Full Name	
Time Frame	**6 weeks - Unit 5**
Unit Name	**Polynomials**
Learning Task/Topics/ Themes	**Analyzing a Polynomial Function**
Standards **and** Elements	**MM3A1 – Students will analyze graphs of polynomial functions of higher degree.** **b. Understand the effects of the following on the graph of a polynomial function: degree, lead coefficient, and multiplicity of real roots.**
Lesson Essential Questions	**What is a polynomial function? How are turning points related to the degree of a polynomial?**
Activator	**Using collaborative pairs to complete "Do you remember?" class opener.**
Vocabulary	Polynomial functions Degree of a polynomial Leading coefficient of a polynomial
Work Session	PowerPoint: Analyze a polynomial function 1—1st part of PowerPoint Task: end behavior lab
Summarizing/Closing/Formative Assessment	

Do you Remember?

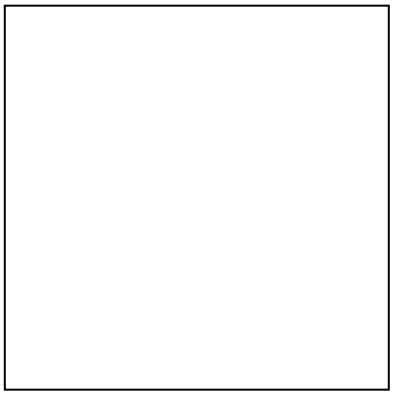
What is the standard form of a linear equation? _____
What is its degree? _____
How many turning points does a linear function have? _____

What is the standard form of a quadratic equation?_____
What is its degree? _____
How many turning points does a quadratic function have? _____
What do you think will happen to a graph as the degree of the polynomial function increases? _____

End Behavior Lab Group Members _____

Make a sketch of the polynomial in the box. _____

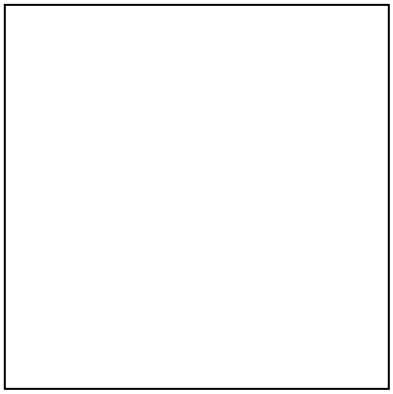
1. Graph $f(x) = 2x^2 + 1$



Is the leading coefficient + or - ? _____

What is the degree? _____

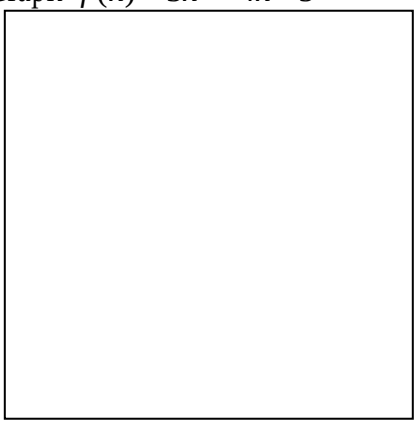
2. Graph $f(x) = -2x^4 + 5x$



Is the leading coefficient + or - ? _____

What is the degree? _____

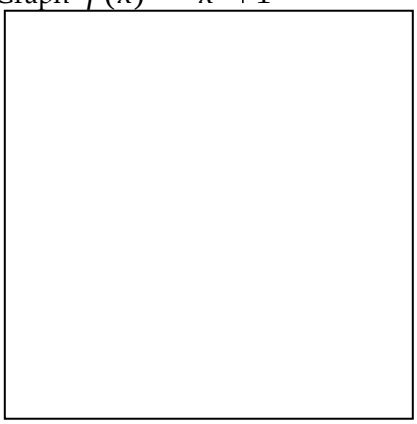
3. Graph $f(x) = 3x^8 - 4x - 5$



Is the leading coefficient + or - ? _____

What is the degree? _____

4. Graph $f(x) = -x^6 + 1$



Is the leading coefficient + or - ? _____

What is the degree? _____

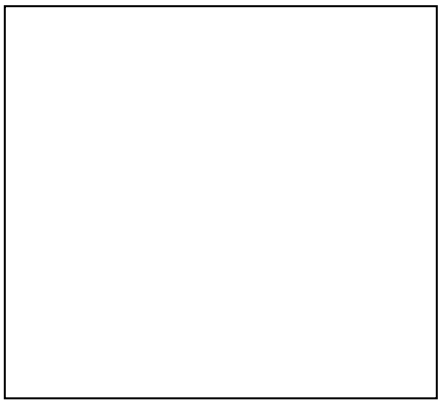
Now, analyze your graphs. Look for relationships between the degree and the leading coefficient of the function and the behavior of the ends of the graph.

