Precalculus 11 **Sec 4.1 – Graphical Solutions of Quadratic Equations**

There are four methods that we can use to solve quadratic equations.

a) By **graphing** using a pencil & paper or a graphing calculator (Sec 4.1)
2. By **factoring** the equation using the BUM method, criss-cross method, Punnet-square method, or the decomposition method (Sec 4.2)
3. By completing the square (Sec 4.3)
4. By using the Quadratic Formula (Sec 4.4)

In all four methods, the roots of an equation or the zeros of a function must be determined. We will use the graphing method in this section

Let's look at some **properties of quadratic equations**.

1. All are 2nd degree functions, ie, the largest term in the function has an exponent of "2"

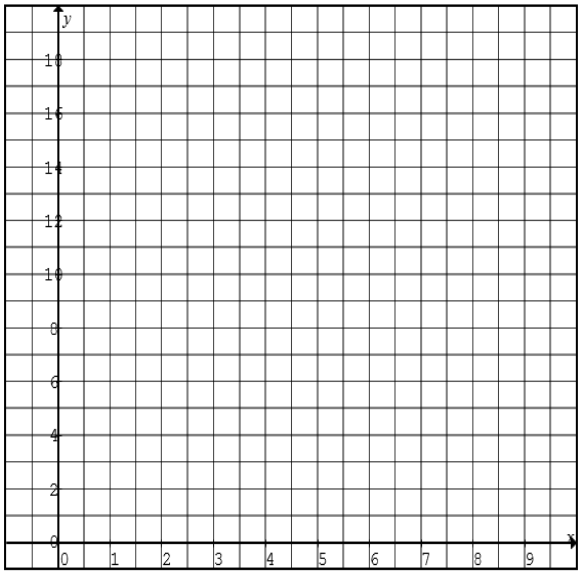
   $f(x) = y = ax^2 + bx + c$ (function) $ax^2 + bx + c = 0$ (equation)

   - a, b, and c, are real numbers, except a ≠ 0
2. When determining the zeros of a function, find the x-intercepts where the function $f(x) = 0$
3. When determining the roots of an equation, find the value(s) of "x" that make the equation = 0

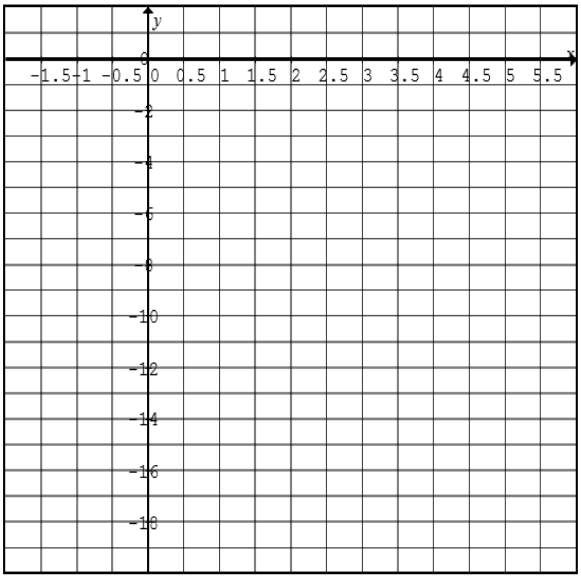
1. Quadratic Functions with one real root or one x-intercept (aka, "double" root)

Example 1: Determine the zero(s) for the function, using a graphing calculator

a) $y = x^2 - 10x + 25$



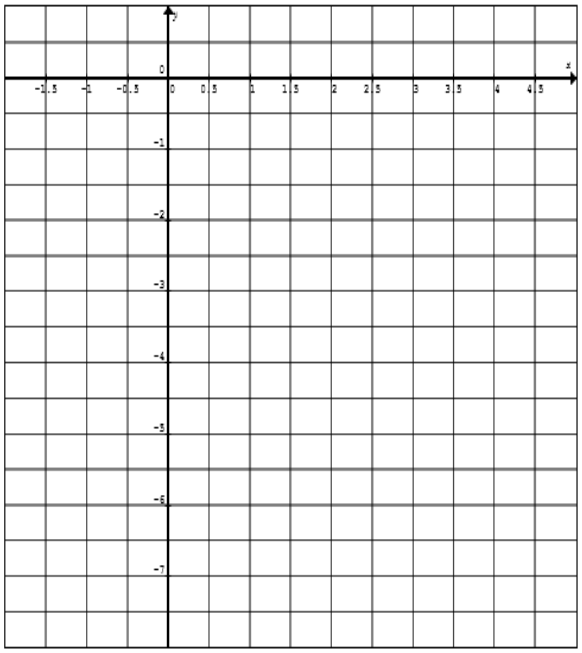
b) $f(x) = -2x^2 + 8x - 8$



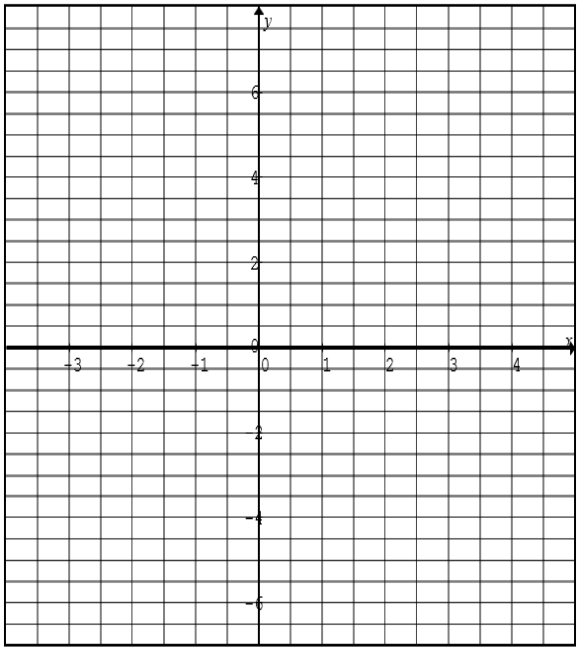
2. Quadratic Functions with two real roots or two x-intercepts

