

# AP CALCULUS AB

- 1) In 1970, the population of Australia was 12.51 million people. In 2010, it was 22.03 million. Estimate the population of Australia in 2030.

$$1970 \Rightarrow t=0$$

$$p = p_0 e^{kt}$$

$$p = 12.51 e^{kt}$$

$$2010 \Rightarrow t = 40$$

$$22.03 = 12.51 e^{40k}$$

$$e^{40k} = \frac{22.03}{12.51}$$

$$40k = \ln\left(\frac{22.03}{12.51}\right)$$

$$k = \frac{1}{40} \ln\left(\frac{22.03}{12.51}\right) = 0.014111 / \text{yr}$$

$$2030 \Rightarrow t = 60$$

$$p = 12.51 e^{60k} = 29.23 \text{ million}$$

# EXPONENTIAL GROWTH AND DECAY

- 2) A sample containing 100% of radioactive Uranium-235 (U-235) will have 60% of the U-235 remaining after 500 million years. What percentage of the U-235 will be left after 800 million years?

$$C = C_0 e^{-kt}$$

$$0.6 C_0 = C_0 e^{-k(500 \times 10^6)}$$

$$\ln 0.6 = -k(500 \times 10^6)$$

$$k = -\frac{\ln 0.6}{500 \times 10^6} = -1.0217 \times 10^{-9} / \text{yr}$$

$$C = C_0 e^{-(800 \times 10^6)k} = 0.4416 C_0$$

$$44.16\%$$