



# Principles of Probability

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**State** Finished  
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**Grade** 8.00 out of 10.00 (80%)

## Question 1

Partially correct  
Mark 8.00 out of 10.00

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A bank operates both a drive-up facility and a walk-up window. On a randomly selected day, let  $X$  = the proportion of time that the drive-up facility is in use (at least one customer is being served or waiting to be served) and  $Y$  = the proportion of time that the walk-up window is in use. Then the set of possible values for  $(X, Y)$  is the rectangular  $R = (x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1$ . Suppose the joint pdf of  $(X, Y)$  is given by

$$f_{X,Y}(x, y) = \begin{cases} k(x^2 + y^2) & 0 \leq x \leq 1; 0 \leq y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

a) The value of the constant  $k$  that makes  $f_{X,Y}(x, y)$  an indeed a joint pdf is

3/2

✓

Write your answer as decimal rounded to four decimal places.

b) Find the  $P(0 \leq X \leq \frac{1}{2}, 0 \leq Y \leq \frac{1}{2})$

0.0301

✓

c) The marginal pdf of  $X$  is given by

$$f_X(x) = \begin{cases} -\frac{3}{2}x^2 + \frac{1}{2} & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

False

✓

Write your answer as decimal rounded to four decimal places.

c) Find the  $P(0.25 \leq X \leq 0.75)$

0.4531

✓

d) Are  $X$  and  $Y$  dependent random variables

No

✗

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