



2. Find a potential function for the vector field \mathbf{F}

$$\mathbf{F} = \langle y \cos(xy), x \cos(xy) \rangle$$

$$\begin{array}{cc} \mathbf{i} & \mathbf{j} \\ \frac{d}{dx} & \frac{d}{dy} \\ y \cos xy & x \cos xy \\ \frac{d}{dx}(x \cos xy) - \frac{d}{dy}(y \cos xy) = 0 \end{array}$$

$$\begin{aligned} f_x &= y \cos(xy) \\ f &= \int y \cos(xy) dx \\ &= \sin(xy) + g(y) \\ x \cos(xy) + g'(y) &= x \cos(xy) \\ g'(y) &= 0 \quad g(y) = 0 \\ f &= \sin(xy) \end{aligned}$$

The potential function is $f = \sin(xy)$

