Math 106 Midterm Exam #3 April 19, 2017

• This is a closed-book examination. No books, notes, calculators, cell phones, communication devices of any sort, webpages, or other aids are permitted.

• Simplify numerical answers such as $\sin\left(\frac{\pi}{6}\right)$, $\ln(e^3)$, $e^{2\ln 3}$ and $4^{\frac{3}{2}}$.

• Please *show* all of your work and *justify* all of your answers. (You may use the backs of pages for additional work space.)

1. [30 Points] Compute each of the following derivatives.

(a) y' where $y = \ln\left(\dfrac{(\sin^2 x)\ \sqrt{1+\sec\sqrt{x}}}{(5-x^7)^{\frac{3}{7}}\ e^{-\cos x}}\right)$ Do not simplify your final answer here.

(b) $\dfrac{d}{dx}\ (\tan x)^{\sqrt{x}}$

(c) $\dfrac{dy}{dx}$ where $y = \dfrac{1}{\sqrt{e^{7+\cos x}}} + \dfrac{1}{e^{\sqrt{5x+2}}} + \sqrt{\ln(\tan x)} + \dfrac{1}{\ln\sqrt{1+\sec^2 x}}$

2. [10 Points] Find the equation of the tangent line to the curve

$$y = \ln(1+\cos x) + \cos(\ln(1+x)) - e^{\sin x} + \frac{e}{1+\ln(x+1)} + \ [e^{x+1}\cdot\cos(e^x-1)]\ - \ln 2$$

at the point where $x = 0$.

3. [54 Points] Evaluate each of the following integrals. Simplify.

(a) $\displaystyle\int_0^{\ln 2} \left(e^x + \frac{1}{e^x}\right)\left(1 + \frac{1}{e^{2x}}\right)\, dx$

(b) $\displaystyle\int_1^{\sqrt{3}} \frac{w}{4 - w^2}\, dw$

(c) $\displaystyle\int_1^{e^3} \frac{\sqrt{4 - \ln x}}{x}\, dx$

(d) $\displaystyle\int_{-e}^{-1} \frac{1 - x^2}{x}\, dx$

(e) $\displaystyle\int \frac{\left(x^{\frac{3}{4}} - 1\right)\left(x^3 - x^{\frac{5}{4}}\right)}{x^3}\, dx$

(f) $\displaystyle\int_1^4 \frac{1}{\sqrt{x}\; e^{1+\sqrt{x}}}\, dx$

(g) $\displaystyle\int_0^{\frac{\pi}{9}} \tan(3x)\, dx$

4. [6 Points] Find the function $f(x)$ that satsifies $f'(x) = \dfrac{e^x}{3e^x - e^5}\, dx$ and $f(5) = 2$.