LESSON 3

Objective

Identify a numerical pattern and graph it on a coordinate plane.

Common Core State Standards

- **5.OA.3** Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Operations and Algebraic Thinking

Graphing Number Patterns

Understanding how to generate number patterns and graph them on a coordinate plane is an important foundational skill for later work with linear functions. In this lesson, students will generate number patterns using given rules, form ordered pairs of corresponding terms, graph the pairs, and identify relationships between the terms.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *What pattern does each column of the table show? What is the relationship between columns? Why are the y-values twice the corresponding x-values?*
- **Ask:** *How do you show the ordered pairs on the XY Coordinate Pegboard?*
- **Ask:** *How could we use the grid paper to extend the relationship?*
- **Ask:** *Why is the line on your graph straight? What does that tell you about the number pattern?*

Solve It

Reread the problem with students. Have students plot the ordered pairs from the function table onto the Centimeter Grid (BLM 6) and draw a line through them. Then have them write two sentences comparing the corresponding terms and explaining why the *y*-terms are twice the *x*-terms.

More Ideas

For other ways to teach about graphing number patterns—

- Have students use Centimeter Cubes on a grid to plot coordinates from a function table.
- Have students who are ready create different lines on the XY Coordinate Pegboard, and then use the coordinates of the lines to create function tables and determine the number patterns they have created.

Formative Assessment

Have students try the following problem.

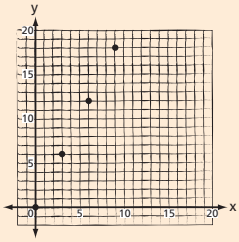
Determine the relationship between the terms given by the ordered pairs (0, 0), (3, 6), (6, 12), and (9, 18).

A. The *y*-terms are 3 more than the *x*-terms.

B. The *x*-terms are 3 more than the *y*-terms.

C. The *y*-terms are double the *x*-terms.

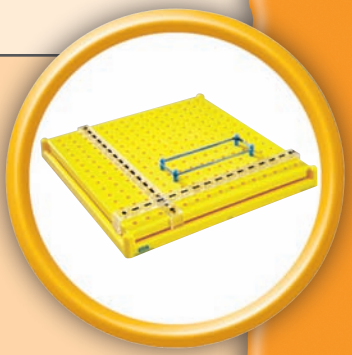
D. The *y*-terms are four times the *x*-terms.



Try It! 15 minutes | Groups of 4

Here is a problem about graphing number patterns.

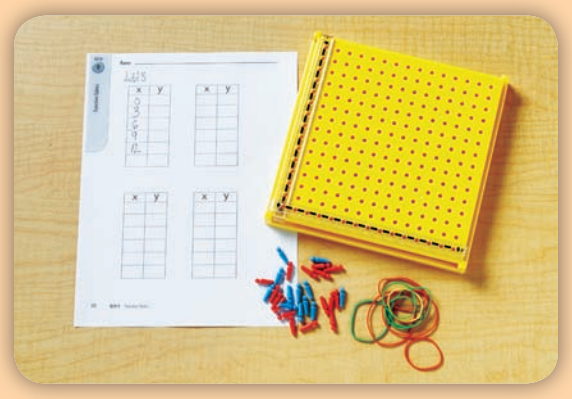
An older machine can make 3 bike chains each minute. A new machine can make 6 bike chains each minute. How can you graph and describe the relationship between the productivity of the machines?



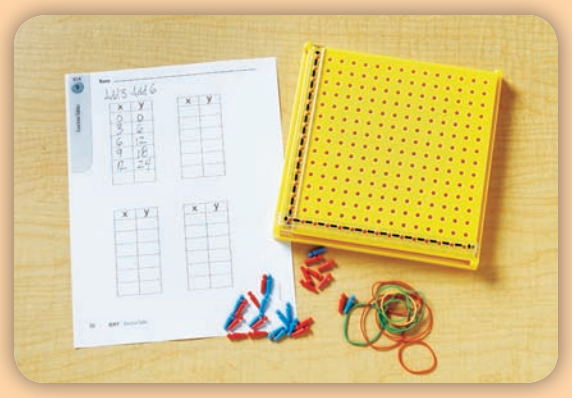
Introduce the problem. Then have students do the activity to solve the problem. Distribute XY Coordinate Pegboards, function tables, and centimeter grids to students.

