MA677
MWF 10-10:50pm
CB 345
Fall 2007

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The following problems will be due on 10 September.

1. Let $\Omega_n$ be the volume of the unit ball in $\mathbf{R}^n$. In a previous homework, we showed that

$$\Omega_n = 2\Omega_{n-1} \int_0^1 (1-t^2)^{(n-1)/2}\, dt.$$

   Make the change of variables $r = t^2$ and to express the integral in terms of the beta function. Show that

$$\Omega_n = \pi^{n/2}/\Gamma(\frac{n}{2}+1).$$

   You may assume that $\Omega_1 = 2$, $\Omega_2 = \pi$, $\Gamma(s+1) = s\Gamma(s)$ and $\Gamma(1/2) = \sqrt{\pi}$.

2. (Extra credit) Find

$$\lim_{n\to\infty} \Omega_n$$

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3. Wheeden and Zygmund, Chapter 6, #1, 2, 3, 5.

August 30, 2007