$\int \tan x\,dx$ $\int \sec x\,dx$ $\int \frac{1}{x}dx = \ln|x|$

$\int \cot x\,dx$ $\int \csc x\,dx$ $y = 5^{3x^2}$

MATH 1432, SECTION 12869

SPRING 2014

HOMEWORK ASSIGNMENT 2

DUE DATE: 1/27/14 IN LAB

Name: Sol.

D: ______________________

INSTRUCTIONS

- Print out this file and complete the problems. You must do all the problems!
- If the problem is from the text, the section number and problem number are in parantheses.
- Use a blue or black pen or a pencil (dark).
- Write your solutions in the spaces provided. You must show work in order receive credit for a problem.
- Remember that your homework must be complete, neatly written and stapled.
- Submit the completed assignment to your Teaching Assistant in lab on the due date.
- If you do not do all of the problems, then your recitation quiz from the previous Friday will automatically become a ZERO.

1. (Section 7.3, Problem 3)

$\ln(x^3+1)$

Domain $x^3+1>0 \Rightarrow (x+1)(x^2-x+1)>0$ $\boxed{\Rightarrow x>-1}$

$[\ln(x^3+1)]' = \frac{3x^2}{x^3+1}$.

2. (Section 7.3, Problem 8)

$\ln(\ln x)$

Domain $\ln x > 0 \Rightarrow x > 1$.

$[\ln(\ln x)]' = \frac{(\ln x)'}{\ln x} = \frac{1}{\ln x}\cdot\frac{1}{x}$

3. (Section 7.3, Problem 9)

$f(x) = (2x+1)^2 \ln(2x+1)$

$2x+1>0 \Rightarrow x > -\frac{1}{2}$

$f'(x) = 2(2x+1)\cdot 2\ln(2x+1)$

$+ (2x+1)^2\cdot\frac{2}{2x+1}$

4. (Section 7.3, Problem 14)

$f(x) = \cos(\ln x)$.

$\ln x \in \mathbb{R} \Rightarrow x > 0$.

$f'(x) = -\sin(\ln x)\cdot\frac{1}{x}$

5. (Section 7.3, Problem 16)

let $u=3-x$ $\quad du=-dx$

$-\int \frac{du}{u} = -\ln|u|+c$

$= -\ln|3-x|+c$

6. (Section 7.3, Problem 17)

$\int \frac{x}{3-x^2}dx$ let $u=3-x^2$ $\quad du=-2x\,dx$

$\Rightarrow \frac{du}{-2}=x\,dx$

$=$

$-\frac{1}{2}\int \frac{du}{u} = -\frac{1}{2}\ln|u|+c$

$= -\frac{1}{2}\ln|3-x^2|+c$

7. (Section 7.3, Problem 19)

$\int \tan 3x\,dx$ let $u=3x$. $\quad du=3dx$

$\Rightarrow \frac{du}{3}=dx$

$=$

$\frac{1}{3}\int \tan u\,du = \frac{-1}{3}\ln|\cos u|+C$

$= +\frac{1}{3}\ln|\sec u|+c$

8. (Section 7.3, Problem 25)

$\int \frac{\sin x}{2+\cos x}dx$ let $u=2+\cos x$ $\quad du=-\sin x\,dx$

$\Rightarrow -du=\sin x\,dx$

$=$

$-\int \frac{du}{u} = -\ln|u|+c$

$= -\ln|2+\cos x|+c$

9. (Section 7.3, Problem 26)

$\int \frac{\sec^2 2x}{4-\tan 2x}dx$ let $u=4-\tan 2x$

$du=-2\sec^2 2x\,dx$

$\frac{du}{-2}=\sec^2 2x\,dx$

$=$

$-\frac{1}{2}\int \frac{du}{u} = -\frac{1}{2}\ln|u|+c$

$= -\frac{1}{2}\ln|4-\tan 2x|+c$

10. (Section 7.3, Problem 29)

