

SKILLS WARM P 4.5

The following warm-up exercises involve skills that were covered in earlier sections. You will use these skills in the exercise set for this section. For additional help, review Sections 2.6, 2.7, and 4.4.

In Exercises 1–6, expand the logarithmic expression. (Assume all variables are positive.)

1. $\ln(x + 1)^2$

2. $\ln x(x + 1)$

3. $\ln \frac{x}{x + 1}$

4. $\ln \left(\frac{x}{x - 3} \right)^3$

5. $\ln \frac{4x(x - 7)}{x^2}$

6. $\ln x^3 \sqrt{x + 1}$

In Exercises 7 and 8, find dy/dx implicitly.

7. $y^2 + xy = 7$

8. $x^2y - xy^2 = 3x$

In Exercises 9 and 10, find the second derivative of the function.

9. $f(x) = x^2(x + 1) - 3x^3$

10. $f(x) = -\frac{1}{6x^2}$

Exercises 4.5

See *CalcChat.com* for tutorial help and worked-out solutions to odd-numbered exercises.



Differentiating Logarithmic Functions In Exercises 1–22, find the derivative of the function. See Examples 1, 2, 3, and 4.

1. $y = \ln x^8$

2. $f(x) = \ln 7x$

3. $y = \ln(x^2 + 3)$

4. $f(x) = \ln(8 - x^4)$

5. $y = \ln \sqrt[4]{3x - 5}$

6. $y = \ln \sqrt[5]{1 - 2x}$

7. $y = (\ln x)^4$

8. $y = (\ln x^2)^2$

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

10. $y = \frac{\ln x}{x^3}$

11. $y = \ln(x\sqrt{x^6 - 2})$

12. $y = \ln[x(2x + 3)^2]$

13. $y = \ln \frac{x}{x + 1}$

14. $y = \ln \frac{x}{x^2 + 1}$

15. $y = \ln \sqrt[3]{\frac{x - 1}{x + 1}}$

16. $y = \ln \sqrt{\frac{x + 1}{x - 1}}$

17. $y = \ln \frac{\sqrt{4 + x^2}}{x}$

18. $y = \ln \frac{(6 - x)^{3/2}}{x^{2/3}}$

19. $g(x) = e^{-x} \ln x$

20. $y = e^{x^2} \ln 4x^3$

21. $g(x) = \ln \frac{e^x + e^{-x}}{2}$

22. $f(x) = \ln \frac{1 + e^x}{1 - e^x}$



Evaluating Logarithms In Exercises 23–28, evaluate the logarithm without using a calculator. See Example 8.

23. $\log_5 25$

24. $\log_7 49$

25. $\log_3 \frac{1}{27}$

26. $\log_6 \frac{1}{36}$

27. $\log_4 64$

28. $\log_8 512$



Changing Bases to Evaluate Logarithms In Exercises 29–34, use the change-of-base formula and a calculator to evaluate the logarithm. See Example 9.

29. $\log_4 7$

30. $\log_6 10$

31. $\log_2 48$

32. $\log_5 12$

33. $\log_3 \frac{1}{2}$

34. $\log_7 \frac{2}{9}$



Differentiating Functions of Other Bases In Exercises 35–44, find the derivative of the function.

35. $y = 3^x$

36. $y = \left(\frac{1}{4}\right)^x$

37. $f(x) = \log_2 x$

38. $g(x) = \log_5 x$

39. $h(x) = 4^{2x-3}$

40. $f(x) = 7^{x^5}$

41. $y = \log_{10}(x^2 + 6x)$

42. $g(x) = \log_6(2x^3 - 5x^2)$

43. $y = x^{2^x}$

44. $y = x^{3^{x+1}}$



Finding an Equation of a Tangent Line In Exercises 45–52, find an equation of the tangent line to the graph of the function at the given point. See Example 5.

45. $y = \ln x^3; (1, 0)$

46. $y = \ln x^{5/2}; (1, 0)$

47. $y = x^3 \ln x; (e, e^3)$

48. $y = \frac{\ln x}{x^4}; \left(e, \frac{1}{e^4}\right)$

49. $f(x) = \ln \frac{5(x + 2)}{x}; \left(-\frac{5}{2}, 0\right)$

50. $f(x) = \ln(x\sqrt{x + 3}); \left(\frac{6}{5}, \frac{9}{10}\right)$

51. $y = \log_3 x; (27, 3)$

52. $g(x) = \log_8 4x; (2, 1)$