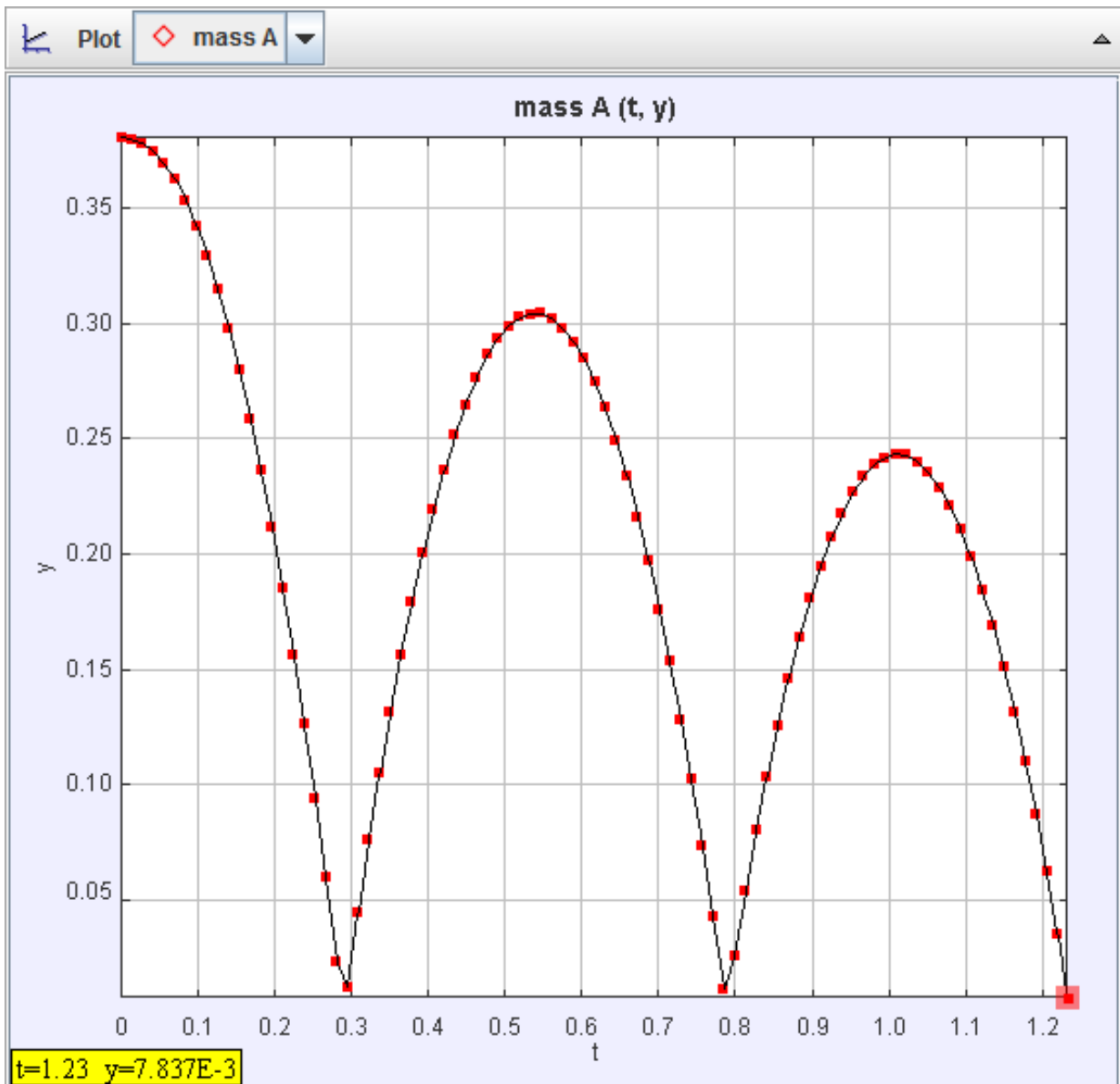
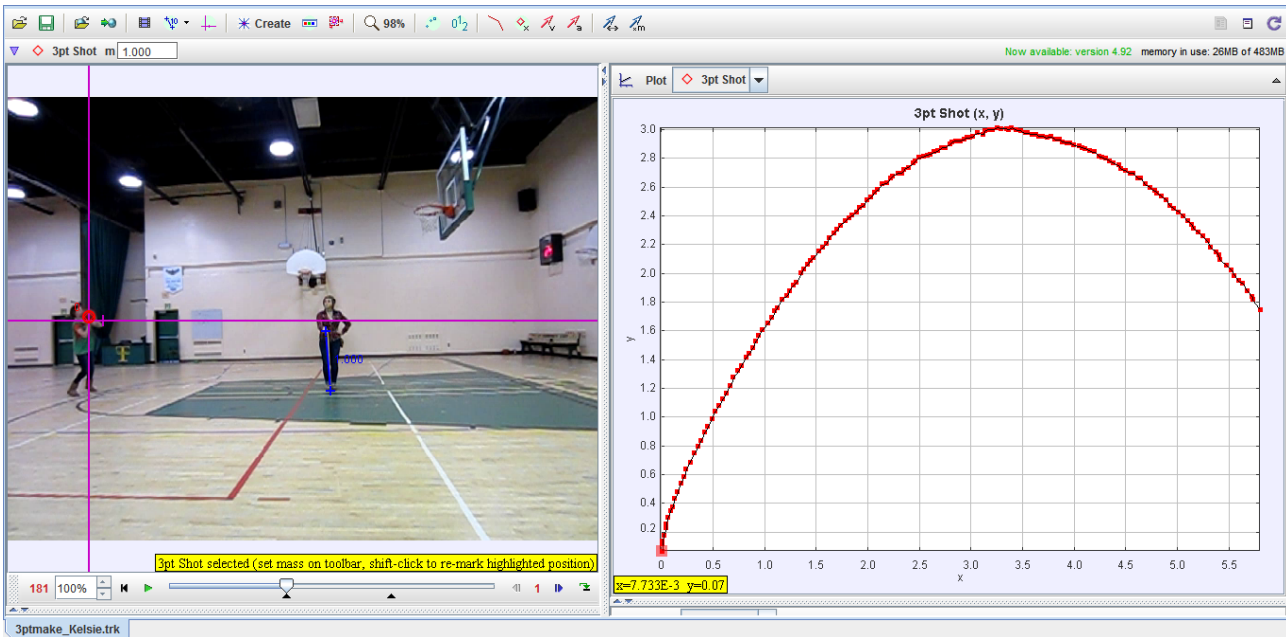


