Final Exam Math 122 Fall 2012 Name:

Work must be shown to receive credit.

1. Let $f(x) = 20x^3 - 3x^5$. (a) Make a sign chart for $f(x)$. (b) Find all local maximum and minimum values of $f(x)$. (c) Find all points of inflection on the curve $y = f(x)$.

2. A rectangular storage container with an open top is to have a volume of 12 ft^3. The length of its base is three times the width of its base. Material for the base costs $10 per square foot. Material for the sides costs $5 per square foot. (a) Find the dimensions of the cheapest container. (b) Find the cost of the cheapest container, rounded off to the nearest cent.

3. Let $f(x) = x \sin x - x$. Find the minimum value of $f(x)$ on the interval $[0, \frac{\pi}{2}]$. Use Newton's Method with $x_0 = 0$ to find the critical value of the function, accurate to 2 decimal places.

4. A car traveling 100 feet per second brakes with constant deceleration of 10 ft/sec^2 and skids to a stop in 10 seconds. How far does the car skid?

5. Approximate the definite integral $\int_0^\pi \sin x \, dx$ using a Riemann Sum with $N = 4$ equally spaced subintervals and the left-hand rule to generate x_1^* through x_4^*. Round your answer to two decimal places.

6. Find the exact value of $\int_0^1 \sqrt{x}(1 + x) \, dx$.

7. Bacteria grow at a rate of $100t^3$ organisms/hour at time t hours. What is the net increase in the bacteria population between hour 5 and hour 6?

8. Evaluate the definite integral $\int_0^1 x^3(1 + x^4)^{100} \, dx$ using u-substitution.