Math 220 – Test 2 Information

The test will be given during your lecture period on Wednesday (3-16-2011). No books, notes, scratch paper, calculators or other electronic devices are allowed. Bring a Student ID.

It may be helpful to look at

- `https://compass.illinois.edu/` – online homework solutions
- `http://www.math.uiuc.edu/~murphyrf/teaching/` – tests in my previous courses

- **Sections 3.1–3.6**
  - With c, n, and a constants with $a > 0$, know short-cut derivative rules for c, x, x^n, e^x, a^x, $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$, $\tan^{-1} x$, $\sin^{-1} x$, $\ln x$, $cf(x)$, $f(x)+g(x)$, $f(x)-g(x)$, $f(x)g(x)$ (product rule), $\dfrac{f(x)}{g(x)}$ (quotient rule), $f(g(x))$ (chain rule).
  - Be able to do implicit differentation from section 3.5.
  - Be able to do logarithmic differentiation from section 3.6.
  - Be able to apply the above derivative rules to problems involving tangent lines, normal (i.e. perpendicular) lines, velocity, acceleration.

- **Section 3.7**
  - The only applications from this section will be on velocity and acceleration.

- **Section 3.8**
  - Answer questions about exponential growth and decay.
  - Know how to answer questions involving half-life.
  - Given a quantity P which is a function of t, you may be told that it has a constant relative growth rate k or that its rate of change $\left(\dfrac{dP}{dt}\right)$ is proportional to P. The homework and quizzes include other ways of giving this same problem. They all lead to the differential equation $\dfrac{dP}{dt} = kP$ which has general solution $P = Ce^{kt}$. Be able to find and work with this general solution.
  - There will be no problems involving *Newton's Law of Cooling* or compound interest on the test.

- **Section 3.9**
  - To solve related rates problems, you may need to know any of the following:
  - Similar triangles
  - Pythagorean Theorem
  - Trigonometric identities: $\sin^2 x + \cos^2 x = 1$, $\tan^2 x + 1 = \sec^2 x$, $1 + \cot^2 x = \csc^2 x$, $\sin(2x) = 2 \sin x \cos x$

- Evaluation of trigonometric functions at special angles
- Relationship of each of the six trigonometric functions to the hypotenuse and the opposite and adjacent sides of a right triangle
- Area formulas for: rectangle ($A = L \times W$), circle ($A = \pi r^2$), triangle ($A = \frac{1}{2}bh$)
- Volume formulas for: box ($V = L \times W \times H$), sphere ($V = \frac{4}{3}\pi r^3$), cylinder ($V = \pi r^2 h$), cone ($V = \frac{1}{3}\pi r^2 h$)

- **Sections 4.1 and 4.3**
  - Given a function $f(x)$ (or sometimes being given $f'(x)$ or $f''(x)$) , say where the graph of f is increasing, decreasing, concave up, concave down, has an inflection point, has a local max/min, has an absolute max/min.
  - Know how to use *The Extreme Value Theorem* along with *The Closed Interval Method* for finding absolute maximum and minimum values of a continuous function on a closed interval.

- **Section 4.4 (Limits)**
  - Be able to use l'Hospital's Rule when it is applicable.
  - Be able to determine limits for other problems where l'Hospital's Rule is not applicable.

- **Section 4.7 (Optimization)**
  - Be able to solve applied max/min problems. You may need to know formulas for circumference ($C = 2\pi r$), diameter ($d = 2r$), area (circle, rectangle, triangle), and volume (box, sphere, cylinder, cone). See area and volume formulas listed for section 3.9. You may also need to know the Pythagorean Theorem, similar triangles, trigonometric functions at special angles along with the relationship to the hypotenuse and the opposite and adjacent sides of a right triangle.