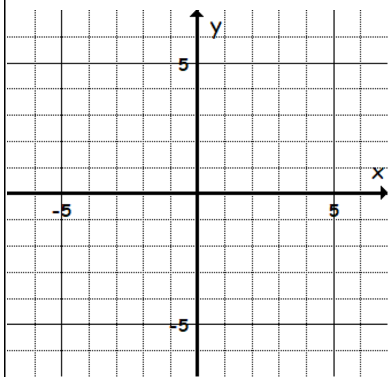
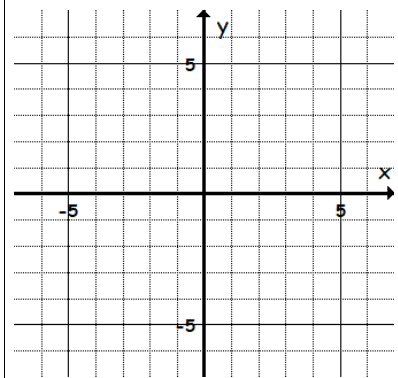
AA6-1 Investigation Name ___________________________

Graphs of quadratic and cubic functions

<u>Review of properties of quadratic functions</u>		
In **graphing form:** We know "a" controls how the parabola opens (up like a cup or down like a frown). In polynomials we call this **end behavior**. The start direction and final direction of the graph (up or down).	Graph: $y = -(x+3)^2 + 4$  **a = -1** **End behavior:** start: down final: down	$y = 2(x-3)^2 - 2$  **a =** ______ **End behavior:** start: ___________ final: ____________
Rewrite each functions from **graphing form** to **standard form:** Note: Does "a" change when you change from graphing to standard form? __________	$y = -(x+3)^2 + 4$ $y = -1(x+3)(x+3) + 4$ $y = -1(x^2 + 6x + 9) + 4$ $y = -x^2 - 6x - 9 + 4$ $Y = -x^2 - 6x - 5$	$y = 2(x-3)^2 - 2$ y = ___________________
Rewrite each function from **standard form** to **factored form** (a box and diamond can help): Note: Does "a" change when you change from standard to factored form? __________	$Y = -x^2 - 6x - 5$ $y = -(x^2 + 6x + 5)$ $y = -(x+5)(x+1)$	$y = 2x^2 - 12x + 16$ $y = 2(x^2 - 6x + 8)$ y = 2(_______)(_______)
From factored form, we can find the **x-intercepts** (also called the roots or zeros) of the graph by setting y=0 and using the zero product property.	$0 = -(x+5)(x+1)$ x = _____ x = ______ roots: (____, 0) and (____, 0)	0 = 2(_______)(_______) x = _______ x = _______ roots: (____, 0) and (____, 0)

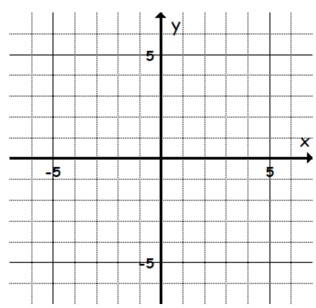
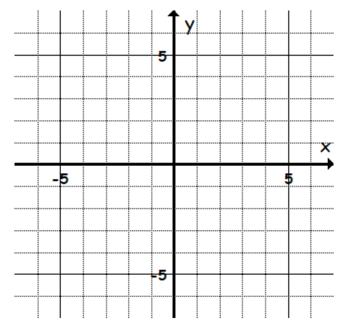
Look back at the graph of these parabolas. <u>Label the roots</u>.

These are called **simple** or **crossing** roots. Notice the graph crosses right through the x-axis at that point.

Quadratics are one type of polynomial. We have already studied three types of polynomials: linear, quadratic and cubic functions.

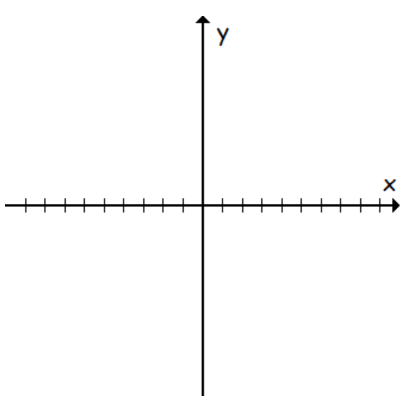
In **standard form** the equations are: $y = ax + b$ (**degree** 1 polynomial) $y = ax^2 + bx + c$ (**degree** 2 polynomial) $y = ax^3 + bx^2 + cx + d$ (**degree** 3 polynomial)

> Polynomials are functions in the form: $f(x) = ax^n + bx^{(n-1)} + cx^{(n-2)} + ... + k$
>
> **a,b,c,...** are **coefficients** and can be any real number
>
> **n** is the **exponent** and must be a positive integer.

In the examples above, we saw **simple** or **crossing roots**. These graphs show two other types of roots a **bouncing root** and a **flat root**. The type of root depends on the **multiplicity** of the factor. $(x - \text{root})^{\text{multiplicity}}$	Graph: $Y = (x-1)^2$  This is a bouncing root.	$y = (x + 2)^3$  This is a flat root.

Polynomials can have a combination of root types. Use a calculator and graph the **cubic functions**. (Set the window to D:[-10,10] and R:[-20,20]. Note the y-axis has no values.)

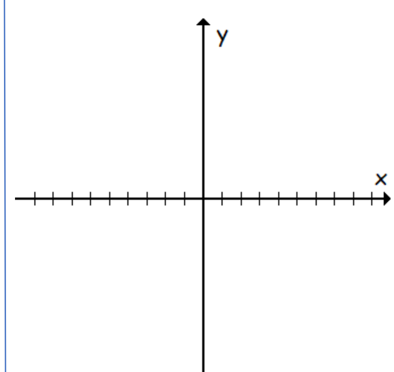
$y = (x-3)(x+1)(x-5)$



end behavior:
start:_______
final: _______

Roots and type:
(,) ______
(,) ______
(,) ______

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



end behavior:
start: _______
final: ________

Roots and type:
(,) ______
(,) ______

Complete these charts:

Factor (multiplicity)	Root	Type (simple, bounce, flat)
$(x - 3)$	(,)	
$(x + 3)^{\text{even}}$	(,)	
x^{odd}	(,)	

Leading term (first in standard form)	End behavior	
	Start	Final
ax^{even}	up	up
ax^{odd}		
$-ax^{\text{even}}$		
$-ax^{\text{odd}}$		