Quadratic Functions

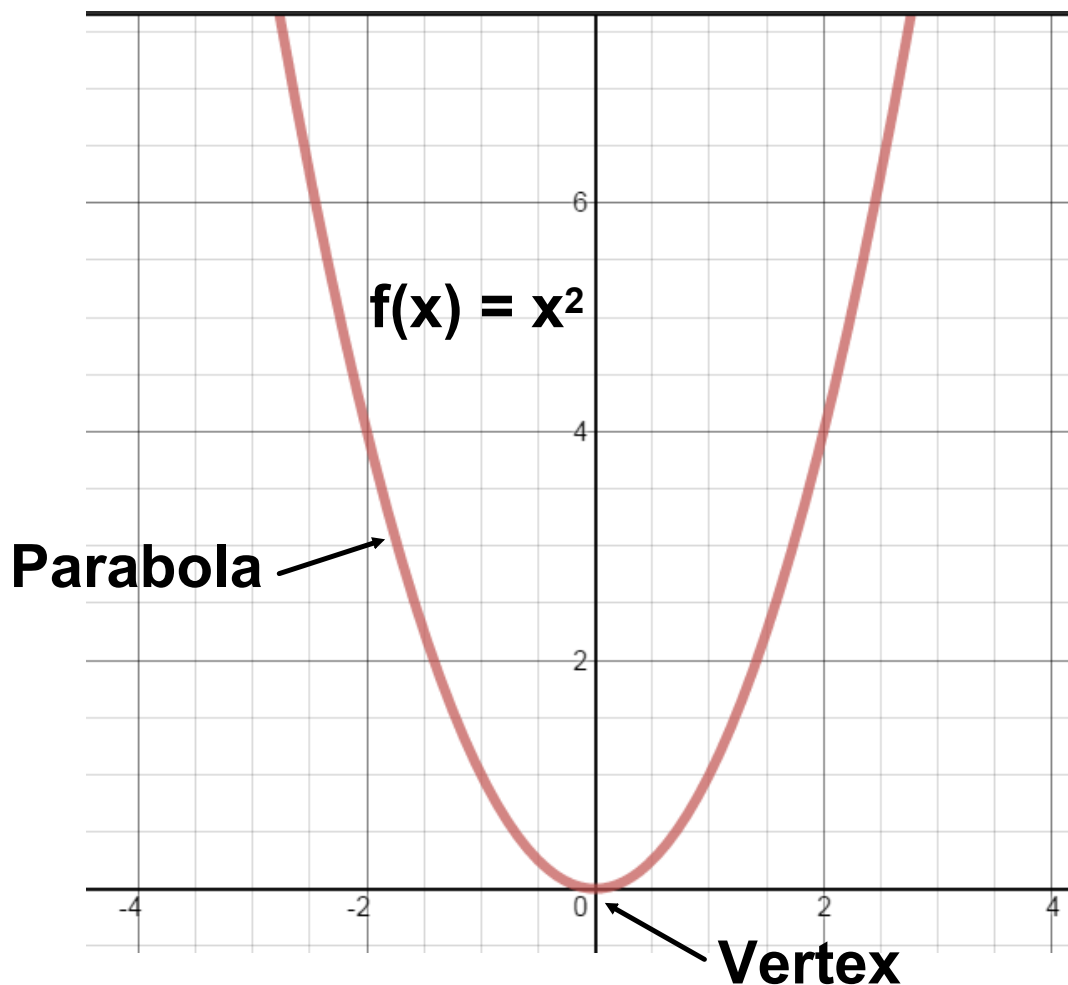


Investigating the Quadratic Function In VERTEX form!

$$\text{Vertex Form: } f(x) = a(x-p)^2 + q$$

$$\text{Standard Form: } f(x) = ax^2 + bx + c$$

