2.12 Solve Quadratic Equations by Graphing

Math I

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

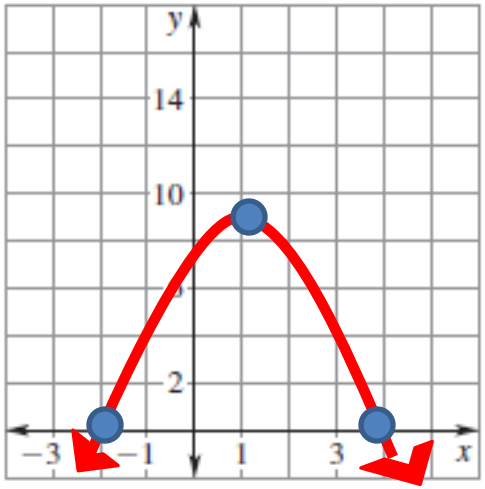
Step 1 Write the equation in **standard form**.

$-x^2 + 2x = -8$ Write original equation.

$-x^2 + 2x + 8 =$ **0** Add **8** to each side.

Step 2 Graph the function $y = -x^2 + 2x + 8$.

The x-intercepts are **-2** and **4**.



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

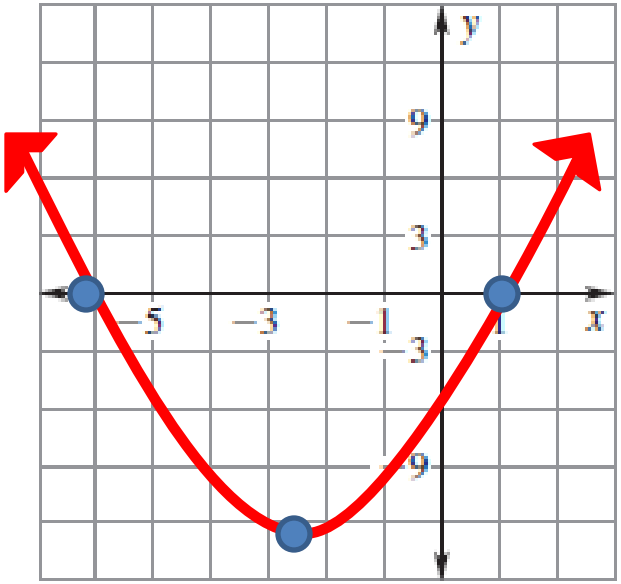
$y = -(1)^2 + 2(1) + 8$

Vertex (1, 9)

$y = -1 + 2 + 8 = 9$

The solutions of the equation $-x^2 + 2x = -8$ are **-2** and **4**.

1. Solve $x^2 - 6 = -5x$ by graphing.



$x^2 + 5x - 6 = 0$

$(x - 1)(x + 6) = 0$

The solutions of the equation are – 6 and 1.

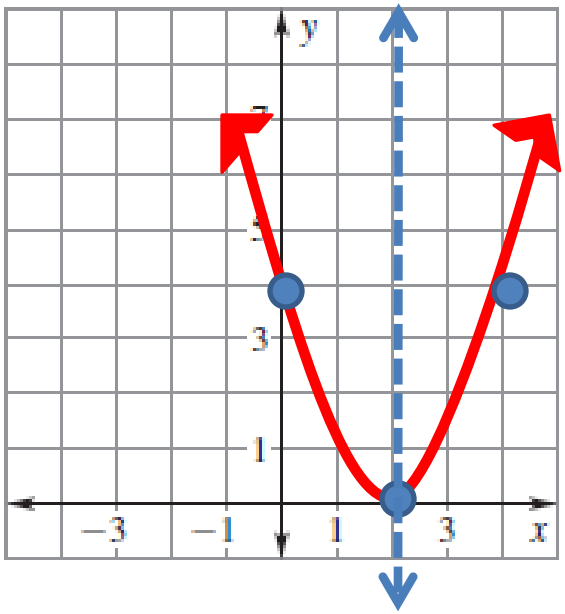
$$x = -\frac{b}{2a} = -\frac{5}{2(1)} = -\frac{5}{2} = -2\frac{1}{2}$$

Vertex (- 2 ½ ,- 12 ¼)

$y = (-2\ ½\ )^2 + 5(-2\ ½) - 6$

$y = 6\ ¼ - 12\ ½ - 6 = -\ 12\ ¼$

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



Step 1 **Write** the equation in standard form.

