Objective 2 - Construct Correct Model

Note: There are no textbook or videos directly to this section. If you want to review a certain type of model, you will need to go back to that Module.

General tips to constructing a model:

- Identify the appropriate function to model the situation.
- Try introducing small numbers to check your model. *For example, if you need to model population growth, try using a small population like 10 to make sure you are seeing the growth you expect.*
- Check your units and variables.

Question 1 *Chemists commonly create a solution by mixing two products of differing concentrations together. For example, a chemist could have large amounts of a 15% acid solution and a 40% acid solution, but need a 9 liter 22% solution. Construct a model that describes the amount of acid in a 22% acid solution, A_{22}, in terms of the volume of the 15% acid solution, v.*

$A_{22} = \boxed{-0.250000000000000\, v + 3.60000000000000}$

Question 2 *There is initially 531 grams of element X. The half-life of element X is 488188 years. Describe the amount of element X remaining as a function of time, t, in years.*

$X(t) = \boxed{531}\ \boxed{e}^{\boxed{-\frac{1}{488188}\log(2)\, t}}$

Question 3 *A company sells doughnuts. They incur a fixed cost of \$18000 for rent, insurance, and other expenses. It costs \$0.05 to produce each doughnut. The company sells each doughnut for \$0.05. Construct a model that describes their total revenue, R, as a function of the number of doughnuts, x, they produce.*

$R(x) = \boxed{-18000}$

Learning outcomes:
Author(s): Darryl Chamberlain Jr.

Question 4 *Kepler's Third Law: The square of the time, T, required for a planet to orbit the Sun is directly proportional to the cube of the mean distance, a, that the planet is from the Sun. Assume that Mars' mean distance from the Sun is 3 AUs and it takes Mars about 251.16 months to orbit the Sun. Write the equation that describes time T (years) in terms of the mean distance, a (AUs).*

$T(a) = \boxed{4.028}\, a^{\boxed{3/2}}$

Question 5 *The half-life of carbon-14 is 5,730 years. Describe the age in years of an object in terms of the ratio of carbon-14, $r = \dfrac{C}{C_0}$, remaining.*

$t(r) = \boxed{-8266.64258429376}\ln(\boxed{r})$

Question 6 *Two UFPD are patrolling the campus on foot. To cover more ground, they split up and begin walking in different directions. Office A is walking at 5 mph while Office B is walking at 3 mph. Construct a model that describes their total distance from each other, T_2, as a function of minutes, m, that have passed if they were walking in exactly 90 degrees from each other (e.g., North/East).*

$T_2(m) = \boxed{\dfrac{1}{30}\sqrt{\dfrac{17}{2}}m}$

Question 7 *A population of bacteria* `quadruples` *every hours. If the culture started with 100, write the equation that models the bacteria population after t hours.*

$P(t) = \boxed{100}\,\boxed{4}^{\boxed{t}}$
