

Fourier Optics EOP513

Assignment 1

1. Given that $f(x) = \text{rect}(x+2) + \text{rect}(x-2)$, use Matlab to plot the following functions:

- (a) $f(x)$
- (b) $g(x) = f(x-1)$
- (c) $h(x) = f(x)\text{sign}(x)$
- (d) $p(x) = h(x-1)$

2. Use Matlab to plot the following:

- (a) $f(x) = \text{rect}(\frac{x}{4}) - \text{rect}(\frac{x}{2})$
- (b) $g(x) = 2\text{tri}(\frac{x}{2}) - \text{tri}(x)$
- (c) $h(x) = 2\text{tri}(\frac{x}{2}) - 2\text{tri}(x)$
- (d) $p(x) = \left[\text{rect}(\frac{x}{4}) - \text{tri}(\frac{x}{2}) \right] \text{sign}(x)$

3. Given the positive real constants b and x_0 , and the function $f(x) = \text{tri}(x)\text{step}(x)$, sketch the following

- (a) $f(x)$
- (b) $f(\frac{x}{b})$
- (c) $f(x+x_0)$
- (d) $f(-x)$
- (e) $f(\frac{x-x_0}{b})$
- (f) $f(\frac{x_0-x}{b})$

4. With ξ a real parameter and a , b , and x_0 real constants, show that:

- (a) $\int_{-\infty}^{\infty} \delta(\frac{\alpha-x_0}{b}) e^{j2\pi\xi\alpha} d\alpha = |b| e^{j2\pi\xi x_0}$
- (b) $\int_{-\infty}^{\infty} e^{j2\pi\xi x} dx = \delta(\xi)$

5. Use Matlab to generate surface plots for the following functions:

- (a) $f(x, y) = \text{sinc}(\frac{x}{2}, y)$.
- (b) $g(x, y) = \text{rect}(\frac{x}{2}, \frac{y}{4}) - \text{rect}(x, \frac{y}{2})$
- (c) $h(x, y) = \text{somb} \left(\sqrt{x^2 + \left(\frac{y}{2}\right)^2} \right)$