

Exam 2, version A
Math 171.501
3/26/09

*An unsupported answer
is a wrong answer!*

1. (15 pts.) You are given the values of f , f' , g , and g' below:

$$\begin{array}{cccc} f(1) = 2 & f'(1) = 4 & g(1) = 4 & g'(1) = -1 \\ f(2) = 3 & f'(2) = 7 & g(2) = 3 & g'(2) = -5 \\ f(3) = 5 & f'(3) = 9 & g(3) = 1 & g'(3) = -6 \end{array}$$

- (a) If $A(x) = f(x)g(x)$, determine $A'(1)$.
(b) If $B(x) = f(g(x))$, determine $B'(3)$.
(c) If $C(x) = \frac{1}{f(x) + g(x)}$, determine $C'(2)$.
2. (10 pts.) Find the derivative of $f(x) = \frac{x}{3x+1}$ using the definition, i.e., by evaluating a certain limit as h goes to zero. No credit for using another method (e.g., the quotient rule).
3. (10 pts.) At what point(s) on the parametric curve $x = 2t^2 + 6t + 1$, $y = 4t^2 + 4t$ is the tangent line
- (a) horizontal?
(b) parallel to the line $y = x$?
4. (10 pts.) For the curve $x^3 + x^2y - y^3 = 1$,
- (a) use implicit differentiation to find dy/dx in terms of x and y .
(b) find the equation of the tangent line at $(1,1)$. (Write this in slope-intercept form, i.e., $y = mx + b$ for the correct values of m and b .)
5. (10 pts.) Find $\frac{dy}{dx}$ if $y = \cos(e^{4x})$.
6. (10 pts.) Find $\frac{d^2y}{dx^2}$ if $y = \tan x$.
7. (10 pts.) Suppose that we're using Newton's method to find the root of $x^5 + x + 1 = 0$. If $x_0 = 0$, what are x_1 and x_2 ?
8. (10 pts.) Using differentials, approximate $\sqrt{9.2}$.

Problem 9 on back!

9. (15 pts.) A water tank has the shape of a square pyramid with the vertex downward. The base (top) of the tank has a side of 5 feet, and the depth of the tank at the center is 10 feet. When the water is 6 ft deep at the center of the tank, it is observed that the water level is dropping at a rate of $1/5$ ft/min due to a leak. How fast is the water leaking from the tank? Give units with your answer. (The volume of a pyramid is one third times the area of the base times the height.)

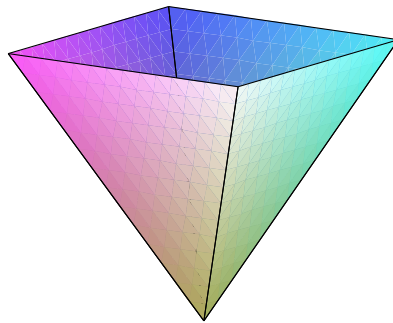


Figure for problem 9