1. Solve the given initial value problem by separation of variables:
\[
\frac{dy}{dx} = y^2 \sin x, \quad y(0) = -1.
\]
We apply the method of separable equations:
\[
\int \frac{1}{y^2} \, dy = \int \sin x \, dx
\]
\[
- \frac{1}{y} = - \cos x + C
\]
\[
y = \frac{1}{\cos x - C}.
\]
We require that
\[
-1 = y(0) = \frac{1}{1 - C}.
\]
Hence, \(C = 2\). The solution to the initial value problem is thus given by
\[
y = \frac{1}{\cos x - 2}.
\]

2. Find the general solution of the following differential equation:
\[
\frac{dy}{dx} - 2xy = xe^{x^2 + x}.
\]
First we solve the associated homogeneous equation:
\[
\frac{dy}{dx} - 2xy = 0.
\]
\[
\int \frac{1}{y} \, dy = \int 2x \, dx
\]
\[
\ln |y| = x^2 + C_1
\]
\[
y = Ce^{x^2}.
\]
We now look for a solution of the form \(y = ue^{x^2}\) to the given differential equation. Substituting we obtain:
\[
u'e^{x^2} + u(2xe^{x^2}) - 2x(ue^{x^2}) = xe^{x^2 + x}.
\]
After cancellation and dividing thru by \(e^{x^2}\) we get \(u' = xe^x\). To find \(u\) we use integration by parts:
\[
u = \int xe^x \, dx = xe^x - \int e^x \, dx = (x - 1)e^x + C.
\]
Therefore the general solution is given by:
\[
y = ue^{x^2} = ((x - 1)e^x + C)e^{x^2}.
\]