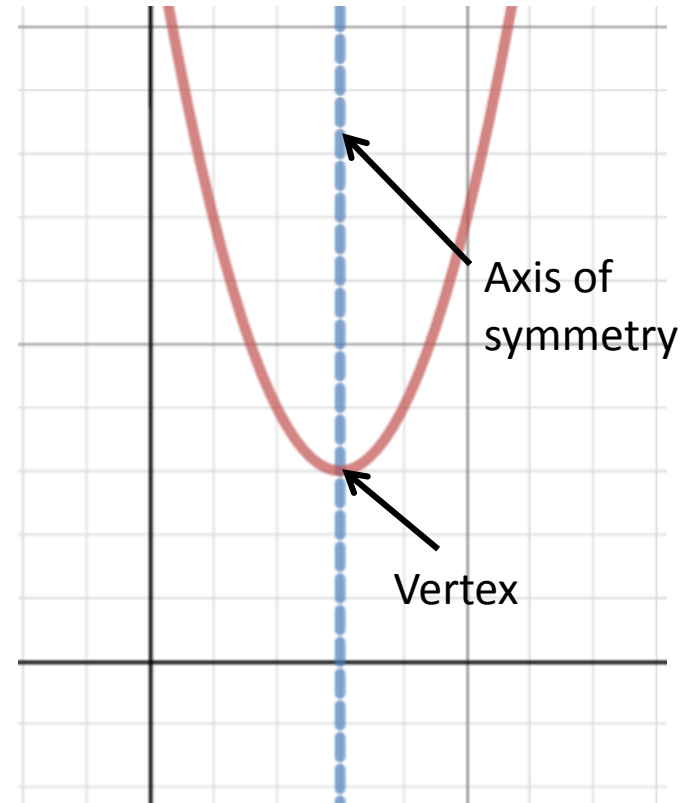


Quadratic Functions and Models

Section 2.1

Quadratic Functions

- $f(x) = ax^2 + bx + c$ is a quadratic function where a , b , and c are real numbers and $a \neq 0$.
- $a > 0$ opens upward
- $a < 0$ opens downward



Standard Form of a Quadratic

- $f(x) = a(x - h)^2 + k$ where $a \neq 0$.
 - Vertical axis $x = h$
 - Vertex at (h, k)
 - Opens upward if a is positive
 - Opens downward if a is negative

$$f(x) = a(x - h)^2 + k$$

↙
(h, k)

- Find the vertex and axis of

$$f(x) = x^2 + 6x - 1$$

$$f(x) = x^2 + \underline{6}x + 9 \quad -1 - 9$$

$$f(x) = (x + 3)^2 - 10$$

$$(-3, -10)$$

Recall:

$x^2 + 10x + 25$ factors as...

$$(x + 5)(x + 5)$$

$$(x + 5)^2$$

$x^2 - 4x + 4$ factors as...

$$(x - 2)(x - 2)$$

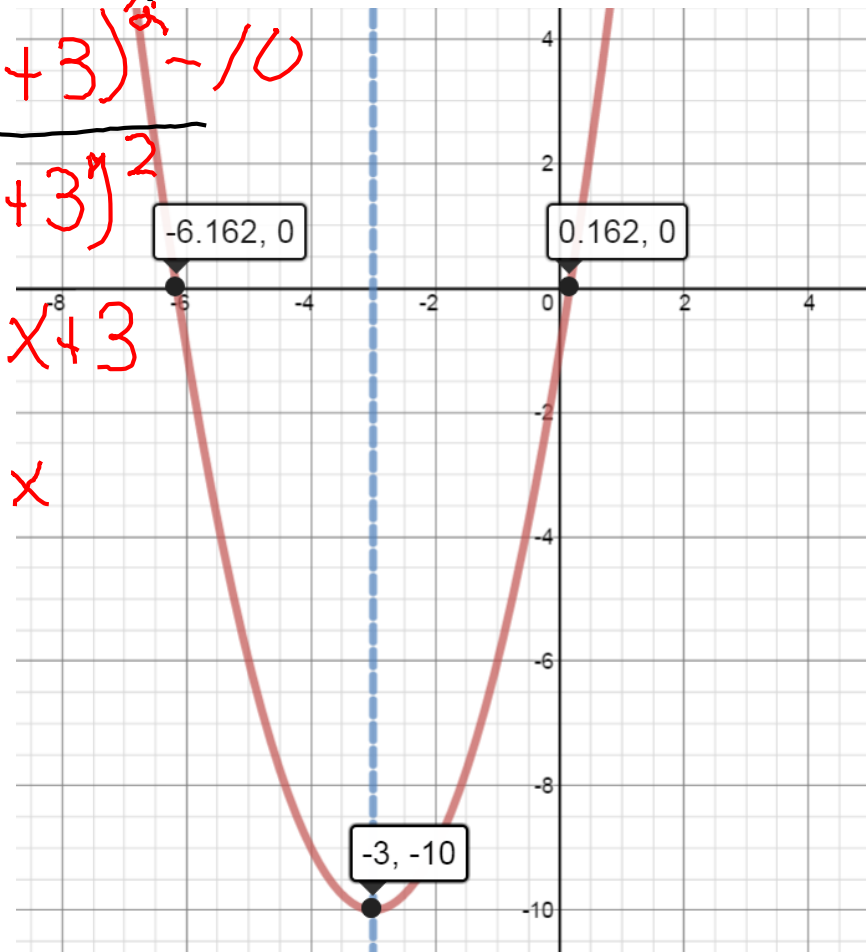
$$(x - 2)^2$$

$x^2 - 6x + 9$ factors as...

