Name _____ Class _____ Date _____

4-7 Reteaching

The Quadratic Formula

You can solve some quadratic equations by factoring or completing the square. You can solve any quadratic equation $ax^2 + bx + c = 0$ by using the Quadratic Formula:

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

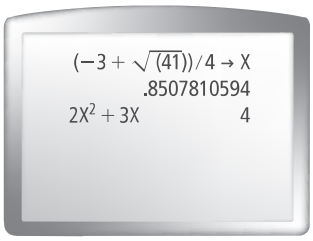
Notice the $\pm$ symbol in the formula. Whenever $b^2 - 4ac$ is not zero, the Quadratic Formula will result in two solutions.

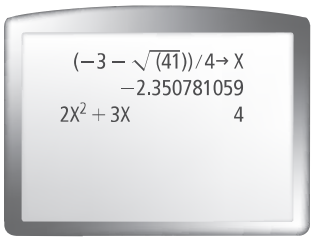
Problem

What are the solutions for $2x^2 + 3x = 4$? Use the Quadratic Formula.

$2x^2 + 3x - 4 = 0$	Write the equation in standard form: $ax^2 + bx + c = 0$
$a = 2; b = 3; c = -4$	a is the coefficient of x^2, b is the coefficient of x, c is the constant term.
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	Write the Quadratic Formula.
$= \frac{-(3) \pm \sqrt{(3)^2 - 4(2)(-4)}}{2(2)}$	Substitute 2 for a, 3 for b, and –4 for c.
$= \frac{-3 \pm \sqrt{41}}{4}$	Simplify.
$= \frac{-3 + \sqrt{41}}{4}$ or $\frac{-3 - \sqrt{41}}{4}$	Write the solutions separately.

Check your results on your calculator. Replace x in the original equation with $\frac{-3 + \sqrt{41}}{4}$ and $\frac{-3 - \sqrt{41}}{4}$. Both values for x give a result of 4. The solutions check.





Exercises

What are the solutions for each equation? Use the Quadratic Formula.

1. $-x^2 + 7x - 3 = 0$ $\frac{7 + \sqrt{37}}{2}$ or $\frac{7 - \sqrt{37}}{2}$
2. $x^2 + 6x = 10$ $-3 + \sqrt{19}$ or $-3 - \sqrt{19}$
3. $2x^2 = 4x + 3$ $\frac{2 + \sqrt{10}}{2}$ or $\frac{2 - \sqrt{10}}{2}$
4. $4x^2 + 81 = 36x$ $\frac{9}{2}$
5. $2x^2 + 1 = 5 - 7x$ -4 or $\frac{1}{2}$
6. $6x^2 - 10x + 3 = 0$ $\frac{5 + \sqrt{7}}{6}$ or $\frac{5 - \sqrt{7}}{6}$

Name _____ Class _____ Date _____

4-7 Reteaching (continued)

The Quadratic Formula

There are three possible outcomes when you take the square root of a real number *n*:

$$n \begin{cases} > 0 & \rightarrow \text{two real values (one positive and one negative)} \\ = 0 & \rightarrow \text{one real value (0)} \\ < 0 & \rightarrow \text{no real values} \end{cases}$$

Now consider the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. The value under the radical symbol determines the number of real solutions that exist for the equation $ax^2 + bx + c = 0$:

$$b^2 - 4ac \begin{cases} > 0 & \rightarrow \text{two real solutions} \\ = 0 & \rightarrow \text{one real solution} \\ < 0 & \rightarrow \text{no real solutions} \end{cases}$$

The value under the radical, $\boldsymbol{b^2 - 4ac}$, is called the **discriminant**.

Problem

What is the number of real solutions of $-3x^2 + 7x = 2$?

$-3x^2 + 7x = 2$	
$-3x^2 + 7x - 2 = 0$	Write in standard form.
$a = -3, b = 7, c = -2$	Find the values of *a*, *b*, and *c*.
$b^2 - 4ac$	Write the discriminant.
$(7)^2 - 4(-3)(-2)$	Substitute for *a*, *b*, and *c*.
$49 - 24$	Simplify.
25	

The discriminant, 25, is positive. The equation has two real roots.

Exercises

What is the value of the discriminant and what is the number of real solutions for each equation?

7. $x^2 + x - 42 = 0$
169; two

8. $-x^2 + 13x - 40 = 0$
9; two

9. $x^2 + 2x + 5 = 0$
–16; none

10. $x^2 = 18x - 81$
0; one

11. $-x^2 + 7x + 44 = 0$
225; two

12. $\frac{1}{4}x^2 - 5x + 25 = 0$
0; one

13. $2x^2 + 7 = 5x$
–31; none

14. $4x^2 + 25x = 21$
961; two

15. $x^2 + 5 = 3x$
–11; none

16. $\frac{1}{9}x^2 = 4x - 36$
0; one

17. $\frac{1}{2}x^2 + 2x + 3 = 0$
–2; none

18. $\frac{1}{6}x^2 = 2x + 18$
16; two