$x^2 - 4x = -4$ **Write original equation.**

$x^2 - 4x + 4 =$ 0 **Add** 4 **to each side.**

Step 2 Graph the function $y = x^2 - 4x + 4$.

The x-intercept is 2.

$y = (x - 2)(x - 2)$

The solution of the equation $x^2 - 4x = -4$ is 2.

The y – intercept is:

$y = (0 - 2)(0 - 2) = (-2)(-2) = 4$

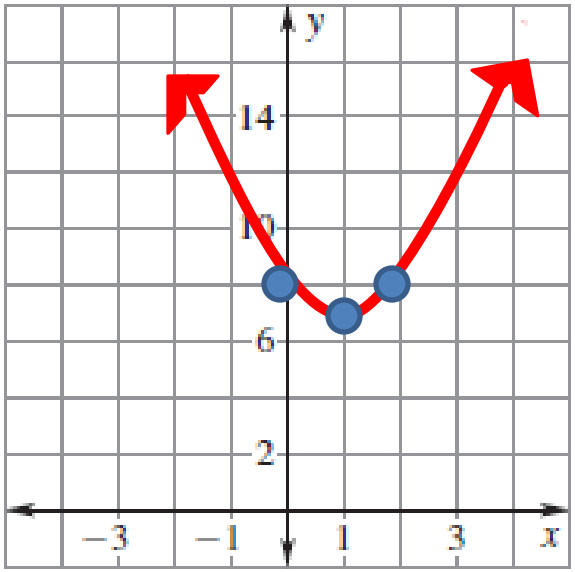
Reflect over x - axis

Solve $x^2 + 8 = 2x$ by graphing.

Step 1 Write the equation in standard form.

$x^2 + 8 = 2x$ Write original equation.

$x^2 - 2x + 8 = 0$ Subtract $2x$ from each side.



Step 2 Graph the function $y = x^2 - 2x + 8$.

The graph has no x-intercepts.

The equation $x^2 + 8 = 2x$ has no solution.

x	y
0	8
2	8

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

Vertex (1, 7)

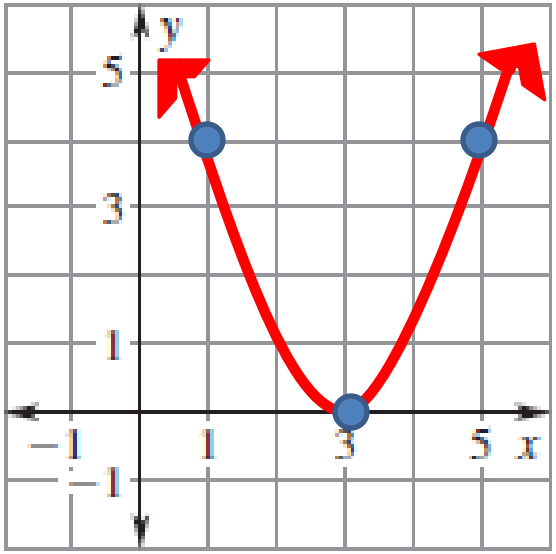
$y = (1)^2 - 2(1) + 8 = 1 - 2 + 8 = 7$

2. $x^2 + 9 = 6x$

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

$(x - 3)(x - 3) = 0$

$x = 3$



$$x = -\frac{b}{2a} = -\frac{-6}{2(1)} = -\frac{-6}{2} = 3$$

Vertex (3, 0)

