Second-Degree Function: FACTORED FORM

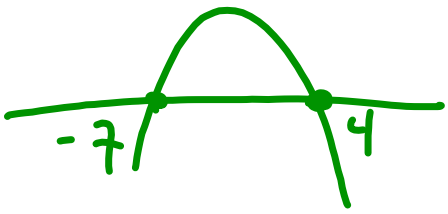
$$f(x) = a(x - x_1)(x - x_2)$$

a is parameter a (same as the standard and general forms) - it lets us know if the parabola opens up or down and how wide .

x_1 and x_2 are the zeros of the function.

Given $f(x) = -3(x-4)(x+7)$

where is the function positive?



Pos: $[-7, 4]$

What is the vertex of the function $f(x) = -3(x-4)(x+5)$?

The zeros are 4 and -5.

Since the parabola is symmetrical, the vertex must be exactly halfway between them.

b) Ran : $]-\infty, 60.75]$

$$h = \frac{x_1 + x_2}{2}$$

The average of the zeros determines the middle.

$$\therefore h = \frac{4 + -5}{2} = \frac{-1}{2}$$

and

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

$$k = f(h) = -3(-0.5-4)(-0.5+5)$$

$$k = -3(-4.5)(4.5)$$

$$k = 60.75$$

$V\left(-\frac{1}{2}, 60.75\right)$

The vertex of the function is $V(-0.5, 60.75)$.

What is the vertex of the function $g(x)=\frac{1}{2}(x-8)(x-20)$?

Zeros: $\{8,20\}$

$$h=\frac{8+20}{2}=14$$

$$k=\frac{1}{2}(14-8)(14-20)$$

$$k=\frac{1}{2}(6)(-6)=-18$$

The vertex is $V(14,-18)$.

Convert $f(x) = -5(x+2)(x-7)$ into...

a) Need h & k

zeros $-2, 7$

1) $h = \dfrac{-2+7}{2} = 2.5$

2) $k = -5(2.5+2)(2.5-7)$

$k = -5(4.5)(-4.5)$

$k = 101.25$

$\therefore f(x) = -5(x-2.5)^2 + 101.25$

b) general form

$f(x) = -5(x+2)(x-7)$

FOIL

$f(x) = -5(x^2 - 5x - 14)$

$\therefore f(x) = -5x^2 + 25x + 70$

Convert $f(x) = -(x-7)^2 + 9$ into factored form.

$a = -1$

Find the zeros (let $y = 0$).

$0 = -(x-7)^2 + 9$

$-9 \quad -9$

$-9 = -(x-7)^2$

$-1 \quad -1$

$9 = (x-7)^2$

$\pm\sqrt{9} = x - 7$

$\pm 3 = x - 7$ ⟶ 1) $3 = x - 7$ 2) $-3 = x - 7$

$10 = x_1$ $4 = x_2$

$f(x) = -(x-10)(x-4)$

or $x = h \pm \sqrt{-\frac{k}{a}}$

$x = 7 \pm \sqrt{\frac{-9}{-1}}$

$= 7 \pm 3$

$a = -1$ Zeros $\{4, 10\}$

Convert $y = 3x^2 - 35x - 12$ into factored form.

$a = 3$ Find the zeros (let $y = 0$).

$$0 = 3x^2 - 35x - 12$$

mxn = -36
m+n = -35
-36, 1

1) By factoring or 2) Quadratic Formula

$$0 = 3x^2 + x - 36x - 12$$
$$0 = x(3x+1) - 12(3x+1)$$
$$0 = (3x+1)(x-12)$$

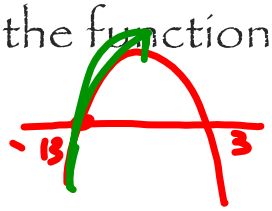
$3x+1=0$ or $x-12=0 \Rightarrow$ $x_1 = -\frac{1}{3}$ $x_2 = 12$

$$x = \frac{-(-35) \pm \sqrt{1225 - 4(3)(-12)}}{6}$$
$$x = \frac{35 \pm \sqrt{1369}}{6} = \frac{35 \pm 37}{6}$$

$x_1 = \frac{-2}{6}$ $x_2 = \frac{72}{6}$

$$y = 3\left(x + \frac{1}{3}\right)(x - 12)$$

Provide a study of the function $f(x)=-\frac{3}{4}(x-3)(x+13)$.



Dom: $\mathbb{R}$

Ran: $]-\infty, 48]$

Max: 48

Min: None

Positive: $[-13, 3]$

Negative: $]-\infty, -13] \cup [3, +\infty[$

$h = \frac{-13+3}{2} = \frac{-10}{2} = -5$

$k = -\frac{3}{4}(-8)(8) = 48$

Increasing: $]-\infty, -5]$

Decreasing: $[-5, +\infty[$

$x = 0$ $-\frac{3}{4}(-3)(13)$ $\frac{117}{4}$

y-intercept:

Zero(s): $\{-13, 3\}$

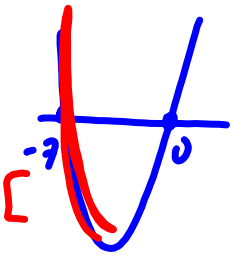
Axis of Symmetry: $x = -5$

Provide a study of the function $f(x) = 2x(x+7)$.

$2(x-0)(x+7)$

Dom: $\mathbb{R}$

Ran: $[-24.5, +\infty[$



$h = -3.5$

$k = 2(-3.5)(3.5)$

$k = -24.5$

Max: none

Min: -24.5

Positive: $]-\infty, -7] \cup [0, +\infty[$

Negative: $[-7, 0]$

Increasing: $[-3.5, +\infty[$

Decreasing: $]-\infty, -3.5]$

y-intercept: 0

Zero(s): $\{-7, 0\}$

Axis of Symmetry: $x = -3.5$