What can you conclude if the degree is **even** and the leading coefficient is **positive**? _____
What can you conclude if the degree is **even** and the leading coefficient is **negative**? _____

Word Bank: degree, positive, negative, ∞, *and* $-\infty$.

1. If the _____ is **even** and the leading coefficient is _____ as $x \to -\infty$ then $f(x) \to$ _____and as $x \to \infty$ then $f(x) \to$ _____.
2. If the _____ is **even** and the leading coefficient is _____ as $x \to -\infty$ then $f(x) \to$ _____and as $x \to \infty$ then $f(x) \to$ _____.

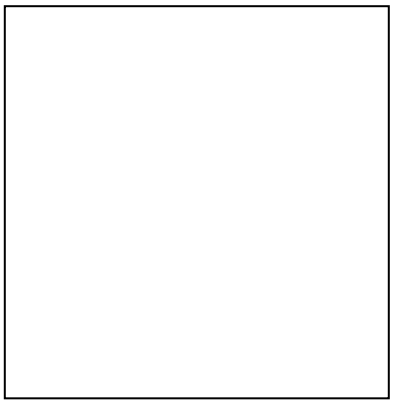
5. Graph $f(x) = -2.1x^5 + 4x^3 - 2$



Is the leading coefficient + or - ? _____

What is the degree? _____

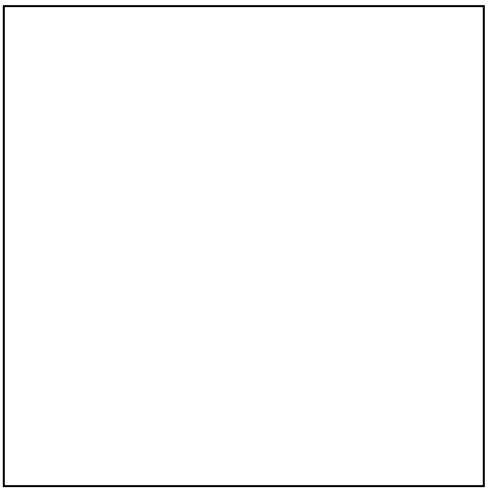
6. Graph $f(x) = 2x^3 - 5x + 7.5$



Is the leading coefficient + or - ? _____

What is the degree? _____

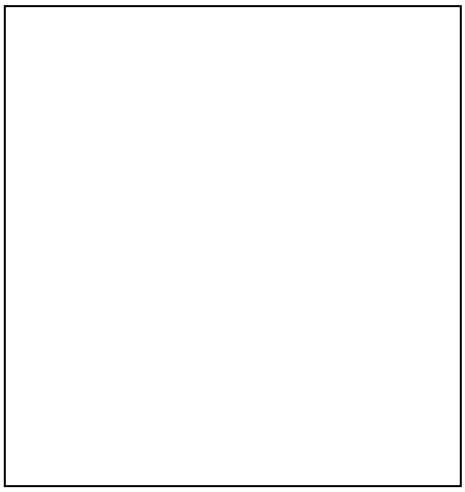
7. $f(x) = x^7 - 2x$



Is the leading coefficient + or - ? _____

What is the degree? _____

8. $f(x) = -4x^3 + 1$



Is the leading coefficient + or - ? _____

What is the degree? _____

Now, analyze your graphs. Look for relationships between the degree and the leading coefficient of the function and the behavior of the ends of the graph.

