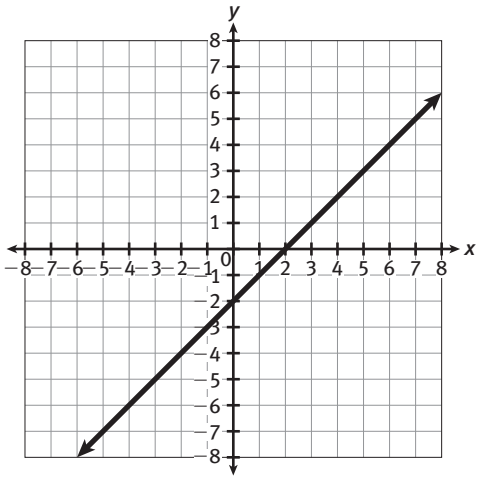
NAME CLASS DATE

Representations of Linear Relationships

A linear relationship is a relationship in which the two quantities being compared have a constant rate of change. Ordered pairs from a linear relationship lie in a straight line when graphed on a coordinate grid.

The graph to the right is an example of a linear relationship.



You may use a linear relationship when figuring out your constant monthly expenses or predicting the total amount of money you'll have if you save the same amount each week.

You can use a table to determine if a relationship is linear by determining if the rate of change is constant.

EXAMPLE A

Do the ordered pairs in the table form a linear relationship? Make a graph to check your answer.

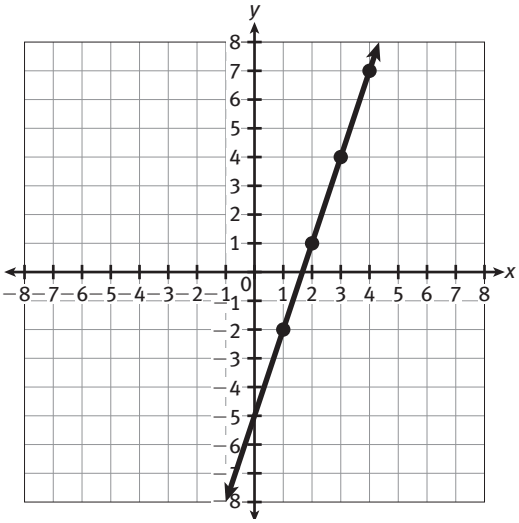
Input	Output
1	−2
2	1
3	4
4	7

Step 1: *Write the ordered pairs for each pair of values in the table. The input is the x-value, and the output is the y-value. As the x-values increase by 1, the y-values increase by 3, so the rate of change is constant and the relationship is linear.*

Step 2: *Plot the points on a coordinate grid.*

Step 3: *Draw a line through the points. The line is straight.*

(1, −2), (2, 1), (3, 4), (4, 7)



Solution: Because the ordered pairs show a constant rate of change and the points lie in a straight line, the ordered pairs in the table form a linear relationship.

You can complete a table representing a linear relationship by comparing the change in y-values, or output values, to the change in x-values, or input values, to determine whether the rate of change is constant. If the relationship is not constant, the relationship is not linear.

EXAMPLE B

Complete the table below so that the data are linear.

x	y
0	1
1	3
2	5
3	
4	9

Step 1: *Find the pattern of change in the input values.*

Each input value increases by 1.

Step 2: *Find the pattern of change in the output values.*

Each output value increases by 2.

Step 3: *The rate of change is constant. Add 2 to the output value 5 to determine the missing number.*

Output: $5 + 2 = 7$

Step 4: *Check your work by adding 2 to the number you found.*

$7 + 2 = 9$, which is the next output value.

Solution:

x	y
0	1
1	3
2	5
3	7
4	9

The linear relationship in the table for Example B can also be described using the linear equation. $y = 2x + 1$.

EXAMPLE C

Given the linear equation $y = 3x - 2$, find the ordered pairs for all integer values of x from -3 to 3.

Step 1: *Substitute each integer value from –3 to 3 for x in the linear equation $y = 3x - 2$ and evaluate.*

$y = 3(-3) - 2 = -11$
$y = 3(-2) - 2 = -8$
$y = 3(-1) - 2 = -5$
$y = 3(0) - 2 = -2$
$y = 3(1) - 2 = 1$
$y = 3(2) - 2 = 4$
$y = 3(3) - 2 = 7$

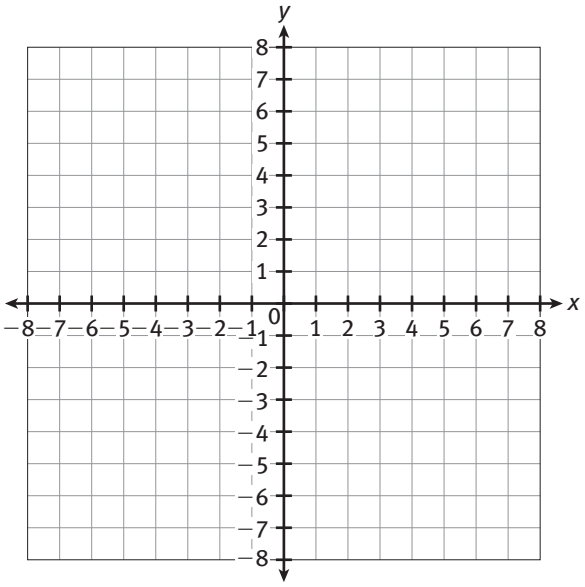
Step 2: *Write the ordered pairs.*

$(-3, -11), (-2, -8), (-1, -5), (0, -2), (1, 1), (2, 4), (3, 7)$

Solution: For the linear equation $y = 3x - 2$, the ordered pairs for integer values of x from -3 to 3 are $(-3, -11)$, $(-2, -8)$, $(-1, -5)$, $(0, -2)$, $(1, 1)$, $(2, 4)$, and $(3, 7)$.

PRACTICE

1. On the grid below, draw a figure that illustrates the meaning of linear.



Name five additional ordered pairs that would be on a graph made from each table.

2.

Input	Output
1	3
2	6
3	9

3.

Input	Output
4	1
5	2
6	3

4.

Input	Output
1	4
2	7
3	10

Complete each table so that the data are linear.

5.

Input	Output
1	
2	6
3	8
4	

6.

Input	Output
4	
6	2
8	3
10	

7.

Input	Output
1	5
2	8
3	
4	

Name three ordered pairs that satisfy each equation.

8. $y = 2x - 3$

9. $y = 3x + 5$

10. $y = 5x - 2$

11. Ron was given the ordered pairs $(-2, -5)$ and $(1, 1)$. Name the ordered pair for each integer value of x from -4 to 4 that would form a linear relationship with Ron's given ordered pairs.