Let's explore the effect of **a**, **p** and **q** on the function $f(x) = x^2$



The Stretch Factor: ax^2

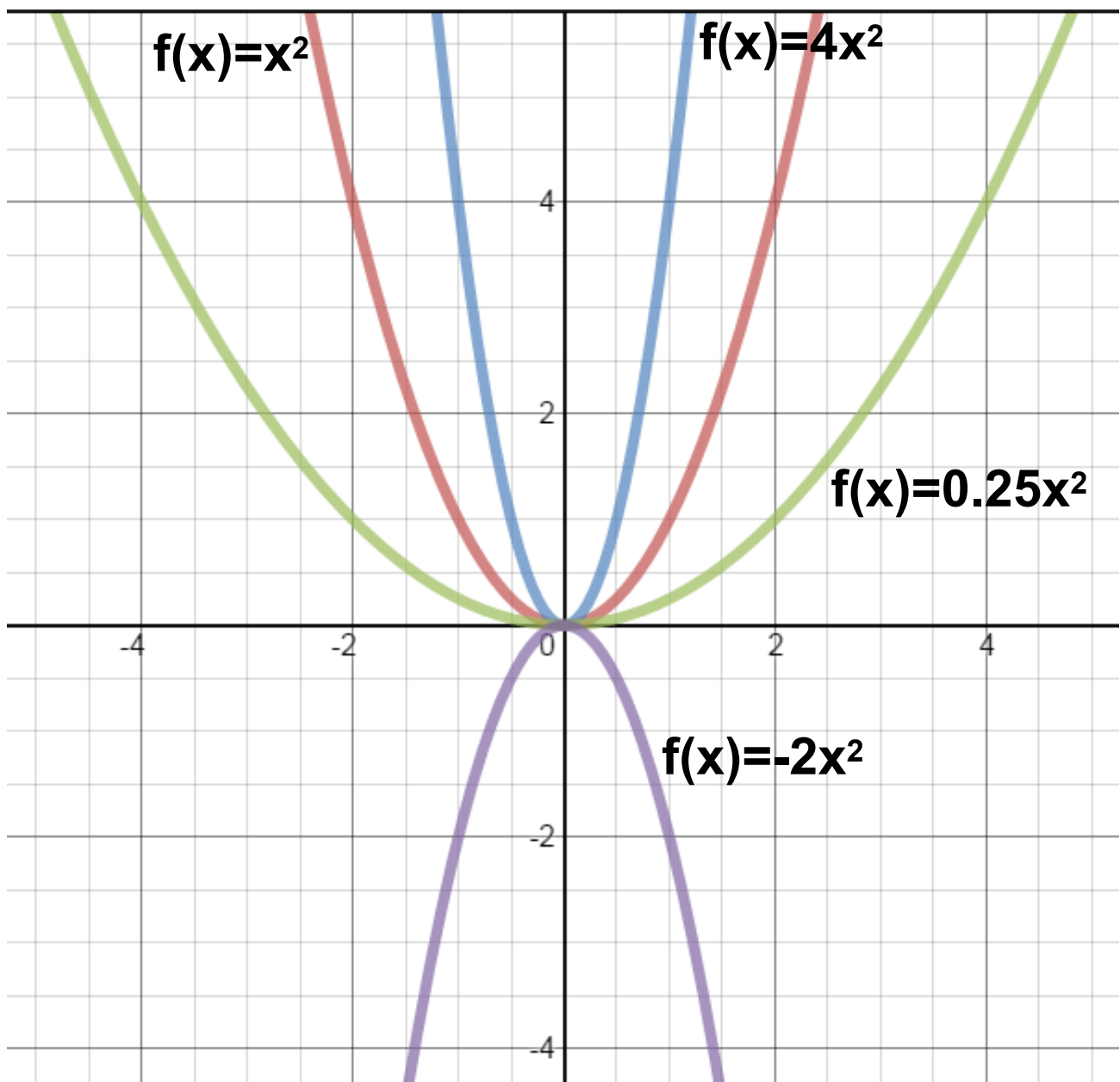
$|a|$ is the stretch factor.

