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> restart
> SolPart := y(t) = 2 exp(2 t) + 4 cos(3 t) - 3 sin(3 t) + t cos(3 t) - 2 t sin(3 t)
    SolPart := y(t) = 2 e^{2 t} + 4 cos(3 t) - 3 sin(3 t) + t cos(3 t) - 2 t sin(3 t) (1)
> DerSolPart := diff(SolPart, t)
    DerSolPart := \frac{d}{dt} y(t) = 4 e^{2 t} - 14 sin(3 t) - 8 cos(3 t) - 3 t sin(3 t) - 6 t cos(3 t) (2)
> DerDerSolPart := diff(DerSolPart, t)
    DerDerSolPart := \frac{d^2}{dt^2} y(t) = 8 e^{2 t} - 48 cos(3 t) + 21 sin(3 t) - 9 t cos(3 t) + 18 t sin(3 t) (3)
> CondUno := y(0) = simplify(subs(t=0, rhs(SolPart)))
    CondUno := y(0) = 6 (4)
> CondDos := D(y)(0) = simplify(subs(t=0, rhs(DerSolPart)))
    CondDos := D(y)(0) = -4 (5)
> CondTres := D(D(y))(0) = simplify(subs(t=0, rhs(DerDerSolPart)))
    CondTres := D^{(2)}(y)(0) = -40 (6)
> Ecua := diff(y(t), t$3) - 2 diff(y(t), t$2) + 9 diff(y(t), t) - 18 y(t) = 6 cos(3 t) + 48 sin(3 t)
    Ecua := \frac{d^3}{dt^3} y(t) - 2 \frac{d^2}{dt^2} y(t) + 9 \frac{d}{dt} y(t) - 18 y(t) = 6 cos(3 t) + 48 sin(3 t) (7)
> with(inttrans) :
> EcuaTL := subs(CondUno, CondDos, CondTres, laplace(Ecua, t, s))
    EcuaTL := s^3 \mathcal{L}(y(t), t, s) - 22 + 16 s - 6 s^2 - 2 s^2 \mathcal{L}(y(t), t, s) + 9 s \mathcal{L}(y(t), t, s)
    - 18 \mathcal{L}(y(t), t, s) = \frac{6 (s + 24)}{s^2 + 9} (8)
> SolTL := simplify(isolate(EcuaTL, laplace(y(t), t, s)))
    SolTL := \mathcal{L}(y(t), t, s) = \frac{6 s^4 - 16 s^3 + 76 s^2 - 138 s + 342}{(s^2 + 9)^2 (s - 2)} (9)
> SolPartFinal := simplify(invlaplace(SolTL, s, t))
    SolPartFinal := y(t) = cos(3 t) (4 + t) + (-2 t - 3) sin(3 t) + 2 e^{2 t} (10)
> SolGral := y(t) = _C1 exp(2 t) + _C2 cos(3 t) + _C3 sin(3 t) + t cos(3 t) - 2 t sin(3 t)
    SolGral := y(t) = _C1 e^{2 t} + _C2 cos(3 t) + _C3 sin(3 t) + t cos(3 t) - 2 t sin(3 t) (11)
> Ecua
    \frac{d^3}{dt^3} y(t) - 2 \frac{d^2}{dt^2} y(t) + 9 \frac{d}{dt} y(t) - 18 y(t) = 6 cos(3 t) + 48 sin(3 t) (12)
> Comprobar := simplify(eval(subs(y(t) = rhs(SolGral), lhs(Ecua) - rhs(Ecua) = 0)))
    Comprobar := 0 = 0 (13)
> SolNoHom := y(t) = t cos(3 t) - 2 t sin(3 t)
    SolNoHom := y(t) = t cos(3 t) - 2 t sin(3 t) (14)
> EcuaNoHom := lhs(Ecua) = 0

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$$EcuaNoHom := \frac{d^3}{dt^3} y(t) - 2 \frac{d^2}{dt^2} y(t) + 9 \frac{d}{dt} y(t) - 18 y(t) = 0 \quad (15)$$

$$\begin{aligned} > Q := \text{simplify}(\text{eval}(\text{subs}(y(t) = \text{rhs}(\text{SolNoHom}), \text{lhs}(EcuaNoHom)))) \\ & \quad Q := 6 \cos(3 t) + 48 \sin(3 t) \end{aligned} \quad (16)$$

