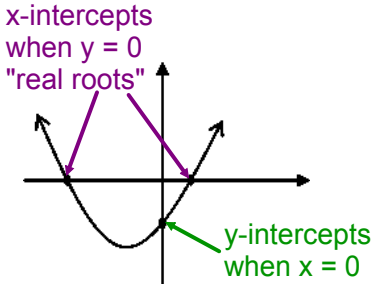
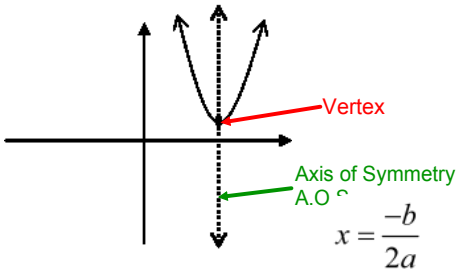
Section 1.7
Quadratic Functions and their Graphs

-Form is $f(x) = ax^2 + bx + c$, $a \neq 0$
-Graph satisfies $y = ax^2 + bx + c$
-Graph is called a PARABOLA

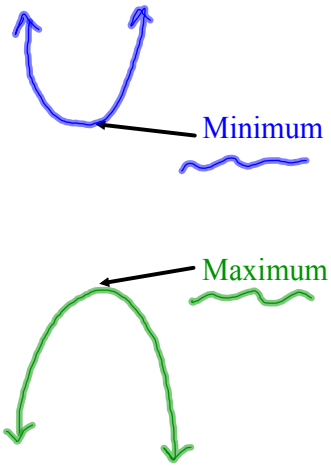


Labels/Terminology



$$x = \frac{-b}{2a}$$

a-value	**Opening**	**Vertex**
$a > 0$	UP	Minimum
$a < 0$	DOWN	Maximum



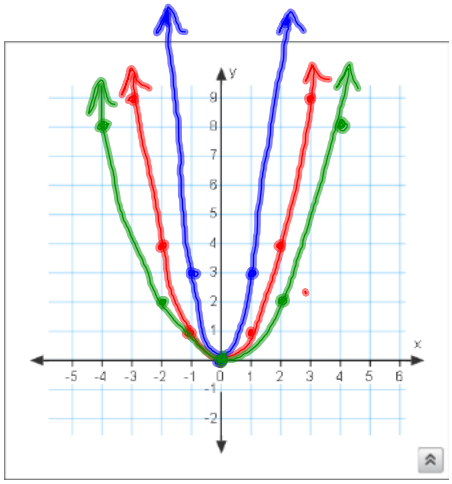
Parent Graph: $y = x^2$

$y = 3x^2$

x	y
0	0
1	3
2	12

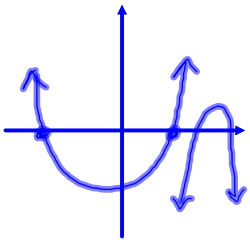
$y = \frac{1}{2} x^2$

X	y
0	0
2	2
4	8



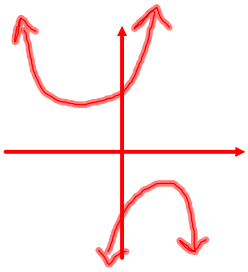
Note: The bigger |a-value| the more narrower the parabola

Number of Roots



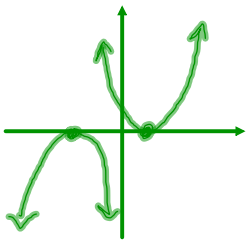
2 real roots

$b^2 - 4ac > 0$



2 imaginary roots

$b^2 - 4ac < 0$



1 real root

$b^2 - 4ac = 0$

Double Root

Example 1

Find the intercepts, A.O.S., and vertex of the parabola. Sketch the graph and label.

