Name **Key**

Logs and Exponentials Applications

Set up each problem and solve.

→ rate 100%

1. A bacterial culture doubles every 2 hours. If the culture started with 14,000 bacteria, how many bacteria will be present in 5 hours?

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

$$y = 14,000(2)^{5/2}$$

$$y \sim 79195.96 \text{ bacteria}$$

2. A radioactive sample has a half-life of 3 years, and has an initial mass of 68 mg. How many months will it take for the sample to lose 8 g?

$$y = P(\tfrac{1}{2})^{t/n}$$

$$60 = 68(\tfrac{1}{2})^{t/3}$$

$$t \sim .5417 \text{ yrs}$$

$$\sim 6.5 \text{ months}$$

3. $2500 is invested at 6.4% compounded quarterly for 4 years. How much money will there be after 4 years?

$$y = P(1+\tfrac{\%}{4})^{4t}$$
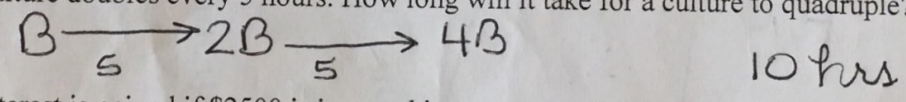
$$y = 2500(1 + \tfrac{.064}{4})^{16}$$

$$y = \$3222.84$$

4. How much money needs to be invested into an account that earns 5% interest compounded monthly in order to have a total of $19,143.49 after 7 years?

$$y = P(1+\tfrac{\%}{12})^{12t}$$

$$19143.49 = P(1 + \tfrac{.05}{12})^{12\cdot7}$$

$$P = \$13,500$$

5. How long will it take to double my money in an account that is compounded continuously at a rate of 7.1%?

$$y = Pe^{rt}$$

$$200 = 100e^{.071t}$$

$$t \sim 9.76 \text{ yr}$$

6. A bacterial culture doubles every 5 hours. How long will it take for a culture to quadruple?

$$B \xrightarrow{5} 2B \xrightarrow{5} 4B$$

10 hrs

7. How much interest is gained if $2500 is invested into an account that earns 5.3% interest compounded quarterly after 5 years?

$$y = 2500(1 + \tfrac{.053}{4})^{4(5)}$$

$$y = 2500(1 + \tfrac{.053}{4})^{20}$$

$$\$752.91 \text{ gain}$$

8. What interest rate is needed if an initial investment of $5000 is compounded continuously for 4 years and results in a total of $6058.35?

$$6058.35 = 5000e^{r(4)}$$

$$6058.35 = 5000e^{4r}$$

$$r = 4.8\%$$

9. A radioactive sample has a half-life of 3 days. How long will it take for only 1/8 of the sample to remain?

$$\tfrac{1}{8} = 1(\tfrac{1}{2})^{t/3}$$

$$y = 8(\tfrac{1}{2})^{t/3}$$

$$t = 9 \text{ days}$$

10. The population of a town triples every 6 years. If 4000 people are present in 2006, how many people will be in the town in 2016?

$$y = .4000$$

$$y = 4000(3)^{10/6}$$

$$y \approx 24.961.006 \text{ people}$$