Exam 2 Review (Problems)

1. Evaluate
$$\int \frac{4x+1}{x^2+9}dx$$

2. Evaluate
$$\int \frac{4x^2}{x^2+9}dx$$

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

4. Evaluate
$$\int \tan^2 2x\ dx$$

5. Evaluate
$$\int \frac{1}{\sqrt{1-4x-x^2}}dx$$

6. Solve the differential equation
$$xy\frac{dy}{dx} = 1 - \ln x; quady(1) = 2$$

7. :: Section 8.2 Evaluate
$$\int xe^{3x}dx$$

8. Evaluate
$$\int \frac{\ln x}{x^2}dx$$

9. Evaluate
$$\int \arcsin x\ dx$$

10. Evaluate
$$\int x\sin x\ dx$$

11. Evaluate
$$\int x\sin x^2\ dx$$

12. Evaluate
$$\int x^2\sin 2x\ dx$$

13. Evaluate
$$\int x^3\cos 2x\ dx$$

14. Evaluate
$$\int e^{2x}\cos x\ dx$$

15. Evaluate
$$\int_0^{\pi/4} x\sin 2x\ dx$$

16. Evaluate
$$\int \frac{x+1}{\sqrt{3x^2+6x}}dx$$

17. Evaluate
$$\int \frac{1}{\cos\theta - 1}d\theta$$

18. Evaluate
$$\int \frac{x^3e^{x^2}}{(x^2+1)^2}dx$$

19. Evaluate
$$\int x^2\ln 3x\ dx$$

20. Evaluate
$$\int x^4\sin 2x\ dx$$

21. Evaluate

$$\int \sin^3 x \cos^4 x \; dx$$

22. Evaluate

$$\int \cos^2\left(\frac{x}{c}\right) dx$$

23. Evaluate

$$\int \sin^4 \theta \; d\theta$$

24. Evaluate

$$\int \tan^3 4x \; dx$$

25. Evaluate Solve the differential equation

$$\frac{dy}{dx} = \tan^3 x \sec x; \quad y(\pi/3) = 0$$

26. Evaluate Find the area of the region bounded by the curves:

$$y = \sin^2(\pi \cdot x); \; y = 0; \; x = 0; \; x = 1$$

27. Evaluate Find the volume of the solid formed when the region bounded by the curves

$$y = \cos\frac{x}{2}; y = \sin\frac{x}{2}; x = 0; x = \frac{\pi}{2}$$

is revolved about the x-axis.

28. Evaluate

$$\int \sin 2x \cos 3x \; dx$$

by using one of the following identities:

$$\sin(mx)\sin(nx) = \frac{1}{2}(\cos[(m-n)x] - \cos[(m+n)x])$$
$$\sin(mx)\cos(nx) = \frac{1}{2}(\sin[(m-n)x] + \sin[(m+n)x])$$
$$\cos(mx)\cos(nx) = \frac{1}{2}(\cos[(m-n)x] + \cos[(m+n)x])$$

29. Evaluate

$$\int_0^{\pi/6} \ln(2\sec x) dx$$

30. Evaluate

$$\int \sin(10x)\cos(3x) dx$$

by using one of the following identities:

$$\sin(mx)\sin(nx) = \frac{1}{2}(\cos[(m-n)x] - \cos[(m+n)x])$$
$$\sin(mx)\cos(nx) = \frac{1}{2}(\sin[(m-n)x] + \sin[(m+n)x])$$
$$\cos(mx)\cos(nx) = \frac{1}{2}(\cos[(m-n)x] + \cos[(m+n)x])$$

31. Evaluate

$$\int \sin(6x)\sin(4x) dx$$

by using one of the following identities:

$$\sin(mx)\sin(nx) = \frac{1}{2}(\cos[(m-n)x] - \cos[(m+n)x])$$
$$\sin(mx)\cos(nx) = \frac{1}{2}(\sin[(m-n)x] + \sin[(m+n)x])$$
$$\cos(mx)\cos(nx) = \frac{1}{2}(\cos[(m-n)x] + \cos[(m+n)x])$$

32. Evaluate

$$\int \sqrt{1-x^2} dx$$

33. Evaluate

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

34. Evaluate

$$\int \frac{1}{\sqrt{9x^2+4}} dx$$

35. Evaluate

$$\int_0^1 \frac{1}{(x^2+1)^{3/2}} dx$$

36. Evaluate

$$\int_0^1 \frac{x}{(x^2+1)^{3/2}} dx$$

37. Evaluate

$$\int \frac{1}{4+9x^2}dx$$

38. Evaluate

$$\int \sqrt{25-4x^2}dx$$

39. Evaluate

$$\int_{13/2}^{13} \sqrt{169-x^2}dx$$

40. Evaluate

$$\int \frac{1}{(1+25x^2)^{3/2}}dx$$

41. Evaluate

$$\int \frac{3}{2x^2-7x-4}dx$$

42. Evaluate

$$\int \frac{x+4}{x^2+5x+6}dx$$

43. Evaluate

$$\int \frac{2x-1}{4x^2-9}dx$$

44. Evaluate

$$\int \frac{4x+7}{(x+1)^2}dx$$

45. Evaluate

$$\int \frac{2x+3}{x^3-2x^2+3x-6}dx$$

46. Evaluate

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

47. Evaluate $\int \frac{1}{x^2+2x-3}dx$ via:

    1. Trigonometric substitution
    2. Partial fraction decomposition

48. Evaluate

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

49. Evaluate

$$\int \sin^3 x \; dx$$

50. Evaluate

$$\int \sqrt{9-4x^2}dx$$

51. Evaluate

$$\int \frac{1}{x^2-9}dx$$

52. Evaluate

$$\int \frac{\sin x}{\cos x+\cos^2 x}dx$$

53. Evaluate

$$\int \sin^3 x \cos x \ln(\sin x)dx$$

using the reduction formula

$$\int x^n \ln u \; du = \frac{u^{n+1}}{(n+1)^2}(-1+(n+1)\ln u)+C, n \neq -1$$

54. Evaluate

$$\int x\sqrt{5-4x^4}dx$$

using the reduction formula

$$\int \sqrt{a^2-x^2}dx = \frac{1}{2}\left(x\sqrt{a^2-x^1}+a^2 \arcsin\frac{x}{a}\right)+C$$

