Math 150 Name: ________________________

QUIZ ON CHAPTER 3

DERIVATIVES; MATH 150 – SPRING 2017 – KUNIYUKI
105 POINTS TOTAL, BUT 100 POINTS = 100%

Show all work, simplify as appropriate, and use "good form and procedure" (as in class).
Box in your final answers!
No notes or books allowed. A scientific calculator is allowed.

1) Use the limit definition of the derivative to prove that $D_x\left[\cos(x)\right] = -\sin(x)$, as in class. Show all steps! (12 points)

THIS IS THE ONLY PROBLEM ON THIS TEST WHEN YOU WILL NEED TO USE THE LIMIT DEFINITION OF THE DERIVATIVE!

2) A particle moving along a coordinate line has as its position function s, where $s(t) = \sin(4t)$. Position $s(t)$ is measured in miles, and time t is measured in hours. Write exact answers with correct units. (10 points total)

a) Find the velocity of the particle at time $t = \frac{\pi}{24}$.

b) Find the acceleration of the particle at time $t = \frac{\pi}{24}$.

3) (2 points). Which of the following equations has a cusp on its graph at $(0, 0)$?

Box in one: $y = x^{3/5}$ $y = x^{4/5}$ $y = |x|$

4) Let $f(x) = (3x-1)^3$. Consider the graph of $y = f(x)$ in the usual *xy*-plane. Also consider the point *P* on that graph with $x = 1$. These are linearization problems. (11 points total)

a) Find an equation of the tangent line to the graph at the point *P*. You may use any appropriate form. (8 points)

b) Use your tangent line from a) to give a linear approximation for the value of $f(0.93)$. Give your answer as a decimal written out to two decimal places. (3 points)

5) Find the indicated derivatives. (27 points total)

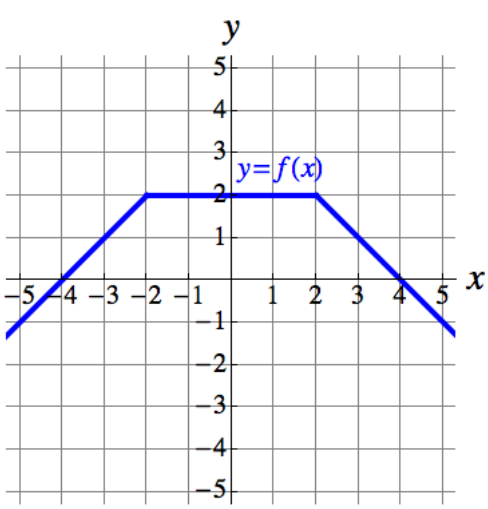
a) $D_x\left[\dfrac{\cot(x)+3}{x^2-1}\right]$. Use the Quotient Rule! Your final answer does <u>not</u> have to be in simplified form, aside from arithmetic. (8 points)

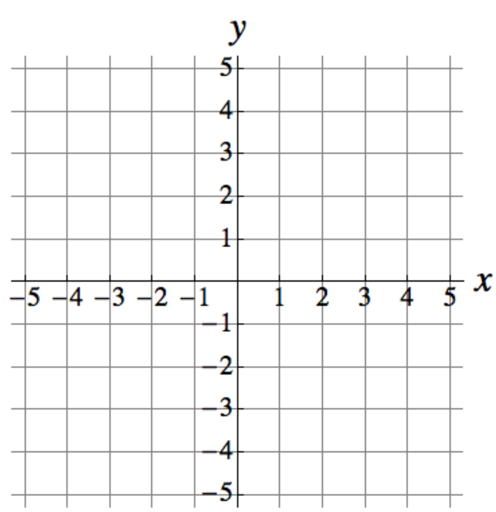
b) $\dfrac{d}{dw}\left[\left(5w^3 - w\right)^{-7}\right]$. Do not leave negative exponents in your final answer. Simplify arithmetic. (5 points)

c) Let $f(x) = (x+2)^5 \cos\left(5x^2\right)$. Find $f'(x)$. Simplify. You do not have to factor your final answer. (8 points)

d) Find $D_\theta\left[\sec^9(3\theta)\right]$. Simplify. (6 points)

6) The graph of $y = f(x)$ is given below, to the left. Sketch the graph of $y = f'(x)$ in the grid to the right. (6 points)





7) Prove that $D_x\left[\csc(x)\right] = -\csc(x)\cot(x)$ without using the limit definition of the derivative. Among the trigonometric derivatives, you may use only the derivatives of $\sin(x)$ and $\cos(x)$ without proof. Show all work! (8 points)

8) Consider the given equation $3x^5 - 4y + x\cos(y) = 7$. Assume that it "determines" an implicit differentiable function f such that $y = f(x)$. Find $\frac{dy}{dx}$ (you may use the y' notation, instead). Use implicit differentiation, as in class. (11 points)

9) $A = \pi r^2$, where r is a differentiable function of t. Find $\dfrac{dA}{dt}$ when $r = 3$ and $\dfrac{dr}{dt} = 5$. (6 points)

10) A 15-foot-long ladder is leaning at an angle against a tall vertical building that is standing upright and perpendicular from the flat ground. The bottom of the ladder is sliding away from the building in such a way that the top of the ladder is falling at a rate of 0.27 feet per minute down the building. Find the rate at which the angle (the "angle of elevation") between the ground and the ladder is changing when the angle is 37°.

• Write your final answer in degrees per minute, and round off your answer as a decimal to four significant digits. (Round off intermediate results to at least four significant digits.) (12 points)