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Name _____
Exam Score: _____ /100

1. (12 pts) Using the *definition of the derivative*, find

$$\frac{d}{dx}\left(\frac{3x}{5x+1}\right)$$

2. (8 pts each) For each function, find the derivative. **Do not simplify your answer.**

(a) $f(x) = \frac{x^2-3x+4}{x^2+4}$

(b) $g(a) = (9a^8 - 8a^9)\left(\frac{1}{a} - \frac{1}{a^2}\right)$

(c) $w(t) = (3t^5 + t)(\sec(t^2))$

(d) $b(z) = (\cos(\sin(z^2)))^{-1}$

(e) $f(x) = (2x+1)^2(3x+1)^3(4x+1)^4$

3. (12 pts) Find $\frac{dy}{dx}$ if

$$3\sin(y) = y\cos(x) - \sin(xy)$$

4. (12 pts) Find the equation of the tangent line to the curve $2(x^2 + y^2)^2 = 50(x - y)$ at the point $(3, -1)$.

5. (12 pts) You're pulling a boat in toward the dock you're standing on. Your hands are 12 feet above the waterline, and the point where the rope attaches to the prow of the boat is 2 feet above the water. If you're pulling in the rope at a constant speed of 2 feet per second, how fast is the boat approaching the dock when it's 25 feet away?

6. (12 pts) A conical paper cup is being filled with coffee. The cup is 3 in. across the top and 5 in. tall, and is being filled at 4 cubic inches per second. How fast is the level of the hot black life-giving substance rising when it's 3 inches deep? (Reminder: the volume of a cone with base radius r and height h is $V = \frac{1}{3}\pi r^2 h$.)