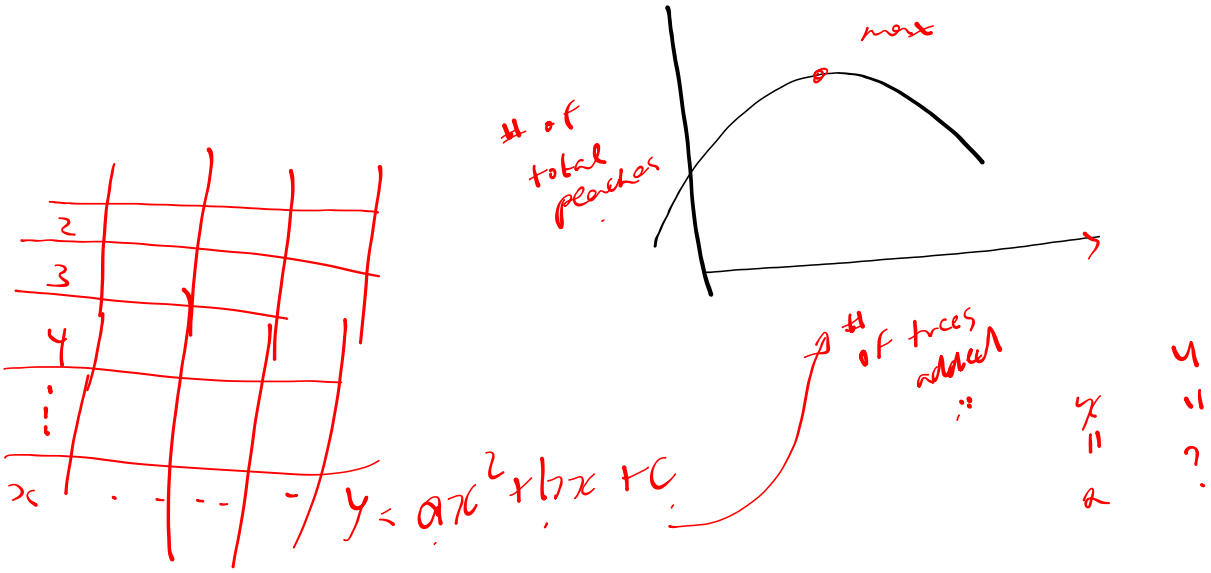

max
# of total peaches
2
3
4
# of trees added
y = ax² + bx + c
x = ?
y = ?

# Unit 3: Graphing a Parabola in the form $y = ax^2$

graph

- $y = 1x^2$

$y = ax^2 + bx + c$

$y = ax^2 + bx + c$ unit 4

$y = ax^2 + bx + c$ unit 7

Step ①

Determine the coordinates of the vertex

$V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$ $a = 1$ $b = 0$ $c = 0$

$\Delta = b^2 - 4ac$

$\Delta = 0^2 - 4(1)(0)$

$\Delta = 0$

$V\left(\frac{-0}{2(1)}, \frac{-0}{4(1)}\right)$

$V(0, 0)$

Step ②

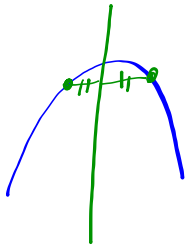
Construct table of values and put vertex in middle. Pick symmetric points around the vertex

$y = x^2$

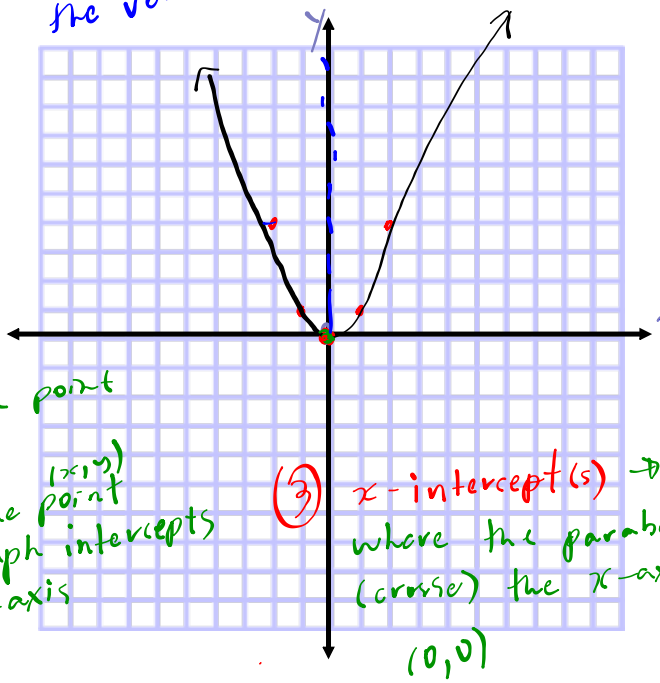
sub in $x$ to find $y$

| $x$ | $y$ |
|---|---|
| $-2$ | $(-2)^2 = 4$ |
| $-1$ | $(-1)^2 = 1$ |
| $V$ 0 | 0 |
| 1 | $(1)^2 = 1$ |
| 2 | $(2)^2 = 4$ |

