

Name: _____

Date: _____

Learning Goal 8.1Solving exponential and logarithmic equations with same base and with different bases, including base e .**More Questions - Solutions**

1. Solve and check.

a. $5^{x+1} \times 5^x = 625$

$$5^{x+1} \times 5^x = 5^4$$

$$5^{2x+1} = 5^4$$

$$2x + 1 = 4$$

$$2x = 3$$

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

b. $\frac{8^{x+6}}{16^{2x-1}} = 32^{3x-4}$

$$\frac{(2^3)^{x+6}}{(2^4)^{2x-1}} = (2^5)^{3x-4}$$

$$\frac{2^{3(x+6)}}{2^{4(2x-1)}} = 2^{5(3x-4)}$$

$$\frac{2^{3x+18}}{2^{8x-4}} = 2^{15x-20}$$

$$2^{(3x+18)-(8x-4)} = 2^{15x-20}$$

$$2^{22-5x} = 2^{15x-20}$$

$$22 - 5x = 15x - 20$$

$$22 = 20x - 20$$

$$42 = 20x$$

$$x = \frac{42}{20}$$

$$= \frac{21}{10}$$

c. $2^{x-1} \times 4^{3x} = \left(\frac{1}{8}\right)^{4-x}$

$$2^{x-1} \times (2^2)^{3x} = \left(\frac{1}{2^3}\right)^{4-x}$$

$$2^{x-1} \times 2^{6x} = (2^{-3})^{4-x}$$

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

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

$$2^{7x-1} = 2^{3x-12}$$

$$7x - 1 = 3x - 12$$

$$4x - 1 = -12$$

$$4x = -11$$

$$x = -\frac{11}{4}$$

d. $(5^3)^{x^2+5} = \left(\frac{1}{5^2}\right)^{-2x^2+4}$

$$5^{3(x^2+5)} = \left(\frac{1}{5^2}\right)^{-2x^2+4}$$

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

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

$$5^{3x^2+15} = 5^{4x^2-8}$$

$$3x^2 + 15 = 4x^2 - 8$$

$$15 = x^2 - 8$$

$$23 = x^2$$

$$x = \pm\sqrt{23}$$

2. Strontium – 90 has a half – life of 25 years.
- a. Write an equation to determine the amount of Strontium – 90 remaining as a function of the number of years.

$$A = A_0 \left(\frac{1}{2}\right)^{t/25}$$

- b. How much time has elapsed if only $\frac{1}{32}$ of the strontium – 90 remains in a sample?

$$\begin{aligned} \frac{1}{32} &= \frac{1}{2^5} \\ &= \left(\frac{1}{2}\right)^5 \\ 5 &= \frac{t}{25} \\ t &= 125 \text{ years} \end{aligned}$$

- c. Approximately how long will it take until 100 gram sample decays to 15 grams?

$$\begin{aligned} 15 &= 100 \left(\frac{1}{2}\right)^{t/25} \\ \frac{15}{100} &= \left(\frac{1}{2}\right)^{t/25} & 0.15 &\approx \frac{1}{8} \\ \frac{1}{8} &\approx \left(\frac{1}{2}\right)^{t/25} \\ \left(\frac{1}{2}\right)^3 &\approx \left(\frac{1}{2}\right)^{t/25} \\ 3 &\approx \frac{t}{25} \\ t &\approx 75 \text{ years} \end{aligned}$$