1) Electric charge is distributed over the disk $x^2 + y^2 \le 4$ so that the charge density at (x, y) is $\sigma = x + y + x^2 + y^2$ (measured in coulombs per square meter). Find the total charge on the disk.

2) Find the mass and center of mass of the lamina that occupies the region $D = \{(x, y) | 0 \le x \le a, 0 \le y \le b\}$ and has the density function $\rho(x, y) = cxy$.

3) Find the moments of inertia I_x, I_y, I_o for the lamina bounded by the parabola $x = y^2$ and the line y = x - 2 and has the density function $\rho(x, y) = 3$.

4) The joint density function for a pair for random variables X and Y is:

$$f(x, y) = \begin{cases} Cx(1+y) & \text{if } 0 \le x \le 1, \ 0 \le y \le 2\\ 0 & \text{otherwise} \end{cases}$$

- a) Find the value of the constant C.
- b) Find $P(X \le 1, Y \le 1)$.
- c) Find $P(X+Y \le 1)$.

5) A lamp has two bulbs of a specific type with an average lifetime of 1000 hours. Assuming that we can model the probability of failure of these bulbs by an exponential density function with mean $\mu = 1000$, find the probability that both of the lamp's bulbs fail within 1000 hours.