

## 2.1 Drawing Wumps: Making Similar Figures

*Focus Question* How can you determine if two shapes are similar by looking at the rule for producing specific coordinates for the image?

### Launch

Students continue to explore equivalence by investigating transformations on the coordinate plane. If your students need to review graphing, you might introduce them to tic-tac-toe on a  $4 \times 4$  board.

When you feel your students are ready, challenge them to draw all of the figures according to the rules given and compare the final figures to the Wump family. Have students divide up the work in their groups of 3 or 4. Be sure that each student draws Mug and at least two other characters. They can share their work as a group so that collectively the group has all five figures.

### Explore

The figures should look roughly like Mug Wump. One thing to ask students is if their new characters generally look like Mug as a quick check to see if they are plotting the points correctly. Be careful to avoid using the word *similar* as this has a particular mathematical meaning, especially in this Problem.

If students' graphs do not resemble Mug, likely mistakes include not going in the correct order of the points, not calculating the coordinates correctly, reversing the order of the  $(x, y)$  coordinates (e.g. graphing  $(2, 1)$  as  $(1, 2)$ ), and not starting over when the table indicates to do so.

### Summarize

It is very helpful to display copies of the figures for the class to view.

### Suggested Questions

- How would you describe to a friend the growth of the figures you drew?
- Which figures seem to belong to the Wump family and which do not?
- Are Lug and Glug related? Did they grow into the same shape?
- You have learned that both the angles and the lengths of edges determine the shape of a figure. Compare the corresponding angles of the five figures.
- Look at some corresponding lengths for the five figures. Are the lengths related? Are some of them related and others not? Compare the lengths in similar Wumps.

### Key Vocabulary

- There are no new glossary terms introduced in this Problem.

### Materials

#### Labsheet

- 2.1: Coordinates of Game Characters

#### Accessibility Labsheets

- Labsheet 2ACE: Exercise 1
- Four First-Quadrant Grids
- First-Quadrant Grid

#### Teaching Aids

- 2.1A: 4-by-4 Board
- 2.1B: Wump Characters
- 2.1C: Wump Characters on Grids

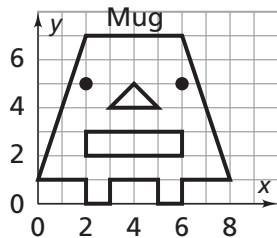


## Assignment Guide for Problem 2.1

Applications: 1–2 | Connections: 14–15  
Extensions: 29

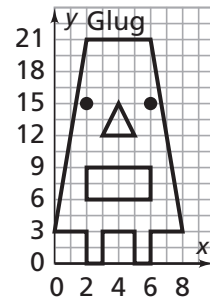
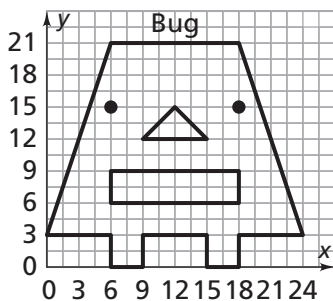
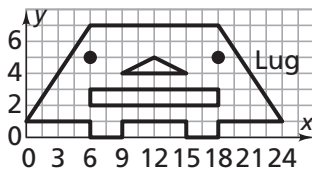
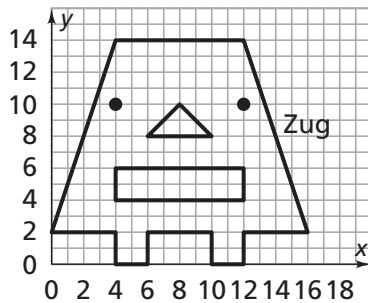
### Answers to Problem 2.1

- A.** Mug is a small figure with a triangular nose, a rectangular mouth, square legs, points for eyes, and a body shaped like a trapezoid.



- B. 1.** (See Figure 1, next page.)

**2.**



- C. 1.** Zug and Bug are big versions of Mug, so they are the other Wumps. Lug is too wide and Glug is too tall. They are impostors.
- 2.** All have a triangular nose, a rectangular mouth, and the same kind of body figure.
- 3.** From Mug to Zug and Bug, the angles and the general shape stayed the same. From Mug to Zug, the lengths doubled and from Mug to Bug they tripled. From Mug to Lug and Glug, corresponding lengths did not grow by the same factor. Lug is the same height as Mug but three times as wide. Glug is the same width as Mug but three times as tall. Many of their angles differ from Mug's.

Figure 1

	Mug Wump	Zug	Lug	Bug	Glug
Rule	$(x, y)$	$(2x, 2y)$	$(3x, y)$	$(3x, 3y)$	$(x, 3y)$
<b>Part 1</b>					
<b>A</b>	(0, 1)	(0, 2)	(0, 1)	(0, 3)	(0, 3)
<b>B</b>	(2, 1)	(4, 2)	(6, 1)	(6, 3)	(2, 3)
<b>C</b>	(2, 0)	(4, 0)	(6, 0)	(6, 0)	(2, 0)
<b>D</b>	(3, 0)	(6, 0)	(9, 0)	(9, 0)	(3, 0)
<b>E</b>	(3, 1)	(6, 2)	(9, 1)	(9, 3)	(3, 3)
<b>F</b>	(5, 1)	(10, 2)	(15, 1)	(15, 3)	(5, 3)
<b>G</b>	(5, 0)	(10, 0)	(15, 0)	(15, 0)	(5, 0)
<b>H</b>	(6, 0)	(12, 0)	(18, 0)	(18, 0)	(6, 0)
<b>I</b>	(6, 1)	(12, 2)	(18, 1)	(18, 3)	(6, 3)
<b>J</b>	(8, 1)	(16, 2)	(24, 1)	(24, 3)	(8, 3)
<b>K</b>	(6, 7)	(12, 14)	(18, 7)	(18, 21)	(6, 21)
<b>L</b>	(2, 7)	(4, 14)	(6, 7)	(6, 21)	(2, 21)
<b>M</b>	(0, 1)	(0, 2)	(0, 1)	(0, 3)	(0, 3)
<b>Part 2 (start over)</b>					
<b>N</b>	(2, 2)	(4, 4)	(6, 2)	(6, 6)	(2, 6)
<b>O</b>	(6, 2)	(12, 4)	(18, 2)	(18, 6)	(6, 6)
<b>P</b>	(6, 3)	(12, 6)	(18, 3)	(18, 9)	(6, 9)
<b>Q</b>	(2, 3)	(4, 6)	(6, 3)	(6, 9)	(2, 9)
<b>R</b>	(2, 2)	(4, 4)	(6, 2)	(6, 6)	(2, 6)
<b>Part 3 (start over)</b>					
<b>S</b>	(3, 4)	(6, 8)	(9, 4)	(9, 12)	(3, 12)
<b>T</b>	(4, 5)	(8, 10)	(12, 5)	(12, 15)	(4, 15)
<b>U</b>	(5, 4)	(10, 8)	(15, 4)	(15, 12)	(5, 12)
<b>V</b>	(3, 4)	(6, 8)	(9, 4)	(9, 12)	(3, 12)
<b>Part 4 (start over)</b>					
<b>W</b>	(2, 5)	(4, 10)	(6, 5)	(6, 15)	(2, 15)
<b>X</b>	(6, 5)	(12, 10)	(18, 5)	(18, 15)	(6, 15)