Name: ______________________ Date: ______________

How can I solve quadratic equations using the zero product property?

Review

The zero product property states that if a product is equal to zero, then at least one of the factors must be zero.

What are the zeros of the function $f(x) = x^2 - 5x - 14$?

Step 1: $x^2 - 5x - 14 = 0$

Step 2: $(x + 2)(x - 7) = 0$

Step 3: Using the zero product property, $x + 2 = 0$ or $x - 7 = 0$.

Step 4: Solve each equation for x.

$$x + 2 = 0 \qquad x - 7 = 0$$
$$x = -2 \qquad x = 7$$

The zeros of the function $f(x) = x^2 - 5x - 14$ are $x = -2$ and $x = 7$.

Solving an Equation by Factoring

1. Write the equation in standard form, setting one side equal to zero.
2. Factor the polynomial.
3. Apply the zero product property.
4. Solve the resulting equations.
5. Check the solutions.

Check the answer by graphing the function on a graphing calculator. The zeros will be the x-intercepts (–2, 0) and (7, 0).

Practice

Complete the steps to solve the equation.

1. What are the roots of the function $x^2 - 6x - 25 = 2$?
   - Get zero on one side of the equation: $x^2 - 6x - 27$ = 0.
   - The polynomial factored is $(x + 3)(x - 9)$ = 0
   - Using the zero product property, $x + 3$ = 0 or $x - 9$ = 0.
   - Solve each equation for x.

     $$x + 3 = 0 \qquad x - 9 = 0$$
     $$x = -3 \qquad x = 9$$

   - The roots are x = –3 and x = 9.

Sometimes the zeros of a polynomial are called the roots or solutions.

Solve.

2. Dominique kicks a ball into the air. The function $h(t) = -16t^2 + 80t$ models h, the height of the ball in feet, after t seconds. When will the ball hit the ground?

   Solution: The ball will hit the ground after 5 seconds.

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Review

The zeros of a function tell us two of the factors, but the equation can also have constant factors.

The zeros of a function are –5 and 4. What is a possible quadratic function with these zeros?

- Zeros of –5 and 4 mean that the x-intercepts of the function's graph are at $x = -5$ and $x = 4$.
- Move the constants to the same side as the variable to find the factors.

$$x = -5 \qquad\qquad x = 4$$

$$x + 5 = 0 \qquad\qquad x - 4 = 0$$

- Multiply and combine like terms.

$$(x + 5)(x - 4) = x^2 + x - 20$$

One possible function with zeros at –5 and 4 is $f(x) = x^2 + x - 20$.

Multiply by constants to find other possible functions with the same roots. So, $g(x) = 2(x^2 + x - 20) = 2x^2 + 2x - 40$ and $h(x) = -7(x^2 + x - 20) = -7x^2 - 14x + 140$ are two other possible functions.

Practice

Fill in the blanks to write one quadratic equation with the given roots.

1. The zeros of a function are 1 and 8. What is a possible quadratic function with these zeros?
   - The x-intercepts of the function's graph are at $x =$ __1__ and $x =$ __8__.
   - Move the constants to the same side as the variable to find the factors.

$$x = 1 \qquad\qquad x = 8$$

$$x - 1 = 0 \qquad\qquad x - 8 = 0$$

   - Multiply and combine like terms.

$$(x - 1)(x - 8) = x^2 - 9x + 8$$

Write a possible quadratic function for the given root(s).

A double root means the two factors are identical.

2. A quadratic function that has a double root of –2.

   Solution: $g(x) = (x + 2)(x + 2) = (x + 2)^2 = x^2 + 4x + 4$

3. A quadratic function that has zeros of –3 and 4.

   Solution: $h(x) = (x + 3)(x - 4) = x^2 - x - 12$

Jeff says he can apply the zero product property to solve the equation $(x - 2)(x + 3) = 5$. Is he correct? Explain why or why not.

In order to apply the zero product property, one side of the equation must be 0. He needs to multiply $(x - 2)(x + 3)$ and then subtract 5 to set the equation equal to 0. Then, he can factor and apply the zero product property and find the solutions to the equation.