Warm-up 4-11

Solve using square roots. Check your answer.

1. $x^2 - 195 = 1$

2. $4x^2 - 18 = -9$

3. $(x + 7)^2 = 81$

4. Solve $0 = -5x^2 + 225$. Round to the nearest hundreth.

Solve by completing the square.

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

Warm-up 4-11

Solve using square roots. Check your answer.

1. $x^2 - 195 = 1$

$+195 \quad +195$

$\sqrt{x^2} = \sqrt{196}$

$x = \pm 14$

$14^2 - 195 = 1$ $\quad$ $(-14)^2 - 195 = 1$

$196 - 195 = 1$ ✓ $\quad$ $196 - 195 = 1$ ✓

2. $4x^2 - 18 = -9$

$+18 \quad +18$

$\frac{4x^2}{4} = \frac{9}{4}$

$\sqrt{x^2} = \sqrt{\frac{9}{4}}$

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

$4(\frac{3}{2})^2 - 18 = -9$ $\quad$ $4(-\frac{3}{2})^2 - 18 = -9$

$9 - 18 = -9$ ✓ $\quad$ $9 - 18 = -9$ ✓

3. $\sqrt{(x+7)^2} = \sqrt{81}$

$x + 7 = \pm 9$

$x + 7 = 9$ $\quad$ $x + 7 = -9$

$-7 \quad -7$ $\quad$ $-7 \quad -7$

$x = 2$ $\quad$ $x = -16$

$(2+7)^2 = 81$

$9^2 = 81$ ✓

$(-16+7)^2 = 81$

$(-9)^2 = 81$ ✓

4. Solve $0 = -5x^2 + 225$. Round to the nearest hundreth.

$-225 \quad -225$

$\frac{-225}{-5} = \frac{-5x^2}{-5}$

$\sqrt{x^2} = \sqrt{45}$

$x = \pm\sqrt{45}$

$x = \pm 6.71$

Solve by completing the square.

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

$+12 \quad +12$

$\left(\frac{b}{2}\right)^2 = \left(\frac{-4}{2}\right)^2 = 4$

$x^2 - 4x + 4 = 12 + 4$

$\sqrt{(x-2)^2} = \sqrt{16}$

$x - 2 = \pm 4$

$x - 2 = 4$ $\quad$ $x - 2 = -4$

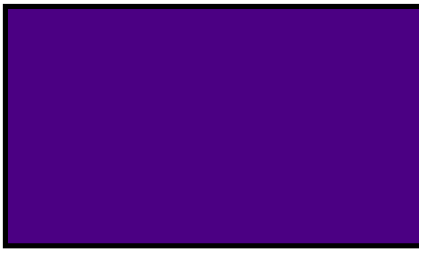
$+2 \quad +2$ $\quad$ $+2 \quad +2$

$x = 6$ $\quad$ $x = -2$

Today's Goal

I can solve quadratic equations by using the Quadratic Formula

Section 10.7: Solving Quadratics using the Formula



Quadratic Formula

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

$2x^2 + 3x - 5 = 0$

$a = 2$

$b = 3$

$c = -5$

$X = \dfrac{-(3) \pm \sqrt{(3)^2 - 4(2)(-5)}}{2(2)}$

$X = \dfrac{-3 \pm \sqrt{9 - (-40)}}{4}$

$X = \dfrac{-3 \pm \sqrt{49}}{4} = \dfrac{-3 \pm 7}{4}$

$\dfrac{-3+7}{4} = \dfrac{4}{4} = 1$

$\dfrac{-3-7}{4} = \dfrac{-10}{4} = -5/2$

$X = 1, -5/2$

$2x = x^2 - 3$

$-2x \quad -2x$

$0 = x^2 - 2x - 3$

$a = 1$

$b = -2$

$c = -3$

$\frac{2+4}{2} = \frac{6}{2} = 3$

$\frac{2-4}{2} = \frac{-2}{2} = -1$

$x = -1, 3$

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-3)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{4 - (-12)}}{2}$$

$$x = \frac{2 \pm \sqrt{16}}{2} = \frac{2 \pm 4}{2}$$

Try this!

$2x^2 + 4x + 3 = 0$

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

The Discriminant

Tells us how many solutions we can expect.

$b^2 - 4ac < 0$ **no real solution**

$b^2 - 4ac = 0$ **1 solution**

$b^2 - 4ac > 0$ **2 solutions**

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

Use the discriminant to determine the number of solutions

$3x^2 + 10x + 2 = 0$

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

$x^2 + x + 1 = 0$

The Discriminant

Tells us how many solutions we can expect.

$b^2 - 4ac < 0$	**no real solution**
$b^2 - 4ac = 0$	**1 solution**
$b^2 - 4ac > 0$	**2 solutions**

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

Use the discriminant to determine the number of solutions

$3x^2 + 10x + 2 = 0$

$a = 3$
$b = 10$
$c = 2$

$$X = \frac{-10 \pm \sqrt{76}}{2(3)}$$

$$X = \frac{-10 \pm \sqrt{76}}{6}$$

$b^2 - 4ac$
$(10)^2 - 4(3)(2)$
$100 - 24$
76 2 solutions

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

$a = 9$
$b = -6$
$c = 1$

$(-6)^2 - 4(9)(1)$
$36 - 36 = 0$
1 solution

$$X = \frac{-(-6) \pm \sqrt{0}}{2(9)}$$

$$X = \frac{6}{18} = \frac{1}{3}$$

$x^2 + x + 1 = 0$

$(1)^2 - 4(1)(1)$
$1 - 4 = -3$

$a = 1$
$b = 1$
$c = 1$

no real solution

Examples!

Determine how many solutions each quadratic will have Then solve it.

$3x^2 - 7x = 12$

$x^2 + x - 1 = 0$

$5x^2 - 2x + 15 = 3x$

Homework

pg. 587 #5-17 (odd), 23

USATestPrep Practice

GUIDED PRACTICE

1. **Vocabulary** If the *discriminant* is negative, the quadratic equation has _____?_____ real solution(s). (*no*, *one*, or *two*)

Solve using the Quadratic Formula.

SEE EXAMPLE 1

2. $x^2 - 5x + 4 = 0$
3. $2x^2 = 7x - 3$
4. $x^2 - 6x - 7 = 0$
5. $x^2 = -14x - 40$
6. $3x^2 - 2x = 8$
7. $4x^2 - 4x - 3 = 0$

SEE EXAMPLE 2

8. $2x^2 - 6 = 0$
9. $x^2 + 6x + 3 = 0$
10. $x^2 - 7x + 2 = 0$
11. $3x^2 = -x + 5$
12. $x^2 - 4x - 7 = 0$
13. $2x^2 + x - 5 = 0$

SEE EXAMPLE 3

Find the number of real solutions of each equation using the discriminant.

14. $2x^2 + 4x + 3 = 0$
15. $x^2 + 4x + 4 = 0$
16. $2x^2 - 11x + 6 = 0$
17. $x^2 + x + 1 = 0$
18. $3x^2 = 5x - 1$
19. $-2x + 3 = 2x^2$
20. $2x^2 + 12x = -18$
21. $5x^2 + 3x = -4$
22. $8x = 1 - x^2$

SEE EXAMPLE 4

23. **Hobbies** The height above the ground in meters of a model rocket on a particular launch can be modeled by the equation $h = -4.9t^2 + 102t + 100$, where t is the time in seconds after its engine burns out 100 m above the ground. Will the rocket reach a height of 600 m? Use the discriminant to explain your answer.