Recall that any quadratic function expressed in <u>standard form</u> is $\boxed{y = a(x-p)^2 + q}$

Quadratic functions can also be written in the <u>general form</u> $\boxed{y = Ax^2 + Bx + C}$ where we have three methods of graphing these functions expressed in this form

1. We can use the <u>X.A.V. method</u>
   a. Factor the trinomial to find the <u>X-intercepts</u>
   b. Find the <u>A of S</u> by calculating the average of the x-intercepts (which is the x-coordinate of the vertex)
   c. Determine the y-coordinate of the <u>Vertex</u> by substituting the x-coordinate from the A of S into the equation and solve for 'y'
   d. Graph the parabola by using the congruency values from the constant 'a'
2. <u>Completing the Square</u> (Sec 3.3) is the other method where we use algebraic manipulation to change the function from general form to standard form
3. The <u>textbook method</u> is similar to XAV method, but finds A of S differently

Example 1: Graph $y = x^2 - x - 6$, and answer the following questions.
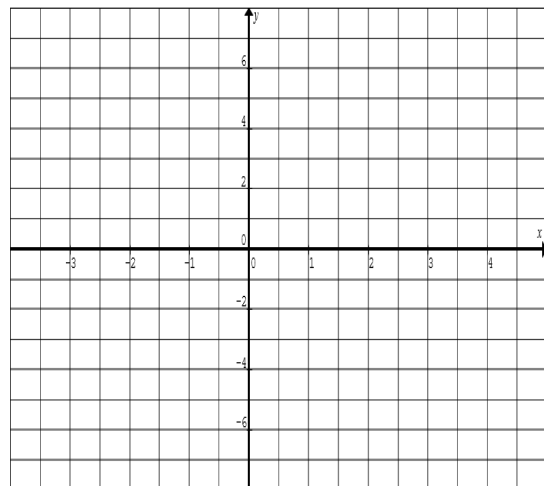
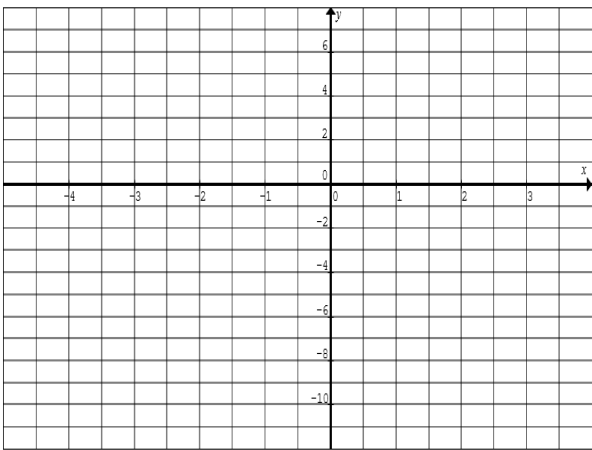|	
a) Determine the x-intercept(s). Make 'y' value equal to zero, then factor	Graph the function
b) Calculate the A of S. Determine the average of the x-intercepts	
c) Find the coordinates of the vertex. Substitute the A of S into the equation and solve for 'y'	e) State the domain (all possible 'x' values) and range (all possible 'y' values)
d) Determine the y-intercept. Make all the 'x' values equal to zero	

Example 2: Graph $y = 2x^2 + 3x - 9$, and answer the questions that follow.

a) Determine the X-intercepts	Graph the function
b) Calculate the A of S	
c) Find the coordinates of the vertex	
d) Determine the y-intercept	
	e) State the domain and range

The textbook method requires us to understand the algebraic manipulation from standard form to general form

$y = a(x - p)^2 + q$ $y = a(x^2 - 2px + p^2) + q$ $y = ax^2 - 2apx + ap^2 + q$ $y = ax^2 + (-2ap)x + (ap^2 + q)$ $y = ax^2 - bx + c$	o Expand the expression o Distributive law to rid brackets o Group "x^2", "x", and constant terms

Did you observe a couple of things when we went from standard to general form?

1. Notice that $b = -2ap$. If we solve for 'p', we get $p = \dfrac{-b}{2a}$. Since A of S is
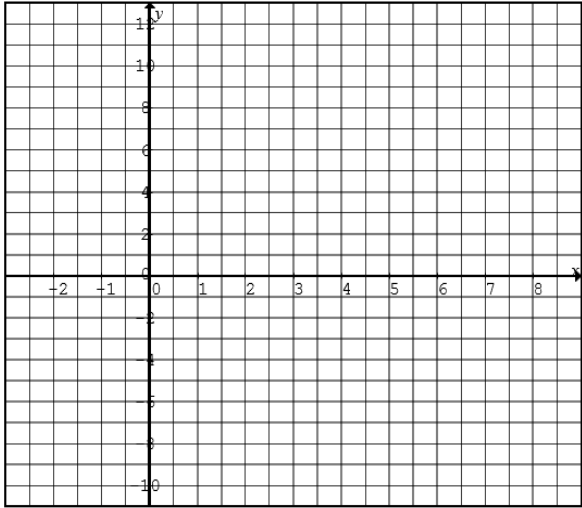
   $x = p$ in standard form, therefore A of S is $x = \dfrac{-b}{2a}$ in general form.

2. You should also notice that $c = ap^2 + q$. Solving for 'q', we get $q = c - ap^2$

To recap then, the textbook has one difference in finding the coordinates of the vertex and the A of S

- o We need to calculate the x-coordinate of the vertex first using $x = \dfrac{-b}{2a}$
- o This coordinate will also be the equation for the A of S
- o Sub this coordinate into the equation and solve for 'y' (the y-coordinate of vertex)
- o The 'x' & 'y' intercepts will be solved the same way
  - o X-intercepts: make y = 0 and solve for 'x'
  - o Y-intercepts: make x = 0 and solve for 'y'

Example 3: Graph $y = (x-3)^2 - 9$, and determine the vertex, A of S, x & y-intercepts, domain, and range

a) Change to general form	f) Find x-intercepts. y-coordinate = 0
b) Determine x-coordinate of vertex	Graph function (congruent to $y = x^2$)
c) This is also equation for A of S	
d) Sub x-coordinate into equation and find 'y' to determine vertex	
e) Find y-intercept. x-coordinate = 0	g) Determine domain and range