Quadratics

A function $f(x)$ is a quadratic if it can be written as

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

(a, b, c ← any #'s!!)

example:

- $2x + 7 - 15x^2$ ✓
- $2023x^2$ ✓
- $2023 - x^2$ ✓
- $\pi + \pi x + \pi^{15}x^2$ ✓ ← $a = \pi^{15}$, $b = \pi$, $c = \pi$
- $7x^2 - 2^x$ ✗

$5(x-3)(x+7)$ ← is this a quadratic?

$(5x-15)(x+7)$

$= 5x^2 + 35x - 15x - 105$

$5[x^2 + 7x - 3x - 21]$

$= [5x^2 + 20x - 105]$

$5x^2 + 20x - 105$

$5[x^2 + 4x - 21]$

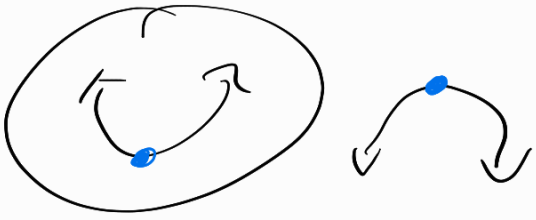
$a = 5$

$b = 20$

$c = -105$

graph this

$5x^2 + 20x - 105$

(Q1) is $f(x)$  ?

$a = 5 > 0$

(Q2) where is vertex

x-coord: $\frac{-b}{2a}$ y-coord: $f(\frac{-b}{2a})$

$a = 5$

$b = 20$

$c = -105$

$x = \frac{-20}{2(5)} = -2$

$f(-2) = 5x^2 + 20x - 105$

$\stackrel{!}{=} 5(-2)^2 + 20(-2) - 105$

$\stackrel{!}{=} 20 - 40 - 105$

$\stackrel{!}{=} -125$

vertex is $(-2, -125)$

(Q3) where are the x & y-intercepts?

y-int: $(0, -105)$

$f(x) = 5x^2 + 10x - 105$

x-int ← use unFOILed version

$f(x) = 5(x-3)(x+7)$

$5 = 0$ ← NEVER TRUE!

$x-3 = 0 \Longrightarrow x = 3$

$x+7 = 0 \Longrightarrow x = -7$

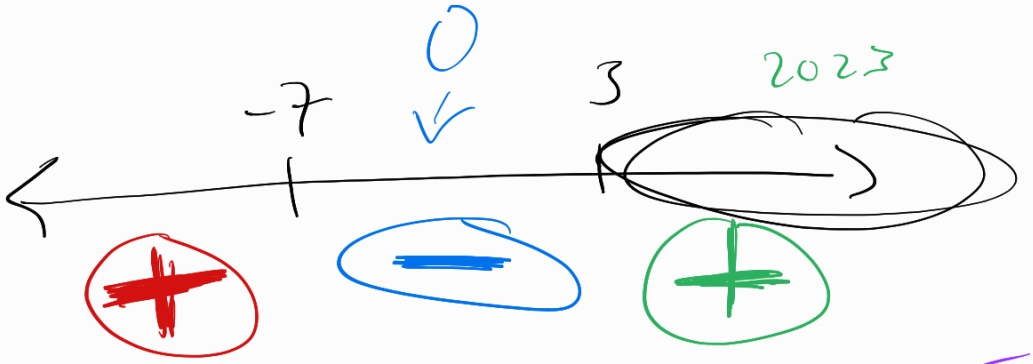
x-ints are $(3,0)$ and $(-7,0)$

Q4 when is $f(x) > 0$?

$f(x) < 0$?

↑ new

↑ use sign chart



$f(x) = 5(x-3)(x+7)$ ← Da Machine

if $x = -5$ bill

$+ \quad - \quad - \longrightarrow (+)$

if $x=0$... $+ \; - \; + \longrightarrow -$

if $x=2023$... $+ \; + \; + \longrightarrow +$

$f(x) \geq 0$ when $x \leq -7$ or $x \geq 3$

$f(x) < 0$ when $-7 < x < 3$

"x is between 3 & -7"

if $g(x) = 2(x+2023)(x-1)$

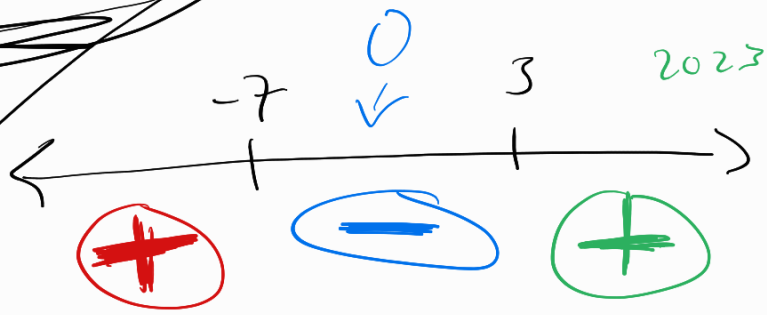
(1) where are x-intercepts of $g(x)$?

