Precalculus

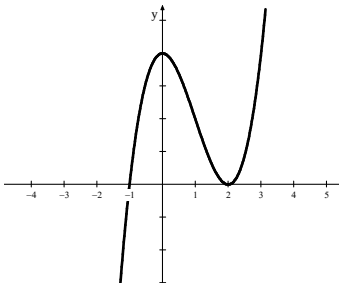
Write your questions and thoughts here!

5.3 Polynomial Graphs

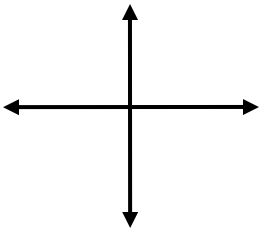
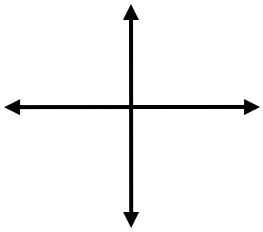
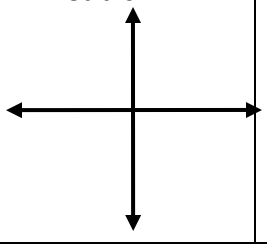
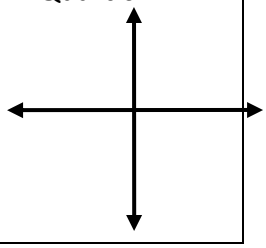
Name:_____

Polynomial Graphs:

- There will be no _____.
- There are no _____.
- Domain: _____.



Common Graphs:

Linear	Quadratic	Cubic	Quartic
			

End Behavior:

	_____ Degree	_____ Degree
_____ Leading Coefficient	$\lim_{x\to-\infty} f(x) =$ $\lim_{x\to\infty} f(x) =$	$\lim_{x\to-\infty} f(x) =$ $\lim_{x\to\infty} f(x) =$
_____ Leading Coefficient	$\lim_{x\to-\infty} f(x) =$ $\lim_{x\to\infty} f(x) =$	$\lim_{x\to-\infty} f(x) =$ $\lim_{x\to\infty} f(x) =$

Turning Points: (extrema)

A polynomial of degree n has **at most** _____ turning points (extrema).

Zeros:

A polynomial of degree n has **at most** _____ zeros (roots).

Multiplicity:

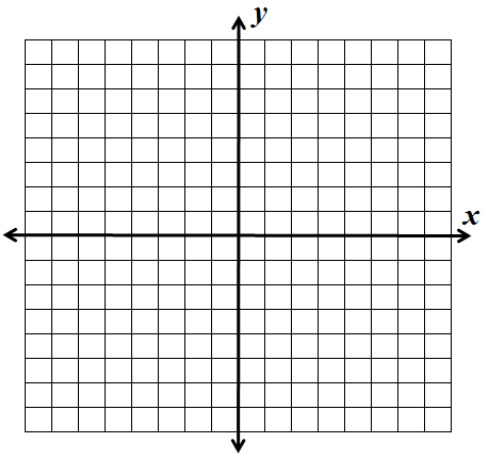
A factor's *multiplicity* is the number of times the factor occurs within the polynomial. For example, examine the function $f(x) = x^2(x-3)(x+1)^5(x-7)^8$. The factor $(x-3)$ has a multiplicity of _____, while the factor $(x-7)$ has a multiplicity of _____.

Write your questions and thoughts here!

5.3 Polynomial Graphs

_____ Multiplicity	_____ Multiplicity
The graph is _____ to the x-axis at the corresponding zero.	The graph _____ the x-axis at the corresponding zero.
$(x-7)^8$	$(x-3)$

1. $f(x) = -2(x+1)(x-2)^2(x-1)^3$



   a. How does the graph behave with relation to the x-axis at $x = 2$?

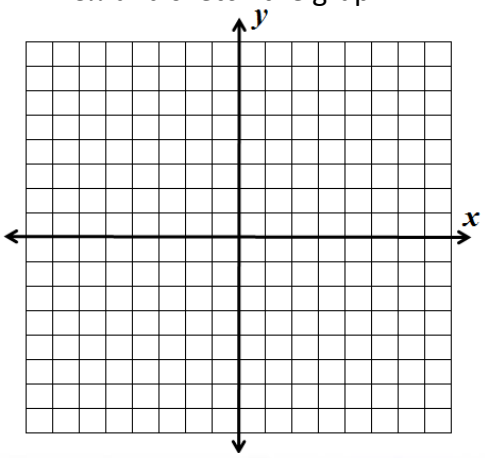
   b. What are the real zeros of the function?

   c. What is the degree of the function?

