⊞—Util

⊞—Numerical Inverse Laplace Transform

⊞—equrep

⊞—laplace

⊞—isol

⊟—isol examples

$isolate(eq, expr)$ try to isolate expr in the eq.

$isolate(c\cdot t + a = b,\ t) = t = \frac{b-a}{c}$ $isolate(c\cdot t + a = b,\ c\cdot t) = c\cdot t = b - a$

$isolate\left(a + b\cdot\tan\left(\theta^2\right) = c,\ \theta\right) = \theta = \sqrt{\operatorname{atan}\left(\frac{c-a}{b}\right)}$

$isolate\left(\cos(a) + b\cdot\exp\left(t^n\right) = c,\ t\right) = t = \sqrt[n]{\ln\left(\frac{c-\cos(a)}{b}\right)}$

$isolate\left(\ln(a) + \frac{b}{\ln\left(t^n\right)} = c,\ t\right) = t = \exp\left(-\frac{b}{(-c+\ln(a))\cdot n}\right)$

$isolate(x + x\cdot\sin(x),\ x) = x\cdot(1+\sin(x)) = 0$

isol returns only the value, or an expression for a numerical procedure

$isol\left(\ln(a) + \frac{b}{\ln\left(t^n\right)} = c,\ t\right) = \exp\left(-\frac{b}{(-c+\ln(a))\cdot n}\right)$

$isol(x + \cos(x) = a,\ x) = -(-x + a + \cos(x))$

⊟—Laplace examples

Laplace Transforms

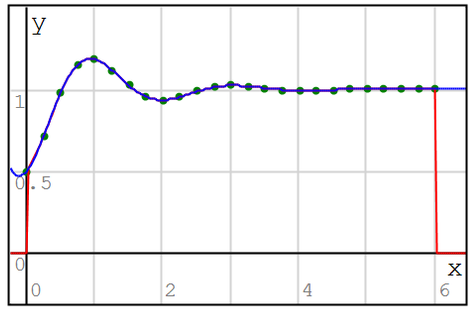
$N := 25$

$$plot := \begin{cases} f(x) \\ \varphi_{lt}(x) \\ \operatorname{augment}(\varphi_{lt}, ".", 12, "green") \end{cases}$$

$f(t) := 1 - \frac{\exp(-t)}{2}\cdot\cos(3\cdot t)$

$F(s) := lt(f(t)) = \frac{2\cdot\left(9+(1+s)^2\right)-(1+s)\cdot s}{2\cdot\left(9+(1+s)^2\right)\cdot s}$

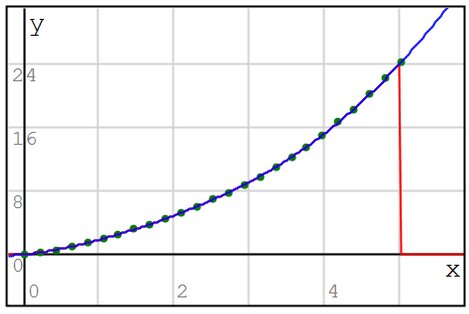
$$\begin{cases} \varphi_{lt} := ILT(F(s),\ 0,\ 6,\ N) \\ \varphi_{lt}(t) := cinterp(\varphi_{lt},\ t) \end{cases}$$



$f(t) := t^2 + \sin(t)$

$F(s) := lt(f(t)) = \frac{s^3 + 2\cdot\left(1+s^2\right)}{s^3\cdot\left(1+s^2\right)}$

$$\begin{cases} \varphi_{lt} := ILT(F(s), 0, 5, N) \\ \varphi_{lt}(t) := cinterp(\varphi_{lt}, t) \end{cases}$$

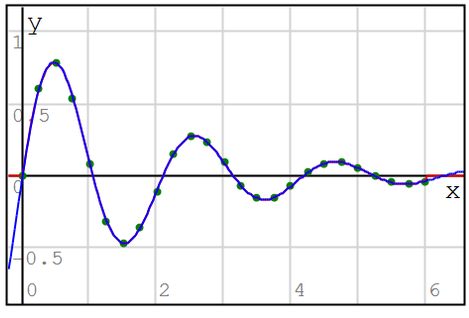


$$f(t) := \exp(-0.5 \cdot t) \cdot \sin(3 \cdot t)$$

$$F(s) := lt(f(t)) = \frac{12}{36 + (1 + 2 \cdot s)^2}$$

$$\begin{cases} \varphi_{lt} := ILT(F(s), 0, 6, N) \\ \varphi_{lt}(t) := cinterp(\varphi_{lt}, t) \end{cases}$$

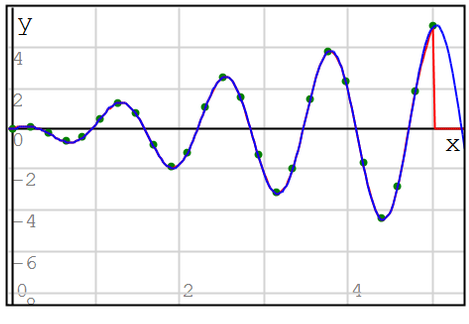
$$\sqrt{t} \cdot \cos(5 \cdot \sqrt{t})$$



$$f(t) := t \cdot \cos(5 \cdot t)$$

$$F(s) := lt(f(t)) = -\frac{25 - s^2}{(25 + s^2)^2}$$

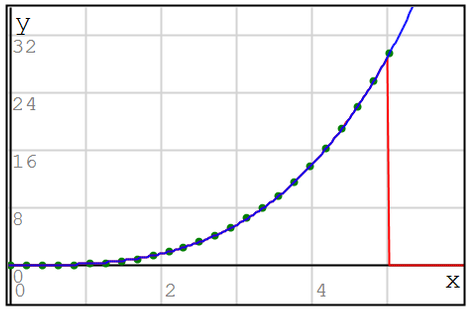
$$\begin{cases} \varphi_{lt} := ILT(F(s), 0, 5, N) \\ \varphi_{lt}(t) := cinterp(\varphi_{lt}, t) \end{cases}$$



$$f(t) := t^2 \cdot \sinh\left(\frac{t}{5}\right)$$

$$F(s) := lt(f(t)) = -\frac{250 \cdot \left((5 \cdot s \cdot \sinh(0) + \cosh(0)) \cdot \left(-1 + 25 \cdot s^2\right) + 10 \cdot \left(\right.\right.}{\left(-1\right.}$$

$$\begin{cases} \varphi_{lt} := ILT(F(s), 0, 5, N) \\ \varphi_{lt}(t) := cinterp(\varphi_{lt}, t) \end{cases}$$



ODE

$$ode := a \cdot \frac{d^2}{d\,t^2} x(t) + b \cdot \frac{d}{d\,t} x(t) + c \cdot x(t) = \varphi(t)$$

Laplace transform

$$lt := lt(ode) = b \cdot \left(-x_o + s \cdot X(s)\right) + a \cdot \left(-x'_o + s \cdot \left(-x_o + s \cdot X(s)\right)\right) + c \cdot X(s) = LT(\varphi(t))$$

Isolation

$$X(s) := isol\left(lt(ode), X(s)\right) = \frac{a \cdot \left(x'_o + s \cdot x_o\right) + b \cdot x_o + LT(\varphi(t))}{c + s \cdot (b + s \cdot a)}$$

Alvaro
