**Exercise 16 (a):**

Let us make the following assumption that the slit width is s and the wall is of infinitesimally small length. From the given transmission function

$$q(u) = \sin^2(\alpha u) \tag{1}$$

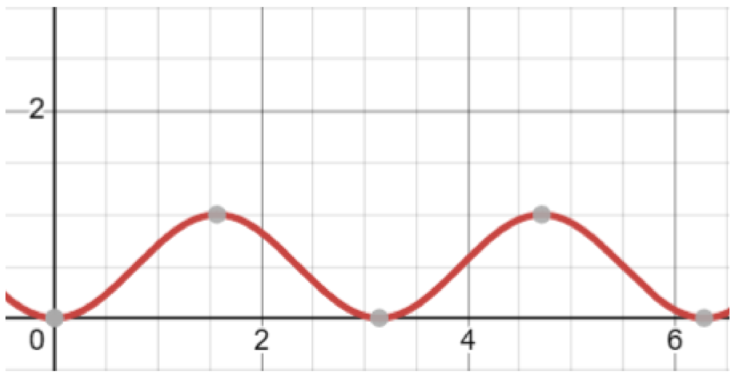


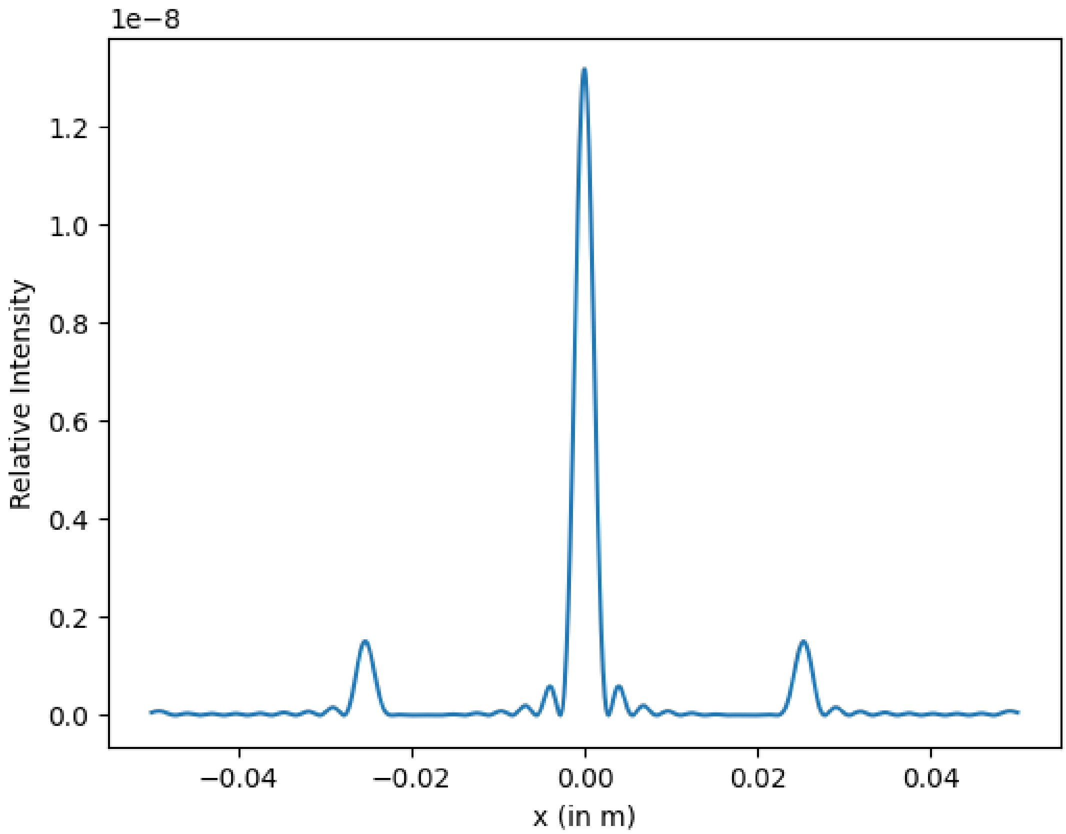

Figure 1: The $\sin^2(x)$ function

Following our assumption, we can conclude that the points at which $\sin^2(\alpha u) = 0$ is the wall. Thus the distance between two consecutive such points is $\pi = \alpha s$. Thus:

$$\boxed{\alpha = \frac{\pi}{s}} \tag{2}$$

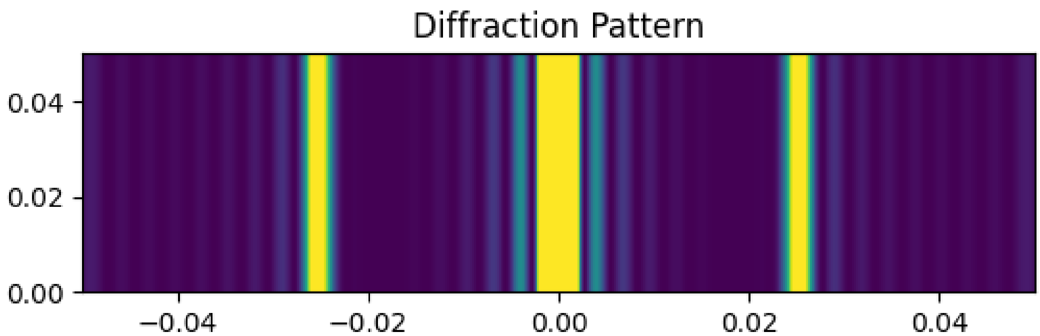
**Exercise 16 (c):**

The method used here to evaluate the integral is Gaussian quadrature with number sample points = 100. The reason is that the integral is evaluated to very high orders of x, thus N = 100 serves as a good and optimal approximate for the integral



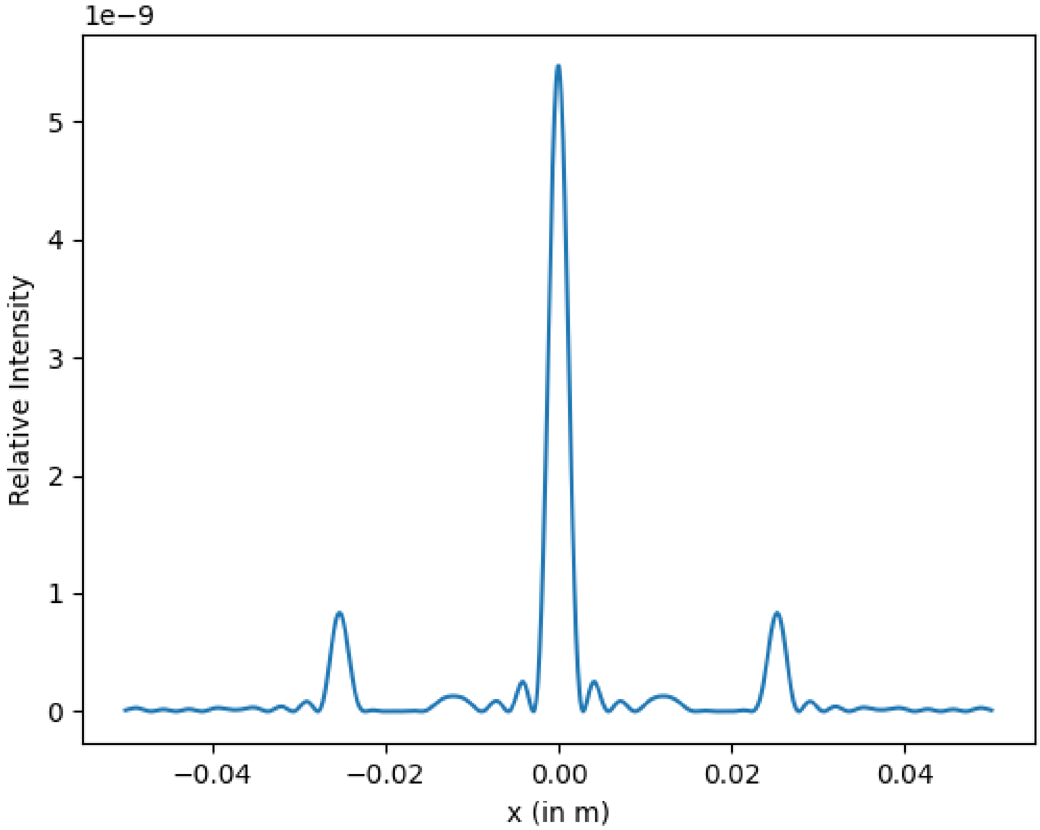

For $q(u) = \sin^2(\alpha u)$

**Exercise 16 (d):**

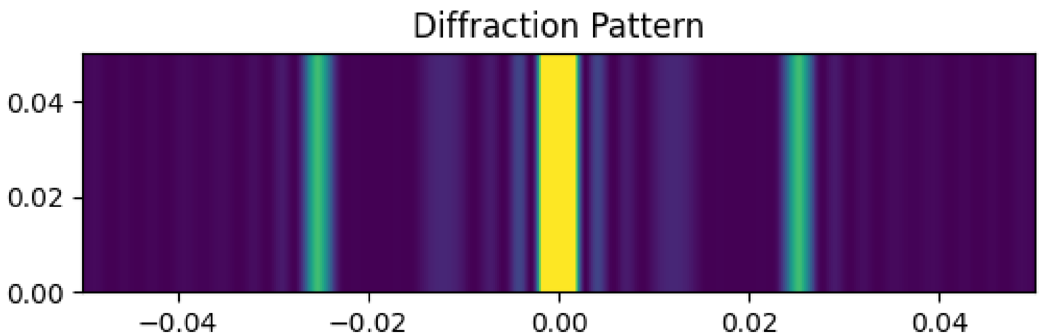



For $q(u) = \sin^2(\alpha u)$

**Exercise 16 (e): (i)**

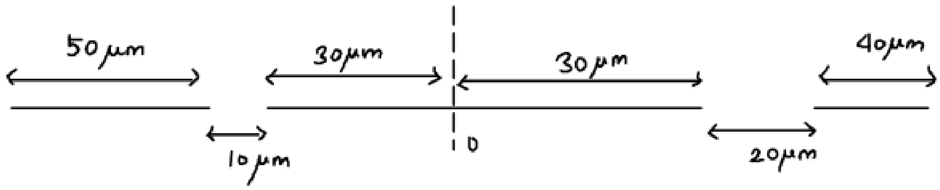



For $q(u) = \sin^2(\alpha u) \sin^2(\alpha u)$

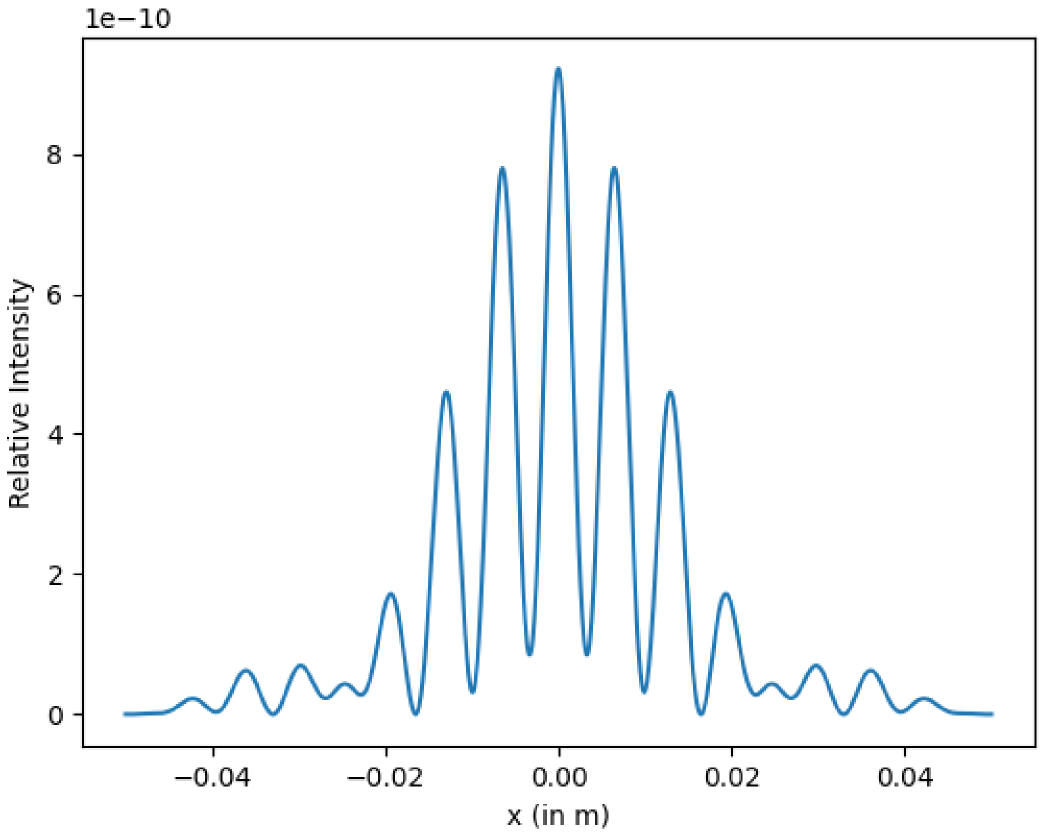



For $q(u) = \sin^2(\alpha u)\sin^2(\beta u)$

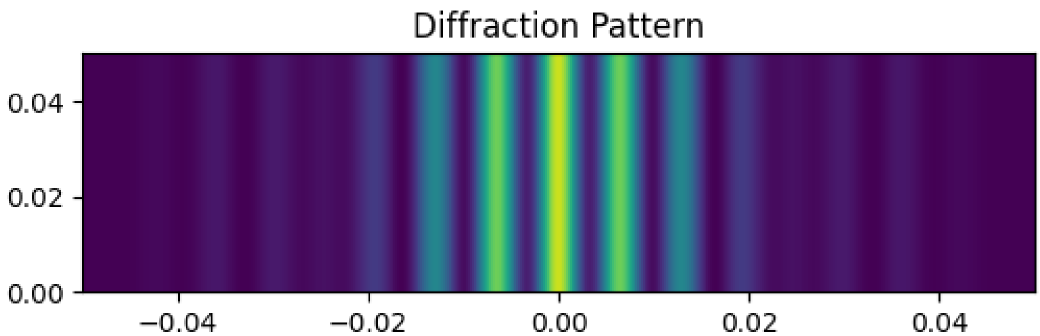
**(i)**




The schematic of the grating




For $q(u)$ = Piecewise 0 and 1




For $q(u)$ = Piecewise 0 and 1