Quadratic Formula Activity

Quadratic Formula:
For any quadratic in the form $y = ax^2 + bx + c$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Guided Practice:
Solve the following quadratic equation using quadratic formula:

$$x^2 - x = 2$$

Step 1: Write the equation in standard form.

The equation must be set equal to zero, so we subtract 2 from each side.

$$x^2 - x = 2$$
$$x^2 - x - 2 = 2 - 2$$
$$x^2 - x - 2 = 0$$

Step 2: Label a, b, and c

$$a = 1,\ b = -1,\ c = -2$$

Step 3: Find the discriminant:

$$b^2 - 4ac$$

Plug into calculator with parentheses! Just like this…

$$(-1)^2 - 4(1)(-2) = 9$$

Step 4: Substitute values into the rest of the quadratic formula. Replace the discriminant with 9.

$$x = \frac{-(-1) \pm \sqrt{9}}{2(1)}$$

Step 5: Simplify signs, take the square root, and simplify the denominator.

$$x = \frac{1 \pm 3}{2}$$

Step 6: Split into 2 problems and solve.

$$x = \frac{1+3}{2} = \frac{4}{2} = 2 \qquad x = \frac{1-3}{2} = \frac{-2}{2} = -1$$

$$x = 2, x = -1$$

Step 7: Check your solutions by plugging your answers back in to the original equation.

$$x = 2, x = -1$$

Original: $x^2 - x - 2 = 0$

$(2)^2 - (2) - 2 = 0$ $\qquad$ $(-1)^2 - (-1) - 2 = 0$

$4 - 2 - 2 = 0$ $\qquad$ $1 + 1 - 2 = 0$

More Guided Practice:

Fill in the missing values for the quadratic: $2x^2 + 3x - 65 = 0$

Find a, b, c: $a = \square, b = \square, c = \square$

Find the discriminant: $b^2 - 4ac = (\ )^2 - 4(\ )(\ ) = \square$

Plug in the formula: $x = \frac{-(\square) \pm \sqrt{\square}}{2(\square)}$

Simplify: $x = \frac{\square \pm \square}{\square}$

Split into two equations: $x = \frac{\square + \square}{\square}$, $x = \frac{\square - \square}{\square}$

Simplify: $x = \frac{\square}{\square}$, $x = \frac{\square}{\square}$

$x = \square$, $x = \square$

NAME _____ DATE _____ PERIOD _____

5-6 Study Guide and Intervention *(continued)*

The Quadratic Formula and the Discriminant

Roots and the Discriminant

Discriminant	The expression under the radical sign, $b^2 - 4ac$, in the Quadratic Formula is called the **discriminant**.

Discriminant	Type and Number of Roots
$b^2 - 4ac > 0$ and a perfect square	2 rational roots
$b^2 - 4ac > 0$, but **not** a perfect square	2 irrational roots
$b^2 - 4ac = 0$	1 rational root
$b^2 - 4ac < 0$	2 complex roots

Example **Find the value of the discriminant for each equation. Then describe the number and type of roots for the equation.**

a. $2x^2 + 5x + 3$

The discriminant is $b^2 - 4ac = 5^2 - 4(2)(3)$ or 1. The discriminant is a perfect square, so the equation has 2 rational roots.

b. $3x^2 - 2x + 5$

The discriminant is $b^2 - 4ac = (-2)^2 - 4(3)(5)$ or -56. The discriminant is negative, so the equation has 2 complex roots.

Exercises

Complete parts a–c for each quadratic equation.

a. Find the value of the discriminant.
b. Describe the number and type of roots.
c. Find the exact solutions by using the Quadratic Formula.

1. $p^2 + 12p = -4$

2. $9x^2 - 6x + 1 = 0$

3. $2x^2 - 7x - 4 = 0$

4. $x^2 + 4x - 4 = 0$

5. $5x^2 - 36x + 7 = 0$

6. $4x^2 - 4x + 11 = 0$

7. $x^2 - 7x + 6 = 0$

8. $m^2 - 8m = -14$

9. $25x^2 - 40x = -16$

10. $4x^2 + 20x + 29 = 0$

11. $6x^2 + 26x + 8 = 0$

12. $4x^2 - 4x - 11 = 0$

NAME _____ DATE _____ PERIOD _____

5-6 Practice

The Quadratic Formula and the Discriminant

Solve each equation by using the Quadratic Formula.

1. $7x^2 - 5x = 0$
2. $4x^2 - 9 = 0$
3. $3x^2 + 8x = 3$
4. $x^2 - 21 = 4x$
5. $3x^2 - 13x + 4 = 0$
6. $15x^2 + 22x = -8$
7. $x^2 - 6x + 3 = 0$
8. $x^2 - 14x + 53 = 0$
9. $3x^2 = -54$
10. $25x^2 - 20x - 6 = 0$
11. $4x^2 - 4x + 17 = 0$
12. $8x - 1 = 4x^2$
13. $x^2 = 4x - 15$
14. $4x^2 - 12x + 7 = 0$

Complete parts a–c for each quadratic equation.

a. Find the value of the discriminant.

b. Describe the number and type of roots.

c. Find the exact solutions by using the Quadratic Formula.

15. $x^2 - 16x + 64 = 0$
16. $x^2 = 3x$
17. $9x^2 - 24x + 16 = 0$
18. $x^2 - 3x = 40$
19. $3x^2 + 9x - 2 = 0$
20. $2x^2 + 7x = 0$
21. $5x^2 - 2x + 4 = 0$
22. $12x^2 - x - 6 = 0$
23. $7x^2 + 6x + 2 = 0$
24. $12x^2 + 2x - 4 = 0$
25. $6x^2 - 2x - 1 = 0$
26. $x^2 + 3x + 6 = 0$
27. $4x^2 - 3x^2 - 6 = 0$
28. $16x^2 - 8x + 1 = 0$
29. $2x^2 - 5x - 6 = 0$

30. **GRAVITATION** The height $h(t)$ in feet of an object t seconds after it is propelled straight up from the ground with an initial velocity of 60 feet per second is modeled by the equation $h(t) = -16t^2 + 60t$. At what times will the object be at a height of 56 feet?

31. **STOPPING DISTANCE** The formula $d = 0.05s^2 + 1.1s$ estimates the minimum stopping distance d in feet for a car traveling s miles per hour. If a car stops in 200 feet, what is the fastest it could have been traveling when the driver applied the brakes?