

Name: _____

Instructor: _____

Math 10560, Exam 1.
February 16, 2006

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 9 pages of the test.

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| PLEASE MARK YOUR ANSWERS WITH AN X, not a circle! | | | | | |
| 1. | (a) | (b) | (c) | (d) | (e) |
| 2. | (a) | (b) | (c) | (d) | (e) |
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| 3. | (a) | (b) | (c) | (d) | (e) |
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| Multiple Choice | _____ |
| 9. | _____ |
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Multiple Choice

1.(7 pts.) Simplify the following expression for x .

$$x = \log_3 81 + \log_3 \frac{1}{9}.$$

(a) $x = 9$

(b) $x = 6$

(c) $x = \ln 9 - \ln 3$

(d) $x = \ln 3$

(e) $x = 2$

2.(7 pts.) The function $f(x) = x^3 + 3x + e^{2x}$ is one-to-one. Compute $(f^{-1})'(1)$.

(a) 0

(b) $\frac{1}{5}$

(c) $\frac{1}{4}$

(d) $\frac{1}{6+e}$

(e) $\frac{1}{6+2e}$

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3.(7 pts.) Differentiate the function

$$f(x) = \frac{(x^2 - 1)^4}{\sqrt{x^2 + 1}}.$$

(a) $f'(x) = \frac{x(x^2 - 1)^4}{\sqrt{x^2 + 1}} \left(\frac{8}{x^2 - 1} + \frac{1}{x^2 + 1} \right)$

(b) $f'(x) = \frac{(x^2 - 1)^4}{\sqrt{x^2 + 1}} \left(\frac{4}{x^2 - 1} - \frac{1}{x^2 + 1} \right)$

(c) $f'(x) = \frac{(x^2 - 1)^4}{\sqrt{x^2 + 1}} \left(\frac{4}{x^2 - 1} + \frac{1}{x^2 + 1} \right)$

(d) $f'(x) = \frac{(x^2 - 1)^4}{\sqrt{x^2 + 1}} \left(\frac{8}{x^2 - 1} - \frac{1}{x^2 + 1} \right)$

(e) $f'(x) = \frac{x(x^2 - 1)^4}{\sqrt{x^2 + 1}} \left(\frac{8}{x^2 - 1} - \frac{1}{x^2 + 1} \right)$

4.(7 pts.) Compute the integral

$$\int_{2e}^{2e^2} \frac{1}{x(\ln \frac{x}{2})^2} dx.$$

(a) 2

(b) $\frac{3}{2}$

(c) $\frac{1}{2}$

(d) 1

(e) 0

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7.(7 pts.) Calculate the following integral.

$$\int_0^1 \frac{\arctan x}{1+x^2} dx .$$

- (a) $\frac{1}{2}$ (b) $\frac{\pi}{8}$ (c) $\frac{\pi^2}{32}$ (d) $\ln 2$ (e) $\frac{\pi^2}{8}$

8.(7 pts.) Evaluate the integral

$$\int_0^{\pi/2} \sin^3(x) \cos^5(x) dx.$$

- (a) 0 (b) $\frac{\pi}{2}$ (c) $-\frac{1}{24}$ (d) $\frac{1}{24}$ (e) $\frac{1}{4}$

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Partial Credit

You must show your work on the partial credit problems to receive credit!

9.(11 pts.) Evaluate the limit

$$\lim_{x \rightarrow 0} (\cosh(x))^{1/x^2}.$$

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10.(11 pts.) Evaluate the integral

$$\int x^2 \cos(2x) dx.$$

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11.(11 pts.) Evaluate:

$$\int \frac{1}{3}x^3\sqrt{9-x^2} dx.$$

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12.(11 pts.) Let $C(t)$ be the concentration of a drug in the bloodstream. As the body eliminates the drug, $C(t)$ decreases at a rate that is proportional to the amount of the drug that is present at the time. Thus $C'(t) = kC(t)$, where k is a constant. The initial concentration of the drug is 4 mg/ml. After 5 hours, the concentration is 3 mg/ml.

(a) Give a formula for the concentration of the drug at time t .

(b) How much drug will there be in 10 hours?

(c) How long will it take for the concentration to drop to 0.5 mg/ml?

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