MAT 136: Calculus I
Weekly Homework 5

NAME:

Instructions

Complete each of the following exercises. Your solutions should be complete and neatly written. In particular, you should show all of your work. Write your solutions on your own paper or prepare them digitally. You will need to capture your work digitally and then upload a single PDF document (possibly with multiple pages) to BbLearn. There are many free smartphone apps for doing this. I use TurboScan on my iPhone. This assignment is due on **Thursday, September 24 by 8:00pm**.

Problems

1. Let $k(x) = f(g(h(x)))$, where $h(2) = 3$, $g(3) = -1$, $h'(2) = 7$, $g'(3) = -2$, and $f'(-1) = -3$. Find $k'(2)$.

2. Differentiate each of the following functions. You do *not* need to simplify your answers, but you do need to show sufficient justification.

   (a) $f(x) = \dfrac{2}{e^x + e^{-x}}$
   (b) $h(x) = 2xe^{1-x^2}$
   (c) $y = \arctan(e^{3x})$
   (d) $y = \sin(2x)\cos(3x)$
   (e) $f(x) = 2\cos(x) + \sec(2x)$
   (f) $h(x) = \sin(\cos x)$
   (g) $k(x) = \sin^3(x)$
   (h) $y = \sin(x^3)$
   (i) $f(x) = \ln(\cos(x))$
   (j) $g(x) = \cos(\ln(x))$
   (k) $g(x) = \dfrac{1+\cos(x)}{1-\cos(x)}$
   (l) $y = \arcsin(1 - 5x^2)$
   (m) $y = \ln(x^2)\sin\left(\dfrac{\pi}{4}x\right)$
   (n) $g(x) = \ln\left(\dfrac{\sqrt{x+1}(2-x)^5}{(x+3)^7}\right)$

3. Use implicit differentiation to find find dy/dx for $x^2y + y^2 = \sin(xy)$.

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

5. Find all x-values where the tangent lines to $f(x) = x^2e^{-x}$ are horizontal.

6. Prove that $\dfrac{d}{dx}[\text{arcsec}(x)] = \dfrac{1}{|x|\sqrt{x^2-1}}$.

7. Suppose f is a function such that its inverse function f^{-1} exists. Prove that $\dfrac{d}{dx}\left[f^{-1}(x)\right] = \dfrac{1}{f'(f^{-1}(x))}$.
   Hint: $f(f^{-1}(x)) = x$.

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