

Please write ***Your name:*** _____

Show all work. You should either write at a sentence explaining your reasoning, or annotate your math work with brief explanations. There is no need to simplify, and no calculators are needed.

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Consider random variables X and Y given by the joint density

$$f(x, y) = \begin{cases} x + y & \text{if } 0 \leq x \leq 1 \text{ and } 0 \leq y \leq 1 \\ 0 & \text{otherwise.} \end{cases}$$

Find $\text{Cov}(X, Y)$

In the same situation, find $\mathbb{E}(X|Y)$.

[(*optional question for extra credit*)]: If Z_1, Z_2 are independent standard normal random variables, and $X = 3Z_1 + 4Z_2$, $Y = 3Z_1 - 4Z_2$, find $\rho(X, Y)$. Do not use any integrals or derivatives.