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> restart
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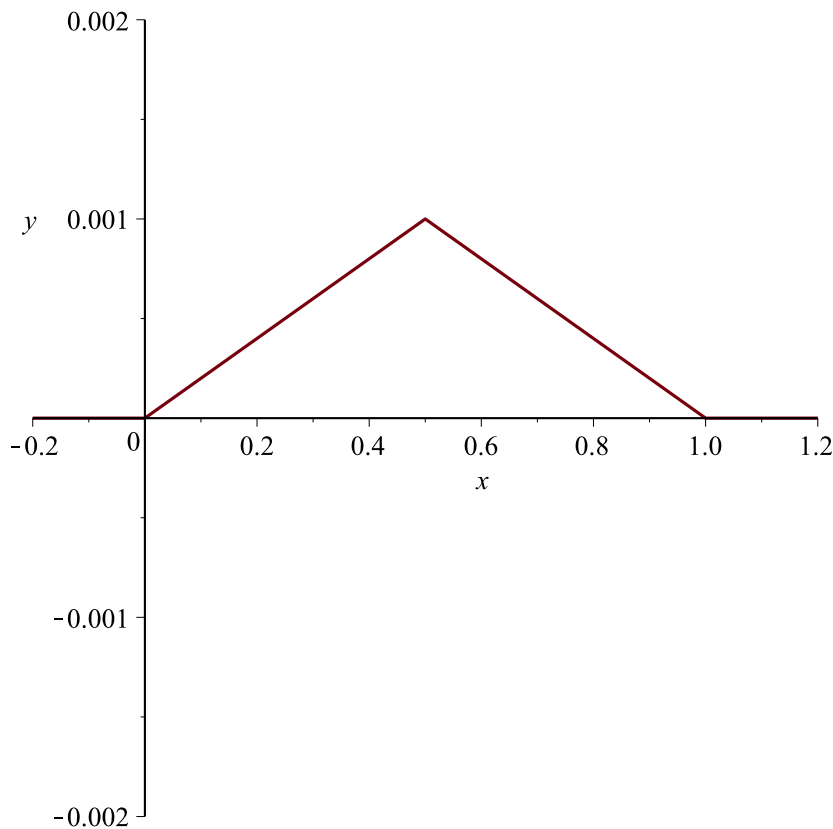
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> Ecuacion := diff(y(x, t), t$2) = c^2·diff(y(x, t), x$2)
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$$Ecuacion := \frac{\partial^2}{\partial t^2} y(x, t) = c^2 \left(\frac{\partial^2}{\partial x^2} y(x, t) \right) \quad (1)$$

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> CondFrontera := F(0) = 0, F(1) = 0
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$$CondFrontera := F(0) = 0, F(1) = 0 \quad (2)$$

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> CondIni := f = \left( \frac{\frac{1}{1000}}{\left(\frac{5}{10}\right)} \cdot x \cdot \text{Heaviside}(x) - 2 \cdot \frac{\frac{1}{1000}}{\left(\frac{5}{10}\right)} \cdot \left(x - \frac{5}{10}\right) \cdot \text{Heaviside}\left(x - \frac{5}{10}\right) + \frac{\frac{1}{1000}}{\left(\frac{5}{10}\right)} \cdot (x - 1) \cdot \text{Heaviside}(x - 1) \right) : plot(rhs(CondIni), x = -0.2 .. 1.2, y = -0.002 .. 0.002)
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> CondIniVel := fprima = 0
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$$CondIniVel := fprima = 0 \quad (3)$$

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> Ecuacion
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$$\frac{\partial^2}{\partial t^2} y(x, t) = c^2 \left(\frac{\partial^2}{\partial x^2} y(x, t) \right) \quad (4)$$

$$> \text{Hipotesis} := y(x, t) = F(x) \cdot G(t)$$

$$\text{Hipotesis} := y(x, t) = F(x) G(t) \quad (5)$$

$$> \text{EcuacionSeparable} := \text{eval}(\text{subs}(y(x, t) = \text{rhs}(\text{Hipotesis}), \text{Ecuacion}))$$

$$\text{EcuacionSeparable} := F(x) \left(\frac{d^2}{dt^2} G(t) \right) = c^2 \left(\frac{d^2}{dx^2} F(x) \right) G(t) \quad (6)$$

$$> \text{EcuacionSeparada} := \text{simplify} \left(\frac{\text{lhs}(\text{EcuacionSeparable})}{F(x) \cdot G(t)} \right)$$

$$= \text{simplify} \left(\frac{\text{rhs}(\text{EcuacionSeparable})}{F(x) \cdot G(t)} \right)$$

$$\text{EcuacionSeparada} := \frac{\frac{d^2}{dt^2} G(t)}{G(t)} = \frac{c^2 \left(\frac{d^2}{dx^2} F(x) \right)}{F(x)} \quad (7)$$

$$> \text{EcuaX} := \text{rhs}(\text{EcuacionSeparada}) = -\beta^2$$

$$\text{EcuaX} := \frac{c^2 \left(\frac{d^2}{dx^2} F(x) \right)}{F(x)} = -\beta^2 \quad (8)$$

