

Name: Key

**Problem Set 5.5**

1) Write each equation in exponential form.

a)  $\log_2 64 = 6$

$$2^6 = 64$$

b)  $\log_4 \left(\frac{1}{64}\right) = -3$

$$4^{-3} = \frac{1}{64}$$

c)  $\log(0.01) = -2$

$$10^{-2} = 0.01$$

2) Write each equation in logarithmic form.

a)  $2^5 = 32$

$$\log_2(32) = 5$$

b)  $5^{-1/2} = \frac{\sqrt{5}}{5}$

$$\log_5\left(\frac{\sqrt{5}}{5}\right) = -\frac{1}{2}$$

c)  $10^{-1} = 0.1$

$$\log_{10}(0.1) = -1$$

3) Evaluate the logarithmic expression.

a)  $\log_2 8 = 3$

$$2^x = 8$$

b)  $\log_6 216 = 3$

$$6^x = 216$$

c)  $\log_7 7 = 1$

d)  $\log_5 \sqrt{5} = \frac{1}{2}$

$$5^x = \sqrt{5}$$

e)  $\log_7 \left(\frac{1}{49}\right) = -2$

$$7^x = \frac{1}{49}$$

f)  $\ln(1) = 0$

4) Solve for x.

a)  $\log_6 x = 2$

$$6^2 = x$$
$$\boxed{36} = x$$

b)  $\log_{16} x = -1$

$$16^{-1} = x$$
$$\boxed{\frac{1}{16}} = x$$

c)  $\log_x 64 = 3$

$$x^3 = 64$$
$$\boxed{x = 4}$$

5) Expand the expression using the properties of logarithms.

a)  $\log_6(3x)$

$$\log_6 3 + \log_6 x$$

b)  $\ln\left(\frac{r}{6}\right)$

$$\ln(r) - \ln(6)$$

c)  $\log(xy^4)$

$$\log x + \log y^4$$

$$\log x + 4\log y$$

d)  $\log_2\left(\frac{x^5y}{3}\right)$

$$\log_2 x^5 y - \log_2 3$$

$$\log_2 x^5 + \log_2 y - \log_2 3$$

$$5\log_2 x + \log_2 y - \log_2 3$$

6) Condense the expression using the properties of logarithms.

a)  $\log_3 7 - \log_3 x$

$$\log_3\left(\frac{7}{x}\right)$$

b)  $2\log_8 x + \log_8 6$

$$\log_8 x^2 + \log_8 6 = \log_8 6x^2$$

c)  $3\log_4 2 + \log_4 6 - 2\log_4 3$

$$\log_4 2^3 + \log_4 6 + \log_4 3^2$$

$$\log_4(8) + \log_4(6) + \log_4(9)$$

$$\log_4(48) - \log_4(9) = \log_4\left(\frac{48}{9}\right) = \log_4\left(\frac{16}{3}\right)$$

d)  $\ln(5) + \ln(x) - \ln(y) = \ln(5x) - \ln(y)$

$$= \ln\left(\frac{5x}{y}\right)$$

7) Condense the left side of the equation. Then solve for x.

a)  $\log_2(6) + \log_2(x) = 6$

$$\log_2(6x) = 6$$

$$2^6 = 6x$$

$$\frac{64}{6} = \frac{6x}{6}$$

$$x = \frac{32}{3}$$

b)  $\log_5(2) + \log_5(x) - \log_5(3) = 2$

$$\log_5(2x) - \log_5(3) = 2$$

$$\log_5\left(\frac{2x}{3}\right) = 2$$

$$5^2 = \frac{2x}{3}$$

$$3 \cdot 25 = 2x / 3 \cdot 3$$

$$75 = 2x$$

$$x = \frac{75}{2}$$