1. Show that

$$F(x,y) = \left\langle \cos(y) - 2 + y^2 e^{xy^2}, \cos(y) - x\sin(y) + 3y^2 + 2xy e^{xy^2} \right\rangle$$

is a conservative vector field by finding its potential function $f(x,y)$.

2. Show that

$$F(x,y) = \left\langle 2y + 2xy^2, 2x + 2y \right\rangle$$

is not a conservative vector field.