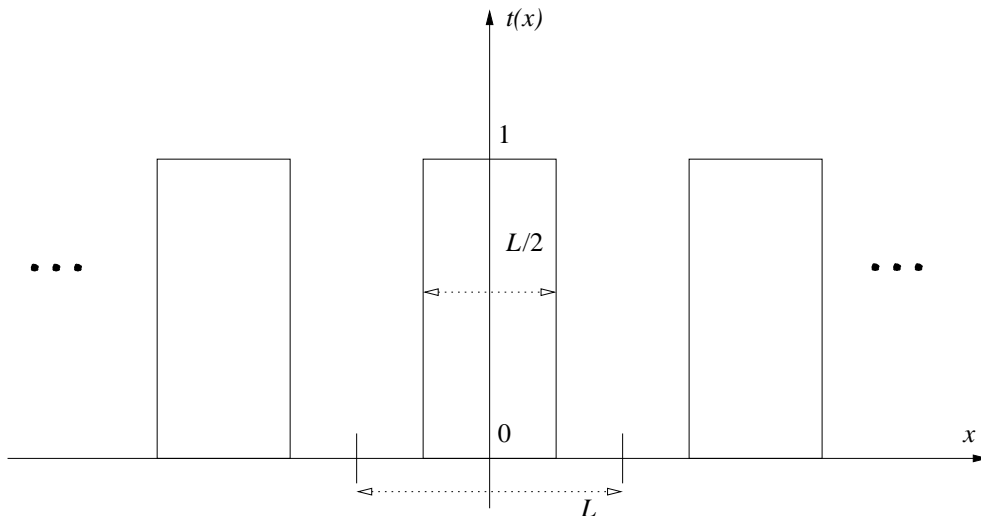
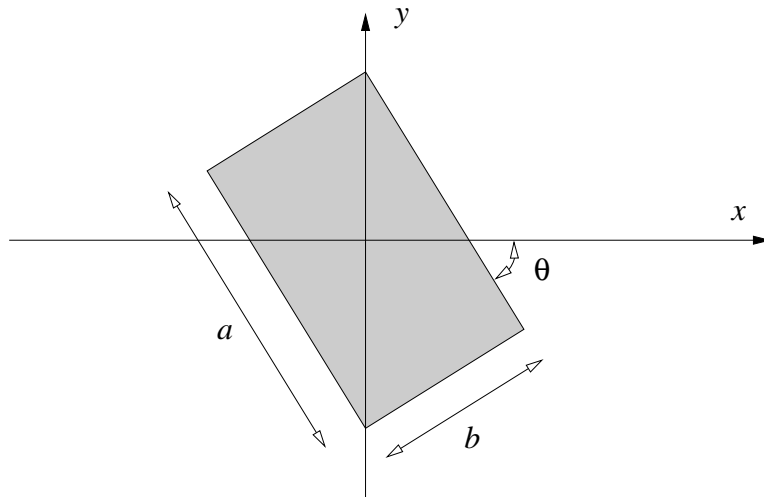


1. A spherical wave is incident on a Fabry-Perot cavity interferometer implemented as a dielectric slab of index n . The wavelength of the spherical wave in vacuum is λ . The spherical wave originates a distance $d = 10^3\lambda$ to the left of the front face of the cavity. The cavity length is $L = 10\lambda/n$ and the intensity reflection coefficient of each face of the cavity is $R = 0.95$. Describe the interference pattern that would be observed on a screen placed a very small distance to the right of the back face of the cavity.
2. Consider the one-dimensional periodic function shown below. In the field of Optics, this is often referred to as a “Binary grating” of infinite extent.
 - 2.a) Calculate the Fourier series coefficients of that periodic function in closed form.
 - 2.b) Write down the Fourier transform of a single boxcar, *i.e.* a single period of this function. What do you observe?



3. **Tilted aperture.** Calculate analytically and sketch the Fourier transform of the tilted aperture shown below (the aperture has value one inside the tilted rectangle and zero outside). The edge lengths are $a = 10\mu\text{m}$, $b = 5\mu\text{m}$ and the tilt is $\theta = 60^\circ$. *Hint:* First calculate the Fourier transform of the same aperture oriented upright; then rotate the (x, y) coordinates.



4. **Tilted binary grating.** Calculate analytically and sketch the Fourier transform of the limited-aperture grating shown below (the aperture has value one at the locations shown as white and zero everywhere else.) Assume spatial period $\Lambda = 10\mu\text{m}$, stripe size $d = 2\mu\text{m}$, tilt $\theta = 30^\circ$ with respect to the aperture, and edge lengths $a = 5\text{mm}$, $b = 3\text{mm}$. *Hint:* First calculate the Fourier transforms of the tilted grating and the aperture individually. Then use the convolution theorem.

