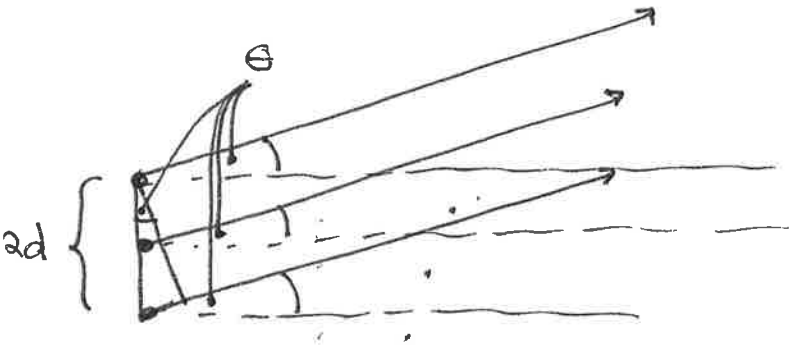
ASG vol 3 Ex 20.4 (Diffraction gratings)



a) When $\theta = 0$, the distance from each slit is very nearly the same (if they are close to each other & the observation screen is very distant-) So Const. interfere when $\theta = 0$

b) When $d\sin\theta = \lambda/3$, the three waves are $\frac{1}{3}\lambda$ out of phase with each other. The result is

$$y = \sin(\phi) + \sin\left(\phi + 2\pi\tfrac{1}{3}\right) + \sin\left(\phi + 2\pi\tfrac{2}{3}\right)$$

which is zero (see plot)

c) When $d\sin\theta = \frac{2\lambda}{3}$, they are $\frac{2}{3}\lambda$ out of phase, so

$$y = \sin(\phi) + \sin\left(\phi + 2\pi\tfrac{2}{3}\right) + \sin\left(\phi + 2\pi\tfrac{4}{3}\right)$$

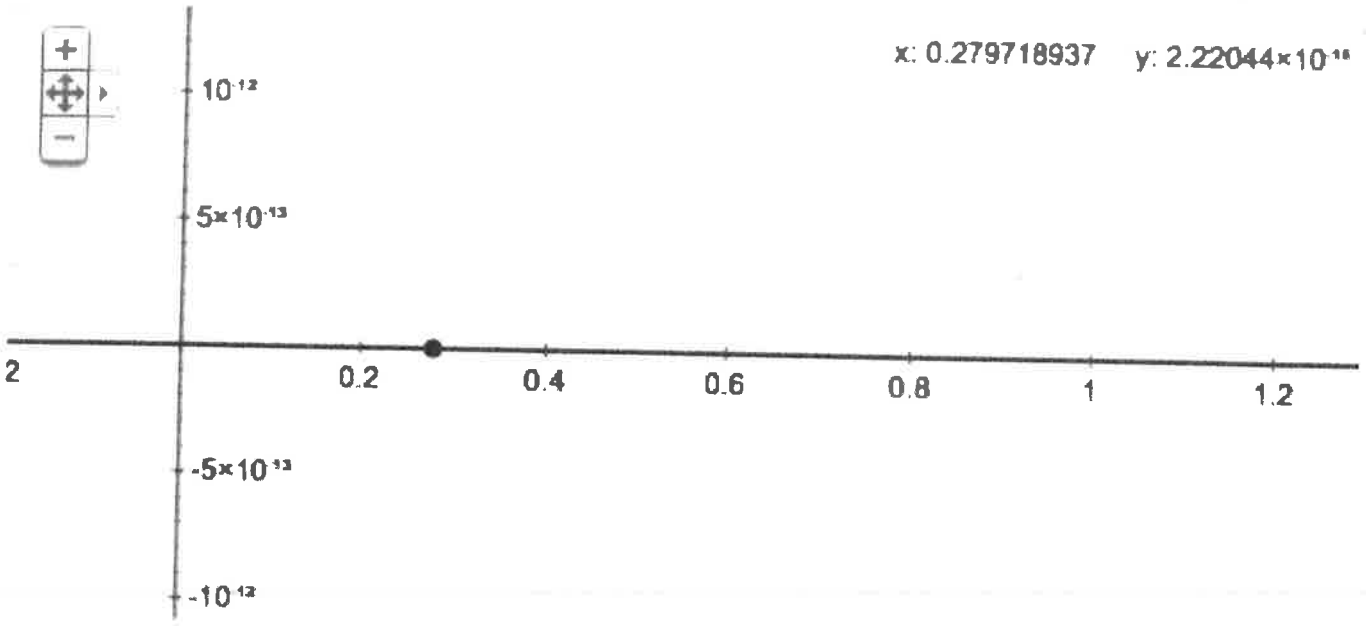
which is again zero (see plot)

d) When $d\sin\theta = \lambda$, the three waves are all in phase

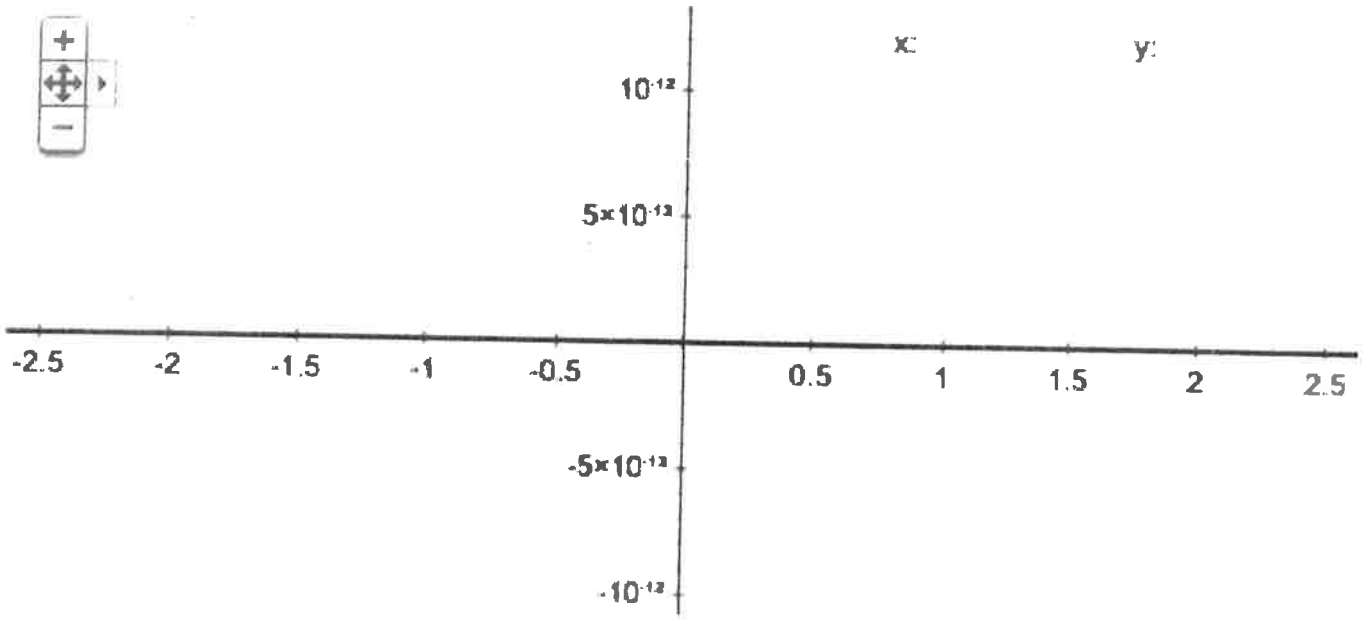
$$y = \sin(\phi) + \sin(\phi + 2\pi) + \sin(\phi + 2\pi \cdot 2)$$

(which is constructive interference).

Graph for sin(x)+sin(x+2*π/3)+sin(x+4*π/3)



Graph for sin(x)+sin(x+4*π/3)+sin(x+8*π/3)



Graph for sin(x)+sin(x+6*π/3)+sin(x+12*π/3)