1. (5 pts.) Show \( y = -x \cos x - x \) is a solution of the following initial value problem.

\[
xy' - y = x^2 \sin x, \quad y(\pi) = 0
\]

\[
y(\pi) = -(\pi) \cos(\pi) - (\pi) = 0 \quad \checkmark
\]

\[
y = -x \cos x - x; \quad y' = -\cos x + x \sin x - 1
\]

\[
x y' - y = x^2 \sin x
\]

\[
x( -x \cos x + x \sin x - 1) - (-x \cos x - x) = x^2 \sin x
\]

\[
- x \cos x + x^2 \sin x - x^2 \sin x + x \cos x + x = x^2 \sin x
\]

\[
x^2 \sin x = x^2 \sin x
\]

LHS = RHS \quad \checkmark

2. (5 pts.) Find the solution of the differential equation that satisfies the given initial condition.

\[
y' = \frac{\sin x}{y}, \quad y(0) = -1
\]

\[
\frac{dy}{dx} = \frac{\sin x}{y}
\]

\[
\int y \ dy = \int \sin x \ dx
\]

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

\[
\frac{1}{2} (-1)^2 = -\cos (0) + C
\]

\[
\frac{1}{2} = -1 + C
\]

\[
C = \frac{3}{2}
\]

\[
\frac{1}{2} y^2 = -\cos x + C = \frac{3}{2}
\]

\[
y^2 = -2\cos x + 3
\]

\[
y = \pm \sqrt{-2\cos x + 3}
\]

\[
y = -\sqrt{-2\cos x + 3}
\]

\[
y(0) = -1
\]

\[
\rightarrow
\]

\[
y = -\sqrt{-2\cos x + 3}
\]