Worksheet #4

I. u-substitutions

1. $\int 3x^2 \sin 4x^3 \, dx$
2. $\int \frac{4x+6}{3x^2+9x} \, dx$
3. $\int 5x^8 (14x^9 - 1)^6 \, dx$
4. $\int \frac{6+3x}{\sqrt[3]{12x+3x^2}} \, dx$
5. $\int_0^1 x^2 e^{4x^3+1} \, dx$
6. $\int_{\pi/4}^{\pi/2} \frac{\cos\sqrt{x}}{2\sqrt{x}} \, dx$
7. $\int_0^2 \frac{1}{2x+4} \, dx$
8. $\int_{\sqrt{\pi/6}}^{\sqrt{\pi/3}} 2x \sec 4x^2 \tan 4x^2 \, dx$

II. Various Integrals

9. $\int x(x^3+1)^2 \, dx$
10. $\int \frac{5x - 5x^2}{3x^3} \, dx$
11. $\int \frac{2x^3 - 4x^2 + 8x - 1}{2x+1} \, dx$
12. $\int \frac{3x+4\sqrt{x}}{9x^2 + 16\sqrt{x^3}} \, dx$
13. $\int \frac{5x^2+1}{x+1} \, dx$
14. $\int \frac{1}{x \ln x} \, dx$
15. $\int x^2(x^3+1)^5 \, dx$
16. $\int 14e^x \sec^2(e^x) \, dx$

III. Integration by Parts

17. $\int 4x \cos 5x \, dx$
18. $\int \arcsin x \, dx$
19. $\int (\ln x)^2 \, dx$
20. $\int x^2 \sin 4x \, dx$
21. $\int_1^e x \ln x \, dx$
22. $\int_0^{\pi} e^{2x} \cos 4x \, dx$
23. $\int_0^{\pi} \sin 2x \cos 3x \, dx$
24. OMIT

IV. Trig Integrals

25. $\int \sin^3 x \cos^2 x \, dx$

26. $\int 5 \sec^3 x \tan^3 x \, dx$

27. $\int \frac{\sin^3 2x}{\cos 2x} \, dx$

28. $\int \sin^2 3x \cos^2 3x \, dx$

29. $\int_0^{\pi} (4 \sin x + \sin^3 x) \cos^2 x \, dx$

30. $\int_{\pi/6}^{\pi/3} \tan^3 x \sec^4 x \, dx$

31. $\int_0^1 \sin^4 \pi x \, dx$

32. $\int_{\pi/4}^{\pi/3} \frac{\tan^3 x}{\sec x} \, dx$

V. Trig Substitutions

33. $\int \frac{x^2}{\sqrt{1-4x^2}} \, dx$

34. $\int \frac{3}{\sqrt{9+16x^2}} \, dx$

35. $\int \frac{\sqrt{9x^2-25}}{x} \, dx$

36. $\int \frac{8}{(36x^2+1)^{3/2}}$

37. $\int \frac{1}{x^2\sqrt{4-x^2}} \, dx$

38. $\int \frac{6}{(100x^2-64)} \, dx$

VI Miscellaneous

39. Consider $\int \frac{2x}{\sqrt{9x^2-1}} \, dx$.

a) What technique should you use? Evaluate the integral.

b) Do the integral with a trig substitution. Do your answers match?

40. Suppose we try to evaluate $\int e^{x^2} \, dx$ as follows:

Let $u = x^2$

$du = 2x \, dx$.

$dx = \frac{du}{2x}$.

So: $\int e^{x^2} \, dx = \int e^u \cdot \frac{du}{2x} = \frac{1}{2x} \int e^u \, du = \frac{1}{2x} e^u + C$

$= \frac{1}{2x} e^{x^2} + C$.

a) Is this correct? If not, how can we tell by the final answer?

b) Which step is erroneous?