Applied Math IV: Example Sheet 1

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Submission deadline: 3:30pm, December 22, 2005

1. **Fourier transform:** Fourier transform is defined as $\widetilde{f}(k) = \int_{-\infty}^{\infty} f(x)\exp(ikx)dx$. Compute $\widetilde{f}(k)$ for the following functions, and draw both $f(x)$ and $\widetilde{f}(k)$:

   (a) $f(x) = \begin{cases} 2-|x|, & \text{when } |x| \leq 1, \\ 1, & \text{when } |x| > 1. \end{cases}$

   (b) $f(x) = \exp(-x^2)$.

2. **Convolution & Correlations:** Compute the following convolutions or correlations of the functions in question 1:

   (a) (1b) * (1b).

   (b) Corr((1b), (1b)).

3. **Deconvolution:**

   (a) Given $g(x) * h(x) = g(x) = (1b)$, what is $h(x)$?

   (b) Given $[g(x) + D] * g(x) = (1a)$ where D is a constant, what is $g(x)$ and D?