

# ANSWERS

## MORE PRACTICE: Applications 1

1. A wildfire is burning in, what is roughly, a circle. The fire is currently 100 square feet. The fire is doubling in size every 10 hours. How long until the fire is 1000 square feet?

$$F = 100(2)^t \quad t = \log_2 1000 = \frac{\log 1000}{\log 2} = 6.64 \text{ time increments of 10 hours}$$

$$1000 = 10(2)^t$$

$$100 = 2^t \quad \text{So } 6.64 \times 10 \text{ hours} = 66.4 \text{ hours}$$

2. Rutherfordium-261 has a half-life of 81 seconds. If you have 50 ounces of Ru-261:

- a. How much will you have in 1 hour?

$$\text{stuff} = 50 \left(\frac{1}{2}\right)^{t/81} = 50 \left(\frac{1}{2}\right)^{\frac{3600}{81}} = 50 \left(\frac{1}{2}\right)^{44.\bar{4}} = 2.089 \times 10^{-12} \text{ ounces}$$

- b. How long until you have 5 ounce left?

$$5 = 50 \left(\frac{1}{2}\right)^{t/81}$$

$$0.1 = \left(\frac{1}{2}\right)^{t/81} \Rightarrow t/81 = \log_{1/2} 0.1 = \frac{\log 0.1}{\log 0.5} = 3.32 \quad \begin{matrix} 81 \times t/81 = 3.32 \times 81 \\ t = 269 \text{ seconds} \end{matrix}$$

$(\frac{1}{2} = 0.5)$

3. The population of Sweden is 9,918,869. It is expected that the population is growing at a rate of 6% annually. How long until the population is 15,000,000?

$$P = 9918869(1+0.06)^t \quad t = \log_{1.06} 1.512$$

$$\frac{15,000,000}{9918869} = \frac{9,918,869}{9918869} (1.06)^t \quad = \frac{\log 1.512}{\log 1.06} = 7.095 \text{ years}$$

$$1.512 = 1.06^t$$

4. The population of Estonia is 1,305,980. The population of this country is decreasing by 6% every year. How long until the population is 1,000,000?

$$P = 1305980(1-0.06)^t$$

$$\frac{1000000}{1305980} = \frac{1305980}{1305980} (0.94)^t$$

$$0.7657 = 0.94^t$$

$$t = \log_{0.94} 0.7657 = \frac{\log 0.7657}{\log 0.94} = 4.31 \text{ years}$$