Name _____ Class _____ Date _____

7-6 Practice

Form G

Natural Logarithms

Write each expression as a single natural logarithm.

1. $\ln 16 - \ln 8$
2. $3 \ln 3 + \ln 9$
3. $a \ln 4 - \ln b$
4. $\ln z - 3 \ln x$
5. $\frac{1}{2} \ln 9 + \ln 3x$
6. $4 \ln x + 3 \ln y$
7. $\frac{1}{3} \ln 8 + \ln x$
8. $3 \ln a - b \ln 2$
9. $2 \ln 4 - \ln 8$

Solve each equation. Check your answers. Round your answer to the nearest hundredth.

10. $4 \ln x = -2$
11. $2 \ln (3x - 4) = 7$
12. $5 \ln (4x - 6) = -6$
13. $-7 + \ln 2x = 4$
14. $3 - 4 \ln (8x + 1) = 12$
15. $\ln x + \ln 3x = 14$
16. $2 \ln x + \ln x^2 = 3$
17. $\ln x + \ln 4 = 2$
18. $\ln x - \ln 5 = -1$
19. $\ln e^x = 3$
20. $3 \ln e^{2x} = 12$
21. $\ln e^{x+5} = 17$
22. $\ln 3x + \ln 2x = 3$
23. $5 \ln (3x - 2) = 15$
24. $7 \ln (2x + 5) = 8$
25. $\ln (3x + 4) = 5$
26. $\ln \frac{2x}{41} = 2$
27. $\ln (2x - 1)^2 = 4$

Use natural logarithms to solve each equation. Round your answer to the nearest hundredth.

28. $e^x = 15$
29. $4e^x = 10$
30. $e^{x+2} = 50$
31. $4e^{3x-1} = 5$
32. $e^{x-4} = 2$
33. $5e^{6x+3} = 0.1$
34. $e^x = 1$
35. $e^{\frac{x}{5}} = 32$
36. $3e^{3x-5} = 49$
37. $7e^{5x+8} = 0.23$
38. $6 - e^{12x} = 5.2$
39. $e^{\frac{x}{2}} = 25$
40. $e^{2x} = 25$
41. $e^{\ln 5x} = 20$
42. $e^{\ln x} = 21$
43. $e^{x+6} + 5 = 1$

7-6 Practice (continued) Form G

Natural Logarithms

The formula $P = 50e^{-\frac{t}{25}}$ gives the power output P, in watts, needed to run a certain satellite for t days. Find how long a satellite with the given power output will operate.

44. 10 W **45.** 12 W **46.** 14 W

The formula for the maximum velocity v of a rocket is $v = -0.0098t + c \ln R$, where c is the exhaust velocity in km/s, t is the firing time, and R is the mass ratio of the rocket. A rocket must reach 7.7 km/s to attain a stable orbit 300 km above Earth.

47. What is the maximum velocity of a rocket with a mass ratio of 18, an exhaust velocity of 2.2 km/s, and a firing time of 25 s?

48. Can the rocket in Exercise 47 achieve a stable orbit? Explain your answer.

49. What mass ratio would be needed to achieve a stable orbit for a rocket with an exhaust velocity of 2.5 km/s and a firing time of 29 s?

50. A rocket with an exhaust velocity of 2.4 km/s and a 28 second firing time can reach a maximum velocity of 7.8 km/s. What is the mass ratio of the rocket?

By measuring the amount of carbon-14 in an object, a paleontologist can determine its approximate age. The amount of carbon-14 in an object is given by $y = ae^{-0.00012t}$, where a is the amount of carbon-14 originally in the object, and t is the age of the object in years.

51. A fossil of a bone contains 32% of its original carbon-14. What is the approximate age of the bone?

52. A fossil of a bone contains 83% of its original carbon-14. What is the approximate age of the bone?

Simplify each expression.

53. $\ln e^4$ **54.** $5 \ln e^5$ **55.** $\frac{\ln e^2}{2}$ **56.** $\ln e^{100}$