1. Identify the key characteristics of the following functions:
   a. \( f(x) = e^x \)
      
      H.A. \( y = 0 \)  
      D: \((\infty, \infty)\)  
      y-int: \((0, 1)\)  
      R: \((0, \infty)\)
   b. \( f(x) = \ln x \)
      
      V.A. \( x = 0 \)  
      D: \((0, \infty)\)  
      x-int \((1, 0)\)  
      R: \((\infty, 0)\)

2. Tell whether the functions represent exponential growth or decay.
   a. \( f(x) = 2.5 \left( \frac{7}{8} \right)^x \)  
      Decay  
      \( 0 < b < 1 \)
   b. \( f(x) = e^{-x} \)  
      Decay

3. Simplify the following expressions:
   a. \( (5e^{-2x})^3 = 5^3 e^{-6x} = \frac{125}{e^{6x}} \)
   b. \( \sqrt[4]{16e^{12x}} = \sqrt[4]{2^4 (e^{3x})^4} = 2e^{3x} \)

4. Evaluate each log expression. NON-Calculator
   a. \( \log_{10} \frac{1}{10,000} = -4 \)
   b. \( \log_2 \sqrt[4]{32} = \log_2 (2^5) \frac{1}{4} \)
      \( = \log_2 2^{5/4} \)
      \( = \frac{5}{4} \)
      \( 2^x = 2^{5/4} \)
      \( x = \frac{5}{4} \)
   c. \( \ln e^{16} = 16 \)
   d. \( \log_7 49 = 2 \)
   e. \( \log_9 1 = 0 \)
   f. \( \log_3 81^{\frac{1}{2}} = \log_3 (3^4) \frac{1}{4} \)
      \( = \log_3 3^{4 \cdot \frac{1}{4}} \)
      \( = \log_3 3^1 \)
      \( = 1 \)
      \( x = \frac{1}{4} \)
   g. \( e^{\ln 7} = 7 \)
   h. \( \log_5 25 + \log_{5^{0.7}} 7 \)
      \( = 2 + 7 \)
      \( = 9 \)
12. Bob invested $5000 at 6%. How much money will he have after 5 years if the interest is compounded...
   a. quarterly \( n = 4 \)
      \[
      A(t) = 5000 \left(1 + \frac{0.06}{4}\right)^{4 \times 5}
      \]
      \$ 6734.28
   b. continuously \( A(t) = Pe^{rt} \)
      \[
      A(t) = 5000 e^{(0.06 \times 5)}
      \]
      \$ 6749.29

13. Radioactive decay: Let \( Q(t) \) represent the mass in grams of a quantity of radium 226 whose half-life is 1620. If 25 grams are present initially, how much will be present after 1000 years?

   \[
   Q(t) = 25 \left(\frac{1}{2}\right)^{\frac{t}{1620}} \\
   Q(1000) = 25 \left(\frac{1}{2}\right)^{\frac{1000}{1620}} \\
   \approx 16.2974
   \]

   There will be approximately 16.3 grams of radium 226 after 1000 years.

14. Depreciation: After \( t \) years, the value of a car (in dollars) is given by \( V(t) = 20000 \left(\frac{3}{4}\right)^t \).
   a. What is the current value of the car? \$ 20,000
   b. What is the percent increase or decrease? 25% decrease in value
   c. What will the value of the car be after 2 years? \( V(2) = 11,250 \) \$11,250
   d. When will the value of the car be $8000? (to the nearest tenth of a year) Justify graphically.

15. Population growth: The population of a town increases according to the model \( P(t) = 2500e^{0.0293t} \) where \( t \) is the time in years since 1990. Use the model to estimate the population in...
   a. 2000 \( t = 10 \)
      \[
      P(10) \approx 3351.11
      \]
      2000 Pop is approx 3351 people
   b. 2010 \( t = 20 \)
      \[
      P(20) \approx 4491.967
      \]
      2010 Pop is approx 4492 people
5. Convert to exponential form: \( \log_{27} 243 = \frac{5}{3} \)

\[ 27^{\frac{5}{3}} = 243 \]

6. Convert to logarithmic form: \( \left(\frac{4}{9}\right)^{\frac{3}{2}} = \frac{3}{2} \)

\[ \log_{\frac{4}{9}} \frac{3}{2} = \frac{1}{2} \]

7. State the domain of the function: \( f(x) = 3 \log(2 - 5x) \)  
NON-Calculator

\[ 2 - 5x > 0 \]

\[ D = (\infty, \frac{2}{5}) \]

\[ -5x > -2 \]

\[ x < \frac{2}{5} \]

8. Solve each equation. NON-Calculator

   a. \( \log_3(4x - 3) = 2 \)

   \[ 3^2 = 4x - 3 \]

   \[ 9 = 4x - 3 \]

   \[ 12 = 4x \]

   \[ 3 = x \]

   b. \( \log_x 27 = \frac{3}{4} \)

   \[ x^{\frac{3}{4}} = 27 \]

   \[ (x^{\frac{3}{4}})^{\frac{4}{3}} = (3^3)^{\frac{4}{3}} \]

   \[ x = 3^2 = 9 \]

9. Given \( A(t) = 2300(3)^{\frac{t}{4}} \) for \( A(t) \) in pounds, and \( t \) days. NON-Calculator

   a. What is the original amount? \( 2300 \) pounds

   \[ \frac{23}{\frac{9}{180}} = 23 \]

   b. How long does it take the amount to triple? \( 4 \) days

   \[ \frac{127}{207} = \frac{127}{207} \]

   c. How much is present after 8 days? \( A(8) = 2300(3)^{\frac{8}{4}} \)

   \[ 207,000 \text{ pounds} \]

   is present after 8 days.

   \[ A(8) = 2300 \cdot 3^2 = (2300)(9) = 20700 \]

10. Start with $1200. Write a function for the amount at time \( t \) if it quadruples every 20 years.

\[ A(t) = 1200(4)^{\frac{t}{20}} \]

<table>
<thead>
<tr>
<th>( t )</th>
<th>( A(t) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1200</td>
</tr>
<tr>
<td>20</td>
<td>4800</td>
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11. Use TI to evaluate each expression (round to 4 decimal places):

   a. \( \log(1+\sqrt{2}) \approx 0.3828 \)

   b. \( \frac{15 \ln 23}{(\ln 7 - \ln 2)} \approx 37.5429 \)