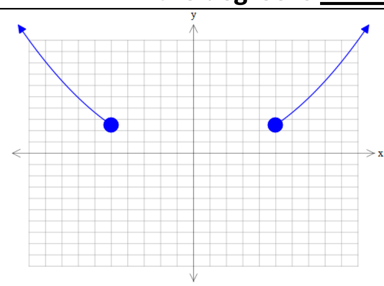
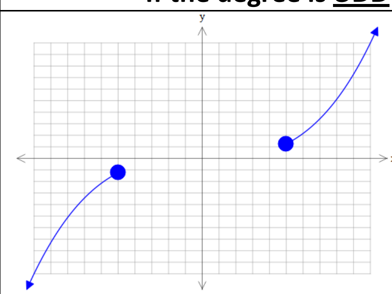
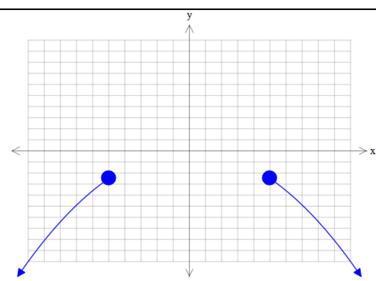
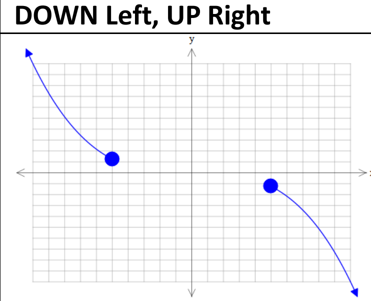
<u>Notes Graphs of Higher Degree Polynomial Functions</u>

Polynomial Functions of degree2 or higher are smooth and continuous. (No sharp corners or breaks).

<u>To graph general polynomial functions we need to:</u>

1. Know the functions end behavior.
2. Determine the x-intercept (s) of the function and the **<u>MULTIPLICITY</u>** of each x-intercept.
3. Determine the y-intercept.

1. **<u>End Behavior</u>** is what the function looks like at the very left and right of the graph. To determine end behavior of will be we need to identify the DEGREE and LEADING COEFFICIENT.
   <u>DEGREE:</u> largest exponent of the polynomial once it is completely distributed
   <u>LEADING COEFFICIENT:</u> the number in front of the variable with the highest degree (exponent)

	If the degree is *<u>EVEN</u>*	**If the degree is *<u>ODD</u>***
If the leading coefficient is *<u>POSITIVE</u>*	 **UP Both Left and Right**	 **DOWN Left, UP Right**
If the leading coefficient is *<u>NEGATIVE</u>*	 **DOWN Both Left and Right**	 **UP Left, DOWN Right**

Determine the Extreme/End Behavior:

EX1: $f(x) = 2x + 5$	EX2: $f(x) = -\frac{1}{4}x^4 + x^2 - x$
EX3: $f(x) = (x-5)(x+1)^2(x-3)$	EX4: $f(x) = -3(x-5)(x+1)^2(x-3)$

2. **<u>Finding x-intercept(s) their multiplicity:</u>** The x-intercept(s) and their multiplicity tell us what happens in the middle of the graph

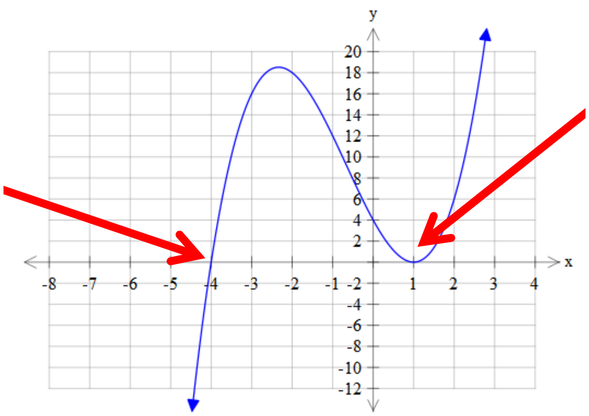
X-INTERCEPT(S): Recall, to find the x-intercept(s) (or zeros) of a function you must set it equal to zero and solve for x.

MULTIPLICITY: Multiplicity is the number of times a number is a zero for the given function.

Given $(x-h)^k = 0$, we say that h is a zero of multiplicity k

- If a zero has **an ODD multiplicity**, then the graph of the function will CROSS the X-Axis at that number.
- If a zero has **an EVEN multiplicity**, then the graph of the function will BOUNCE (touch the X-Axis and turn around) at that number.