$\int \frac{dx}{x(\ln x)^2}$ let $u=\ln x$ $\quad du=\frac{dx}{x}$

$=$

$\int \frac{du}{u^2} = -\frac{1}{u}+c$

$= -\frac{1}{\ln x}+c$

1. (Section 7.3, Problem 31)

$$\int \frac{\sin x - \cos x}{\sin x + \cos x}\,dx \quad \text{let } u = \sin x + \cos x$$

$$du = \cos x - \sin x\,dx$$

$$-du = (\sin x - \cos x)dx$$

$$= -\int \frac{du}{u} = -\ln|u| + c$$

$$= -\ln|\sin x + \cos x| + c$$

2. (Section 7.3, Problem 32)

$$\int \frac{dx}{\sqrt{x}(1+\sqrt{x})} \quad \text{let } u = 1+\sqrt{x}, \quad du = \frac{1}{2}\frac{1}{\sqrt{x}}dx$$

$$2du = \frac{1}{\sqrt{x}}dx$$

$$= 2\int \frac{du}{u} = 2\ln|1+\sqrt{x}| + C$$

3. (Section 7.3, Problem 34)

$$\int \frac{\tan(\ln x)}{x}dx \quad \text{let } u = \ln x \quad du = \frac{dx}{x}$$

$$= \int \tan u\,du = \ln|\sec u| + C$$

$$= \ln|\sec(\ln x)| + C$$

14. (Section 7.3, Problem 38)

$$\int_1^{e^2} \frac{dx}{x} = \ln|x|\Big|_1^{e^2} = \ln|e^2| - \ln 1$$

$$= 2\ln e - 0$$

$$= 2$$

15. (Section 7.3, Problem 41)

$$\int_4^5 \frac{x}{x^2-1}dx = \frac{1}{2}\ln|x^2-1|\Big|_4^5$$

$$= \frac{1}{2}[\ln 24 - \ln 15]$$

$$= \frac{1}{2}[\cancel{\ln 3} + \ln 8 - \cancel{\ln 3} - \ln 5] = \frac{1}{2}[\ln 8 - \ln 5]$$

16. (Section 7.3, Problem 43)

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cos x}{1+\sin x}dx = \ln|1+\sin x|\Big|_{\frac{\pi}{6}}^{\frac{\pi}{2}}$$

$$= \ln|2| - \ln|\frac{3}{2}|$$

antiderivative of $\frac{1}{(x-2)}$

17. (Section 7.3, Problem 47)

$$\int_1^4 \frac{dx}{x-2} = \ln|x-2|$$

$\boxed{\text{ch5 } 5.42}$ The Fundamental Thm of Calculus

Assumpsion: Let f be continuous on [a,b]

$\rightarrow$ f is not continuous at $x=2$

18. (Section 7.3, Problem 51)

$$g(x) = \frac{x^4(x-1)}{(x+2)(x^2+1)}$$ log. differentiation

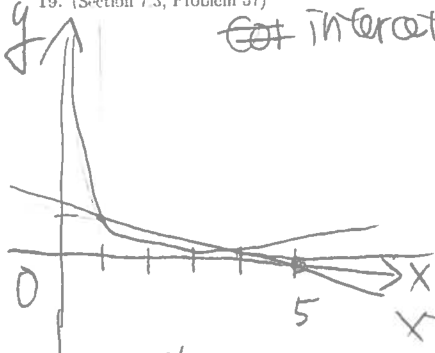
$$\ln g(x) = \ln x^4 + \ln(x-1) - \ln(x+2) - \ln(x^2+1)$$

diff

$$\frac{g'(x)}{g(x)} = \frac{4x^3}{x^4} + \frac{1}{x-1} - \frac{1}{x+2} - \frac{2x}{x^2+1}$$

$$g'(x) = \frac{x^4(x-1)}{(x+2)(x^2+1)}\left[\frac{4}{x} + \frac{1}{x-1} - \frac{1}{x+2} - \frac{2x}{x^2+1}\right].$$

19. (Section 7.3, Problem 57)



$x+4y-5=0$

~~cot~~ interaction pt. $x = 5-4y$

$\Rightarrow (5-4y)y = 1$

$\Rightarrow 4y^2-5y+1=0$

$\Rightarrow (4y-1)(4y-1)=0$

$y = 1$ or $\frac{1}{4}$

$x = 1$ or 4

$$\int_1^4 \frac{5-x}{4} - \frac{1}{x}\, dx$$

$$= \frac{5}{4}x - \frac{x^2}{8} - \ln x \Big|_1^4 = \frac{15}{4} - \frac{15}{8} - \ln 4 \ldots$$

