# 11-5 Common Logarithms

Common logarithms are logarithms that have a base of 10. The value of the logarithm is broken out into two parts, the part left of the decimal called the characteristic, and the part right of the decimal called the mantissa. Together, the characteristic and the mantissa represent the logarithmic value of the power of 10 of the number and the value less than 1.

Ex. $\log_{10} 2000 = 3.3010$

characteristic ↑ ↑ mantissa

$$\log_{10} 2000 = \log_{10}(2 \times 10^3) = \log_{10} 2 + \log_{10} 10^3$$
$$= .3010 + 3 = 3.3010$$

Ex. $\log_{10} 0.002 = \log_{10}(2 \times 10^{-3}) = \log_{10} 2 + \log_{10} 10^{-3}$
$$= .3010 - 3 = -2.699$$

antilogarithm - The reverse of a logarithm.

If $\log x = a$ then $x = \text{antilog } a$

Remember the inverse of a logarithm is an exponential function. If $\log x = a$ then $10^a = x$

# Practice Problems 11-5

Given: $\log 4 = 0.6021$

$\log 9 = 0.9542$

$\log 12 = 1.0792$

Evaluate:

20. $\log 0.00009 = \log(9 \times 10^{-5}) = \log 9 + \log 10^{-5}$

$0.9542 - 5 = -4.0458$

22. $\log 0.06 = \log(6 \times 10^{-2}) = \log 6 + \log 10^{-2}$

$\log \frac{12}{4^{1/2}} + (-2) = \log 12 - \frac{1}{2}\log 4 + (-2)$

$1.0792 - \frac{1}{2}(0.6021) - 2 = -1.2218$

34. $\log_2 8 = \frac{\log 8}{\log 2} = \frac{0.90309}{0.30103} = 3$

36. $\log_6 24 = \frac{\log 24}{\log 6} = \frac{1.38021}{0.77815} = 1.7737$

43. $0.16^{4+3x} = 0.3^{8-x}$

$\log 0.16^{4+3x} = \log 0.3^{8-x}$

$(4+3x)\log(0.16) = (8-x)\log(0.3)$

$4\log(0.16) + 3x\log(0.16) = 8\log(0.3) - x\log(0.3)$

$3x\log(0.16) + x\log(0.3) = 8\log(0.3) - 4\log(0.16)$

$x(3\log(0.16) + \log(0.3)) = 8\log(0.3) - 4\log(0.16)$

$$x = \frac{8\log(0.3) - 4\log(0.16)}{3\log(0.16) + \log(0.3)} = \frac{-0.9995}{-2.9105} = \boxed{0.3434}$$

50. $\log_2 x = -3$

$2^{-3} = x$

$\boxed{0.125 = x}$