This review is meant to highlight basic concepts from Chapter 4. It does not cover all concepts presented by your instructor. Refer back to your notes, handouts, the book, MyMathLab, etc. for further prepare for your exam.
4.1: More Nonlinear Functions and Their Graphs

• This section covers the following:
  – Polynomial Functions
  – Absolute Extrema
  – Local Extrema
  – Symmetry
Polynomial Functions:

• The book states a polynomial function as the following:

\[ f(x) = a_n x^n + \cdots + a_0 \]

Basically this boils down to any functions \( f(x) \) that contain powers of \( x \): \( x^2, x^3, x^4 \) \( \cdots \) etc.

Things that **ARE NOT** polynomials:

Radicals (\( \sqrt{x} \)), Ratios (\( \frac{1}{x^2+3} \)) and Absolute Values (\( |x| \))
Examples:

Are these functions polynomial functions: Y/N?

- $f(x) = 2x^3 - x + 5$  Yes
- $f(x) = -x^4 + 1$  Yes
- $f(x) = \sqrt{x}$  No
- $f(x) = 2x^3 - \sqrt[3]{x}$  No
- $f(x) = 1 - 4x - 5x^4$  Yes
- $f(x) = 5 - 4x$  Yes
- $f(x) = \frac{1}{x^2 + 3x - 1}$  No
- $f(x) = \frac{1}{1 - x}$  No
- $f(x) = 22$  Yes
- $f(x) = |2x|$  No
Absolute vs: Local Extrema

• Absolute Extrema you must look at the graph as a whole and find the highest and lowest points

• Local Extrema you “localize” what you look at onto the turning points: maximums occur at “peaks”, minimums occur at the “valley”. Local Extrema cannot occur at endpoints

With all extrema, you list the y-coordinates as your values for maximums and minimums
This graph *does not* have an absolute maximum point because the graph continues on to positive infinity.

This graph *does* have an absolute maximum and minimum because the graph stops at the endpoints: the bottom endpoint is the absolute minimum, the top endpoint the absolute maximum.

Graphs can have both, one of each, just one, or none in terms of the types of extrema.
Examples:

Local Max: 18, -8
Local Min: -13
Absolute Max: 18
Absolute Min: none

Local Max: 6
Local Min: none
Absolute Max: 6
Absolute Min: none

Local Max: 2
Local Min: -2
Absolute Max: none
Absolute Min: none

Local Max: 0
Local Min: -1
Absolute Max: 0
Absolute Min: none
Symmetry:

- Functions can be either even, odd or neither in terms of symmetry.
- Even functions are symmetric to the \( y \)-axis.
- Odd functions are symmetric to the origin.

I think of it like this:
Even functions can be folded like a greeting card, right down the middle and the graphs should match.
Odd functions can be folded from corner to corner so that the graphs match. AKA: The opposite corners (or quadrants of the graph) match.
An example of an even function:

An example of an odd function:
Examples:

EVEN

EVEN

ODD

ODD

NEITHER

NEITHER