1. Rewrite the following sum of iterated integrals as a single iterated integral by reversing the order of integration, and evaluate.

\[ \int_0^8 \int_0^{\sqrt{\frac{y}{3}}} y \, dx \, dy + \int_8^{12} \int_{\sqrt{\frac{y}{3}}}^{\sqrt{\frac{y}{8}}} y \, dx \, dy \]

2. A probability density function is given by

\[ f(x, y) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 2 \text{ and } 0 \leq y \leq 1, \\ 0 & \text{otherwise.} \end{cases} \]

(a) Find the value of the constant \( k \) using the property

\[ \int_{\mathbb{R}^2} f(x, y) \, dA = 1. \]

This property expresses the condition that the probability that a point \((x, y)\) belongs to the plane equals 1.

(b) Find the probability that \((x, y)\) satisfies \(x + y \leq 2\).

(c) Find the probability that \((x, y)\) satisfies \(x \leq 1\) and \(y \leq 1/2\).

3. Find the average value of the sum of the squares of three numbers \(x, y, z\) where each number is between 0 and 2.