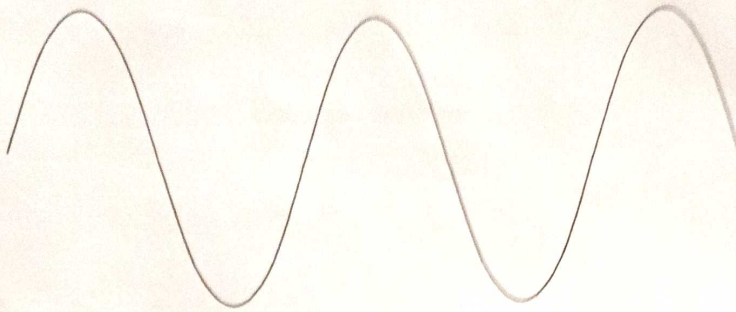
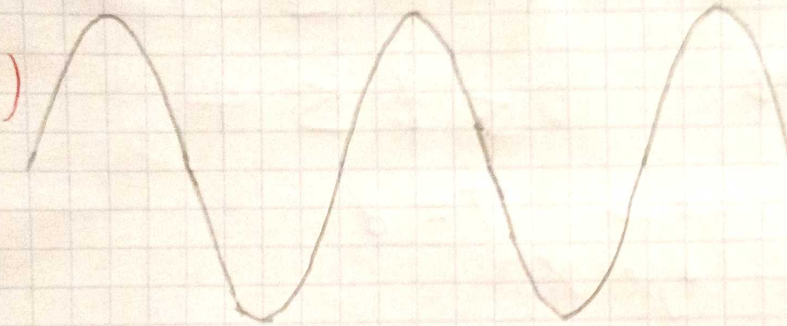
1)

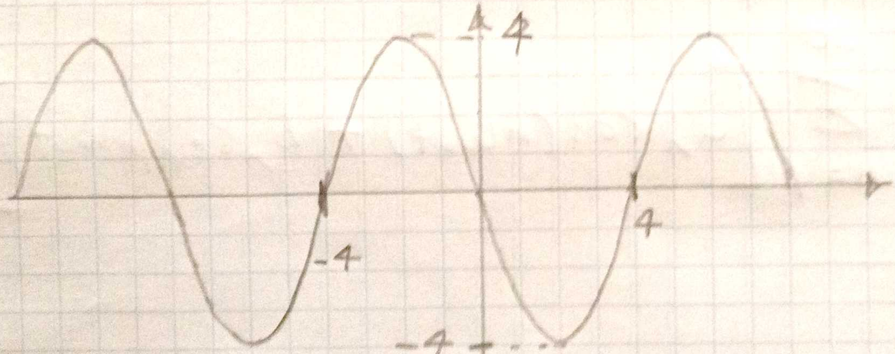
Gráfica 24



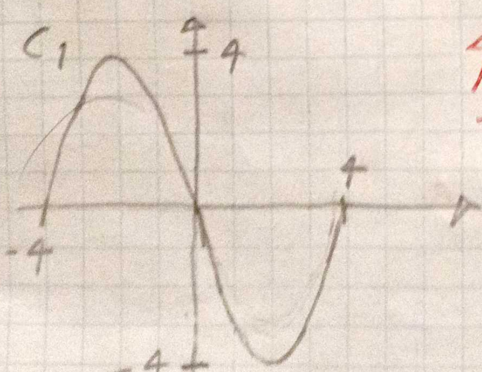
No es una función senoidal

2)





3)



1) c_2: raíces en -4 y 0

$y = a(x-(-4))(x-0)$

$y = a(x+4)x$

$y = a(x^2+4x)$

dado $x=-2$; $y=4$

$4 = a(4-8)$

$a = \frac{4}{-4} = -1$

$y = -(x^2+4x)$

4) C_2: raíces en 4 y 0 dado $x=2$; $y=-4$

$y = a(x-(4))(x-0)$

$y = a(x-4)x$

$y = a(x^2-4x)$

$-4 = a(4-4(2))$

$a = \frac{-4}{-4} = 1$

$y = (x^2-4x)$

5.-

$$f(t) = \begin{bmatrix} -(t^2+4t) & -4 \leq t \leq 0 \\ t^2-4t & 0 \leq t \leq 4 \end{bmatrix}$$