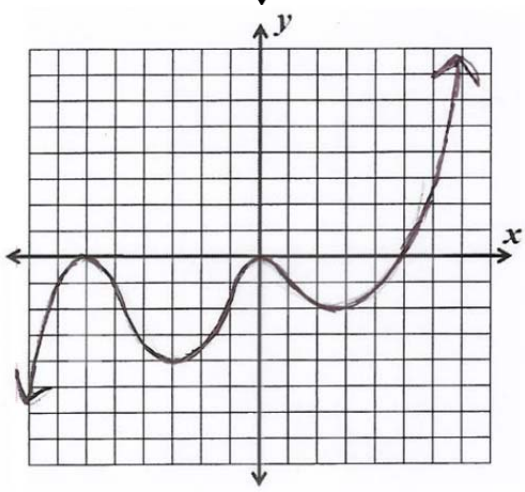
   d. Describe the end behavior using limit notation.

   e. Sketch a possible graph.

2. Factor the function $f(x) = x^5 + 6x^4 - 8x^3 - 96x^2 - 128x$ and sketch the graph if $f(-2) = 0$.



3. Given the graph of $g(x)$ on the right, identify the following:



   a. Local minimum value(s)

   b. Local maximum value(s)

   c. Minimum Degree

   d. Write out a possible function. Leave it in factored form.

Write your questions and thoughts here!

5.3 Polynomial Graphs

Descartes' Rule of Signs:

The # of _____ real zeros	=	The # of changes in sign of the coefficients of .	(*or less than this by an even number*)
The # of _____ real zeros	=	The # of changes in sign of the coefficients of .	(*or less than this by an even number*)

4. List the possible numbers of zeros for f.
$f(x) = 2x^6 - 3x^5 + 7x^4 - x^2 - 2x - 11$

Possible number of ***positive*** zeros:

Possible number of ***negative*** zeros:

Now summarize what you learned!

Skills Review: Find the x- and y-intercepts for each function. SHOW ALL WORK!

1. $x = 4y + 56$

x-int: y-int:

2. $f(x) = \frac{x^2-3x+2}{x^2-9}$

x-int: y-int:

5.3 Practice –Polynomial Graphs

Pre-Calculus

For 1-3, determine the possible numbers of positive and negative real zeros.

1. $f(x) = 5x^4 + 17x^2 - 12$ 2. $h(x) = 5x^6 + 2x^3 - 36x - 9$ 3. $f(x) = x^3 - 7x^2 - x + 15$

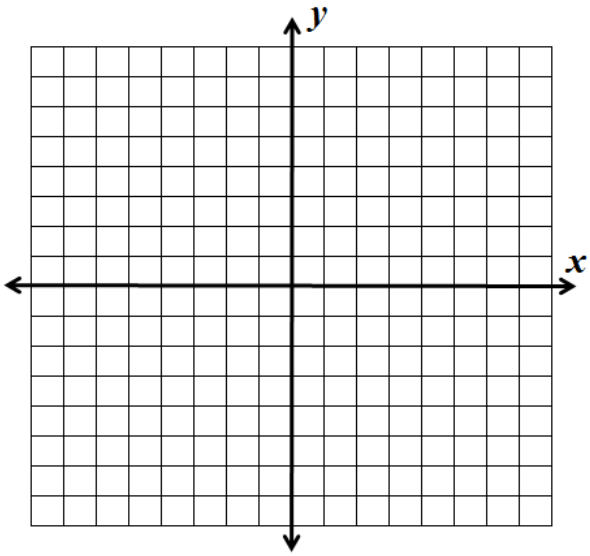
Positive Zeros:	Positive Zeros:	Positive Zeros:
Negative Zeros:	Negative Zeros:	Negative Zeros:

