

# MAT126 – Technical Math & Trig

## Assignment 6

Compute each of the following. Round your answers to 4 decimal places:

1.  $e^{0.125}$

5.  $\log 24$

2.  $e^{-1.82}$

6.  $\log_5 12.6$

3.  $e^{5.75}$

7.  $\log_{12} 14.6$

4.  $\ln 2$

8.  $\ln 36.52$

Write each logarithmic equation in exponential form

9.  $\log_2 32 = 5$

10.  $\ln 23 = 3.135$

Write each exponential equation in logarithmic form

11.  $2^{-8} = \frac{1}{256}$

12.  $e^7 = 1096.63$

**Express as the sum or difference of two or more logarithms**

13.  $\log \frac{588}{5x}$

14.  $\ln \frac{5xy}{2b}$

**Express as a single logarithm**

15.  $\log 17 + \log 3 - 2 \log 5$

16.  $4 \log x + 2 \log y - \log c$

**Solve the following equations.**

17.  $3^x = 30$

20.  $2 \ln 4x - 3 \ln 3 = \ln x$

18.  $\ln(2x + 5) = 6$

21.  $e^{3x-1} = 10$

19.  $4^{y+5} = 30$

22.  $\log(x - 1) = 2$

**Make a table of values and graph each function. Graph paper is included on the last page of the assignment**

23.  $y = 4e^x$ ; select  $\{x \mid -2 \leq x \leq 4\}$

24.  $y = \log x$ ; select  $\{x \mid 0.5 \leq x \leq 8\}$

**Solve problems (25 – 32). Write your answer as part of a complete sentence with appropriate units rounded to the correct number of significant figures.**

25. Radium decays exponentially and has a half-life of  $1600\bar{0}$  years. How much of  $100\bar{0}$  mg will be left after  $2000\bar{0}$  years?

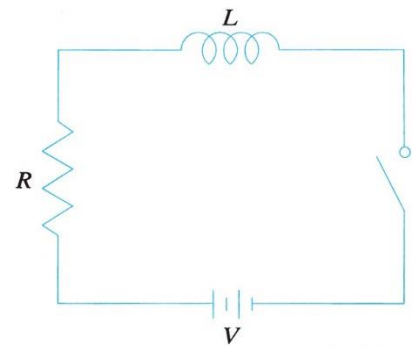
26. The number of bacteria in a certain culture increases from 5000 to 15000 in 20.0 hours. If we assume these bacteria grow exponentially; Note: the number of bacteria is a counting number.

a. How many will be there after 10 hours?

b. How many can we expect after 30 hours?

27. A piece of metal is heated to  $150^{\circ}\text{C}$  and is then placed in the outside air, which is  $30.0^{\circ}\text{C}$ . After 15.0 minutes, the temperature of the metal is  $90.0^{\circ}\text{C}$ . What will its temperature be in another 15.0 minutes?
- a. Use Newton's Law of Cooling:  $T = T_m + (T_o - T_m)e^{-kt}$ . In this formula,  $T_o$  is the original temperature and  $T_m$  is the temperature of the surrounding medium.

28. The circuit shown in the figure contains a resistance  $R$ , a voltage  $V$ , and an inductance  $L$ . The current  $I$  at  $t$  seconds after the switch is closed is given by  $I = I_o(1 - e^{-t/T})$  where  $I_o$  is the steady state current  $\frac{V}{R}$  and  $T = \frac{L}{R}$ . If a circuit has  $V = 120\text{ V}$ ,  $R = 40.0\ \Omega$ , and  $L = 3.00\text{ H}$ , determine the current in the circuit



- a. 0.0100 seconds
- b. 0.100 seconds
- c. 1.00 seconds after the connection is made.
29. A  $130\ \mu\text{F}$  capacitor is charged by being connected to a  $120\text{ V}$  circuit. The resistance is  $4500\ \Omega$ . What is the charge on the capacitor 0.500 s after the circuit is disconnected?

30. In chemistry, the pH of a substance is defined by  $pH = -\log[H^+]$  where  $[H^+]$  is the concentration of hydrogen ions in the substance measured in moles per liter. The pH of distilled water is exactly 7. A substance with a pH less than 7 is known as an acid. A substance with a pH greater than 7 is a base.
- Find the pH of rain and snow if the hydrogen ion concentration is  $[H^+] = 2.5 \times 10^{-6}$  moles per liter.
  - The pH of some acid rain is 5.3. Find the hydrogen ion concentration in acid rain.
31. The formula for the exponential decay of electric current is given by the formula  $Q = Q_0 e^{-t/T}$ , where  $T = RC$ . If  $Q_0 = 0.40$  A,  $R = 500 \Omega$ , and  $C = 100 \mu F$ , what is  $t$  when  $Q = 0.050$  A?
32. The brightness of a star perceived by the naked eye is measured in terms of a quantity called magnitude. The brightest stars are of magnitude 1 and the dimmest of magnitude 6. The magnitude  $M$  is given by  $M = 6 - 2.5 \log \frac{I}{I_0}$ , where  $I_0$  is the intensity of light from a just visible star, and  $I$  is the actual intensity from a star. Even though the sun is a star, it has a magnitude of -27.0 and the moon has a magnitude of -12.5.
- Express the magnitude equation in exponential form by solving for  $I$ .
  - How many times more intense is the moon than Polaris, a star with a magnitude of 2.00?