- vertex
- y-int
- x-ints
- axis of sym
- image point



Step ③ plot points and draw the curve




find the image point of (1,1):

(-1,1)

5 important characteristics

① Vertex max/min point

(0, 0)

② y-intercept → the point (x,y) where the graph intercepts (crosses) the y-axis

(0,0)

③ x-intercept(s) → the point(s) where the parabola intercepts (crosses) the x-axis

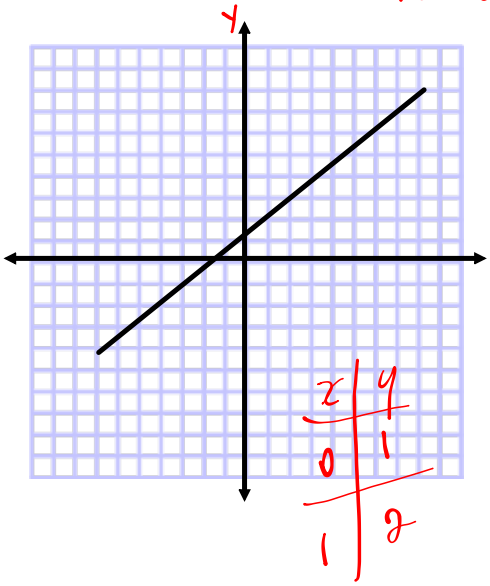
(0,0)

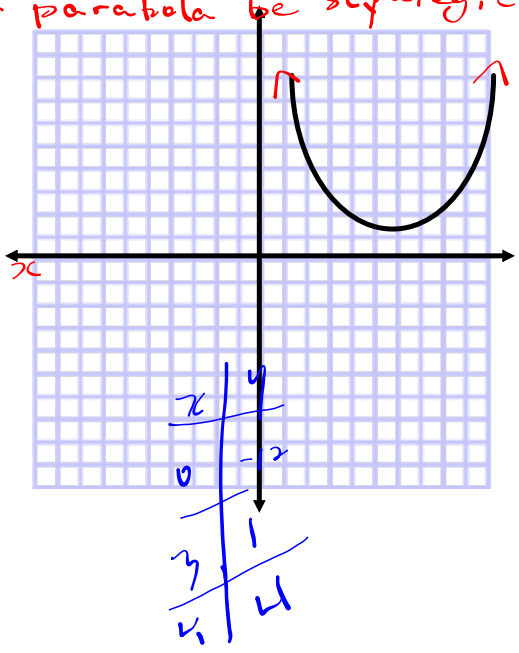
④ axis of symmetry → a straight invisible line that cuts the parabolic symmetrically in half.

$x = 0$

⑤ image point of the y-int → the point with same height and same distance away from axis of symmetry on the other side.

For table of values, you pick the x-values (independent variable). For a parabola be strategic in the x values you pick?



graph and determine:

① Vertex
② y-int
③ x-int
④ axis of sym
⑤ image point of $(1, -2)$

$y = -2x^2$

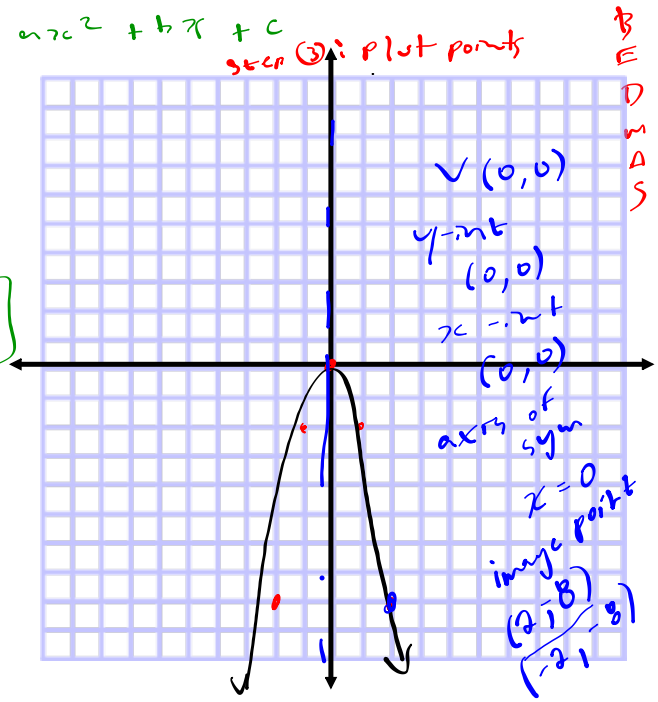
$y = ax^2 + bx + c$

step ① plot points

step ① V (0,0)

step ②

| x | y |
|---|---|
| -2 | $-2(-2)^2 = -2 \cdot 4 = -8$ |
| -1 | $-2(-1)^2 = -2$ |
| V 0 | 0 |
| 1 | $-2(1)^2 = -2$ |
| 2 | $-2(2)^2 = -8$ |

