Functions
- lines
- polynomials
- quadratics

Q: what is a quadratic??

Algebraic

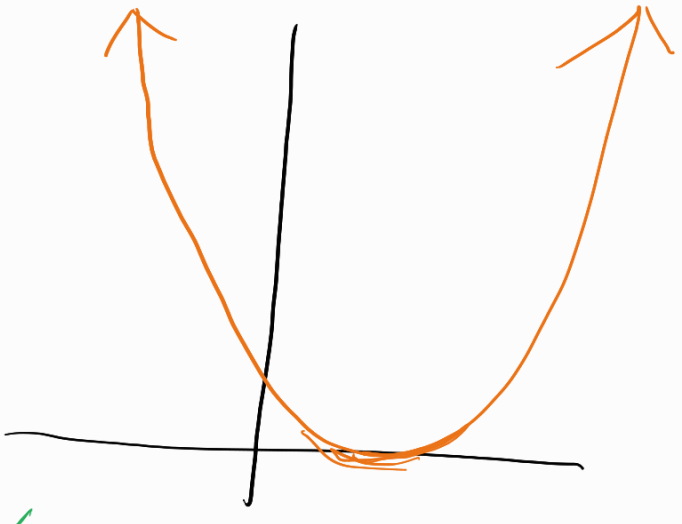
a function of the form

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

for some #'s a, b, c

$a \neq 0$

Geometric



(1) $2023x^2 - x^3 + 15x$ ✗

(2) $5 - 2x^2$ ✓

(3) $1 + x + x^2 + x^3$ ✗

(4) $1 - 2x - 3x^2$ ✓

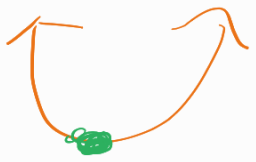
(5) $2x^2$ ✓

(6) $3x^5 + x^2$ ✗

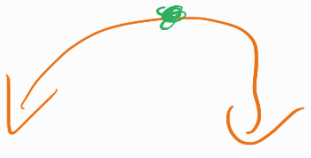
✓ ← wrong

Food for thought:

Q1 is it



or



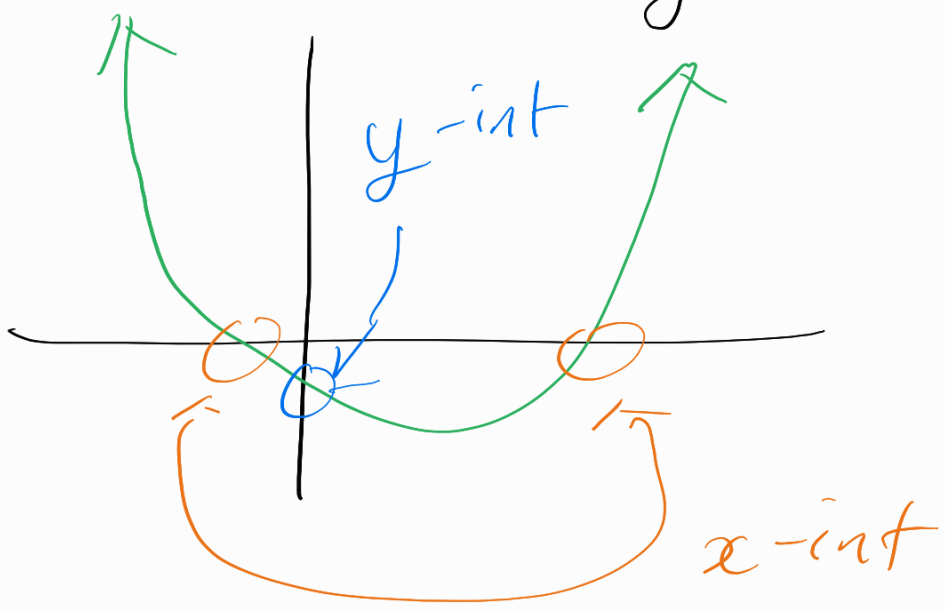
Q2

memorise → where is the

for now

where is the vertex?

(Q3) where are the x & y intercepts?



