$$y_1(r_1,t) \quad = \quad A\left(\frac{1}{r_1}\right)\sin(kr_1-\omega t)$$

$$y_2(r_2,t) \quad = \quad A\left(\frac{1}{r_2}\right)\sin(kr_2-\omega t)$$

$$y_{\text{sum}} \quad = \quad A\left\{\frac{1}{r_1}\sin(kr_1-\omega t) \;+\; \frac{1}{r_2}\sin(kr_2-\omega t)\right\}$$

$$y_{\text{sum}} \quad \simeq \quad \frac{A}{r_{\text{avg}}}\left\{\sin(kr_1-\omega t) \;+\; \sin(kr_2-\omega t)\right\}$$

$$\sin(\alpha) \;+\; \sin(\beta) \quad = \quad 2\,\sin\left(\frac{\alpha+\beta}{2}\right)\,\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$y_{\text{sum}} \quad \simeq \quad \frac{2A}{r_{\text{avg}}}\left\{\sin\left(\frac{kr_1-\omega t+kr_2-\omega t}{2}\right)\,\cos\left(\frac{kr_1-\omega t-kr_2+\omega t}{2}\right)\right\}$$

$$y_{\text{sum}} \quad \simeq \quad \frac{2A}{r_{\text{avg}}}\left\{\sin\left(\frac{k[r_1+r_2]}{2}-\omega t\right)\,\cos\left(\frac{k[r_1-r_2]}{2}\right)\right\}$$

$$\cos\left(\frac{k[r_1-r_2]}{2}\right) \quad = \quad 0$$

$$\frac{k[r_1-r_2]}{2} \quad = \quad (2N-1)\,\frac{\pi}{2} \quad , \qquad N=1,2,3,\ldots$$

$$k \quad = \quad \frac{2\pi}{\lambda}$$

$$\text{sum} \;=\; \text{zero when} \qquad |r_1 \;-\; r_2| \quad = \quad \frac{(2N-1)}{2}\,\lambda$$

$$\cos\left(\frac{k[r_1-r_2]}{2}\right) \quad = \quad 1$$

$$\text{sum} \;=\; \text{max when} \qquad |r_1 \;-\; r_2| \quad = \quad N\,\lambda$$

$$x \quad = \quad d\,\sin(\theta)$$

$$\text{zeroes} \qquad x \quad = \quad \frac{2N-1}{2}\,\lambda \quad = \quad d\,\sin(\theta)$$

$$\text{if} \quad d << L\ , \qquad \sin(\theta) \quad = \quad \frac{y}{r_{\text{avg}}} \quad \simeq \quad \frac{y}{L}$$

$$\text{zeroes} \qquad \frac{y\,d}{L} \quad = \quad \frac{2N-1}{2}\,\lambda$$