

12. An anthropologist studying the bones of a prehistoric person knows that there were originally 172 milligrams of Carbon-14 in the tibia. How old is the bone if there are 13 milligrams of Carbon-14 remaining?

$$y = ae^{-kt}$$

$$13 = 172e^{-.00012t}$$

$$\ln \frac{13}{172} = \ln e^{-.00012t}$$

$$\frac{\ln\left(\frac{13}{172}\right)}{-.00012} = \frac{-.00012t}{-.00012}$$

$$yrs = t$$

15. The element plutonium-239 is highly radioactive.

Nuclear reactors can produce and also use this element. If the half-life of plutonium-239 is 24,360 years, what is the value of k for this element?

$$\frac{5}{10} = \frac{10e}{10}$$

$$.5$$

$$y = ae^{-kt}$$

$$\frac{1}{2}a = \frac{ae^{-k(24,360)}}{a}$$

$$\ln \frac{1}{2} = \ln e^{-24,360k}$$

$$\frac{\ln \frac{1}{2}}{-24,360} = \frac{-24,360k}{-24,360}$$

$$\approx k$$

$$\frac{15}{30} = \frac{30e}{30}$$

16. A certain medication is eliminated from the bloodstream at a steady rate. It decays according to the equation $y = ae^{-0.25t}$, where t is in hours. After 5 hours, a patient still has 22 cc's of the medication still in their bloodstream. How much of the medication was originally administered?

$$\frac{22}{e^{-0.25(5)}} = \frac{ae^{-0.25(5)}}{e^{-0.25(5)}} \approx a$$

7. A home was purchase in 2003 for \$152,000. In 2012, the home was worth \$175,000. To the nearest tenth of a percent, what was the rate of inflation per year?

$$y = a(1+r)^t$$

$$\frac{175,000}{152,000} = \frac{152,000(1+r)^9}{152,000}$$

$$\sqrt[9]{\frac{175}{152}} = \sqrt[9]{(1+r)^9}$$

$$\sqrt[9]{\frac{175}{152}} = 1+r$$

$$\sqrt[9]{\frac{175}{152}} - 1 = r$$

$$\approx r$$

$$\%$$

6. Hugo begins a walking program by walking $\frac{1}{2}$ mile per day for one week. Each week thereafter he increases his mileage by 10%. After how many weeks is he walking more than 5 miles per day?

$$y = a(1+r)^t$$

$$\frac{5}{\frac{1}{2}} = \frac{\frac{1}{2}(1+.1)^t}{\frac{1}{2}}$$

$$\log 10 = \log 1.1^t$$

$$\frac{\log 10}{\log 1.1} = \frac{t \log 1.1}{\log 1.1}$$

$$24.159 \approx t$$

$$\text{25 weeks}$$