**2.2 Graphing Polynomial Functions**

It is easier to graph polynomial functions, if they are in factored form. The following rules apply when graphing polynomial functions:

1. If (x – a) has multiplicity of 1, the graph of *f* **crosses** the x-axis directly at *x* =a.
2. If (x – a) has multiplicity of an even number, the graph of *f touches* the x-axis but does not cross, with this general shape. It bounces at the zero.
3. If (x – a) has multiplicity of an odd number greater than one, the graph of *f* crosses the x- axis with this general shape. Looks like it will bounce, but at the zero it changes directions and crosses.

**Summary of Steps in Graphing a Polynomial**

Step 1: Find the x- intercept(s) by solving the equation \_\_\_\_\_\_\_ , that is let y=0 and solve for x. (use factoring, if possible).

Step 2: Find the \_\_\_\_\_\_\_\_\_\_ by finding f(0) , or let x=0 and solve for y.

Step 3: Determine the general shape at each x- intercept.

Step 4: Look at \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_ to determine the end behaviour of the graph of *f*. (Starts up or down / ends up or down)

Step 5: Determine the number of turning points.

Step 6: Some graphs have symmetry. Make sure to check if the graph has symmetry, with the following rules:

If $f\left(-x\right)=-f(x)$, then the function is \_\_\_\_\_, and we have origin symmetry. Eg: $y=f\left(x\right)=x^{3}$

If $f\left(-x\right)=f(x)$, then the function is \_\_\_\_\_\_\_, and we have symmetry in the y-axis. Eg: $y=f\left(x\right)=x^{2}$

Step 7: Use the x-value between the x-intercept values to estimate the highs and lows of the graph of *f*(x). (optional)

Step 8: Plot a reasonable number of points and draw a smooth continuous curve.

Example 1: Graph y= $(1+x)\left(x-3\right)^{2}$

Example 2: Graph y= ($1-x)\left(x-2\right)^{2}(x+2)$

Example 3: Graph y= $(x-3)(x+1)^{3}(x-2)^{2}$

You may also use a graphing calculator to graph a polynomial function, especially if it is not in factored form.

1. Input the function 2) Set the WINDOW!
2. Find the y –intercepts, the x- intercepts, and the max or min points by pressing the CALC button (2nd Trace) and following the prompts.

Example 4: Graph $y=2x^{4}-3x^{2}+2x-1$ by using a graphing calculator.