MA 161 & 161E

# FINAL EXAM

SPRING 2003

Name ____________________

Student ID number ____________________

Lecturer ____________________

Recitation Instructor ____________________

Recitation Time ____________________

Instructions:

1. The exam has 25 problems, each worth 8 points, for a total of 200 points.
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. 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, May 9, 2003. Be sure to fill in the circles for each of the answers of the 25 exam questions.

MA 161 & 161E **FINAL EXAM** **SPRING 2003**

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1. $\tan(\sec^{-1}(\sqrt{10})) =$

A. 8

B. $\sqrt{3}$

C. 2

D. 3

E. $\dfrac{\sqrt{10}}{3}$

2. If $f(x) = e^{2x} + 1$ and $g(x) = \ln x$, then the domain of $(g \circ f)(x)$ is

A. $-\infty < x < \infty$

B. $0 < x < \infty$

C. $-\ln 2 < x < \infty$

D. $\ln 2 < x < \infty$

E. $e^{-\frac{1}{2}} < x < \infty$

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3. $f(x) = \ln\left(\frac{(x^2+1)^4 \cdot (x^4+3)^2}{(x^6+5)^3}\right)$, then $f'(1) =$

A. $8\ln 2 - 18\ln 3$

B. 3

C. 9

D. $3\ln(3)$

E. $2\ln(2)$

4. $\lim\limits_{x \to \infty} \frac{\sqrt{4x^2+x}}{3x-1} =$

A. $\frac{4}{9}$

B. $\frac{4}{3}$

C. $\frac{8}{3}$

D. $\frac{16}{3}$

E. $\frac{2}{3}$

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5. If $f(x) = \sqrt{x^3 + 3x}$, then $f'(1) =$

A. $\frac{3}{4}$

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

C. $\frac{3}{2}$

D. 1

E. 3

6. If $f(x) = \sin(x^3 + 5)$, $f''(x) =$

A. $3x^2 \cos(x^3 + 5) + \sin(x^3 + 5)$

B. $6x \cos(x^3 + 5) - 9x^4 \sin(x^3 + 5)$

C. $6x \cos(x^3 + 5) - 3x^2 \sin(x^3 + 5)$

D. $3x^2 \cos(x^3 + 5)$

E. $\cos(x^3 + 5) + 5 \sin(x^3 + 5)$

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7. $\lim\limits_{x \to 0} \dfrac{\cos(x^2) - 1}{x^4} =$

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

B. 1

C. $-\frac{1}{2}$

D. $\frac{1}{8}$

E. 8

8. The absolute minimum value of the function $f(x) = x^6 - 6x$ in the interval $[0, 3]$ is

A. $-5$

B. 0

C. $-2$

D. $-3$

E. $-1$

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9. Suppose that $f(x) = \sin x$ and that $[a, b] = [0, 3\pi]$. The largest number $c$ that satisfies the conclusion of Rolle's Theorem is

A. $\frac{3\pi}{2}$

B. $2\pi$

C. $\pi$

D. $\frac{\pi}{2}$

E. $\frac{5\pi}{2}$

10. Suppose that a cardboard box has a square bottom and no top. If the volume is 4 cubic feet, then the minimum surface area is

A. 8 $\text{ft}^2$

B. 9 $\text{ft}^2$

C. 10 $\text{ft}^2$

D. 12 $\text{ft}^2$

E. 15 $\text{ft}^2$

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11. If $f''(x) = 2x + 1,\ f'(0) = 1,\ f(0) = 2$, then $f(1) =$

A. $4\frac{1}{2}$

B. $4\frac{1}{6}$

C. $3\frac{5}{6}$

D. $3\frac{1}{2}$

E. $3\frac{1}{3}$

12. Let $f(x) = x^2$ on $[0, 2]$. Let the interval be partition as follows:

$$P = \{0, \frac{1}{2}, 1, \frac{3}{2}, 2\}.$$

Find the value of the Riemann sum $\sum_{i=1}^{n} f(x_i^*)\Delta x_i$ if each $x_i^*$ is the right point of the interval.

