Functions from a Calculus Perspective

Polynomial Functions

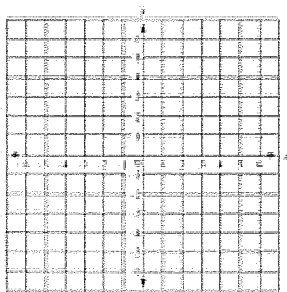Common Core State Standards: A-SSE.2, A-REI.1, A-REI.2, A-REI.10, F-IF.5, F-IF.7b,

Objectives:

- Graph polynomial functions.
- Model real-world data with polynomial functions.

I. *Polynomial Functions: any function of the form $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2 x^2 + a_1 x + a_0$.*
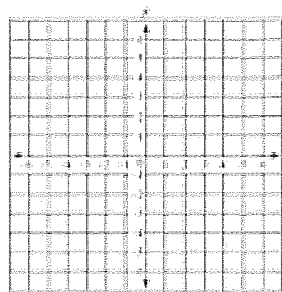(M):

1.

Graph each function.

a. $f(x) = (x-3)^5$

b. $f(x) = x^6 - 1$

What: Leading term test. The end behaviors of a polynomial will be the lim $_{x \to \pm\infty}$ of the leading term (term with the highest exponent)

(M):

2.

Describe the end behavior of the graph of each polynomial function using limits. Explain your reasoning using the leading term test.

a. $f(x) = 3x^4 - x^3 + x^2$

b. $f(x) = -3x^2 + 2x^5 - x^3$

c. $f(x) = -2x^5 - 1$

What: Turning points. Points on a graph that are either a maximum or a minimum.

What: Zeros of a function. The zeros of a function are the x-intercepts.

For each polynomial, state the degree, number of zeros, number of factors and number of turns. Then find the zeros and the factors.

Degree of Polynomial	Number of possible zeros	Number of factors	Number of turns
$f(x) = x^3 + 5x^2 + 4x$	What are they?	What are they?	
$f(x) = x^4 - 4x^2 + 3$	What are they?	What are they?	
$f(x) = 3x^5 - 18x^4 + 27x^3$	What are they?	What are they?	
$f(x) = x(3x + 1)(x-2)^2$	What are they?	What are they?	

(U):

Given any polynomial of the form $f(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_2 x^2 + a_1 x + a_0$, state the following:

    a. Degree:
    b. Maximum number of turning points:
    c. At a zero of odd multiplicity, will the graph cross the x-axis?
    d. At a zero of even multiplicity, will the graph cross the x-axis?
    e. The end behavior of the graph is determined by?

II. *Modeling Data – curve fitting – before deciding on which regression equation to use, look at the number of turns.*

M):

POPULATION The table below shows a town's population over an 8-year period. Year 1 refers to the year 2001, year 2 refers to the year 2002, and so on.

Year	Population
1	5050
2	5510
3	5608
4	5436
5	5201
6	5089
7	5095
8	4675

a. Create a scatter plot of the data, and determine the type of polynomial function that could be used to represent

the data

b. Write a polynomial function to model the data set. Round each coefficient to the nearest thousandth, and state the correlation coefficient.

c. Use the model to estimate the population of the town in the year 2012.

d. Use the model to determine the approximate year in which the population reaches 10,712

Homework: pgs. 104 – 107 #'s 3 – 87 (x 3), 97 – 99.