$201.81

# 6.6 MORE APPLICATIONS OF EXPONENTS AND LOGARITHMS

1. The half-life of Cesium-137 is 30.2 years. If the initial mass of the sample is 15 kg, how much will remain after 151 years? $A = 15\left(\frac{1}{2}\right)^{151/30.2}$

   $A = 0.46875$ $\boxed{0.469\text{ kg}}$

2. Myerstopia has a population of 6000. After 10 years, the population has increased exponentially to 7183 people. How many people will be living in Myerstopia after 23 years? $7183 = 6000(b)^{10}$ $b = \sqrt[10]{\frac{7183}{6000}}$ $y = 6000(1.018158665)^{23}$

   $\frac{7183}{6000} = b^{10}$ $b = 1.018158665$ $y = 9076.2587$ $\boxed{9076\text{ people}}$

3. A loaf of bread that currently sells for \$3.60 sold for \$3.10 six years ago. At what rate has the cost of the loaf of bread increased each year?

   $3.60 = 3.10(b)^6$ $b = \sqrt[6]{\frac{3.6}{3.1}} = 1.0252$ $\boxed{2.52\%}$

   $1.161290323 = b^6$

4. A diamond ring currently worth \$3000 increases in value by 8% each year. What is the value of the ring in 50 years? $y = 3000(1.08)^{50}$ $\boxed{\$140,704.84}$

   $y = 140704.8375$

5. Carbon-14 has a half-life of 5700 years. Find the age of a sample at which 22% of the radioactive nuclei originally present have decayed. $x = \frac{(\ln 0.88)\cdot 570}{\ln(\frac{1}{2})}$ $\boxed{105.122\text{ years}}$

   $88 = 100\left(\frac{1}{2}\right)^{x/570}$ $0.88 = \left(\frac{1}{2}\right)^{x/570}$ $\ln(0.88) = \frac{x}{570}(\ln\frac{1}{2})$

   $\ln(0.88) = \ln\left(\frac{1}{2}\right)^{x/570}$ $x = 105.122$

6. A population of 100 rabbits are living on an island. After one year, the rabbit population has increased exponentially to 500 rabbits. What will the population be after another 6 months? $500 = 100(b)^1$ $y = 100(5)^{1.5}$

   $5 = b$ $y = 1118.033989$

   $\boxed{1118\text{ rabbits}}$

7. Carbon-14 has a half-life of 5700 years. Consider a sample of fossilized wood that when alive would have contained 24g of C-14. It now contains 1.5g. How old is the sample?

   $1.5 = 24\left(\frac{1}{2}\right)^{x/5700}$ $0.0625 = \left(\frac{1}{2}\right)^{x/5700}$ $\ln .0625 = \ln\left(\frac{1}{2}\right)^{x/5700}$ $x = \frac{(\ln 0.0625)5700}{\ln(\frac{1}{2})} = \boxed{22800\text{ years}}$

   $\ln 0.0625 = \frac{x}{5700}\ln\left(\frac{1}{2}\right)$

8. The half-life of a radioactive element is 133 days, but your sample will not be useful to you after 65% of the radioactive nuclei originally present have disintegrated. About how many days can you use the sample?

   $65 = 100\left(\frac{1}{2}\right)^{x/133}$ $\ln(0.65) = \ln(0.5)^{x/133}$ $x = \frac{\ln(0.65)\cdot 133}{\ln(0.5)}$ $\boxed{82\text{ days}}$

   $0.65 = \left(\frac{1}{2}\right)^{x/133}$ $\ln(0.65) = \frac{x}{133}\cdot\ln 0.5$ $x = 82.65795411$