$y = x^2 - 4x - 5$

x-intercepts

$y=0$

$0 = x^2 - 4x - 5$ $\quad -5 \times 1 = -5$, $-5 + 1 = -4$

$(x-5)(x+1)$

$x=5 \quad x=-1$

y-intercepts

$x=0$

$y = 0^2 - 4(0) - 5 = -5$

AOS

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

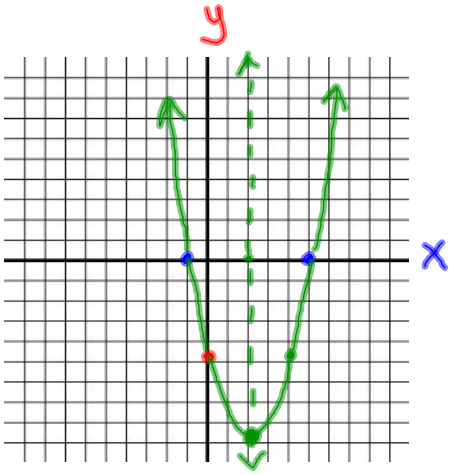
Vertex

(x, y)

$(2, -9)$ vertex

$y = (2)^2 - 4(2) - 5$

$= 4 - 8 - 5 = -9$



Example 2

Find the intercepts, A.O.S., and vertex of the parabola. Sketch the graph and label.

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

x-intercepts

$y=0$

$0 = x^2 - 2x - 5$

$\frac{2 \pm \sqrt{4 - 4(1)(-5)}}{2(1)} = \frac{2 \pm \sqrt{24}}{2}$ $\quad x = 3.4$, $x = -1.4$

y-intercepts

$x=0$

$y = 0^2 - 2(0) - 5 = -5$

AOS

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

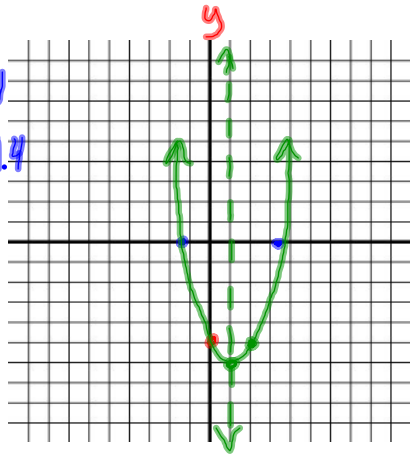
Vertex

(x, y)

$(1, -6)$

$y = (1)^2 - 2(1) - 5$

$1 - 2 - 5 = -6$



Another Way To Graph: $y = a(x - h)^2 + k$ (opposite)

Vertex: **(h, k)**
A.O.S: **x = h**

Example 3
Graph and label.
$y = x^2 + 4x + 9$

* complete the square

$x^2 + 4x = -9$

$\left(\frac{4}{2}\right)^2 = (2)^2 = 4$

$x^2 + 4x + 4 = -9 + 4$

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

$+5 \quad +5$

$y = (x+2)^2 + 5$ (h, k)

Vertex $(-2, 5)$

AOS $x = -2$

y-intercepts
$x = 0$ $(0, 9)$

y int
$(0+2)^2 + 5 = 9$

x-intercepts
$y = 0$

$0 = (x+2)^2 + 5$

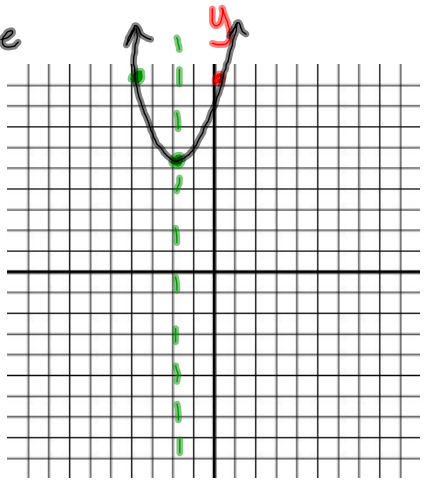
$-5 \quad -5$

$\sqrt{-5} = \sqrt{(x+2)^2}$

$\pm i\sqrt{5} = x + 2$

$-2 \quad -2$

$x = -2 \pm i\sqrt{5}$ 2 imag. roots ⇒ No x-int.



Methods of Graphing Parabolas

Method #1: AOS $x = \frac{-b}{2a}$ and Vertex $\left(\frac{-b}{2a}, y\right)$

(plug in x-value & solve for y-value)

Method #2: $y = a(x - h)^2 + K$ Vertex (h, k)

AOS $x = h$

Note: $y = ax^2 + bx + c$ **the y-intercept is always the c-value**

Homework

p41 #4, 6, 11, & 12, 15-19 all

like ex:1&2 **ex:3** **your way**