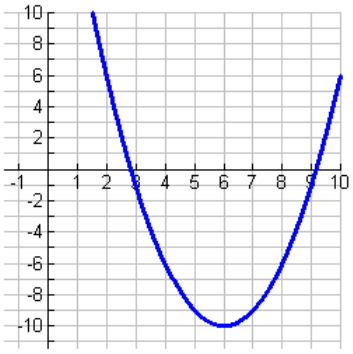
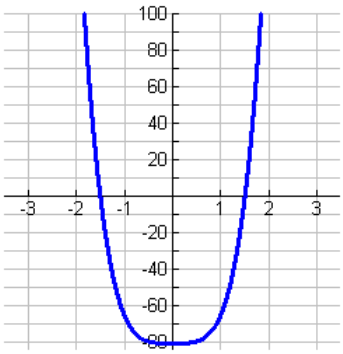
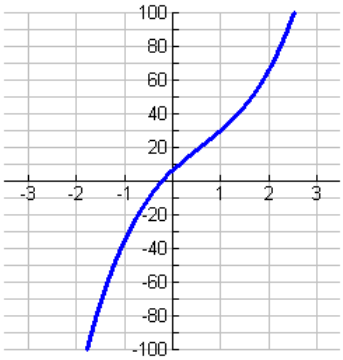
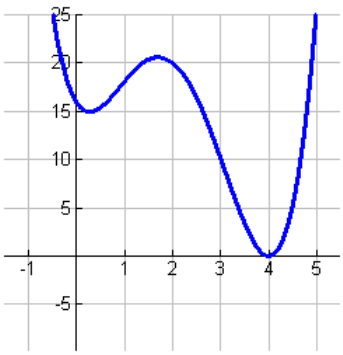
1. What can you conclude if the degree is **odd** and the leading coefficient is **positive**? …to the left it is _____ to the right it is _____

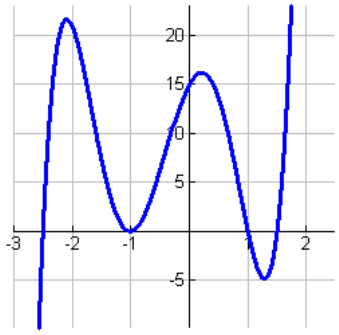
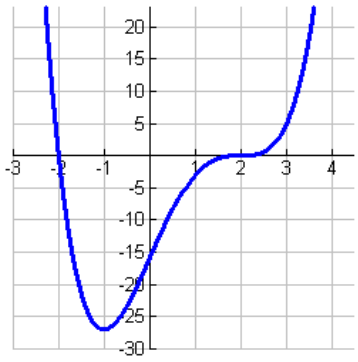
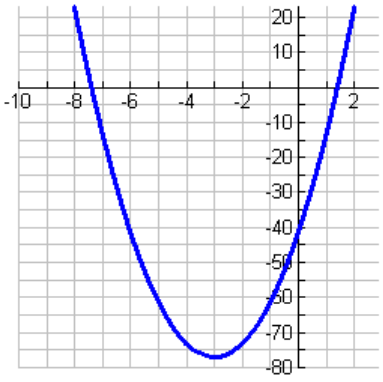
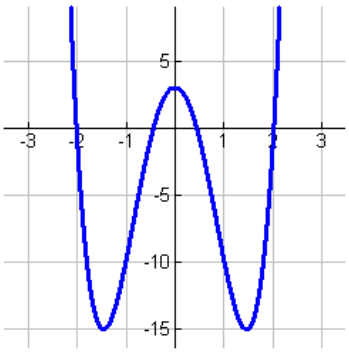
2. What can you conclude if the degree is **odd** and the leading coefficient is **negative**? …to the left it is _____ to the right it is _____

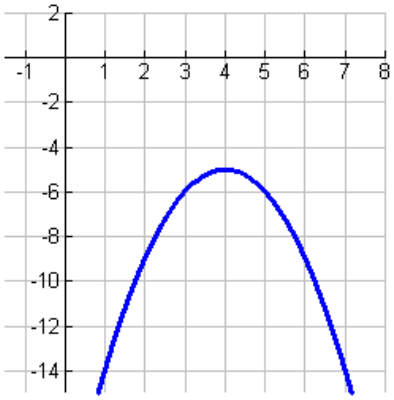
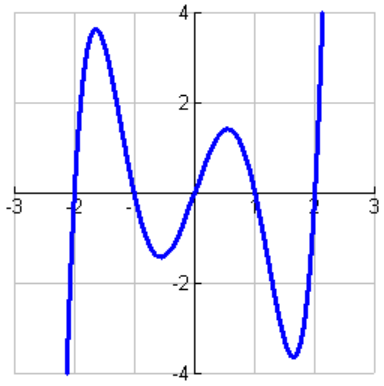
Word Bank: degree, positive, negative, ∞, *and* $-\infty$.

