*Solve each for the given variable

Solve.

1. $9x - 4 = 5x - 12$

$-5x + 4 \quad -5x + 4$

$\frac{4x}{4} = \frac{-8}{4}$

$x = -2$

2. $14b = 5b + 18$

$-5b \quad -5b$

$\frac{9b}{9} = \frac{18}{9}$

$b = 2$

3. $4x = 12 + x$

$-x \quad -x$

$\frac{3x}{3} = \frac{12}{3}$

$x = 4$

4. $5y + 1 = -14 + 2y$

$-2y - 1 \quad -1 + 2y$

$\frac{3y}{3} = \frac{-15}{3}$

$y = -5$

5. $5y + 7 = 2y + 7$

$-2y - 7 \quad -2y - 7$

$3y = 0$

$y = 0$

6. $10 + 3n = 15 - 2n$

$-10 + 2n \quad -10 + 2n$

$\frac{5n}{5} = \frac{5}{5}$

$n = 1$

Warm Up

*Zero product property rule → If numbers or expressions are multiplied together and the resulting product is 0, one of the two factors must be equal to zero

Solve the equation.

1. $x(x - 9) = 0$

$x = 0 \quad x - 9 = 0$

$x = 9$

2. $11t(2t + 4) = 0$

$11t = 0 \quad 2t + 4 = 0$

$t = 0 \quad 2t = -4$

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

$t = -2$

3. $(s + 10)s = 0$

$s = 0 \quad s + 10 = 0$

$s = -10$

4. $(3a + 6)(4a - 16) = 0$

$3a + 6 = 0 \quad 4a - 16 = 0$

$3a = -6 \quad 4a = 16$

$a = -2 \quad a = 4$

5. $(6m - 3)^2 = 0$

$6m - 3 = 0$

$6m = 3$

$m = 3/6 = 1/2$

6. $(4 + g)(8 - 2g) = 0$

$4 + g = 0 \quad 8 - 2g = 0$

$g = -4 \quad -2g = -8$

$g = 4$

Cumulative Warm Up

Essential Question

How can you use a graph to solve a quadratic equation in one variable?

What you will learn:

- Solve quadratic equations by graphing
- Use graphs to find and approximate the zeros of the function
- Solve real-life problems using graphs of quadratic functions

Essential Question

Core Concept

Solving Quadratic Equations by Graphing

Step 1 Write the equation in standard form, $ax^2 + bx + c = 0$.

Step 2 Graph the related function $y = ax^2 + bx + c$.

Step 3 Find the x-intercepts, if any.

The solutions, or *roots*, of $ax^2 + bx + c = 0$ are the x-intercepts of the graph.

- Axis of symmetry

  $x = \frac{-b}{2a}$ → find the vertex

- Create a table of values for x and solve for y. → Graph

Core Concept

Solve $x^2 + 2x = 3$ by graphing.

① $x^2 + 2x - 3 = 0$ ← always begin in Standard form ($ax^2 + bx + c$)

$a = 1 \quad b = 2 \quad c = -3$

② axis of symmetry $x = \frac{-b}{2a} = \frac{-2}{2(1)} = \frac{-2}{2} = -1$

③ Vertex $(-1)^2 + 2(-1) - 3 = 1 - 2 - 3 = -4$ vertex point $(-1, -4)$

④ Table

x	x^2+2x-3	y
-3	$(-3)^2+2(-3)-3$	0
-2	$(-2)^2+2(-2)-3$	-3
-1	vertex	-4
0	$0^2+2(0)-3$	-3
1	$(1)^2+2(1)-3$	0

* Use values on either side of the vertex

⑤ * plot points

Example 1

Student practice

Solve the equation by graphing. Check your solutions.

1. $x^2 - x - 2 = 0$ **2.** $x^2 + 7x = -10$ **3.** $x^2 + x = 12$

Step 1: Start In Standard form

Step 2: Calculate Axis of Symmetry $x = \frac{-b}{2a}$

Step 3: Use Axis of symmetry to Calculate y value of vertex

Step 4: Create a table of values beginning w/ the vertex in the center of your table - Choose at least 2 points on either side of vertex - remember graph must cross x-axis to solve (y=0)

Step 5: Graph points

Monitoring Progress 1-3

Solve $x^2 - 8x = -16$ by graphing.

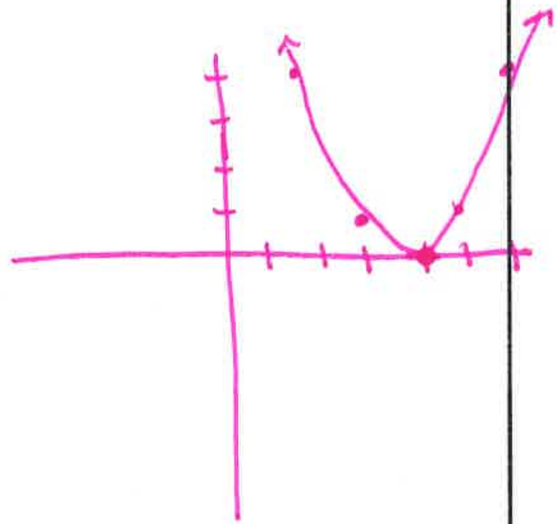
$x^2 - 8x + 16 = 0$

$x = \frac{-b}{2a} = \frac{-(-8)}{2(1)} = \frac{8}{2} = 4$

$4^2 - 8(4) + 16 = 0$

vertex $= (4, 0)$

x	$x^2-8x+16$	y
6	$6^2-8(6)+16$	4
5	$5^2-8(5)+16$	1
4	vertex	0
3	$3^2-8(3)+16$	1
2	$2^2-8(2)+16$	4



