

Mathematics 11C

4.2 – The Quadratic Relation

$$y = ax^2 + k$$

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The bare bones, stripped down quadratic is $y = x^2$.

So, what do the a and k represent?

→ a is called the stretch factor. The y coordinates from $y = x^2$ are multiplied by a .

→ k is the maximum or minimum value.

k is added to the values of $y = ax^2$

Let's take a look.

$$\textcircled{1} y = x^2$$

$$\textcircled{2} y = 2x^2$$

$$\textcircled{3} y = 5x^2$$

$$\textcircled{4} y = -2x^2$$

$$\textcircled{5} y = \frac{1}{25}x^2$$

$$\textcircled{6} y = -\frac{1}{100}x^2$$

$$\textcircled{7} y = x^2$$

$$\textcircled{8} y = x^2 + 2$$

$$\textcircled{9} y = 2x^2 - 4$$

$$\textcircled{10} y = -3x^2 + 2$$

$$\textcircled{11} y = \frac{1}{4}x^2 - 1$$

$$y = \frac{5}{3}x^2 + 1$$

Notes:

- when $a > 0$, the graph opens up and therefore K is a minimum value
- when $a < 0$, the graph opens down and K is a maximum value
- when $a > 1$ or $a < -1$, the graph is skinny
- when $-1 < a < 1$, graph is wide.

a and k are called transformations. They transform the base-boned $y = x^2$ into a new parabola.

$a > 1, a < -1 \Rightarrow$ skinny

$\rightarrow a$ is called Vertical Stretch/compression

$-1 < a < 1$
wider

$\rightarrow k$ is call vertical Shift

$$\textcircled{1} \quad y = \underline{\underline{-2}}x^2 - 3$$

- Vertical stretch of -2

- Vertical shift of -3

$$\textcircled{2} \quad y = \frac{1}{3}x^2 + 4$$

- V. Compression of $\frac{1}{3}$

- V. shift of 4