MA 161 & 161E **EXAM 3** **SPRING 2002**

________________________ Name

________________________ Student ID Number

________________________ Lecturer

________________________ Recitation Instructor

________________________ Time of Recitation Class

Instructions:

1. The exam has 14 problems, each worth 7 points, for a total of 100 points (that includes 2 bonus points for taking the exam).
2. Please supply all information requested above.
3. Work only in the space provided, or on the backside of the pages.
4. No books, notes, or calculators are allowed.
5. Use a number 2 pencil on the answer sheet. Print your last name, first name, and fill in the little circles. Under "Section Number", print the division and section number of your recitation class and fill in the little circles. Under "Test/Quiz Number" print 03 and fill in the little circles. Similarly, fill in your student ID and fill in the little circles. Also, fill in your recitation instructor's name; the course, MA 161; and the date, April 4, 2002. Be sure to fill in the circles for each of the answers of the 14 exam questions.

1. If $f(x) = (x^3 + 2x - 1)^2$, then $f''(1) =$

A. 4

B. 20

C. 50

D. 74

E. 100

2. If $F(x) = \sin(g(x))$, then $F''(x) =$

A. $\cos(g(x))g'(x) + \sin(g(x))$

B. $-\sin(g(x))g'(x) + \cos(g(x))$

C. $-\sin(g(x))g'(x) + (g'(x))^2$

D. $-\sin(g(x))g''(x) + \cos(g(x))(g'(x))^2$

E. $-\sin(g(x))(g'(x))^2 + \cos(g(x))g''(x)$

3. If $f(x) = \ln\left(\dfrac{x}{1+x}\right)$, then $f'(2) =$

A. $\dfrac{3}{2}$

B. $-\dfrac{3}{8}$

C. $\dfrac{1}{6}$

D. $-\dfrac{1}{6}$

E. $\dfrac{5}{6}$

4. Use logarithmic differentiation to find $\frac{d}{dx}\left(x^{\sin x}\right)$

A. $x^{\sin x}\left(\cos x \ln x + \frac{\sin x}{x}\right)$

B. $x^{\sin x}\left(\ln(\sin x) + \frac{\cos x}{\sin x}\right)$

C. $x^{\sin x} \cos x$

D. $\cos x \ln x + \frac{\sin x}{x}$

E. $\ln(\sin x) + \frac{\cos x}{\sin x}$

5. If 40% of a certain radioactive substance decays in 50 days, what is the half-life of the substance?

A. $50\,\frac{\ln 0.5}{\ln 0.4}$

B. $50\,\frac{\ln 0.5}{\ln 0.6}$

C. $50\,\frac{\ln 0.6}{\ln 0.5}$

D. $50\,\frac{\ln 0.4}{\ln 0.5}$

E. $50\,\frac{\ln 0.4}{\ln 0.6}$

6. Use differentials (or, equivalently, a linear approximation) to estimate $\sqrt[3]{8.1}$.

A. $2\,\frac{1}{120}$

B. $2\,\frac{1}{12}$

C. $2\,\frac{1}{10}$

D. $2\,\frac{1}{100}$

E. $2\,\frac{1}{1000}$

7. The difference between the absolute maximum and the absolute minimum of $f(x) = \dfrac{x}{x^2+1}$ on $[0,2]$ is

A. $\dfrac{1}{10}$

B. 1

C. $\dfrac{1}{2}$

D. $\dfrac{9}{10}$

E. $\dfrac{2}{5}$

8. How many critical numbers does the function $G(x) = \sqrt[3]{x^2 - x}$ have?

A. 0

B. 1

C. 2

D. 3

E. 4

9. Classify the local extrema of the function $f(x) = x^4(x-2)^3$.

A. Exactly two local maximum and one local minimum

B. Exactly one local maximum and one local minimum

C. Exactly one local maximum and two local minimum

D. Exactly two local maximum and two local minimum

E. None

10. Over what intervals is the function $f(x) = x^4 - 8x^3 + 200$ concave up?

A. $(0, 4)$

B. $(-\infty, 0)$

C. $(4, \infty)$

D. $(-\infty, 0)$ and $(4, \infty)$

E. $(0, 4)$ and $(4, \infty)$

11. $\lim_{x \to 0} \frac{\sin 2x}{e^x - 1} =$

A. 1

B. ∞

C. 0

D. $-\infty$

E. 2

12. $\lim_{x \to 0^-} (1 + x)^{\frac{1}{x}} =$

A. e

B. $\frac{1}{e}$

C. 1

D. 0

E. ∞

13. Suppose f is a function which is continuous on the interval $[-1, 2]$ and differentiable on the interval $(-1, 2)$. Suppose also that $f(-1) = 3$ and $f(2) = 1$. Then there is a c in the interval $(-1, 2)$ such that

A. $f(c) = -\frac{2}{3}$

B. $f(c) = \frac{2}{3}$

C. $f'(c) = 0$

D. $f'(c) = \frac{2}{3}$

E. $f'(c) = -\frac{2}{3}$

14. At noon, ship A is 10 miles east of ship B. Ship A is traveling north at 20 mph and ship B is traveling west at 10 mph. How fast is the distance between them changing at 3 pm?

A. $\frac{1400}{\sqrt{5200}}$ mph

B. $\frac{100}{\sqrt{5200}}$ mph

C. $\frac{90}{\sqrt{4500}}$ mph

D. $\frac{1600}{\sqrt{5200}}$ mph

E. $\frac{1500}{\sqrt{4500}}$ mph