> $restart$

> $Ecua := diff(y(x,t),x) + diff(y(x,t),x,t) - diff(y(x,t),t) = 0$

$$Ecua := \frac{\partial}{\partial x}\, y(x,t) + \frac{\partial^2}{\partial t \partial x}\, y(x,t) - \frac{\partial}{\partial t}\, y(x,t) = 0 \qquad \textbf{(1)}$$

> $EcuaDos := simplify(eval(subs(y(x,t) = P(x) \cdot Q(t), Ecua)))$

$$EcuaDos := \left(Q(t) + \frac{d}{dt}\, Q(t)\right)\left(\frac{d}{dx}\, P(x)\right) - P(x)\left(\frac{d}{dt}\, Q(t)\right) = 0 \qquad \textbf{(2)}$$

> $EcuaTres := lhs(EcuaDos) + P(x)\left(\frac{d}{dt}\, Q(t)\right) = rhs(EcuaDos) + P(x)\left(\frac{d}{dt}\, Q(t)\right)$

$$EcuaTres := \left(Q(t) + \frac{d}{dt}\, Q(t)\right)\left(\frac{d}{dx}\, P(x)\right) = P(x)\left(\frac{d}{dt}\, Q(t)\right) \qquad \textbf{(3)}$$

> $EcuaCuatro := \frac{lhs(EcuaTres)}{\left(Q(t) + \frac{d}{dt}\, Q(t)\right) \cdot P(x)} = \frac{rhs(EcuaTres)}{\left(Q(t) + \frac{d}{dt}\, Q(t)\right) \cdot P(x)}$

$$EcuaCuatro := \frac{\frac{d}{dx}\, P(x)}{P(x)} = \frac{\frac{d}{dt}\, Q(t)}{Q(t) + \frac{d}{dt}\, Q(t)} \qquad \textbf{(4)}$$

> $EcuaX := lhs(EcuaCuatro) = \mathrm{alpha}$

$$EcuaX := \frac{\frac{d}{dx}\, P(x)}{P(x)} = \alpha \qquad \textbf{(5)}$$

> $EcuaT := rhs(EcuaCuatro) = \mathrm{alpha}$

$$EcuaT := \frac{\frac{d}{dt}\, Q(t)}{Q(t) + \frac{d}{dt}\, Q(t)} = \alpha \qquad \textbf{(6)}$$

> $EcuaXcero := subs(\mathrm{alpha} = 0, EcuaX)$

$$EcuaXcero := \frac{\frac{d}{dx}\, P(x)}{P(x)} = 0 \qquad \textbf{(7)}$$

> $EcuaTcero := subs(\mathrm{alpha} = 0, EcuaT)$

$$EcuaTcero := \frac{\frac{d}{dt}\, Q(t)}{Q(t) + \frac{d}{dt}\, Q(t)} = 0 \qquad \textbf{(8)}$$

> $SolGralXcero := dsolve(EcuaXcero)$

$$SolGralXcero := P(x) = c_1 \qquad \textbf{(9)}$$

> $SolGralTcero := dsolve(EcuaTcero)$

$$SolGralTcero := Q(t) = c_1 \qquad \textbf{(10)}$$

> $SolGralCero := y(x,t) = \_C10$

$$SolGralCero := y(x,t) = \_C10 \quad \mathbf{(11)}$$

> *Ecua*

$$\frac{\partial}{\partial x} y(x,t) + \frac{\partial^2}{\partial t \partial x} y(x,t) - \frac{\partial}{\partial t} y(x,t) = 0 \quad \mathbf{(12)}$$

> $EcuaXpos := subs(\mathrm{alpha} = \beta^2, EcuaX)$

$$EcuaXpos := \frac{\frac{d}{dx} P(x)}{P(x)} = \beta^2 \quad \mathbf{(13)}$$

> $EcuaTpos := subs(\mathrm{alpha} = \beta^2, EcuaT)$

$$EcuaTpos := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = \beta^2 \quad \mathbf{(14)}$$

> $SolGralXpos := dsolve(EcuaXpos)$

$$SolGralXpos := P(x) = c_1 \, e^{\beta^2 x} \quad \mathbf{(15)}$$

> $SolGralTpos := dsolve(EcuaTpos)$

$$SolGralTpos := Q(t) = c_1 \, e^{-\frac{\beta^2 t}{(\beta-1)(\beta+1)}} \quad \mathbf{(16)}$$