$$(x - 3)^2$$

- Find the zeros of $f(x) = (x + 3)^2 - 10$.

$$0 = (x + 3)^2 - 10$$
$$\sqrt{10} = \sqrt{(x + 3)^2}$$
$$\pm\sqrt{10} = x + 3$$
$$-3 \pm \sqrt{10} = x$$



$$y = -2x^2 - 4x + 1$$

$$\frac{y-1}{-2} = \frac{-2x^2-4x}{x^2+2x+1}$$

$$a \neq 1$$

- Find the vertex and axis of

$$f(x) = -2x^2 - 4x + 1$$

Recall:

$x^2 + 6x + 9$ factors as...

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

$$-2$$

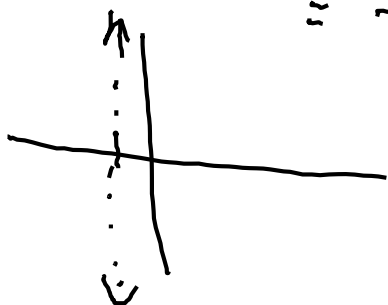
$$0$$

$$+2$$

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

$$(-1, 3)$$

$$x = -1$$



$$\frac{-1 \pm 1}{2}$$

$$\frac{1}{2} \left(\frac{1}{2} \right) \\ \left(\frac{1}{4} \right)^2$$

Your Turn

$$2 \left(\frac{1}{16} \right)$$

- Find the vertex and axis of

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

$$f(x) = 2 \left(x^2 - \frac{1}{2}x + \frac{1}{16} \right) + 1$$

$$\uparrow \qquad \qquad + \frac{1}{8} \qquad \qquad - \frac{1}{8}$$

$$2 \left(x - \frac{1}{4} \right)^2 + \frac{7}{8}$$

$$\left(\frac{1}{4}, \frac{7}{8} \right)$$

$$x = \frac{1}{4}$$

$\frac{1}{2}$ of middle term squared?

$$x^2 + 10x + 25 \\ \left(\frac{1}{2}(10) \right)^2$$

$$(x+5)^2$$

$$\left(x \pm \sqrt{c} \right)^2$$

$$y = a(x-h)^2 + k$$

- Find the standard form of the equation of the parabola with vertex at (1, -2) and passing through (3, 6).

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

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

$$6 = a(3-1)^2 - 2$$

$$6 = a(2)^2 - 2$$

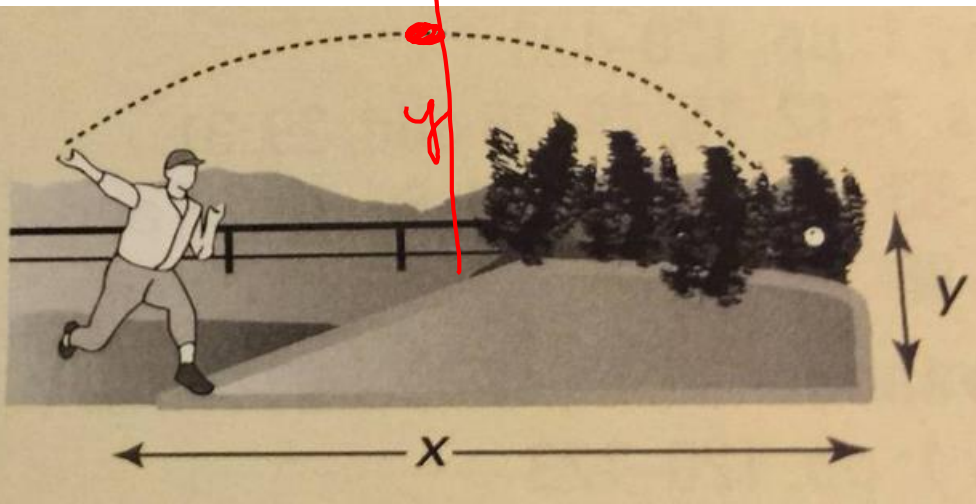
$$6 = 4a - 2$$

$$+2 \quad +2$$

$$8 = 4a \quad a = 2$$

Finding Min and Max

- The height y (in feet) of a ball thrown by a child is given by $y = -\frac{1}{8}x^2 + x + 4$, where x is the horizontal distance (in feet) from where the ball is thrown. How high is the ball when it's at its maximum height?



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

$-\frac{b}{2a}$ will get the x value of the max/min

- **2.1 Pg 120: 7-12, 15, 17, 20, 23, 30, 31, 34, 37, 43-44, 47, 50, 75**