* 1 solution - vertex touches the x-axis

Example 2

Student practice

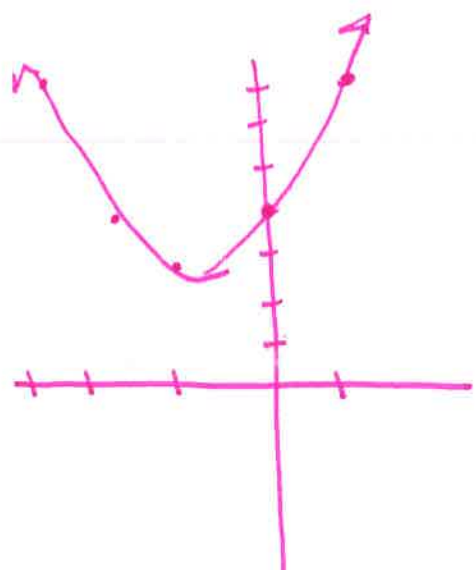
Solve $-x^2 = 2x + 4$ by graphing.

$0 = x^2 + 2x + 4$ ← keep x^2 term positive

$x = \frac{-b}{2a} = \frac{-2}{2(1)} = -1$

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

x	x^2+2x+4	y
-3	$(-3)^2+2(-3)+4$	7
-2	$(-2)^2+2(-2)+4$	4
-1	vertex	3
0	$(0)^2+2(0)+4$	4
1	$(1)^2+2(1)+4$	7



* No solution - parabola will never cross the x-axis

Example 3

Student practice- Make sure to state solutions!

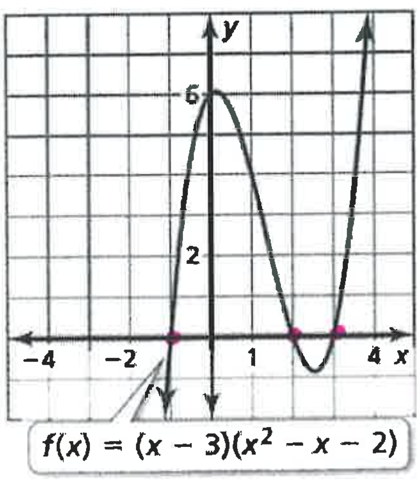
Solve the equation by graphing.

4. $x^2 + 36 = 12x$ **5.** $x^2 + 4x = 0$ **6.** $x^2 + 10x = -25$

7. $x^2 = 3x - 3$ **8.** $x^2 + 7x = -6$ **9.** $2x + 5 = -x^2$

Monitoring Progress 4-9

The graph of $f(x) = (x - 3)(x^2 - x - 2)$ is shown. Find the zeros of f.



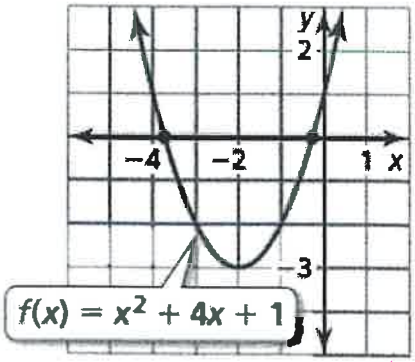
Zeros: where the graph crosses the x-axis

$x = -1$
$x = 2$
$x = 3$
three zeros

Example 4

The graph of $f(x) = x^2 + 4x + 1$ is shown. Approximate the zeros of f to the nearest tenth.

just state between which units the graph crosses.



x - graph crosses between −4 and −3

and

x - graph crosses between −1 and 0

Example 5

10. Graph $f(x) = x^2 + x - 6$. Find the zeros of f.

11. Graph $f(x) = -x^2 + 2x + 2$. Approximate the zeros of f to the nearest tenth.

To graph on a graphing Calculator:

- y=
- Clear any functions
- enter function as seen
- graph key will graph the function
- Second and graph will provide a table of values.

Monitoring Progress 10-11

A football player kicks a football 2 feet above the ground with an initial vertical velocity of 75 feet per second. The function $h = -16t^2 + 75t + 2$ represents the height h (in feet) of the football after t seconds. (a) Find the height of the football each second after it is kicked. (b) Use the results of part (a) to estimate when the height of the football is 50 feet. (c) Using a graph, after how many seconds is the football 50 feet above the ground?

$h = -16t^2 + 75t + 2$

a.)

sec: t	height: h
0	2
1	61
2	88
3	83
4	46
5	-23

b.) height of football is 50 ft between 0 and 1 second between 3 and 4 seconds.

c.) $h = 50$ $50 = -16t^2 + 75t + 2$

$-16t^2 + 75t - 48 = 0$

* use graphing calculator to graph: at about 0.8 seconds and 3.9 seconds.

Example 6

12. WHAT IF? After how many seconds is the football 65 feet above the ground?

Monitoring Progress 12

When a quadratic equation has two solutions, what do you know about the graph of its related function?

Closure