AA 6-2 Investigation Name ____________________________________

Higher degree polynomials

We have looked at the graphs of quadratic (2nd degree) and cubic (3rd degree) polynomials. We need to determine how to graph higher degree polynomials (4th, 5th, etc.).

The degree of a polynomial is the exponent of the first term (leading term) if the polynomial was written in standard form.

Complete this chart:

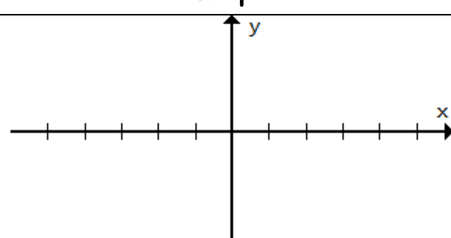
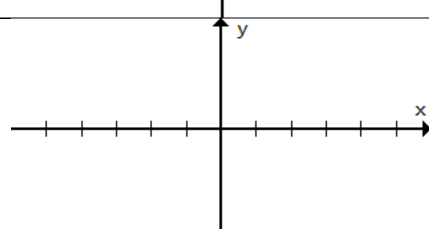
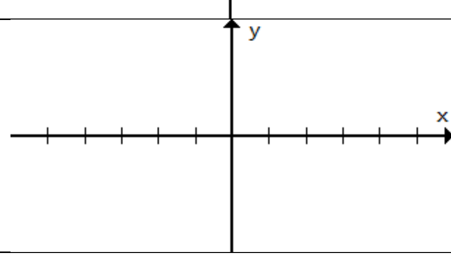
Standard form polynomial	Leading term	degree
$Y = 3x^2 - 6x - 105$	$3x^2$	2
$Y = -7x^3 + 14x^2 - 9x + 18$	$-7x^3$	3
$Y = x^7 - 4x^6 + 1$		
$Y = -x^5 + 3x^3 + x^2 - 1$		
$Y = 4x^8 - 9x + 1$		

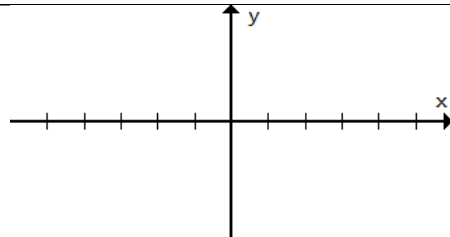
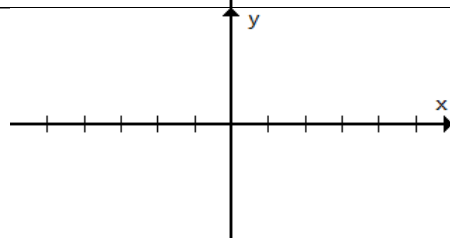
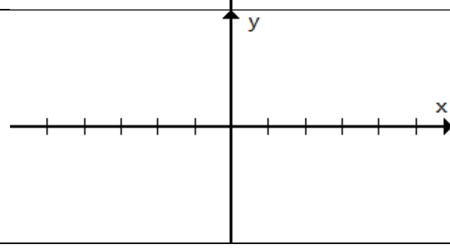
If it is in factored form, we must determine what the leading terms would be. As we have seen, the "a" value does not change between forms of the equation. Therefore, we just need to determine the exponent of the first term. This can be as easy as counting x's.

Factored form polynomial	Leading term	degree
$Y = 3(x-7)(x+5)$	$3x^2$	2
$Y = 5x(x + 2)(x + 1)$	$5x^3$	3
$Y = -2(x-7)^2(x+3)^3(x-4)$	$-2x^6$	6
$Y = 3(x + 4)(x-7)^2(x+3)^5$		
$Y = x(x-4)(x+8)(x-5)$		
$Y = - 0.2(x+5)^3(x-1)(x+18)^9$		

What did you do to determine the degree and leading term of the polynomial:

Let's explore the graphs of higher degree polynomials. Using Desmos graph each functions and sketch a graph below:

Equation	Graph	Leading term	Degree	Start	end
$y = x^4 - 21x^2 + 20x$					
$y = -0.1x(x+4)^3$					
$y = 0.5(x+3)^2(x+1)(x-1)(x+5)$					

Equation	Graph	Leading term	Degree	Start	end
$y = -0.5x(x-3)^2(x-1)(x+2)$					
$y = 0.1x^6(x-4)^2$					
$y = -x^4(x+4)^5$					

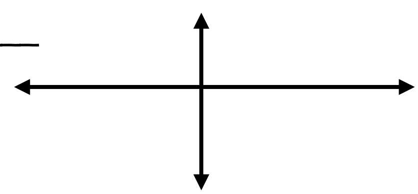
In investigation AA6-1 we completed these charts. Are they correct for higher degree polynomials?

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

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

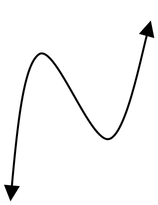
Based on the graphs you have seen:
What is the maximum number of roots a 3rd degree polynomial can have? _______

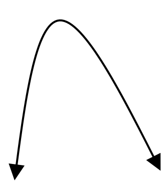
Sketch an example.

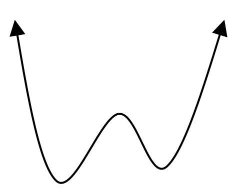


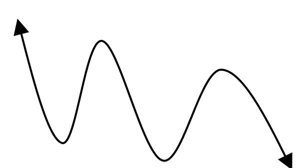
What is the maximum number of roots an n-degree polynomial can have? _______

For each polynomial function shown below, draw a horizontal line through the graph and state the **minimum** degree the equation could have.

#1) 
Degree_________

#2) 
degree__________

#3) 
degree ___________

#4) 
degree___________