Group #: _____   Members: _____

1. (21 points) A grey squirrel population was introduced in a certain county of Great Britain 30 years ago. Biologists observe that the population doubles every 6 years, and now the population is 100,000.

   (a) (8 points) What was the initial size of the squirrel population?

   (b) (5 points) Estimate the squirrel population 10 years from now.

   (c) (8 points) How many years from now will the squirrel population become 200,000?

2. (24 points) The half-life of cesium-137 is 30 years. Suppose we have a 10-g sample.

   (a) (8 points) Find a function $m(t) = m_0 2^{-t/h}$ that models the mass remaining after t years.

   (b) (8 points) How much of the same will remain after 80 years?

   (c) (8 points) After how many years will only 2 grams of the same remain?

3. (10 points) If 250mg of a radioactive element decays to 200 mg in 48 hours, find the half-life of the element.

4. (26 points)

   (a) (10 points) Sketch the graph of both $f(x) = 2^x$ and $g(x) = \log_2 x$ on the same grid. Label each graph with its name. Label the $x-$ and $y-$intercepts of each graph, if any.

   (b) (8 points) Write a formula for the **function** $h(x)$ whose graph is the same as $f(x) = 2^x$, shifted to the left by 7 and down by 9 units. Use correct function notation.

   (c) (8 points) Write a formula for the **function** $k(x)$ whose graph is the same as $g(x) = \log_2 x$ stretched horizontally by a factor of 6. Use correct function notation.

5. (19 points) The height in feet of a certain tree t years from now is modeled by $H(t) = \dfrac{126}{6 + 45e^{-0.66t}}$.

   (a) (6 points) Find the height of the tree 5 years from now. **Round** to two decimal places and **include units** with your answer.

   (b) (7 points) After how many years will the tree be 17 feet tall? **Round** to two decimal places and **include units** with your answer.

   (c) (6 points) Fill in the blank: According to the model, this tree cannot grow taller than _____ feet. Explain how you know.