

* 3 decimal places!

Solving Exponential and Logarithmic Equations

Equal Powers Property: For $b > 0$ and $b \neq 1$, if $b^x = b^y$, then $x = y$.

1. $2^{7x-4} = 2^3$

$$\begin{array}{r} 7x-4 = 3 \\ +4 \quad +4 \end{array}$$

$$\frac{7x}{7} = \frac{7}{7}$$

$$\boxed{x=1}$$

2. $2^{x+2} = 16^{x-4}$

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

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

$$\begin{array}{r} x+2 = 4x-16 \\ -x-16 \quad -x+16 \end{array}$$

$$\frac{18}{3} = \frac{3x}{3}$$

$$\boxed{x=6}$$

3. $5^{x+3} = 5^{4x-9}$

$$\begin{array}{r} x+3 = 4x-9 \\ -x+9 \quad -x+9 \end{array}$$

$$\frac{12}{3} = \frac{3x}{3}$$

$$\boxed{x=4}$$

4. $6^{4x+1} = 36^{8x-1}$

$$6^{4x+1} = (6^2)^{8x-1}$$

$$4x+1 = 2(8x-1)$$

$$\begin{array}{r} 4x+1 = 16x-2 \\ -4x+2 \quad -4x+2 \end{array}$$

$$\frac{3}{12} = \frac{12x}{12}$$

$$\boxed{x=1/4}$$

Taking a Common Logarithm of Each Side

① isolate exponential ② rewrite in log form

5. $9^x = 35$

$$\log_9 35 = x$$

change of base $\rightarrow \frac{\log 35}{\log 9} = x$

$$\boxed{x=1.618}$$

6. $2^x - 4 = 5$

$$\begin{array}{r} +4 \quad +4 \end{array}$$

$$2^x = 9$$

$$\log_2 9 = x$$

$$\frac{\log 9}{\log 2} = x$$

$$\boxed{x=3.17}$$

$$7. \quad e^{3x} = 5$$

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

$$\boxed{x = .536}$$

Practice:

$$9. \quad 3^4 = 3^{3x+1}$$

$$4 = 3x + 1$$

-1

$$3 = 3x$$

$$\boxed{x = 1}$$

$$11. \quad 5^{5x-6} = 25^x$$

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

$$5x - 6 = 2x$$

$$-2x + 6 \quad -2x + 6$$

$$\frac{3x}{3} = \frac{6}{3}$$

$$\boxed{x = 2}$$

$$13. \quad 2^x - 3 = 11$$

$$+3 \quad +3$$

$$2^x = 14$$

$$\log_2 14 = x$$

$$\boxed{x = 3.807}$$

$$15. \quad e^{4x} = 100$$

$$\frac{\ln 100}{4} = \frac{4x}{4}$$

$$\boxed{x = 1.15}$$

$$8. \quad 10^{2x+5} = 6$$

$$\log_{10} 6 = 2x + 5$$

$$.778 = 2x + 5$$

$$-5 \quad -5$$

$$-4.22 = 2x$$

$$\boxed{x = -2.11}$$

$$10. \quad 6^{5x-7} = 6^{18}$$

$$5x - 7 = 18$$

$$+7 \quad +7$$

$$\frac{5x}{5} = \frac{25}{5}$$

$$\boxed{x = 5}$$

$$12. \quad 4^{4x+3} = 64^{2x}$$

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

$$4x + 3 = 6x$$

$$-4x \quad -4x$$

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

$$\boxed{x = 1.5}$$

$$14. \quad 7^{3x} = 5$$

$$\log_7 5 = 3x$$

$$\frac{.827}{3} = \frac{3x}{3}$$

$$\boxed{x = .276}$$

$$16. \quad 10^{4x-5} + 11 = 20$$

$$-11 \quad -11$$

$$4x - 5$$

$$10 \quad = 9$$

$$\log_{10} 9 = 4x - 5$$

$$.954 = 4x - 5$$

$$+5 \quad +5$$

$$\frac{5.954}{4} = \frac{4x}{4}$$

$$\boxed{x = 1.489}$$