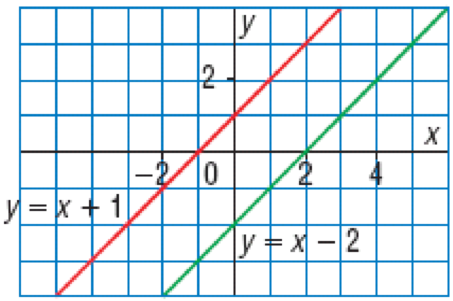
2.6 Transformations

Here is the graph of two parallel lines. Which translation would move one line so that it coincides with the other line?



translation 3 units down

Start with the equation of the quadratic function $y = x^2$. mother function

* Graph the function in $y_1 = x^2$
* In y_2 Graph $y = x^2 + q$ (Try multiple values of q)

$y_2 = x^2 + 5$ $y_3 = x^2 - 7$

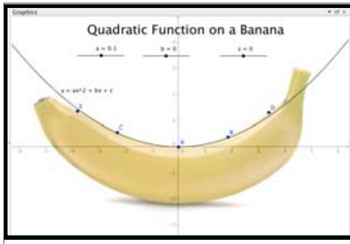
How does the graph of $y = x^2 + q$ change as the value of q changes?

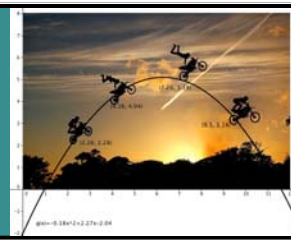
Vertical translation q units

What is true for all graphs?

$q > 0$ vertical translation up

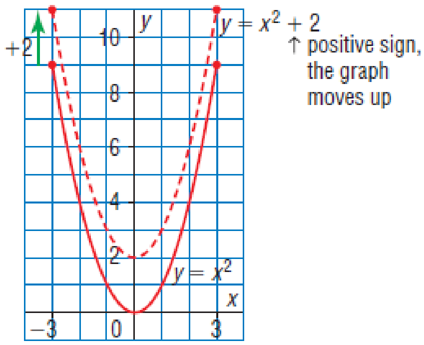
$q < 0$ " " down

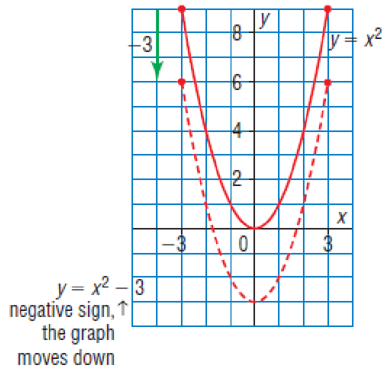


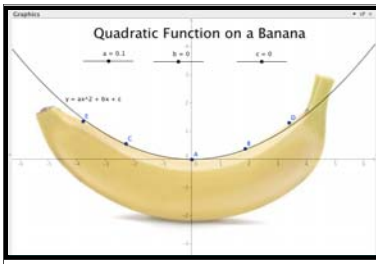


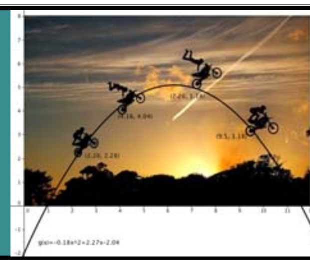
The Effect of Changing q in $y = x^2 + q$

The graph of $y = x^2 + q$ is the image of the graph of $y = x^2$ after a vertical translation of q units.









Start with the equation of the quadratic function $y = x^2$.

* Graph the function in $y_1 = x^2$
* In y_2 Graph $y = (x-p)^2$ (Try multiple values of p)

How does the graph of $y = (x-p)^2$ change as the value of p changes?

