

# 6.1

## Exploring Quadratic Relations

### GOAL

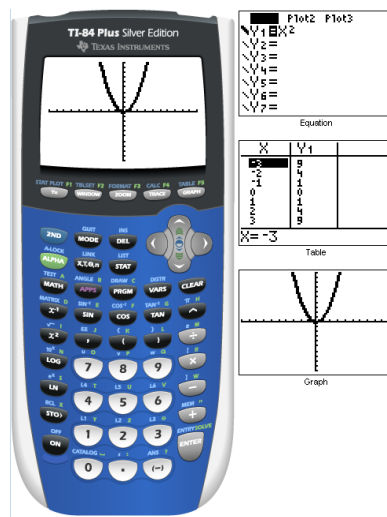
Determine the characteristics of quadratic relations.

#### quadratic relation

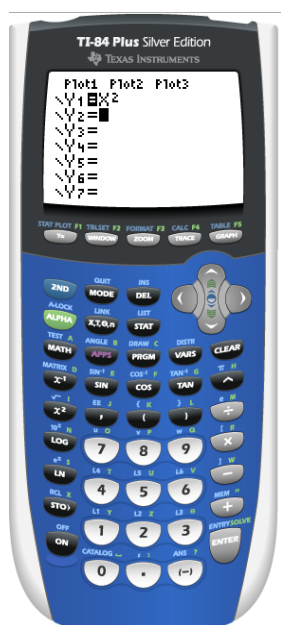
A relation that can be written in the standard form  $y = ax^2 + bx + c$ , where  $a \neq 0$ ; for example,  $y = 4x^2 + 2x + 1$

#### Notes...

- parabolic in shape
- non linear
- highest power is 2 (degree 2)
- is a **function**, where each x value has only one y value [vertical line test]



# Properties in Vertex Form...



Grab a 'Graphing Calculator'

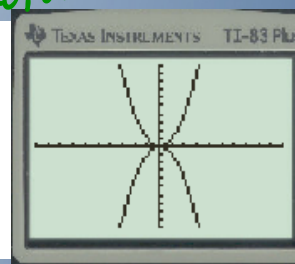
# Vertex Form..

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

horizontal (pointing to  $x - h$ )  
vertical (pointing to  $k$ )  
stretch factor (pointing to  $a$ )

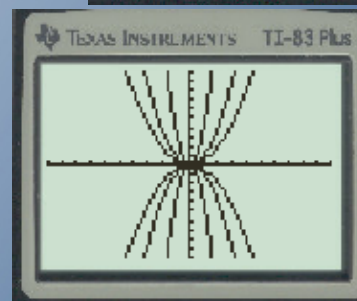
**Direction of Opening:** ("Look at the sign of the stretch factor")

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



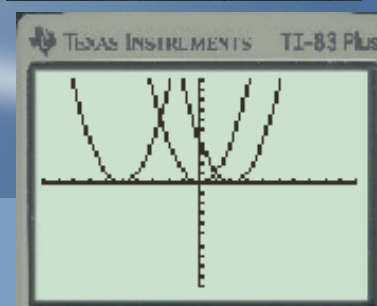
**Vertical Stretch:** ("Look at the magnitude of the stretch factor")

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



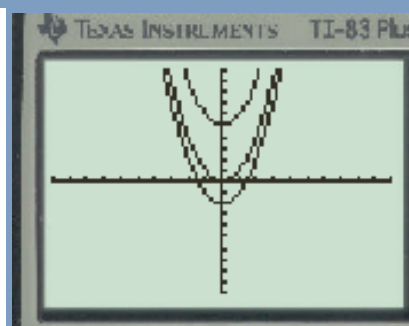
**Horizontal Translation:** ("Think opposite")

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



**Vertical Translation:** ("Exactly the same")

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



## ALL Properties of a Quadratic

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

- **TRANSFORMATIONS...**

- stretch factor 'a' --> direction of opening & shape
- translations 'h' and 'k' --> horizontal / vertical movements

- **KEY POINTS...**

- vertex (h, k) --> lowest / highest point on the parabola
- x intercept(s) --> where the graph crosses the x axis
  - > let  $y = 0$  and solve for x
  - (we will come back to this property)**
- y intercept --> where the graph crosses the y axis
  - > let  $x = 0$  and solve for y
  - > is the 'c' value in standard form

- **PROPERTIES...**

- Domain --> describes all possible x values
  - > for quadratic functions  $\{x \in \mathbb{R}\}$
- Range --> describes all possible y values
  - > depends on direction of opening and "k" value in vertex
- Maximum / Minimum Value --> highest / lowest y value
  - > depends on direction of opening and "k value)
- Axis of symmetry --> vertical line of symmetry through vertex
  - [A.O.S] --> described through  $x = h$

# HOMEWORK EXERCISE:

	OPEN UP? OPEN DOWN?	NARROW? WIDER?	LEFT? RIGHT?	UP? DOWN?
Plot1				
Plot2				
Plot3				
$Y_1 = X^2$				
$Y_2 = -2X^2 + 5$				
$Y_3 = 0.5(X-3)^2 - 4$				
$Y_4 = 5X^2$				
$Y_5 = -1/2(X+7)^2 + 2$				
$Y_6 = 7(X-1)^2 - 22$				