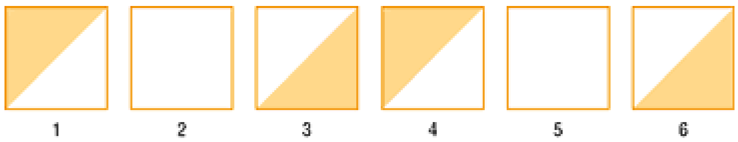
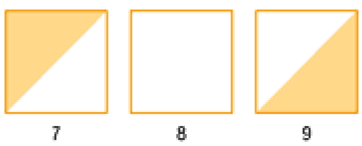
Lesson 4-8

Example 1 Extend a Pattern
Study the pattern below.



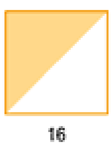
a. Draw the next three figures in the pattern.

The pattern consists of squares. The squares alternate shading. The first has the square divided in two sections by a line connecting the bottom left corner to the top right corner. It has the upper portion shaded. The second square is not shaded. The third square is divided in two sections by a line connecting the bottom left corner to the top right corner. It has the lower portion shaded. This pattern then repeats. The next three figures are shown.



b. Draw the 16th square in the pattern.

The pattern repeats every third design. Therefore designs 3, 6, 9, 12, and so on, will all be the same. Since 15 is the greatest number less than 16 that is a multiple of 3, the 16th square in the pattern will be the same as the first square.



Example 2 Patterns in a Sequence
Find the next three terms in the sequence –2, 3, 1, 6, 4, 9,…

Study the pattern in the sequence.

-2 → 3 → 1 → 6 → 4 → 9
+5 -2 +5 -2 +5

You can use inductive reasoning to find the next term in a sequence. Notice the pattern –2, 3, 1, 6, 4, 9,… The difference between each term is 5 then –2, then 5 then –2 and so on. To find the next three terms in the sequence subtract 2 then add five then subtract 2.

-2 → 3 → 1 → 6 → 4 → 9 → 7 → 12 → 10
+5 -2 +5 -2 +5 -2 +5 -2

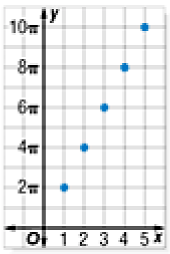
The next three terms are 7, 12, and 10.

Example 3 Write an Equation from Data

The table below shows the circumference of a circle depending on its radius.

Radius	**1**	**2**	**3**	**4**	**5**
Circumference	**2π**	**4π**	**6π**	**8π**	**10π**

a. **Graph the data. What conclusion can you make about the relationship between the radius of a circle and the circumference?**



The graph shows a linear relationship between the radius *r* of the circle and the circumference *C*.

b. **Write an equation to describe this relationship.**

Look at the relationship between the domain and range to find a pattern that can be described by an equation.

+1 →   +1 →   +1 →   +1 →

Radius	1	2	3	4	5
Circumference	2π	4π	6π	8π	10π

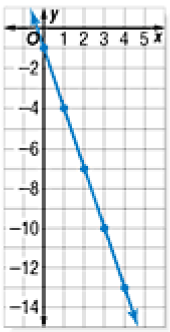
→ +2π   → +2π   → +2π   → +2π

Since this is a linear relationship, the ratio of the range values to the domain values is constant. The difference of the values for *r* is 1, and the difference of the values of *C* is 2π. This suggests that $C = 2\pi r$. Check to see if this equation is correct by substituting values of *r* into the equation.

Check: If $r = 1$, then $C = 2\pi(1)$ or 2π.
If $r = 2$, then $C = 2\pi(2)$ or 4π.
If $r = 3$, then $C = 2\pi(3)$ or 6π.

The equation checks. Since this relation is also a function, we can write the equation as $f(r) = 2\pi r$ where, $f(r)$ represents the circumference of a circle.

Example 4 Write an Equation with a Constant
Write an equation in functional notation for the relation graphed below.



Make a table of ordered pairs for several points on the graph.

	+1 →	+1 →	+1 →	+1 →
x	0	1	2	3	4
y	-1	-4	-7	-10	-13
	→ -3	→ -3	→ -3	→ -3

The difference of the *x* values is 1, and the difference of the *y* values is –3. The difference in the *y* values is –3 times the difference of the *x* values. This suggest that $y = -3x$. Check this equation.

Check: If $x = 1$, then $y = -3(1)$ or –3. But the *y* value for $x = 1$ is –4. This is a difference of –1. Try some other values in the domain to see if the same difference occurs.

x	0	1	2	3	4
-3*x*	0	-3	-6	-9	-12
y	-1	-4	-7	-10	-13

y is always 1 less than $-3x$

This pattern suggests that –1 should be added to one side of the equation in order to correctly describe the relation. Check $y = -3x - 1$.

Check: If $x = 2$, then $y = -3(2) - 1$ or –7.
If $x = 3$, then $y = -3(3) - 1$ or –10.

Thus, $y = -3x - 1$ correctly describes this relation. Since this relation is also a function, we can write the equation in functional notation as $f(x) = -3x - 1$.