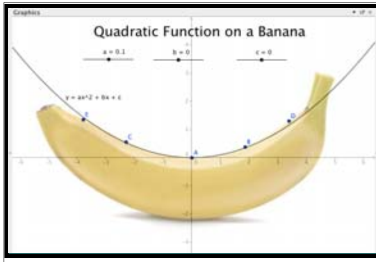
horizontal translation p units

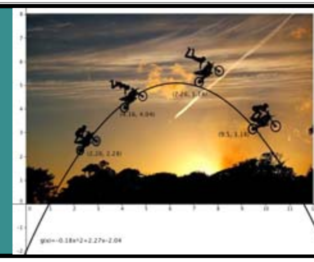
What is true for all graphs?

$p > 0$ horizontal translation left

$p < 0$ " " right

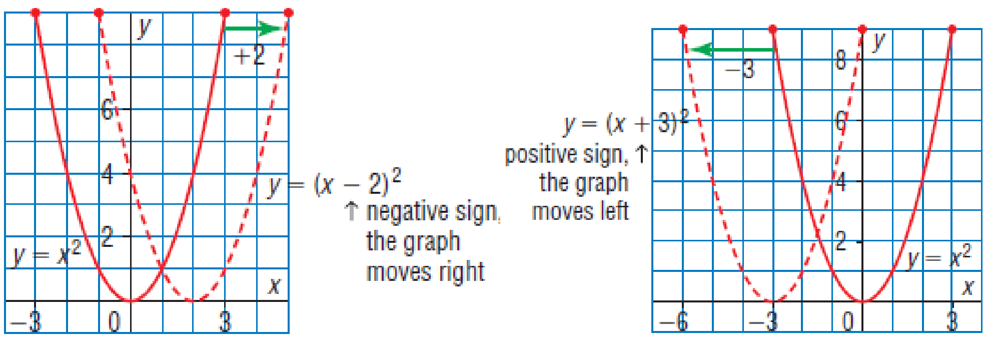
opposite of your intuition

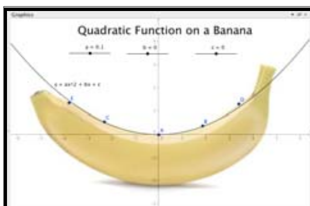


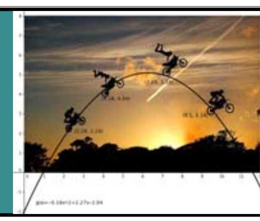


The Effect of Changing p in $y = (x-p)^2$

The graph of $y = (x-p)^2$ is the image of the graph of $y = x^2$ after a horizontal translation of p units.







Start with the equation of the quadratic function $y = x^2$.

* Graph the function in $y_1 = x^2$
* In y_2 Graph $y = \underline{a}x^2$ (Try multiple values of a)
  (Use 0, positive and negative values)

How does the graph of $y = ax^2$ change as the value of a changes?

- negative : reflection about the x-axis
- Value: vertical stretch or compression of x^2

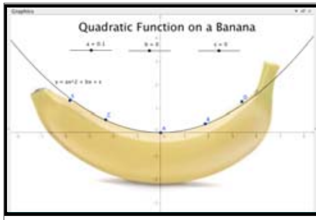
What is true for all graphs?

$a>0$ opens up

$a<0$ opens down

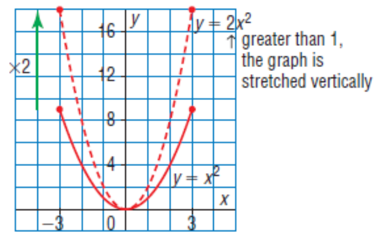
$\underbrace{0<a<1}_{\text{fraction}}$ vertical compression

$a>0$ vertical stretch

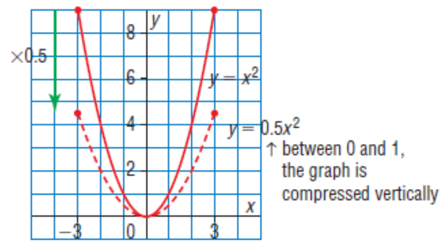


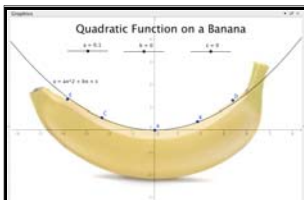
The Effect of Changing a in $y = ax^2$

The graph of $y = ax^2$ is the image of the graph of $y = x^2$ after a vertical stretch of factor a when $a > 1$.

