Introduction to Quadratic Equations

In mathematics, a quadratic equation is a polynomial of second degree that can be written in the form:

$$y = ax^2 + bx + c \qquad \textbf{where } a \neq 0$$

Quadratic equations are most noticeable because they have an 'x^2'.

On a graph, a quadratic equation makes a U-shaped curve called a parabola.

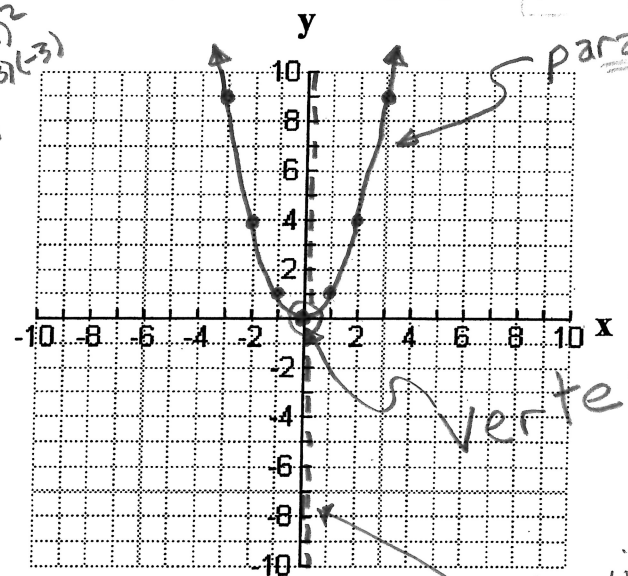
Example:

Fill in the following table of values and use it to graph → $y = x^2$

x	$y = x^2$
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$y = (-3)^2$
$y = (-3)(-3)$
$y = 9$

← origin



parabola

vertex

axis of symmetry

Quadratic equations have many real world applications.
For example:

- relates the height of an object thrown in the air as time elapses
- to relate the amount of profit from selling a product vs. selling price
- finding the sides of right triangle with Pythagoras ← $c^2 = a^2 + b^2$
- communications (the parabolic receiver/ satellite dish)

Multiplying Monomials

A quadratic equation is produced whenever the variable 'x' is multiplied by another 'x'.

Practice (Multiplying Monomials)

Simplify the following equations:

a) $y = x(x)$ $y = x^2$

b) $y = -3x(x)$ $-3x(1x)$ $y = -3x^2$

c) $y = -2x(-6x)$ $y = 12x^2$

d) $y = 3x(2x-1)$ $y = 6x^2 - 3x$

When two monomials are multiplied:
→ first multiply the coefficients
→ second multiply the variables; note $x(x) = x^2$

Note $\begin{cases} (x)(x) = x^2 \\ (x)+(x) = 2x \end{cases}$

Using the FOIL Rule to Multiply Two Binomials

The Foil Rule stands for:

Firsts
Outsides
Insides
Lasts

Example: Use the FOIL RULE to expand and simplify the following expressions:

a) $(x+2)(x+3)$ F O I L

$= x^2 + 3x + 2x + 6$

$= x^2 + 5x + 6$

b) $(x+5)(x+2)$

$= x^2 + 2x + 5x + 10$

$= x^2 + 7x + 10$

c) $(x-7)(x+9)$

$= x^2 + 9x - 7x - 63$

$= x^2 + 2x - 63$

d) $3(x-2)(x+7)$

$= 3(x^2 + 7x - 2x - 14)$

$= 3(x^2 + 5x - 14)$

$= 3x^2 + 15x - 42$

e) $(x-6)(x+6)$

$= x^2 + 6x - 6x - 36$

$= x^2 - 36$

difference of squares

f) $(x+5)^2$

$= (x+5)(x+5)$

$= x^2 + 5x + 5x + 25$

$= x^2 + 10x + 25$

Hwk
pg 367-368 #6, 8, 9, 10, 11

Expanding Binomials – Practice

1. Expand the following expressions:

a) $(x+3)(x+8)$

$= x^2+8x+3x+24$

$= x^2+11x+24$

b) $(x-4)(x+7)$

$= x^2+7x-4x-28$

$= x^2+3x-28$

c) $(x-3)(x-9)$

$= x^2-9x-3x+27$

$= x^2-12x+27$

d) $(2x+1)(x-3)$

$= 2x^2-6x+1x-3$

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

e) $(x+2)(3x+5)$

$= 3x^2+5x+6x+10$

$= 3x^2+11x+10$

f) $(2x-1)(3x+4)$

$= 6x^2+8x-3x-4$

$= 6x^2+5x-4$

g) $2(x+5)(x+1)$

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

$= 2(x^2+6x+5)$

$= 2x^2+12x+10$

h) $3(x-1)(x+4)$

$= 3(x^2+4x-1x-4)$

$= 3(x^2+3x-4)$

$= 3x^2+9x-12$

i) $-2(x-9)(x-2)$

$= -2(x^2-2x-9x+18)$

$= -2(x^2-11x+18)$

$= -2x^2+22x-36$

j) $(x+4)^2$

$= (x+4)(x+4)$

$= x^2+4x+4x+16$

$= x^2+8x+16$

k) $(x-3)^2$

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

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

$= x^2-6x+9$

l) $2(x+5)^2$

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

$= 2(x^2+5x+5x+25)$

$= 2(x^2+10x+25)$

$= 2x^2+20x+50$

2. Complete the table of values then graph the parabola:

$y = (x-4)^2 - 3$

vertex form

x	y
1	6
2	1
3	-2
4	-3
5	-2
6	1
7	6

$y = [(1)-4]^2-3$

$= [-3]^2-3$

$= 9-3$

$= 6$