Quadratic Functions – The Four Main Features

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

Vertex Form: $f(x) = a(x-h)^2 + k$ where the vertex is (h, k)

(Inconsistancy alert! Some books call the vertex form the standard form.)

1. The vertical intercept (y-intercept): $(0, c)$

2. The axis of symmetry: The line that cuts the parabola in half by running vertically through the vertex.

$$x = \frac{-b}{2a}$$

Note: Since this is the equation of a line, don't drop the "x =" part when writing your answer.

3. The vertex: The point at which the parabola changes direction because it reaches a {minimum output value OR maximum output value

(h, k)

$$h = \frac{-b}{2a} \qquad k = f(h)$$

4. The horizontal intercept(s): ("x-intercept(s)" – although in real life, time is more likely than distance to be on the horizontal axis.)

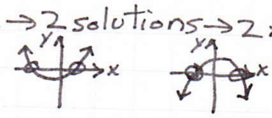
$(x, 0)$

① The discriminate $= b^2 - 4ac$

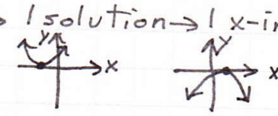
> Note: Start with $ax^2 + bx + c = 0$ Because $y = 0$ on the x-axis, you must have zero on one side of the equal sign and everything else on the other side.

If the discriminate is

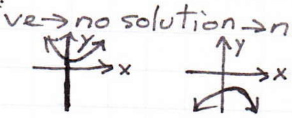
- positive → 2 solutions → 2 x-intercepts



- zero → 1 solution → 1 x-intercept



- negative → no solution → no x-intercept



② If the discriminate is positive or zero, plug into the quadratic formula to find the x-intercepts:

$$x = \frac{-b \pm \sqrt{\text{discriminate}}}{2a} \rightarrow \begin{cases} x = \dfrac{-b + \sqrt{\text{discriminate}}}{2a} \\ x = \dfrac{-b - \sqrt{\text{discriminate}}}{2a} \end{cases}$$

"Round answer" → Plug into calculator & round to specified place value.

"Exact answer" → Factor any complete squares out of the radical, leaving fractions & radicals that don't simplify to integers.

Rule: $\sqrt{a \cdot b} = (\sqrt{a})(\sqrt{b})$ Example: $\sqrt{18} = \sqrt{9 \cdot 2} = (\sqrt{9})(\sqrt{2}) = 3\sqrt{2}$