(2) when is $g(x) > 0$

When is $g(x) < 0$

GRAPHING

$f(x) = 5(x-3)(x+7)$



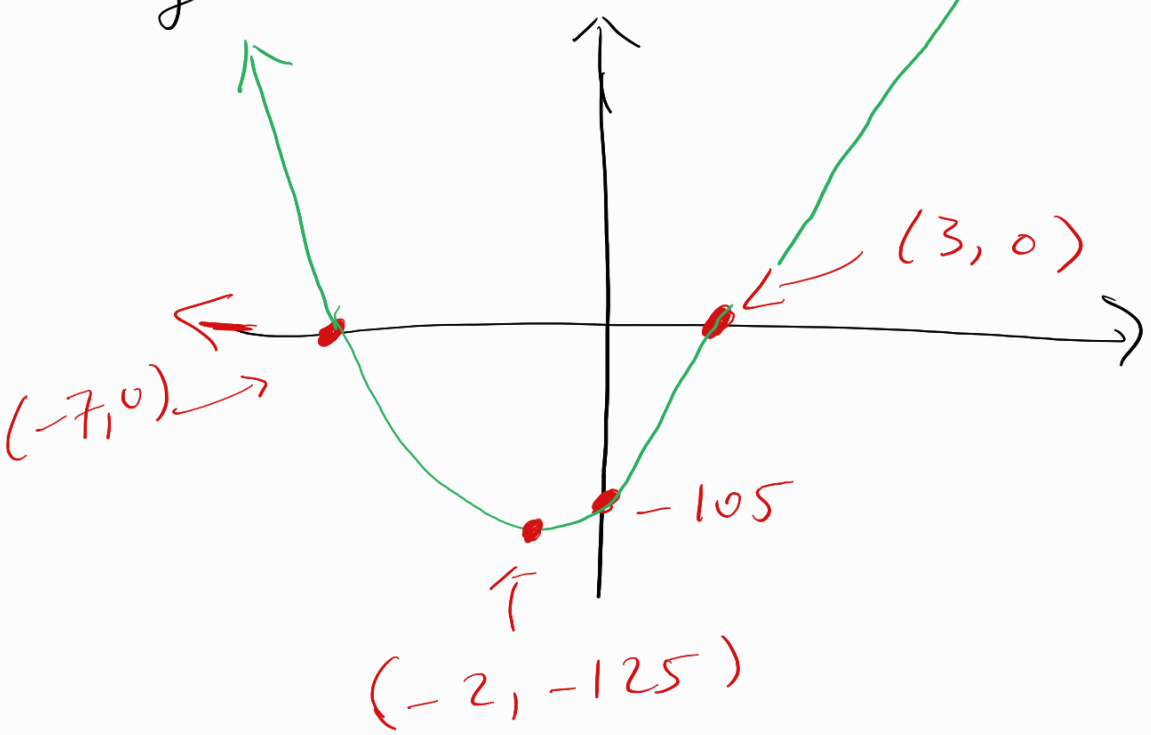
$f(x) = 5 \cdot (x-3)(x+7)$ ← Da Machine

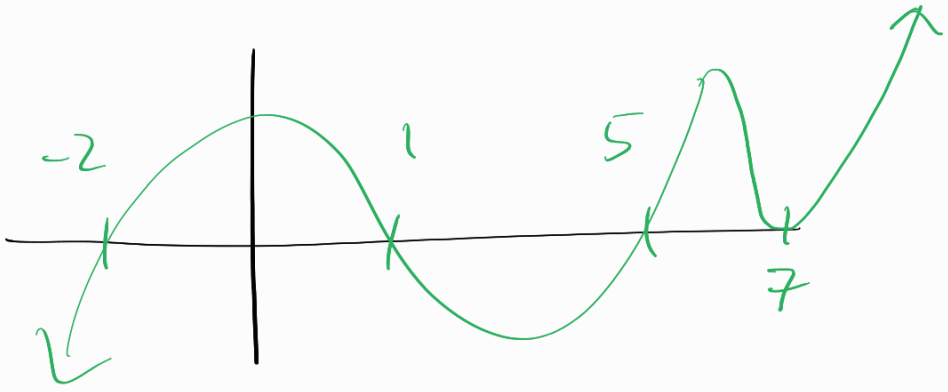
$5x^2 + 20x - 105$

↑ vertex was $(-2, -125)$

x-int: $(3, 0)$ $(-7, 0)$

y-int: $(0, -105)$





Create sign chart