1. (10 points) Find the general solution to the differential equation

\[
\frac{dy}{dx} = \frac{1}{e^y \sqrt{1 - x^2}}
\]

Solution:

\[
\frac{dy}{dx} = \frac{1}{e^y \sqrt{1 - x^2}} \\
e^y \, dy = \frac{dx}{\sqrt{1 - x^2}} \\
\int e^y \, dy = \int \frac{dx}{\sqrt{1 - x^2}} \\
e^y = \arcsin(x) + C \\
y = \ln(\arcsin(x) + C)
\]

2. (10 points) Find a solution to the initial value problem

\[
\frac{dy}{dx} = (y - 1) \cdot \frac{1}{x} \\
y(-1) = 0
\]

Solution:

\[
\frac{dy}{dx} = (y - 1) \cdot \frac{1}{x} \\
\frac{1}{y - 1} \, dy = \frac{1}{x} \, dx \\
\int \frac{1}{y - 1} \, dy = \int \frac{1}{x} \, dx \\
\ln|y - 1| = \ln|x| + c \\
y - 1 = \pm|x|e^c \\
y = 1 \pm |x|e^c
\]
We are working near $-1$, so $|x| = -x$. Plugging in $y(-1) = 0$,

$$0 = 1 \pm e^c \left( \frac{-(-1)}{|-1|} \right)$$

$e^c$ is always positive, so we must have

$$0 = y(-1) = 1 - e^c$$

Thus $1 = e^c$ and we get as our final answer

$$y(x) = 1 - e^c(-x)$$
$$y(x) = 1 + x$$