$|a| > 1$: narrows the graph.

$0 < |a| < 1$: widens out the graph.

$a > 0$: Opens up (vertex is a minimum).

$a < 0$: Opens down (vertex is a maximum).

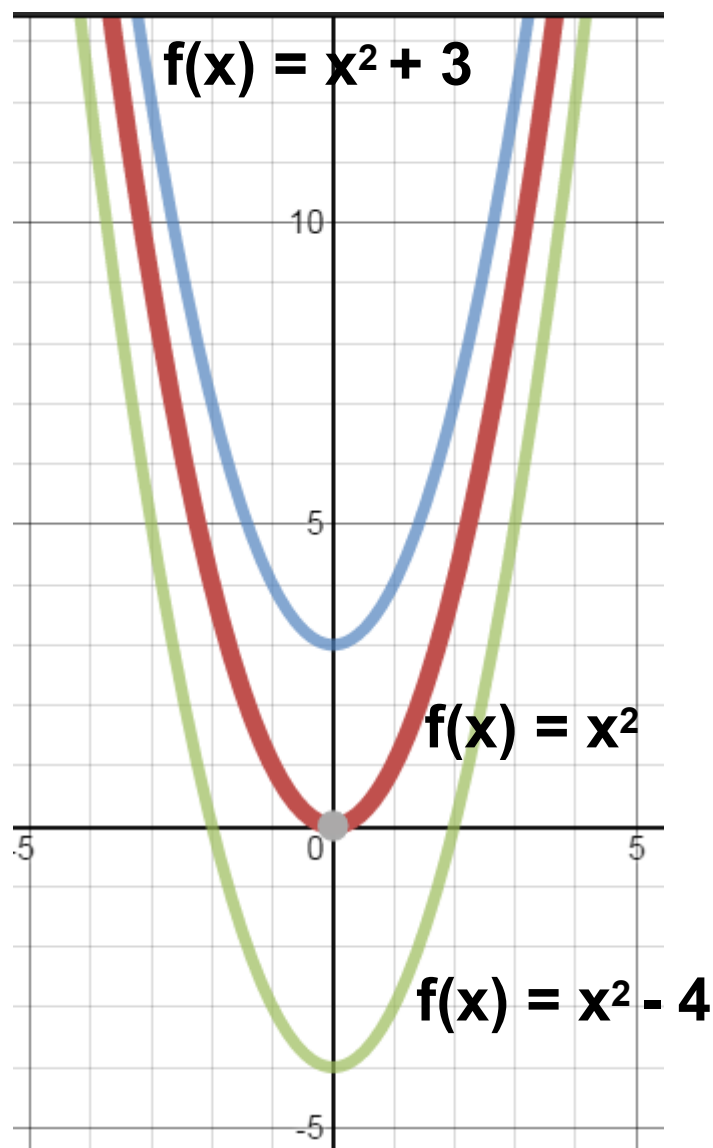


The Effect of "q": $f(x) = x^2 + q$

$q > 0$: translates (moves) the graph up vertically.

