Mathematics - 1

1. Find the derivative, $\frac{dy}{dx}$, for the expression: $x^2y - e^{2x} = \sin y$ **(30 points)**

2. Find the general solution for: $(x^2 + 9)\frac{dy}{dx} = xy$ **(30 points)**

   HINTS:

   $$\int u^n du = \frac{u^{n+1}}{n+1} + C, \qquad n \neq -1$$

   $$\int \frac{1}{u} du = \ln|u| + C$$

3. Find the absolute maximum and minimum of the following function in the indicated region. Show analytic work for full credit.

   $f(x,y) = 6x^2 + 18xy + 4y^2 - 6x - 10y + 5 \qquad where\ x \in [0,1]\ and\ y \in [0,1]$

   (40 points)