One-Dimensional

(1) Find the Fourier transform directly from the definition of $e^{-3|x|} = f(x)$

(2) State and prove the derivative property of the one-dimensional Fourier transform.

(3) Give the definition of $f * g$ in one-dimension and state the convolution theorem.

(4) If $\hat{f}(s) = e^{-s^2}$ and $\hat{g}(s) = \frac{1}{1+s^2}$ what is $\mathcal{F}(f * g)$?

(5) $\hat{f}(s) = \frac{1}{1+s^2}$, what is $\mathcal{F}(f(3t-4))$?

(6) If $\int_{-\infty}^{\infty} |f(t)|^2 dt = 2\pi$, what is $\int_{-\infty}^{\infty} |\hat{f}(s)|^2 ds$?

Two Dimensional

(1) $f(x,y) = 1$ for $|x| \le \pi/2$, $|y| \le 1$

0 otherwise

(a) Compute the Fourier series of f

(b) compute the Fourier transform of f

(2) State the derivative property for the two-dimensional Fourier transform

(3) If $\hat{f}(r,s) = \frac{\sin r}{r} \cdot \frac{1}{1+s^2}$

~~what is $\mathcal{F}(f(\frac{x}{3}, 5y))$~~

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(4) $f(x,y) = x$ $|x| \le \pi, |y| \le \pi/2$

0 otherwise

(a) compute the Fourier series of f

(b) compute the Fourier transform of f