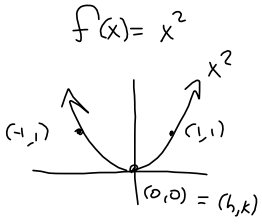
Special: Quadratic Functions



Completing the square to get vertex $= (h,k)$

$g(x) = x^2 - 10x - 11$

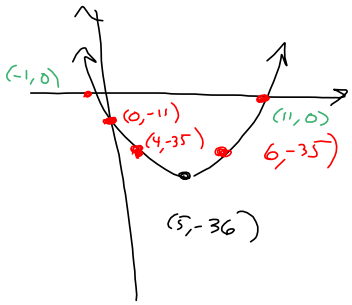
$= x^2 - 10x + 5^2 - 25 - 11$

$\frac{10}{2} = 5 \rightsquigarrow 5^2 = 25$

$= (x-5)^2 - 25 - 11$

$= (x-5)^2 - 36$

$(h, k) = (5, -36)$



SET $= 0$ $\Rightarrow$ $(x-5)^2 = 36$

$x - 5 = \pm 6$

$x = 5 \pm 6$ $\rightarrow$ 11, -1

THE CHEAT

$(h,k) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

$x^2 - 10x - 11$

$= x^2 - 10x + 5^2 - 25 - 11$

$= (x-5)^2 - 36$

$= (x-h)^2 + k$

$= \left(x + \frac{b}{2a}\right)^2 + f\left(-\frac{b}{2a}\right)$

$a = 1,\ b = -10,\ c = -11$

$-\frac{b}{2a} = -\frac{-10}{2(1)} = 5 = h$

$f(5) = 5^2 - 10(5) - 11$

$= 25 - 50 - 11 = -36 = k$

$ax^2 + bx + c$

$= a(x-h)^2 + k$

$= 1(x-5)^2 + (-36)$

$= a\left(x + \frac{b}{2a}\right)^2 + f\left(-\frac{b}{2a}\right)$

$f(x) = 5x^2 + 3x - 10$

Added $5\left(\frac{9}{100}\right)$

$= 5\left(x^2 + \frac{3}{5}x + \frac{9}{100}\right) - 10 - 5\left(\frac{9}{100}\right)$

$\frac{3}{5} \cdot \frac{1}{2} = \frac{3}{10} \rightarrow \left(\frac{3}{10}\right)^2 = \frac{9}{100}$

$= 5\left(x^2 + \frac{3}{5}x + \left(\frac{3}{10}\right)^2\right) - 10 - \frac{9}{20}$

$= 5\left(x - \frac{3}{10}\right)^2 - \frac{209}{20}$

$a = 5,\ b = 3,\ c = -10$

$-\frac{b}{2a} = \frac{-3}{2(5)} = -\frac{3}{10} \rightarrow -\frac{b}{2a}$

$f\left(-\frac{b}{2a}\right) = 5\left(-\frac{3}{10}\right)^2 + 3\left(-\frac{3}{10}\right) - 10$

$= 5\left(\frac{9}{100}\right) - \frac{9}{10} - 10$

$= \frac{9}{20} - \frac{9}{10} - 10$

$= \frac{9 - 18 - 200}{20} = \frac{-209}{20}$

$-\frac{(10)(20)}{20} - \frac{9}{20} = -\frac{209}{20}$

$5x^2 + 3x - 10$

$= 5\left(x + \frac{3}{10}\right)^2 - \frac{209}{20}$

$a(x + \frac{b}{2a})^2 + f(-\frac{b}{2a})$

$= a(x-h)^2 + k$

$(h,k) =$ vertex.

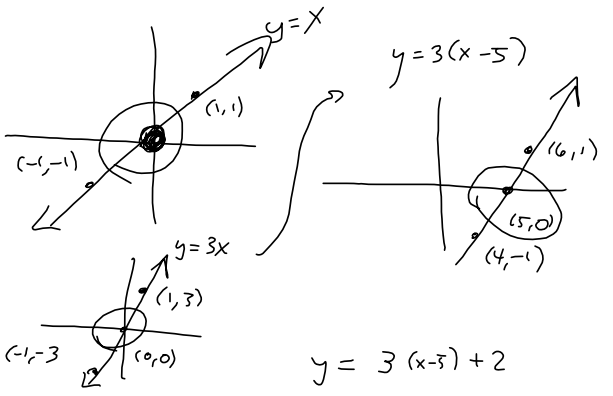
$y - y_1 = m(x - x_1)$

$y = m(x - x_1) + y_1$

Point-slope, the MILLS way

$y = m(x - x_1) + y_1$

$y = 3(x - 5) + 2$



$y = 3(x - 5) + 2$