> $SolGralPos := y(x,t) = rhs(SolGralXpos) \cdot subs(c_1 = 1, rhs(SolGralTpos))$

$$SolGralPos := y(x,t) = c_1 \, e^{\beta^2 x} \, e^{-\frac{\beta^2 t}{(\beta-1)(\beta+1)}} \quad \mathbf{(17)}$$

> $EcuaXneg := subs(\mathrm{alpha} = -\beta^2, EcuaX)$

$$EcuaXneg := \frac{\frac{d}{dx} P(x)}{P(x)} = -\beta^2 \quad \mathbf{(18)}$$

> $EcuaTneg := subs(\mathrm{alpha} = -\beta^2, EcuaT)$

$$EcuaTneg := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = -\beta^2 \quad \mathbf{(19)}$$

> $SolGralXneg := dsolve(EcuaXneg)$

$$SolGralXneg := P(x) = c_1 \, e^{-\beta^2 x} \quad \mathbf{(20)}$$

> $SolGralTneg := dsolve(EcuaTneg)$

$$SolGralTneg := Q(t) = c_1 \, e^{-\frac{\beta^2 t}{\beta^2 + 1}} \quad \mathbf{(21)}$$

> $SolGralNeg := y(x,t) = rhs(SolGralXneg) \cdot subs(c_1 = 1, rhs(SolGralTneg))$

(22)

$$SolGralNeg := y(x,t) = c_1\, e^{-\beta^2 x}\, e^{-\frac{\beta^2 t}{\beta^2+1}} \quad \textbf{(22)}$$

> *Ecua*

$$\frac{\partial}{\partial x} y(x,t) + \frac{\partial^2}{\partial t \partial x} y(x,t) - \frac{\partial}{\partial t} y(x,t) = 0 \quad \textbf{(23)}$$

> *restart*

Desarrollo de la serie trigonométrica de Fourier

> $F := \exp(x)$

$$F := e^x \quad \textbf{(24)}$$

> $L := 2$

$$L := 2 \quad \textbf{(25)}$$

> $a[0] := \frac{1}{L} \cdot int(F, x = -L..L);\ evalf(\%, 3)$

$$a_0 := -\frac{e^{-2}}{2} + \frac{e^2}{2}$$
$$3.63 \quad \textbf{(26)}$$

> $a[n] := subs\left(\sin(n \cdot \mathrm{Pi}) = 0, \cos(n \cdot \mathrm{Pi}) = (-1)^n, \frac{1}{L} \cdot int\left(F \cdot \cos\left(\frac{n \cdot \mathrm{Pi}}{L} \cdot x\right), x = -L..L\right)\right)$

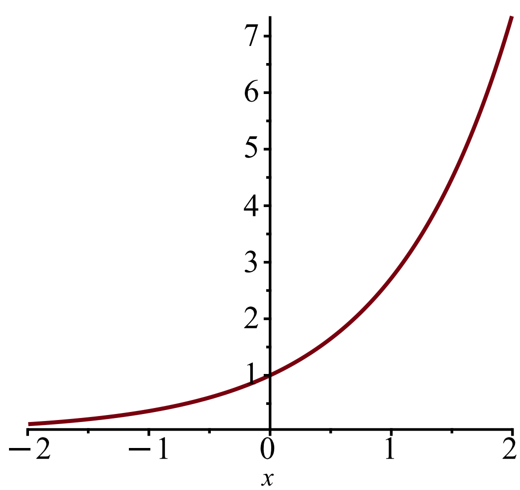
$$a_n := \frac{-2\, e^{-2} (-1)^n + 2\, e^2 (-1)^n}{n^2 \pi^2 + 4} \quad \textbf{(27)}$$

> $b[n] := subs\left(\sin(n \cdot \mathrm{Pi}) = 0, \cos(n \cdot \mathrm{Pi}) = (-1)^n, \frac{1}{L} \cdot int\left(F \cdot \sin\left(\frac{n \cdot \mathrm{Pi}}{L} \cdot x\right), x = -L..L\right)\right)$

