Today's Objectives

- **Solve real-world application problems** by listening to and analyzing the properties of quadratic functions and recognizing corresponding polynomial features using the foursquare model as a graphic organizer.

- Success Criteria:
  - Apply transformations to a quadratic function
  - Rewrite quadratic in vertex form
  - Characterize quadratic functions from the verbal, algebraic, graphical, and analytical point of view.

- Vocabulary: quadratic, vertex, axes of symmetry, standard form, coefficients

Example **Transforming the Squaring Function**

Describe how to transform the graph of $f(x) = x^2$ into the graph of

$f(x) = 2(x-2)^2 + 3.$ ← up 3 units

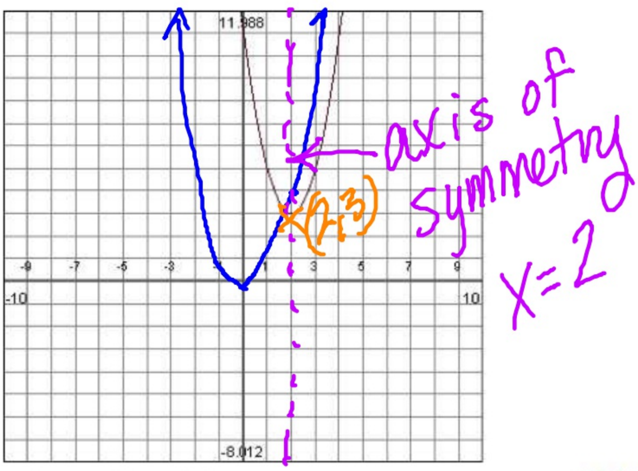
stretch by a factor of 2

Right 2 units

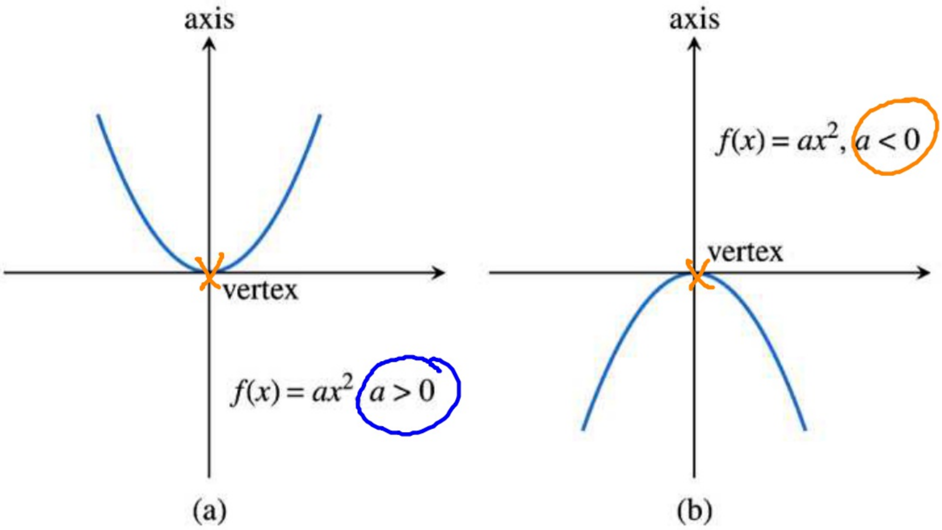
Example **Transforming the Squaring Function**

Describe how to transform the graph of $f(x) = x^2$ into the graph of $f(x) = 2(x-2)^2 + 3$.

The graph of $f(x) = 2(x-2)^2 + 3$ is obtained by vertically stretching the graph of $f(x) = x^2$ by a factor of 2 and translating the resulting graph 2 units right and 3 units up.



The Graph of $f(x) = ax^2$



Vertex Form of a Quadratic Equation

Any quadratic function $f(x) = ax^2 + bx + c$, $a \neq 0$, can be written in the vertex form

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

The graph of f is a parabola with vertex (h,k) and axis $x = h$, where $h = -b/(2a)$ and $k = c - ah^2$.

If $a > 0$, the parabola opens upward, and if $a < 0$, it opens downward.

Example **Finding the Vertex and Axis of a Quadratic Function**

Use the vertex form of a quadratic function to find the vertex and axis of the graph of $f(x) = 2x^2 - 8x + 11$. Rewrite the equation in vertex form.

$a=2 \quad b=-8 \quad c=11$

$h=\frac{-b}{2a} = \frac{--8}{2(2)} = \frac{8}{4} = 2$ $\quad (2,3)$

$k=c-ah^2 \quad 11-2(2)^2 = 3$

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

Example **Finding the Vertex and Axis of a Quadratic Function**

Use the vertex form of a quadratic function to find the vertex and axis of the graph of $f(x) = 2x^2 - 8x + 11$. Rewrite the equation in vertex form.

The standard polynomial form of f is $f(x) = 2x^2 - 8x + 11$.
So $a = 2$, $b = -8$, and $c = 11$, and the coordinates of the vertex are
$h = -\dfrac{b}{2a} = \dfrac{8}{4} = 2$ and $k = f(h) = f(2) = 2(2)^2 - 8(2) + 11 = 3$.
The equation of the axis is $x = 2$, the vertex is $(2,3)$, and the vertex form of f is $f(x) = 2(x-2)^2 + 3$.

Characterizing the Nature of a Quadratic Function

Fill in the following information in your 4-square graphic organizer.

Point of View	Characterization
Verbal	polynomial of degree 2
Algebraic	
Standard Form	$f(x) = ax^2 + bx + c$ or
Vertex Form	$f(x) = a(x-h)^2 + k \quad (a \neq 0)$
Graphical	parabola with vertex (h,k) and axis $x = h$; opens upward if $a > 0$, opens downward if $a < 0$; initial value = y-intercept = $f(0) = c$
	x-intercepts $= \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
analytical	increases & decreases at different rates

AM: Solve a proportion that generates a linear or quadratic equation

3. $\dfrac{3y}{-18} = \dfrac{-6}{y-9}$

[A] $y=-12$ or $y=3$ [B] $y=12$ or $y=3$

[C] $y=12$ or $y=-3$ [D] $y=-12$ or $y=-3$

$$(\cancel{-18})(y-9)\frac{3y}{\cancel{-18}} = \frac{-6}{\cancel{y-9}}(-18)(\cancel{y-9})$$

$$3y^2-27y=108$$
$$-108 \quad -108$$

$$3y^2-27y-108=0$$

$a=3$ $b=-27$ $c=-108$

18