05/29/2009 **STUDY SHEET for TEST #3 (Monday, June 1)**

The test will cover:
- Ch. 3; Sections 3.5, 3.6, 3.7, 3.8, 3.9, 3.10
- Ch. 4 Sections 4.1, 4.2, 4.3, 4.5

The best way to prepare to the exam is to read the book and to do the homework exercises. Please, take time to go over the material. Also, go over review of chapter 3 on pages 261 – 264.

Here is what you have to have an idea about:

1. Implicit differentiation. Derivatives of inverse trigonometric functions. (3.5)
2. Derivatives of logarithmic functions. Logarithmic differentiation. (3.6)
3. The number *e* as a limit. (3.6)
4. Rates of change in natural and social sciences. (3.7)
5. Exponential growth and decay. (3.8)
6. Related rates. (3.9)
7. Linear approximations and differentials. (3.10)
8. Maximum and minimum vales. Absolute maximum, absolute minimum. Local maximum, local minimum. (4.1)
9. The Extreme Value Theorem. (4.1)
10. Fermat's Theorem. (4.1)
11. Critical numbers. (4.1)
12. The closed interval method to find absolute maximum and minimum values of a continuous function. (4.1)
13. Rolle's Theorem. (4.2)
14. The Mean Value Theorem. (4.2)
15. How derivatives affect the shape of a graph? Increasing/Decreasing Test. The First Derivative Test. (4.3)
16. Concave upward, concave downward. Concavity Test. Inflection points. The Second Derivative Test. (4.3)
17. Summary of curve sketching: domain, intercepts, symmetry, asymptotes, increasing/decreasing intervals, local maximum and minimum values, concavity and inflection points.(4.5)

Below is the list of typical problems in the most general from which you can expect on the test:

1. Find $\frac{dy}{dx}$ by implicit differentiation.

   a) $2x^3 + x^2y - xy^3 = 2$
   b) $1 + x = \sin(xy^2)$
   c) $\sin x + \cos y = \sin x \cos y$
   d) $e^{x/y} = x - y$

2. Use implicit differentiation to find an equation of the tangent line to the curve $x^2 + y^2 = (2x^2 + 2y^2 - x)^2$ at point (0, 1/2).
3. Differentiate
    a) $y = \arctan(\arcsin\sqrt{x})$
    b) $y = log_5(1 + 2x)$
    c) $y = \sqrt{xln(x^4)}$
4. Use logarithmic differentiation to find the derivative of a function.
    a) $y = \frac{x\sqrt[3]{x^2-5}}{(3x+1)^3}$
    b) $y = \sqrt[4]{\frac{x^2+1}{x^2-1}}$
    c) $y = \sqrt{x}^x$
    d) $y = (\ln x)^{\cos x}$

5. Rate of change in natural and social sciences. See homework problems from section 3.7.
6. Exponential growth and decay. See homework problems from section 3.8.
7. Related rates. See homework problems from section 3.9.
8. Find the differential of a given function. (See problems 11-14 on page 252)
9. Evaluate *dy* if $y = x^3 - 2x^2 + 1$, *x* = 2, and *dx* = 0.2.
10. Use a linear approximation (or differentials) to estimate the given number. (See problems 23-28 on page 252)
11. A window has a shape of a square surmounted by a semicircle. The base of the window is measured as having width 60 cm with a possible error in measurement of 0.1 cm. Use differentials to estimate the maximum error possible in computing the area of the window. What is the relative error? What is the percentage error?
12. Explain the difference between an absolute maximum and a local maximum. Illustrate with a sketch.
13. Find the local and absolute extreme values of the function on a given interval. (See problems 1-6 on page 348)
14. What does Extreme Value Theorem say?
15. State the Mean Value Theorem and give its geometrical interpretation.
16. Verify that a given function satisfies the hypotheses of the Mean Value Theorem on the given interval. Then find all numbers *c* that satisfy the conclusion of the Mean Value Theorem.
    a) $f(x) = 3x^2 + 2x + 5$, [-1, 1]
    b) $f(x) = e^{-2x}$, [0, 3]
17. Show that the equation $3x + 2\cos x + 5 = 0$ has exactly one real root.
18. By applying the Mean Value Theorem to the function $f(x) = \sqrt[5]{x}$ on the interval [32, 33], show that $2 < \sqrt[5]{33} < 2.0125$.
19. Sketch the graph of a function that satisfies the given conditions. (See problems 15-17 on page 348)
20. Problem 18 on page 348.
21. Use the summary of curve sketching to sketch the curve. (See problems 19-34 on page 348)