

115. The stock prices of two companies at the end of any given year are modeled with random variables X and Y that follow a distribution with joint density function

$$f(x, y) = \begin{cases} 2x & \text{for } 0 < x < 1, \ x < y < x + 1 \\ 0 & \text{otherwise.} \end{cases}$$

What is the conditional variance of Y given that $X = x$?

(A) $\frac{1}{12}$

(B) $\frac{7}{6}$

(C) $x + \frac{1}{2}$

(D) $x^2 - \frac{1}{6}$

(E) $x^2 + x + \frac{1}{3}$