Math 151
Winter 2012
Practice Problems To Study for the Final Exam
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- Limits

Evaluate the following Limits: Your answer should be either a number, ∞, - ∞, "Does Not Exist" or a function of x. Show some work.

Plug in, use algebra to factor and cancel…

1. $\displaystyle \lim_{x \to -4} \frac{x^2 + 2x - 8}{x + 4}$

2. $\displaystyle \lim_{x \to 4} \frac{2 - \sqrt{x}}{4 - x}$

3. $\displaystyle \lim_{x \to -2} \frac{x^2 - 4}{x^2 - 3x + 10}$

Asymptotes, limits are plus/minus infinity or does not exist.

4. $\displaystyle \lim_{x \to 2^+} \frac{x^2 + 3x - 10}{(x - 2)^2}$

5. $\lim\limits_{x \to 0} \dfrac{\sin(3x)}{xCos(x)}$

6. $\lim\limits_{x \to 5^-} \dfrac{x^2 - 9}{x^2 - 25}$

End Behavior limits…

7. $\lim\limits_{x \to \infty} \dfrac{x^2 - x + 1729}{3x^3}$

8. $\lim\limits_{x \to -\infty} \dfrac{(x+5)^2}{3x^2 + 7x}$

- Definition of Derivative

  1. Write Down the limit definition of the derivative of y=f(x) for any point x.

2. Use that definition to determine the derivative $y = x^2 + 8x - 7$.

3. Use that definition to determine the derivative $y = \dfrac{1}{x^2}$.

- Rules for Derivatives

Evaluate the following derivatives (Do not simplify)

1. $f(x) = 2x^7 - 5\left(x^{3/2}\right) + \dfrac{4}{x}$
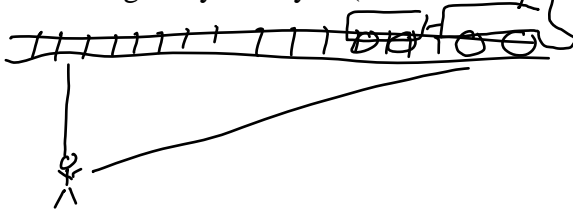
2. $f(x) = \dfrac{Cos^2(x)(x^4 + 4x^3)}{(5x^2 + 11)^2}$

3. $f(x) = Sin\left(\sqrt{4x^2 - 1}\right)$

- Implicit Differentiation

Find the slope of the following curve at the point $(2,1)$ $\quad 3x\sqrt{y} - yx = 4$

- Related Rates Problems

1. A train is traveling at 25 mph on a track 250 feet in front of you (See picture). After when the engine is 1000 feet from the crossing, how fast is the engine moving away from you (measure the distance diagonally)?

2. Suppose the trunk of a tree is a right cylinder, the radius is increasing at a rate of 2 cm year and the height is increasing at a rate of 10 cm per year. How fast is the volume of the tree increasing when the tree is 400 cm tall and has a radius of 15 cm?

- Approximations
    1. Using the formulas for linear approximations estimate $(2.003)^5$ and $\sqrt{3.99}$

- Critical Points and Increasing/Decreasing

    1. Find the critical points in the following equations
    2. Determine where they are increasing and decreasing
    3. Determine the local maxima and local minima

$f(x) = x\sqrt{6-x}$ $\qquad\qquad\qquad\qquad$ $f(x) = x + 2Cos(x)$

- Absolute Max/Min

1. Find absolute maximum value and absolute minimum value of the following function on a closed interval.

$f(x) = x^3 - 3x + 1$ $\qquad\qquad$ $[0,3]$

- Optimization Word Problems

1. A poster is supposed to have 180 square inches of total area with 1-inch margins at the bottom and sides and a 2-inch margin at the top. What dimensions will give the largest printed area?

2. In your summer job working for Dairy Queen, you are asked to design a new ice cream cone. It must be able to contain 24 cubic inches of ice cream including the cone and a half-sphere shaped scoop on top. See the pictures. Using the formulas given, find an equation to with only one variable (radius or height, your choice) that you could use to minimize the surface are of the cone. (You don't actually have to find the minimum, just set it up).

Surface area of a cone: $SA = \pi R\sqrt{R^2 + H^2}$

Volume of a cone: $V = \dfrac{1}{3}\pi R^2 H$

Volume of half a sphere: $V = \dfrac{4}{3}\pi R^3$

Surface Area $\quad SA =$
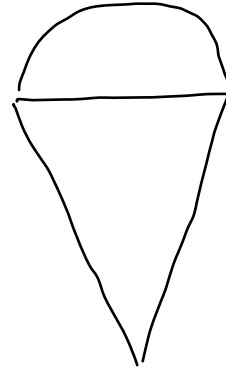
- Graphing
  1. Determine as much information about the following graph as you can and draw a nice graph of it. Use end behavior, asymptotes, intercepts, increasing/decreasing chart, and a concave up/down chart.

$y = 2x^3 - 6x^2 - 18x + 7$

Finally, I would suggest you look over the three midterms, the homeworks and the daily quizzes for types of problems to study for the final exam.