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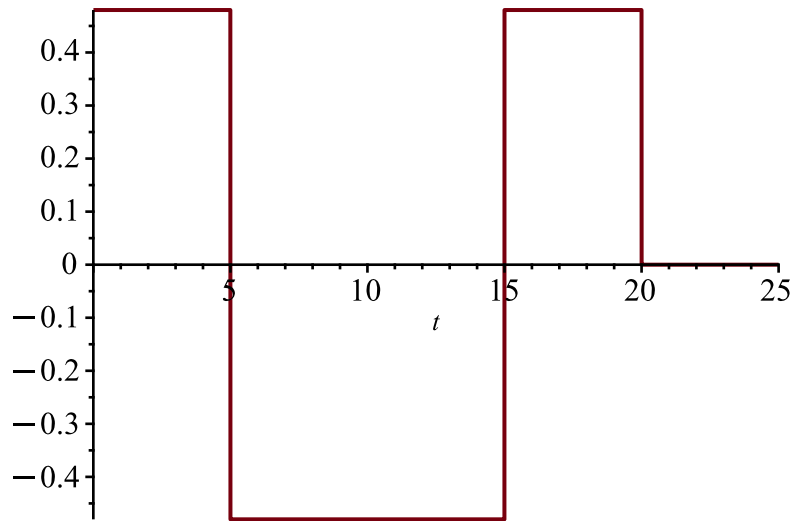
> restart

problema del elevador de la Torre Mayor

$$\begin{aligned} > Sacudida := s(t) = & \frac{48}{100} \cdot \text{Heaviside}(t) - \frac{96}{100} \cdot \text{Heaviside}(t - a) + \frac{96}{100} \cdot \text{Heaviside}(t - 3 \cdot a) \\ & - \frac{48}{100} \cdot \text{Heaviside}(t - 4 \cdot a) \end{aligned}$$

$$\begin{aligned} Sacudida := s(t) = & \frac{12 \text{Heaviside}(t)}{25} - \frac{24 \text{Heaviside}(t - a)}{25} + \frac{24 \text{Heaviside}(t - 3 a)}{25} \\ & - \frac{12 \text{Heaviside}(t - 4 a)}{25} \end{aligned} \quad (17)$$

$$> \text{plot}(\text{subs}(a = 5, \text{rhs}(Sacudida)), t = 0 .. 25)$$



$$\begin{aligned} > Condiciones := y(0) = 0, D(y)(0) = 0, D(D(y))(0) = 0 \\ & \quad Condiciones := y(0) = 0, D(y)(0) = 0, D^{(2)}(y)(0) = 0 \end{aligned} \quad (18)$$

$$> EDO := \text{diff}(y(t), t\$3) = \text{subs}\left(a = \frac{6165}{1000}, \text{rhs}(Sacudida)\right)$$

$$\begin{aligned} EDO := \frac{d^3}{dt^3} y(t) = & \frac{12 \text{Heaviside}(t)}{25} - \frac{24 \text{Heaviside}\left(t - \frac{1233}{200}\right)}{25} \\ & + \frac{24 \text{Heaviside}\left(t - \frac{3699}{200}\right)}{25} - \frac{12 \text{Heaviside}\left(t - \frac{1233}{50}\right)}{25} \end{aligned} \quad (19)$$

>

> with(inttrans)

[addtable, fourier, fouriercos, fouriersin, hankel, hilbert, invfourier, invhilbert, invlaplace, (20)

*inv Mellin, Laplace, Mellin, save table, setup]*

> *EDOtrans* := subs(*Condiciones*, laplace(*EDO*, *t*, *s*))

$$EDOtrans := s^3 \mathcal{L}(y(t), t, s) = \frac{12 \left( 1 - 2 e^{-\frac{1233 s}{200}} + 2 e^{-\frac{3699 s}{200}} - e^{-\frac{1233 s}{50}} \right)}{25 s} \quad (21)$$

> *SOLtrans* := isolate(*EDOtrans*, laplace(*y(t)*, *t*, *s*))

$$SOLtrans := \mathcal{L}(y(t), t, s) = \frac{12 \left( 1 - 2 e^{-\frac{1233 s}{200}} + 2 e^{-\frac{3699 s}{200}} - e^{-\frac{1233 s}{50}} \right)}{25 s^4} \quad (22)$$

> *SOL* := invlaplace(*SOLtrans*, *s*, *t*)

$$SOL := y(t) = \frac{2 t^3}{25} - \frac{4 \operatorname{Heaviside}\left(t - \frac{1233}{200}\right) \left(t - \frac{1233}{200}\right)^3}{25} \quad (23)$$

$$+ \frac{4 \operatorname{Heaviside}\left(t - \frac{3699}{200}\right) \left(t - \frac{3699}{200}\right)^3}{25} - \frac{2 \operatorname{Heaviside}\left(t - \frac{1233}{50}\right) \left(t - \frac{1233}{50}\right)^3}{25}$$

