Math 130 Fall 2011

Name: Section:

Biomodule 14: Integration

1. Let the expected number of cells in a culture that have an *p* percent probability of undergoing cell division during the next hour be denoted by *n(p)*.
   a. Explain why $\int_{30}^{40} n(p)dp$ approximates the total number of cells with a 30% to 40% chance of dividing during the next hour. (2 points)

   b. Give an integral representing the number of cells which have less than a 50% chance of dividing during the next hour. (1 point)

   c. Let $n(p) = \sqrt{4p + 2}$ give the expected number of cells (in millions) with *p* percent probability of dividing during the next hour. Find the number of cells with a 15% to 20% chance of dividing. (2 points)

2. The velocity v of the blood in a blood vessel is given as

$$v = k(R^2 - r^2)$$

where R is the (constant) radius of the blood vessel, r is the distance of the flowing blood from the center of the blood vessel, and k is a constant. Total blood flow (in millimeters per minute) is given by

$$Q(R) = \int_0^R 2\pi v r \, dr$$

a. Find the general formula for Q in terms of R by evaluating the definite integral given above. (2 points)

b. The radius of an ascending aorta is, on average, 33.5 mm in men and 36 mm in women. What is the total blood flow in the ascending aorta of an average man? An average woman? (1 point)

c. If $Flow = vdA$ where v is velocity, A is the cross-sectional area of the vessel (assume it is circular), and d is the density of the plasma, do men and women have the same plasma density? (Treat r as a constant). Make sure to show your work and/or give your reasoning. (2 points)