

7.5 Day 1: Exponential and Logarithmic Eqs.

Ex. Solving an Exponential Equation – Common Base

Multiple Choice What is the solution of $16^{3x} = 8$?

(A) $x = \frac{1}{4}$

(B) $x = \frac{3}{7}$

(C) $x = 1$

(D) $x = 4$

$$2^{4 \cdot 3x} = 2^3$$

$$12x = 3$$

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

Feb 26-3:15 PM

Ex. What is the solution of $15^{3x} = 285$?

$$\log(15)^{3x} = \log(285)$$

$$3x \cdot \frac{\log(15)}{\log(15)} = \frac{\log(285)}{\log(15)}$$

$$3x = 2.0873$$

$$x \approx 0.6958$$

What's different about this problem? Why can't we use the same strategy as the last problem?

Feb 26-3:19 PM

Ex. Solve.

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

$$\quad \quad \quad \underline{-3} \quad \quad \underline{-3}$$

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

$$(3x-4) \cdot \frac{\log(2)}{\log(2)} = \frac{\log(5)}{\log(2)}$$

$$3x-4 = 2.321928095$$

$$x \approx 2.1073$$

Isolate the exponential term first!

Then take the "log" of both sides to "get the exponent down."

Feb 26-3:26 PM



Apply to Word Problems:



Resource Management Wood is a sustainable, renewable, natural resource when you manage forests properly. Your lumber company has 1,200,000 trees. You plan to harvest 7% of the trees each year. How many years will it take to harvest half of the trees?

Remember the exponential model is $y = a(1+r)^x$

Where a = initial amount, r = rate growth/decay, x = time periods and y = amount after x time periods.

$$\frac{600000}{1200000} = \frac{1200000}{1200000} (1 - .07)^x$$

$$0.5 = (0.93)^x$$

$$\log(0.5) = \log(0.93)^x$$

$$\frac{\log(0.5)}{\log(0.93)} = x$$

$$x \approx 9.55 \text{ yrs.}$$

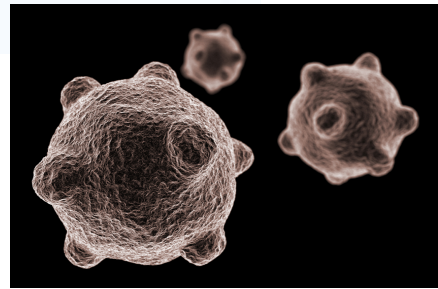
Feb 26-3:29 PM

Ex. A culture of 10 bacteria is started, and the number of bacteria will double every hour. In about how many hours will there be 3,000,000 bacteria?

$$\frac{3\,000\,000}{10} = \frac{10}{10} (1+1)^x \quad \begin{matrix} 100\% \\ 1.00 \end{matrix}$$

$$300000 = (2)^x$$

$$\frac{\log(300000)}{\log(2)} \rightsquigarrow \boxed{x \approx 18.19 \text{ hrs.}}$$



Feb 26-3:34 PM

Check for Understanding

1. Solve. $6^{3x+1} = 215$

$$3x+1 = \frac{\log(215)}{\log(6)}$$

$$3x+1 = 2.997410155$$

$$\boxed{x \approx 0.6658}$$

2. Suppose you deposit \$2500 in a savings account that pays you 5% interest per year. Use: $y = a(1+r)^x$

How many years will it take for your account to reach \$8,000?

$$\frac{8000}{2500} = \frac{2500}{2500} (1+0.05)^x$$

$$3.2 = (1.05)^x$$

$$\frac{\log(3.2)}{\log(1.05)} = x$$

$$x \approx 23.84 \text{ yrs}$$

$$\boxed{24 \text{ yrs}}$$



Feb 26-3:38 PM

Homework:

P. 473:

#'s: 7-22, 31, 49, 89-99 odds

Feb 26-3:45 PM