Chapter 9

Day 8

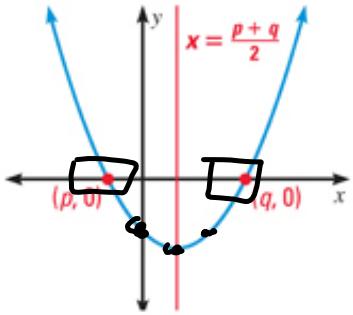
Solve Quadratic Equations by Graphing

KEY CONCEPT *For Your Notebook*

Graph of Intercept Form $y = a(x - p)(x - q)$

Characteristics of the graph of $y = a(x - p)(x - q)$:

- The x-intercepts are p and q.
- The axis of symmetry is halfway between $(p, 0)$ and $(q, 0)$. So, the axis of symmetry is $x = \frac{p + q}{2}$.
- The parabola opens up if $a > 0$ and opens down if $a < 0$.

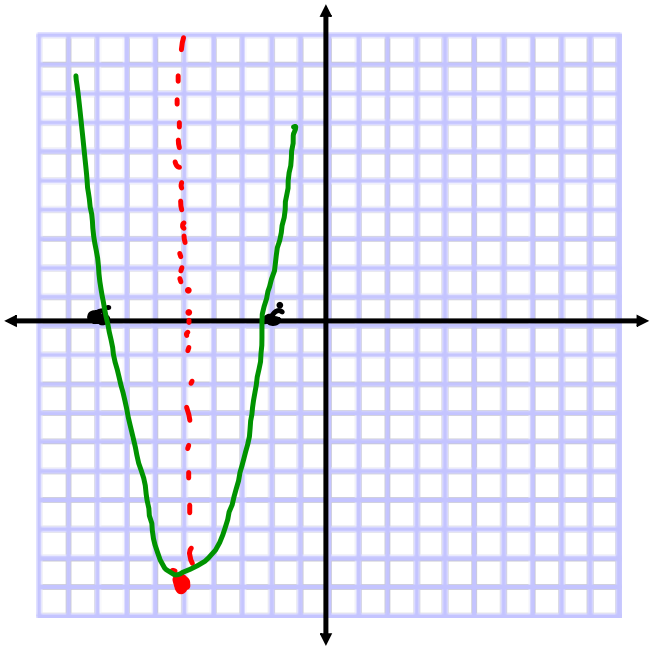


Ex: $(x+2)(x+8)=0$

$-2, -8$

$\frac{-2 + -8}{2}$

$(-5, $



Ex: Graph $y = -(x+1)(x-5)$

$-(2+1)(2-5)$

$-3 \cdot -3$

9

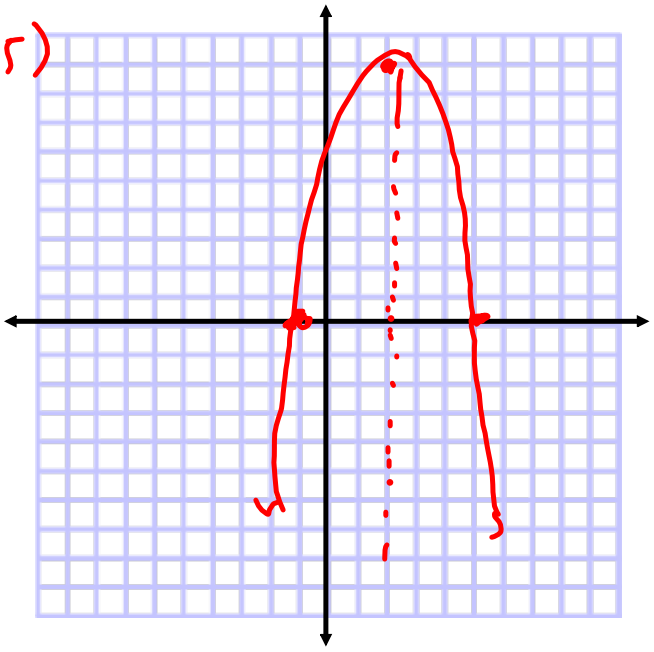
$-1 \quad 5$

$x = -1$

$x = 5$

$\frac{-1+5}{2} = 2$

$(2, \quad)$



A **quadratic equation** is an equation that can be written in the **standard form** $ax^2 + bx + c = 0$ where $a \neq 0$.