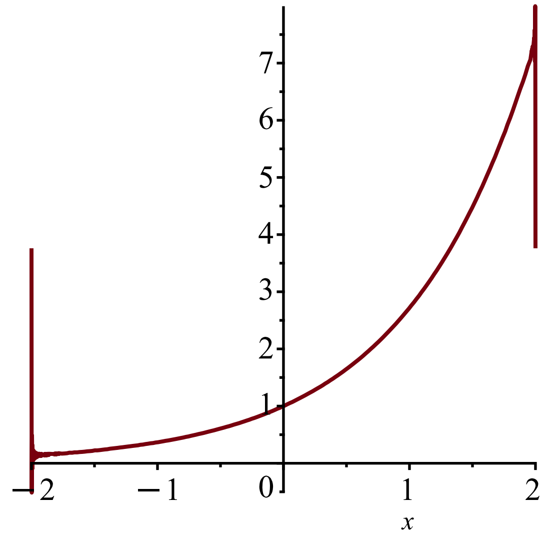
$$b_n := \frac{e^{-2} \pi (-1)^n n - e^2 \pi (-1)^n n}{n^2 \pi^2 + 4} \quad \textbf{(28)}$$

> $STFexp := \frac{a[0]}{2} + sum\left(a[n] \cdot \cos\left(\frac{n \cdot \pi}{L} \cdot x\right) + b[n] \cdot \sin\left(\frac{n \cdot \pi}{L} \cdot x\right), n = 1..1000\right) :$

> $plot(F, x = -L..L)$



> $plot(STFexp, x = -L..L)$

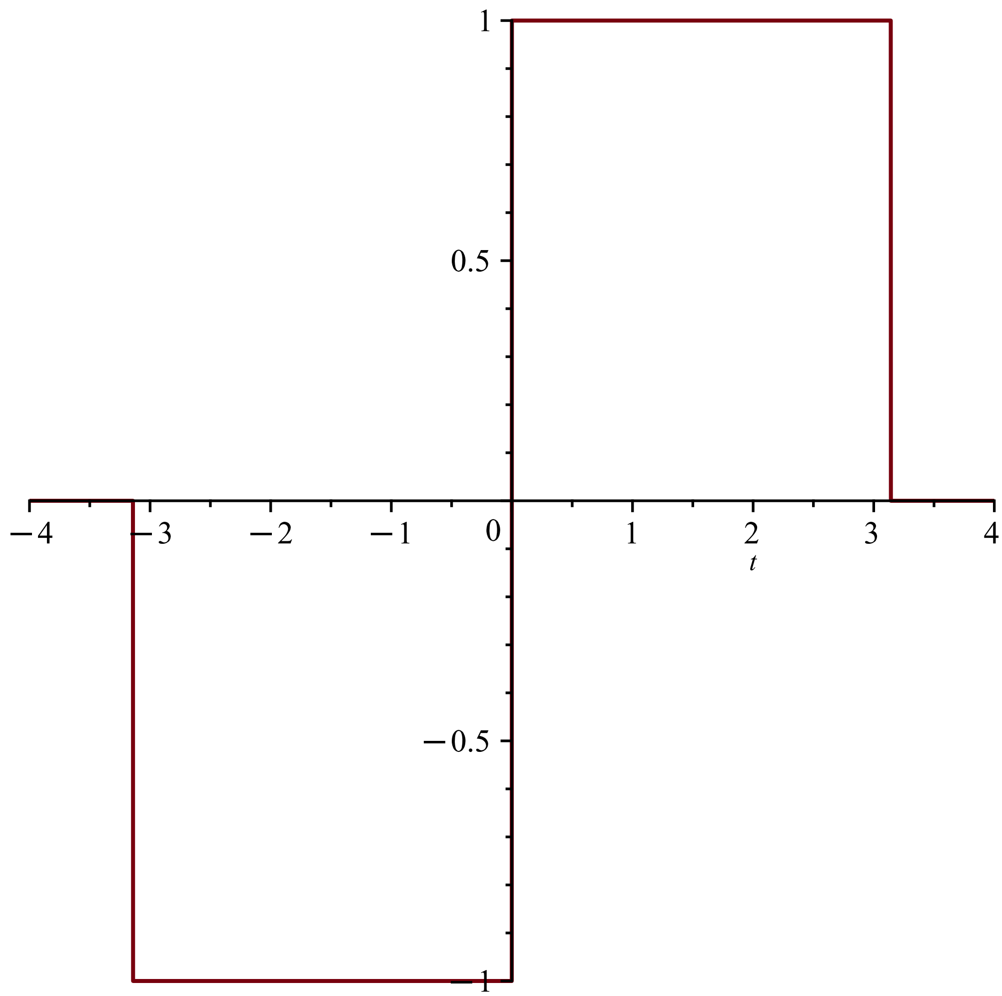


> *restart*

> *with*(*inttrans*) :