$q < 0$: translates the graph down vertically.

q is the y -coordinate of the vertex.



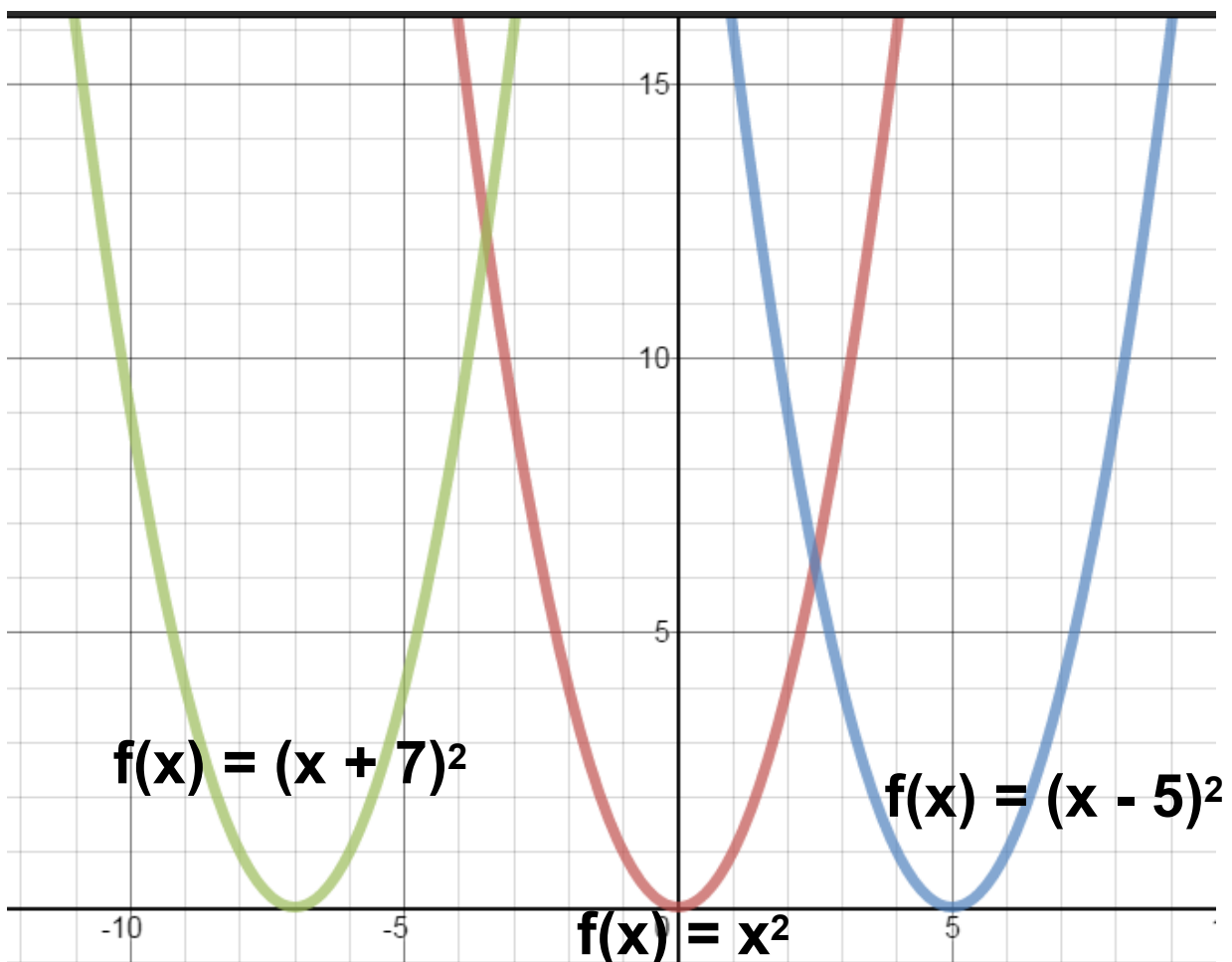
The Effect of "p": $f(x) = (x - p)^2$

$p > 0$: translates the graph horizontally to the right.

$p < 0$: translates the graph horizontally to the left.

p is the x-coordinate of the vertex.

$x = p$ is the equation of the axis of symmetry.

