NAME DATE PERIOD

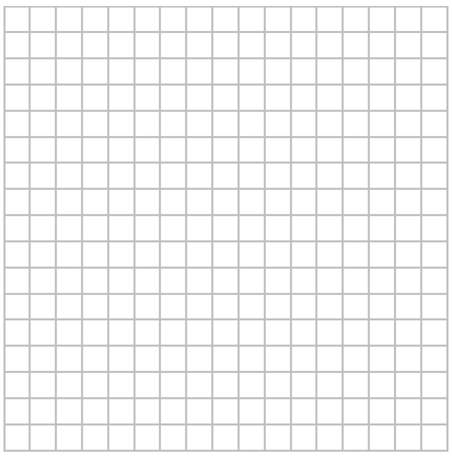
Lesson 3: Building the Perfect Square

Develop Understanding

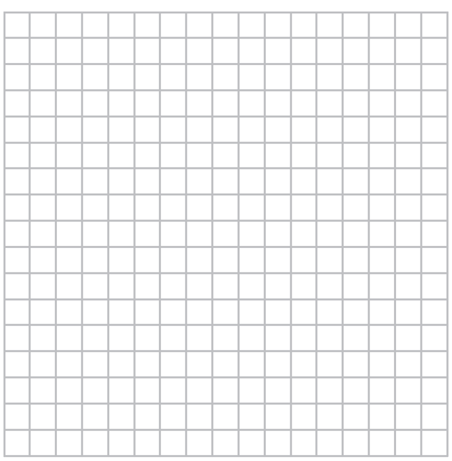
Jump Start

Graph each function.

1. $y = -x^2 + 5$



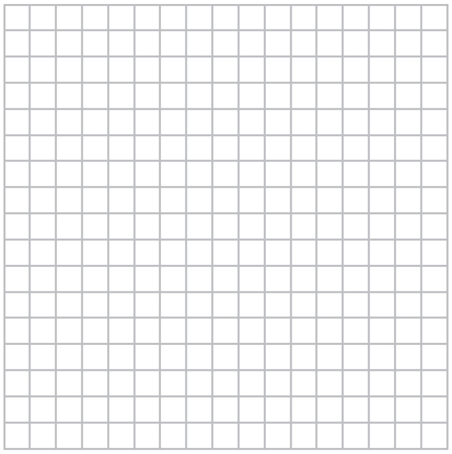
2. $y = (x - 1)^2 - 3$



3. $y = 2x^2 - 5$

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD



Learning Focus

Find the square of a binomial expression.

Recognize a perfect square trinomial.

Create perfect squares from partial areas.

Find relationships between terms in a perfect square trinomial.

How can we use models to find equivalent expressions for perfect squares?

Open Up the Math

Launch, Explore, Discuss

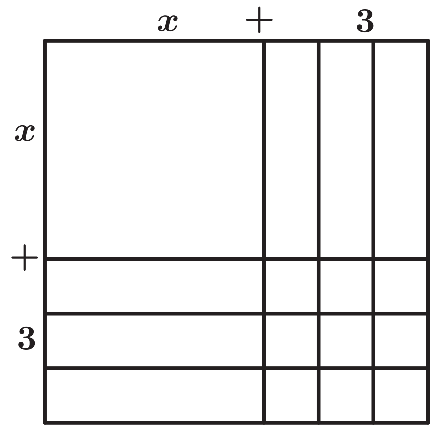
Optima has a quilt shop where she sells many colorful quilt blocks for people who want to make their own quilts. She has quilt designs that are made so that they can be sized to fit any bed. She bases her designs on quilt squares that can vary in size, so she calls the length of the side for the basic square x, and the area of the basic square is the function $A(x) = x^2$. In this way, she can customize the designs by making bigger squares or smaller squares.

1. If Optima adds 3 inches to the side of the square, what is the area of the square?

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD

When Optima draws a pattern for the square in problem 1, it looks like this:



2. Use both the diagram and the equation $A\left(x\right)=\left(x+3\right)^{2}$ to explain why the area of the quilt block square, $A\left(x\right)$, is also equal to $x^{2}+6x+9$.

The customer service representatives at Optima's shop work with customers and write up the orders based on the area of the fabric needed. As you can see from problem 2, there are two ways that customers can call in and describe the area of the quilt block. One way describes the length of the sides of the block, and the other way describes the areas of each of the 4 sections of the block.

For each of the following quilt blocks, draw the diagram of the block and write two equivalent equations for the area of the block.

3. Block with side length $x+2$.

4. Block with side length $x+1$.

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD

5. What patterns do you notice when you relate the diagrams to the two expressions for the area?

6. Optima likes to have her little dog, Clementine, around the shop. One day, Clementine got a little hungry, and started to chew up the orders. When Optima found the orders, one of them was so chewed up that there were only partial expressions for the area remaining. Help Optima by completing each of the following expressions for the area so that they describe a perfect square. Then, write the two equivalent equations for the area of the square.

a. $x^2 + 4x$

b. $x^2 + 6x$

c. $x^2 + 8x$

d. $x^2 + 12x$

7. **a.** If $x^2 + bx + c$ is a perfect square, what is the relationship between b and c?

b. What process can be used to find c and complete the square, given $x^2 + bx$?

c. Will this strategy work if b is negative? Why or why not?

d. Will the strategy work if b is an odd number? What happens to c if b is odd?

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD

8. One of the new customer service representatives thinks she doesn't need to draw diagrams anymore because she found a great shortcut. She writes $(x+5)^2 = x^2 + 25$. Examine her thinking. Is she right, or does she need to revise her strategy? What suggestions would you make, and how would they help?

Ready for More?

Prove that $(x+h)^2 = x^2 + 2xh + h^2$, either algebraically or using a diagram.

Takeaways

If $x^2 + bx + c$ is a perfect square,

The square of a binomial:

An example is:

Adding Notation, Vocabulary, and Conventions

Binomial:

Trinomial:

Squaring a binomial:

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD

Vocabulary

- **binomial**
- **completing the square**
- **trinomial**

Bold terms are new in this lesson.

Lesson Summary

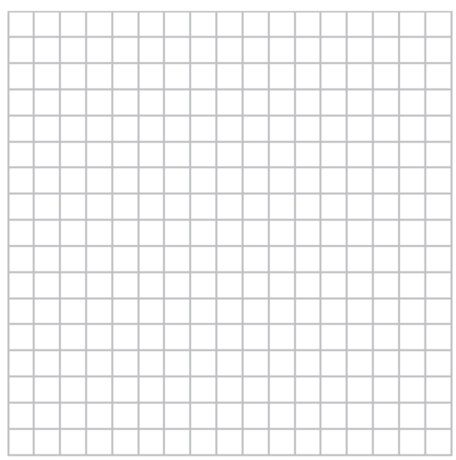
In this lesson, we connected area models for multiplication to show how to multiply binomials to get a perfect square trinomial. We learned to recognize a perfect square trinomial by looking for a relationship between the second and third terms. We also worked to create a perfect square when given the first two terms of a trinomial.

Retrieval

1. Find the x-intercept and the y-intercept, and graph the equation. $3x + 2y = 12$

   x-intercept:

   y-intercept:



Each of the following equations has just one intercept; find it and state whether it is an x-intercept or y- intercept.

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org

NAME DATE PERIOD

2. $y = -8$

3. $x = 13$

© 2021 Open Up Resources and Mathematics Vision Project Download for free at openup.org