

## Section 9.0B Review of Properties of Logarithms

### Inverse Properties

$$\log(10^x) = x$$

$$\ln(e^x) = x$$

$$\log_a(a^x) = x$$

$$10^{\log x} = x$$

$$e^{\ln x} = x$$

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

$$\log_4 64 = 3$$

4 to the what power is 64?

$$\log_a x = b \text{ if } a^b = x$$

$$\log_5 25 = 2 \text{ since } 5^2 = 25$$

$$\log_3 27 = 3$$

ex:  $\log(10^{3x}) = 3x$

$$\ln(e^{-.012x}) = -.012x$$

$$e^{\ln(.023x)} = .023x$$

$$e \approx 2.71828$$

$$e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$

ex: Solve  $10^x = 0.47$

$$\log 10^x = \log 0.47$$

$$x = -0.328$$

ex:  ~~$5e^{0.01x} = \frac{8}{5}$~~

$$e^{.01x} = 1.6$$

$$\ln e^{.01x} = \ln 1.6$$

$$\frac{.01x}{.01} = \frac{\ln 1.6}{.01}$$

$$x = 47.000$$

$$\log(A^n) = n \log A$$

$$\ln(A^n) = n \ln A$$

ex: Solve  $1.03^x = 2$

$$\ln 1.03^x = \ln 2$$

$$\frac{x \ln 1.03}{\ln 1.03} = \frac{\ln 2}{\ln 1.03}$$

$$\ln(2)/\ln(1.03)$$

$$x \approx 23.450$$

ex: Solve  $\frac{74(10)^{0.042x}}{74} = \frac{148}{74}$

$$10^{0.042x} = 2$$

$$\log 10^{0.042x} = \log 2$$

$$.042x = \log 2$$

$$x = \frac{\log 2}{.042}$$

$$x \approx 7.167$$

ex:  $\frac{5 \cdot 3^x}{5} = \frac{100}{5}$

$$3^x = 20$$

$$\ln 3^x = \ln 20$$

$$x \ln 3 = \ln 20$$

$$x = \frac{\ln 20}{\ln 3}$$

$$x \approx 2.727$$

Assignment

In 1-3, simplify:

1)  $\log(10^{15+2x})$

2)  $e^{\ln 65}$

3)  $\ln(e^{-.013x})$

In 4-8, solve for x:

4)  $3e^x = 14$

5)  $7 \cdot 10^{.02x} = 20$

6)  $10^{-4x} = 0.752$

7)  $4.5^{3x} = 123$

8)  $10 \cdot 2^{6x} = 1010$