

6.1

Exploring Quadratic Relations

GOAL

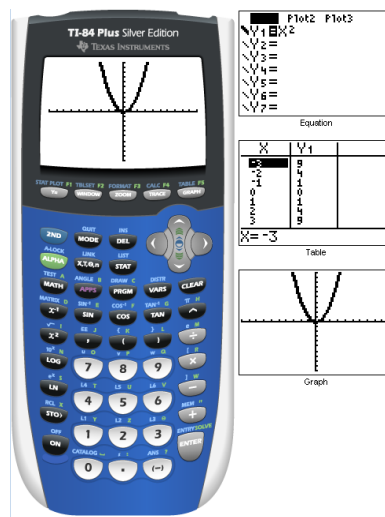
Determine the characteristics of quadratic relations.

quadratic relation

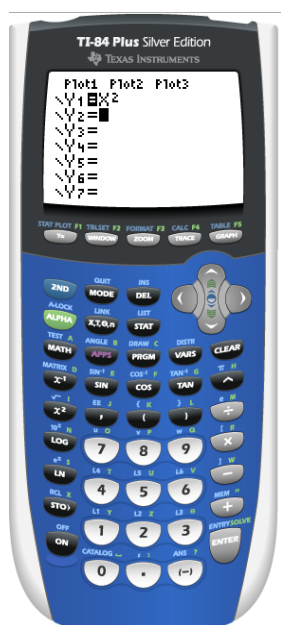
A relation that can be written in the standard form $y = ax^2 + bx + c$, where $a \neq 0$; for example, $y = 4x^2 + 2x + 1$

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..

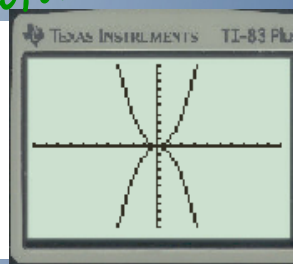
$$y = a(x - h)^2 + k$$

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")

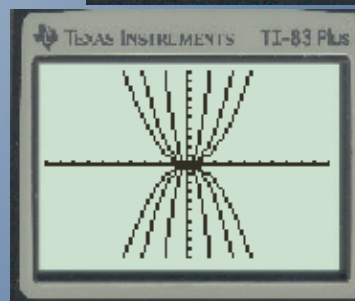
positive

- 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.

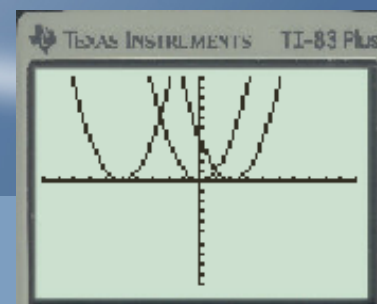


Horizontal Translation: ("Think opposite")

positive

- 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.

negative

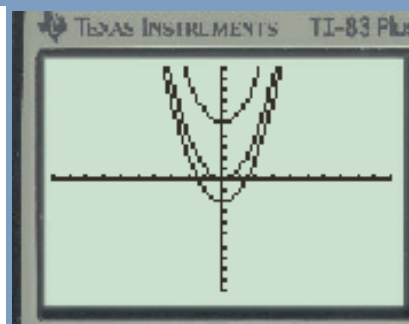


Vertical Translation: ("Exactly the same")

positive

- 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.

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				
$Y_1 = X^2$				
$Y_2 = -2X^2 + 5$				
$Y_3 = 0.5(X-3)^2 - 4$				
$Y_4 = 5X^2$				
$Y_5 = -1/2(X+7)^2 + 2$				
$Y_6 = 7(X-1)^2 - 22$				