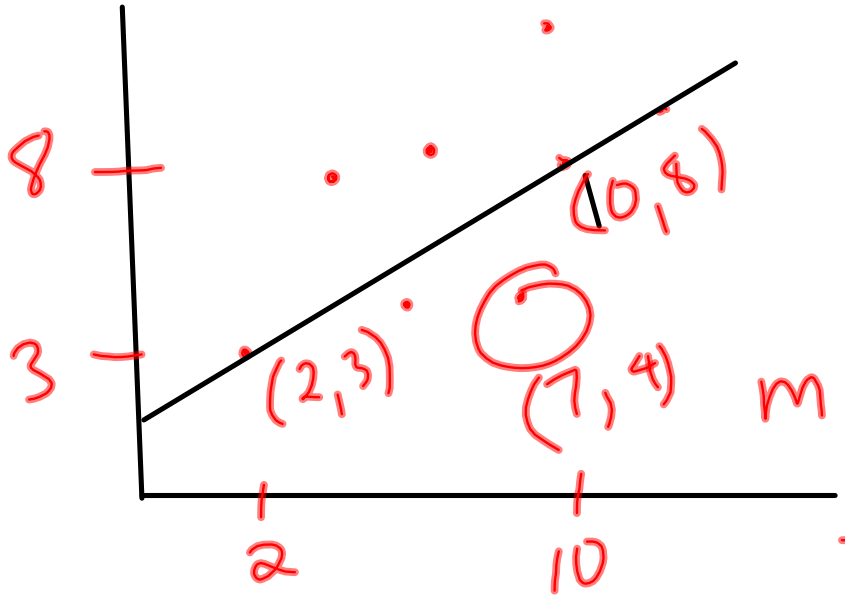
Mathematical modelling

- linear $y = mx + b$
  - slope → rate of change → rise/run $= \frac{y_2 - y_1}{x_2 - x_1}$
  - y-intercept
    - initial amount
    - flat fee

