

Quadratic function: $y = ax^2 + bx + c$

Linear function: $y = mx + b$

\uparrow slope \uparrow y-intercept

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

$$x=0 \\ f(0) = \cancel{a(0)^2} + \cancel{b(0)} + c$$

$$f(0) = c \rightarrow \text{y-intercept}$$

$$f(0) = 0^2 = 0 \quad \{(0, 0)\}$$

$$f(1) = 1^2 = 1 \quad (1, 1)$$

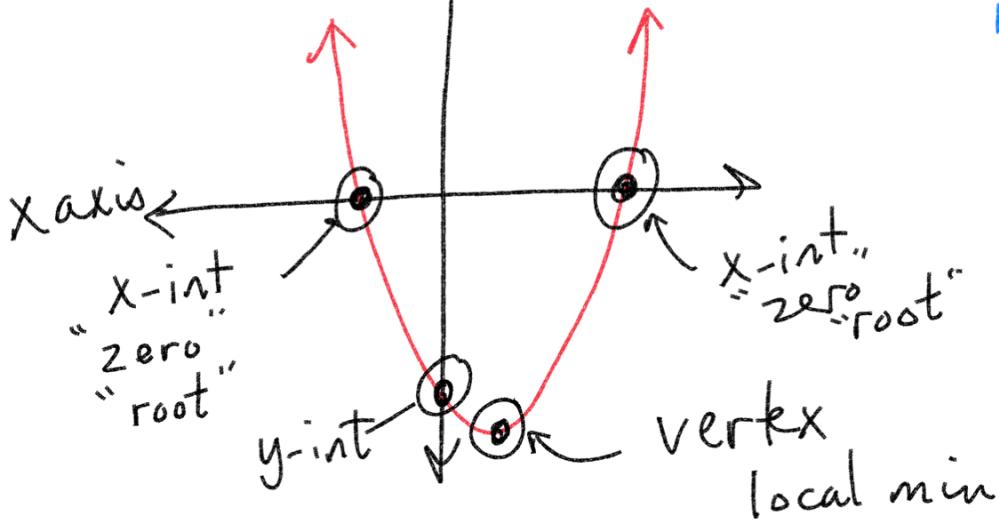
$$f(2) = 2^2 = 4 \quad (2, 4)$$

$$f(3) = 3^2 = 9 \quad (3, 9)$$

$$f(-1) = (-1)^2 = 1 \quad (-1, 1)$$

$$f(-2) = (-2)^2 = 4 \quad (-2, 4)$$

y -axis



$$f(x) = x^2$$

parabola
 $y = x^2 = x \cdot x$

symmetrical

$$y = -x^2$$

local max

$$y = x^2 \quad \uparrow \quad y = x \quad \uparrow \quad \text{up to} \quad \uparrow \quad \text{zeros}$$

Quadratic Function $y = ax^2 + bx + c$

- 1.) Must have a square as the highest exponent

$$y = \boxed{x^2} + 3x + 5 \text{ quadratic}$$

$$y = \circled{x^3} + x^2 - 8 \text{ not quadratic}$$

$$y = 3x - 7 \text{ not quadratic}$$

- 2.) All exponents on variables

must be a whole number

$$y = x^2 + x^{1/3} \leftarrow \text{not whole number; not quadratic}$$

$$y = x^{-2} \leftarrow \text{not whole number; not quadratic}$$

Which of the following equations is a quadratic?