5.3 Practice –Polynomial Graphs (continued)

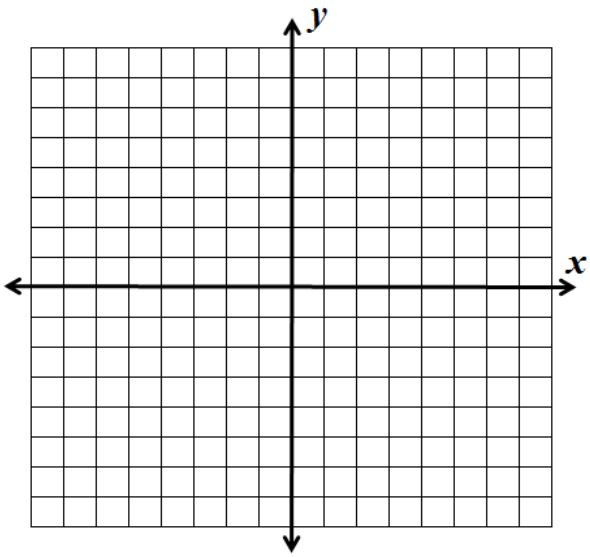
Name: _____

Pre-Calculus

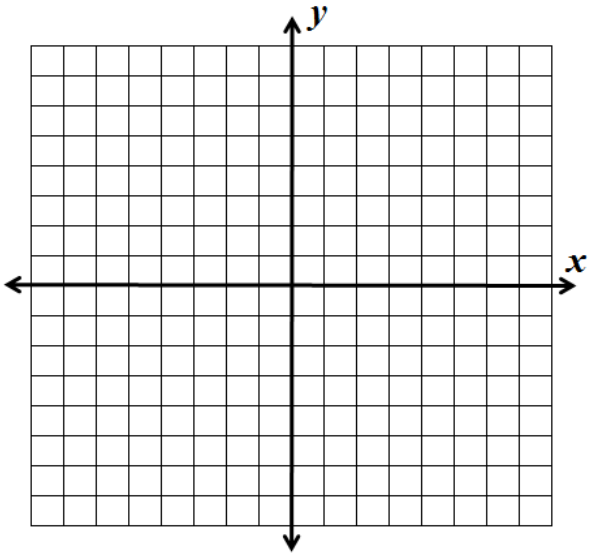
4. $f(x) = 3(x+2)(x-3)^2(x+5)$
   a. How does the graph behave with relation to the x-axis at $x = 3$?
   b. What are the real zeros of the function?
   c. What is the degree of the function?
   d. Describe the end behavior using limit notation.
   e. Sketch a possible graph



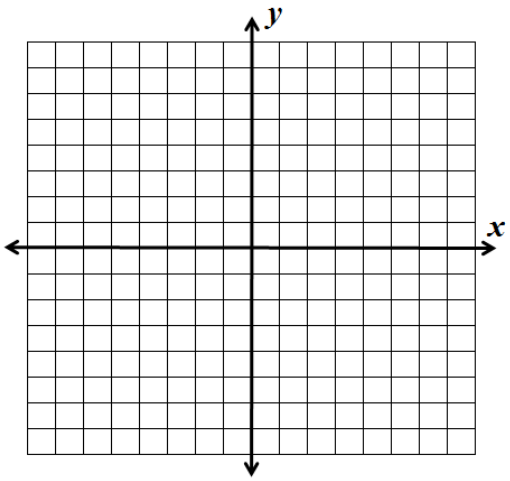
5. $f(x) = -2x(x+6)(x-4)^3(x-2)^4$
   a. How does the graph behave with relation to the x-axis at $x = 4$?
   b. What are the real zeros of the function?
   c. What is the degree of the function?
   d. Describe the end behavior using limit notation.
   e. Sketch a possible graph



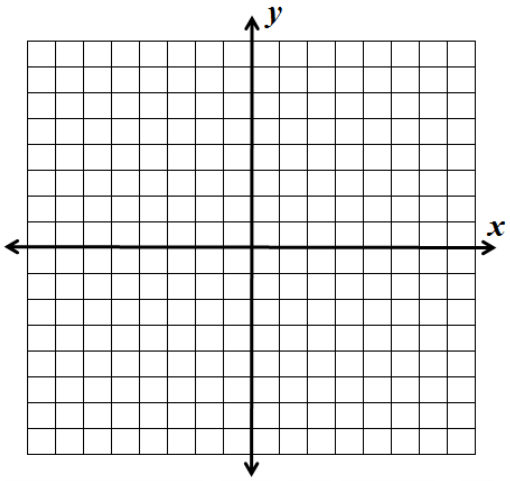
6. $f(x) = 3x^2(2x+4)(x-6)^6(x-3)^3$
   a. How does the graph behave with relation to the x-axis at $x = 6$?
   b. What are the real zeros of the function?
   c. What is the degree of the function?
   d. Describe the end behavior using limit notation.
   e. Sketch a possible graph



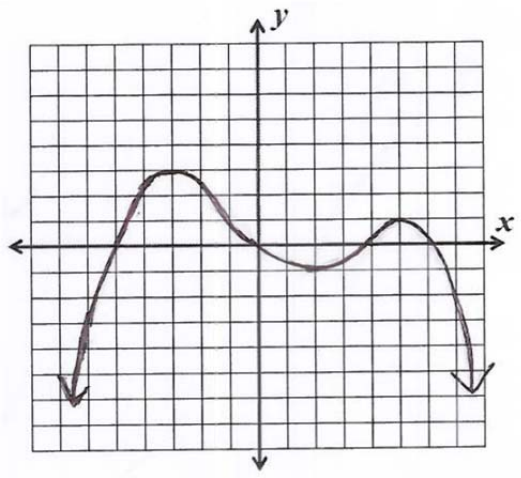
7. Factor the function $f(x) = 3x^3 - 3x^2 - 48x - 60$ and sketch the graph if $f(-2) = 0$.



