Change of Base Theorem

For any positive real numbers x, a and b, where $a \neq 1$ and $b \neq 1$, the following holds.

$$\log_a x = \frac{\quad}{\quad}$$

1. Use the change-of-base theorem to find an approximation to four decimal places for each of the following:
   a. $\log_4 20 =$
   b. $\log_2 0.7 =$

2. Solve:
   a. $8^x = 21$
   b. $5^{2x+3} = 8^{x+1}$
   c. $e^{|x|} = 50$
   d. $e^{4x} \bullet e^{x-1} = 5e$
   e. $e^{2x} - 6e^x + 5 = 0$

Recall that the domain of $y = \log_a x$ is ________. For this reason, *it is always necessary to check that proposed solutions of a logarithmic equation result in logarithms of _________ numbers in the original equation.*

3. Solve the following and check for extraneous solutions.

a. $4\ln x = 36$

b. $\log_3(x^3 - 5) = 1$

c. $\log(2x + 1) + \log x = \log(x + 8)$

d. $\log_3(4x + 1)(x + 1) = 3$

e. $\log_2(2x - 5) + \log_2(x - 3) = 3$

f. $\ln e^{\ln x} - \ln(x - 4) = \ln 5$