1. If $\text{FT}\{g(x)\} = G(k)$, show that $\text{FT}\{g(x-a)\} = \exp(-ika) G(k)$.

2. Calculate the Fourier Transform of $A \cos(k_0 x + a)$, for $a/k_0 = \{0, \pi/4, \pi/2, \pi\}$. Plot the result.

3. If $\text{FT}\{g(x)\} = G(k)$, show that $\text{FT}\{g(ax)\} = (1/a) G(k/a)$.

4. Calculate the Fourier Transform of (A) TopHat($x/A$), for $A = \{1, 2, 4\}$. Plot the result.

5. Approximate the shape of a TopHat function from the Fourier Transform given in 4. Use 4, 8, 16, and 32 Fourier components in your approximation. Plot the result. You can calculate this in Matlab or Mathematica.

6. Calculate in real space the convolution of TopHat($x$) with TopHat($x/2$).

7. Repeat the calculation in 7 using Fourier convolution.

8. Calculate the convolution of TopHat($x/a$) with Comb($x/b$) for $2a<b$, $2a>b$, $2a=b$.


10. What is the relationship between the modulation transfer function, the optical transfer function and the point spread function? How is the system resolution defined?