Materials

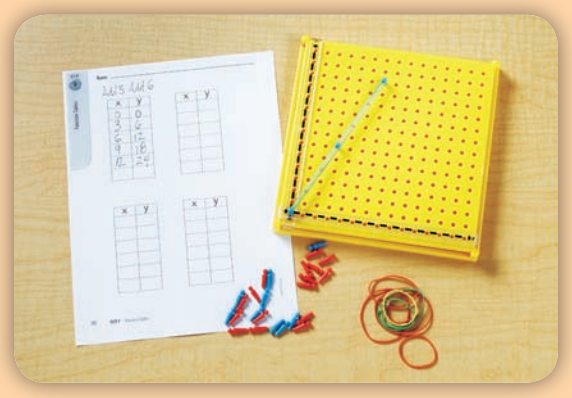
- XY Coordinate Pegboard (1 per group)
- Function Tables (BLM 9)
- Centimeter Grid (BLM 6)



1. Say: *Let's make a table. Let* x *represent the output of the older machine and* y *represent the output of the new machine. We can generate each output using a rule.* Elicit that the rule for the older machine is "Add 3" and have students write *Add 3* above the *x*-column. Then have students generate five values for *x*, starting with 0.



2. Ask: *What is the rule for the output of the new machine?* Elicit that the rule is "Add 6" and have students write *Add 6* above the *y*-column. Have students generate five values for *y*, starting with 0. **Say:** *The* x *and* y *values form ordered pairs. We can plot the ordered pairs on our XY Coordinate Pegboard and on grid paper.*



3. Have students set the axes on the XY Coordinate Pegboard to show the first quadrant of a coordinate plane. Have students plot as many points from the table as they can using blue pegs and add a rubber band to create a line along the points.

⚠ Look Out!

Students may be confused by what each axis represents and how to peg values from the function table. Have them write "Older machine" on a sticky note and place it under the *x*-axis. Have them write "Newer machine" on a sticky note and place it to the left of the *y*-axis.

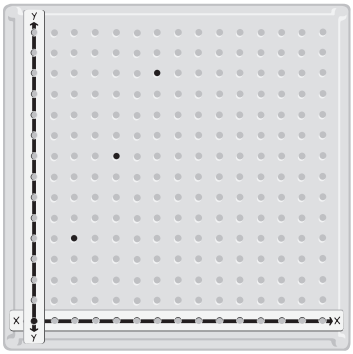
Answer Key

Complete the number pattern for *y*. Use an XY Coordinate Pegboard to plot the ordered pairs.

(Check students' work.)

1.

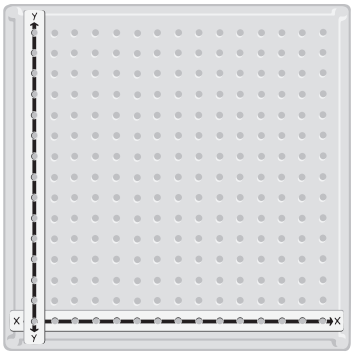
x "Add 2"	*y* "Add 4"
0	0
2	4
4	8
6	12



Complete the number pattern for *y*. Use an XY Coordinate Pegboard to plot the ordered pairs. Sketch the graph.

2.

