# Mathematic 108, Fall 2015: Assignment #5

## Due: **In your assigned section, either Tues., Oct. 13th or Thurs., Oct. 15th**

*Instructions:* Please ensure your name, your TA's name and your section number appear on the first page. Also that your answers are legible and all pages are stapled. Page numbers refer to the course text.

**Problem #1.** Find $\frac{dy}{dx}$ by implicit differentiation

a) $xe^{-y} = x^2 - y$.
b) $x\cos(y) + y = -1$.

**Problem #2.** Determine the equation of the tangent line to the curve given $\cos(y) + \sin(y) = x$ at $(-1, 3\pi)$.

**Problem #3.** Compute $y'' = \frac{d^2y}{dx^2}$ by implicit differentiation when $x^2 - y^2 = 1$.

**Problem #4.** Suppose $f(x)$ satisfies $f(f(x)) = \frac{1}{2}\left(f(x)^2 + x^4\right)$ and $f(1) = 1$. What are the possible values of $f'(1)$?

**Problem #5.** Suppose $x > 0$ and $x^y = y$.

a) Compute $\frac{dy}{dx}$.
b) Determine the tangent at $(1, 1)$.

**Problem #6.** Differentiate the following functions

a) $f(x) = \sqrt{1 + (\ln(x))^2}$.
b) $f(x) = \cos(\ln|x|)$.
c) $f(x) = (\sqrt{x})^{x-1}$.

**Problem #7.** Compute the following limits by interpreting them as derivatives

a) $\lim_{x \to -\pi} \frac{-\ln(-\cos(x))}{x+\pi}$.
b) $\lim_{x \to e} \frac{\ln(\ln(x))}{x-e}$.

**Problem #8.** An ant is crawling along a hyperbola $x^2 - y^2 = 3$. As it reaches the point $(2, -1)$ its $x$ coordinate increases at a rate of 5. Determine the rate of change of the $y$ coordinate when this occurs.

**Problem #9.** Linearize the given function at the given value and use it approximate the given number.

a) Linearize $f(x) = x^4$ at $a = 2$. Approximate $f(2.02)$.
b) Linearize $f(x) = \sqrt{x}$ at $a = 36$. Approximate $f(36.1)$.

**Problem #10.** Let $f$ and $g$ and $h$ be functions with $h = f \circ g$. If $L_f(x)$ is the linearization of $f$ at $g(a)$, $L_g(x)$ is the linearization of $g$ at $a$ and $L_h$ is the linearization of $h$ at $a$, then show that $L_h = L_f \circ L_g$

## Book Problems.

a) Section 3.5: #56
b) Section 3.6: #28, #34
c) Section 3.9: #18, #20, #22, #28
d) Section 3.10: #4, #14, #30