

5-1 Modeling Data with Quadratic Functions

Quadratic Function

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

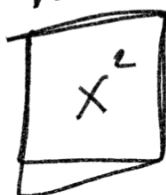
$a \neq 0$

$f(x)$ = function with respect to x

$$f(x) = y$$

⇒ Highest degree term must be 2.
you must have a 2 → x^2

⇒ All exponents must be whole numbers
no negatives, fractions, or decimals



quadratic

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

slope

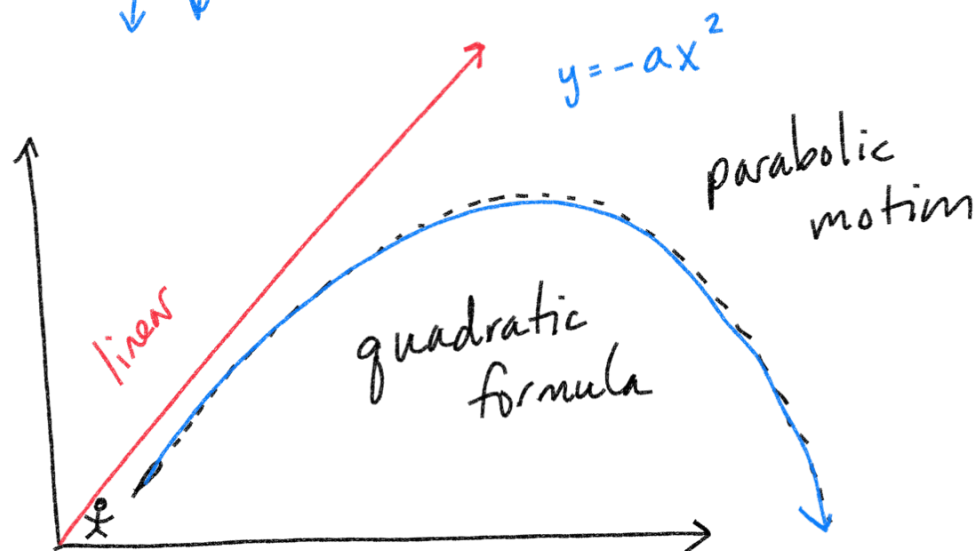
y-intercept

linear

$$y = mx + b$$

slope

y-intercept



$$(1+x)(9+x)$$

$$9 + x + 9x + x^2$$

$$9 + 10x + x^2$$

$$x^2 + 10x + 9$$

quadratic

FOIL

First

Outside

Inside

Last

$$x \cdot x = x^2$$

$$9 = 9x^0$$

Identify Quadratics

$$f(x) = (-5x-4)(-5x-4)$$

FOIL

quadratic

$$a=25 \quad b=40 \quad c=16$$

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

$$25x^2 + 20x + 20x + 16$$

$$25x^2 + 40x + 16$$

$$f(x) = \boxed{x^2} + 24 - 11x \boxed{-x^2}$$

not quadratic

FOIL

$$y = (3-x)(3-x)$$

$$9 - 3x - 3x + x^2$$

quadratic

$$9 - 6x + x^2$$

$$a=1 \quad b=-6 \quad c=9$$

DISTRIBUTE

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

$$\boxed{3}x^2 \boxed{-6}x \boxed{+9}$$

quadratic

$$3x^2 + 3x - x$$

$$a=3 \quad b=2 \quad c=0$$

$$3x^2 + 2x$$

FOIL

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

FOIL

$$x^2 + 4x - 2x - 8$$

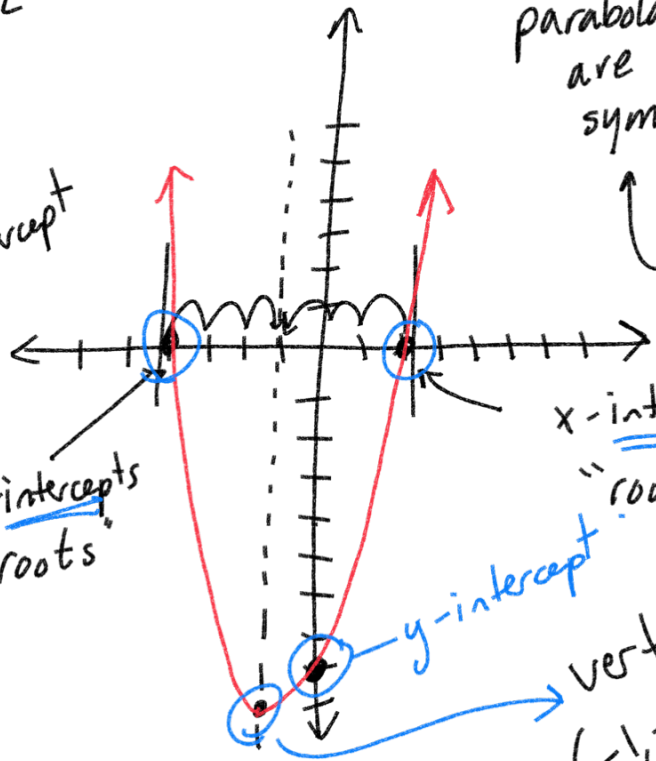
$$y = ax^2 + bx + c$$

$$x^2 + 2x - 8$$

y-intercept

x-intercepts
"roots"

parabolas are symmetrical



x-intercepts
"roots"

y-intercept

vertex
(-1, -9)

$$y = x^2 + 2x - 8$$

$$(-1)^2 + (-2) - 8$$

$$1 - 2 - 8$$

$$-1 - 8 = -9$$

$$y = (x-2)(x+4)$$

$$\boxed{0} = (x-2)(x+4)$$

$$x-2=0 \quad x+4=0$$

$$+2 \quad +2 \quad -4 \quad -4$$

