Math 106 **Practice Exam #3** **Spring 2014** Compact Version

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

Derivatives Compute each of the following derivatives.

1. Show that $f''(x) = -\left(\dfrac{x^2+3x+\ln x+1}{x^2(x+\ln x)^2}\right)$, where $f(x) = \ln(x+\ln x)$.

2. $g'(x)$, where $g(x) = e^x + \dfrac{1}{e^x} + x^e + \dfrac{1}{x^e} + \dfrac{x}{e} + \dfrac{e}{x} + ex + \dfrac{1}{ex} + e^{e^x+x} + e^{x-e} + (x-e)^e$. Do not simplify.

3. $\dfrac{dy}{dx}$, if $ye^{x+y} + \sec^2 x = \ln(3x) + \sec y$.

4. y' where $y = x^{\sin x}$.

5. $\dfrac{d}{dx}\ \ln\left(\dfrac{e^{-\sin x}\sqrt{1+\sec\sqrt{x}}}{(5-x^7)^{-\frac{2}{3}}}\right)$

6. $f'(x)$ where $f(x) = \dfrac{e^{-x}\sin(e^x)}{e^x\cos(e^{-x})}$. Do not simplify.

7. $g'(x)$, where $g(x) = \sqrt{x}\ln x + \ln\sqrt{x} + \sqrt{x\ln x} + \dfrac{1}{x\sqrt{\ln x}}$. Do not simplify.

Integration Compute each of the following integrals:

8. $\displaystyle\int \frac{(x^{\frac{1}{3}}+1)(1-x^{\frac{2}{3}})}{x^2}\,dx$

9. $\displaystyle\int_{e^4}^{e^9} \frac{\sqrt{\ln x}}{3x}\,dx$

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

11. $\displaystyle\int e^x + \frac{1}{e^x} + x^e + \frac{1}{x^e} + \frac{x}{e} + \frac{e}{x} + ex + \frac{1}{ex} + e^{e^x+x} + e^{x-e} + (x-e)^e\,dx$ look familiar?

12. $\displaystyle\int_{\frac{\pi}{18}}^{\frac{\pi}{9}} \tan(3x)\,dx$

13. $\displaystyle\int \frac{1}{e^{3x}(1+e^{-3x})^{\frac{2}{9}}}\,dx$

14. $\displaystyle\int \frac{e^x}{(1+e^x)^2}\,dx$

15. $\displaystyle\int \frac{(1+e^x)^2}{e^x}\,dx$

16. $\displaystyle\int_0^1 \frac{x}{1+x^2}\,dx$

17. $\displaystyle\int e^{x^2+\ln x+1}\,dx$

Tangent Lines

18. Find the equation of the tangent line to the curve
$f(x) = \dfrac{e^{3x}}{1+e^x}$ at the point where $x = \ln 2$.

Curve Sketching

19. Let $\boldsymbol{f(x) = e^{-\frac{x^2}{2}}}$.
For this function, discuss domain, vertical and horizontal asymptote(s), interval(s) of increase or decrease, local extreme value(s), concavity, and inflection point(s). Then use this information to present a detailed and labelled sketch of the curve.