Mathematics 114Q
Integration Practice Problems

Name: _____

This is a collection of problems of the type in Chapter 7, sections 1, 2, 4, and 7. You will need to be able to solve integration problems using substitution, integration by parts, the method of partial fractions, and trigonometric substitution.

1. $\int (2x+5)(x^2+5x)^7 dx$

2. $\int (3-x)^{10} dx$

3. $\int \sqrt{7x+9} dx$

4. $\int \frac{x^3}{(1+x^4)^{1/3}} dx$

5. $\int e^{5x+2} dx$

6. $\int 4\cos(3x) dx$

7. $\int \frac{\sin(\ln x)}{x} dx$

8. $\int \frac{x+2}{x^2+4x-3} dx$

9. $\int \left(3^{x^2+1}\right)\left(x\right)\, dx$

10. $\int \frac{1}{x \ln x} dx$

11. $\int \frac{\cos(5x)}{e^{\sin(5x)}} dx$

12. $\int_0^{\sqrt{\pi}} x \sin(x^2) dx$

13. $\int x\sqrt{4-x} dx$

    [Hint: If $u = 4 - x$, what does that make x in terms of u?]

14. $\int xe^x dx$

15. $\int x \sin x dx$

16. $\int x \ln x dx$

17. $\int \ln x dx$

18. $\int \frac{\ln x}{x^5} dx$

19. $\int x^2 e^{3x} dx$

20. $\int x^3 \ln(5x) dx$

21. $\int x\sqrt{x+3} dx$

22. $\int \sin^2(x) dx$

[Hint: write $\sin^2(x)$ as $\sin(x)\sin(x)$ and use the Pythagorean Theorem.]

23. $\int x \sin(x) \cos(x) dx$

[Hint: let $u = x$. You will need to use the result of the previous problem.]

24. $\int x \cos(x) dx$

25. $\int x^2 \cos(x) dx$

26. $\int e^x \cos(x) dx$

[Hint: Do integration by parts twice. Look carefully at both sides of the resulting equation.]

27. $\int \frac{1}{x^2-4}dx$

28. $\int \frac{x}{x^2-4}dx$

29. $\int \frac{1}{x(x+1)}dx$

30. $\int \frac{1}{x^2(x+1)}dx$

31. $\int \frac{x-1}{x^2-16}dx$

32. $\frac{x+7}{x^2(x+2)}dx$

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

34. $\int \frac{1}{e^x+1}dx$

[Hint: This one is tricky. Multiply by $\frac{e^x}{e^x}$ and then use substitution.]

35. $\int \frac{1}{1+x^2}\,dx$

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

37. $\int \frac{1}{x^2+4x+5}\,dx$

38. $\int \frac{x^2}{1+x^2}\,dx$

[Hint: This one is tricky. You might have to add and subtract 1 from the numerator.]

39. $\int_0^1 \frac{1}{x^2}\,dx$

40. $\int_1^\infty \frac{1}{x^2}\,dx$

41. $\int_e^\infty \frac{\ln x}{x}\,dx$

42. $\int_e^\infty \frac{1}{x(\ln x)^2}\,dx$

43. $\displaystyle\int_0^\infty xe^{-x}\,dx$

44. $\displaystyle\int_0^\infty xe^{-x^2}\,dx$

45. $\displaystyle\int_1^\infty \frac{\arctan x}{x^2+1}\,dx$

[Hint: What is the derivative of $\arctan(x)$?]

46. $\displaystyle\int_0^\infty f(x)\,dx$, where $f(x) = \begin{cases} \frac{1}{\sqrt{x}} & \text{if } x \le 1 \\ \frac{1}{x^2} & \text{if } x \ge 1 \end{cases}$