**Exam 2 MTH 201 Fall 2013**

To receive full credit, answers must be accompanied by complete, correct justification that is both legible and organized properly. No Calculators.

Recall:

$$\sin(A+B) = \sin A \cdot \cos B + \sin B \cdot \cos A$$

$$\cos(A+B) = \cos A \cdot \cos B - \sin A \cdot \sin B$$

1. (10 pts) Find the derivative of $f(x) = 5\sin(8x)$ using the definition of the derivative. No partial credit will be given for using short-cut methods.

2. (20 pts) Differentiate and simplify completely.

(a) $g(t) = 5\cos^9(2t^3 - 4t) + \tan^{14}(e^t) - e^{4-6t^2}$

(b) $y = \dfrac{\sqrt{x^2 - x}}{10x + 2}$

3. (40 pts) Differentiate. (You do NOT need to simplify after you differentiate.)

(a) $f(w) = 3w^{\ln 5} + w + e^9 + \pi^w - 4e^w$

(b) $y = x\sin^4(2x) + \tan^{-1}(3x) + \cos^{-1}(4x^3 + x)$

(c) $f(z) = \ln\left(\dfrac{(3z^2 - 2z + 1)^5\sqrt{4z + 8}}{ze^{3z}\sin z}\right)$

(d) $h(\theta) = e^{\sec\left(\sqrt[7]{6\theta^2-14\theta}\right)}$

4. (10 pts) Use logarithmic differentiation to find the derivative of $y = (\ln x)^{\ln x}$.

5. (10 pts) A 5 ft ladder propped up against a wall is sliding downward such that the rate at which the top of the ladder is **falling** to the floor is 2 ft/min. Find the rate at which the distance between the bottom of the ladder and the base of the wall is increasing when the top of the ladder is 3 ft from the base of the wall. You must use Calculus to receive credit.

6. (a) (10 pts) Given $e^{xy} + 7y^3 = \tan(x - y) + 1$, find $\frac{dy}{dx}$ by implicit differentiation.

(b) (10 pts) Find the tangent line of equation given above at the point $(0, 0)$.