> $F := -\text{Heaviside}(t+\text{Pi}) + 2\cdot\text{Heaviside}(t) - \text{Heaviside}(t-\text{Pi})$; *plot*(*F*, *t* = −4 ..4)

$$F := -\text{Heaviside}(t+\pi) + 2\,\text{Heaviside}(t) - \text{Heaviside}(t-\pi)$$



> $L := \text{Pi}$

$$L := \pi \tag{29}$$

> $a[0] := \frac{1}{L} \cdot int(F, t = -L..L)$

$$a_0 := 0 \qquad \textbf{(30)}$$

> $a[n] := \frac{1}{L} \cdot int\left(F \cdot \cos\left(\frac{n \cdot \mathrm{Pi}}{L} \cdot t\right), t = -L..L\right)$

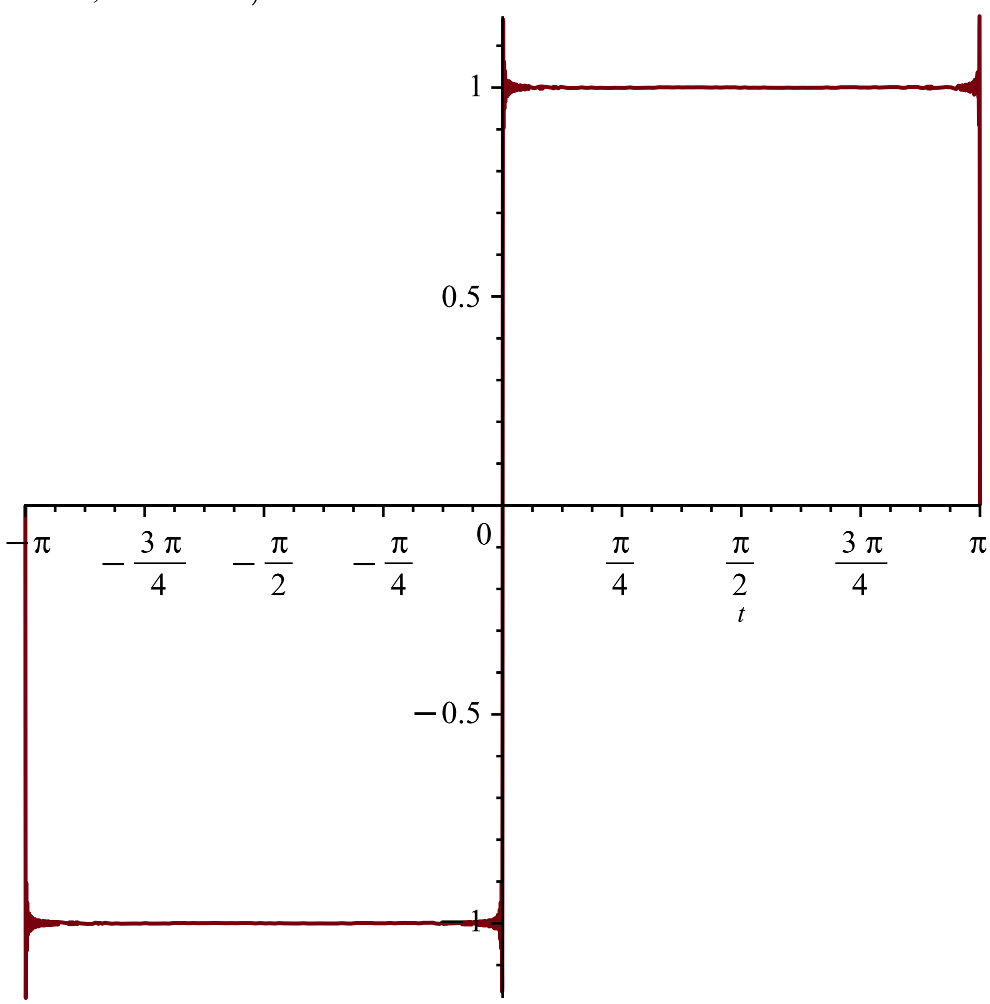
$$a_n := 0 \qquad \textbf{(31)}$$

> $b[n] := simplify\left(subs\left(\sin(n \cdot \mathrm{Pi}) = 0, \cos(n \cdot \mathrm{Pi}) = (-1)^n, \frac{1}{L} \cdot int\left(F \cdot \sin\left(\frac{n \cdot \mathrm{Pi}}{L} \cdot t\right), t = -L ..L\right)\right)\right)$

