Name: ___________________________ Date: ____________________

Learning Goal 8.1	Solving exponential and logarithmic equations with same base and with different bases, including base e.

More Questions - Solutions

Power Law	**Product Law**	**Quotient Law**	**Change of Base**
$\log_b x^y = y \log_b x$	$\log_b(xy) = \log_b x + \log_b y$	$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$	$\log_b x = \frac{\log_a x}{\log_a b}$

1. Solve for x. Round your answers to the nearest hundredth.

a. $2^z = 2500$

$$\log(2^x) = \log(2500)$$
$$x\log(2) = \log(2500)$$
$$x = \frac{\log(2500)}{\log(2)}$$
$$x \approx 11.29$$

b. $5^{x-3} = 1700$

$$\log(5^{x-3}) = \log(1700)$$
$$(x-3)\log(5) = \log(1700)$$
$$x - 3 = \frac{\log(1700)}{\log(5)}$$
$$x = \frac{\log(1700)}{\log(5)} + 3$$
$$x \approx 7.62$$

c. $8(3^{2x}) = 568$

$$3^{2x} = 71$$
$$\log(3^{2x}) = \log(71)$$
$$2x\log(3) = \log(71)$$
$$2x = \frac{\log(71)}{\log(3)}$$
$$x = \frac{\log(71)}{2\log(3)}$$
$$x \approx 1.94$$

d. $6^{3x+1} = 8^{x+3}$

$$\log(6^{3x+1}) = \log(8^{x+3})$$
$$(3x+1)\log(6) = (x+3)\log(8)$$
$$3x\log 6 + \log 6 = x\log 8 + 3\log 8$$
$$3x\log 6 + \log 6 = x\log 8 + \log 512$$
$$3x\log 6 - x\log 8 = \log 512 - \log 6$$
$$x(3\log 6 - \log 8) = \log\left(\frac{512}{6}\right)$$
$$x(\log 216 - \log 8) = \log\left(\frac{256}{3}\right)$$
$$x\log\left(\frac{216}{8}\right) = \log\left(\frac{256}{3}\right)$$
$$x\log(27) = \log\left(\frac{256}{3}\right)$$
$$x = \log\left(\tfrac{256}{3}\right)\Big/\log(27)$$
$$x \approx 1.35$$

e. $4(7^{x+2}) = 9^{2x-3}$

$$\log\left(4(7^{x+2})\right) = \log(9^{2x-3})$$
$$\log(4) + \log(7^{x+2}) = \log(9^{2x-3})$$
$$\log(4) + (x+2)\log(7) = (2x-3)\log(9)$$
$$\log(4) + x\log(7) + 2\log(7) = 2x\log(9) - 3\log(9)$$
$$\log(4) + x\log(7) + \log(49) = x\log(81) - \log(729)$$
$$x\log(7) - x\log(81) = -\log(729) - \log(4) - \log(49)$$
$$x(\log 7 - \log 81) = \log\left(\frac{1}{729}\right) + \log\left(\frac{1}{4}\right) + \log\left(\frac{1}{49}\right)$$
$$x\log\left(\frac{7}{81}\right) = \log\left(\frac{1}{729} \times \frac{1}{4} \times \frac{1}{49}\right)$$
$$x\log\left(\frac{7}{81}\right) = \log\left(\frac{1}{142\,884}\right)$$
$$x = \log\left(\frac{1}{142\,884}\right) \Big/ \log\left(\frac{7}{81}\right)$$
$$x \approx -4.85$$

2. Find the half – life of an isotope if 10 grams of a 150 gram sample remains after 21.9 days.

$$w(t) = w_0 \times \left(\frac{1}{2}\right)^{\frac{t}{t_H}}$$

$$10 = 150 \times \left(\frac{1}{2}\right)^{\frac{21.9}{t_H}}$$
$$\frac{10}{150} = \left(\frac{1}{2}\right)^{\frac{21.9}{t_H}}$$
$$\frac{1}{15} = \left(\frac{1}{2}\right)^{\frac{21.9}{t_H}}$$
$$\log\left(\frac{1}{15}\right) = \log\left(\left(\frac{1}{2}\right)^{\frac{21.9}{t_H}}\right)$$
$$\log\left(\frac{1}{15}\right) = \left(\frac{21.9}{t_H}\right)\log\left(\frac{1}{2}\right)$$
$$t_H\log\left(\frac{1}{15}\right) = 21.9\log\left(\frac{1}{2}\right)$$
$$t_H = 21.9\log\left(\frac{1}{2}\right) \Big/ \log\left(\frac{1}{15}\right)$$
$$t_H \approx 5.60$$

The half – life of the isotope is approximately 5.6 days.