ODD Multiplicity at x=-4



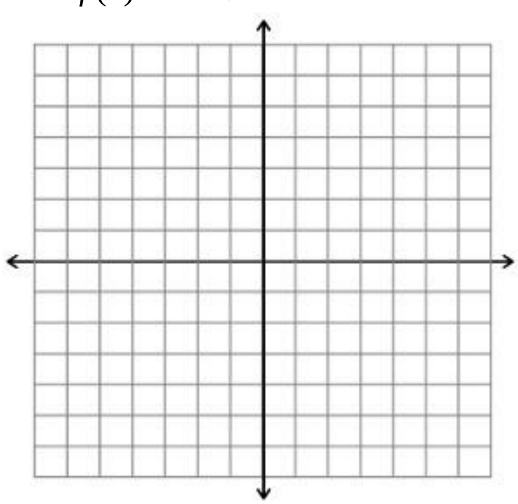
EVEN Multiplicity at x=1

3. **<u>Finding the y-intercept</u>:** The y-intercept tell us what happens in the middle of the graph

Y-INTERCEPT: To find the y-intercept, compute $f(0)$.

Graph the following polynomial functions and identify the end behavior, x-intercepts and their multiplicity, and the y-intercept of each

EX5: $f(x) = x^3 - 9x$

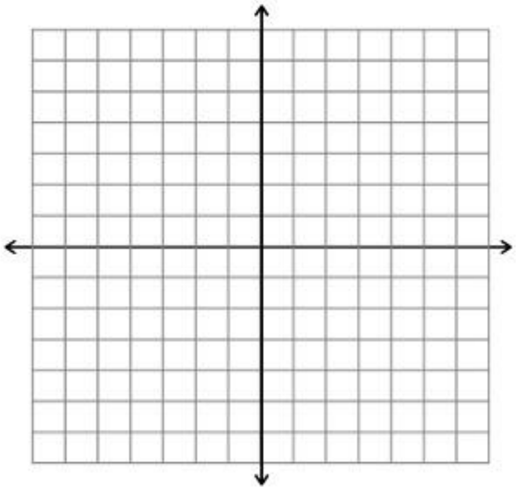
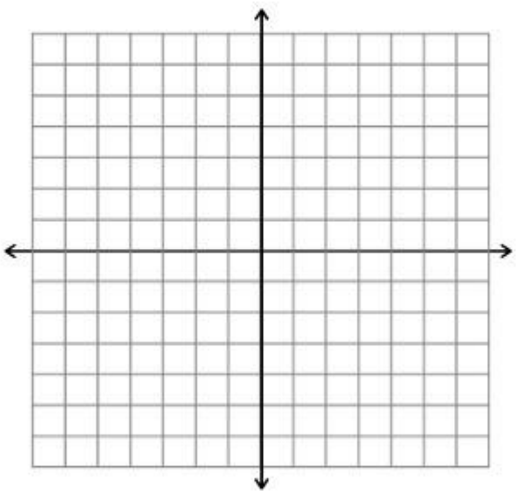
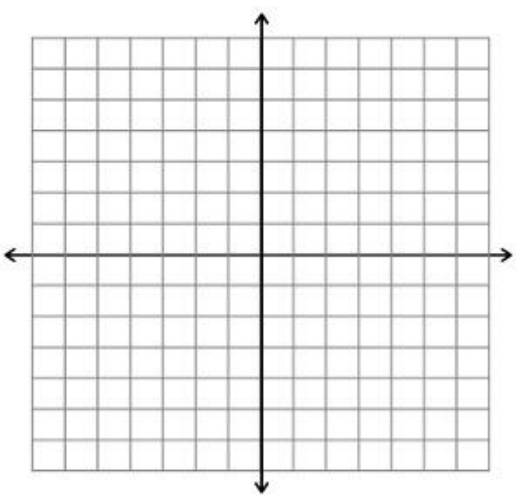


a. End behavior:____________________

b. X-intercepts:_____________________________

Multiplicity:______________________________

c. Y-intercept:______________________________

EX6: $f(x) = -\frac{1}{2}x(x+3)(x-1)^2$ 	a. End behavior:____________________ b. X-intercepts:____________________________ Multiplicity:_____________________________ c. Y-intercept:______________________________
EX7: $f(x) = x^4 + 6x^3 + 9x^2$ 	a. End behavior:____________________ b. X-intercepts:____________________________ Multiplicity:_____________________________ c. Y-intercept:______________________________
EX8: $f(x) = -x^3 - x^2 + 4x + 4$ 	a. End behavior:____________________ b. X-intercepts:____________________________ Multiplicity:_____________________________ c. Y-intercept:______________________________