

MAC1105 College Algebra  
5.4 Practice Problems

Solve each exponential equation.

1.  $4^{2x+4} = 64$

$$4^{2x+4} = 4^3$$

$$2x+4 = 3$$

$$-4 \quad -4$$

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

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

3.  $3^{2x+1} = \frac{1}{27}$

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

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

$$2x+1 = -3$$

$$-1 \quad -1$$

$$2x = -4$$

$$\frac{2x}{2} = \frac{-4}{2}$$

$$x = -2$$

5.  $4^{x+5} = 5^{2x-3}$

$$\ln 4^{x+5} = \ln 5^{2x-3}$$

$$(x+5)\ln 4 = (2x-3)\ln 5$$

$$x\ln 4 + 5\ln 4 = 2x\ln 5 - 3\ln 5$$

$$x\ln 4 - 2x\ln 5 = -3\ln 5 - 5\ln 4$$

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

$$x = \frac{-3\ln 5 - 5\ln 4}{\ln 4 - 2\ln 5}$$

2.  $8^{x+3} = 4^{x-2}$

$$(2^3)^{x+3} = (2^2)^{x-2}$$

$$2^{3(x+3)} = 2^{2(x-2)}$$

$$3x+9 = 2x-4$$

$$-2x \quad -2x$$

$$x+9 = -4$$

$$-9 \quad -9$$

$$x = -13$$

4.  $3^x = 19$

convert

$$\log_3 19 = x$$

or

ln of both

$$\ln 3^x = \ln 19$$

$$\frac{x \ln 3}{\ln 3} = \frac{\ln 19}{\ln 3}$$

$$x = \frac{\ln 19}{\ln 3}$$

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.  $3^{2x} - 8 \cdot 3^x + 15 = 0$

$$u = 3^x$$

$$u^2 = 3^{2x}$$

$$u^2 - 8u + 15 = 0$$

$$(u-5)(u-3) = 0$$

$$u-5=0$$

$$u-3=0$$

$$u=5$$

$$u=3$$

$$3^x = 5$$

$$3^x = 3$$

$$x = 1$$

$$3^x = 5$$

$$\ln 3^x = \ln 5$$

$$\frac{x \ln 3}{\ln 3} = \frac{\ln 5}{\ln 3}$$

$$x = \frac{\ln 5}{\ln 3}$$

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

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

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

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

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

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

$$3x-6 = 3x+1$$

$$\begin{array}{r} -3x \\ -3x \end{array}$$

$$-6 = 1$$

No Solution