

[> with(inttrans) :

> $de := \text{diff}(y(t), t^2) + 2 \cdot \text{diff}(y(t), t) + y(t) = t - t \cdot \text{Heaviside}(t - 2);$
 $de := \frac{d^2}{dt^2} y(t) + 2 \frac{d}{dt} y(t) + y(t) = t - t \text{Heaviside}(t - 2)$ (1)

> $Lde := \text{laplace}(de, t, s);$
 $Lde := s^2 \text{laplace}(y(t), t, s) - D(y)(0) - s y(0) + 2 s \text{laplace}(y(t), t, s) - 2 y(0)$ (2)
 $+ \text{laplace}(y(t), t, s) = \frac{1 - e^{-2s} (2s + 1)}{s^2}$

> $rLde := \text{subs}(\{y(0) = 0, D(y)(0) = 2\}, Lde);$
 $rLde := s^2 \text{laplace}(y(t), t, s) - 2 + 2 s \text{laplace}(y(t), t, s) + \text{laplace}(y(t), t, s)$ (3)
 $= \frac{1 - e^{-2s} (2s + 1)}{s^2}$

> $Ys := \text{solve}(rLde, \text{laplace}(y(t), t, s));$
 $Ys := -\frac{2 e^{-2s} s - 2 s^2 + e^{-2s} - 1}{s^2 (s^2 + 2s + 1)}$ (4)

> $z := \text{invlaplace}(Ys, s, t);$
 $z := 2 t e^{-t} + 2 e^{-\frac{t}{2}} \left(t \cosh\left(\frac{t}{2}\right) - 2 \sinh\left(\frac{t}{2}\right) \right) + 2 \left(-1 + e^{-t+2} (t-1) + \left(- (t \right.$ (5)
 $\left. - 2) \cosh\left(\frac{t}{2} - 1\right) + 2 \sinh\left(\frac{t}{2} - 1\right) \right) e^{-\frac{t}{2} + 1} \right) \text{Heaviside}(t - 2)$

> $q := t \rightarrow t - 2 + 2 \cdot \exp(-t) + 3 \cdot t \cdot \exp(-t) + \text{Heaviside}(t - 2) \cdot (2 - t + (t - 2) \cdot \exp(-(t - 2)));$
 $q := t \mapsto t - 2 + 2 e^{-t} + 3 t e^{-t} + \text{Heaviside}(t - 2) (2 - t + (t - 2) e^{-t+2})$ (6)

> $\text{plot}(\{z, q(t)\}, t = 0 .. 5);$