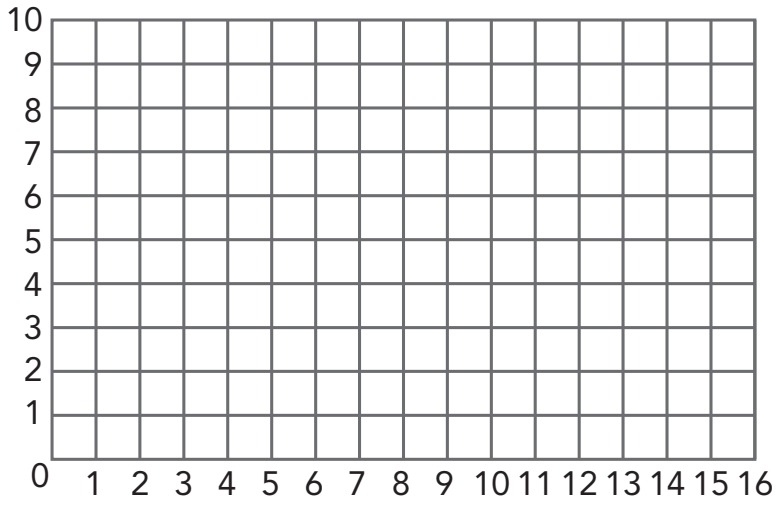
x "Add 1"	*y* "Add 2"
0	0
1	2
2	4
3	6



Complete the number patterns for *x* and *y*. Graph the ordered pairs.

3.

x "Double"	*y* "Double – 1"
2	2
4	3
8	5
16	9



Answer Key

Challenge! Starting with (1, 1), make an *x*-*y* function table using the patterns "double" for the *x*-coordinate and "double + 1" for the *y*-coordinate. Graph the ordered pairs in the work space below or on grid paper and describe the relationship between corresponding terms.

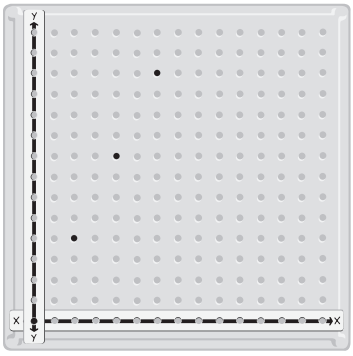
Challenge: $x = 1, 2, 4, 8, 16$; $y = 1, 3, 7, 15, 31$; the *y*-terms are one less than the *x*-terms doubled. The *y*-terms grow faster than the *x*-terms because "double + 1" is a larger growth rate than "double."

Name _____

Complete the number pattern for *y*. Use an XY Coordinate Pegboard to plot the ordered pairs.

1.

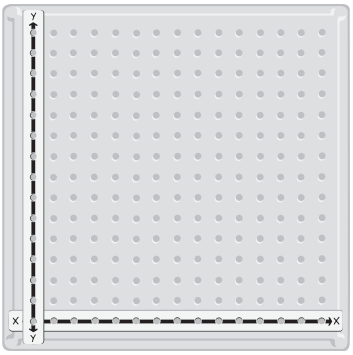
x **“Add 2”**	***y*** **“Add 4”**
0	0
2	
4	
6	



Complete the number pattern for *y*. Use an XY Coordinate Pegboard to plot the ordered pairs. Sketch the graph.

2.

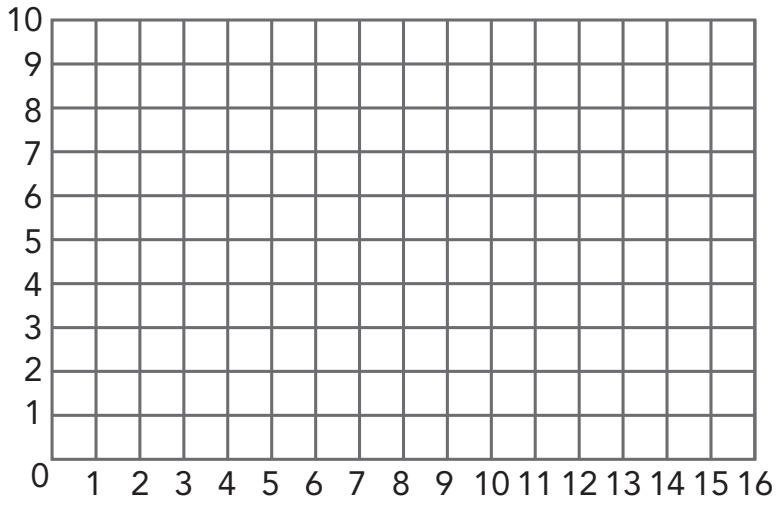
x **“Add 1”**	***y*** **“Add 2”**
0	0
1	
2	
3	



Complete the number patterns for *x* and *y*. Graph the ordered pairs.

