1) Graph and Compare the following:
   a) \( f(x) = e^x \) and \( g(x) = \ln(x) \)
   b) \( h(x) = 2^x \) and \( k(x) = \log_2 x \)
   c) \( m(x) = e^x \) and \( n(x) = 3 - e^{-x} \)
   d) \( p(x) = 5^x \) and \( q(x) = \log_5 x \)
   e) \( r(x) = \log_3 x \) and \( s(x) = \log_7 x \)

2) Graph the following functions:
   \( p(x) = 4^x \) and \( q(x) = \left( \frac{1}{4} \right)^x \)
   Describe the relation between \( p \) and \( q \)
   Find the domain and the range.

3) Graph the following functions: \( f(x) = 2^x \) and \( g(x) = 4^x \)
   a) Describe the difference between \( f \) and \( g \)
   b) Find the domain and the range

4) Solve the following using graphical method:
   a) \( 87e^{0.066t} = 3t + 200 \)
   b) \( 5(1.044)^t = t + 10 \)

5) There is a mathematical relation between an airplane’s weight \( x \) and the runway length required at takeoff. For some airplanes the minimum runway length in thousands of feet may be modeled by: \( L(x) = 3\log x \), where \( x \) is measured in thousands of pounds.
   a) Graph \( L \)
   b) Estimate (graphically) and evaluate (algebraically) the length of the runway when the weight is 10,000 and 100,000 pounds.
   c) Does the length of the runway from part b) increase by a factor of 10?
   d) Generalize your answer for part b) and c)
1) As age increases, so does the likelihood of coronary heart disease (CHD). The fraction of people \( x \) years old with some CHD is modeled by:

\[
f(x) = \frac{0.9}{1 + 27e^{-1.22x}}
\]

a) Graph \( f(x) \)
b) Estimate (graphically) and Evaluate (algebraically) \( f(25) \) and \( f(65) \). Compare your estimation with your algebraic results.
c) Interpret the results from part b)
d) Estimate at what age does this likelihood equal 50%?

2) A) Find an exponential model for the federal debt, based on the data in the table for Accumulated Gross Federal Debt. Let \( x = 0 \) correspond to 1960.

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</thead>
<tbody>
<tr>
<td>Amount (billions)</td>
<td>291</td>
<td>322</td>
<td>381</td>
<td>542</td>
<td>909</td>
<td>1,818</td>
<td>3,207</td>
<td>4,921</td>
<td>5,182</td>
</tr>
</tbody>
</table>

B) Plot both the data points and the model on the same x-y axis. Describe how well the model matches the data points.
C) Use the model to predict the federal debt in 2002

3) The Drug Medication formula: can be used to find the number of milligrams \( D \) of a certain drug that is in a patient’s bloodstream \( h \) hours after the drug has been administered. When the number of milligrams reaches 2, the drug is to be administered again. Plot the function \( D \) and estimate the time between injections.

(Brain teaser☺) After how many hours will the third injection occur?

4) Strontium-90 is a radioactive material that decay according to the following function: \( A = A_0e^{-0.024t} \), \( A_0 \) is the initial amount. A) What is the half-life of strontium-90? B) Suppose you start with 50 milligrams, graph the function and use the graph to convince yourself that part A) is the correct answer. C) Use the graph to estimate when 7 milligrams will remain. D) Find the exact value for part C)

5) The table shows the number of babies born as twins, triplets, quadruplets, etc, in recent years.

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</thead>
<tbody>
<tr>
<td>Mult. births</td>
<td>92,916</td>
<td>96,893</td>
<td>98,125</td>
<td>99,255</td>
<td>100,613</td>
<td>101,658</td>
<td>101,709</td>
</tr>
</tbody>
</table>

a) Make a scattered plot of the data.
b) Use the following models and plot each on the same x-y axis as the data points

\[
f(t) = 93,201.973 + 4,545.977 \ln t
\]

\[
g(t) = \frac{102,519.98}{1 + 1.1536e^{-4.263t}}
\]
c) Which model do you think is a better predictor over the long run?
d) Use that model to predict the number of multiple births in 2005

6) A $1000 is invested at a continuously compounding rate of 6% annually. A) Estimate and calculate exactly how long it takes for that investment to double. Compare your estimate with your exact value. B) How long it takes that same investment to quadruple. (Show both estimation and exact calculation.). C) When will the investment reach $12,000?

7) The population of the U.S. is measured every 10 years by the Census Bureau. The following is a partial list of the census figures.

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</thead>
<tbody>
<tr>
<td>Pop. In million</td>
<td>76.1</td>
<td>123.2</td>
<td>151.7</td>
<td>204.9</td>
<td>226.5</td>
<td>249.6</td>
</tr>
</tbody>
</table>

a) Make a scatter plot of the data
b) Find a formula that describes the growth of the population in the US
c) Plot both the formula and the data on the same x-y-axis
d) Use the formula to predict the population of the US in 2005