

Solve. Some can be solved with the one-to-one property; others must use logarithms.

1.)  $4^{5x-1} = 16^{2x-1}$   
 $4^{5x-1} = (4^2)^{2x-1}$

$5x-1 = 4x-2$   
 $-4x \quad -4x$

$x-1 = -2$   
 $+1 \quad +1$

$x = -1$

2.)  $e^{x^2-3} = e^{2x}$

$x^2 - 3 = 2x$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x = 3 \quad x = -1$

3.)  $(\frac{1}{5})^{x+1} = 125$

$(5^{-1})^{x+1} = 5^3$

$-x-1 = 3$   
 $+1 \quad +1$

$-x = 4$

$x = -4$

4.)  $e^x + 5 = 50$

$e^x = 45$

$\ln 45 = x$

$3.81 = x$

5.)  $4^{2x-7} = 64$

$4^{2x-7} = 4^3$

$2x-7 = 3$   
 $+7 \quad +7$

$\frac{2x}{2} = \frac{10}{2}$

$x = 5$

6.)  $8^{-2-x} = 431$

$\log_8 431 = -2-x$

$\frac{\log 431}{\log 8} = -2-x$

$2.917 = -2-x$   
 $+2 \quad +2$

$4.917 = -x$

$x = -4.917$

7.)  $5^{x-1} = 7$

$\log_5 7 = x-1$

$\frac{\log 7}{\log 5} = x-1$

$1.209 = x-1$   
 $+1 \quad +1$

$x = 2.209$

8.)  $6^{5x-2} = 348$

$\log_6 348 = 5x-2$

$\frac{\log 348}{\log 6} = 5x-2$

$3.266 = 5x-2$   
 $+2 \quad +2$

$\frac{5.266}{5} = \frac{5x}{5}$

$x = 1.053$

9.)  $4^{x+2} - 2 = 12$   
 $+2 \quad +2$

$4^{x+2} = 14$

$\log_4 14 = x+2$

$\frac{\log 14}{\log 4} = x+2$

$1.904 = x+2$   
 $-2 \quad -2$

$x = -.096$

$$10.) 4^{5x-x^2} = 4^{-6}$$

$$5x - x^2 = -6$$

$$-5x + x^2 + x^2 - 5x$$

$$x^2 - 5x - 6 = 0$$

$$(x-6)(x+1) = 0$$

$$x=6 \quad x=-1$$

$$11.) 2^{x-3} = 32$$

$$2^{x-3} = 2^5$$

$$x-3 = 5$$

$$+3 \quad +3$$

$$x=8$$

$$12.) e^{3x} = 12$$

$$\ln 12 = 3x$$

$$\frac{2.485}{3} = \frac{3x}{3}$$

$$x = .828$$

$$13.) 4e^{2x+5} - 6 = 30$$

$$4e^{2x+5} = 36$$

$$e^{2x+5} = 9$$

$$\ln 9 = 2x+5$$

$$2.197 = 2x+5$$

$$\frac{-2.803}{2} = \frac{2x}{2}$$

$$x = -1.401$$

$$14.) 5(10)^{3x-6} + 8 = 63$$

$$\frac{5(10)^{3x-6}}{5} = \frac{55}{5}$$

$$(10)^{3x-6} = 11$$

$$\log_{10} 11 = 3x-6$$

$$\frac{\log 11}{\log 10} = 3x-6$$

$$\log_{10} 1.041 = 3x-6$$

$$\frac{7.041}{3} = \frac{3x}{3}$$

$$x = 2.347$$

$$15.) 4^{3x+4} = 8^{5x-6}$$

$$(2^2)^{3x+4} = (2^3)^{5x-6}$$

$$6x+8 = 15x-18$$

$$8 = 9x-18$$

$$\frac{26}{9} = \frac{9x}{9}$$

$$x = \frac{26}{9} \text{ or } x = 2.89$$

Solve. Check for extraneous solutions. Keep answers in exact form, and then round to 4 decimal places.

$$16.) \log_4 16 = y$$

$$\frac{\log 16}{\log 4} = y$$

$$2 = y$$

$$17.) \log(5-2x) = \log(3x+1)$$

$$5-2x = 3x+1$$

$$5 = 5x+1$$

$$\frac{4}{5} = \frac{5x}{5}$$

$$x = \frac{4}{5} \text{ or } x = .8$$

$$18.) \log_4 x = \frac{1}{2}$$

$$4^{1/2} = x$$

$$\sqrt{4} = x$$

$$x = 2 \quad x = -2 \text{ (extraneous)}$$

$$19.) \ln x = -3$$

$$e^{-3} = x$$

$$x = .0498$$

$$20.) \ln(x+4) - \ln(x-2) = \ln x$$

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

$$\frac{x+4}{x-2} = \frac{x}{1}$$

$$x(x-2) = x+4$$

$$x^2 - 2x = x+4$$

$$x^2 - 3x - 4 = 0$$

$$(x-4)(x+1) = 0$$

$$x = 4$$

$$x = -1 \text{ (extraneous)}$$

$$21.) \log_3 x^2 = 2$$

$$3^2 = x^2$$

$$\sqrt{9} = \sqrt{x^2}$$

$$x = 3$$

22.)  $\log(x-3) + \log x = 1$

$\log(x-3) \cdot x = 1$

$10^1 = x^2 - 3x$

$x^2 - 3x - 10 = 0$

$(x-5)(x+2) = 0$

$x = 5$

~~$x = -2$~~

extraneous

23.)  $\log_2(10x+26) - \log_2(x+3) = 5$

$\log_2 \frac{10x+26}{x+3} = 5$

$2^5 = \frac{10x+26}{x+3}$

$\frac{32}{1} = \frac{10x+26}{x+3}$

$32(x+3) = 10x+26$

No Real solution

$32x + 96 = 10x + 26$   
 $-10x$   
 $22x + 96 = 26$   
 $-96$   
 $22x = -70$   
 $\frac{22x}{22} = \frac{-70}{22}$   
 $x = -3.182$   
 extraneous

24.)  $\log_4(2x^2 - 4x - 6) = \log_4(-5x - 12)$

$2x^2 - 4x - 6 = -5x - 12$

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

$a=2 \quad b=1 \quad c=6$

$x = \frac{-1 \pm \sqrt{(1)^2 - 4(2)(6)}}{2(2)}$

$x = \frac{-1 \pm \sqrt{-47}}{4}$

No Real solution

25.)  $\ln(x-2) + \ln(2x-3) = 2 \ln x$

$\ln(x-2)(2x-3) = \ln x^2$

$(x-2)(2x-3) = x^2$

$2x^2 - 3x - 4x + 6 = x^2$

$x^2 - 7x + 6 = 0$

$(x-6)(x-1) = 0$

$x = 6$

~~$x = 1$~~  extraneous

Graph.

26.)  $y = -4\left(\frac{1}{4}\right)^{x-3} + 2$

Parent Function:  $y = 4\left(\frac{1}{4}\right)^x$

Transformation(s): Right 3  
 up 2

Domain:  $(-\infty, \infty)$

Range:  $(-\infty, 2)$

End Behavior:

as  $x \rightarrow \infty, f(x) \rightarrow 2$

as  $x \rightarrow -\infty, f(x) \rightarrow \infty$

