Chapter 4 Review

From a time when I was freaking out about a test that I haven't writen yet, good luck on the exam brother.

4.1 Increasing and decreasing functions

- A function is increasing over an interval when rightmost point on that interval is of lesser value that the leftmost point on the interval
- A function is decreasing when the inverse of that
- be able to define the sections of a graph where it is increasing / decreasing
- sketch a graph of a function increasing and decreasing at different points i.e. given ranges of increasing and decreasing create a graph

$$f\prime(x) > 0; increasing$$
$$f\prime(x) < 0; decreasing$$
$$f\prime(x) = 0; min/max$$

- solve for max's and mins of a function by deriving a function and finding zeros **POLYNOMIAL / RATIONAL**

4.2 Critical points, Local Max, Local Min

A critical Number is when the function is defined at a point but the derivative is either 0 not defined at said point

1. every local max or min is a critical num
2. the first derivative test implies looking at a function, when the sign changes, you have a local max or min
3. a cubic curve for straight vertical line is a critical point even though it is not a max or min

- determining critical points on
    - simple ploynomial
    - complex polynomial
    - radical
        * CUSPS AND SHIT ON THESE, IF DERIVATIVE IS UNDEFINED BUT FUNCTION IS DEFINED THIS IS A CRITICAL POINT, BUT IT'S DISCONTINUOUS SO PROBABLY A CUSP OR DIRECT VERTICAL
    - rational
        * be aware of oblique asymptotes, which present themselves when the top term is a greater power than the bottom term

4.3 Vertical Horizontal and Oblique Asymptotes

- A horizontal asymptote occurs at y=0 when the degree on top is lower than that on the bottom, as as $x \to \pm\infty$ the bottom will get much larger than the top

$$\frac{x^2}{x^3}$$

- a horizontal asymptot occurs at y=a when the degree of top and bottom are the same, but the ratio of coefficients = a

- an oblique asmptote occurs when the degree on the bottom is one less than the degree on the top, in that case if the top is a quadratic synthetic division can be used, otherwise long division is used.

  – the equation of an oblique asymptote includes the remainder which can be used to check the end behavior of the function, and if it will approach the bottom or top of the asymptote as the function approaches infinity (if the remainder divided by the quotient is positive or negative it will approach from the corrisponding positive or negative side.)

- A hole can be told when a factor on top cancels with a factor on the bottom

4.4 Concavity and points of inflection

- the second derivative is positive at a point,then the function is concave up, if negative, concave down.
- the 2nd derivative test is an extension of the last rule such that a critical point can be defined as a max or min based on it's concavity. Although if the 2nd derivative is 0 the point is
  – an inflection
  – **a local max or min in some cases** WHAT
  – linear

A FUNCTION FAILS THE SECOND DERIVATIVE TEST WHEN THE SECOND DERIVATIVE IS EQUAL TO 0

- points of inflection occur when the concavity of a function occurs. they can be at any angle, athough a direct vertical inflection will have a slope of null
  – basically just the 1rst derivative test for the second derivative
- use second derivative to test for local max or min values,
  – polynomials
  – complex polynomials
  – rationals
  – irrationals

the 2nd derivative test looks something like

$$if x = 0$$
$$\therefore y = 1/3, y\prime = 0$$
$$since y\prime\prime < 0$$
$$\therefore max @ (0, 1/3)$$

4.5 CURVE SKETCHING ALGORITHM

1. FACTOR THE MAIN FUNCTION GET EAZY INFO
   - get VA HA OA
   - get simple points, roots intercepts
2. DERIVE AND 1RST DERIVATIVE TEST
   - find C.N.
   - first derivative test
   - find maxs / mins
3. SKETCH POINTS / GRAPH

be able to do this for the standard polynomial, rational and irrational

$1. y = x^4 - 3x^2 + 2x$

$2. y = \dfrac{1 - x}{1 + x^2}$

$3. y = x^{1/3}(x + 3)^{2/3}$