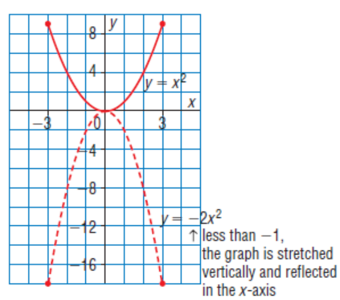


The graph of $y = ax^2$ is the image of the graph of $y = x^2$ after a vertical compression of factor a when $0 < a < 1$.

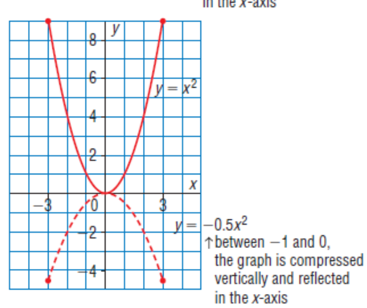


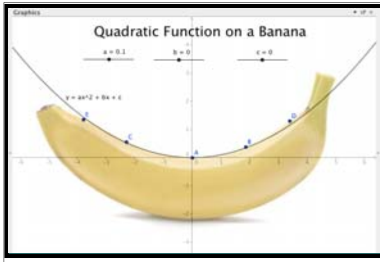


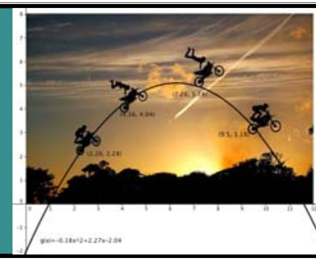
The graph of $y = ax^2$ is the image of the graph of $y = x^2$ after a vertical stretch of factor a and a reflection in the x-axis when $a < -1$.



The graph of $y = ax^2$ is the image of the graph of $y = x^2$ after a vertical compression of factor a and a reflection in the x-axis when $-1 < a < 0$.







When these three transformations are combined, the resulting equation is the [redacted] of the equation of a quadratic function:

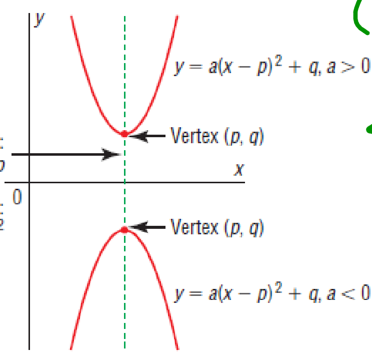
$y = a(x - \underline{p})^2 + \underline{q}$

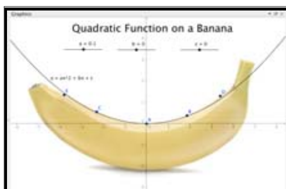
Vertex Form

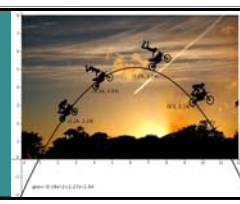
$y = a(x-h)^2 + k$

(p, q) vertex

switch sign

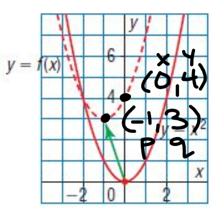






Writing an Equation in Vertex Form

Ex.) Write an equation of the function $y = f(x)$ in vertex form.



$y = a(x-p)^2 + q$

$y = a(x+1)^2 + 3$ * Finding 'a'.

$4 = a(0+1)^2 + 3$

$4 = 1a + 3$

$-3 \qquad -3$

$1 = a$

$\boxed{y = 1(x+1)^2 + 3}$

Pg. 157 # 1, 3, 5, 6.