

Assignment 3

Ex 1

$$\begin{aligned} a) \quad I_y(x, y) &= \frac{\partial}{\partial y} [g(x) \cdot g(y) \cdot I(x, y)] \\ &= g(x) \left[\frac{d}{dy} g(y) \cdot I(x, y) \right] \end{aligned}$$

$$\begin{aligned} I_{yy}(x, y) &= \frac{\partial}{\partial y} [g(x) \cdot g(y) \cdot I_y(x, y)] \\ &= g(x) \left[\frac{d}{dy} g(y) \cdot I_y(x, y) \right] \end{aligned}$$

$$\begin{aligned} I_{xy}(x, y) &= \frac{\partial}{\partial y} [I_x(x, y)] \\ &= \frac{\partial}{\partial y} \left[\frac{d}{dx} g(x) \cdot g(y) \cdot I(x, y) \right] \\ &= \frac{d}{dx} g(x) \cdot \left[\frac{d}{dy} g(y) \cdot I(x, y) \right] \end{aligned}$$

b) $P_1(0, 0)$, $P_2(1, 1)$, $P_3(1, 0)$, $P_4(2, 2)$

$$\begin{aligned} \bullet \quad P_1 - P_2 \\ y = x \quad (k = \frac{1-0}{1-0}) \\ \rho = 0, \theta = \frac{\pi}{4} \end{aligned}$$

$$x \cdot \cos(\theta) + y \cdot \sin(\theta) = \rho$$

$$\begin{aligned} \bullet \quad P_1 - P_3 \\ y = 0 \\ \rho = 0, \theta = \frac{\pi}{2} \end{aligned}$$

$$\begin{aligned} \bullet \quad P_1 - P_4 \\ y = x \\ \rho = 0, \theta = \frac{\pi}{4} \end{aligned}$$

Obg:

1. $P_1 \rightarrow P_2 \rightarrow P_4$
2. $P_1 \rightarrow P_3$
3. $P_2 \rightarrow P_3$
4. $P_3 \rightarrow P_4$

} So collinear

$$\begin{aligned} \bullet \quad P_2 - P_3 \\ y = 1 \\ \rho = 1, \theta = 0 \end{aligned}$$

$$\begin{aligned} \bullet \quad P_2 - P_4 \\ y = x \\ \rho = 0, \theta = \frac{\pi}{4} \end{aligned}$$

$$\begin{aligned} \bullet \quad P_3 - P_4 \\ y = 2x - 2 \end{aligned}$$

$$2x - y - 2 = 0 \Rightarrow A=2, B=-1, C=-2$$

$$\|n\| = \sqrt{A^2 + B^2} = \sqrt{5}$$

$$\cos \theta = \frac{A}{\|n\|} = \frac{2}{\sqrt{5}}, \quad \sin \theta = \frac{B}{\|n\|} = \frac{-1}{\sqrt{5}}$$

$$\theta = \arctan\left(-\frac{1}{2}\right) = -0.46 \text{ rad}$$

$$\rho = \frac{C}{\|n\|} = \frac{-2}{\sqrt{5}}$$