

## Solving Exponential Equations – Intermediate Algebra

- Steps:**
1. Isolate the exponential part on one side of the equation.
  2. Take the common logarithm of both sides of the equation.
  3. Use the power property for logarithms to bring the exponent down to the front of the log.
  4. Solve the equation by isolating the variable.

Examples: Solve, round to three decimal places.

1.  $8^{4x} + 10 = 47$

$$\frac{-10 \quad -10}{8^{4x} = 37}$$

$$\log 8^{4x} = \log 37$$

$$4x \log 8 = \log 37$$

↑    ↑

$$x = \frac{\log(37)}{4 \log(8)} = .4341211138$$

0.434

2.  $5(3)^{x+7} = 30$

① Isolate:  $\div 5$   $\frac{5(3)^{x+7}}{5} = \frac{30}{5}$

② Common log  $3^{x+7} = 6$

$$\log 3^{x+7} = \log(6)$$

③  $(x+7) \log(3) = \log(6)$

④  $x+7 = \frac{\log(6)}{\log(3)}$

$$x = \frac{\log(6)}{\log(3)} - 7 = -3.904096726$$

X = -5.369

~~-3.904~~

always check!

3.  $4^{2x-5} = 264$

Isolate ✓

$$4^{2x-5} = 4^4$$

$$2x-5 = 4$$

$$2x = 9$$

$$x = \frac{9}{2} = 4.5$$

log:  $\log 4^{2x-5} = \log 264$

pow prop:  $(2x-5) \log(4) = \log(264)$

$$2x-5 = \frac{\log(264)}{\log(4)}$$

$$2x = \frac{\log(264)}{\log(4)} + 5$$

$$x = \frac{1}{2} \left( \frac{\log(264)}{\log(4)} + 5 \right)$$

X ≈ 4.511

4.  $5^{3x} = 5.6$

$$\log 5^{3x} = \log 5.6$$
$$3x \log(5) = \log(5.6)$$
$$x = \frac{\log(5.6)}{(3 \log(5))} \approx 0.356805$$

0.357

~~P~~  
~~E~~  
\*MD\*  
AS

5.  $2(8)^{x-2} = 24$

$$\frac{2}{2} \frac{(8)^{x-2}}{2} = \frac{24}{2}$$
$$8^{x-2} = 12$$

$$\log 8^{x-2} = \log(12)$$
$$(x-2) \log(8) = \log(12)$$

$$x-2 = \frac{\log(12)}{\log(8)}$$

$$x = \frac{\log(12)}{\log(8)} + 2 \approx 3.1949875$$

3.195

6.  $3^x - 9 = 21$

$$\frac{+9 + 9}{+9 + 9}$$

$$3^x = 30$$

$$\log 3^x = \log 30$$

$$x \log 3 = \log 30$$

$$x = \frac{\log(30)}{\log(3)} \approx 3.095903274$$

exact

decimal approx

3.096