\[ y' = \pm \sin t - \cos t - 1 \]

\[
\text{LHS} = x \frac{dy}{dt} = \pm \sin t - \cos t - 1 \\
\text{RHS} = y + \tan^2 t = \tan^2 t - \tan t - 1 \\
\therefore \quad y(0) = -\tan 0 \pi - \pi = 0
\]

\[
\begin{align*}
\text{(a)} & \quad k^2 = \frac{3\pi}{4} \\
\text{(b)} & \quad \text{Omitted}
\end{align*}
\]

\[
L = \frac{-1}{k(x \log x + 1) + k + 1} \\
\text{The constant is determined by} \quad L(1) = -1.
\]

\[
20 \quad dv = d\left(\frac{y}{x}\right) = \frac{y'x - y}{x^2} \, dx \\
= \frac{x \, dy - y \, dx}{x^2} \\
\text{Using} \quad \frac{y'x - y}{x^2} = \frac{y}{x^2} + \frac{y/x}{x^2} \\
= \frac{x \, e^{-x}}{x^2} \, dx = \frac{e^{-x}}{x} \, dx
\]

\[ e^{-x} \, dv = \frac{1}{x} \, dx \]

\[
\begin{align*}
\text{So} & \quad u = -\log (c - \log x) \\
\text{Then} & \quad y = x \, v = -x \log (c - \log x)
\end{align*}
\]
First derive both sides

\[ y' = x - xy \]

Solve the IVC \( y(2) = 2 \).

\[ y = e^{-\frac{1}{2}x^2} + 1 \]

\[ \frac{dp}{dt} = 0.02 \ p \ (1 - \frac{p}{50}) \]

**Carrying capacity** 50

\[ \lambda = 0.02 \]

\[ p(10) = 41.5047 \]

\[ p(x) = 50 \ \frac{1}{1 + 0.25 e^{-0.02x}} \]