A. $3\frac{3}{4}$

B. $7\frac{1}{2}$

C. $1\frac{1}{4}$

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

E. $2\frac{3}{4}$

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13. Find $\int_0^1 (3x^{1/2} + 2x^{1/3})\, dx$

A. $4\frac{1}{4}$

B. $3\frac{1}{2}$

C. 4

D. $3\frac{1}{4}$

E. $2\frac{3}{4}$

14. If $F(x) = (3 + x) \int_0^x \cos 2t dt$, then $F'(0) =$

A. 0

B. 1

C. 2

D. 3

E. 6

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15. $\int_0^1 \frac{x}{1+x^2}\,dx =$

A. $\ln 2$
B. $\frac{2}{3}$
C. $\frac{1}{2}$
D. $\frac{1}{3}$
E. $\frac{\ln 2}{2}$

16. If $x^3 - 4xy + y^3 = 25$ then $\frac{dy}{dx} =$

A. $\frac{y - 3x^2}{3y^2 - 4x}$
B. $\frac{4y - 3x^2}{3y^2}$
C. $\frac{3y^2}{4y - 3x}$
D. $\frac{3x^2 - 4y}{3y^2 - 4x}$
E. $\frac{3x^2 - 4y}{4x - 3y^2}$

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17. The function $f(x)$ has $f''(x) = x^5 - x^3$. How many inflection points does it have?

A. 4

B. 3

C. 1

D. 0

E. 10

18. $\int x^3(1+2x^4)^{1/4}\,dx =$

A. $\frac{5}{32}(1+2x^4)^{5/4}+C$

B. $\frac{1}{8}(1+2x^4)^{5/4}+C$

C. $\frac{4}{5}(1+2x^4)^{5/4}+C$

D. $\frac{1}{10}(1+2x^4)^{5/4}+C$

E. $\frac{2}{5}(1+2x^4)^{5/4}+C$

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19. Water is poured into a conical paper cup at the rate of 2 cubic centimeters per second. If the cup is 8 cm tall and the top has a radius 4 cm, how fast is the water level rising when the water is 4 cm deep? (volume of cone: $V = \frac{1}{3}\pi r^2 h$)

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

B. $\frac{1}{2\pi}$

C. $\frac{1}{3\pi}$

D. $\frac{1}{4}$

E. None of the above

20. $\int_{-2}^{1} (x+3)\sqrt{x+3}\, dx =$

A. $12\frac{2}{5}$

B. $11\frac{1}{5}$

C. 12

D. $20\frac{2}{3}$

E. $13\frac{1}{5}$

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21. The approximation of $(4.1)^{3/2}$ obtained from the linear approximation of $f(x) = x^{3/2}$ near $a = 4$ is

A. 8.1

B. 8.2

C. 8.3

D. 8.6

E. 8.25

22. The number of bacteria in a bacterial colony is initially observed to equal 400. Two hours later the number is 600. Assuming exponential growth, how many hours after the initial observation will the number of bacteria equal 800?

A. $\dfrac{\ln(3/2)}{\ln 2}$

B. $2\ln\frac{3}{2}$

C. $\dfrac{2\ln 2}{\ln(\frac{3}{2})}$

D. $\dfrac{\ln 2}{\ln 3}$

E. $\dfrac{\ln 2}{2\ln(\frac{3}{2})}$

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23. If $f(x) = 2^{\sqrt{x}}$, compute $f'(4)$.

A. $\ln 2$
B. $1$
C. $\frac{2}{\ln 2}$
D. $2\ln 2$
E. $\frac{\ln 2}{2}$

24. If $C$ is the curve $y = \sqrt{x}$, $0 \le x < \infty$, and if $P$ is the point on $C$ that is closest to $(2,0)$, then the $x$-coordinate of $P$ is:

A. $\frac{5}{4}$
B. $\frac{4}{3}$
C. $\frac{11}{8}$
D. $\frac{3}{2}$
E. $\frac{5}{3}$

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25. Suppose that $f(x) = \dfrac{\sqrt{1+2x^2}}{2x-1}$. Then $\int_1^2 f'(x)dx$ equals

A. $1$

B. $3-\sqrt{3}$

C. $1-\sqrt{3}$

D. $\sqrt{3}$

E. $\sqrt{3}+1$