Math 141 Test 3 July 2, 1996 sec. 3.5 through sec. 4.2

Show all work that is necessary to complete a problem. Each problem is worth 10 points.

1. Let $f(x) = 7x^2 - 2x + 1$. Find the third derivative of *f*.

2. Find the second derivative of *g*(*x*) where $g(x) = \frac{5}{x}$.

3. Find and solve for $\frac{dy}{dx}$ where $\frac{xy + x}{y + 2} = 5x$.

4. Find the equation of the tangent line to the graph of $x^2y^2 + y^3 = 5$ at the point (-2, 1).

5. Assume that *x* and *y* are both functions of *t*. Solve for $\frac{dy}{dx}$ where $\sqrt{x + y} = y$.

6. The area *A* of a skin lesion is related to its diameter by the equation $A = \frac{\pi d^2}{4}$. If the diameter is growing at a rate of 10 mm per week, find the time rate of change of *A* when *d* = 6 mm.

7. Let $f(x) = 9x^4 - 2x^2$.

   a) Find all of the critical points ((*x*, *y*)) .

   b) Use either the first or second derivative test to determine the type of critical point (max., min., or neither) for each of the above.

8. Find the absolute maximum and absolute minimum for $g(x) = 2x^3 + 3x^2 - 36x + 2$ on the interval: $-4 \le x \le 5$.

9. The owner of an apple orchard finds that the annual yield per tree is constant at 330 lb. when the number of trees per acre is 45 or fewer. For each additional tree over 45, the annual yield per tree decreases by 3 lb. Because of overcrowding. How many trees should be planted on each acre to maximize the annual yield from an acre?

10. On back, don't forget it.

Bonus: A light is at the top of a 16-ft pole. A boy 5 ft tall walks away from the pole at a rate of 4 ft/sec. At what rate is the tip of his shadow moving when he is 18 ft from the pole?

10. Match the following functions whose derivatives are given with one of the graphs.

(i.) $f'(x) = \dfrac{x(x+4)}{x+2}$ ___ (ii.) $f'(x) = \dfrac{x^2(x+4)}{(x+2)^2}$ ___ (iii.) $f'(x) = \dfrac{x(x+4)^2}{x+2}$ ___