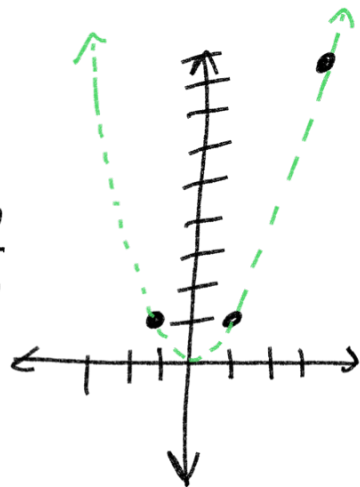
$$x=2 \quad x=-4 \quad (-4, 0)$$

(2, 0)

Find the quadratic model

- 1.) (-1, 1) (1, 1) (3, 9)

quadratic model $\{ax^2 + bx + c = y\}$



(-1, 1)

x y

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

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

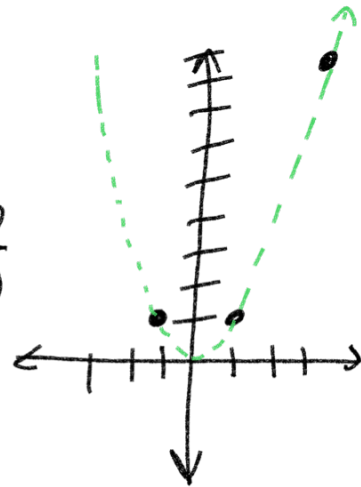
$$1 = a - b + c$$

$$1 = a - b + c$$

Find the quadratic model

1.) $(-1, 1)$ $(1, 1)$ $(3, 9)$

quadratic model $\{ax^2 + bx + c = y\}$



$(-1, 1)$
x y

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

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

$$1 = a - b + c$$

$(1, 1)$
x y

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

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

$$1 = a + b + c$$

$(3, 9)$

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

$$9 = a(3)^2 + b(3) + c$$

$$9 = 9a + 3b + c$$

$$\begin{cases} a - b + c = 1 \\ a + b + c = 1 \\ 9a + 3b + c = 9 \end{cases}$$

$$\begin{array}{r} a - b + c = 1 \\ - (a + b + c = 1) \\ \hline -2b = 0 \end{array}$$

$$\begin{array}{r} -2b = 0 \\ \hline -2 \quad \hline -2 \\ \hline b = 0 \end{array}$$

$$b = 0$$

$$8a + 2b = 8$$

$$\frac{8a}{8} = \frac{8}{8}$$

$$a = 1$$

$$\begin{array}{r} 9a + 3b + c = 9 \\ - (a + b + c = 1) \\ \hline 8a + 2b = 8 \end{array}$$

$$\begin{array}{r} 9a + 3b + c = 9 \\ - a - b - c = -1 \\ \hline 8a + 2b = 8 \end{array}$$

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

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

$$y = ax^2 + \cancel{bx} + \cancel{c} \quad a=1 \quad b=0 \quad c=0$$
$$y = \underset{\downarrow 1}{x^2}$$

$$y = 1x^2$$

$$y = x^2$$

HW
Online HW 20 } March 4th
Quiz 20 }
Actual test due Feb 24-ish
HW / Quiz 18 Feb 19th