3.

x **“Double”**	***y*** **“Double – 1”**
2	2

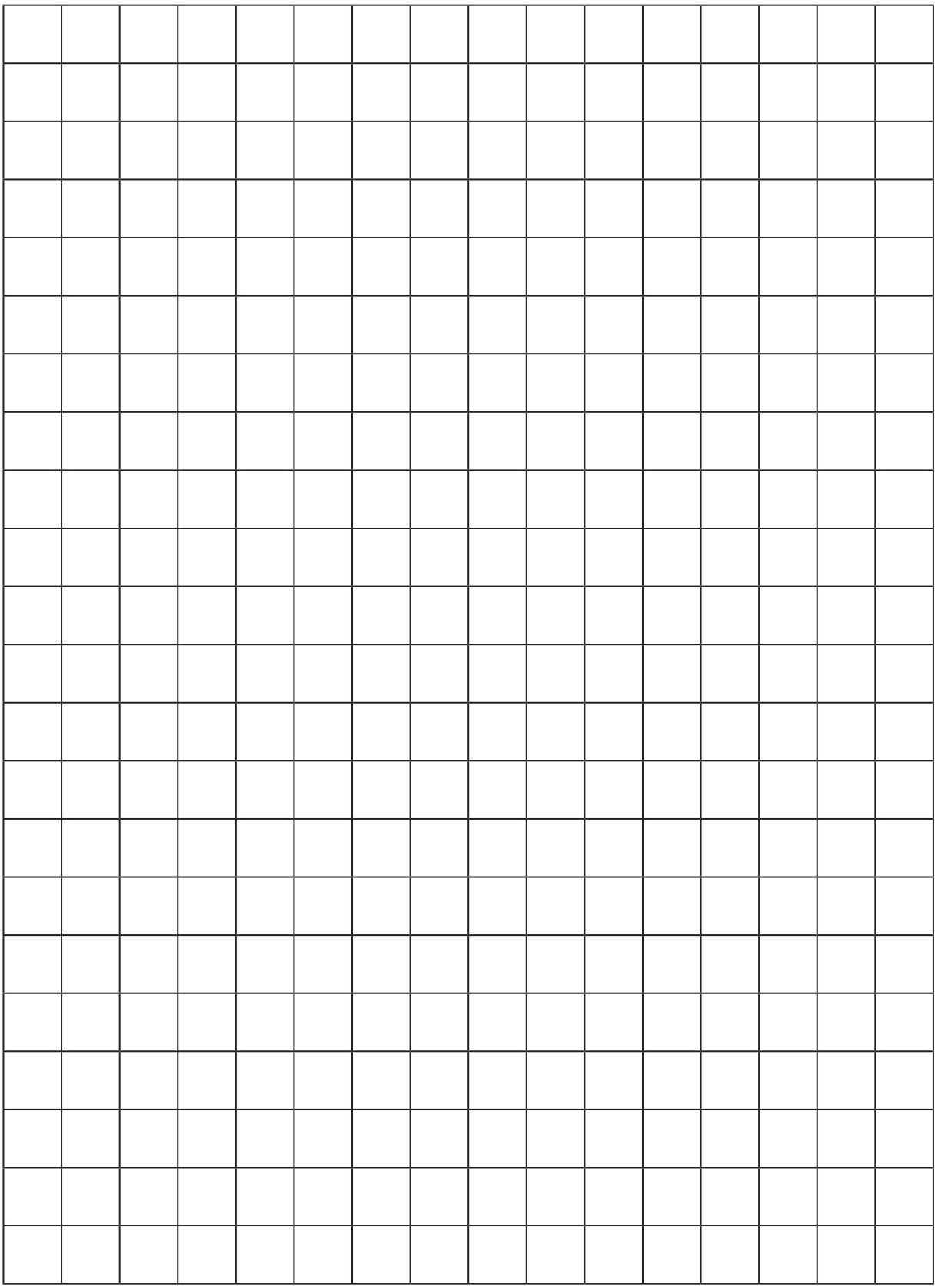


Name _____

Challenge! Starting with (1, 1), make an *x*-*y* function table using the patterns "double" for the *x*-coordinate and "double + 1" for the *y*-coordinate. Graph the ordered pairs in the work space below or on grid paper and describe the relationship between corresponding terms.

Centimeter Grid

Name _____



Name _____

x	y

x	y

x	y

x	y