More on Applications

The population of River Oaks in 1950 was 6500. If the population is growing at a rate of 8% per year, in how many years will it reach 10,000?

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

$$\frac{10000}{6500} = \frac{\cancel{6500}(1+.08)^x}{\cancel{6500}}$$

Isolate the exponential

$$\log \frac{10,000}{6,500} = \log(1+.08)^x$$

take the log of both sides

$$\frac{\log\left(\frac{10000}{6500}\right)}{\log 1.08} = \frac{x \log \cancel{1.08}}{\cancel{\log 1.08}}$$

$$\boxed{5.6 \text{ yrs} = x}$$

Bacteria is doubling every hour. If there are 68 present initially, how long will it take to have 700?

$$\frac{700}{68} = \frac{\cancel{68}(2)^x}{\cancel{68}}$$

$$\log \frac{700}{68} = \log(2)^x$$

$$\frac{\log\left(\frac{700}{68}\right)}{\log 2} = \frac{x \log(\cancel{2})}{\cancel{\log 2}}$$

$$x = 3.4 \text{ hrs}$$

If I invest $5000 in a bank that pays 5% interest compounded monthly, how many years will it take for my investment to reach $15,000?

$$y = P\left(1+\frac{r}{n}\right)^{nt}$$

$$\frac{15{,}000}{5000} = \frac{\cancel{5000}\left(1+\frac{.05}{12}\right)^{12x}}{\cancel{5000}}$$

$$\log 3 = \log\left(1+\frac{.05}{12}\right)^{12x}$$

$$\frac{\log 3}{\log\left(1+\frac{.05}{12}\right)} = \frac{12x \log\left(1+\frac{.05}{12}\right)}{\cancel{\log\left(1+\frac{.05}{12}\right)}}$$

$$= 12x$$

$$22.02 = x$$

Suppose the half-life of a certain radioactive material is $\boxed{\text{20 days}}$ and there are $\boxed{\text{10 grams}}$ initially. In how many days will there be 2 grams left?

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

$$\frac{2}{10} = \frac{\cancel{10}(0.5)^{\frac{x}{20}}}{\cancel{10}}$$

$$\log\frac{2}{10} = \log(0.5)^{\frac{x}{20}}$$

$$\frac{\log 2/10}{\log .5} = \frac{x}{20}\cancel{\log(.5)}$$

$$20 \cdot \frac{\log 2/10}{\log .5} = \frac{x}{\cancel{20}}\cancel{20}$$

$$x = 46.44$$