1. The time, $t$, in minutes, that it takes for an ingot of metal to cool from 1,000°F to a temperature $T$ is given by the formula:

$$ t = -50 \ln \frac{T - 80}{920} $$

Find the time to cool to $T = 220°F$. Round to the nearest minute.

$$ t \approx 94 \text{ minutes} $$

$$ t = -50 \ln \frac{220 - 80}{920} $$

$$ t = -50 \ln (0.1522) $$

$$ t \approx 94.1366 $$

2. Select the expression that is equivalent to $\ln (x + n) - \ln z$.

a. $\ln \frac{xn}{z}$

b. $\ln \frac{x + n}{z}$

c. $\ln (xz + nz)$

3. Solve the equation. Round your answer to the nearest tenth.

$$ 12 = 2.5 \ln x $$

$$ x \approx \frac{12}{2.5} = 121.5 $$

4.8 = ln $x$

$$ e^{4.8} = x $$

$$ x \approx 121.5104 \text{ ANSWER} $$
4. Solve the equation. Round your answer to the nearest tenth.

\[ 56 = 8e^{x-4} \]
\[ x = \frac{5.9}{8} \]
\[ \frac{56}{8} = e^{x-4} \]
\[ 7 = e^{x-4} \]
\[ \ln 7 = \ln e^{x-4} \]
\[ \ln 7 = (x-4)\ln e \]
\[ \ln 7 = x-4 \]
\[ \ln 7 + 4 = x \rightarrow x \approx 5.9459 \]

5. Solve the equation. Round your answer to the nearest tenth.

\[ 36 = 4e^x \]
\[ x = \frac{2.2}{4} \]
\[ \frac{36}{4} = e^x \]
\[ 9 = e^x \]
\[ \ln 9 = \ln e^x \]
\[ \ln 9 = x\ln e \]
\[ \ln 9 = x \]
\[ 2.1972 \approx x \]