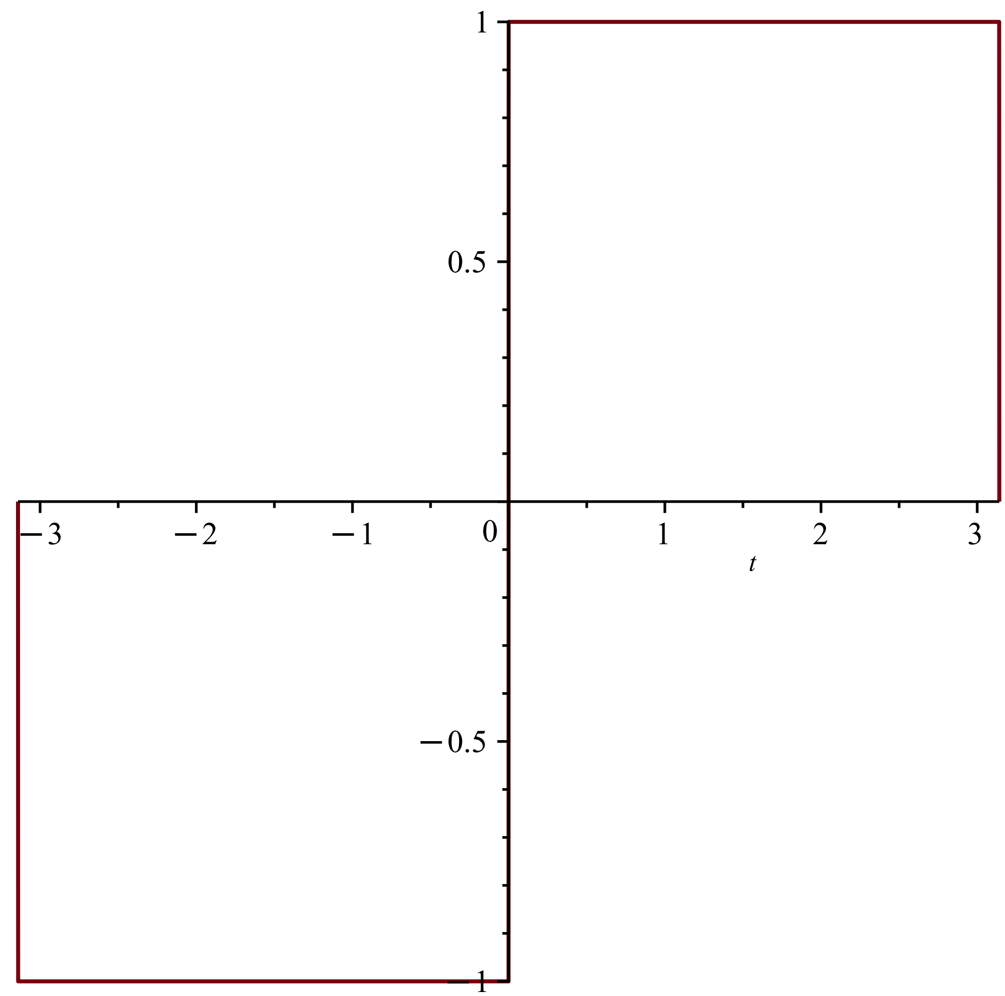
$$b_n := \frac{-2\,(-1)^n + 2}{\pi\, n} \qquad \textbf{(32)}$$

> $STFescalon := sum\left(b[n] \cdot \sin\left(\frac{n \cdot \mathrm{Pi}}{L} \cdot t\right), n = 1..1000\right):$

> $plot(STFescalon, t = -\mathrm{Pi}..\mathrm{Pi})$



> $plot(F, t = -(\mathrm{Pi} + 0.000001)..\mathrm{Pi} + 0.000001)$



1
0.5
−3
−2
−1
0
1
2
3
t
−0.5
−1

>

>