Answer to Question #84208 – Math – Algebra

Question

In an exponential decay process given by $M = M_0 e^{-kt}$ the original amount M_0 has been reduced by a factor 16 in 321 days. How many days did it take to be reduced by a factor of 2? What is the value of k?

Solution

$$\frac{M_0}{16} = M_0 e^{-321k}$$

$$\frac{1}{16} = e^{-321k}$$

$$\ln \frac{1}{16} = -321k$$

$$k = -\frac{1}{321} \cdot \ln \frac{1}{16} = 0.00864$$

$$M = M_0 e^{-0.00864t}$$

$$\frac{M_0}{2} = M_0 e^{-0.00864t}$$

$$\frac{1}{2} = e^{-0.00864t}$$

$$\ln \frac{1}{2} = -0.00864t$$

$$t = -\frac{1}{0.00864} \cdot \ln \frac{1}{2} = 80.225 \approx 80 \ days.$$

Answer: about 80 days, $k = -\frac{1}{321} \cdot \ln \frac{1}{16} = 0.00864$.