

# Math 180 E

## 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. In answering a question, please bring it to the point where all you need to do is to punch numbers into a calculator (unless it is clear how to do the final calculations). In particular, it is appropriate to leave square and cube roots *as is* in your answer (unless it is something like the square root of 4 or the cube root of 27, etc.)

Friday, Nov. 9, 2012  
100 pts

I. Definitions, theorems, and the like

1. (5 pts.) State the Extreme Value Theorem (with preconditions)

2. Consider the function  $f(x) = 2x^3 - 3x^2 - 12x + 6$  defined on the interval  $[-2, 3]$ .

a. (10 pts.) Find the critical points of the function.

b. (5 pts.) List all the values of  $x$  which must be checked to find the absolute maximum and absolute minimum of the function on the interval  $[-2, 3]$  (but do not actually calculate the corresponding  $y$ -values).

3. (5 pts.) State Rolle's Theorem (with preconditions)

4. (5 pts.) Verify Rolle's theorem for  $f(x) = x^2 - 2x$  on the interval  $[0, 2]$

5. (5 pts.) State the Mean Value Theorem (with preconditions)

6. (5 pts.) Verify the Mean Value Theorem (MVT) for the function  $f(x) = x^2$  in the interval  $[1,2]$ . Please be sure to show your work.

## II. Miscellaneous Problems

1. (5 pts. each) Give derivatives for the following:
  - a.  $\text{ArcTan}(x)$
  - b.  $\ln(x)$
  - c.  $x^x$
  
2. (10 pts.) **Using logarithmic differentiation**, find  $y'$  for  $y = \frac{(2x+1)(x^2-1)}{(x+2)}$

3. (10 pts.) Find the approximation for  $\sqrt[3]{8.01}$  (cube root of 8.01) given that the cube root of 8 is 2. Please remember to leave your answer in the form in which all you need next to do is to punch numbers into your calculator.
4. (15 pts.) The point  $(1, \frac{4\sqrt{2}}{3})$  lies on the curve defined by  $4x^2 + 9y^2 = 36$ . Use implicit differentiation to find the slope of the line tangent to the curve at the point  $(1, \frac{4\sqrt{2}}{3})$ ? What is the slope of the line perpendicular to the tangent line at that point?

3. (10 pts.) The length of each side of a cube is increasing at the rate of 1 cm/min. How fast is the volume of the cube increasing when each side of the cube is 10 cm? Please recall that the volume of a cube is given by  $V = x^3$ , where  $x$  is the length of a side of the cube.