3. If the _____ is **<u>odd</u>** and the leading coefficient is _____ as $x \to -\infty$ then $f(x) \to$ _____and as $x \to \infty$ then $f(x) \to$ _____.

4. If the _____ is **<u>odd</u>** and the leading coefficient is _____ as $x \to -\infty$ then $f(x) \to$ _____and as $x \to \infty$ then $f(x) \to$ _____.

1. $f(x) = x^2 - 12x + 26$	C. 	S. The domain of this polynomial is $\mathbb{R}$ and the range is $-10, \infty$.
2. $f(x) = 16x^4 - 81$	H. 	Q. This even function has real roots at $\pm\frac{3}{2}$ and two imaginary roots.
3. $f(x) = 5x^3 - 9x^2 + 28x + 6$	F. 	U. The lists of rational roots for this function includes $\pm\frac{1}{5}$, and ± 2. Start with those to find the real zeros.
4. $f(x) = x^4 - 8x^3 + 17x^2 - 8x + 16$	J. 	N. This polynomial has a zero at 4 with a multiplicity of 2.

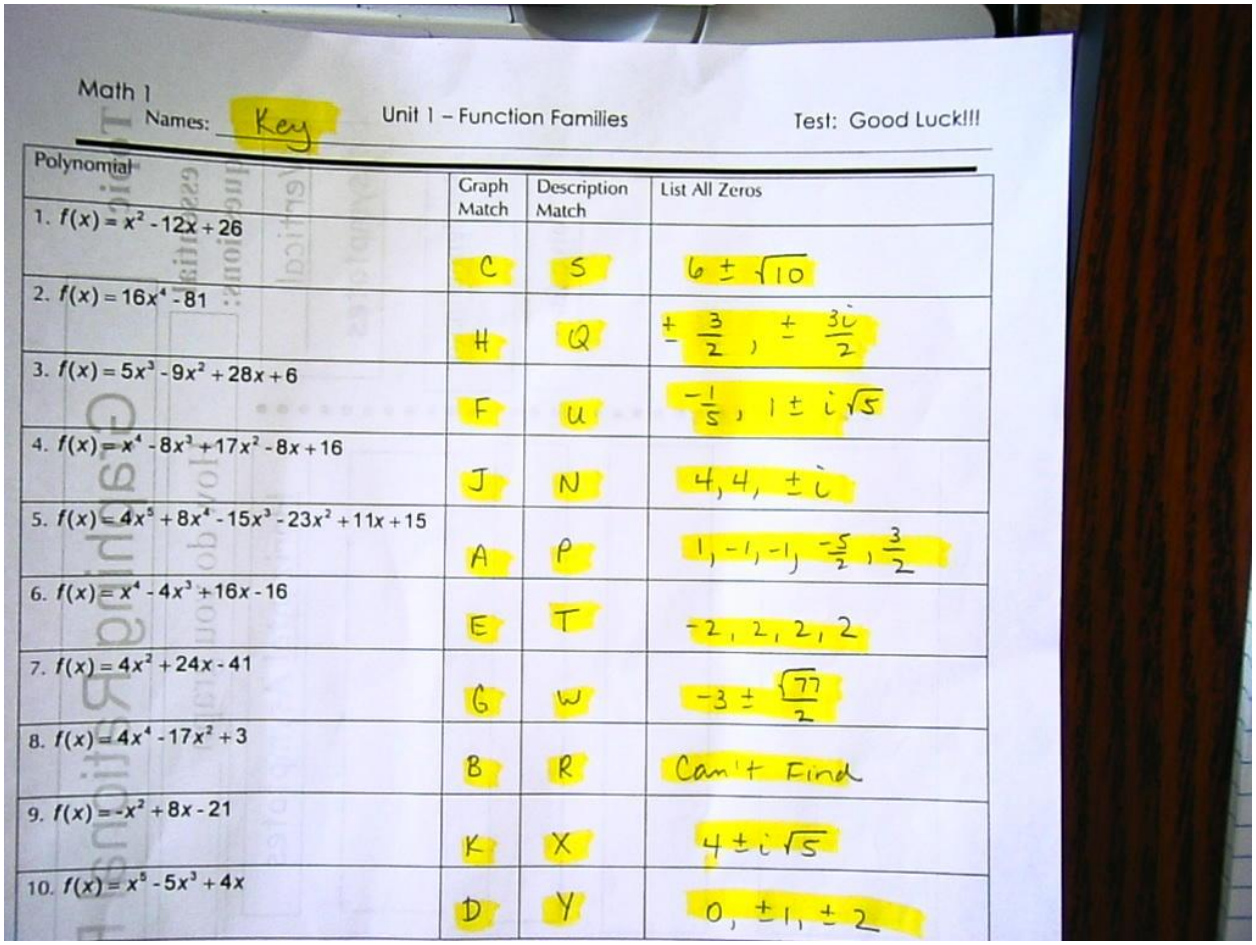
5. $f(x) = 4x^5 + 8x^4 - 15x^3 - 23x^2 + 11x$	A. 	P. This polynomial has 5 real roots. According to Descartes' rule, it could have 2 or zero positive real roots.
6. $f(x) = x^4 - 4x^3 + 16x - 16$	E. 	T. This is a polynomial of degree 4 and y-intercept of -16.
7. $f(x) = 4x^2 + 24x - 41$	G. 	W. This polynomial has a vertex at $-3,-77$.
8. $f(x) = 4x^4 - 17x^2 + 3$	B. 	R. This polynomial has 4 real zeros.

