Standard Form of a Quadratic Relation:
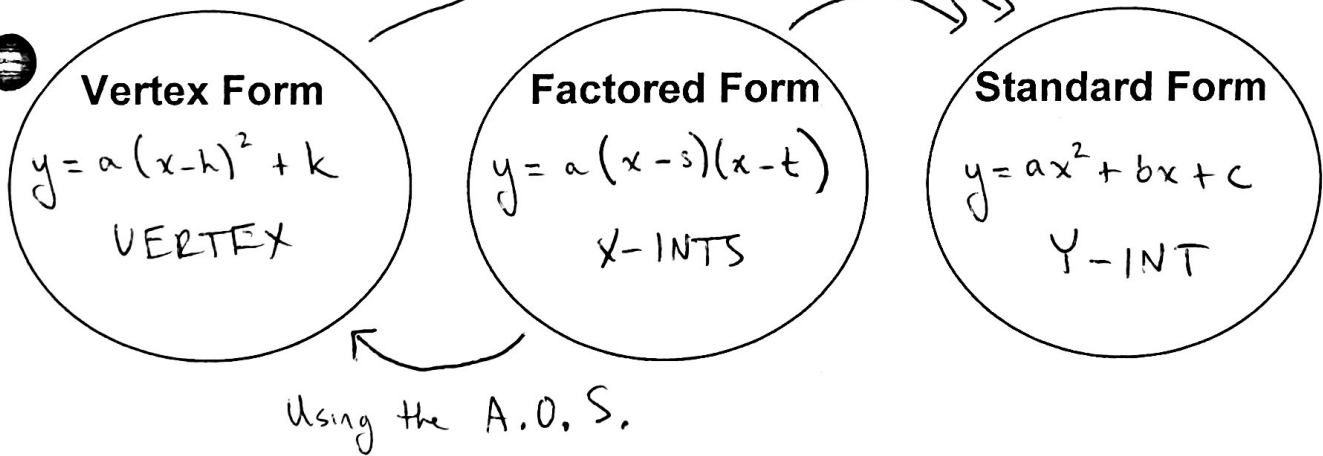
$$y = ax^2 + bx + c$$

This tells you the step pattern
$1a, 3a, 5a$

This tells you the y-intercept $(0, c)$

Summary of the Three Forms

This flow chart will encompass our learning for this first unit on quadratic relations

Expanding & Simplifying

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

Factored Form
$$y = a(x-s)(x-t)$$
X-INTS

Standard Form
$$y = ax^2 + bx + c$$
Y-INT

Using the A.O.S.

Getting to Standard Form...

In order to get to standard form, some algebra is required. Specifically, you will be using the distributive law that you learned in grade 9.

Try the following:

a) $5(x - 10)$
$= 5x - 50$

b) $-2(2x - 5)$
$= -4x + 10$

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

d) $3(x^2 - 4x + 1)$
$= 3x^2 - 12x + 3$

How can we use this distributive law to expand and simplify two binomials? Let's do some examples converting factored form and vertex form into standard form.

Examples:

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

$$= x(x+5) + 2(x+5)$$
$$= x^2 + 5x + 2x + 10$$
$$= x^2 + 7x + 10$$

b) $y = (x - 2)(x + 7)$

$$= x(x+7) - 2(x+7)$$
$$= x^2 + 7x - 2x - 14$$
$$= x^2 + 5x - 14$$

To make this quicker, you can do all 4 multiplications at once. An acronym that helps you remember what things to multiply is FOIL (first, outside, inside, last). Let's use FOIL together!

c) $y = (x + 1)(x - 8)$

$$= x^2 - 8x + x - 8$$
$$= x^2 - 7x - 8$$

d) $y = (x + 4)^2$

$$= (x+4)(x+4)$$
$$= x^2 + 4x + 4x + 16$$
$$= x^2 + 8x + 16$$

Lastly let's look at how to deal with expressions where the a-value is not one.

e) $y = 4(x + 1)(x - 2)$

$$= 4(x^2 - 2x + x - 2)$$
$$= 4(x^2 - x - 2)$$
$$= 4x^2 - 4x - 8$$

f) $y = 3(x - 1)^2 + 5$

$$= 3(x-1)(x-1) + 5$$
$$= 3(x^2 - x - x + 1) + 5$$
$$= 3(x^2 - 2x + 1) + 5$$
$$= 3x^2 - 6x + 3 + 5$$
$$= 3x^2 - 6x + 8$$

You try it: Expand the following 2 quadratic relations to convert them into standard form. A graph has been provided so that you can check your answer.
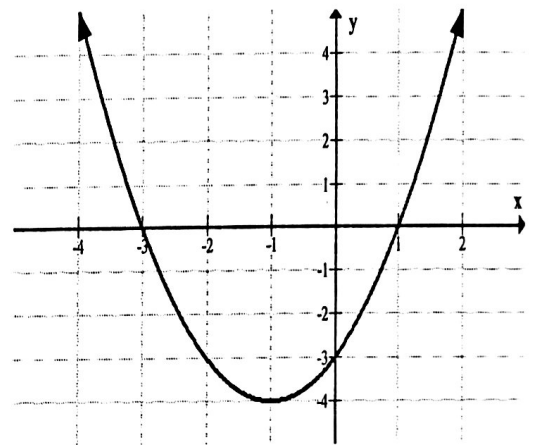
1)

a) Vertex Form:

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

$$= (x+1)(x+1) - 4$$

$$= x^2 + x + x + 1 - 4$$

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

b) Factored Form:

$$y = (x + 3)(x - 1)$$

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

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

Sketch:

2)

a) Vertex Form:

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

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

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

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

$$= -2x^2 - 8x - 8 + 2$$

$$= -2x^2 - 8x - 6$$

b) Factored Form:

$$y = -2(x + 1)(x + 3)$$

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

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

$$= -2x^2 - 8x - 6$$

Sketch: