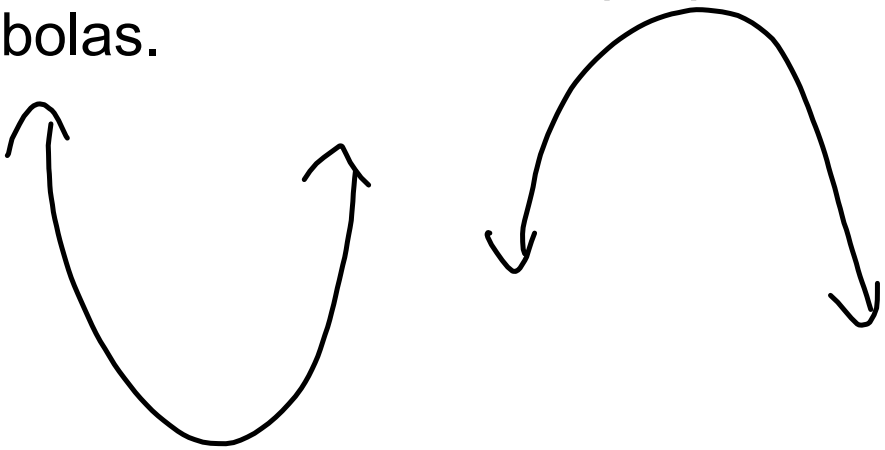
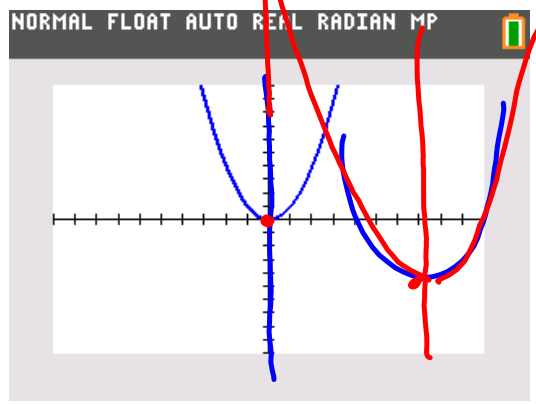
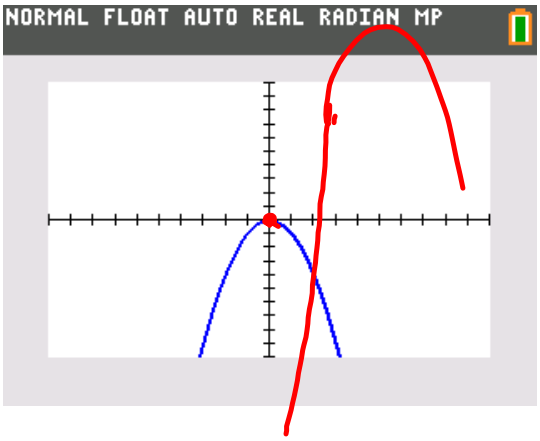
Chapter 9 Day 1:

Today we will learn how to graph a parabola and also how to determine properties of parabolas.



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

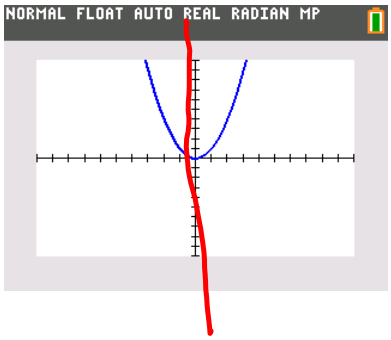




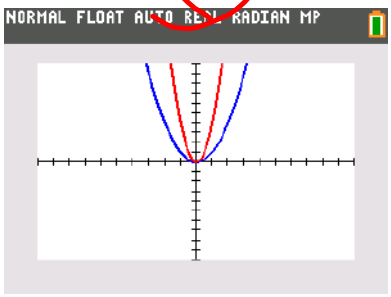
Vocabulary:

- coefficients
- axis of symmetry
- vertex
- y-intercept
- domain
- range
- minimum
- maximum

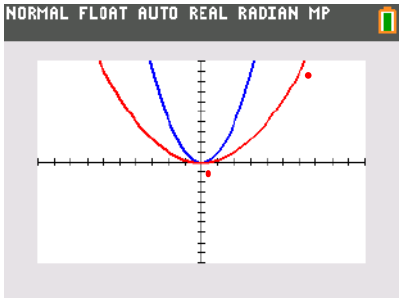
$y = x^2$



$y = 4x^2$



$y = \frac{1}{4}x^2$



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

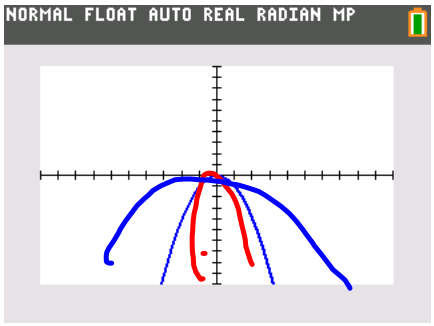
if $|a| \geq 1$ the graph gets skinnier
if $0 < |a| < 1$ the graph gets fatter

What if a is negative?

$y = -x^2$

$y = -4x^2$

$y = -\frac{1}{4}x^2$



Standard Form of a Quadratic (Parabola)

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

The following steps will take you through the problem:

1. Identify a, b, and c
2. Find the axis of symmetry
3. Start a table of values using your x value from step 2
4. Identify your vertex (using steps 2 & 3)
5. Identify your y-intercept (0,c)
6. Plot your vertex, y-intercept and your axis of symmetry on your graph
7. Choose at least one more x-value to add to your table of values, then plot this point.
8. Connect your points to form your parabola.

Ex: $y = x^2 - 2x + 1$

a= 1

b= -2

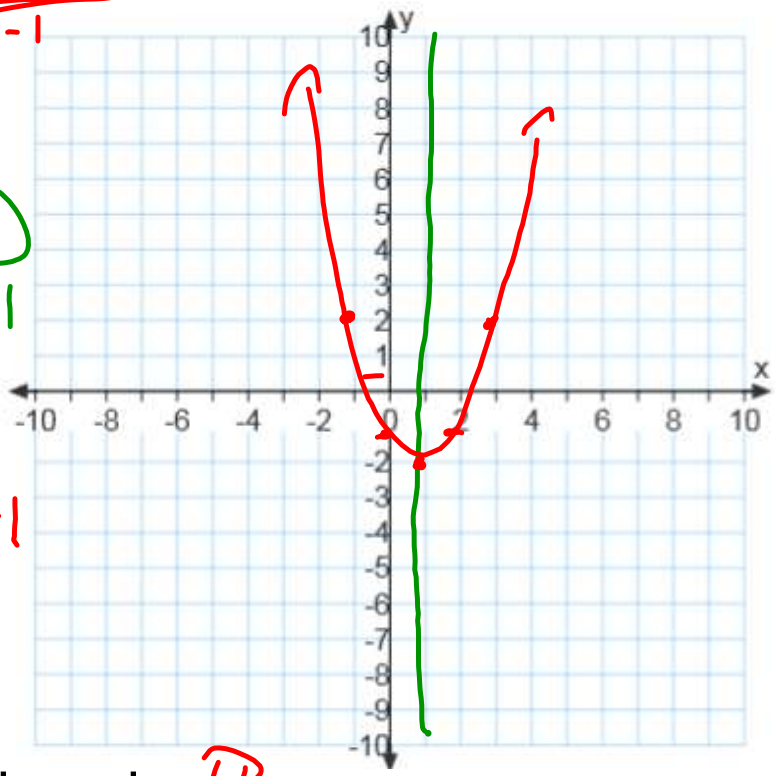
c= -1

axis of symmetry

$x = \frac{-b}{2a}$ $= \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$

Vertex (1, -2)

X	Y
1	-2
0	-1
2	1
3	



domain: $\mathbb{R}$

range: $y \geq -2$

minimum or maximum?