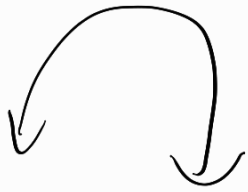
$$f(x) = (x-3)(2x+1)$$

is this a quadratic? yes because you FOIL

$$= 2x^2 + 1x - 6x - 3$$

$$= 2x^2 - 5x - 3$$

$a = 2$, $b = -5$, $c = -3$

is this  or 

if $x \to +\infty$ x = billion

$2x^2 - 5x - 3 \longrightarrow +$

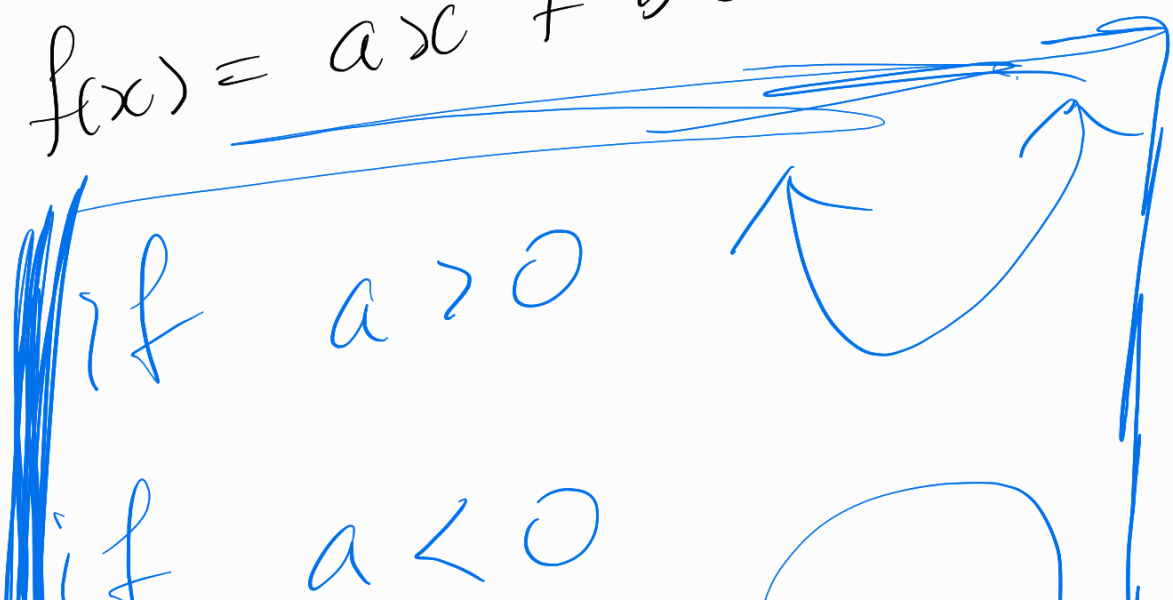
if $x \to -\infty$

$2x^2 - 5x - 3 \longrightarrow +$

super

+

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



(Q2) where's the vertex?

"I will prove formula later"

vertex of "$f(x) = ax^2 + bx + c$" is

located @ $\left(-\frac{b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$-\frac{b}{2a}$ ← x-coord

$f\left(\frac{-b}{2a}\right)$ ← plug into function

Ex)

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

$a = 2$

$b = -5$

$c = -3$

vertex:

$\frac{-(-5)}{2(2)} = \frac{5}{4}$ ← x-coord

$f(5/4) = 2\left(\frac{5}{4}\right)^2 - 5\left(\frac{5}{4}\right) - 3$

$$= 2 \cdot \frac{25}{16} - \frac{25}{4} - 3$$

$$= \frac{50}{16} - \frac{25}{4} - 3$$

$$= \frac{50}{16} - \frac{100}{16} - \frac{48}{16}$$

$$= \frac{-50-48}{16} = \frac{-98}{16} = \frac{-49}{8}$$

Vertex is:

$$\left(\frac{5}{4}, \frac{-49}{8}\right)$$

$x = -b/2a$, $y = f(-b/2a)$

Find vertex of

$$f(x) = 2x^2 - 8x + 10$$

$$= \frac{-(-8)}{} \quad \frac{8}{}$$

$x = \frac{-b}{2a} = \frac{\quad}{2(2)} = \frac{\quad}{4} = 2$

$f(2) = 2(2)^2 - 8(2) + 10$

$= 2 \cdot 4 - 16 + 10$

$= 8 - 16 + 10 = 2$

(2, 2)

Q3 where are the intercepts? (x & y)

$f(x) = (x-3)(2x+1)$

To find x-int:

set $f(x) = 0$ ⇝ solve for x

$(x-3)(2x+1) = 0$

- $x - 3 = 0 \Rightarrow x = 3$
- $2x + 1 = 0 \Rightarrow x = -1/2$

x-ints are (3, 0) (−½, 0)

To y-int

calculate $f(0)$

$f(0) = (0-3)(0+1)$

$= -3 \cdot 1$

$= -3$

y-int is (0, −3)

Recap: quadratics are

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

if $a > 0 \Rightarrow$ ∪ ; $a < 0 \Rightarrow$ ∩ ; c ← y-int

vertex: $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

x-int you get by factoring

rewrite $f(x) = (x-p)(x-q)$

x-int are at $x = p, q$

Example: $f(x) = (3x-3)(x+4)$

- is it ∪ or ∩
- where's vertex? ← Don't simplify
- where's y-int?
- where's x-int?