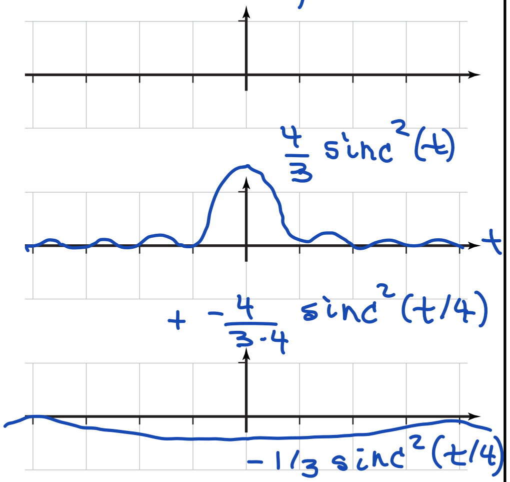
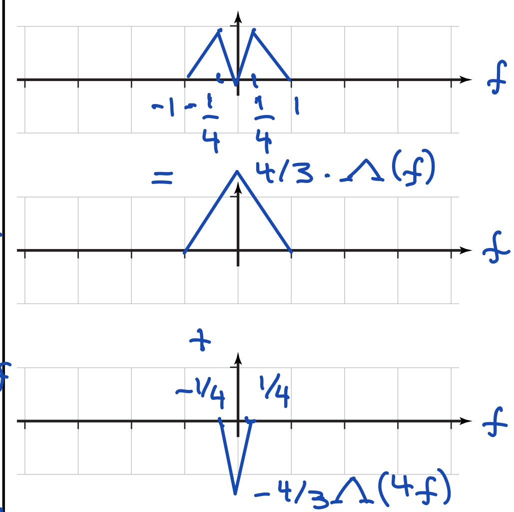
$x(t)$ | $X(f)$





$$X(f) = 4f \qquad 0 \le f \le \tfrac{1}{4}$$

$$-\tfrac{4}{3}(f-1) \qquad \tfrac{1}{4} \le f \le 1$$

$$x(t) = 2\Big[4\int_0^{1/4} f\cos(2\pi f t)\,df - \frac{4}{3}\int_{1/4}^{1} f\cos(2\pi f t)\,df + \frac{4}{3}\int_{1/4}^{1} \cos(2\pi f t)\,df\Big]$$

$$\int_a^b x\cos(2\pi y x)\,dx = \frac{b\sin(2\pi b y)}{2\pi y} + \frac{\cos(2\pi b y)}{(2\pi y)^2} - \frac{a\sin(2\pi a y)}{2\pi y} - \frac{\cos(2\pi a y)}{(2\pi y)^2}$$

$$x(t) = 8\Big[\cancel{\frac{\frac{1}{4}\sin(\frac{\pi}{2}t)}{2\pi t}} + \frac{\cos(\frac{\pi}{2}t)}{(2\pi t)^2} - \cancel{\frac{0\cdot\sin(0 t)}{2\pi t}} - \frac{\cos(0\cdot t)}{(2\pi t)^2}\Big]$$

$x(t) =$

$$\cancel{\left(2+\frac{2}{3}-\frac{8}{3}\right)\sin\left(\frac{\pi}{2}t\right)}$$

$$-\frac{8}{3}\,\frac{\cos(2\pi t)}{(2\pi t)^2}$$

$$+\underbrace{\left(8+\frac{8}{3}\right)}_{\frac{32}{3}}\frac{\cos\left(\frac{\pi}{2}t\right)}{(2\pi t)^2}$$

$$x(t) = -\frac{8}{3}\,\frac{\cos(2\pi t)}{(2\pi t)^2} + \frac{32}{3}\,\frac{\cos\left(\frac{\pi}{2}t\right)}{(2\pi t)^2}$$

$$-\frac{8}{3}\left[\cancel{\frac{\sin(2\pi t)}{2\pi t}} + \frac{\cos(2\pi t)}{(2\pi t)^2} - \frac{1}{4}\cancel{\frac{\sin\left(\frac{\pi}{2}t\right)}{2\pi t}} - \frac{\cos\left(\frac{\pi}{2}t\right)}{(2\pi t)^2}\right]$$

$$+\frac{8}{3}\left[\cancel{\frac{\sin(2\pi t)}{2\pi t}} - \cancel{\frac{\sin\left(\frac{\pi}{2}t\right)}{2\pi t}}\right]$$

$$\operatorname{sinc}^2(t) = \frac{\sin^2(\pi t)}{(\pi t)^2} = \frac{\frac{1}{2}-\frac{1}{2}\cos(2\pi t)}{(\pi t)^2}$$

$$= \frac{2}{(2\pi t)^2} - \frac{2\cos(2\pi t)}{(2\pi t)^2}$$

$$\frac{4}{3}\operatorname{sinc}^2(t) - \frac{1}{3}\operatorname{sinc}^2(t/4)$$

$$= \frac{4}{3}\,\frac{\sin^2(\pi t)}{(\pi t)^2} - \frac{1}{3}\,\frac{\sin^2(\pi t/4)}{(\pi t/4)^2}$$

$$= \frac{4}{3}\left[\frac{2}{(2\pi t)^2} - \frac{2\cos(2\pi t)}{(2\pi t)^2}\right] - \frac{1}{3}\left[\frac{2}{(\pi t/2)^2} - \frac{2\cos(\pi t/2)}{(\pi t/2)^2}\right]$$

$$= -\frac{8}{3}\,\frac{\cos(2\pi t)}{(2\pi t)^2} + \frac{2}{3}\,\frac{\cos(\pi t/2)}{(\pi t/2)^2} + \frac{4}{3}\,\frac{2}{(2\pi t)^2} - \frac{2}{3}\,\frac{1}{(\pi t/2)^2}$$

$$\frac{2\cdot 16}{3}\,\frac{\cos(\pi t/2)}{(2\pi t)^2}$$

$$\underbrace{\frac{\cancel{4}}{3}\,\frac{2}{\cancel{4}\pi^2 t^2} - \frac{2\cdot 4}{3\pi^2 t^2}}$$

$$\frac{2}{3} - \frac{8}{3} = -2$$

$$-\frac{2}{\pi^2 t^2} = -\frac{8}{(2\pi t)^2}$$