# Math 180 F

# THIRD HOUR EXAM

NAME________________________________________________________________

**General Notes:**

1. **Show work**.
2. Look over the test first, and then begin.
3. Calculators are not permitted on this exam. Carry out any calculations to the point at which you would need a calculator (for example, to take the square root of the logarithm of a number) and leave it in that form.

Friday, Nov. 13, 2009
100 pts.

I. Inverses and hyperbolics

a. (5 pts.) Find $ArcCos(\frac{1}{\sqrt{2}})$ (inverse cos)

b. (5 pts.) $\frac{d}{dx} ArcTan(x) =$

c. (5 pts.) $\frac{d}{dx} \cosh(x) =$

II. Approximations and rates of change

a. (10 pts.) Find the standard linear approximation to the function $f(x) = x^{\frac{1}{3}}$ at the point x = 27, and use it to approximate the cube root of 27.01.

b. (10 pts.) The radius of a spherical cloud in space is expanding at the rate of 100 ft/sec. How fast is the volume of the cloud increasing when the radius is 1000 feet? The volume of a sphere is given by $V = \frac{4}{3}\pi R^3$

III. Mean Value Theorem and some applications.

a. (5 pts.) State the mean value theorem (with preconditions)

b. (5 pts.) Verify the mean value theorem for the function $y = x^2$ on the interval [0, 1]

c. Consider the function $y = x(6-2x)^2 = 36x - 24x^2 + 4x^3$ (problem 12, page 268)

i. (15 pts) Find the critical points of the function and say where (over what intervals) the function is increasing and where it is decreasing.

ii. (15 pts.) Take the second derivative and classify the critical points as local maxima, local minima, and points of inflection, saying why in each case.

d. (10 pts.) Suppose that we know that the derivative of some function *f(x)* satisfies $\frac{df}{dx} = 2x + 2$ and that f(1) = 4. What is f(x)?

IV Implicit differentiation

a. (15 pts.) Find the equation of the line tangent to the curve $\frac{x^2}{9} + \frac{y^2}{4} = 1$ at the point $(\sqrt{3}, 2\sqrt{\frac{2}{3}})$ by first finding the slope at that point $\frac{dy}{dx}$ using implicit differentiation and then using the slope and the point to find the tangent line at that point.