Math 132 Fall 2017
Group Quiz 4 10/04/17 Name (Print): Solutions.

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1. Find the derivative of $f(x) = \sin(x + \cos(x))$

$$f' = \cos(x + \cos x)\,(x + \cos x)' = \cos(x + \cos x)\,(1 + (-\sin x))$$

2. Find the equation of the tangent line to $g(x) = (x^2 + (1+x)^{-1})^2$ at $x = 1$.

$$g' = 2(x^2 + (1+x)^{-1})\,(x^2 + (1+x)^{-1})'$$

$$= 2(x^2 + (1+x)^{-1})\,(2x - (1+x)^{-2})$$

$$g(1) = (1 + (1+1)^{-1})^2 = \frac{9}{4}$$

$$g'(1) = 2 \cdot \frac{3}{2} \cdot \frac{7}{4} = \frac{21}{4}.$$

$$\frac{y - 9/4}{x - 1} = \frac{21}{4}$$

3. Suppose $\frac{1}{x} + \frac{1}{y} = xy$ find y'.

$$x^{-1} + y^{-1} = xy$$

$$-x^{-2} + (-y^{-2})\,y' = xy' + y$$

$$\Rightarrow \quad -x^{-2} - y = (x + y^{-2})\,y'$$

$$y' = -\frac{x + y^{-2}}{x^{-2} + y}$$

4. Suppose $x^2 + y^2 = xy$ find y''.

$$2x + 2yy' = xy' + y$$

$$(2y - x)\,y' = y - 2x$$

$$y' = \frac{y - 2x}{2y - x}$$

$$y'' = \frac{(2y-x)(y'-2) - (y-2x)(2y'-1)}{(2y-x)^2}$$

5. Suppose $\sin(y^2) = \cos(x)$, find the equation of the tangent line at $(x, y) = \left(\frac{\pi}{4}, \frac{\sqrt{\pi}}{2}\right)$

$$\cos(y^2)\,2yy' = -\sin x$$

$$y' = -\frac{\sin x}{(\cos y^2)\,2y} = -\frac{1}{2\sqrt{\pi}/2} = -\frac{1}{\sqrt{\pi}}.$$

$$\frac{y - \frac{\sqrt{\pi}}{2}}{x - \frac{\pi}{4}} = -\frac{1}{\sqrt{\pi}}.$$