20. (Section 7.4, Problem 3)

$y = e^{x^2-1}$

$y' = 2x e^{x^2-1}$

21. (Section 7.4, Problem 5)

$y = e^x \ln x \rightarrow$ product rule

$y' = e^x \ln x + \frac{e^x}{x}$

22. (Section 7.4, Problem 7)

$y = x^{-1}e^{-x}$

$y' = -x^{-2}e^{-x} - x^{-1}e^{-x}.$

3. (Section 7.4, Problem 12)

$y = (3-2e^{-x})^3$

$y' = 3(3-2e^{-x})^2(2e^{-x})$

$= 6e^{-x}(3-2e^{-x})^2$

4. (Section 7.4, Problem 13)

$y = (e^{x^2}+1)^2$.

$y' = 2(e^{x^2}+1) \cdot 2xe^{x^2}$.

$= 4xe^{x^2}(e^{x^2}+1)$.

5. (Section 7.4, Problem 18)

$y = \frac{e^{2x}-1}{e^{2x}+1} \Rightarrow$ quotient rule

or log differential

$\ln y = \ln(e^{2x}-1) - \ln(e^{2x}+1)$

$\frac{y'}{y} = \frac{e^{2x}}{e^{2x}-1} - \frac{e^{2x}}{e^{2x}+1} \Rightarrow y' = \left(\frac{e^{2x}-1}{e^{2x}+1}\right)\left(\frac{e^{2x}}{e^{2x}-1} - \frac{e^{2x}}{e^{2x}+1}\right)$

26. (Section 7.4, Problem 21)

$f(x) = \sin(e^{2x})$

$f'(x) = [\cos(e^{2x})] \cdot 2e^{2x}$.

27. (Section 7.4, Problem 24)

$f(x) = \ln(\cos e^{2x})$

$f'(x) = \frac{2e^{2x}[-\sin e^{2x}]}{\cos e^{2x}}$

28. (Section 7.4, Problem 26)

$\int e^{-2x}dx = \frac{e^{-2x}}{-2} + C$

$u = x^2$

29. (Section 7.4, Problem 29)

$\int x e^{x^2} dx = \frac{e^{x^2}}{2} + c$

30. (Section 7.4, Problem 31)

$\int \frac{e^{\frac{1}{x}}}{x^2} dx = -e^{\frac{1}{x}} + c$

31. (Section 7.4, Problem 33)

$\int e^{\ln x} dx = \int x dx = \frac{x^2}{2} + c$

32. (Section 7.4, Problem 34)

$\int e^{\ln x} dx = \int x dx = \frac{x^2}{2} + c$

33. (Section 7.4, Problem 37)

$\int \frac{e^x}{\sqrt{e^x + 1}} dx = 2\sqrt{e^x + 1} + c$

34. (Section 7.4, Problem 40)

$\int \frac{\sin(e^{-2x})}{e^{2x}} dx = \frac{+1}{2} \cos(e^{-2x}) + c$

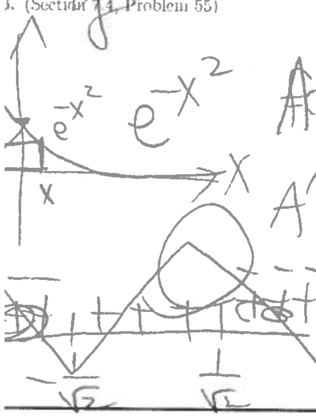
5. (Section 7.4, Problem 49)

$$\int_0^{\ln 2} \frac{e^x}{e^x+1}\,dx = \ln|\cancel{e^x}+1|\,\Big|_0^{\ln 2}$$

$$= \ln|3| - \ln|1|$$

$$= \ln 3.$$

6. (Section 7.4, Problem 55)



$$e^{-x^2}$$

$$A(x) = 2x \cdot e^{-x^2}$$

$$A' = 2e^{-x^2} - 4x^2 e^{-x^2}.$$

$$= (2-4x^2)\underbrace{e^{-x^2}}_{>0} = 0$$

$$2(1-2x^2) = 0$$

$$2(1+\sqrt{2}x)(1-\sqrt{2}x) = 0$$

$$x = \frac{1}{\sqrt{2}}.$$

$$\max A\left(\tfrac{1}{\sqrt{2}}\right) = \frac{2}{\sqrt{2}}e^{-\frac{1}{2}}.$$

7. (Section 7.5, Problem 19)

log diff.