$C = 5 + 0.50k$ rate of change = \$0.50/km



$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{8 - 3}{10 - 2}$

$= \frac{5}{8}$

$= 0.625$

$y = 0.625x + b$

$3 = 0.625(2) + b$

$3 = 1.25 + b$

$1.75 = b$

$y = 0.625x + 1.7$

Quadratics

vertex form

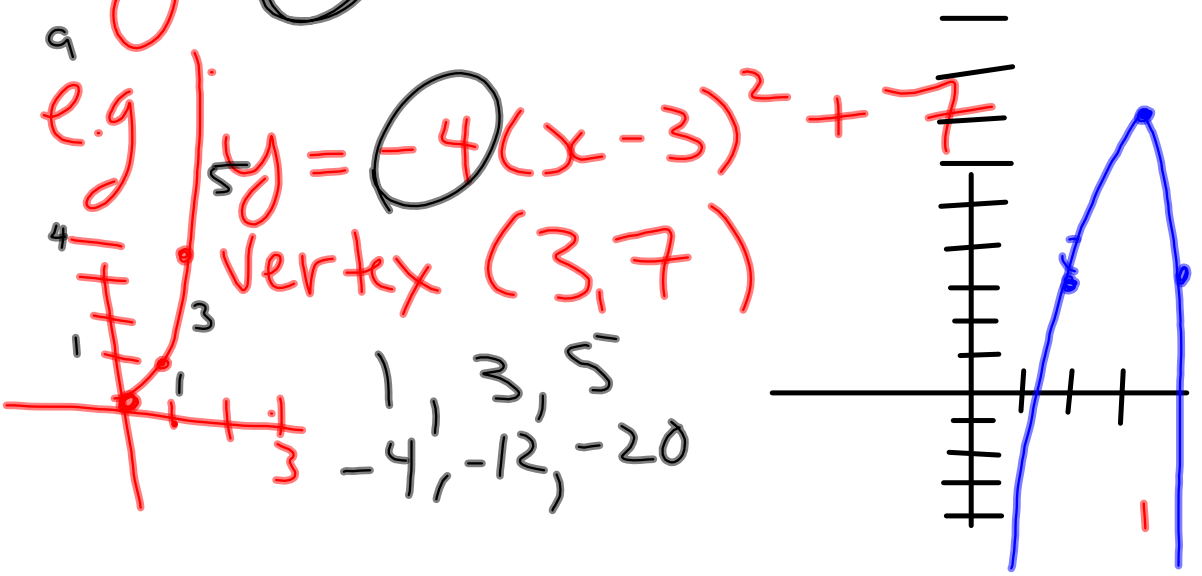
$y = a(x-k)^2 + h$

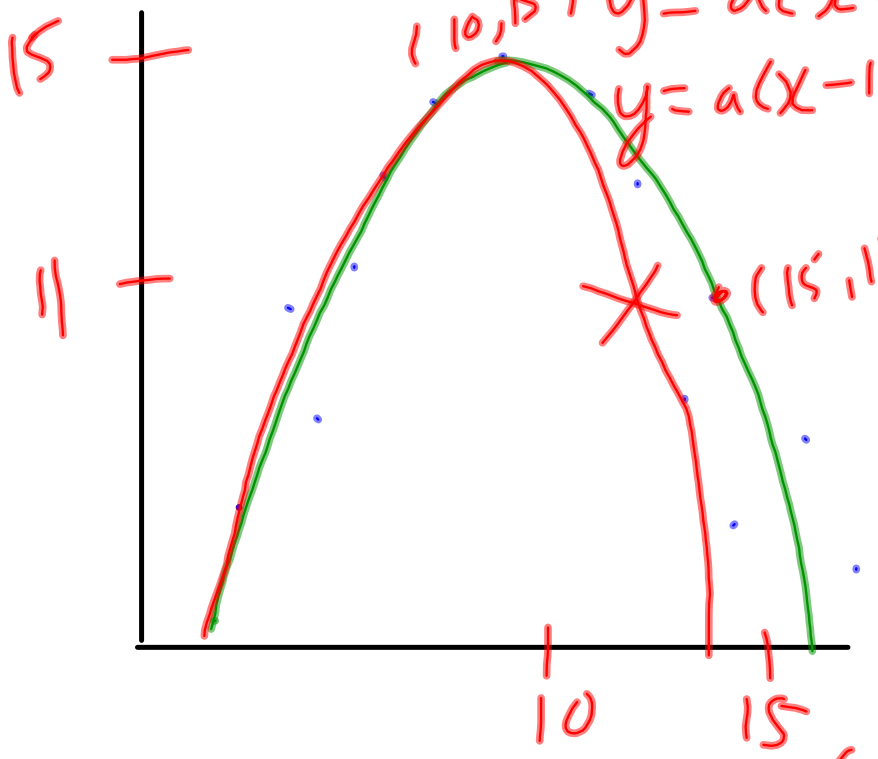
e.g. $y = -4(x-3)^2 + 7$

Vertex $(3, 7)$

1, 3, 5

-4, -12, -20





$y = a(x-k)^2 + h$

$y = a(x-10)^2 + 15$

BEDMAS

$11 = a(15-10)^2 + 15$

$11 - 15 = a \cdot 25 + 15 - 15$

$\frac{-4}{25} = \frac{a \cdot 25}{25}$

$-0.16 = a$

$y = -\frac{4}{25}(x-10)^2 + 15$

Exponential

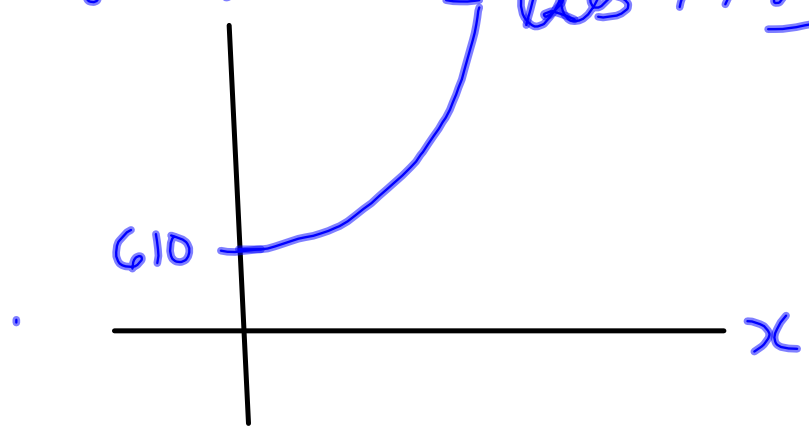
$$y = a \cdot b^x$$

- a: initial value
- b: rate of growth
  - $b = 1 + r$ increasing
  - $b = 1 - r$ decreasing

Rideau has a student body of 610. It is increasing by 3% a year. What will the population be in 2020?

$$y = a \cdot b^x$$
$$= a(1+r)^x$$
$$y = 610(1+0.03)^x$$
$$y = 610(1.03)^x$$
$$y = 610(1.03)^8$$
$$\doteq 772$$

$x = 2020 - 2012 = 8$



$9847.60

Mrs Moodie has a car that is currently worth $25,000. It depreciates 17% per year. How much will it be worth in 5 years?

