Pg. 228, # 13 Given: $A = \$10{,}000$; $r = 4\% = 0.04$

For interest compounded continuously, use: $A = Pe^{rt}$

For the time to double, solve:

$20{,}000 = 10{,}000\, e^{0.04t} \Rightarrow 2 = e^{0.04t} \Rightarrow \ln 2 = \ln e^{0.04t}$

$\Rightarrow 0.04t = \ln 2 \Rightarrow t = (\ln 2)/0.04 = \boxed{17.3 \text{ years}}$

In 10 years: $A = 10{,}000\, e^{0.04(10)} = \boxed{\$ 14{,}918.25}$

Pg. 229, #30 Given: $\tfrac{1}{2}$-life $= 87.74$ yrs. ; $A(1000) = 0.1\text{g}$

For radioactive decay, use: $A = A_0 e^{rt}$

To find the rate of decay, solve:

$\tfrac{1}{2} A_0 = A_0 e^{r \cdot (87.74)} \Rightarrow \tfrac{1}{2} = e^{r \cdot (87.74)}$

$\Rightarrow \ln(\tfrac{1}{2}) = \ln e^{r \cdot (87.74)} \Rightarrow \ln(\tfrac{1}{2}) = r \cdot (87.74)$

$\Rightarrow r = \ln(\tfrac{1}{2})/87.74 = -0.0079$

To find A_0, solve: $0.1 = A_0 e^{-0.0079(1000)}$

$\Rightarrow 0.1 = A_0 (0.000371) \Rightarrow A_0 = \dfrac{0.1}{0.000371} = \boxed{269.7\text{g}}$

Pg. 230, #40 Given: ½-life = 1600 years

For radioactive decay, use: $A = A_0 e^{rt}$

To find the rate of decay, solve:

$\frac{1}{2} A_0 = A_0 e^{r \cdot 1600} \Rightarrow \frac{1}{2} = e^{r \cdot 1600}$

$\Rightarrow \ln(\frac{1}{2}) = \ln e^{r \cdot 1600} \Rightarrow \ln(\frac{1}{2}) = r \cdot 1600$

$\Rightarrow r = \ln(\frac{1}{2})/1600 = -0.000433$

So, after 100 years,

$A = A_0 e^{-0.000433(100)} = A_0 e^{-0.0433} = 0.957 A_0$

Thus, 95.7% of the original amount remains.

Pg 229, #35 Given: $P = 90 e^{0.013t}$

a) The population has been increasing since the exponent is positive.

b) In 2006: $P(6) = 90 e^{0.013(6)} = 97{,}301$

In 2009: $P(9) = 90 e^{0.013(9)} = 101{,}171$

In 2012: $P(12) = 90 e^{0.013(12)} = 105{,}194$

c) To find when the population is 116,000, solve:

$116 = 90 e^{0.013t} \Rightarrow 116/90 = e^{0.013t}$

$\Rightarrow \ln(116/90) = \ln e^{0.013t} = 0.013t$

$\Rightarrow t = \ln(116/90)/0.013 = 19.5$

So, in the year $\boxed{2019.}$