Example 2: Determine the zero(s) for the function using a graphing calculator

c) $y = -x^2 + 3x - 2$



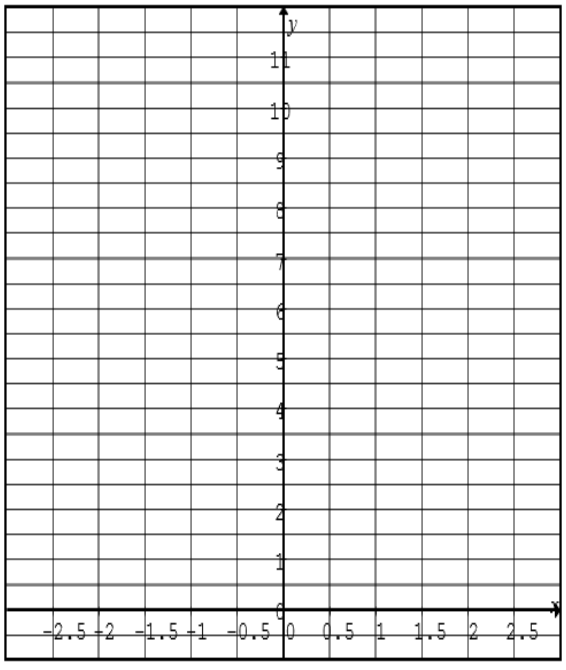
d) $f(x) = x^2 - x - 6$



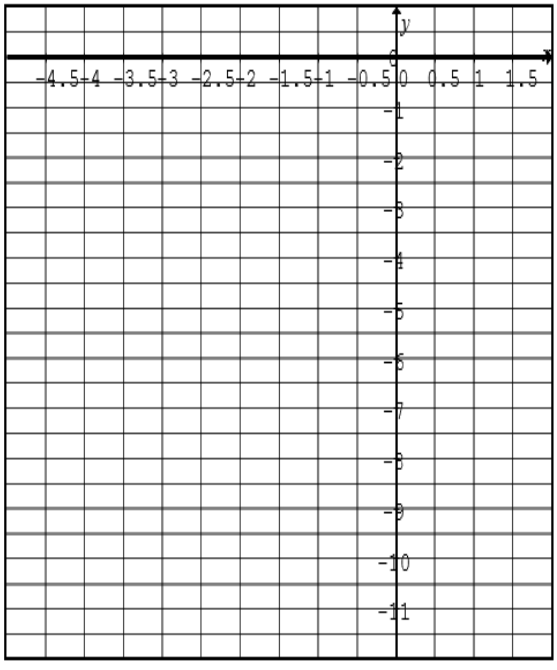
3. Quadratic Functions with <u>no real roots</u> or <u>no x-intercepts</u>

Example 3: Determine the zero(s) for the function using a graphing calculator

e) $y = 2x^2 - x + 1$



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



In summary, how can you recognize the number of roots/zeros given a quadratic equation? The following is only a general rule of thumb:

1. For one real root, the trinomial is a perfect square

$$x^2+8x+16=0 \longrightarrow (x+4)(x+4)=0$$

2. For two real roots, the trinomial is easily factorable

$$x^2+3x-10=0 \longrightarrow (x+5)(x-2)=0$$

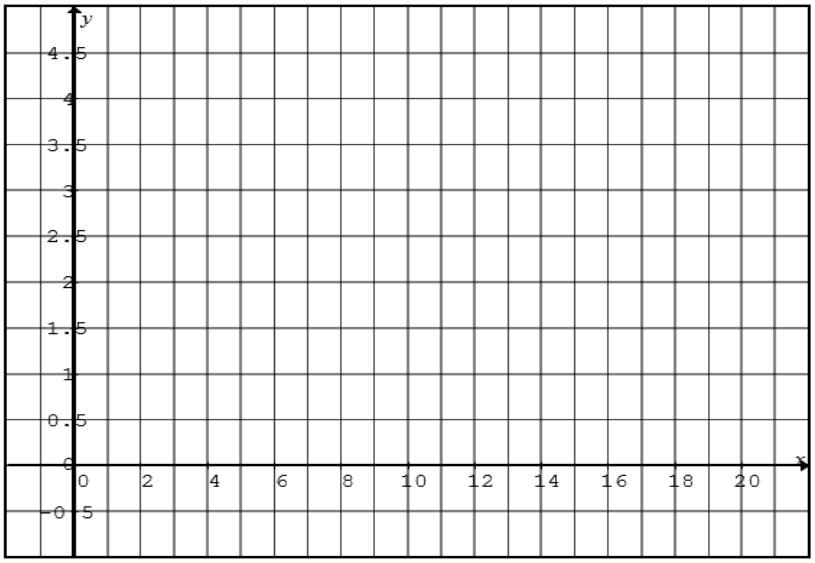
3. For no real roots, the trinomial can't be factored

$$-x^2-2x-4=0 \longrightarrow \infty$$

Example 4: The function $h(d) = -0.04d^2 + 0.8d$ models the height of a soccer ball in $h(d)$ meters, in terms of the horizontal distance, d meters, from where the ball was kicked on the ground.

a) Write an equation to represent the situation when the ball lands on the ground

b) How far does the ball travel horizontally until it first hits the ground? Use a graph to find the solution.



Homework: