Calculus C - Homework Assignment Sheet Name: _____ Per. ____

# Chapters 7 & 8 - Techniques of Integration

Each assignment has a total possible of ***10 points***. For each section, self-grade for completion. (You may use ½ points.) I trust that you will give an honest evaluation of your own work. Your signature at the bottom indicates that this is an honest, accurate assessment of your work. Grades will be verified, as explained in class. Try additional problems for extra practice. Each assignment lists "Priority Problems" with a "PP" designation. Full credit awarded for completion of full assignment. *Assignments are subject to change. Any changes will be announced in class.*

0th Assignment: Return last page of Syllabus and complete E-mail Assignment. (Separate 10 points)

_____ Larson 7.1 Integration Review (Handout attached with odd answers): p. 476 #15 – 59 odd
*Copy the problems and show all work on separate paper.* Hint: #43 & 45 Complete the Square
PP: 15, 21, 23, 33, 37, 39, 43, 45, 49, 51, 57, 59

_____ 7.1 (Stewart Textbook): p. 457 #1 – 31 odd (skip 21), 51, 52, 53, Optional: #57, 59, 61
Hint: #9 Let $y = 2x + 1$ and first do a $y$-substitution. PP: 9, 11, 13, 17, 23 – 31 odd

_____ 7.2: p. 465 #1 – 49 e.o.o. (every other odd), 39, 55, 57, 61 PP: 5, 9, 17, 25, 33, 37, 39, 41, 49
Hint: #41 multiply by $(\csc x - \cot x)/(\csc x - \cot x)$, #45 use p. 465 formulas. Try other problems as needed.
#33 Alternate Answer: $(\sec^6 x)/6 - (\sec^4 x)/4 + C$ differs from book answer by a constant

Quiz: Basic Derivatives & Integrals
*Optional checkpoint and/or review. Does not need to be included with HW.*

_____ 7.3: p. 472 #1 – 29 odd, but do 24 instead of 25. *Draw triangle and label parts for each.*
Hint: #15 Switch integration limits to $\theta$ limits so don't need to go back to $x$.
#19 in the trig integral, replace $\sec^2 x$ with $1 + \tan^2 x$ and distribute, solve as two integrals.
#23 – 27 complete the square, #27 use result of Example 8 on p. 464 for $\int \sec^3 x\, dx$, #29 $u$-sub first.
PP: 5, 7, 9, 17, 19, 23, 24, 29

_____ 7.4: p. 481 #1 – 5 odd*, 9 - 37 e.o.o., 39, 41 (Hint #41: Ex. 9 p. 481), Read 7.5
*Note parts (a) and (b) for each and only set up decomposition, do not solve.
Hints: #29 let $x + 4 = (x + 1) + 3$ and split, #37 set-up only don't integrate, #39 let $u = \sqrt{x+1}, x = u^2 - 1$
Bring your book or copy of Integration Tables for 7.6. PP: 3, 17, 21, 25, 33, 37, 39

_____ 7.5: p. 488 (Do *NOT* use tables) #3 – 63 odd multiples of 3 (Replace 21 with 19 and 27 with 29)
7.6: p. 493 (Use tables) #1 – 29 e.o.o. (Don't do 17), Indicate formula(s) and clearly label $u$, $du$, $a$, etc.
PP: As needed for review.

Quiz: Review – 7.5
*Optional checkpoint and/or review. Does not need to be included with HW.*

_____ Larson 7.7 L'Hôpital's Rule Handout: p. 532 #1 - 29 e.o.o. (not 13), 31 – 37 all, 43 – 46 all, 49
PP: 5, 9, 17, 29, 32, 35, 37, 44, 45

_____ 7.8: p. 515 #1 – 31 odd (skip 23), Show all work, including for divergence. PP: 3, 9, 11, 17, 19, 25, 29, 31

_____ 8.1: p. 530 #1, 3*, 5*, 7, 13, 15*, 17* Hint: #13 Use identities to simplify integrand.
8.2: p. 537 #1ab*, 3ab*, 5, 9*, 13 *Set up only (for both sections) PP: 8.1 #1, 3, 5, 7, 13, 15, 17

_____ **Total** (90 Points) Signature: _____ Date: _____

Verified By: _____
Print Signature

# Larson 7.1 Integration Review

Name: _____

Copy exercises and show all work on separate paper.

**In Exercises 15–46, evaluate the indefinite integral.**

15. $\int (-2x + 5)^{3/2}\,dx$

16. $\int \frac{2}{(t - 9)^2}\,dt$

17. $\int \left[v + \frac{1}{(3v - 1)^3}\right] dv$

18. $\int x\sqrt{4 - 2x^2}\,dx$

19. $\int \frac{t^2 - 3}{-t^3 + 9t + 1}\,dt$

20. $\int \frac{2x}{x - 4}\,dx$

21. $\int \frac{x^2}{x - 1}\,dx$

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

23. $\int \left(\frac{1}{3x - 1} - \frac{1}{3x + 1}\right) dx$

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

25. $\int (1 + 2x^2)^2\,dx$

26. $\int x\left(1 + \frac{1}{x}\right)^3 dx$

27. $\int x(\cos 2\pi x^2)\,dx$

28. $\int \sec 4u\,du$

29. $\int \csc \pi x \cot \pi x\,dx$

30. $\int \frac{\sin x}{\sqrt{\cos x}}\,dx$

31. $\int e^{5x}dx$

32. $\int \csc^2 x e^{\cot x}\,dx$

33. $\int \frac{2}{e^{-x} + 1}\,dx$

34. $\int \frac{1}{2e^x - 3}\,dx$

35. $\int \frac{1 + \sin x}{\cos x}\,dx$

36. $\int \frac{1}{\sec x - 1}\,dx$

37. $\int \frac{2t - 1}{t^2 + 4}\,dt$

38. $\int \frac{3}{t^2 + 1}\,dt$

39. $\int \frac{-1}{\sqrt{1 - (2t - 1)^2}}\,dt$

40. $\int \frac{1}{4 + 3x^2}\,dx$

41. $\int \frac{\tan(2/t)}{t^2}\,dt$

42. $\int \frac{e^{1/t}}{t^2}\,dt$

43. $\int \frac{3}{\sqrt{6x - x^2}}\,dx$

44. $\int \frac{1}{(x - 1)\sqrt{4x^2 - 8x + 3}}\,dx$

45. $\int \frac{4}{4x^2 + 4x + 65}\,dx$

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

**In Exercises 47–52, solve the differential equation.**

47. $\frac{dy}{dx} = (1 + e^x)^2$

48. $\frac{dr}{dt} = \frac{(1 + e^t)^2}{e^t}$

49. $\frac{ds}{dt} = \frac{t}{\sqrt{1 - t^4}}$

50. $\frac{dy}{dt} = \frac{1}{x\sqrt{4x^2 - 1}}$

51. $(4 + \tan^2 x)y' = \sec^2 x$

52. $y' = \tan^2 2x$

**In Exercises 53–60, evaluate the definite integral.**

53. $\int_0^{\pi/4} \cos 2x\,dx$

54. $\int_0^{\pi} \sin^2 t \cos t\,dt$

55. $\int_0^1 xe^{-x^2}dx$

56. $\int_1^e \frac{1 - \ln x}{x}\,dx$

57. $\int_0^4 \frac{2x}{\sqrt{x^2 + 9}}\,dx$

58. $\int_1^2 \frac{x - 2}{x}\,dx$

59. $\int_0^{2/\sqrt{3}} \frac{1}{4 + 9x^2}\,dx$

60. $\int_0^4 \frac{1}{\sqrt{25 - x^2}}\,dx$

**Answers to Odd-Numbered Exercises**

9. $\int \frac{du}{\sqrt{a^2 - u^2}}$ 11. $\int \sin u\,du$ $u = t, a = 1$ $u = t^2$

13. $\int e^u\,du$ 15. $-\frac{1}{5}(-2x + 5)^{5/2} + C$ $u = \sin x$

17. $\frac{1}{2}v^2 - \frac{1}{6(3v - 1)^2} + C$

19. $-\frac{1}{3}\ln|-t^3 + 9t + 1| + C$

21. $\frac{1}{2}x^2 + x + \ln|x - 1| + C$ 23. $\frac{1}{3}\ln\left|\frac{3x - 1}{3x + 1}\right| + C$

