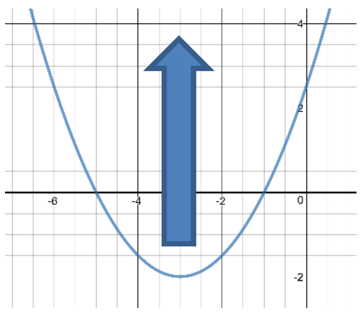
Quadratics in Vertex Form:

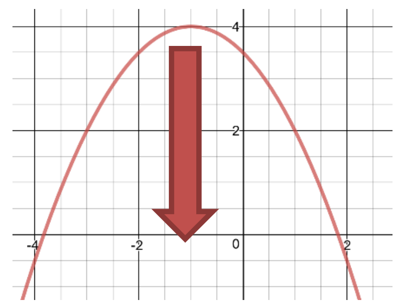
Concavity, Maximums, and Minimums

A quadratic can be written in many forms:

- Vertex Form: $y = a(x-h)^2 + k$
- Transformation Form: $y = a(bx - c) + d$
- Factor Form: $y = a(x-b)(x-c)$
- Standard Form: $y = ax^2 + bx + c$

This station will focus on the concavity, maximums, and minimums. Concavity refers simply to which direction the graph opens. From a graph, concavity can be determined by looking at the graph. From an equation, concavity can be determined by the value of a in $y = a(x-h)^2 + k$.





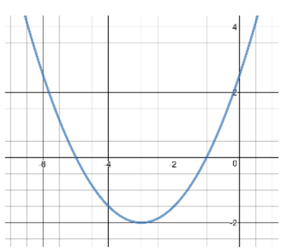
$$y = \frac{1}{2}(x+3)^2 - 2$$

Since $a = \frac{1}{2}$ you can see the quadratic opens up so it is concave up from $(-\infty, \infty)$

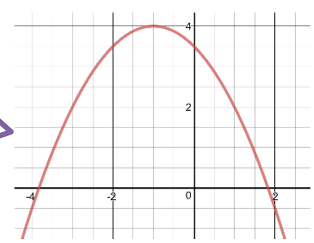
$$y = -\frac{1}{2}(x+1)^2 + 4$$

Since $a = \frac{1}{2}$ you can see the quadratic opens up so it is concave down from $(-\infty, \infty)$

The maximum is a point where the quadratic reaches its greatest (largest) y-values. The minimum is a point where the quadratic reaches its least y-value. Conveniently, maximum and minimums are also the vertex when it function is a quadratic. So if the quadratic function is concave up then the vertex is a minimum. If the quadratic function is concave down then the vertex is a maximum.



When = x value
What= y-value



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

Concave up with vertex $(-3,-2)$ so vertex is a minimum. When does function reach a minimum $x = -3$. What is the minimum value $y = -2$.

$$y = -\frac{1}{2}(x+1)^2 + 4$$

Concave down with vertex $(-1,4)$ so vertex is a maximum. When does function reach a minimum $x = -1$. What is the minimum value $y = 4$.