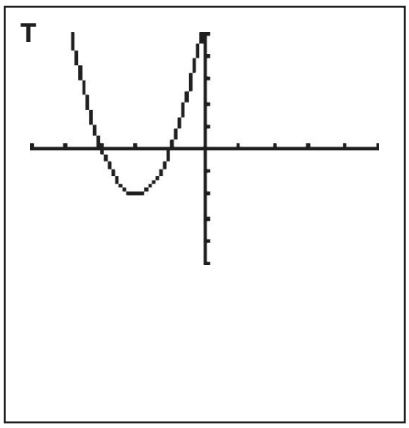
Ashley

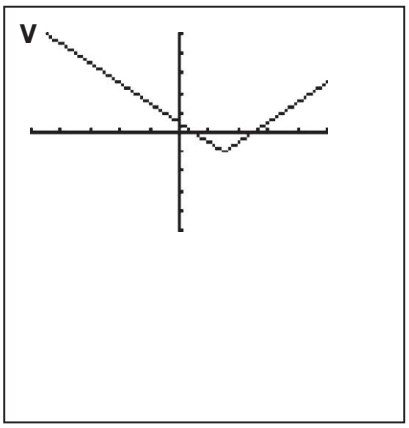
I grouped these graphs together because they all show vertical symmetry. If I draw a vertical line through the middle of the graph, the image is the same on both sides.











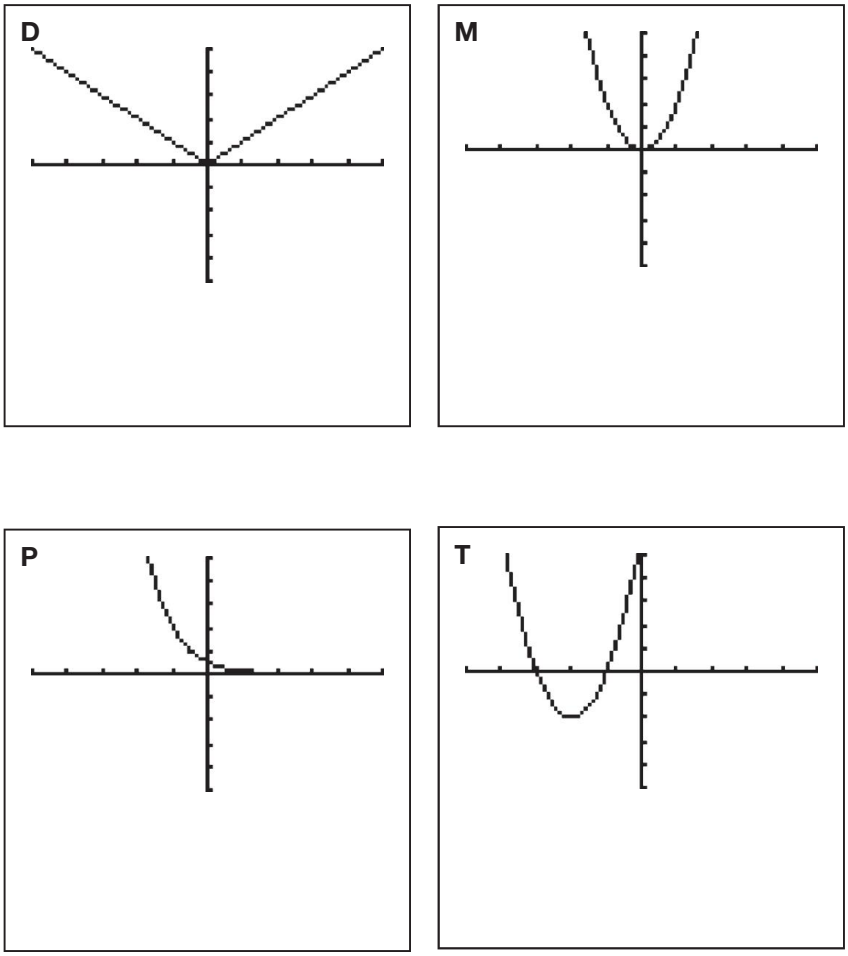
a. Show why Ashley's reasoning is correct.

b. If possible, identify other graphs that show vertical symmetry.

3.

Duane

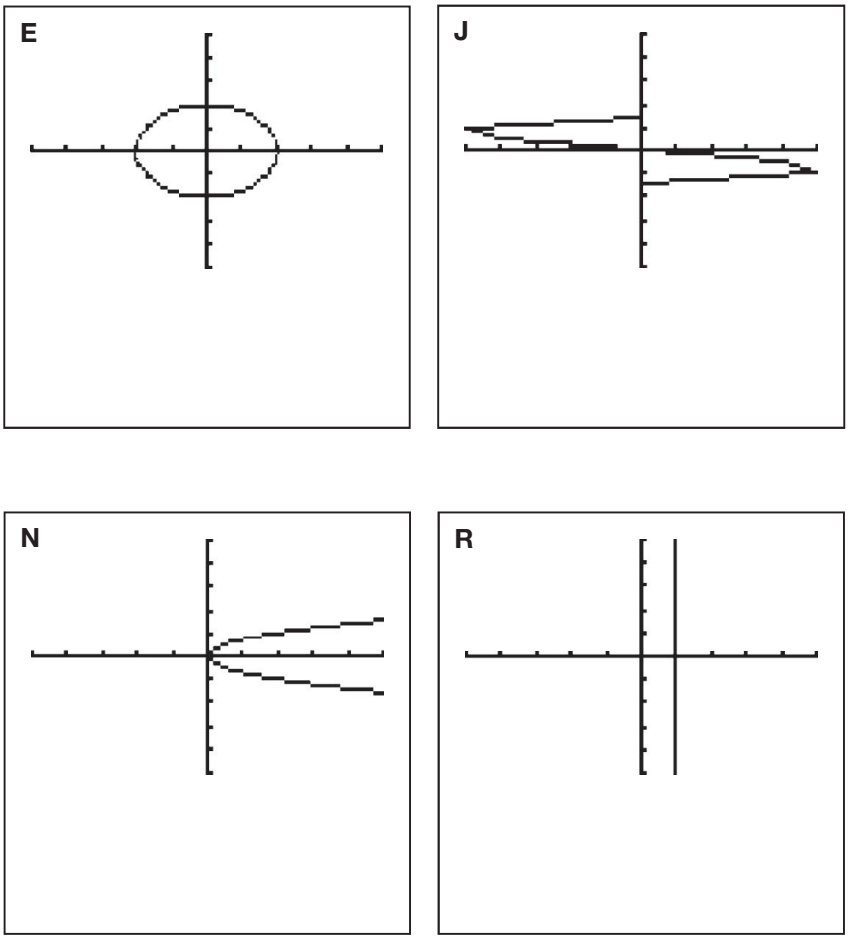
I grouped these graphs together because each graph only goes through two quadrants.



