Normalization of Functions
Example of Calculating Normalizaton Contants

In homework problem (9) you will be asked to normalize several functions. In class we will discuss the 'physical' meaning of normalizing quantum mechanical wavefunctions and do examples. The actual process of obtaining normalization constants is relatively straightforward; however, we may not quite have all of this done before problem (9) is due, so this handout works through an example.

$$to\,normalize \quad f_{unorm}(x) = xe^{-bx} \quad in\,x = (0,\infty)$$

$$set \qquad f(x) = N\,f_{unorm}(x) = Nxe^{-bx} \qquad where\,N\,is\,the\,normalization\,constant$$

$$\int_0^\infty [N^*\,f^*_{unorm}(x)][N\,f_{unorm}(x)]dx = \int_0^\infty N^2\,f^2_{unorm}(x)dx = 1 \qquad since\,f_{unorm}(x)\,is\,real$$

$$N^2\int_0^\infty \left(xe^{-bx}\right)^2 dx = N^2\int_0^\infty x^2e^{-2bx}dx = 1$$

$$using\,the\,integral\,on\,the\,front\,cover\,of\,McQ \int_0^\infty x^ne^{-ax}dx = \frac{n!}{a^{n+1}}$$

$$N^2\left[\frac{2}{(2b)^3}\right] = 1$$

$$N^2 = 4b^3$$

$$N = 2b^{\frac{3}{2}}$$

$$f(x) = 2b^{\frac{3}{2}}\,x\,e^{-bx}$$