Wed 1 July

- Exam 3 tomorrow! covers $\oint$3.10-4.6. $\oint$4.7 will be next week... unless we exhaust the review slides and you have no questions, in which case we'll start 4.7.
- Exam 3 is 50 minutes long. Class will start 30 min late to enforce that timeframe.
- Exam 3: bring a scientific calculator. Answers should be in boss notation, where appropriate.
- MLP homeworks are both due Sunday. Happy 4th!

Exam #3 Review

- $\oint$ 3.10 Related Rates
  - Know the steps to solving related rates problems, and be able to use them to solve problems given variables and rates of change.
  - Be able to solve related rates problems. If, while doing the HW (paper or computer), you were provided a formula in order to solve the problem, then I will do the same. If you were not provided a formula while doing the HW (paper or computer), then I also will not provide the formula.

Exam #3 Review (cont.)

Exercise (s)

(1) Sand falls from an overhead bin and accumulates in a conical pile with a radius that is always three times its height. Suppose the height of the pile increases at a rate of 2 cm/sec when the pile is 12 cm high. At what rate is the sand leaving the bin at that instant?

(2) At what rate is soda being slurped out of a cylindrical glass that is 6 in tall and has a radius of 2 in? The depth of the soda decreases at a constant rate of 0.25 in/sec.

Exam #3 Review (cont.)

Exercise (s)

(3) An inverted conical water tank with a height of 12 ft and a radius of 6 ft is drained through a hole in the vertex at a rate of 2 ft^3/sec. What is the rate of change of the water depth when the water depth is 3 ft?

Exam #3 Review (cont.)

- $\oint$ 4.1 Maxima and Minima
  - Know the definitions of maxima, minima, and what makes these points local or absolute extrema (both analytically and graphically).
  - Know how to find critical points for a function.
  - Given a function on a given interval, be able to find absolute extrema.
  - Given specified properties of a function, be able to sketch a graph of that function.

Exam #3 Review (cont.)

- $\oint$ 4.2 What Derivatives Tell Us
  - Be able to use the first derivative to determine where a function is increasing or decreasing (set up the inequality).
  - Be able to use the First Derivative Test to identify local maxima and minima (plugging in points with a number line). Be able to explain in words how you arrived at your conclusion.
  - Be able to find critical points, local/absolute extrema, and inflection points for a function.

Exam #3 Review (cont.)

- Be able to use the second derivative to determine the concavity of a function (set up the inequality).
- Be able to use the Second Derivative Test to determine whether a given point is a local max or min (plug critical points into the second derivative). Be able to explain in words how you arrived at your conclusion.
- Know your Derivative Properties!!! (see Figure 4.36)

Exam #3 Review (cont.)

- $\oint$ 4.3 Graphing Functions
  - Be able to find specific characteristics of a function that are spelled out in the Graphing Guidelines (e.g., know how to find x- and y-intercepts, vertical/horizontal asymptotes, critical points, inflection points, intervals of concavity and increasing/decreasing, etc.).
  - Be able to use these specific characteristics of a function to sketch a graph of the function.

Exam #3 Review (cont.)

- $\oint$ 4.4 Optimization Problems
  - Be able to solve optimization problems that maximize or minimize a given quantity.
  - Be able to identify and express the constraints and objective function in an optimization problem.
  - Be able to determine your interval of interest in an optimization problem (e.g., what range of x-values are you searching for your extreme points?)
  - **As to formulas, the same comment made above with respect to formulas for related rates problems applies here as well.**

Exam #3 Review (cont.)

Exercise (s)

(1) A right triangle has legs of length h and r and a hypotenuse of length 4. It is revolved about the leg of length h to sweep out a right circular cone. What values of h and r maximize the volume of the cone?

(2) What two nonnegative real numbers a and b whose sum is 23 will

   (a) minimize $a^2 + b^2$?
   (b) maximzie $a^2 + b^2$?

Exam #3 Review (cont.)

- $\oint$ 4.5 Linear Approximation and Differentials
  - Be able to find a linear approximation for a given function.
  - Be able to use a linear approximation to estimate the value of a function at a given point.
  - Be able to use differentials to express how the change in x (dx) impacts the change in y (dy).

Exam #3 Review (cont.)

Exercise (s)

Use differentials to express the approximate change in $y = f(x)$, given a small change in x.

(1) $f(x) = 2x + 1$

(2) $f(x) = \sin^2 x$

(3) $f(x) = \ln(1 - x)$

Exam #3 Review (cont.)

- $\oint$ 4.6 Mean Value Theorem
  - Know and be able to state Rolle's Thm and the Mean Value Thm, including knowing the hypotheses and conclusions for both.
  - Be able to apply Rolle's Thm to find a point in a given interval.
  - Be able to apply the MVT to find a point in a given interval.
  - Be able to use the MVT to find equations of secant and tangent lines.

Exam #3 Review (cont.)

Exercise (s)

Determine whether the Mean Value Theorem (or Rolle's Theorem) applies to the following functions. If it does, then find the point(s) guaranteed by the theorem to exist.

(1) $f(x) = \sin(2x)$ on $\left[0, \frac{\pi}{2}\right]$

(2) $g(x) = \ln(2x)$ on $[1, e]$

(3) $h(x) = 1 - |x|$ on $[-1, 1]$

(4) $j(x) = x + \frac{1}{x}$ on $[1, 3]$

(5) $k(x) = \frac{x}{x+2}$ on $[-1, 2]$

Pep Talk

- Read the question!
- Do the book problems.
- Find a buddy who understands concepts a little better than you and work on problems for 2-3 hours. Then find a buddy who is struggling and work with them 2-3 hours. Explaining to someone else tests how deeply you really know the material. This strategy also helps reduce stress because it doesn't require you to devote a full day or night of studying, just 2-3 hours at a time of productive work.

Pep Talk (cont.)

- If you encounter an unfamiliar type of problem on the exam, relax, because it's most likely not a trick. The solutions will always rely on the information from the required reading/assignments. Take your time and do each baby step carefully.
- During the exam, do the problems you are most confident with first! Different people will find different problems easier.
- The exam is not a race. If you finish early take advantage of the time to check your work. You don't want to leave feeling smug about how quickly you finished only to find out next week you lost a letter grade's worth of points from silly mistakes.