Math 111 Final Review Packet for Remaining Material since Exam #3

Integration Compute each of the following integrals:

1. $\int x(x^2+1)^{14}\,dx$
2. $\int \sin(4x)\cos(4x)\,dx$
3. $\int \dfrac{e^x - e^{-x}}{e^x + e^{-x}}\,dx$
4. $\int \dfrac{1}{x}\sqrt{1+\ln x}\,dx$
5. $\int \dfrac{1}{(x+1)\ln(x+1)}\,dx$
6. $\int \dfrac{\sin x}{7+\cos x}\,dx$
7. $\int \dfrac{6e^x}{e^x+7}\,dx$
8. $\int \dfrac{e^{\ln(\sin x)}}{e^{\ln(\cos x+7)}}\,dx$
9. $\int \ln(e^{x^2}e^x e^7)\,dx$
10. $\int \dfrac{6x+3}{x^2+x-5}\,dx$
11. $\int \dfrac{1}{1-2x}\,dx$
12. $\int e^{3x+1}\,dx$
13. $\int \dfrac{e^{-\frac{1}{x^7}}}{x^8}\,dx$
14. $\int \dfrac{1}{e^x}\,dx$
15. $\int_0^1 \dfrac{1}{7x+1}\,dx$
16. $\int_e^{e^2} \dfrac{1}{x(\ln x)^2}\,dx$
17. $\int_{\ln 4}^{\ln 7} 9e^{2x}\,dx$

18. $\displaystyle\int_0^{\ln 3} \left(2 + \frac{1}{e^x}\right)^2 \, dx$

19. $\displaystyle\int \frac{we^{w^2}}{17 + e^{w^2}} \, dw$

20. $\displaystyle\int_{\ln 2}^{\ln 3} e^{2x} \, dx$

21. $\displaystyle\int \frac{e^{-x}\ln(1 + e^{-x})}{1 + e^{-x}} \, dx$

22. $\displaystyle\int_e^{e^4} \frac{1}{x\sqrt{\ln x}} \, dx$

23. $\displaystyle\int (e^{3x} + e^{-7x})^2 \, dx$

24. $\displaystyle\int \frac{1}{2x - 1} \, dx$

Derivatives/Tangent Lines

25. Find the equation of the tangent line to the curve $y = (x + 2)e^{-x}$ at the point $(0, 2)$.

26. Find the equation of the tangent line to the curve $y = \ln(xe^{-3x})$ at the point $(1, -3)$.

27. Let $y = \dfrac{\ln x}{1 + x^2}$, find $f'(1)$.

28. Let $f(x) = x \ln x$ with $x > 0$. Where is $f(x)$ concave up?

29. Let $x^2 e^y = \ln(xy)$. Find $\dfrac{dy}{dx}$.

30. Find all local maximum and minimum value(s) of the function $f(x) = (x^2 - 7)e^{-x}$.

31. Compute the derivatives of the following functions. (Hint: You may want to simplify first.)

    (a) $f(x) = \ln(5xe^{-5x})$

    (b) $f(x) = e^{\left(\ln(x^2 + x) - \ln x\right)}$

    (c) $f(x) = \ln\left(\dfrac{xe^x}{\sqrt{e^{7x}}}\right)$

32. Let $f(x) = x^{\cos x}$. Compute $f'(x)$.

33. Let $f(x) = (\tan x)^x$. Compute $f'(x)$.

34. Let $f(x) = x^4 e^{-x}$. 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.

    Take my word that $\lim\limits_{x\to\infty} f(x) = 0$ and $\lim\limits_{x\to-\infty} f(x) = +\infty$

Areas between Curves and Volumes of Revolution

35. Consider the region in the plane bounded by the curves $y = e^{x+1}$, $y = e^{2x}$, and the y-axis.
    (a). Find the area of this region.
    (b). Rotate this region about the x-axis. What is the volume of the resulting solid?

36. Consider the region enclosed by $y = e^{-x}$, $y = e^{x}$, and $x = 2$ and rotate it about the x–axis. What is the volume of the resulting solid?

37. Consider the region enclosed by $y = \dfrac{1}{x}$, $y = 0$, $x = 1$ and $x = 3$ and rotate it about the x–axis. What is the volume of the resulting solid?

38. Find the area enclosed by $y = e^{x}, y = e^{3x}$ and $x = 1$.

Properties of e^x and $\ln x$

39. Simplify each of the following
    (a) $\ln(e^{\ln e})$
    (b) $\ln\left|\ln\dfrac{1}{e}\right|$

40. Solve each of the the following equations for x:
    (a) $\ln(\ln x) = 1$
    (b) $\ln(x^2) = 2 + \ln x$
    (c) $e^{3x-4} = 7$

41. Decide whether each statement is True or False. Explain why or why not.
    (a) $(e^x)^2 = e^{x^2}$
    (b) $\ln 5 - \ln 3 = \ln 2$
    (c) $(\ln x)(\ln x) = \ln(x^2)$