$y = (3)^2 - 6(3) + 9$

$y = 9 - 18 + 9 = 0$

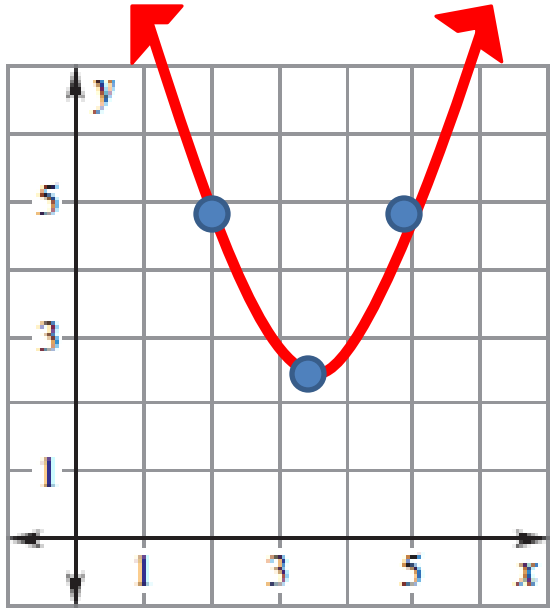
x	y
1	4
5	4

3. $x^2 - 7x = -15$

$x^2 - 7x + 15 = 0$

No Solution

$$x = -\frac{b}{2a} = -\frac{-7}{2(1)} = -\frac{-7}{2} = 3\frac{1}{2}$$



Vertex (3 ½ , 2 ¾)

$y = (3\frac{1}{2})^2 - 7(3\frac{1}{2}) + 15$

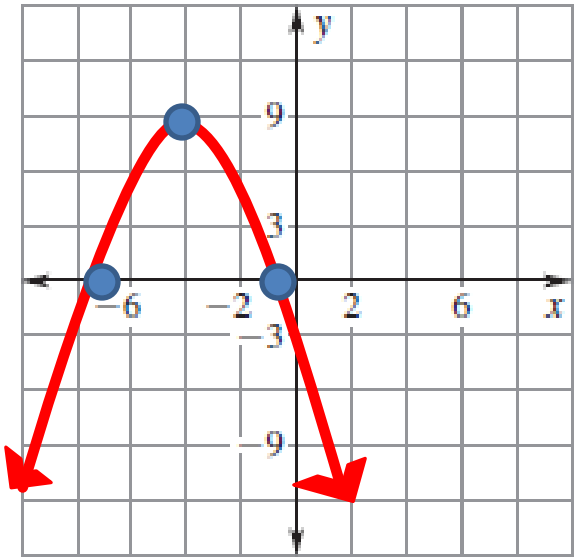
$y = 12\frac{1}{4} - 24\frac{1}{2} + 15$

$y = 12\frac{1}{4} - 24\frac{1}{2} + 15 = 2\frac{3}{4}$

x	y
2	5
5	5

FInd the zeros of $f(x) = -x^2 - 8x - 7$.

Graph the function $f(x) = -x^2 - 8x - 7$. The x-intercepts are **−7** and **−1**.



The zeros of the function are **−7** and **−1**.

CHECK Substitute **−7** and **−1** in the original function.

$f(\mathbf{-7}) = -(\mathbf{-7})^2 - 8(\mathbf{-7}) - 7 = \mathbf{0}$

$f(\mathbf{-1}) = -(\mathbf{-1})^2 - 8(\mathbf{-1}) - 7 = \mathbf{0}$

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

Vertex (–4, 9)

$y = -(-4)^2 - 8(-4) - 7$

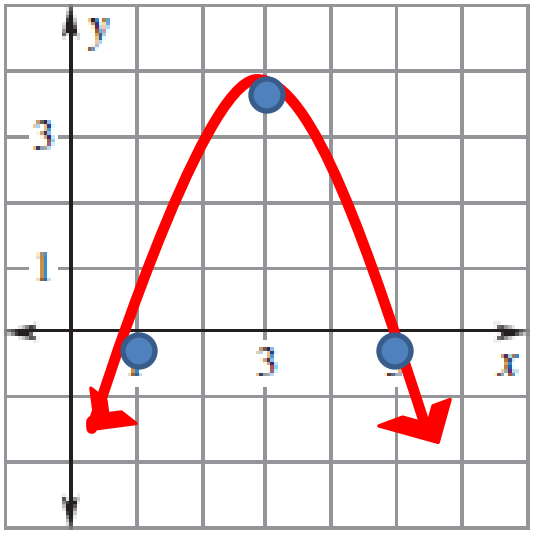
$y = -16 + 32 - 7 = 9$

4. $f(x) = -x^2 + 6x - 5$

f(x) = – (x² – 6x + 5)

f(x) = – (x – 5)(x – 1)

x = 1, 5



$$x = -\frac{b}{2a} = -\frac{6}{2(-1)} = -\frac{6}{-2} = 3$$

Vertex (3, 4)

y = –(3)² + 6(3) – 5

y = – 9 + 18 – 5 = 4