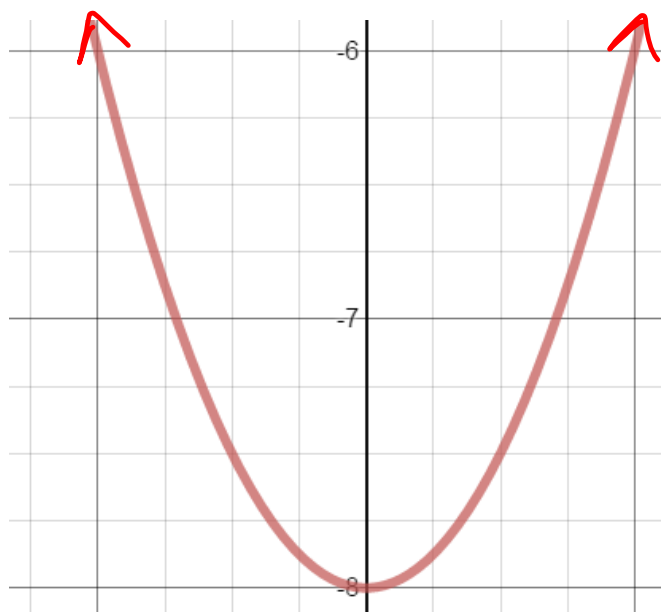


Note on Domain & Range

Domain: All possible x-axis values.

Range: All possible y-axis values.

The mathematical notation for domain and range contains a lot of information. It is a formal use of math communication. In math everything must be defined and made clear for communicating information.