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

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

$A = 1$ $\quad x = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$

$B = -2$

$C = -3$

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

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

$1 - 2 + -3 = 4$

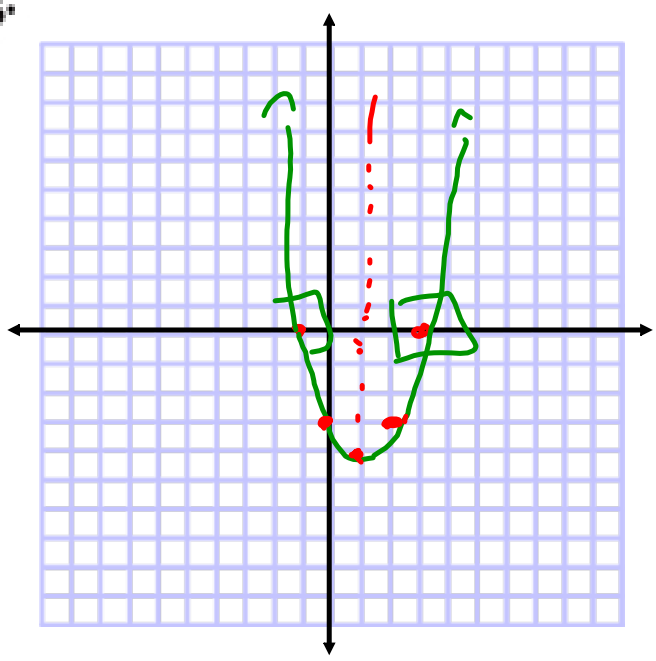
$-4 = 4$

$x^2 + (x) - 4$

$0^2 + (0) - 4$

$-3 = 0$

$(0, -3)$ $\quad (2, 3)$



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

$(x - 3)(x + 1) = 0$

$x = 3, -1$

Solve $-x^2 + 2x = 1$ by graphing.

$-x^2 + 2x = 1$ $+1$ $+1$

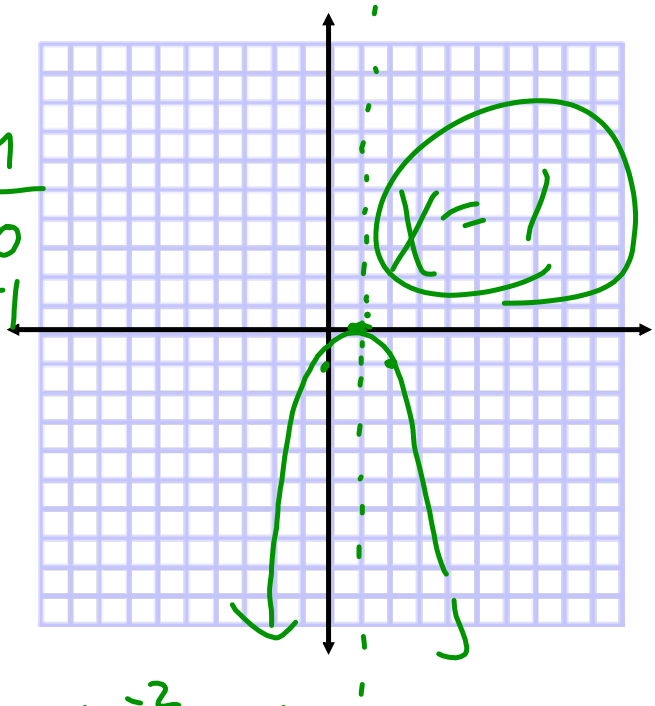
$-x^2 + 2x + 1 = 0$

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

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

$x = 1$

x	y
1	0
0	-1



$A = -1$

$B = 2$

$C = -1$

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

Solve $x^2 + 7 = 4x$ by graphing.

