1. Consider a pair of random variables $X, Y$ with constant joint density on the quadrilateral with vertices located at the points $(0, 0), (3, 0), (5, 2), (0, 2)$.

1a. Find $P(X > Y)$.

1b. Find $P(X + Y \leq 3)$.

2. Suppose $X$ and $Y$ have a constant joint density on the square with vertices $(0, 0), (0, 5), (5, 5), (5, 0)$. Find $E(\max(X, Y))$.

3. Suppose that I am standing at the exact center of a rectangular region with corners $(0, 0), (6, 0), (6, 4), (0, 4)$, i.e., I am standing exactly at the point $(3, 2)$. A butterfly lands somewhere on the ground, uniformly at random within this rectangular region. What is the probability that the butterfly lands within 1 unit of me, i.e., what is the probability that we are less than 1 unit away from each other?

4. Suppose $X$ has density $f_X(x) = \frac{1}{2}$ for $0 < x < 2$, and $f_X(x) = 0$ otherwise. Suppose that $Y$ has density $f_Y(y) = e^{-y}$ for $y > 0$, and $f_Y(y) = 0$ otherwise. Also suppose that $X$ and $Y$ are independent. Find $P(Y > X)$. 