Math 141,   Exam 2,   2000

PRINT Your Name:_____ Recitation Time _____ Tu. Th.
There are 10 problems on 6 pages. Each problem is worth 10 points. In problem 3 you MUST use the definition of the derivative. In the other problems you may use any legitimate derivative rule. SHOW your work. $\boxed{CIRCLE}$ your answer. **NO CALCULATORS!**

1. Let $y = x\sin x$. Find dy.

2. Let $y = \sin\left(x^3\cos^2(2x) + 19x^2\right)$. Find $\frac{dy}{dx}$.

3. Use the DEFINITION of the DERIVATIVE to find the derivative of
   $f(x) = \dfrac{2}{3x - 4}$.

4. Graph $y = 2\cos 3x$. Mark a few points on each axis.

5. **(The penalty for each mistake is five points.)** Let
$$
f(x) = \begin{cases} 4 - x & \text{if } 2 \le x, \\ x & \text{if } 1 < x < 2, \text{ and} \\ 4 - x^2 & \text{if } x \le 1. \end{cases}
$$

   (a) Graph $y = f(x)$.
   (b) Fill in the blanks:

   $f(0) = $ __ $\lim\limits_{x \to 0^+} f(x) = $ __ $\lim\limits_{x \to 0^-} f(x) = $ __ $\lim\limits_{x \to 0} f(x) = $ __

   $f(1) = $ __ $\lim\limits_{x \to 1^+} f(x) = $ __ $\lim\limits_{x \to 1^-} f(x) = $ __ $\lim\limits_{x \to 1} f(x) = $ __

   $f(2) = $ __ $\lim\limits_{x \to 2^+} f(x) = $ __ $\lim\limits_{x \to 2^-} f(x) = $ __ $\lim\limits_{x \to 2} f(x) = $ __

   (c) Where is $f(x)$ continuous?
   (d) Where is $f(x)$ differentiable?

6. The volume of a cube is growing at the rate of 6 cubic inches per second. Find the rate at which each side of the cube is growing at the instant when each side has length 10 inches.

7. **(The penalty for each mistake is five points.)** The picture represents the graph of $y = f(x)$.
   Fill in the blanks:

   $f(2) = $ __ $\lim\limits_{x \to 2^+} f(x) = $ __ $\lim\limits_{x \to 2^-} f(x) = $ __ $\lim\limits_{x \to 2} f(x) = $ __

   $f(3) = $ __ $\lim\limits_{x \to 3^+} f(x) = $ __ $\lim\limits_{x \to 3^-} f(x) = $ __ $\lim\limits_{x \to 3} f(x) = $ __

8. Let $4x^5y^3 = \sin(3x^4y^6)$. Find $\frac{dy}{dx}$.

9. Find the equation of the line tangent to $f(x) = \cos^2 x$ at $x = \frac{\pi}{4}$.

10. The height of an object above the ground at time t is $s(t) = -16t^2 + 32t + 48$, where s is measured in feet and t is measured in seconds. What is the velocity of the object when it strikes the ground?