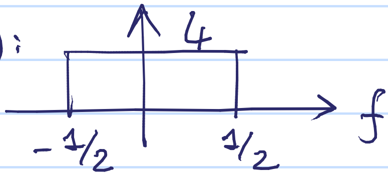
1) $x(t) = 2\,\mathrm{sinc}(t) \longrightarrow G_x(f):$



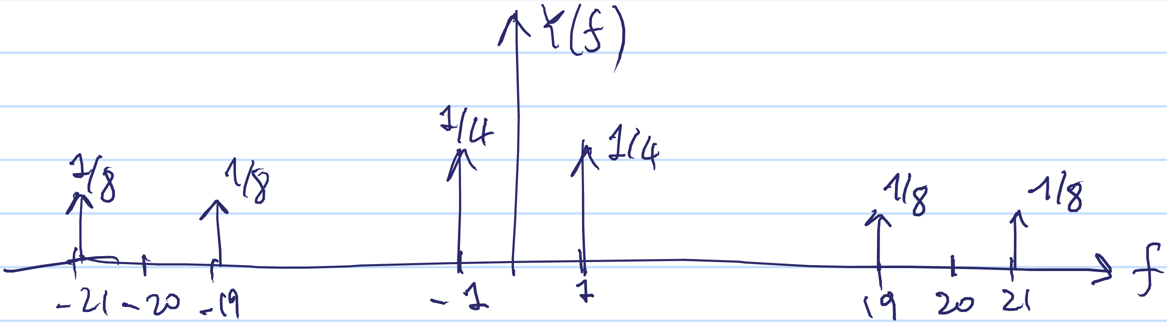
$$\longrightarrow R_x(\tau) = \mathcal{F}^{-1}\{G_x(f)\} = 4\,\mathrm{sinc}(\tau)$$

2) $x(t) = \cos(2\pi t)\cos(20\pi t)$

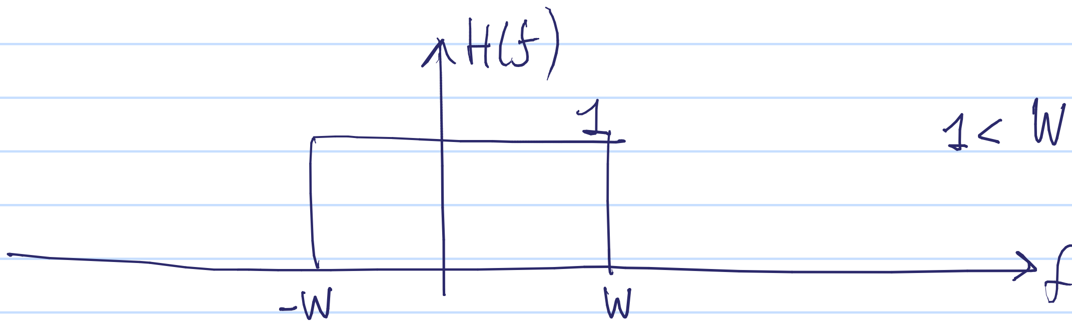
a. $y(t) = \cos(2\pi t)\left(\cos(20\pi t)\right)^2$

$= \cos(2\pi t)\,\frac{1}{2}\left(1 + \cos(40\pi t)\right)$

$= \frac{1}{2}\cos(2\pi t) + \frac{1}{2}\cos(2\pi t)\cos(40\pi t)$



b.

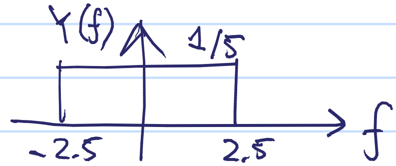


$1 < W < 19$

$\rightarrow$ output: $\frac{1}{2}\cos(2\pi t)$

4. $x(t) = 4\,\mathrm{sinc}(5t)\,\sin(200\pi t)$

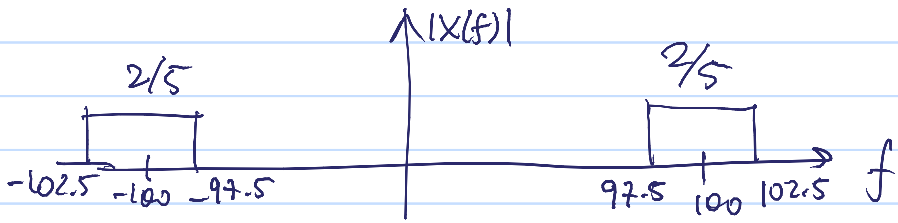
$y(t) = \mathrm{sinc}(5t) \overset{\mathcal{F}}{\longleftrightarrow}$

