Show all work on this sheet, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical syntax/notation. Box short final answers.

1. Solve for $x$:
   $$e^{3x-4} = 2$$

2. The relativistic mass $m > 0$ of a particle with speed $v \geq 0$ is:
   $$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$
   where $m_0 > 0$ is the rest mass of the particle and $c > 0$ is the speed of light in vacuum (i.e., $m_0$ and $c$ are just positive constants).

   Find the inverse function $f^{-1}$ (i.e., $v = f^{-1}(m)$) and its domain.

\[
\begin{align*}
\ln \left[ e^{3x-4} = 2 \right] \\
\ln e^{3x-4} &= \ln 2 \\
3x-4 &= \ln 2 \\
3x &= 4 + \ln 2 \\
x &= \frac{4 + \ln 2}{3}
\end{align*}
\]

\[
\begin{align*}
m &= \frac{m_0}{\left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}}} \\
\text{Cross-multiply:} \\
\left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}} &= \frac{m_0}{m} \\
The square: \\
1 - \frac{v^2}{c^2} &= \left(\frac{m_0}{m}\right)^2 = \frac{m_0^2}{m^2} \\
\text{Add/sub:} \\
1 - \frac{m_0^2}{m^2} &= \frac{v^2}{c^2} \\
\text{Mult:} \\
c^2 \left(1 - \frac{m_0^2}{m^2}\right) &= v^2 \\
\uparrow \quad \quad \uparrow \quad \quad \uparrow \quad \quad \uparrow \quad \quad \uparrow \quad \quad \uparrow \quad \quad \uparrow \\
v = \sqrt{v^2} = \sqrt{c^2 \left(1 - \frac{m_0^2}{m^2}\right)} \\
v \geq 0 &= \sqrt{c^2} \sqrt{1 - \frac{m_0^2}{m^2}} \\
&= c \sqrt{1 - \frac{m_0^2}{m^2}} \\
V &= c \sqrt{1 - \frac{m_0^2}{m^2}} = f^{-1}(m)
\end{align*}
\]