Math 13 Fall 2009 Homework 6

1.) Although the topic was not covered extensively in class, integrals can be used in applications to probability. On your own, read through the section of your text that explains how to use double and triple integrals to calculate the probability of an event occurring. The relevant page numbers are 1021-1023 of section 16.5 and 1032-1033 of section 16.6. If you do not recall the material regarding the use of single integrals in applications to probability, you may find it helpful to review that topic which is located in section 9.5 of the text. After you have reviewed this material on the use of double and triple integrals in probability calculations, write an essay (less than 500 words) which explains the topic to an "imaginary" Math 13 student who has studied double and triple integrals, but who has not yet studied their application to probability.

In order to receive full credit you must cover joint density functions of random variables, and how a multiple integral of a joint density function over a particular region in the domain can be interpreted as the probability of an event happening. If you are not comfortable writing in abstract terms, you may use an example multiple-integral-probability problem as the foundation of your explanation and still receive full credit.

You may assume that the reader of your essay is familiar with the use of single integrals in probability applications. More precisely you may assume that your reader is familiar with section 9.5 of your text. You do NOT need to provide any references in your essay.

2.) Consider a quadratic equation $aX^2 + bX + c = 0$ whose coefficients a, b and c have been chosen randomly from the interval $[0, 1]$. What is the probability that the equation has real roots? Feel free to kill two birds with one stone, and use this problem as the example you craft your essay from problem 1 around.

3.) Consider the region bounded by $y = 1/x$, $y = 4/x$, $y = x$ and $y = 4x$.

a.) Integrate the function $F(x, y) = y^2/x^2$ over this region without using substitution.

b.) Integrate the function again, this time using the substitution $x = u/v$ and $y = uv$. Check that you arrive at the same value for parts a and b.