Quadratic Functions

$$f(x) = ax^2 + bx + c$$

$ax^2 \rightarrow$ quadratic term (it's not a quadratic without this ☺)

- If a is $\begin{cases}\text{positive, the parabola opens upwards} \\ \text{negative, the parabola opens downwards}\end{cases}$
- The larger the magnitude of "a" (absolute value - ignore the sign), the more narrow the parabola will be.
- "a" is the coefficient. It includes any sign but does not include the x^2.

$bx \rightarrow$ linear term "b" is the coefficient, including the sign but not the x.

- Moves the vertex off of the y-axis
- If $b=0$ (so there's no linear term), the vertex and y-intercept will be the same.

$c \rightarrow$ constant term, also known as the "initial value"

- The vertical intercept is $(0, c)$

(Because $x=0$ on the y-axis, and after substituting zero for x, you're left with just c.)

Most questions involving quadratic functions can be answered by finding four things, which are also all you need for a rough sketch of the graph in most cases.

1. The vertical intercept (y-intercept): $(0, c)$
2. The axis of symmetry: $x = \frac{-b}{2a}$
3. The vertex, (h, k) $\quad x \rightarrow h = \frac{-b}{2a}$

   $y \rightarrow k = f(h)$
4. The x-intercepts, if any. There can be none, one, or two.

   ① Find the discriminate: $b^2 - 4ac$ if this is $\begin{cases}\text{positive} \rightarrow 2 \\ \text{zero} \rightarrow 1 \\ \text{negative} \rightarrow \text{none}\end{cases}$

   ② Find the intercepts: $x = \frac{-b \pm \sqrt{\text{discriminate}}}{2a}$