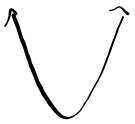


Nota Bene: In $y = ax^2 + bx + c$, the 'a' parameter has two functions:

(1) · determines whether the parabola is facing up/down

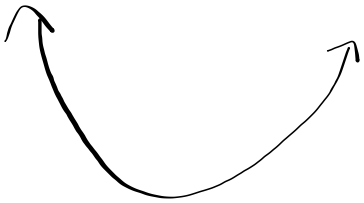
graph: $y = \frac{-1}{2}x^2$

'a' is positive ..



'a' is negative ..

(2) · determines how narrow or wide the parabola is.



· as the absolute value of 'a' increases, the parabola becomes more narrow.

# Unit 4: Graphing 2nd degree function of the form $y = ax^2 + c$

graph $y = -4x^2 - 2$

$y = ax^2 + bx + c$

$a = -4$

$b = 0$

$c = -2$

**Step ①**

Find Vertex

$V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$

$\Delta = b^2 - 4ac$

$\Delta = 0^2 - 4(-4)(-2)$

$\Delta = -32$

$V\left(\frac{-0}{2(-4)}, \frac{-(-32)}{4(-4)}\right)$

$V(0, -2)$

$y = -4x^2 - 2$

**Step ②: TOV**

| x | y |
|---|---|
| 2 | $-4(2)^2 - 2 = -18$ |
| 1 | $-4(1)^2 - 2 = -6$ |
| 0 | $-2$ |
| -1 | $-4(-1)^2 - 2 = -6$ |
| -2 | $-4(-2)^2 - 2 = -18$ |

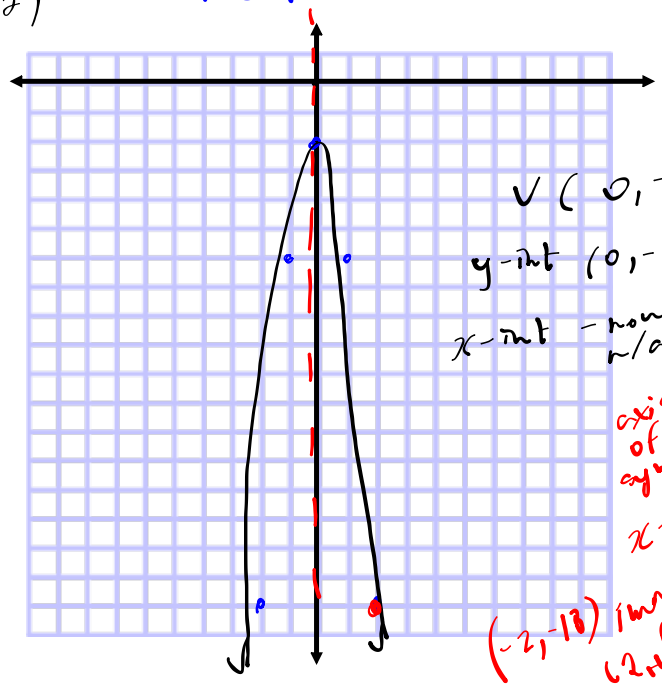
PM

G ✓

D

C

**Step ③ Plot point / draw curve**



$V(0, -2)$

y-int $(0, -2)$

x-int – none n/a

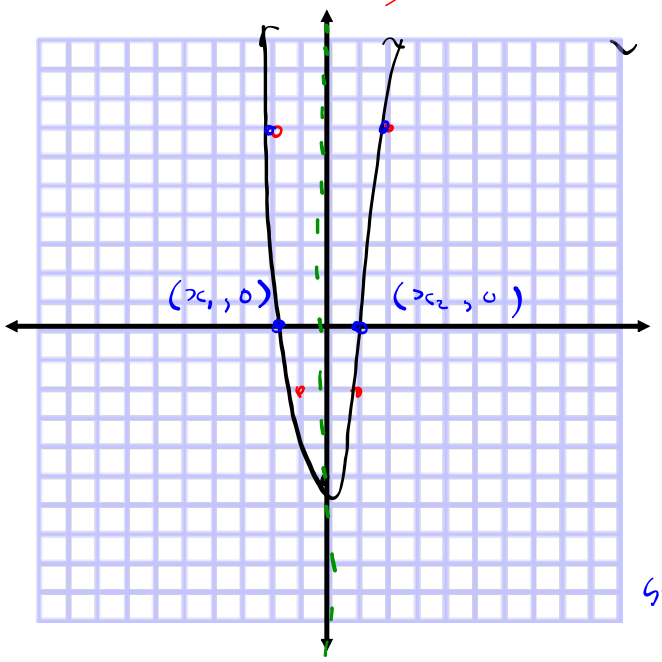
axis of sym $x = 0$

$(-2, -18)$ (mirror this)

