Name _____ Class _____ Date _____

Practice 8-6

Natural Logarithms

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

1. 10 W **2.** 12 W **3.** 14 W

The formula for the maximum velocity v of a rocket is $v = c \ln R$, where c is the velocity of the exhaust in km/s and R is the mass ratio of the rocket. A rocket must reach 7.8 km/s to attain a stable orbit. Round answers to the nearest hundredth.

4. Find the maximum velocity of a rocket with a mass ratio of about 18 and an exhaust velocity of 2.2 km/s. Can this rocket achieve a stable orbit?

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

6. A rocket with an exhaust velocity of 2.4 km/s can reach a maximum velocity of 7.8 km/s. What is the mass ratio of the rocket?

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

7. $e^x = 15$ **8.** $4e^x = 10$ **9.** $e^{x+2} = 50$ **10.** $4e^{3x-1} = 5$

11. $e^{x-4} = 2$ **12.** $5e^{6x+3} = 0.1$ **13.** $e^x = 1$ **14.** $e^{\frac{x}{5}} = 32$

15. $3e^{3x-5} = 49$ **16.** $7e^{5x+8} = 0.23$ **17.** $6 - e^{12x} = 5.2$ **18.** $e^{\frac{x}{2}} = 25$

19. $e^{2x} = 25$ **20.** $e^{\ln 5x} = 20$ **21.** $e^{\ln x} = 21$ **22.** $e^{x+6} + 5 = 1$

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

23. $4 \ln x = -2$ **24.** $2 \ln (3x - 4) = 7$ **25.** $5 \ln (4x - 6) = -6$

26. $-7 + \ln 2x = 4$ **27.** $3 - 4 \ln (8x + 1) = 12$ **28.** $\ln x + \ln 3x = 14$

29. $2 \ln x + \ln x^2 = 3$ **30.** $\ln x + \ln 4 = 2$ **31.** $\ln x - \ln 5 = -1$

32. $\ln e^x = 3$ **33.** $3 \ln e^{2x} = 12$ **34.** $\ln e^{x+5} = 17$

35. $\ln 3x + \ln 2x = 3$ **36.** $5 \ln (3x - 2) = 15$ **37.** $7 \ln (2x + 5) = 8$

38. $\ln (3x + 4) = 5$ **39.** $\ln \frac{2x}{41} = 2$ **40.** $\ln (2x - 1)^2 = 4$

Write each expression as a single natural logarithm.

41. $\ln 16 - \ln 8$ **42.** $3 \ln 3 + \ln 9$ **43.** $a \ln 4 - \ln b$

44. $\ln z - 3 \ln x$ **45.** $\frac{1}{2} \ln 9 + \ln 3x$ **46.** $4 \ln x + 3 \ln y$

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