Example: $y = 2x^2 + 8x + 6$

a= 2

b= 8

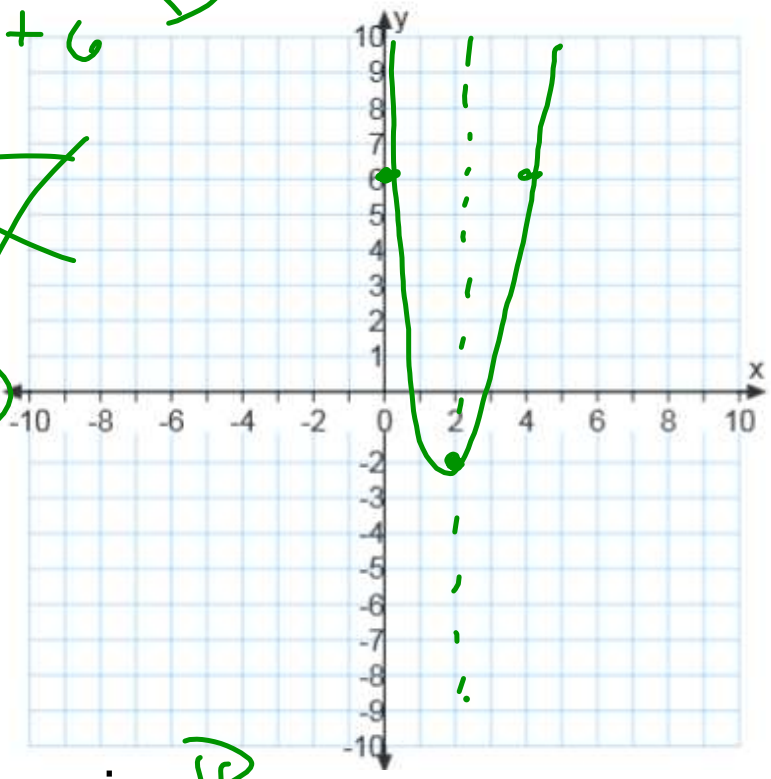
c= 6

$8 + -16 + 6$

axis of symmetry

$x = \frac{-b}{2a}$ $\frac{-(8)}{2(2)} = \frac{8}{4} = 2$

Vertex (2, -2)



X	Y
2	-2
0	6
4	6

domain: R

range: $y \geq -2$

minimum or maximum?