55. Derive the reduction formula

$$\int u^n \cos u \; du = u^n \sin u - n\int u^{n-1}\sin u \; du$$

56. Evaluate

$$\int_1^\infty \frac{1}{e^x} dx$$

57. Evaluate

$$\int_1^2 \frac{1}{(x-1)^2} dx$$

58. Evaluate $\int_1^\infty \frac{1}{x^p} dx$ converges if _____, otherwise it diverges.

59. Evaluate $\int_0^1 \frac{1}{x^p} dx$ converges if _____, otherwise it diverges.

60. Evaluate

$$\int_0^\infty \frac{1}{1+x^2} dx$$

61. Evaluate

$$\int_1^4 \frac{1}{(x-2)^{2/3}} dx$$

62. Find the volume of the solid formed by revolving the region bounded by $y = e^{-2x}$ and the x-axis from $[0, \infty)$ about the x-axis.

63. Evaluate

$$\int \frac{-\csc\theta}{\csc\theta - \cot\theta} d\theta$$

64. Evaluate

$$\int e^{2x} x^2 \, dx$$

65. Evaluate

$$\int_2^4 8x \ln x \, dx$$

66. Use integration by parts to establish a reduction formula for the integral

$$\int x^n e^x dx$$

67. Evaluate

$$\int_0^{\pi/4} \sin^3 4x \, dx$$

68. Evaluate

$$\int \cos^2\theta \sin 2\theta \, d\theta$$

69. Use trig substitution to evaluate

$$\int \frac{1}{\sqrt{4x^2+1}} dx$$

70. Evaluate

$$\int \frac{8x^3 + 13x}{(x^2+2)^2} dx$$

71.

$$\int_1^\infty \frac{4}{(1+x^2)\arctan x} dx$$

72. Evaluate the integral

$$\int \cot^4 4x \, dx$$

using the reduction formula

$$\int \cot^m(u) du = -\frac{\cot^{m-1}(u)}{m-1} - \int \cot^{m-2}(u) du + C$$

73. Evaluate

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

74. Evaluate

$$\int \sin^3(2x) dx$$

75. Evaluate

$$\int \frac{\sqrt{x^2-9}}{x} dx$$

$$\frac{\sqrt{x^2-9}}{3} - \arctan\frac{x}{3} + C$$

76. Evaluate

$$\int \frac{3x-1}{x^2-5x+4}dx$$

77. Evaluate

$$\int_1^\infty \frac{1}{\sqrt{x+2}}dx$$

78. Evaluate

$$\int_2^5 \frac{1}{\sqrt{x-2}}dx$$

79. How would you approach the following?

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

80. How would you approach the following?

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

81. How would you approach the following?

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

82. Prove the reduction formula:

$$\int (\ln x)^n dx = x(\ln x)^n - n\int (\ln x)^{n-1}dx$$

83. Evaluate

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

Exam 2 Review (Answers)

63. *(Quiz 3)*

$$\cot\theta + \csc\theta + C$$

64. *(Quiz 3)*

$$\frac{1}{2}x^2e^{2x} - \frac{1}{2}xe^{2x} + \frac{1}{4}e^{2x} + C$$

65. *(Quiz 3)*

$$(64\ln 4 - 32) - (16\ln 2 - 8) \approx 53.6$$

66. *(Quiz 3)*

$$x^n e^x - n\int x^{n-1}e^x dx$$

67. *(Quiz 3)*

$$\frac{1}{3}$$

68. *(Quiz 3)*

$$-\frac{1}{2}\cos^4\theta + C$$

69. *(Quiz 4)*

$$\frac{1}{2}\ln\left|\sqrt{4x^2+1} + 2x\right| + C$$

70. *(Quiz 4)*

$$4\ln(x^2+2) + \frac{3}{2(x^2+2)} + C$$

71. *(Quiz 4)*

$$4\ln 2 \to \text{Converges}$$

72. *(Quiz 4)*

$$-\frac{1}{12}\cot^3(4x) + \frac{1}{4}\cot(4x) + x + C$$

73. *(Exam 2 Studyguide)*

$$\frac{1}{2}x^3e^{2x} - \frac{3}{4}x^2e^{2x} + \frac{3}{4}xe^{2x} - \frac{3}{8}e^{2x} + C$$

74. *(Exam 2 Studyguide)*

$$-\frac{1}{2}\left(\cos(2x) - \frac{1}{3}\cos^3(2x)\right) + C$$

77. *(Exam 2 Studyguide)*

$$\infty \to \text{diverges}$$

78. *(Exam 2 Studyguide)*

$$2\sqrt{3} \to \text{converges}$$

79. *(Exam 2 Studyguide)*
Use the inverse tangent integration formula

80. *(Exam 2 Studyguide)*
Use u-substitution

81. *(Exam 2 Studyguide)*
Use trig-substitution

83. *(Exam 2 Studyguide)*

$$\frac{1}{2}\ln|e^x - 1| - \frac{1}{4}\ln|e^{2x} + 1| - \frac{1}{2}\arctan(e^x) + C$$