Quiz 15

Name: _____

Solutions given without showing work will earn a zero. Circle your answers.

Problem 1. **[3+3=6 points]** A small town had a population of 35,000 people in 1990. By 2015 the population had grown to 50,000.

(a) Find an exponential growth model $f(t) = A_0e^{kt}$ that describes the town's population, where t represents the number of years after 1990. Round k to 3 decimal places.

$t=0 \to 1990$

$f(0) = 35{,}000 = A_0$

$f(t) = 35{,}000\,e^{kt}$

$2015 \to t = 25$

$f(25) = 50{,}000$

$\frac{50{,}000}{35{,}000} = \frac{35{,}000\,e^{k(25)}}{35{,}000}$

$1.4286 = e^{k(25)}$

$\ln(1.4286) = k(25)$

$\frac{0.3567}{25} = \frac{k(25)}{25}$

$k = 0.014$

$f(t) = 35{,}000\,e^{0.014t}$

(b) According to your model in Part (a), in what year will the town's population reach 60,000?

$\frac{60{,}000}{35{,}000} = \frac{35{,}000\,e^{0.014t}}{35{,}000}$

$1.7143 = e^{0.014t}$

$\ln(1.7143) = 0.014t$

$\frac{0.5390}{0.014} = \frac{0.014t}{0.014}$

$t \approx 38$

$1990 + 38 = 2028$

Problem 2. **[4 points]** The half-life of a certain radioactive chemical is 17 years. Find the value of k in the exponential decay model $f(t) = A_0e^{kt}$ for this chemical. Round k to 3 decimal places.

$\frac{0.5A_0}{A_0} = \frac{A_0e^{17k}}{A_0}$

$0.5 = e^{17k}$

$\ln(0.5) = 17k$

$\frac{-0.6931}{17} = \frac{17k}{17}$

$k = -0.041$