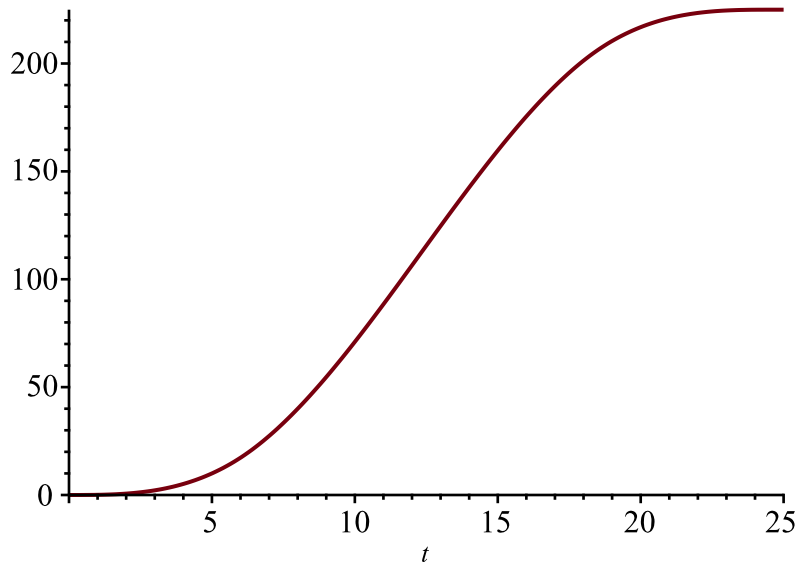
> *TiempoFinal* := evalf(4 \*  $\frac{6165}{1000}$ , 3)

$$TiempoFinal := 24.7 \quad (24)$$

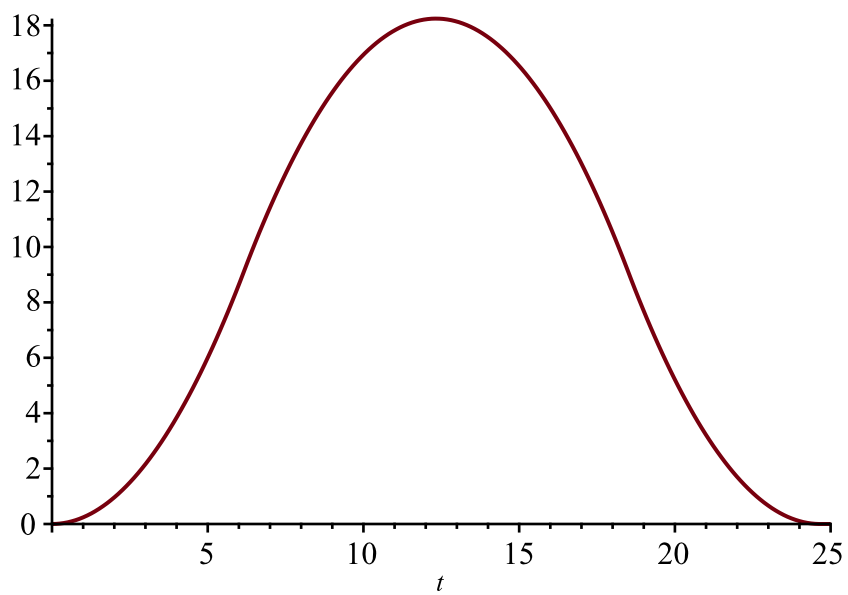
> *Altura* := evalf(subs(*t* = 24, *SOL*), 4)

$$Altura := y(24) = 225.0 \quad (25)$$

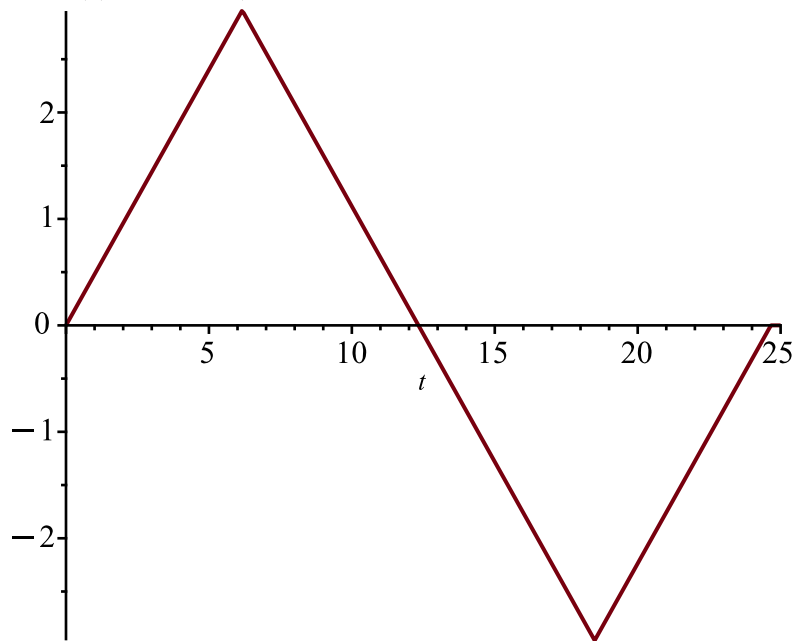
> plot(rhs(*SOL*), *t* = 0 .. 25)



> plot(rhs(diff(*SOL*, *t*)), *t* = 0 .. 25)



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> plot(rhs(diff(SOL, t$2)), t=0..25)
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> plot(rhs(diff(SOL, t$3)), t=0..25)
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