

MAC1105 College Algebra  
5.4 Practice Problems

Solve each exponential equation.

1.  $4^{2x+4} = 64$   
 $4^{2x+4} = 4^3$   
 $2x+4 = 3$   
 $\begin{array}{r} -4 \quad -4 \\ \hline 2x = -1 \\ \hline x = -\frac{1}{2} \end{array}$

2.  $8^{x+3} = 4^{x-2}$   
 $(2^3)^{x+3} = (2^2)^{x-2}$   
 $2^{3(x+3)} = 2^{2(x-2)}$   
 $3x+9 = 2x-4$   
 $\begin{array}{r} -2x \quad -2x \\ \hline x+9 = -4 \\ \hline -9 \quad -9 \\ \hline x = -13 \end{array}$

3.  $3^{2x+1} = \frac{1}{27}$   
 $3^{2x+1} = \frac{1}{3^3}$   
 $3^{2x+1} = 3^{-3}$   
 $2x+1 = -3$   
 $\begin{array}{r} -1 \quad -1 \\ \hline 2x = -4 \\ \hline x = -2 \end{array}$

4.  $3^x = 19$   
 Convert or  $\ln$  of both  
 $\log_3 19 = x$   
 $\frac{\ln 3^x}{\ln 3} = \frac{\ln 19}{\ln 3}$   
 $x \ln 3 = \frac{\ln 19}{\ln 3}$   
 $x = \frac{\ln 19}{\ln 3}$

5.  $4^{x+5} = 5^{2x-3}$   
 $\ln 4^{x+5} = \ln 5^{2x-3}$   
 $(x+4)\ln 4 = (2x-3)\ln 5$   
 $x\ln 4 + 4\ln 4 = 2x\ln 5 - 3\ln 5$   
 $x\ln 4 - 2x\ln 5 = -3\ln 5 - 4\ln 4$   
 $x(\ln 4 - 2\ln 5) = \frac{-3\ln 5 - 4\ln 4}{\ln 4 - 2\ln 5}$   
 $x = \frac{-3\ln 5 - 4\ln 4}{\ln 4 - 2\ln 5}$

6.  $30e^{2x} - 5 = 355$   
 $+5 \quad +5$   
 $\frac{30e^{2x}}{30} = \frac{360}{30}$   
 $e^{2x} = 12$   
 $\ln e^{2x} = \ln 12$   
 $2x \ln e = \ln 12$   
 $2x(1) = \ln 12$   
 $\frac{2x}{2} = \frac{\ln 12}{2}$   
 $x = \frac{\ln 12}{2}$

7.  $3^{2x} - 8 \cdot 3^x + 15 = 0$   
 $u = 3^x$   
 $u^2 = 3^{2x}$   
 $u^2 - 8u + 15 = 0$   
 $(u - 5)(u - 3) = 0$   
 $u - 5 = 0 \quad u - 3 = 0$   
 $u = 5 \quad u = 3$   
 $3^x = 5 \quad 3^x = 3$   
 $x = 1$   
 $\frac{\ln 3^x}{\ln 3} = \frac{\ln 5}{\ln 3}$   
 $x \ln 3 = \frac{\ln 5}{\ln 3}$   
 $x = \frac{\ln 5}{\ln 3}$

Solve each logarithmic equation in problems 8 - 12. Be sure to reject any value of  $x$  that is not in the domain of the original logarithmic expression.

8.  $\log_3(x+5)=4$

$$3^4 = x+5$$

$$81 = x+5$$

$$\begin{array}{r} -5 \\ -5 \end{array}$$

$$\boxed{76 = x}$$

9.  $\log_6 x + \log_6(x+5) = 2$

$$\log_6 [x(x+5)] = 2$$

$$6^2 = x(x+5)$$

$$36 = x^2 + 5x$$

$$0 = x^2 + 5x - 36$$

$$0 = (x+9)(x-4)$$

$$x+9=0 \quad x-4=0$$

$$\cancel{x=-9} \quad \boxed{x=4}$$

check  
 $x=-9 \log_6(-9)$   
 no  
 $x=4 \log_6 4$   
 ok  
 $\log_6(4+5)$   
 $\log_6(9)$   
 ok

10.  $\frac{3 \ln x}{3} = \frac{12}{3}$

$$\ln x = 4$$

$$\boxed{e^4 = x}$$

11.  $\log_4 x + \log_4(x+6) = 2$

$$\log_4 [x(x+6)] = 2$$

$$4^2 = x(x+6)$$

$$16 = x^2 + 6x$$

$$0 = x^2 + 6x - 16$$

$$0 = (x+8)(x-2)$$

$$x+8=0 \quad x-2=0$$

$$\cancel{x=-8} \quad \boxed{x=2}$$

check  
 $x=-8 \log_4(-8)$   
 no  
 $x=2 \log_4(2)$   
 $\log_4(2+6)$   
 $\log_4(8)$

12.  $\log_3(x-2)+1=\log_3(3x+1)$

$$1 = \log_3(3x+1) - \log_3(x-2)$$

$$1 = \log_3\left(\frac{3x+1}{x-2}\right)$$

$$3^1 = \frac{3x+1}{x-2}$$

$$3 = \frac{3x+1}{x-2}$$

$$3(x-2) = \frac{3x+1}{x-2} \cdot x-2$$

$$3x-6 = \frac{3x+1}{x-2} \cdot x-2$$

$$-6 = 1$$

No Solution