#1 (a) we previously computed

$$\chi_{\frac{\pi}{2}}(t) = \frac{1}{2} + \sum_{\substack{n=-\infty \\ n\neq 0}}^{\infty} \frac{\sin(n\pi/2)}{n\pi} e^{int}$$

and so

Now $f(x,y) = \chi_{\frac{\pi}{2}}(x)\,\chi_{\frac{\pi}{2}}(y)$

$$f(x,y) \sim \left(\frac{1}{2}\cdot\frac{1}{2}\right) + \sum_{\substack{m=-\infty \\ m\neq 0}}^{\infty} \frac{1}{2}\frac{\sin m\pi/2}{m\pi} e^{imx}$$

$$+ \sum_{\substack{n=-\infty \\ n=\infty}}^{\infty} \frac{1}{2} \frac{\sin n\pi/2}{n\pi} e^{inx} + \sum_{\substack{m=-\infty \\ m\neq 0}}^{\infty} \sum_{\substack{n=-\infty \\ n\neq 0}}^{\infty} \frac{\sin m\pi/2 \, \sin n\pi/2}{mn\pi^2} e^{i(mx+ny)}$$

(b) we also computed

$$\hat{\chi}_{\frac{\pi}{2}}(s) = \frac{1}{\sqrt{2\pi}} \frac{2\sin \pi/2\, s}{s}$$

so
$$\hat{f}(r,s) = \frac{2}{\sqrt{2\pi}} \frac{\sin \pi/2\, r}{r} \cdot \frac{2}{\sqrt{2\pi}} \frac{\sin \pi/2\, s}{s}$$

$$= \frac{2}{\pi} \frac{\sin(\pi/2\, r)\cdot \sin(\frac{\pi}{2}s)}{rs}.$$

(#2a) we previously computed when $g(x) = x$ on $[-\pi, \pi]$

that
$$g(t) = \sum_{\substack{n=-\infty \\ n \neq 0}}^{\infty} \frac{(-1)^n i}{n} \quad (g_0 = 0)$$

Since $f(x,y) = g(x)\,g(y)$.
$$f(x,y) = \sum_{\substack{m=-\infty \\ m \neq 0}}^{\infty} \sum_{\substack{n=-\infty \\ n \neq 0}}^{\infty} \frac{(-1)^m i}{m} \frac{(-1)^n i}{n} e^{i(mx+ny)}$$

$$= \sum_{m \neq 0} \sum_{n \neq 0} \frac{(-1)^{m+n+1}}{mn} e^{i(mx+ny)}.$$

(#2b) we also computed
$$\hat{g}(s) = \frac{2i}{\sqrt{2\pi}} \left[\frac{\pi \cos \pi s}{s} - \frac{\sin \pi s}{s^2} \right]$$

so
$$\hat{f}(r,s) = \hat{g}(r)\,\hat{g}(s)$$
$$= -\frac{4}{2\pi} \left(\frac{\pi \cos \pi r}{r} - \frac{\sin \pi r}{r^2} \right) \left(\frac{\pi \cos \pi s}{s} - \frac{\sin \pi s}{s^2} \right)$$

(3)

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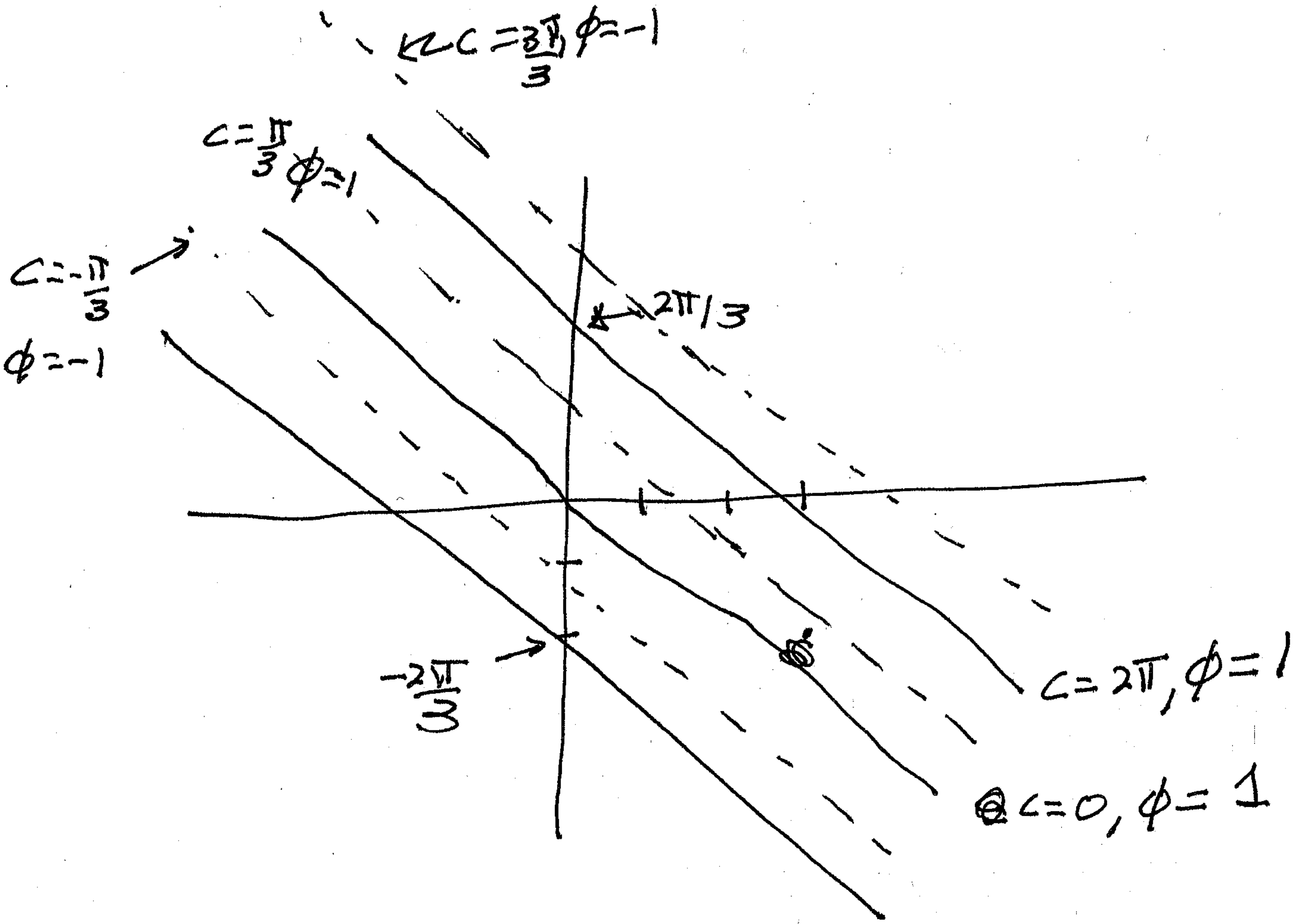
$$2x+3y=0$$

$$2x+3y=c \Rightarrow 3y=-2x+c$$

$$y=-\frac{2}{3}x+\frac{c}{3}$$



$$\text{wave length} = \frac{2\pi}{\sqrt{4+9}} = \frac{2\pi}{\sqrt{13}}$$