

Name:
Section:

Final Exam
29 May 2008

Instructions: **Show all work to receive full or partial credit.** All University rules and guidelines for student conduct are applicable.

Indiana: Meet me at Omar's. Be ready for me. I'm going after that truck.

Sallah: How?

Indiana: I don't know. I'm making this up as I go.

Indiana Jones and The Raiders of the Lost Ark.

Questions are worth 10 points each.

Question	Score
1	
2	
3	
4	
5	
6	
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8	
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10	
11	
12	
13	
14	
Total	

1. Calculate a value of a such that the function $f(x)$ is continuous.

$$f(x) = \begin{cases} \ln(3x^2), & x < 2 \\ a \ln x, & x \geq 2. \end{cases}$$

Simplify the solution as much as possible.

2. Differentiate $f(x) = e^x \sin x$.

3. Differentiate the function.

$$f(x) = \frac{\sqrt{x} + x^2 + 1}{1 + e^x}$$

4. Differentiate

$$y = \ln \left(x^2 + \frac{1}{x^2} \right).$$

5. Find the equation of the tangent line to the curve

$$(x + 1)y + e^y \cos(x) + \ln(x + 1) = 1$$

at the point $(0, 0)$.

6. Using linearization or differentials, estimate the quantity $\sin(5\pi/16)$.

7. The half-life of Cobalt-53 is 100 years. A sample of Cobalt-53 has a mass of 800 mg. Derive a formula for the mass of the sample that remains after t years.

8. Prove that the equation

$$\frac{1}{x} + 9x^2 - 3x^3 = 1$$

has at least one solution for $x \geq 1$. If you use a theorem, state the theorem and why it is applicable to this problem.

9. Sketch the curve

$$y = \frac{\sqrt{x^2 + 1}}{x}$$

clearly labeling on the graph its domain, vertical and horizontal asymptotes, x and y intercepts, and local maxima and minima.

10. Find the absolute maximum and absolute minimum values of $f(x)$ on the given interval.

$$f(x) = \frac{\ln x}{x^2}, \quad [1, e^2]$$

11. The combined perimeter of an equilateral triangle and a square is 10 feet. Find the dimensions of the triangle and square that produce a minimum total area.

12. Evaluate

$$\frac{d}{dx} \left(\int_1^{x^2} \ln(t^2 + t + 1) dt \right).$$

13. Evaluate the integral.

$$\int_0^2 \sqrt{4-x^2} dx.$$

14. Find the indefinite integral.

$$\int \frac{\sin(\ln x)}{x} dx$$