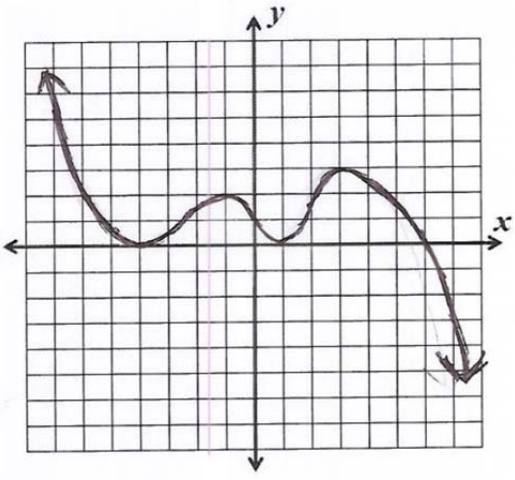
8. Factor the function $f(x) = 3x^6 + 4x^5 - 42x^4 - 36x^3 + 135x^2$ and sketch the graph if $f(-3) = 0$.



9. Given the graph of $g(x)$ on the right, identify the following:
   a. Local minimum value(s)
   b. Local maximum value(s)
   c. Minimum Degree
   d. Write out a possible function. Leave it in factored form.



10. Given the graph of $g(x)$ on the right, identify the following:
   a. Local minimum value(s)
   b. Local maximum value(s)
   c. Minimum Degree
   d. Write out a possible function. Leave it in factored form.



5.3 Application and Extension

Use a graphing calculator!

1. From 1994 to 2003, the average salary S (in thousands of dollars) for major league baseball players can be modeled by
$$S(t) = -4.1t^3 + 67.4t^2 - 121t + 1170$$
where t is the number of years since 1994. Find a good viewing window for the graph of S.

Xmin:
Xmax:
Xscl:
Ymin:
Ymax:
Yscl:

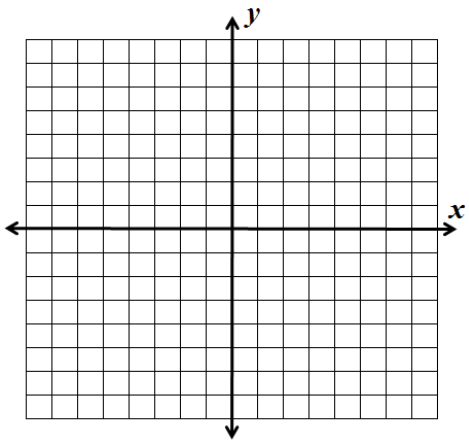
2. The data in the table gives the annual consumption of hydroelectric power (in quadrillion BTU) in the United States for selected years since 1983.
   a. From the table, identify any years in which a polynomial model would have an obvious turning point. (A 0.01 change is not an obvious turning point!)
   b. Based on the number of turning points you identified in part a, what is the smallest degree possible for this model?
   c. Using your calculator, find a regression model.
   d. Use the model to predict the consumption of hydroelectric power in 2018.
   e. Compare the consumption of hydroelectric power in 2003 (from the table) to the consumption given by the model.

U.S. Consumption of Hydroelectric Power

Year	Quadrillion BTU
1983	3.9
1985	3.4
1987	3.12
1989	2.99
1991	3.14
1993	3.13
1995	3.48
1997	3.88
1999	3.47
2001	2.38
2003	2.53
2005	2.61

Source: U.S. Department of Energy

3. $P(x)$ is cubic. $P(0) = 0, P(2) = -4,$ and $P(x) > 0$ only when $x > 4$. Sketch a possible graph, then find the equation of $P(x)$. (Your equation may be left in factored form, but don't forget to find the leading coefficient.)



4. Write and graph the equation for a quartic function passing through the point $(3, -4)$ and tangent to the x-axis at $x = 5$ and $x = -2$. Don't forget to find the leading coefficient.