Quadratic Functions

$$y' = ax^2 + bx + c$$

where "a" and "b" are **coefficients** and "c" is a **constant**

- The functions is said to have a degree of 2 (highest exponent)
- There are 3 forms of a quadratic equation...

GENERAL	STANDARD	TRANSFORMATIONAL
$y = ax^2 + bx + c$	* $y = a(x-h)^2 + k$ $V(h,k)$	$\frac{1}{a}(y-k) = (x-h)^2$ $V(h,k)$

Standard Quadratic

$y = x^2$

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

$V(7,-2)$

where **"a"** is the **vertical stretch factor**
"**h**" is the **horizontal translation**
"**k**" is the **vertical translation**

Mapping Notation - a notation that describes how a graph and its image are related.

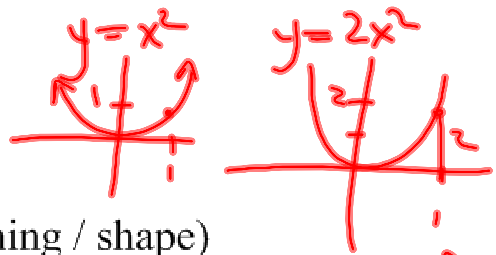
For Quadratic Functions...

$$(x, y) \Rightarrow (x + h, ay + k)$$

Where the first point from the graph $y = x^2$ maps onto a point in the image graph.

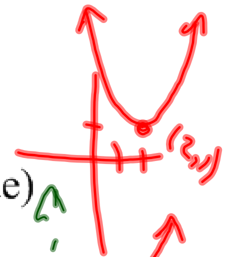
Properties of a Quadratic

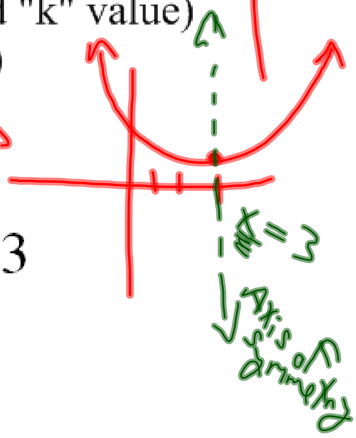
- identify key properties and points...



STANDARD FORM:

- Stretch Factor (direction of opening / shape)
- Translations (horizontal / vertical)
- Vertex (h, k)
- Domain {any real number} → $x \in R$
- Range (depends on direction of opening and "k" value)
- Mapping Notation: $(x, y) \longrightarrow (x + h, ay + k)$
- Axis of symmetry where $x = h$
- y intercept (let $x = 0$)





ex: $y = -2(x-1)^2 + 3$

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

1) Direction of opening: Down

2) Vertex: $(1, 3)$

3) Stretch Factor: 2

4) Max. or Min. Value: Max $= 3$

5) Domain: $x \in R$

6) Range: $\{y \mid y \leq 3, y \in R\}$

7) Mapping Notation ($y = x^2$)

$(x, y) \rightarrow (x+1, -2y+3)$

8) Draw a sketch

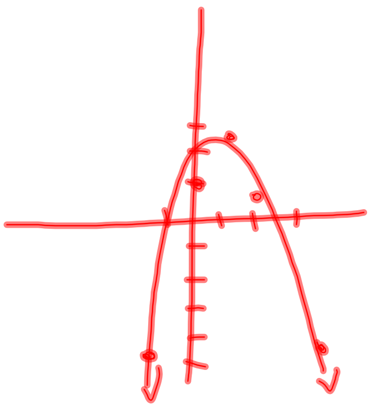
$$y = x^2 \longrightarrow y = -2(x-1)^2 + 3$$

$(x, y) \rightarrow (x+1, -2y+3)$

$(0,0) \rightarrow (0+1, -2(0)+3)$

x	y
0	0
1	1
2	4
-1	1
-2	4

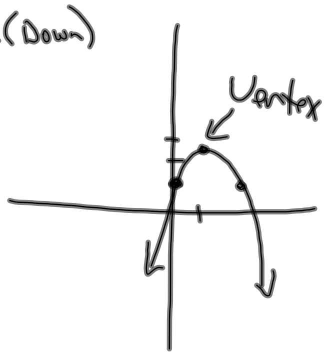
x	y
1	3
2	1
3	-5
0	1
-1	-5



OR Method II

Vertex, S. Factor, & Symmetry

S.F. = 2 (Down)

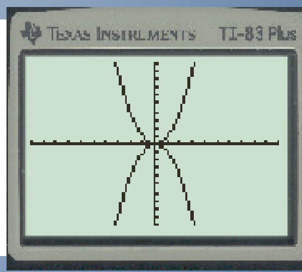


Transformations of the Quadratic Function in Standard Form

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

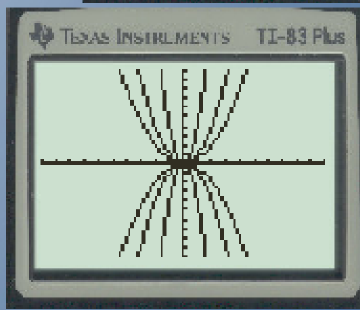
Direction of Opening: ("Look at the sign of the stretch factor")

- If $a > 0$, then the graph *opens upward*.
- If $a < 0$, then the graph opens *downward*.



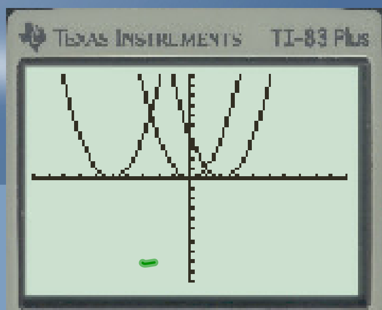
Vertical Stretch: ("Look at the magnitude of the stretch factor")

- If $|a| > 1$, then the graph becomes *narrower*.
- If $|a| = 1$, then the graph *stays the same*. ______.
- If $0 < |a| < 1$, then the graph becomes *wider*.



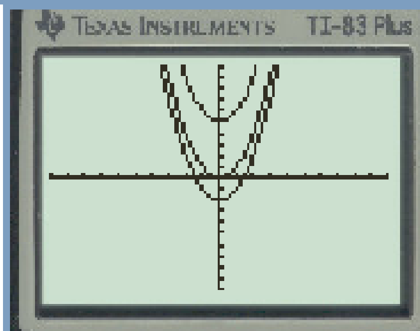
Horizontal Translation: ("Think opposite")

- If $h > 0$, then the graph *moves to the right h units*.
- If $h = 0$, then the graph *does not move horizontally*.
- If $h < 0$, then the graph *moves to the left h units*.



Vertical Translation: ("Exactly the same")

- If $k > 0$, then the graph *moves upward k units*.
- If $k = 0$, then the graph *does not move vertically*.
- If $k < 0$, then the graph *moves downward k units*.



ex. $y = -3(x+4)^2 - 2$ (Standard)

express in Transformational & General Form

Transformational

$-\frac{1}{3}(y+2) = (x+4)^2$

General

$y = -3(x^2+8x+16) - 2$

$y = -3x^2 - 24x - 48 - 2$

$y = -3x^2 - 24x - 50$

HOMEWORK...

Sheet #1

Worksheet - Transformations of the Quadratic.doc

Worksheet Solns - Transformations Sheet 1.doc

Worksheet Solns - Transformations Sheet 2.doc

Attachments

Worksheet - Transformations of the Quadratic.doc

Worksheet Solns - Transformations Sheet 1.doc

Worksheet Solns - Transformations Sheet 2.doc