$x^2 + 7 = 4x$ $-4x$ $-4x$

$x^2 - 4x + 7 = 0$

$A = 1$ $B = -4$ $C = 7$

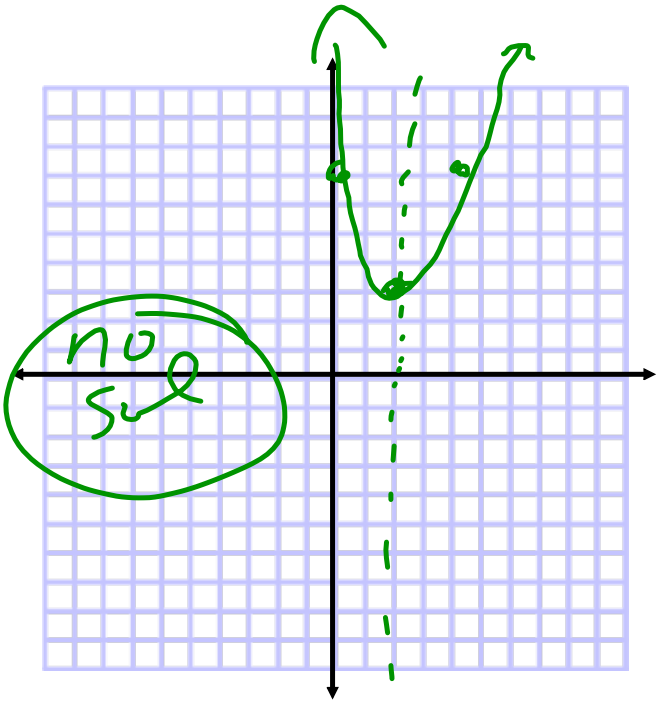
$x = -\frac{(-4)}{2(1)} = \frac{4}{2} = 2$

$(2, 3)$

$2^2 - 4(2) + 7$

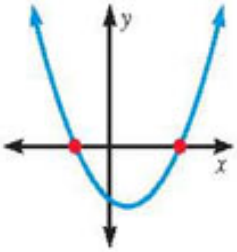
$4 - 8 + 7$

$(0, 7)$

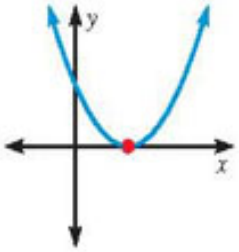


KEY CONCEPT *For Your Notebook*

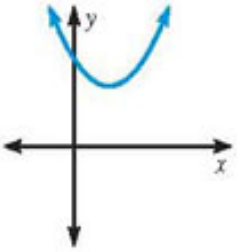
Number of Solutions of a Quadratic Equation



A quadratic equation has **two solutions** if the graph of its related function has **two *x*-intercepts.**



A quadratic equation has **one solution** if the graph of its related function has **one *x*-intercept.**



A quadratic equation has **no real solution** if the graph of its related function has **no *x*-intercepts.**

Find the zeros of $f(x) = x^2 + 6x - 7$.

$0 = x^2 + 6x - 7$

$0 = (x - 1)(x + 7)$

$x = -7, 1$

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

INTERPRET FUNCTION VALUES

The function value that is closest to 0 indicates the x-value that best approximates a zero of the function.

x	−3.9	−3.8	**−3.7**	−3.6	−3.5	−3.4	−3.3	−3.2	−3.1
$f(x)$	0.61	0.24	**−0.11**	−0.44	−0.75	−1.04	−1.31	−1.56	−1.79

x	−0.9	−0.8	−0.7	−0.6	−0.5	−0.4	**−0.3**	−0.2	−0.1
$f(x)$	−1.79	−1.56	−1.31	−1.04	−0.75	−0.44	**−0.11**	0.24	0.61

SPORTS An athlete throws a shot put with an initial vertical velocity of 40 feet per second as shown.

a. Write an equation that models the height h (in feet) of the shot put as a function of the time t (in seconds) after it is thrown.

b. Use the equation to find the time that the shot put is in the air.

Solution

a. Use the initial vertical velocity and the release height to write a vertical motion model.

$$h = -16t^2 + vt + s$$ **Vertical motion model**