25. $\frac{x}{15}(12x^4 + 20x^2 + 15) + C$ 27. $\frac{1}{4\pi}\sin 2\pi x^2 + C$

29. $-\frac{1}{\pi}\csc \pi x + C$ 31. $\frac{1}{5}e^{5x} + C$

33. $2\ln(1 + e^x) + C$ 35. $\ln|\sec x(\sec x + \tan x)| + C$

37. $\ln(t^2 + 4) - \frac{1}{2}\arctan\frac{t}{2} + C$

39. $-\frac{1}{2}\arcsin(2t - 1) + C$ 41. $\frac{1}{2}\ln\left|\cos\frac{2}{t}\right| + C$

43. $3\arcsin\frac{x - 3}{3} + C$ 45. $\frac{1}{4}\arctan\frac{2x + 1}{8} + C$

47. $y = \frac{1}{2}e^{2x} + 2e^x + x + C$ 49. $s = \frac{1}{2}\arcsin t^2 + C$

51. $y = \frac{1}{2}\arctan\frac{\tan x}{2} + C$ 53. $\frac{1}{2}$

55. $\frac{1}{2}(1 - e^{-1}) \approx 0.316$ 57. 4 59. $\frac{\pi}{18}$

# Larson 7.7 L'Hôpital's Rule

Name: _____

Copy exercises and show all work on separate paper.

**In Exercises 1–6, evaluate the limit (a) using techniques from Chapters 1 and 3 and (b) using L'Hôpital's Rule.**

1. $\lim_{x\to 3}\frac{2(x-3)}{x^2-9}$
2. $\lim_{x\to -1}\frac{2x^2-x-3}{x+1}$
3. $\lim_{x\to 3}\frac{\sqrt{x+1}-2}{x-3}$
4. $\lim_{x\to 0}\frac{\sin 4x}{2x}$
5. $\lim_{x\to \infty}\frac{5x^2-3x+1}{3x^2-5}$
6. $\lim_{x\to \infty}\frac{2x+1}{4x^2+x}$

**In Exercises 7–26, evaluate the limit, using L'Hôpital's Rule if necessary. (In Exercise 13, $n$ is a positive integer.)**

7. $\lim_{x\to 2}\frac{x^2-x-2}{x-2}$
8. $\lim_{x\to -1}\frac{x^2-x-2}{x+1}$
9. $\lim_{x\to 0}\frac{\sqrt{4-x^2}-2}{x}$
10. $\lim_{x\to 2^-}\frac{\sqrt{4-x^2}}{x-2}$
11. $\lim_{x\to 0}\frac{e^x-(1-x)}{x}$
12. $\lim_{x\to 0^+}\frac{e^x-(1+x)}{x^3}$
13. $\lim_{x\to 0^+}\frac{e^x-(1+x)}{x^n}$
14. $\lim_{x\to 1}\frac{\ln x}{x^2-1}$
15. $\lim_{x\to 0}\frac{\sin 2x}{\sin 3x}$
16. $\lim_{x\to 0}\frac{\sin ax}{\sin bx}$
17. $\lim_{x\to 0}\frac{\arcsin x}{x}$
18. $\lim_{x\to 1}\frac{\arctan x-(\pi/4)}{x-1}$
19. $\lim_{x\to \infty}\frac{3x^2-2x+1}{2x^2+3}$
20. $\lim_{x\to \infty}\frac{x-1}{x^2+2x+3}$
21. $\lim_{x\to \infty}\frac{x^2+2x+3}{x-1}$
22. $\lim_{x\to \infty}\frac{x^2}{e^x}$
23. $\lim_{x\to \infty}\frac{x}{\sqrt{x^2+1}}$
24. $\lim_{x\to \infty}\frac{\sin x}{x-\pi}$
25. $\lim_{x\to \infty}\frac{\ln x}{x}$
26. $\lim_{x\to \infty}\frac{e^x}{x}$

**In Exercises 27–40, describe the type of indeterminate form (if any) that is obtained with direct substitution. Then evaluate the limit, using L'Hôpital's Rule when necessary. (For a geometric approach to Exercise 27, see the article by John H. Mathews in the May, 1992 issue of *The College Mathematics Journal.*)**