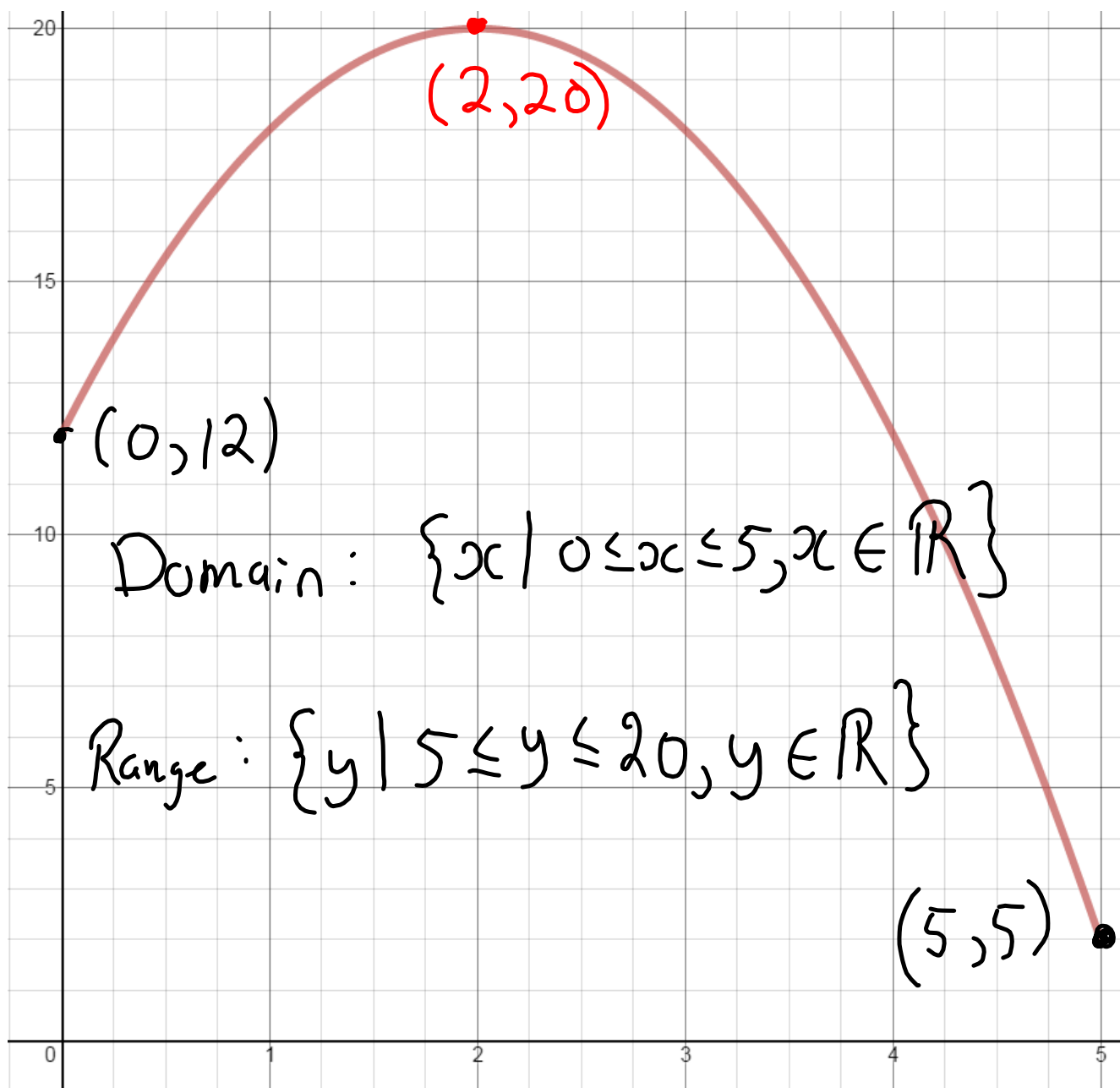


$$\{x|x \in \mathbb{R}\}$$

The set of all **x**-values such that **x** is an element of the real numbers.

$$\{y|y \geq -8, y \in \mathbb{R}\}$$

The set of all **y**-values such that **y** is greater or equal to negative eight and **y** is an element of the real numbers.

Write the Domain and Range of the Following

Putting it All Together

Determine the following characteristics for each function.


- the stretch factor
- the vertex
- the domain and range
- the direction of opening
- the equation of the axis of symmetry.

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

$$f(x) = -2(x - 9)^2 + 4$$

Stretch factor, $a = -2$

Vertex $(p, q) = (9, 4)$

opening: down ($a < 0$) 

