Quiz over logs

Use exact answers (1/3 is not the same as 0.333) unless otherwise indicated
Write answers in simplified form.
Write answers on the line provided and show your work ON the test (Where work is needed, NO WORK means NO CREDIT)

1. Rewrite in exponential form: Don’t solve.
   \[ \log R = p \quad \text{Answer: } 10^p = r \]
   \[ \log_2 (7) = 5 - y \quad \text{Answer: } 2^{5-y} = 7 \]
   \[ \ln 3 = x + 2 \quad \text{Answer: } e^{x+2} = 3 \]

2. Use the Change-of-Base formula and a calculator to approximate the following to 3 decimal places. \( \log_3 25 \)
   \[ \frac{\ln 25}{\ln 3} \quad \text{Answer: } 2.930 \]

4. The world population was 6 billion in 1999. Now it is \( \frac{7}{6} \) billion. If the population behaves according to the equation \( A = A_0 e^{rt} \), find \( r \), the growth rate. (\( A = \) population after \( t \) years, \( A_0 \) is the initial population)
   \[ 6.5 = 6 e^{r(1)} \]
   \[ \frac{6.5}{6} = e^r \quad r = \frac{\ln(1.083)}{1} \]
   \[ \ln \frac{6.5}{6} = 0.0114 \]
   \[ \text{Answer: } 0.0114 \]

5. Using the above equation, predict the population 20 years from now?
   \[ A = 6 e^{0.0114(20)} \]
   \[ \text{Answer: } 8.2 \text{ billion} \]

6. Rewrite in logarithmic form: \( a^x = e + 3 \)
   \[ 10^x = y - 7 \]
   \[ \text{Answer: } \log_a (e+3) = x \]
   \[ \log (y-7) = x \]

7. Write the expression as a single logarithm.
   \[ \frac{1}{3} \log(x+2) - 4 \log(x-4) \]
   \[ \log \left( \frac{3 \sqrt{x+2}}{(x-4)^4} \right) \]
   \[ \text{Answer: } \]
8. Solve the equation. Give both the exact answer and the decimal approximation to 3 places where appropriate.

A. \( \log_5(x - 3) = e \)
\[
5^e = x - 3 \\
5^e + 3 = x
\]
Answer: \( 5^e + 3 \approx 82.432 \)

B. \( 2e^{4-x} + 1 = 5 \)
\[
2e^{4-x} = 4 \\
e^{4-x} = 2 \\
\ln 2 = 4 - x \\
x = 4 - \ln 2
\]
Answer: \( 4 - \ln 2 \approx 3.307 \)

C. \( \ln x + 2 \ln 3 = \ln(x + 5) \)
\[
\ln(x \cdot 9) = \ln(x + 5) \\
9x = x + 5 \\
8x = 5 \\
x = \frac{5}{8}
\]
Answer: \( \frac{5}{8} = 0.625 \)

D. \( \log(3 - 2x) = 4 \)
\[
10^4 = 3 - 2x \\
10000 - 3 = -2x \\
9997 = -2x \\
x = \frac{9997}{-2}
\]
Answer: \( -4998.5 \) or \( -4997.5 \)