

Graphing Parabolas in Vertex Form

* Vertex Form for a parabola: $y = a(x-h)^2 + k$

flip parabola if "a" is (-).
 moves parabola L/R
 * Think opposite!
 moves parabola up/down

pattern: from vertex $\Rightarrow 1 \uparrow 1$
 $\Rightarrow 2 \uparrow 4$

axis of symm: $x = h$

Vertically stretches or shrinks the parabola.

* where (h,k) is the vertex.

ex: $y = -(x+2)^2 - 3$ Describe the transformations.

flip the parabola
 left 2
 down 3

ex: $y = 2(x-1)^2 + 4$ Vertex: $(1, 4)$

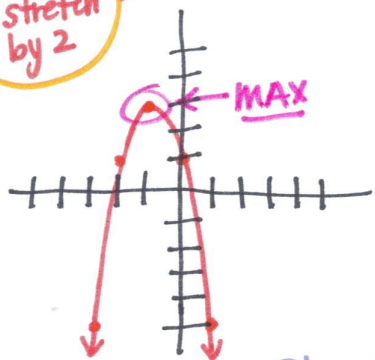
RI up 4
 Axis of Symm: $x = 1$
 use the x-value of the vertex or "h".

ex: $y = 3x^2 + 2$ Vertex: $(0, 2)$

No movement up 2
 Axis of Symm: $x = 0$

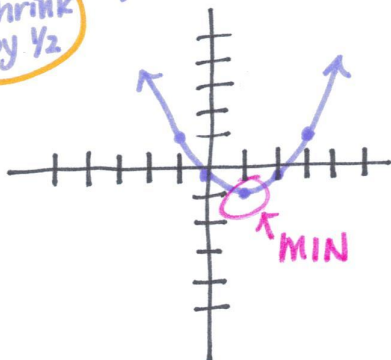
ex: $y = -2(x+1)^2 + 3$ Graph. Is the vertex a max or a min?

flip LI up 3
 stretch by 2
 Vertex: $(-1, 3)$
 pattern: $\Rightarrow 1 \downarrow 1 \cdot 2 = \downarrow 2$
 $\Rightarrow 2 \downarrow 4 \cdot 2 = \downarrow 8$



ex: $y = \frac{1}{2}(x-1)^2 - 1$ Graph. Is the vertex a max or a min?

shrink by 1/2
 RI down 1
 Vertex: $(1, -1)$
 pattern: $\Rightarrow 1 \uparrow 1 \cdot \frac{1}{2} = \uparrow \frac{1}{2}$
 $\Rightarrow 2 \uparrow 4 \cdot \frac{1}{2} = \uparrow 2$

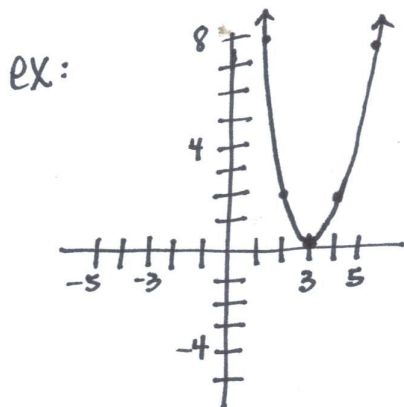


* Writing an equation from a graph: $y = a(x-h)^2 + k$

① Find the vertex $\rightarrow (h, k)$

② Check the pattern for stretches or shrinks $\rightarrow a$

③ If parabola is flipped over the x-axis \rightarrow make a negative

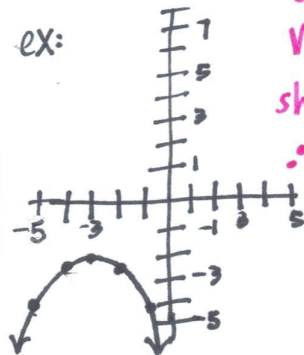


Vertex: $(3, 0)$

stretch by 2

$$\therefore y = 2(x-3)^2 + 0$$

ex:



upside-down

Vertex: $(-3, -2)$

shrunk by $1/2$

$$\therefore y = -\frac{1}{2}(x+3)^2 - 2$$

* Writing an equation given the vertex & one other point:

* Use the equation: $y = a(x-h)^2 + k$

* Plug in the vertex for h & k

* Plug in the other point for x & y

* Solve for a .

ex: vertex: $(-1, 3)$ $h = -1$
 $k = 3$
 point: $(1, 7)$ $x = 1$
 $y = 7$

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

$$7 = a(1 - (-1))^2 + 3$$

$$4 = a(2)^2$$

$$a = \frac{4}{2^2}$$

$$a = \frac{1}{2} \rightarrow y = \frac{1}{2}(x+1)^2 + 3$$

ex: vertex: $(2, -4)$ $h = 2$
 $k = -4$
 y-intercept: $2 \rightarrow (0, 2)$
 so... $x = 0$
 $y = 2$

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

$$2 = a(0-2)^2 - 4$$

$$\frac{6}{4} = \frac{a(2)^2}{4}$$

$$a = \frac{3}{2}$$

$$a = \frac{3}{2} \rightarrow y = \frac{3}{2}(x-2)^2 - 4$$