Mathematics 11U

3.6 – Zeros of a Quadratic Function

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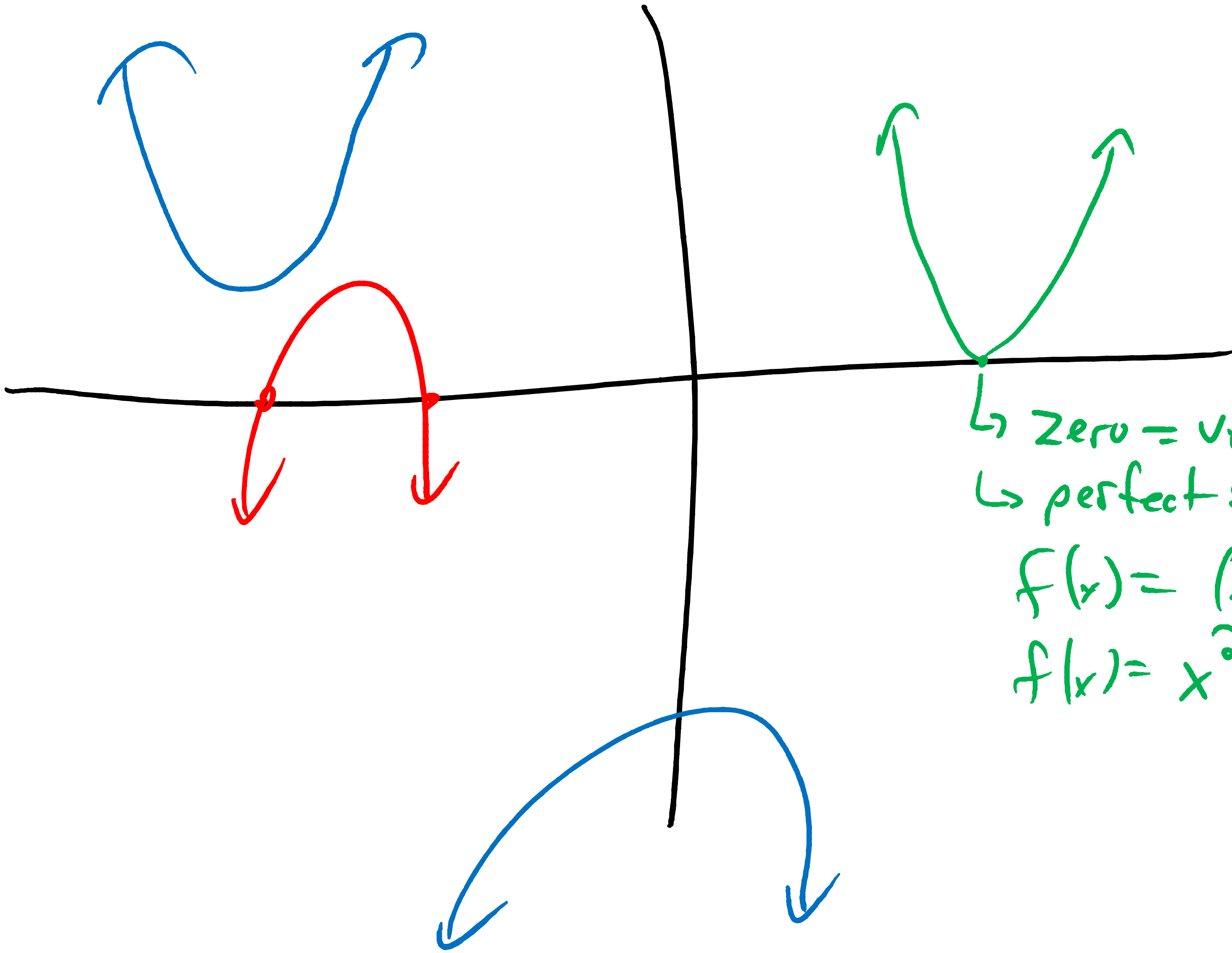
<u>Zero, One, or Two?</u>



↳ zero = vertex

↳ perfect square

$f(x) = (x-3)^2$

$f(x) = x^2 + 10x + 25$

Three methods to determine the number of zeros.

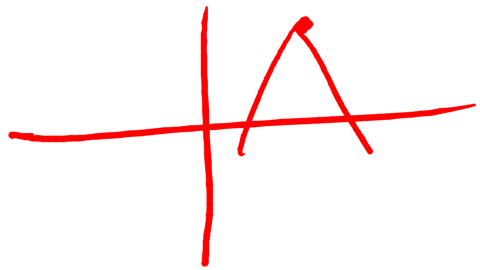
1. Graph it.
2. Vertex Form

a and k need to have opposite signs.

$$f(x) = -3(x-4)^2 + 5$$

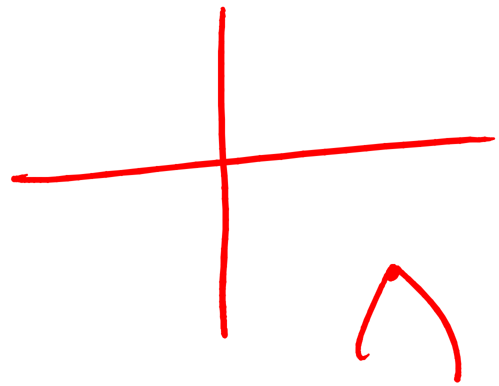
+4

Two



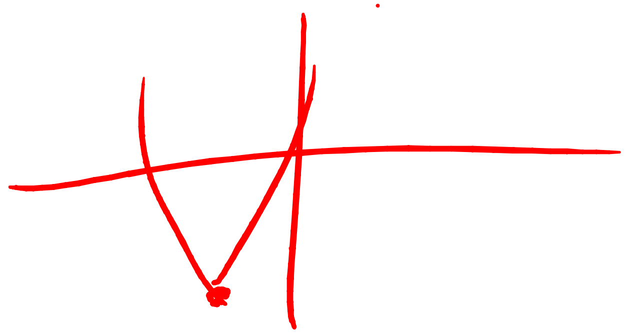
$$g(x) = -5(x-6)^2 - 10$$

No zeros.



$$h(x) = 2(x+1)^2 - 8$$

two zeros.



3. Algebra!

Recall: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

To find the number of zeros, just look at the radical, or more commonly known as the discriminant.

If,

$b^2 - 4ac > 0$, then there are 2 zeros. $\sqrt{9} = \pm 3$

If,

$b^2 - 4ac = 0$, then there is 1 zero. $\sqrt{0} = 0$

If,

$b^2 - 4ac < 0$, then there are 0 zeros. $\sqrt{-9} = $ undefined

doesn't work

Example:

$$f(x) = \underset{a}{\underline{-2}}x^2 + \underset{b}{\underline{6}}x \underset{c}{\underline{-9}}$$

How many zeros?

$b^2 - 4ac \Rightarrow 6^2 - 4(-2)(-9)$

$= 36 - 72$

$= -36 < 0$

$\therefore$ no zeros.

The curveball…

$$\overset{a}{}\qquad f(x) = -\overset{a}{2}x^2 + \overset{b}{3}x + \overset{c}{k}$$

Solve for *k* so that *f(x)* has only one solution.

$b^2 - 4ac = 0$

$3^2 - 4(-2)(k) = 0$

$9 + 8k = 0$

$9 = -8k$

$-\frac{9}{8} = k$

$f(x) = -2x^2 + 3x - \frac{9}{8}$

$3^2 - 4(-2)(-\frac{9}{8})$

$= 9 - 9$

$= 0$ $\therefore$ 1 solution.