La función es impar $T=8$

y simetría respecto eje x

6)

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left[a_n \cos(n w_0 t) + b_n \operatorname{sen}(n w_0 t) \right]$$

$$w_0 = \frac{2\pi}{T}$$

$a_0 = 0$ $a_n = 0$

$$b_n = \frac{2}{T} \int_0^T f(t) \operatorname{sen}(n w_0 t)\, dt$$

f)

$a_0 = 0 \qquad a_n = 0$

$$b_n = \frac{2}{8}\left[-\int_{-4}^{0} t^2 sen(nw_0 t)dt - 4\int_{-4}^{0} t\, sen(nw_0 t)dt + \int_{0}^{4} t^2 sen(nw_0 t)dt - 4\int_{0}^{4} t\, sen(nw_0 t)dt\right]$$

$$b_n = \frac{1}{4}\left[\int_{0}^{-4} t^2 sen(nw_0 t)dt - 4\int_{-4}^{0} t\, sen(nw_0 t)dt + \int_{0}^{4} t^2 sen(nw_0 t)dt + 4\int_{4}^{0} t\, sen(nw_0 t)dt\right]$$

$$b_n = \frac{1}{4}\left[\left[\frac{(2-(nw_0 t)^2)\cos(nw_0 t) + 2nw_0 t\, sen\, nw_0 t}{(nw_0)^3}\right]_0^{-4} \checkmark\right.$$

$$4\left[\frac{1}{(nw_0)^2} sen(nw_0 t) - \frac{t}{nw_0}\cos(nw_0 t)\right]_{-4}^{0} \checkmark$$

$$+\left[\frac{(2-(nw_0 t)^2)\cos(nw_0 t) + 2nw_0 t\, sen(nw_0 t)}{(nw_0)^3}\right]_0^4 \checkmark$$

$$\left. + 4\left[\frac{1}{(nw_0)^2} sen(nw_0 t) - \frac{t}{nw_0}\cos(nw_0 t)\right]_4^0\right]$$

$$b_n = \frac{1}{4}\left[\frac{(2-(n\pi)^2)\cos \pi n - 2}{(nw_0)^3}\right.$$

$$-4\left[0 - \left(-\frac{(-4)}{nw_0}\cos(-\pi n)\right)\right]$$

$$+\left[\frac{(2-(\pi n)^2)\cos \pi n - 2}{(nw_0)^3}\right]$$

$$+4\left[0 - \left(-\frac{4}{nw_0}\cos(\pi n)\right)\right]$$

$$b_n = \frac{1}{4}\left[2\left[\frac{(2-(n\pi)^2)\cos\pi - 2}{(n\omega_0)^3}\right] + \frac{16}{n\omega_0}\cos\pi n\right]$$

$$b_n = \frac{1}{2}\left(\frac{(2-(n\pi)^2)\cos\pi - 2}{(n\omega_0)^3}\right) + \frac{8}{n\omega_0}\cos\pi n$$

$a_0 = 0$ $\qquad$ $a_n = 0$

Simulación de la grafica por series de Fourier

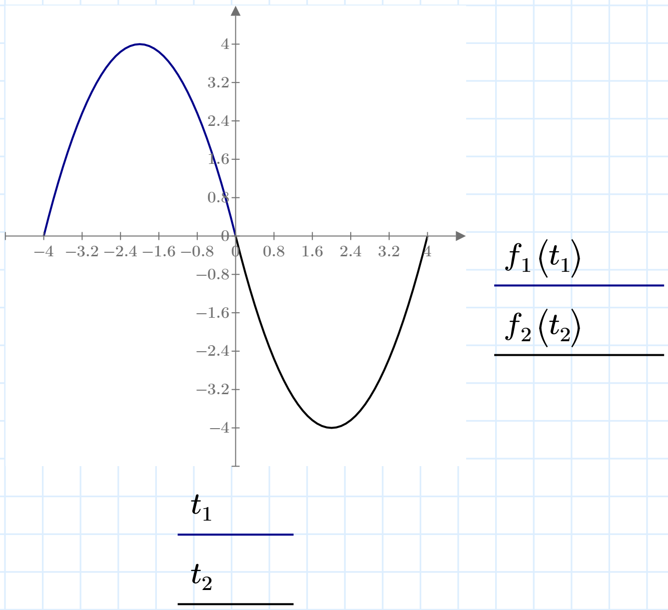
Comprobación del modelo matemático propuesto para el primer periodo de la grafica