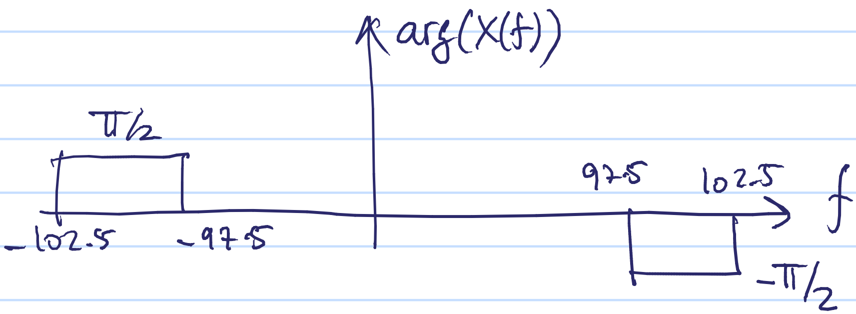


$$4\,\mathrm{sinc}(5t)\sin(200\pi t)$$

$$= 4\left(\frac{1}{2j}\,\mathrm{sinc}(5t)\,e^{j200\pi t} - \frac{1}{2j}\,\mathrm{sinc}(5t)\,e^{-j200\pi t}\right)$$

$$\overset{\mathcal{F}}{\longleftrightarrow} X(f) = \frac{2Y(f-100)}{j} - \frac{2Y(f+100)}{j}$$





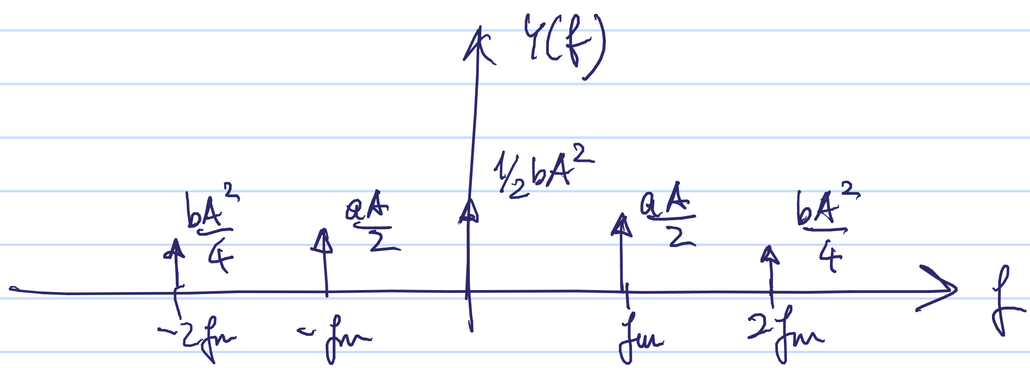
5) Periodic (Fourier series)
Complex (no Hermitian symmetry)
Power

3) 2.8 (a)

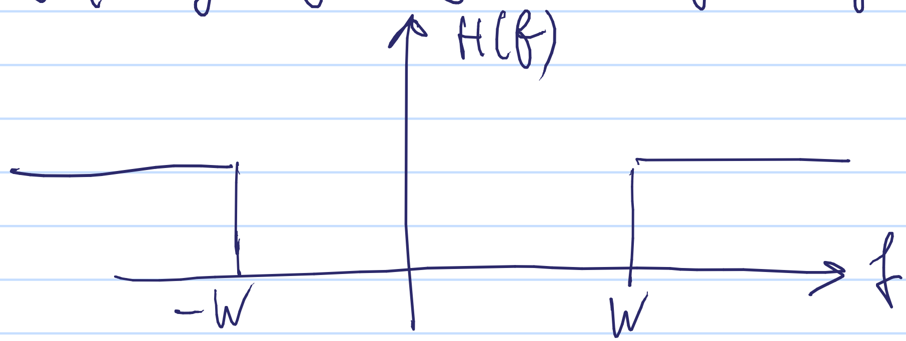
$$x(t) = A\cos(2\pi f_m t) \Rightarrow y(t) = a\,x(t) + b\,x(t)^2$$

$$y(t) = aA\cos(2\pi f_m t) + bA^2\left(\frac{1}{2} + \frac{1}{2}\cos(4\pi f_m t)\right)$$

$$= \frac{1}{2}bA^2 + aA\cos(2\pi f_m t) + \frac{bA^2}{2}\cos(4\pi f_m t)$$



2.8 (c) Based on the figure above, we can obtain a sine wave at frequency $2f_m$ by means of a high-pass filter



$f_m < W < 2f_m$