Name: _____ Score: _____ /20

Review Assignment III
due Friday, May 6, 2005

For each problem completed (with all work), you will receive 1 point (for a possible 10 points). I will randomly choose one problem to grade for a possible 10 additional points.

1. Let $C(x)$ be the cost, in dollars, of manufacturing x widgets. Fill in the table with a mathematical expression and appropriate units corresponding to each description.

Description	Mathematical Expression	Units
cost of manufacturing 100 widgets		
cost of manufacturing the 101st widget		
average rate of change of cost from a production level of 100 widgets to a production level of 101 widgets		
instantaneous rate of change of cost at a production level of 100 widgets		
instantaneous rate of change of cost at a production level of 100 widgets *(another expression)*		

2. Let $f(x)$ be a function. Fill in the table with a mathematical expression corresponding to each description.

Description	Mathematical Expression
y-coordinate of the point on the graph $y = f(x)$ where $x = 27$	
height above the x-axis of the point on the graph $y = f(x)$ where $x = 27$	
slope of the secant line through the points on the graph $y = f(x)$ where $x = 27$ and where $x = 30$	
slope of the tangent line to the graph $y = f(x)$ at the point where $x = 27$	
slope of the tangent line to the graph $y = f(x)$ at the point where $x = 27$ *(another expression)*	

3. Let $T(t)$ be temperature, in degrees Fahrenheit, at time t. For each scenario, fill in the banks with one of the symbols $<, >, =,$ or ? (if the sign cannot be determined).

   (a) The temperature held steady at $70°$ all afternoon.

   $T(t)$ _____ 0 $\qquad\qquad$ $T'(t)$ _____ 0 $\qquad\qquad$ $T''(t)$ _____ 0

   (b) The temperature increased from the low in the 60's at a slow but steady rate.

   $T(t)$ _____ 0 $\qquad\qquad$ $T'(t)$ _____ 0 $\qquad\qquad$ $T''(t)$ _____ 0

   (c) At midnight, the temperature was $0°$ and it has been falling more and more rapidly ever since.

   $T(t)$ _____ 0 $\qquad\qquad$ $T'(t)$ _____ 0 $\qquad\qquad$ $T''(t)$ _____ 0

   (d) As the sun came out, the temperature increased more and more quickly.

   $T(t)$ _____ 0 $\qquad\qquad$ $T'(t)$ _____ 0 $\qquad\qquad$ $T''(t)$ _____ 0

   (e) The temperature is still falling, although not as rapidly as earlier in the evening.

   $T(t)$ _____ 0 $\qquad\qquad$ $T'(t)$ _____ 0 $\qquad\qquad$ $T''(t)$ _____ 0

4. Find the absolute extreme values of the function $f(x) = 3x^4 - 16x^3 + 18x^2$ on the closed, bounded interval $[-1, 4]$. *You must show all your steps carefully so that I know you are using calculus rather than relying on your grapher.*

   The absolute minimum value of f on $[-1, 4]$ is _____ which occurs at $x =$ _____.

   The absolute maximum value of f on $[-1, 4]$ is _____ which occurs at $x =$ _____.

5. A bank offers money market accounts at 2.75% annual interest compounded continuously.

   (a) Give the formula for the amount FV in the account after t years when PV dollars are invested.

   (b) How soon will a deposit triple in value? *Show your reasoning. Round to the nearest year.*

6. A bank offers money market accounts at 5.25% annual interest. Rounded to the nearest cent, what is the present value of $1,000 ten years from now ...

   (a) ... if interest is compounded continuously?

   (b) ... if interest is compounded weekly?

   (c) ... if interest is compounded quarterly?

7. Evaluate each indefinite integral. Try simplifying the integrand algebraically instead of or in addition to using a substitution. *Show all steps. Check your answer by differentiating.*

(a) $\displaystyle \int e^{3x} \left(2 - e^{3x}\right)^5 \, dx$ 　　　　　　　　　　　　　　　*Check:*

(b) $\displaystyle \int \frac{\left(x^2 + 2\right)^2}{x^3} \, dx$ 　　　　　　　　　　　　　　　*Check:*

(c) $\displaystyle \int \frac{\ln(1 - x)}{1 - x} \, dx$ 　　　　　　　　　　　　　　　*Check:*

8. (a) If $w'(t)$ is the rate of growth of a child in pounds per year, what does $\int_5^{10} w'(t)\, dt$ represent?

    (b) If a honeybee population starts with 100 bees and increases at a rate $n'(t)$ bees per week, what does $100 + \int_0^{15} n'(t)\, dt$ represent?

    (c) If oil leaks from a tank at a rate of $r'(t)$ gallons per minute, what does $\int_0^{120} r'(t)\, dt$ represent?

9. The marginal cost of manufacturing x yards of a certain fabric is $3 - 0.01x + 0.000006x^2$ (in dollars per yard). Find the increase in cost if the production level is raised from 2000 yards to 4000 yards. *Introduce your function(s) with a "Let" statement.*

10. Find each definite integral. *Give exact answers, simplified. Show all steps for full credit.*

(a) $\displaystyle\int_1^2 2x + \frac{x}{2} + \frac{2}{x} + \frac{1}{2x}\, dx$

(b) $\displaystyle\int_0^a x\sqrt{a^2 - x^2}\, dx$

(c) $\displaystyle\int_e^{e^9} \frac{1}{x\sqrt{\ln x}}\, dx$