Example: Convert the function $y = x^2 + 9x - 2$ to standard form.

$9 \div 2 = 4.5$

$(4.5)^2 = 20.25$

$y = x^2 + 9x - 2$

$y = x^2 + 9x + 20.25 - 20.25 - 2$

$y = (x + 4.5)^2 - 22.25$

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

b) Form ax^2+bx+c $a \neq 1$

Example: $9x^2-18x-7$

Step 1: Factor a out of only the first two terms .

$$9\left(x^2-2x\right)-7$$

Step 2: Inside the parentheses , follow the steps to complete the square .

$$9\left(x^2-2x\right)-7$$

$-2\div 2=-1$

$(-1)^2=1$

$$9\left(x^2-2x+1-1\right)-7$$

Step 3a: Factor the perfect square trinomial.

$$9\left(x^2-2x+1-1\right)-7=9\left((x-1)^2-1\right)-7$$

Step 3b: Multiply both terms by the a factored out in step 1.

$$9\left((x-1)^2-1\right)-7=9(x-1)^2-9-7$$

Add the constants.

$$9(x-1)^2-16$$

Complete the square.

a) $3x^2+12x-4$

$3(x^2+4x)-4$

$4\div 2 = 2$, $2^2 = 4$

$3(x^2+4x+4-4)-4$

$3((x+2)^2-4)-4$

$3(x+2)^2-12-4$

$3(x+2)^2-16$

b) $4x^2-2x+7$

$4(x^2-0.5x)+7$

$-0.5\div 2 = -.25$, $(-.25)^2 = 0.0625$

$4(x^2-0.5x+0.0625-0.0625)+7$

$4((x-0.25)^2-0.0625)+7$

$4(x-0.25)^2-0.25+7$

$4(x-0.25)^2+6.75$

Example: Determine the vertex of the function

$$f(x) = -2x^2 - 6x + 7$$

$f(x) = -2x^2 - 6x + 7$ convert to stand. form

$f(x) = -2\left(x^2 + 3x\right) + 7$

$f(x) = -2\left(x^2 + 3x + 2.25 - 2.25\right) + 7$

$f(x) = -2\left((x + 1.5)^2 - 2.25\right) + 7$

$f(x) = -2(x + 1.5)^2 + 4.5 + 7$

$f(x) = -2(x + 1.5)^2 + 11.5$

$\therefore V(-1.5, 11.5)$

Determine the vertex of the function $f(x) = -x^2 + 8x - 5$.

Using formulas

$h = \frac{-b}{2a}$ and $k = \frac{4ac - b^2}{4a}$ or $k = f(h)$

$f(x) = \underset{a}{-1}x^2 \underset{b}{+8}x \underset{c}{-5}$

$h = \frac{-b}{2a} = \frac{-8}{-2}$

$h = +\frac{8}{2} = 4$

$k = \frac{4ac - b^2}{4a} = \frac{4(-1)(-5) - (8)^2}{-4}$

$k = \frac{20 - 64}{-4} = \frac{-44}{-4} = 11$

$\therefore V(4,11)$

What is the vertex of the function $f(x)=5x^2-3x+11$?

$a \quad b \quad c$

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

$$h=\frac{-(-3)}{10}=\frac{3}{10}=0.3$$

$$k=f(h) \longrightarrow k=f(0.3)=5(0.3)^2-3(0.3)+11$$

$$k=5(0.09)-0.9+11$$

$$k=0.45-0.9+11$$

$$k=10.55=\frac{211}{20}$$

$$\therefore V(0.3,10.55)$$

Write $f(x)=\frac{2}{3}(x-6)^2+1$ in general form.

$f(x)=\frac{2}{3}(x^2-12x+36)+1$

$f(x)=\frac{2}{3}x^2-8x+24+1$

$f(x)=\frac{2}{3}x^2-8x+25$

Write $f(x)=-0.5x^2+7x-25$ in standard form.

$a=-0.5$

$h=\frac{-7}{2(-0.5)}=\frac{-7}{-1}=7$

$k=\frac{4(-0.5)(-25)-7^2}{4(-0.5)}$

$k=\frac{50-49}{-2}=-\frac{1}{2}$

$f(x)=-0.5(x-7)^2-\frac{1}{2}$

What are the zeros of the function $f(x) = -2x^2 + 9x + 5$?

$$f(x) = -2x^2 + 9x + 5$$

let $y = 0$

$$0 = -2x^2 + 9x + 5$$

Factor

$$-2 \times 5 = -10 = m \times n$$

$$+9 = m + n$$

$10, -1$

$$0 = -2x^2 - x + 10x + 5$$

$$0 = -x(2x+1) + 5(2x+1)$$

$$0 = (2x+1)(-x+5)$$

1) $0 = 2x + 1$

$-1 = 2x$

$-\frac{1}{2} = x$

2) $0 = -x + 5$

$x = 5$

Zeros: $\left\{-\frac{1}{2}, 5\right\}$

What are the zeros of the function $f(x)=3x^2-5x+12$?

Use the Quadratic Equation

$$f(x)=3x^2-5x+12$$

let $y=0$

$$0=3x^2-5x+12$$

a b c

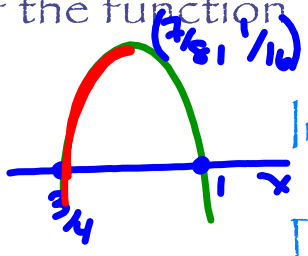
$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$x=\frac{5\pm\sqrt{(-5)^2-4(3)(12)}}{2(3)}$$

$$x=\frac{5\pm\sqrt{-119}}{6}=?$$

No zeros.

Provide a study of the function $f(x) = -4x^2 + 7x - 3$



Dom: $\mathbb{R}$

Ran: $]-\infty, 1/16]$

Max: $1/16$

Min: none

Positive: $[3/4, 1]$

Negative: $]-\infty, 3/4] \cup [1, +\infty[$

Increasing: $]-\infty, 7/8]$

Decreasing: $[7/8, +\infty[$

y-intercept: -3

Zero(s): $\{3/4, 1\}$

Axis of Symmetry: $x = 7/8$

$h = \frac{-7}{-8}$

$k = \frac{4(-4)(-3) - 7^2}{-16} = \frac{-1}{-16}$