27. $\lim_{x\to 0^+}(-x\ln x)$
28. $\lim_{x\to 0^+}x^2\cot x$
29. $\lim_{x\to \infty}\left(x\sin\frac{1}{x}\right)$
30. $\lim_{x\to \infty}x\tan\frac{1}{x}$
31. $\lim_{x\to 0^+}x^{1/x}$
32. $\lim_{x\to 0^+}(e^x+x)^{1/x}$
33. $\lim_{x\to \infty}x^{1/x}$
34. $\lim_{x\to \infty}\left(1+\frac{1}{x}\right)^x$
35. $\lim_{x\to 0^+}(1+x)^{1/x}$
36. $\lim_{x\to \infty}(1+x)^{1/x}$
37. $\lim_{x\to 2^+}\left(\frac{8}{x^2-4}-\frac{x}{x-2}\right)$
38. $\lim_{x\to 2^+}\left(\frac{1}{x^2-4}-\frac{\sqrt{x-1}}{x^2-4}\right)$
39. $\lim_{x\to 1^+}\left(\frac{3}{\ln x}-\frac{2}{x-1}\right)$
40. $\lim_{x\to 0^+}\left(\frac{1}{x}-\frac{1}{x^2}\right)$

**In Exercises 43–48, use L'Hôpital's Rule to determine the comparative rates of increase of the functions**

$$f(x)=x^m,\quad g(x)=e^{nx},\quad \text{and}\quad h(x)=(\ln x)^n$$

**where $0<n$, $0<m$, and $x\to\infty$. The limits obtained in these exercises suggest that $(\ln x)^n$ approaches infinity more slowly than $x^m$, which, in turn, approaches infinity more slowly than $e^{nx}$.**

43. $\lim_{x\to \infty}\frac{x^2}{e^{5x}}$
44. $\lim_{x\to \infty}\frac{x^3}{e^{2x}}$
45. $\lim_{x\to \infty}\frac{(\ln x)^3}{x}$
46. $\lim_{x\to \infty}\frac{(\ln x)^2}{x^3}$
47. $\lim_{x\to \infty}\frac{(\ln x)^n}{x^m}$
48. $\lim_{x\to \infty}\frac{x^m}{e^{nx}}$

49. Complete the table to show that $x$ eventually "overpowers" $(\ln x)^4$.

| $x$ | 10 | $10^2$ | $10^4$ | $10^6$ | $10^8$ | $10^{10}$ |
|---|---|---|---|---|---|---|
| $\frac{(\ln x)^4}{x}$ | | | | | | |

50. Complete the table to show that $e^x$ eventually "overpowers" $x^5$.

| $x$ | 1 | 5 | 10 | 20 | 30 | 40 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|
| $\frac{e^x}{x^5}$ | | | | | | | | |

### Answers to Odd-Numbered Exercises

1. $\frac{1}{5}$ 3. $\frac{1}{4}$ 5. $\frac{5}{3}$ 7. 3 9. 0 11. 2
13. $n=1:0$ 15. $\frac{2}{3}$ 17. 1 19. $\frac{3}{2}$ 21. $\infty$ 23. 1
$n=2:\frac{1}{2}$
$n\geq 3:\infty$
25. 0 27. $0\cdot\infty$; 0 29. $0\cdot\infty$; 1 31. Not indeterminate, 0
33. $\infty^0$; 1 35. $1^\infty$; $e$ 37. $\infty-\infty$; $-\frac{3}{2}$ 39. $\infty-\infty$; $\infty$
41. a. $f(x)=x^2-25$, $g(x)=x-5$
b. $f(x)=(x-5)^2$, $g(x)=x^2-25$
c. $f(x)=x^2-25$, $g(x)=(x-5)^3$
43. 0 45. 0 47. 0
49.

| $x$ | 10 | $10^2$ | $10^4$ | $10^6$ | $10^8$ | $10^{10}$ |
|---|---|---|---|---|---|---|
| $\frac{(\ln x)^4}{x}$ | 2.811 | 4.498 | 0.720 | 0.036 | 0.001 | 0.000 |