graph $y = 3x^2 - 5$

- Vertex
- y-int
- x-int(s)
- axis of sym
- image point of $(1, -2)$

$V(0, -5)$




| x | y |
|---|---|
| 2 | 7 |
| 1 | -2 |
| 0 | -5 |
| -1 | -2 |
| -2 | 7 |

$V(0, -5)$

y-int $(0, -5)$

x-ints

to find x-ints algebraically: sub $y = 0$ into equation

x - ints

$(1.29, 0)$

$(-1.29, 0)$

axis of sym

$x = 0$

$y = 3x^2 - 5$

$+5 \quad +5$

$0 = 3x^2 - 5$

$5 = 3x^2$

$\frac{5}{3} = x^2$

To solve, isolate $x$ by performing opposite operations

$\sqrt{\frac{5}{3}} = \sqrt{x^2}$

When taking square root, always plus/minus

$x = \pm 1.29$

The role of the 'c' parameter

'c' is the vertical translation

(1) as c increases, the graph moves up

(2) the 'c' is always the y-int of the graph

y-int $(0, c)$

$y = ax^2 + bx + c$

What's the y-int?

| | y-int |
|---|---|
| $y = x^2$ | $(0,0)$ |
| $y = x^2 + 1$ | $(0,1)$ |
| $y = x^2 + x$ | $(0,0)$ |
| $y = 2x^2 - 2$ | $(0,-2)$ |
| $y = 2 + 2x^2$ | $(0,2)$ |

# Unit 7 : Graphing 2nd degree equation of the form $y = ax^2 + bx + c$

graph $y = x^2 - 6x + 5$

$y = ax^2 + bx + c$

$0^2 - 6(0) + 5$

Step (1) Find Vertex

$V\left(-\frac{b}{2a}, -\frac{\Delta}{4a}\right)$ $V\left(\frac{-(-6)}{2(1)}, \frac{-16}{4(1)}\right)$

$\Delta = b^2 - 4ac$ $\Delta = (-6)^2 - 4(1)(5)$ $V(3, -4)$

$a = 1$

$b = -6$ $\Delta = 16$

$c = 5$

Step (2) TOV

$y = x^2 - 6x + 5$

| x | y |
|---|---|
| 1 | $1^2 - 6(1) + 5 = 0$ |
| 2 | $(2)^2 - 6(2) + 5 = -3$ |
| 3 | $-4$ |
| 4 | $(4)^2 - 6(4) + 5 = -3$ |
| 5 | $(5)^2 - 6(5) + 5 = 0$ |

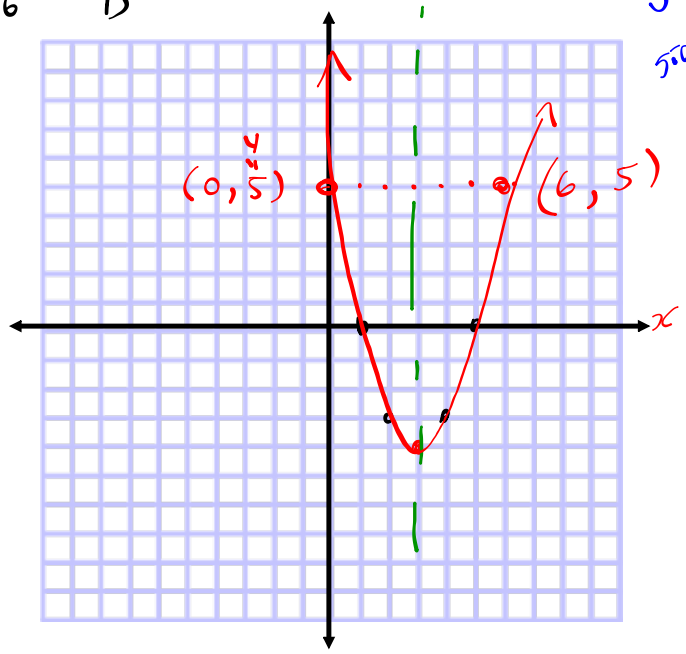
alg → 3-2

solve 3-1

V

Julie 3+1

sym 3+2




vertex (3, -4)

y-int

x-ints (1,0) and (5,0)

axis of sym $x = 3$

image point of y-int

graph

$$y = 2x^2 - 12x + 9$$

→ look at what 'b' parameter does on monday!