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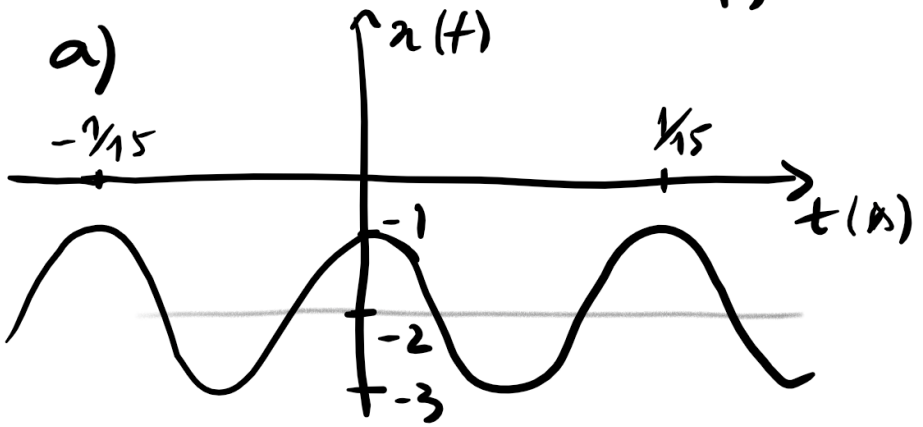
1- $x(t) = -2 + \cos(2\pi 15 t)$

$y(t) = \cos(2\pi 5 t - \pi/4) + \sin(2\pi 30 t) =$

$= \cos(2\pi 5 t - \pi/4) + \cos(2\pi 30 t - \pi/2)$

a)



$T_x = \frac{1}{15} = 0.0667$

$f_y = mdc\{5, 30\} =$

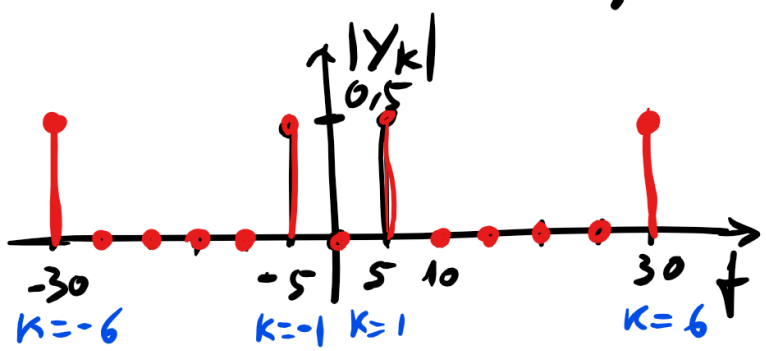
$= 5$ Hz

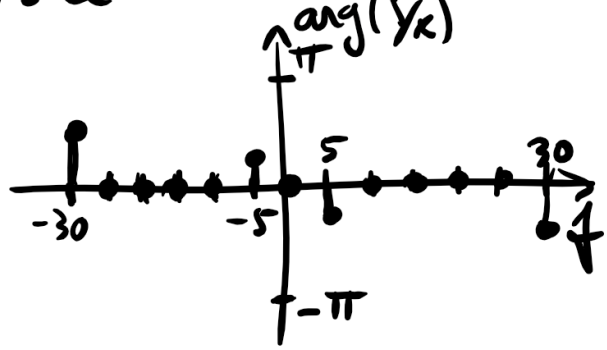
$f_x = 15$ Hz

b) $Y_0 = 0$ $\quad Y_1 = 0{,}5\, e^{-j\pi/4}$ $\quad Y_{-1} = 0{,}5\, e^{j\pi/4}$

$Y_2 = Y_{-2} = Y_3 = Y_{-3} = Y_4 = Y_{-4} = Y_5 = Y_{-5} = 0$

$Y_6 = 0{,}5\, e^{-j\pi/2}$ $\quad Y_{-6} = 0.5\, e^{j\pi/2}$





c) $P_x = \sum_{k \in \{-1,0,1\}} |X_k|^2 = 4 + 0{,}25 + 0.25 = 4.5$ W

$X_0 = 2\, e^{j\pi}$ $\quad X_1 = 0{,}5$ $\quad X_{-1} = 0{,}5$

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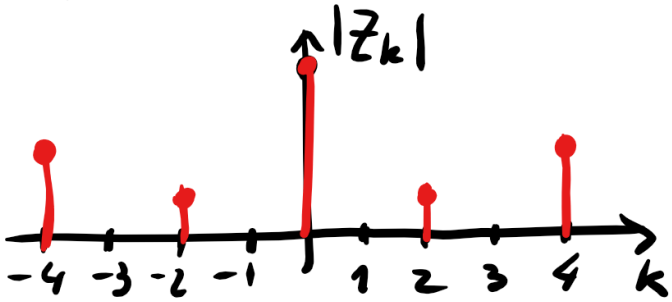
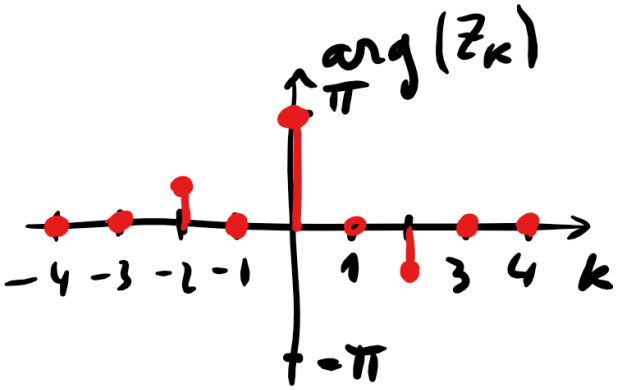
2- $$z_k = \begin{cases} -10 & , k=0 \\ 2e^{-j\pi/3} & , k=2 \\ 2e^{j\pi/3} & , k=-2 \\ 5 & , k=-4,4 \end{cases} = \begin{cases} 10e^{j\pi} & , k=0 \\ \vdots & \cdots \\ \cdots & \cdots \\ \cdots & \cdots \end{cases}$$

