Quiz-2 Review

1. Important Concepts

   (a) Continuous random variables
        i. PDF's
        ii. Conditioning
   (b) CDF's

   (c) Derived distributions
        i. Two steps method
        ii. Short cuts

   (d) Transforms
        i. Properties
        ii. Those of common PMF's / PDF's

   (e) Law of iterated expectations
   (f) Law of conditional variances
   (g) Random sums of random variables

   (h) Least squares estimation
        i. Least squares estimate
        ii. Linear least squares estimate

   (i) Bivariate Normals / Jointly Gaussians

   (j) Normal
        i. PDF / Expectation and variance
        ii. Linear transformations
        iii. Sum of independent Normals

   (k) Exponential

2. Problem 1: Mary has an old sprinkler for her garden that uniformly sprays water on the area shown below. Let X and Y be the coordinates of a random drop of water from the sprinkler.
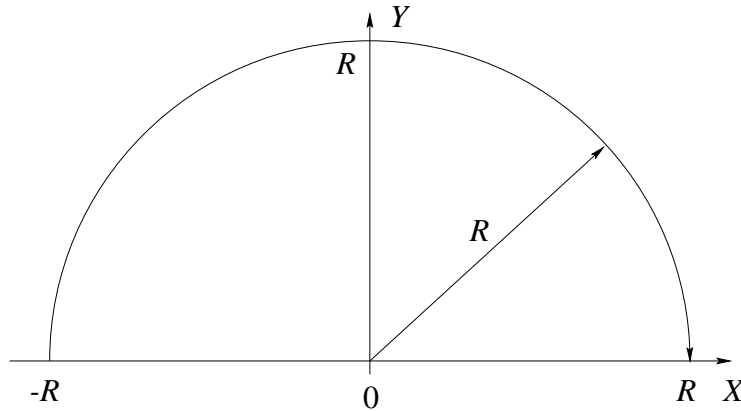
The old sprinkler is defective: On any day, R is equally likely to be equal to 3 or 5.

(a) What is the joint PDF of X and Y?

(b) Mary planted vegetables in columns. At $X = -1$ she has a column of tomatoes. Given that a random drop of water falls on the tomatoes, find and plot the PDF of the water drops.

(c) Mary is concerned that the vegetables closer to the origin might not get enough water. Let $D = \sqrt{X^2 + Y^2}$ be the distance from the origin of a water drop. What are the PDF and transform of D?

(d) You observe D, give the least-squared estimate of Y^2.