1. Solve the differential equation \( \frac{dy}{dx} = \cot^2(x+y) \) by using an appropriate substitution.

2. The population increases at a rate proportional to the number of people present at time \( t \). After 3 years, the population will be 10000 and 80000 after 10 years. Write the expression for initial population.
1. Change the following differential equation to a linear DE by a suitable substitution (Do not solve the new DE):

\[ x^2 \frac{dy}{dx} - xy = -y^2 \]

2. A thermometer is taken from inside room to outside where the air temperature is 5° F. After 1 minute, the thermometer reads 55° F and after 5 minutes it reads 30° F. What was the initial temperature inside the room?
1. Solve the differential equation: 
\[ 6xy \, dx + (4y + 9x^2) \, dy = 0 \]

2. Solve the differential equation: 
\[ x \sin \frac{y}{x} \, dy = \left( y \sin \frac{y}{x} - x \right) \, dx \]