a)





b) $f_0 = 5\ Hz$

$$z(t) = z_0 + z_2 e^{j(k\pi 5\times 2t - \pi/3)} + z_{-2} e^{-j(2\pi 5\times 2t - \pi/3)} +$$

$$+ z_4 e^{j2\pi 5\times 5t} + z_{-4} e^{-j2\pi 5\times 5t} =$$

$$= -10 + 2e^{j(k\pi 10t - \pi/3)} + 2e^{-j(2\pi 10t - \pi/3)} +$$

$$+ 5e^{j2\pi 25t} + 5e^{-j2\pi 25t} =$$

$$= -10 + 4\cos(2\pi 10t - \pi/3) + 10\cos(2\pi 25t)$$

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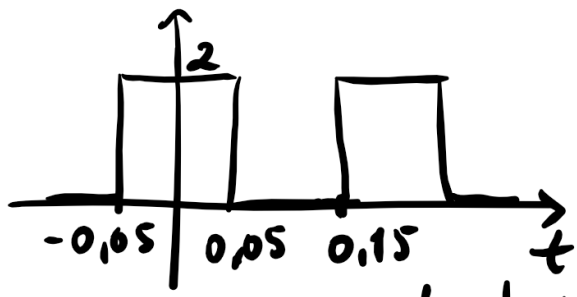
3-

a) Usando a tabela de coef. de Fourier



onda quadrada por amplitude 2

$T_1 = 0,05\,s \quad T_0 = 0,2\,s$

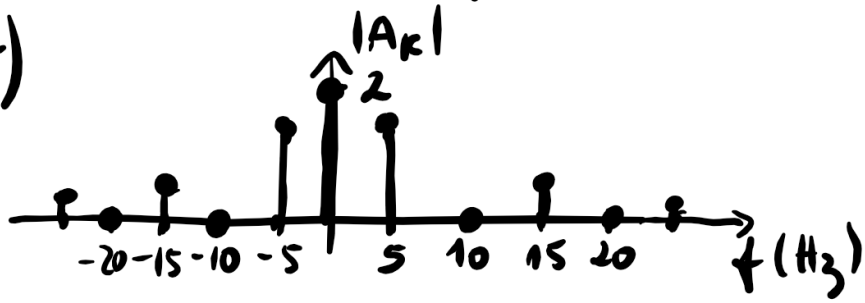
$f_0 = 5\,Hz$

$$A_k = 2\,\frac{2T_1}{T_0}\,\text{sinc}\left(k\,\frac{2T_1}{T_0}\right)$$

$$= 4\,\frac{0,1}{0,2}\,\text{sinc}\left(k\,\frac{0,1}{0,2}\right) =$$

$$= 2\,\text{sinc}\left(\frac{k}{2}\right)$$

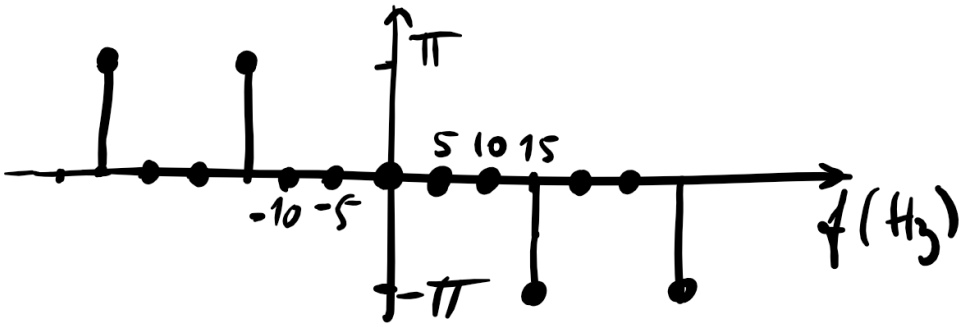
b)



$A_0 = 2 \quad A_2 = 0$

$A_1 = \frac{4}{\pi} \quad A_3 = -\frac{4}{3\pi}$

$A_4 = 0 \quad A_5 = \frac{4}{5\pi}$



c) $b(t) = 3a(t+0,5)+1$

$B_0 = 3A_0 + 1 = 7$

$B_1 = 3A_1\,e^{-j2\pi 5 \times 1 \times 0,5} = \frac{12}{\pi}\,e^{-j5\pi} = -\frac{12}{\pi}$

$B_2 = 0$

$B_3 = -\frac{12}{3\pi}\,e^{-j2\pi 5 \times 3 \times 0,5} = -\frac{4}{\pi}\,e^{-j15\pi} = \frac{4}{\pi}$

$B_4 = 0$

$B_5 = \frac{12}{5\pi}\,e^{-j2\pi 5 \times 5 \times 0,5} = \frac{12}{5\pi}\,e^{-j25\pi} = -\frac{12}{5\pi}$

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3 e) cont.