Math 220 Sample Midterm 2

Name: _____

Recitation instructor: _____

Recitation time: _____

- This is a closed-book, closed-notes exam. No calculators or electronic aids are permitted.
- Read each question carefully and show your work unless explicitly told otherwise.

Problem 1.
Find the following derivatives. You **do not need to simplify** your answers or show all steps. However, showing your work may help you earn partial credit if your answer is incorrect.

A. $\frac{d}{dx}\left(5x^3 - \frac{1}{\sqrt{x}} + 7\log_5(x) + e^3\right)$

B. $\frac{d}{dx}\left(20^x \cdot x^{20}\right)$

C. $\frac{d}{dx}\arccos\left(\frac{3}{x} - 1\right)$

D. $\frac{d}{d\theta}\sec\left(\sin(\theta^2)\right)$

E. $\frac{d}{dx}\left(\frac{e^{2x}+\ln(2x+1)}{x^6-7x}\right)$

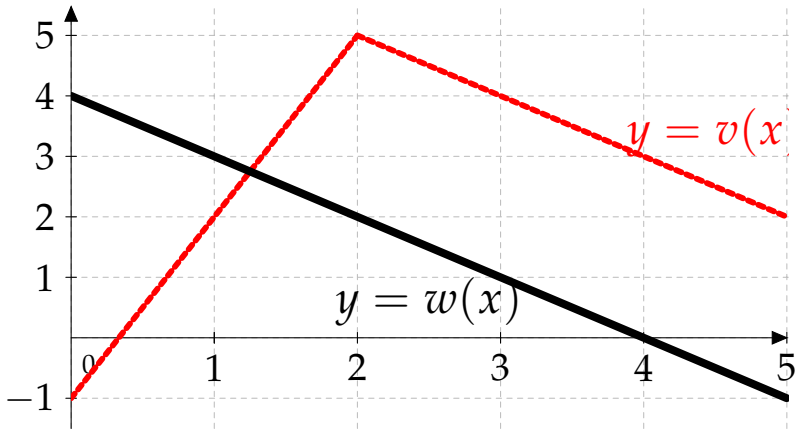
Problem 2. Using logarithmic differentiation, find the derivative of $f(x) = x^{7\tan(x)}$.

Problem 3. Using implicit differentiation, find $\frac{dy}{dx}$ if $\cos(x^2y^3) = e^x$.

Problem 4. Let $g(x) = 7x^2 + x$. Using the limit definition of the derivative, find $g'(x)$. Make sure to use limit notation correctly.

Problem 5. Suppose that a waiter brings you a cup of hot tea. Let $F(t)$ denote the temperature in degrees Fahrenheit of the tea after t minutes. Is $F'(3)$ positive or negative? Explain your answer.

Problem 6.



Suppose that $f(x) = v(x) \cdot w(x)$ and $g(x) = v(w(x))$. Find $f'(1)$ and $g'(1)$.

Problem 7. Find the equation of the tangent line to the curve $y = \sin(5x) + 2$ at $x = 0$.

Problem 8. On an alien planet, Alice throws a softball vertically upward. For $t \geq 0$, it has height in feet given by $s(t) = 10 + 6t - t^2$, where t is in seconds.

A. Calculate $s'(t)$. When is the softball going upward/downward?

B. At what time does the softball obtain its maximum height? (**include unit with your answer.**)

C. What is the acceleration $s''(t)$? (**include unit with your answer.**)