$$f(x) = 3^{2x}$$

$$\ln f(x) = 2x \ln 3.$$

$$\frac{f'(x)}{f(x)} = 2\ln 3 \Rightarrow f'(x) = 2 \cdot 3^{2x} \ln 3.$$

38. (Section 7.5, Problem 21)

$$f(x) = 2^{5x} \cdot 3^{\ln x}$$

$$\ln f(x) = 5x \ln 2 + \ln x \ln 3$$

$$\frac{f'(x)}{f(x)} = 5\ln 2 + \frac{\ln 3}{x}$$

$$f'(x) = 2^{5x} 3^{\ln x}\left(5\ln 2 + \frac{\ln 3}{x}\right)$$

39. (Section 7.5, Problem 22)

$$F(x) = 5^{-2x^2+x}$$

$$\ln F(x) = (-2x^2+x)\ln 5$$

$$\frac{F'(x)}{F(x)} = (-4x+1)\ln 5$$

$$F'(x) = (-4x+1)\ln 5 \cdot 5^{-2x^2+x}.$$

40. (Section 7.5, Problem 26)

$$g(x) = \frac{\log_{10} x}{x^2} = \frac{\ln x}{\ln 10} \cdot \frac{1}{x^2}$$

$$g'(x) = \frac{1}{\ln 10}\left[\frac{1}{x^3} + \ln x \cdot \frac{-2}{x^3}\right]$$

$$(2^{-x})' = -\ln 2 \cdot 2^{-x}$$

41. (Section 7.5, Problem 30)

$$\int 2^{-x}\,dx = \frac{-2^{-x}}{\ln 2} + C$$

42. (Section 7.5, Problem 32)

let $u = -x^2$ $\quad du = -2x\,dx \Rightarrow \frac{du}{-2} = x\,dx$

$$\int x\, 10^{-x^2} dx = -\frac{1}{2}\int 10^u du = -\frac{1}{2}\cdot\frac{10^u}{\ln 10} + C$$

$$= -\frac{1}{2}\,\frac{10^{-x^2}}{\ln 10} + C$$

43. (Section 7.5, Problem 34)

$$\int \frac{\log_5 x}{x}\,dx = \frac{1}{\ln 5}\int \frac{\ln x}{x}\,dx = \frac{1}{\ln 5}\frac{(\ln x)^2}{2} + C$$

44. (Section 7.5, Problem 43)

$f(x) = (x+1)^x$

$\ln f(x) = x\ln(x+1)$

$\frac{f'(x)}{f(x)} = \ln(x+1) + \frac{x}{x+1}$

$f'(x) = (x+1)^x\left[\ln(x+1) + \frac{x}{x+1}\right]$

45. (Section 7.5, Problem 48)

$f(x) = (\cos x)^{(x^2+1)}$

$\ln f(x) = (x^2+1)\ln\cos x$

$\frac{f'(x)}{f(x)} = 2x\ln\cos x + (x^2+1)\frac{-\sin x}{\cos x}$

$f'(x) = (\cos x)^{(x^2+1)}\left(2x\ln\cos x - (x^2+1)\frac{\sin x}{\cos x}\right)$

46. (Section 7.5, Problem 49)

$f(x) = (\sin x)^{\cos x}$

$\ln f(x) = \cos x\,\ln(\sin x)$

$\frac{f'(x)}{f(x)} = -\sin x\cdot\ln(\sin x) + \cos x\frac{\cos x}{\sin x}$

$f'(x) = (\sin x)^{\cos x}\left[-\sin x\ln(\sin x) + \frac{\cos^2 x}{\sin x}\right]$