

Section 1.4 Logarithmic Functions

COMMON LOG

ex: $\log 1000 = 3$

$\log_{10} x = c$ means $10^c = x$
on calculator it's the log button

NATURAL LOG

$\ln_e x = c$ means $e^c = x$
on calculator it's the ln button

$\ln x$ means $\log_e x$

$\log x$ means $\log_{10} x$

PROPERTIES OF LOG

1) $\log_a (AB) = \log_a A + \log_a B$

2) $\log_a \left(\frac{A}{B}\right) = \log_a A - \log_a B$

3) $\log_a (A)^p = p \log_a A$

4) $\log_a a^x = x$

5) $a^{\log_a x} = x$

6) $\log_a 1 = 0$

$\ln e^x = x$

$\log 10^x =$

$$\underline{\text{ex:}} \quad \underbrace{2 \ln(e^A)}_{2A} + \underbrace{3 \ln(B^e)}_{3e \ln B}$$

$$\underline{\text{ex:}} \quad 17^x = 2$$

$$\ln 17^x = \ln 2$$

$$x \ln 17 = \ln 2$$

$$x = \frac{\ln 2}{\ln 17} \approx 0.245$$

on calculator
 $\ln(2) / \ln(17)$

$$\underline{\text{ex:}} \quad 2^x = e^{x+1}$$

$$\ln 2^x = \ln e^{x+1}$$

$$x \ln 2 = x+1$$

$$0.693x = \cancel{x} + 1$$

$$\frac{-1x \quad \cancel{x}}{\hline}$$

$$\frac{-0.307x = 1}{\hline}$$

$$\frac{-0.307 \quad -0.307}{\hline}$$

$$x = -3.257$$

$$\ln e^p = p$$

$$\underline{\text{ex:}} \quad 10^{x+3} = 5e^{7-x}$$

$$\log 10^{x+3} = \log 5e^{7-x}$$

$$x+3 = \log 5 + \log e^{7-x}$$

$$x+3 = \log 5 + (7-x) \log e$$

$$x+3 = 0.699 + (7-x)0.434$$

$$|x+3 = 0.699 + 3.038 - 0.434x$$

$$1.434x = .737$$

$$x = 0.514$$

p27-28

5, 9, 11, 29, 37, 41

$$29) \quad P = 15(1.5)^t$$

$$P = 15(e^k)^t$$

$$e^k = 1.5$$

$$\ln e^k = \ln 1.5$$

$$k = .405$$

$$P = 15e^{.405t}$$

$$37) \quad A = 10(0.82)^t$$

a) 10 mg

b) $1 - 0.82 = 18\%$

c) $A = 10(0.82)^6 \approx 3.04 \text{ mg}$

d) $1 = 10(0.82)^t$

$$0.1 = .82^t$$

$$\ln 0.1 = t \ln .82$$

$$t = 11.6 \text{ hrs}$$