$y = a \cdot b^x$

$= 25000(1-0.17)^x$

$= 25000(1-0.17)^5 = 25000(0.83)^5$

Rate of change: What was the average rate of change in Mrs Moodie car value over the five years

years	0	5
	25000	9847.60

$$\text{Rate of Change} = \frac{\text{change in } y}{\text{change in } x}$$

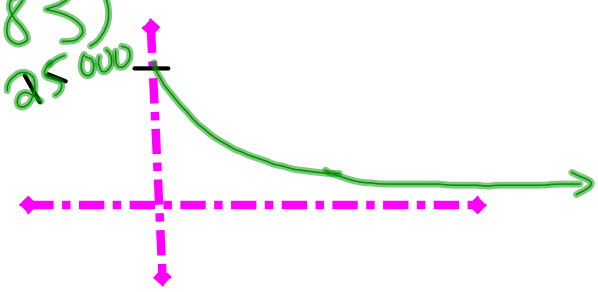
$$= \frac{-15152.40}{5-0}$$

$$= \frac{-15152.40}{5}$$

$$= -3030.48$$

On average each year the car depreciates about $3030.48

$y = 25000(0.83)^x$



$$\frac{a^{7} \cdot a^{3}}{a^{-6}} = \frac{a^{7+3}}{a^{-6}}$$

$$\frac{(a^{2})^{-6}}{a^{4}} = \frac{a^{16}}{a^{-6}}$$

$$= \frac{a^{-12}}{a^{4}} = a^{-16} = a^{16-(-6)}$$

$$= \frac{1}{a^{16}} = a^{16}$$

$4^{(x+4)} = 4^{(7)}$

$x + 4 = 7$

$x = 7 - 4$

$x = 3$

Check: $4^{3+4} = 4^{7}$ ✓

$3^{x} = 9$

$3^{(x)} = 3^{(2)}$

2x2 x2x2 x2 = 4, 8, 16, 32

$x = 2$

$2^{2x-3} = 32$

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

$2x - 3 = 5$ (+3 +3)

$\frac{2x}{2} = \frac{8}{2}$

$x = 4$

$9^{2x+1} = 27^{x+4}$

$(3^{2})^{2x+1} = (3^{3})^{x+4}$

1.09 ^ 20

1.09 ^ 20

$4x + 2 = 3x + 12$ (−3x −3x)

$1x + 2 = 12$

$x = 12 - 2$

$x = 10$