

# Algebra 1

## Lesson 10.4

### Use Square Roots to Solve Quadratic Equations

#### Warm-Up

Sketch the graph of the quadratic equation  $y = -x^2 - 2x + 3$ .

Opens: DOWN b/c  $a < 0$

Vertex:  $(-1, 4)$

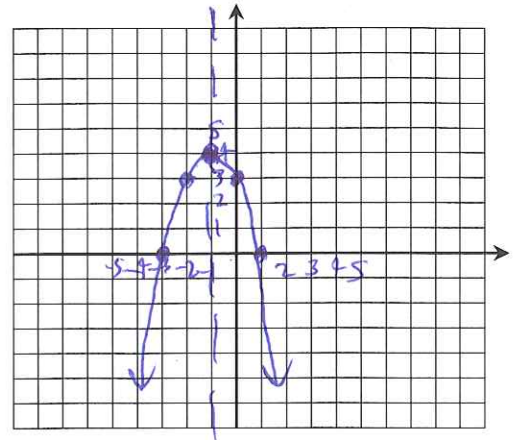
Axis of Symmetry:  $x = \frac{-(-2)}{2(-1)} = \frac{2}{-2}$

$x = -1$

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

x	-3	-2	-1	0	1
y	0	3	4	3	0

$y = -(-1)^2 - 2(-1) + 3$   
 $y = -1 - 2 + 3$   
 $y = 0$



Fill in the table of perfect squares.

x	1	2	3	4	5	6	7	8	9	10	11	12
$x^2$	1	4	9	16	25	36	49	64	81	100	121	144

#### Example 1. Solving Quadratic Equations

Solve each equation.

(a)  $x^2 = 4$   
 $x = \pm 2$

(b)  $\frac{3x^2}{3} = \frac{27}{3}$   
 $x^2 = 9$   
 $x = \pm 3$

(c)  $m^2 + 12 = 12$   
 $-12 - 12$   
 $m^2 = 0$   
 $m = 0$

(d)  $c^2 - 25 = 0$   
 $+25 +25$   
 $c^2 = 25$   
 $c = \pm 5$

(e)  $a^2 - 3 = -4$   
 $+3 +3$   
 $a^2 = -1$   
 NO REAL SOLUTION

(f)  $2 \cdot \frac{1}{2} t^2 = 18 \cdot 2$   
 $t^2 = 36$   
 $t = \pm 6$

#### Example 2. Taking the Square Root of a Fraction

Solve each equation.

(a)  $\frac{4x^2}{4} = \frac{25}{4}$   
 $4x^2 - 25 = 0$   
 $(2x+5)(2x-5) = 0$   
 $x = \pm \frac{5}{2}$   
 $x^2 = \frac{25}{4}$   
 $x = \pm \sqrt{\frac{25}{4}}$   
 $x = \pm \frac{5}{2}$

(b)  $\frac{9b^2}{9} = \frac{100}{9}$   
 $b^2 = \frac{100}{9}$   
 $b = \pm \frac{10}{3}$

(c)  $\frac{16s^2}{16} = \frac{49}{16}$   
 $s^2 = \frac{49}{16}$   
 $s = \pm \frac{7}{4}$

**Try It!**

Solve each equation.

(a)  $x^2 - 1 = 0$

$$\begin{array}{r} +1 \quad +1 \\ \sqrt{x^2 - 1} = \sqrt{1} \end{array}$$

$x = \pm 1$

(b)  $x^2 + 17 = 13$

$$\begin{array}{r} -17 \quad -17 \\ x^2 = -4 \end{array}$$

NO REAL SOLUTION

(c)  $\frac{64m^2}{64} = \frac{9}{64}$

$$\sqrt{m^2} = \sqrt{\frac{9}{64}}$$

$m = \pm \frac{3}{8}$

**Example 3. Multiple-Step Solving Using Square Roots**

Solve each equation.

(a)  $3x^2 + 5 = 32$

$$\begin{array}{r} -5 \quad -5 \\ \frac{3x^2}{3} = \frac{27}{3} \\ x^2 = 9 \end{array}$$

$x = \pm 3$

(b)  $2x^2 - 10 = 6$

$$\begin{array}{r} +10 \quad +10 \\ \frac{2x^2}{2} = \frac{16}{2} \\ \sqrt{x^2} = \sqrt{8} \end{array}$$

$x = \pm \sqrt{8}$

$x \approx \pm 2.83$

(c)  $4g^2 + 10 = 11$

$$\begin{array}{r} -10 \quad -10 \\ \frac{4g^2}{4} = \frac{1}{4} \\ \sqrt{g^2} = \sqrt{\frac{1}{4}} \end{array}$$

$g = \pm \frac{1}{2}$

**Example 4. Solving Quadratic Equations with Parentheses**

Solve each equation.

(a)  $2(x-2)^2 = 18$

$$\begin{array}{r} \frac{2}{2} \quad \frac{2}{2} \\ \sqrt{(x-2)^2} = \sqrt{9} \end{array}$$

$x-2 = \pm 3$

$$\begin{array}{r} +2 \quad +2 \\ x = 2 \pm 3 \end{array}$$

$x = 5, -1$

(b)  $3(x+1)^2 - 15 = 75$

$$\begin{array}{r} +15 \quad +15 \\ 3(x+1)^2 = 90 \end{array}$$

$$\frac{3(x+1)^2}{3} = \frac{90}{3}$$

$$\sqrt{(x+1)^2} = \sqrt{30}$$

$$\begin{array}{r} -1 \quad -1 \\ x+1 = \pm \sqrt{30} \end{array}$$

$x = -1 \pm \sqrt{30}$

**Assignment**

New: Pg. 655 #4 - 34 (evens), 56

Review:

Factor.

1.  $b^2 - 81$

2.  $3x^2 - 10x - 8$

3.  $x^3 + 7x^2 + 12x$

$x \approx 4.48, -6.48$

APPROXIMATE