Example: $f(x) = -x^2 - 3x + 10$

a= -1

b= -3

c= 10

$-(-1.5)^2 + -3(-1.5) + 10$

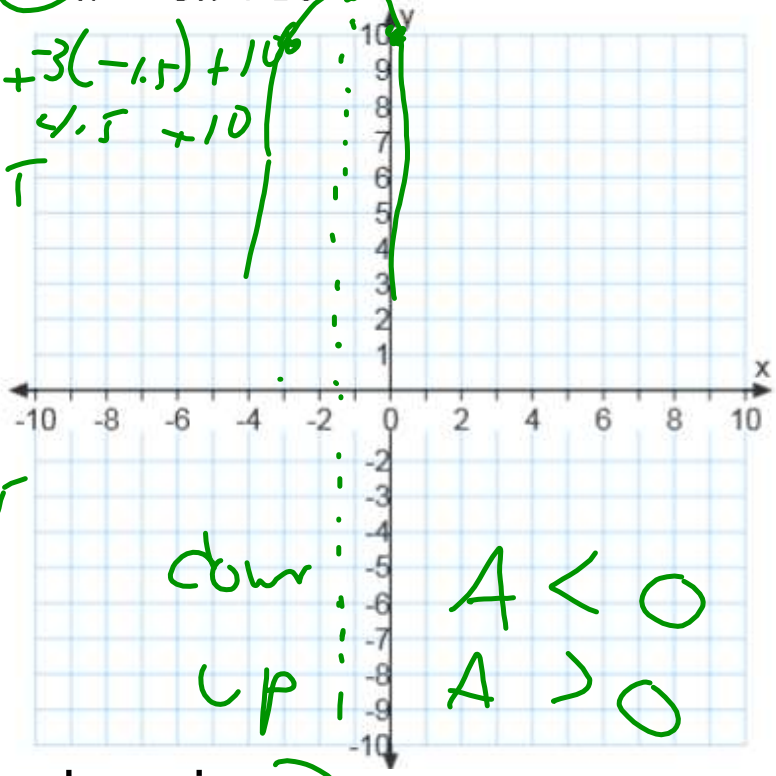
$-2.25 + 4.5 + 10$

17.25

axis of symme

$x = \frac{-b}{2a}$ $\frac{-(-3)}{2(-1)} = \frac{3}{-2}$

Vertex $(-1.5, 17.25)$



down $A < 0$

up $A > 0$

X	Y
-1.5	17.25
0	10
-3	10

domain: $\mathbb{R}$

range: $y \leq 17.25$

minimum or maximum?

Example: $y = \frac{1}{4}x^2 + 0x + 0$

a= $\frac{1}{4}$

b= 0

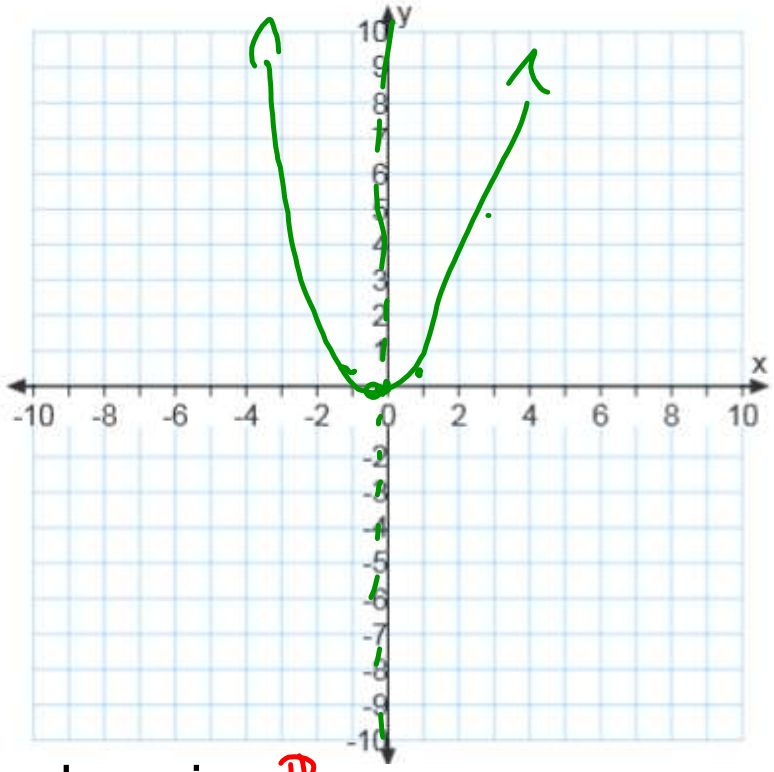
c= 0

axis of symme

$x = \frac{-b}{2a} = \frac{-0}{2(\frac{1}{4})} = 0$

Vertex (0, 0)

X	Y
0	0
1	.25
-1	.25



domain: $\mathbb{R}$

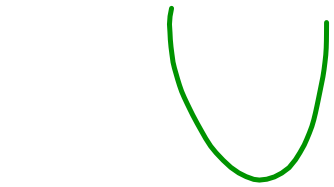
range: $y \geq 0$

minimum or maximum?

Example: Determine whether the function

$$y = 3x^2 - 18x + 20$$

has a minimum value or a maximum value. Then, find the minimum or maximum value.



$A = 3$

$B = -18$

$C = 20$

$x = \frac{-B}{2A} \quad \frac{-(-18)}{2 \cdot 3} = \frac{18}{6} = 3$

$(3, -7)$

min val $= -7$