2.4 Application and Extension

1. Mr. Sullivan decides to start raising bunnies. On the right is the population of these bunny rabbits over a 2-year period.
   a. Graph the scatterplot with a “friendly” window and record it here.
   b. Find a logistic regression model for the data. (Be patient, it will take the calculator a little extra time to calculate this.) Write out the logistic model below. Round all values to the nearest thousandth (three decimal places).

   \[
   f(x) = \frac{57.712}{1 + 0.391 e^{-0.186x}}
   \]
   c. Find the limit of that model as time approaches infinity. Write it below using limit notation.
   \[
   \lim_{x \to \infty} f(x) = 57.712 \text{ hundred bunnies}
   \]
   d. How does your answer from part c relate to the problem?
   The population of rabbits will grow to about 57,712 bunnies no matter how long he raises the bunnies.
   e. Provide a reasonable explanation why a population would have a growth limit instead of growing indefinitely like an exponential model.
   A population would have a growth limit because of limited resources (like food) needed to keep the population alive.

For 2 – 3, sketch a graph of a function \( y = f(x) \) that satisfies the stated conditions.

2. Sketch (freehand) a graph of a function \( f \) that satisfies all of the following conditions. Include any asymptotes.
   a. \( \lim_{x \to 0} f(x) = \infty \)
   b. \( \lim_{x \to \infty} f(x) = \infty \)
   c. \( \lim_{x \to \infty} f(x) = 2 \)

3. Sketch (freehand) a graph of a function \( f \) that satisfies all of the following conditions. Include any asymptotes.
   a. \( \lim_{x \to \infty} f(x) = \infty \)
   b. \( \lim_{x \to -3} f(x) = \infty \)
   c. \( \lim_{x \to -3} f(x) = -\infty \)
   d. \( \lim_{x \to \infty} f(x) = -1 \)