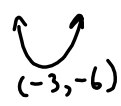
Domain: $\{x \mid x \in \mathbb{R}\}$

Range: $\{y \mid y \leq 4, y \in \mathbb{R}\}$

Eq. of symmetry: $x = 9$

$$f(x) = 0.1(x + 3)^2 - 6$$

$a = 0.1$

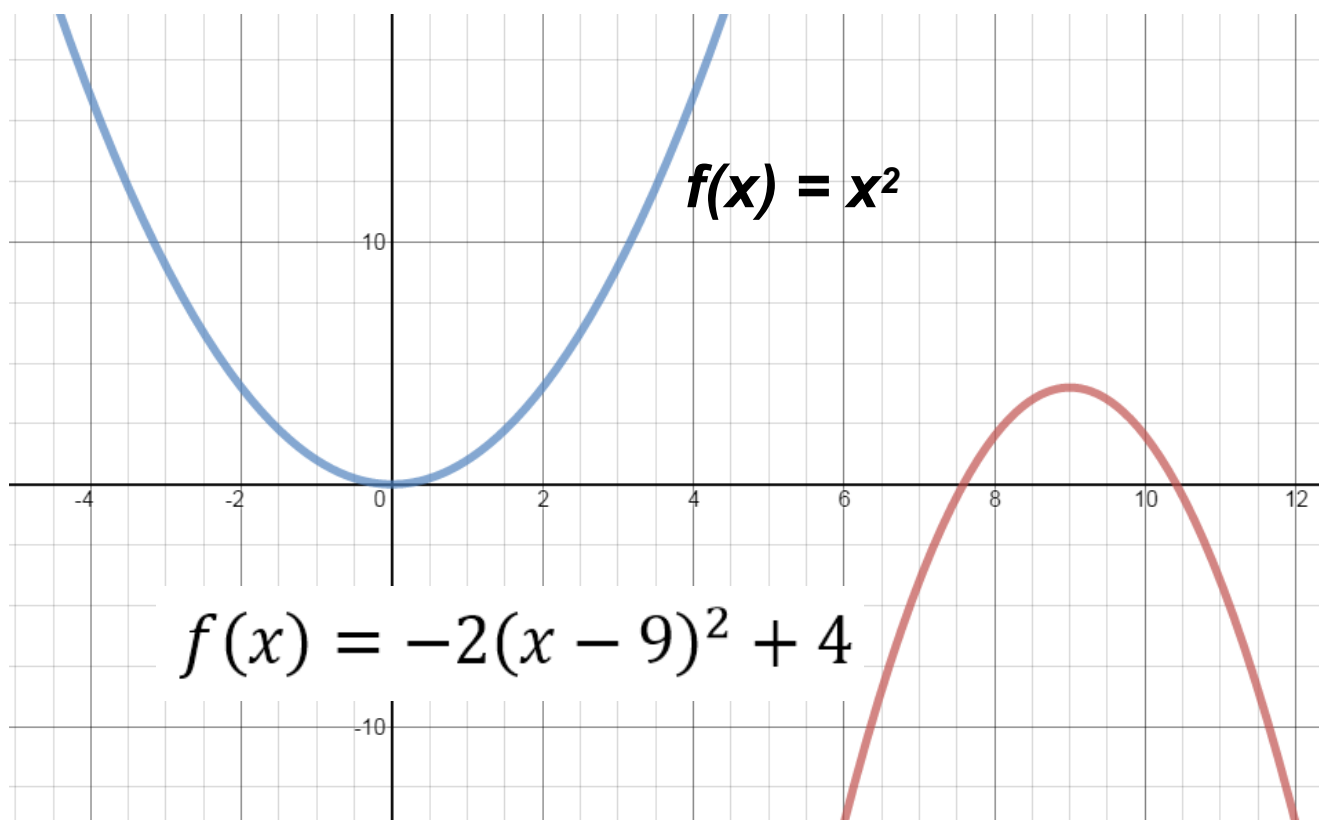
opening: up 

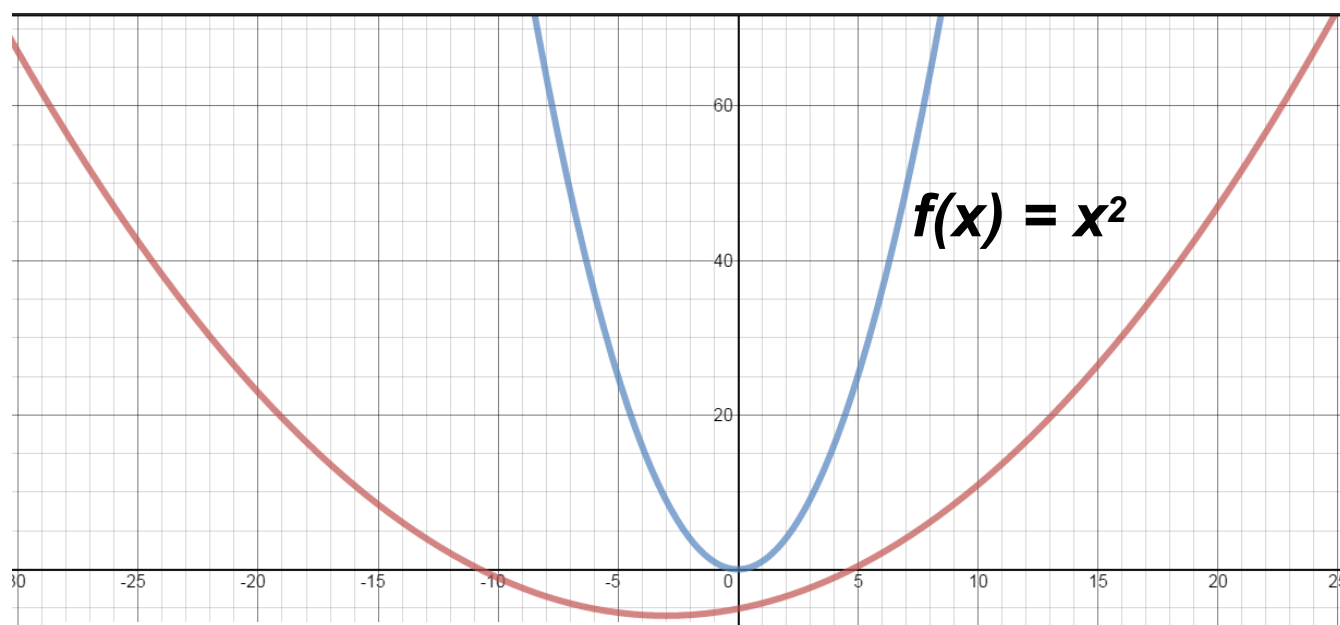
Vertex $(p, q) = (-3, -6)$

Domain: $\{x \mid x \in \mathbb{R}\}$

Range: $\{y \mid y \geq -6, y \in \mathbb{R}\}$

axis of symmetry: $x = -3$ ($x = p$)





$$f(x) = 0.1(x + 3)^2 - 6$$

1. Complete Worksheet

"Getting Info. from Vertex Form"