

Name: _____

Student ID: _____

Section: _____

Instructor: _____

Math 112 (Calculus I) Final Exam Form A

April 17, 2010, 7:00-10:00 a.m.

Instructions:

- Work on scratch paper will not be graded.
- For questions 22 to 29, show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer. Please write neatly.
- Should you have need for more space than is allotted to answer a question, use the back of the page the problem is on and indicate this fact.
- Simplify your answers. Expressions such as $\ln(1)$, e^0 , $\sin(\pi/2)$, etc. must be simplified for full credit.
- Calculators are not allowed.

For Instructor use only.

#	Possible	Earned
MC	40	
21	10	
22	6	
23	8	
24	6	
Sub	70	

#	Possible	Earned
25	6	
26	6	
27	6	
28	6	
29	6	
Sub	30	
Total	100	

Short Answer. Fill in the blank with the appropriate answer. 1 point each

21. (10 points)

(a) If $f(x) = e^{3x}$ then $f''(x) =$ _____

(b) $\frac{d}{dx} (a^3 + \cos^3 x) =$ _____

(c) $\frac{d}{dx} e^{x^2} =$ _____

(d) $\frac{d}{dx} (\tan^{-1}(x^2)) =$ _____

(e) $\lim_{x \rightarrow 0^+} \frac{\ln(1+x)}{x} =$ _____

(f) $\frac{d}{dx} \ln(\sinh(x)) =$ _____

(g) $\frac{d}{dx} \sin(\pi^2 + e^3) =$ _____

(h) Use the linearization of $f(x) = \sqrt{x}$ at $a = 9$ to approximate $\sqrt{11}$. _____

(i) $\lim_{x \rightarrow 0} \frac{x^2 + 3}{e^x} =$ _____

(j) $\int 3x^2 + 2x + 1 dx =$ _____

Free response: Give your answer in the space provided. Answers not placed in this space will be ignored. 5 points each

22. (6 points) Hannah the Human Cannonball is riding a rocket car at the Bonneville speedway. During her trip, her distance $q(t)$ (measured in kilometers) from the start, t seconds after starting, has been calculated to be given by the function $q(t) = 36t^2 - 2t^3$.

(a) (3 points) What is her velocity after 1 second?

(b) (3 points) When does she stop, i.e., at what time $t > 0$ is her velocity zero.?

23. (8 points) State the definition of the derivative of $f(x)$, and **use the definition** to find the derivative of $f(x) = 3x^2 + 5$.

24. (6 points) Compute the definite integral $\int_0^{\frac{\sqrt{2}}{2}} \frac{x \, dx}{\sqrt{1-x^4}}$

25. (6 points) I want to make a fenced rectangular play space for my children, with an area of 96 square meters. One side (the front) will face the road. Most of the fencing will cost me \$10 per meter, but the fencing for the front side costs \$20 per meter because it looks nicer. What should the dimensions be to minimize the total cost of the fencing? How much will it cost?

26. (6 points) If a car is initially moving at 14 meters per second, and the driver begins braking so that the car slows down at the constant rate of 2 meters per second per second until it stops, how far will the car travel from the time that the driver began braking until the time the car stops?

27. (6 points) $\lim_{x \rightarrow 0^+} x \csc(x) =$

28. (6 points) Find the derivative of $f(x) = x^{\sin x}$.

29. (6 points) Sketch the graph of a function $f(x)$ which is twice differentiable on the interval $(-\infty, \infty)$ and which has the following properties:

- The second derivative $f''(x)$ is positive on the interval $(0, \infty)$ and negative on the interval $(-\infty, 0)$.
- $\lim_{x \rightarrow \infty} f(x) = 2$
- The first derivative is zero only at $x = -3$