Función propuesta

$$\begin{bmatrix} -\left(t^2+4\ t\right) & -4 \le t \le 0 \\ \left(t^2-4\ t\right) & 0 \le t \le 4 \end{bmatrix}$$

$$t_1 := -4, -3.9 .. 0 \qquad t_2 := 0, 0.1 .. 4$$

$$f_1\left(t_1\right) := -\left(t_1{}^2 + 4 \cdot t_1\right) \qquad f_2\left(t_2\right) := \left(t_2{}^2 - 4 \cdot t_2\right)$$



grafica de la serie de Fourier de la función dada

$T:=8$ $k:=10000$ $d_1:=2$ $d_2:=3$ $r:=0.01$

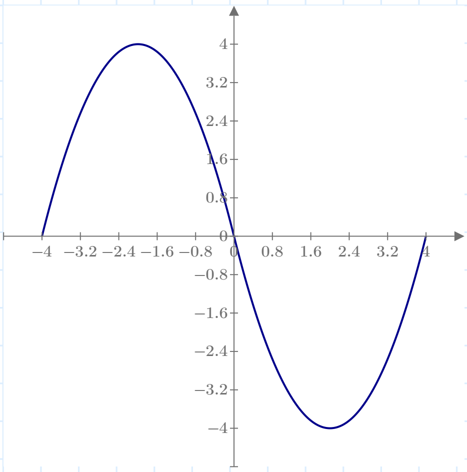
$t:=-d_1 \cdot T, -d_1 \cdot T + r \,..\, d_2 \cdot T$ $t_3:=-4, -3.99 \,..\, T-4$

$w:=\dfrac{2\,\pi}{T}$ $a_0:=0$ $n:=1, 2 \,..\, k$

$a_n(n):=0$

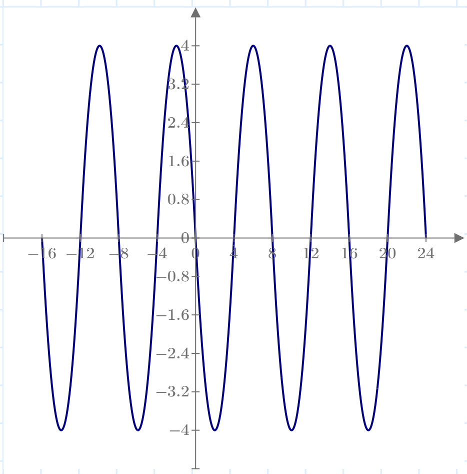
$$b_n(n):=\frac{1}{2\,(n \cdot w)^3}\,\left(\left(2-(n \cdot \pi)^2\right)\,\cos(\pi \cdot n)-2\right)+\frac{8}{n \cdot w} \cdot (\cos(\pi \cdot n))$$

$$f(t):=\frac{a_0}{2}+\sum_{n=1}^{k}\left(a_n(n) \cdot \cos(n \cdot w \cdot t)+b_n(n) \cdot \sin(n \cdot w \cdot t)\right)$$



$f(t_3)$

t_3



$f(t)$

t

Espectro de amplitud y espectro de frecuencia

$$m := 1,2..15$$

$$c(m) := \frac{1}{2} \cdot \sqrt[2]{\left(a_n(|m|)\right)^2 + \left(b_n(|m|)\right)^2} \qquad \phi(m) := \operatorname{atan}\left(-\frac{b_n(|m|)}{a_n(|m|)}\right)$$

$$\omega(m) := m \cdot w \qquad \phi(m) := \frac{\pi}{2}$$

Debido a que la tangente inversa de infinito es 90 grados o pi / 2, redefinimos el espectro de frecuencia de esa manera