

Math 220 – Test 2 Information

The test will be given during your lecture period on Wednesday (10-24-2012). No books, notes, scratch paper, calculators or other electronic devices are allowed. Bring a Student ID.

It may be helpful to look at

- <https://compass2g.illinois.edu/> – online homework solutions
- <http://www.math.uiuc.edu/~murphyrf/teaching/M220/> – 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 , $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$, $\tan^{-1} x$, $\sin^{-1} x$, $\sec^{-1} x$, $\ln x$, $cf(x)$, $f(x) + g(x)$, $f(x) - g(x)$, $f(x)g(x)$ (product rule), $\frac{f(x)}{g(x)}$ (quotient rule), $f(g(x))$ (chain rule).
 - Be able to do implicit differentiation 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.
 - Be able to use both *Leibniz* and *prime* notation for derivatives correctly using the given variables.

- **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 $\left(\frac{dP}{dt}\right)$ is proportional to P . The homework and quizzes include other ways of giving this same problem. They all lead to the differential equation $\frac{dP}{dt} = kP$ which has general solution $P = Ce^{kt}$. Be able to find and work with this general solution using the variables given in the problem. Recognize the difference between differential equations $\frac{dP}{dt} = kP$ and $\frac{dP}{dt} = kt$ and be able to find a solution in both cases.
 - 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: $\sin^2 x + \cos^2 x = 1$, $\tan^2 x + 1 = \sec^2 x$, $1 + \cot^2 x = \csc^2 x$, $\sin(2x) = 2 \sin x \cos x$, $\cos(2x) = \cos^2 x - \sin^2 x$
- 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**

- Know the definition of the terms *critical number*, *increasing*, *decreasing*, *concave up*, *concave down*, *inflection point*, *local max/min*, *absolute max/min*.
- Be able to state and use the *First Derivative Test* and the *Second Derivative Test*.
- Given a formula or graph for a function $f(x)$ (or sometimes its derivatives $f'(x)$ 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.
- Be able to state and use *The Extreme Value Theorem*. Be able to use this 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. This includes dealing with indeterminate forms such as those listed in *Daily Assignments* on October 17th. To fully justify an answer, you must state when you are using l'Hospital's Rule and why it is applicable to the given problem.
- 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.