a. Explain why Duane's reasoning is not correct.

b. If possible, identify other graphs that only go through two quadrants.

4. Judy grouped these four graphs together, but did not provide any rationale.



a. What do you notice about the graphs?

b. What rationale could Judy have provided?

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PROBLEM 3 Function Junction

A **relation** is the mapping between a set of input values called the **domain** and a set of output values called the **range**. A **function** is a relation between a given set of elements, such that for each element in the domain there exists exactly one element in the range.

The **Vertical Line Test** is a visual method used to determine whether a relation represented as a graph is a function. To apply the Vertical Line Test, consider all of the vertical lines that could be drawn on the graph of a relation. If any of the vertical lines intersect the graph of the relation at more than one point, then the relation is not a function.

A **discrete graph** is a graph of isolated points. A **continuous graph** is a graph of points that are connected by a line or smooth curve on the graph. Continuous graphs have no breaks.

The Vertical Line Test applies for both discrete and continuous graphs.

1. Analyze the four graphs Judy grouped together. Do you think that the graphs she grouped are functions? Explain how you determined your conclusion.

2. Use the Vertical Line Test to sort the graphs in Problem 1 into two groups: functions and non-functions. Record your results by writing the letter of each graph in the appropriate column in the table shown.

Functions	Non-Functions

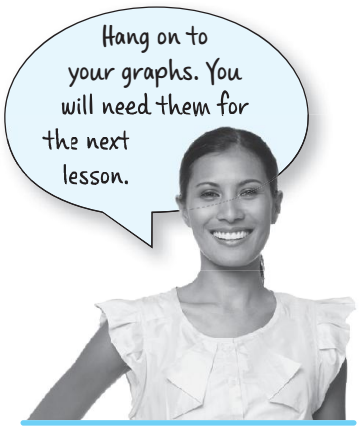
3. Each graph in this set of functions has a domain that is either:

- the set of all real numbers, or
- the set of integers.

For each graph, remember that the x-axis and the y-axis display values from -10 to 10 with an interval of 2 units.

Label each function graph with the appropriate domain.

4. Clip all your graphs together and keep them for the next lesson.



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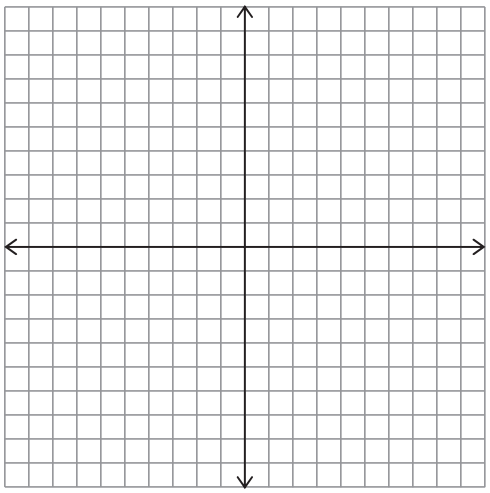
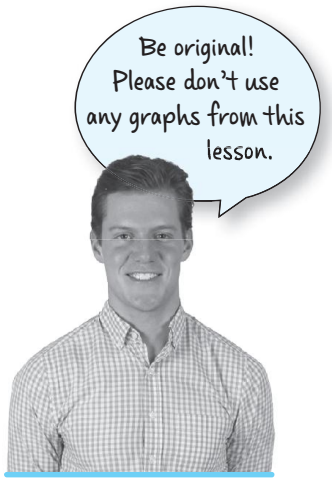
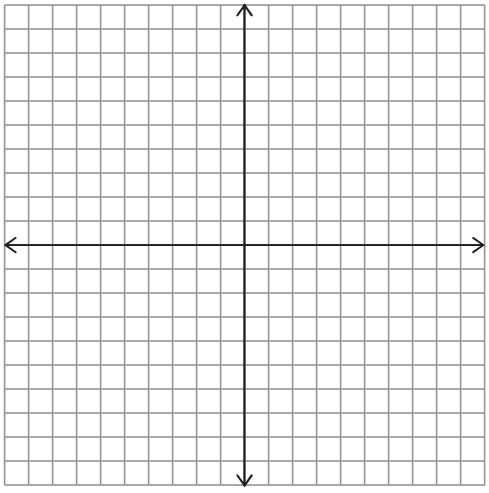
Talk the Talk

1. Sketch a graph of a function. Explain how you know that it is a function.





2. Sketch a graph that is not a function. Explain how you know that it is not a function.



Be prepared to share your solutions and methods.