$$> \text{EcuaT} := \text{lhs}(\text{EcuacionSeparada}) = -\beta^2$$

$$\text{EcuaT} := \frac{\frac{d^2}{dt^2} G(t)}{G(t)} = -\beta^2 \quad (9)$$

$$> c := 1$$

$$c := 1 \quad (10)$$

$$> \text{SolXneg} := \text{dsolve}(\text{EcuaX})$$

$$\text{SolXneg} := F(x) = _C1 \sin(\beta x) + _C2 \cos(\beta x) \quad (11)$$

$$> \text{ParametroDos} := \text{simplify}(\text{subs}(x=0, \text{rhs}(\text{SolXneg})=0))$$

$$\text{ParametroDos} := _C2 = 0 \quad (12)$$

$$> \text{beta} := n \cdot \text{Pi}$$

$$\beta := n \pi \quad (13)$$

$$> \text{SolXpart} := \text{subs}(_C2 = \text{rhs}(\text{ParametroDos}), \text{SolXneg})$$

$$\text{SolXpart} := F(x) = _C1 \sin(n \pi x) \quad (14)$$

$$> \text{SolTneg} := \text{dsolve}(\text{EcuaT})$$

$$\text{SolTneg} := G(t) = _C1 \sin(n \pi t) + _C2 \cos(n \pi t) \quad (15)$$

$$> \text{SolUno} := y(x, t) = \text{subs}(_C1 = 1, \text{rhs}(\text{SolXpart})) \cdot \text{rhs}(\text{SolTneg})$$

$$\text{SolUno} := y(x, t) = \sin(n \pi x) (_C1 \sin(n \pi t) + _C2 \cos(n \pi t)) \quad (16)$$

$$> \text{SolGeneral} := y(x, t) = \text{Sum}(\text{subs}(_C2 = b[n], _C1 = a[n], \text{rhs}(\text{SolUno})), n = 1 .. \text{infinity})$$

$$\text{SolGeneral} := y(x, t) = \sum_{n=1}^{\infty} \sin(n \pi x) (a_n \sin(n \pi t) + b_n \cos(n \pi t)) \quad (17)$$

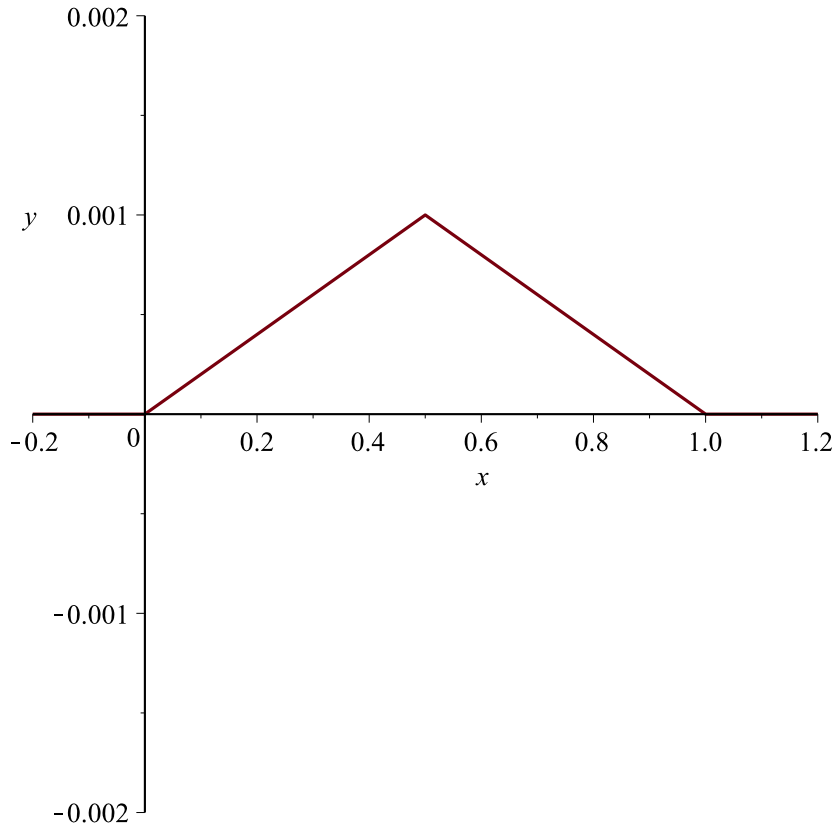
$$> \text{SolPartIni} := F(x) = \text{eval}(\text{subs}(t=0, \text{rhs}(\text{SolGeneral})))$$

$$SolPartIni := F(x) = \sum_{n=1}^{\infty} \sin(n \pi x) b_n \quad (18)$$

$$> L := \frac{5}{10}$$

$$L := \frac{1}{2} \quad (19)$$

> plot(rhs(CondIni), x=-0.2..1.2, y=-0.002..0.002)



> $b[n] := \left(\frac{1}{L}\right) \cdot \text{int}(\text{rhs}(\text{CondIni}) \cdot \sin(n \cdot \text{Pi} \cdot x), x=0..1)$

$$b_n := \frac{1}{250} \frac{-\sin(n \pi) + 2 \sin\left(\frac{1}{2} n \pi\right)}{n^2 \pi^2} \quad (20)$$

> $a[n] := 0$

$$a_n := 0 \quad (21)$$

> SolParticular := y(x, t) = Sum(subs(_C2 = b[n], _C1 = a[n], rhs(SolUno)), n = 1..500) :

>

> with(plots) :

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> animate(rhs(SolParticular), x = 0 .. 1, t = 0 .. 4, frames = 150, view = [0 .. 1, -0.002 .. 0.002])
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