FOIL

First
Outside
Inside
Last

1.) $y = (-5x-4)(-5x-4)$

$$25x^2 + 20x + 20x + 16 = \{25x^2 + 40x + 16\} \text{ yes}$$

2.) $y = 3(x-1) + 3$

$$3x - 3 + 3 = 3x \text{ not quadratic}$$

3.) $y = \cancel{x^2} - 11x + 24 - \cancel{x^2}$ not quadratic

4.) $y = 2(x+2)^2 - 2x^2$ FOIL

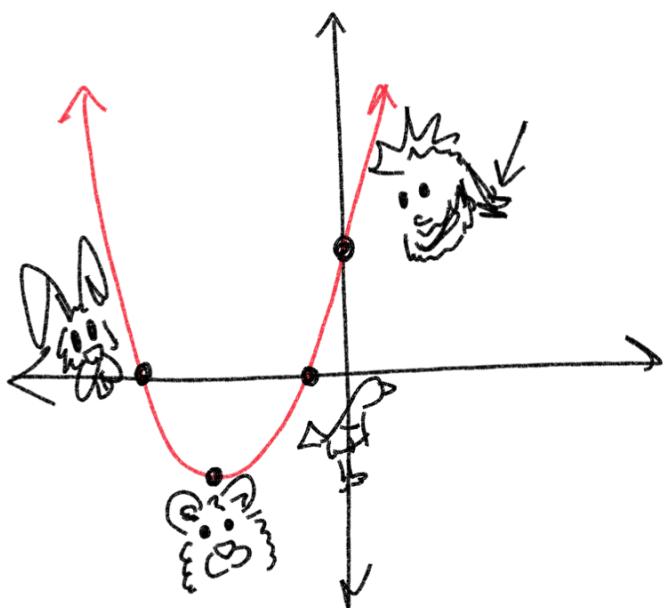
$$2(x+2)(x+2) - 2x^2$$

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

$$\rightarrow 2(x^2 + 4x + 4) - 2x^2$$

$$\cancel{2x^2} + 8x + 8 - \cancel{2x^2} = 8x + 8$$

not quadratic



Bunny \rightarrow x-int, zero, root
 Bear \rightarrow vertex
 Duck \rightarrow x-int, zero, root
 Mullet \rightarrow y-int
 Nate \rightarrow y-int

Quadratic Function

$$y = ax^2 + bx + c$$

$(-1, 1)$	$(1, 1)$	$(3, 9)$
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$$y = ax^2 + bx + c$$

$$\downarrow$$

$$1 = a(-1)^2 + b(-1) + c$$

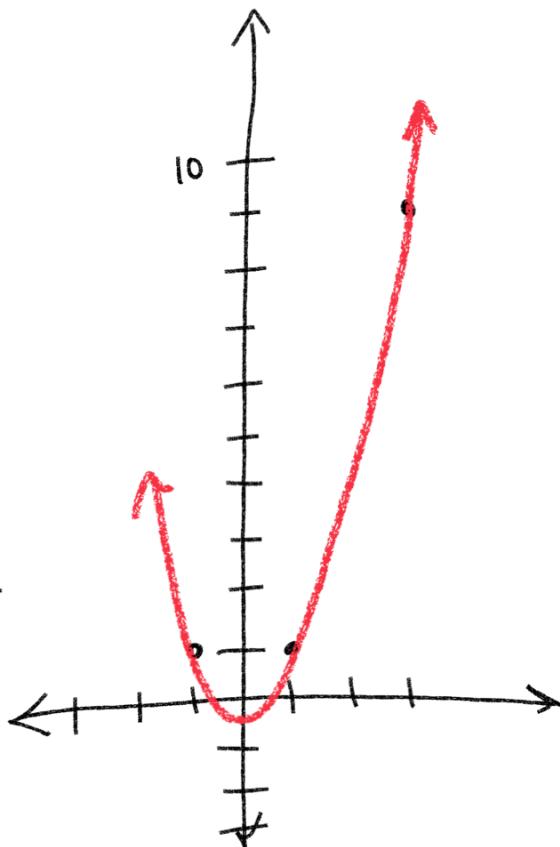
$$\textcircled{1} \quad 1 = a - b + c$$

$$y = ax^2 + bx + c$$

$$\downarrow$$

$$1 = a(1)^2 + b(1) + c$$

$$\textcircled{2} \quad 1 = a + b + c$$



$$y = ax^2 + bx + c$$

$$\downarrow$$

$$1 = a(3)^2 + b(3) + c$$

$$\textcircled{3} \quad 9a + 3b + c$$

$$\rightarrow ① a - b + c = 1$$

$$\rightarrow ② a + b + c = 1$$

$$\rightarrow ③ 9a + 3b + c = 9$$

$$① 3(a - b + c = 1)$$

$$③ 9a + 3b + c = 9$$

$$\begin{array}{r} 3a - 3b + 3c = 3 \\ + 9a + 3b + c = 9 \\ \hline \frac{12a}{4} + \frac{4c}{4} = \frac{12}{4} \end{array}$$

$$⑤ 3a + c = 3$$

$$a + c = 1$$

$$\begin{array}{r} 1 + c = 1 \\ -1 \\ \hline c = 0 \end{array}$$

$$y = ax^2 + bx + c$$

$$\boxed{y = x^2}$$

$$\textcircled{1} \quad a \cancel{- b} + c = 1$$

$$\textcircled{2} \quad a \cancel{+ b} + c = 1$$

$$\frac{2a}{2} + \frac{2c}{2} = \frac{2}{2}$$

$$\textcircled{4} \quad a + c = 1$$

$$\textcircled{4} \quad \cancel{(a + c = 1)}$$

$$\textcircled{5} \quad 3a + c = 3$$

$$\begin{array}{r} -a - c = -1 \\ + 3a + c = 3 \\ \hline 2a = 2 \end{array}$$

$$\boxed{a = 1}$$

$$a + b + c = 1$$

$$\begin{array}{r} \downarrow \\ 1 + b + 0 = 1 \end{array}$$

$$\begin{array}{r} 1 + b = 1 \\ -1 \\ \hline b = 0 \end{array}$$

$$\boxed{b = 0}$$