9. $f(x) = -x^2 + 8x - 21$	K. 	X. This polynomial has no real roots.
10. $f(x) = x^5 - 5x^3 + 4x$	D. 	Y. This odd polynomial has a zero at the origin.

Names: _____

Polynomial	Graph Match	Description Match	List All Zeros
1. $f(x) = x^2 - 12x + 26$			
2. $f(x) = 16x^4 - 81$			
3. $f(x) = 5x^3 - 9x^2 + 28x + 6$			
4. $f(x) = x^4 - 8x^3 + 17x^2 - 8x + 16$			
5. $f(x) = 4x^5 + 8x^4 - 15x^3 - 23x^2 + 11x + 15$			
6. $f(x) = x^4 - 4x^3 + 16x - 16$			
7. $f(x) = 4x^2 + 24x - 41$			
8. $f(x) = 4x^4 - 17x^2 + 3$			
9. $f(x) = -x^2 + 8x - 21$			
10. $f(x) = x^5 - 5x^3 + 4x$			

Answer Key to Polynomial Matching Activity



Math 1
Names: Key
Unit 1 – Function Families
Test: Good Luck!!!

Polynomial	Graph Match	Description Match	List All Zeros
1. $f(x) = x^2 - 12x + 26$	C	S	$6 \pm \sqrt{10}$
2. $f(x) = 16x^4 - 81$	H	Q	$\pm \frac{3}{2}, \pm \frac{3i}{2}$
3. $f(x) = 5x^3 - 9x^2 + 28x + 6$	F	U	$-\frac{1}{5}, 1 \pm i\sqrt{5}$
4. $f(x) = x^4 - 8x^3 + 17x^2 - 8x + 16$	J	N	$4, 4, \pm i$
5. $f(x) = 4x^5 + 8x^4 - 15x^3 - 23x^2 + 11x + 15$	A	P	$1, -1, -1, -\frac{5}{2}, \frac{3}{2}$
6. $f(x) = x^4 - 4x^3 + 16x - 16$	E	T	$-2, 2, 2, 2$
7. $f(x) = 4x^2 + 24x - 41$	G	W	$-3 \pm \frac{\sqrt{77}}{2}$
8. $f(x) = 4x^4 - 17x^2 + 3$	B	R	Can't Find
9. $f(x) = -x^2 + 8x - 21$	K	X	$4 \pm i\sqrt{5}$
10. $f(x) = x^5 - 5x^3 + 4x$	D	Y	$0, \pm 1, \pm 2$