

MAT250 Assignment 4
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Problem 1

$$\begin{aligned} > \text{with(inttrans)} : \\ > \text{invlaplace}\left(\frac{1}{s-4}, s, t\right) \\ & \quad \text{e}^{4t} \end{aligned} \tag{1}$$

$$\begin{aligned} > \text{invlaplace}\left(\frac{1}{s^2+3}, s, t\right) \\ & \quad \frac{\sqrt{3} \sin(\sqrt{3} t)}{3} \end{aligned} \tag{2}$$

$$\begin{aligned} > \text{invlaplace}\left(\frac{1}{(s+4)^5}, s, t\right) \\ & \quad \frac{t^4 e^{-4t}}{24} \end{aligned} \tag{3}$$

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Problem 2

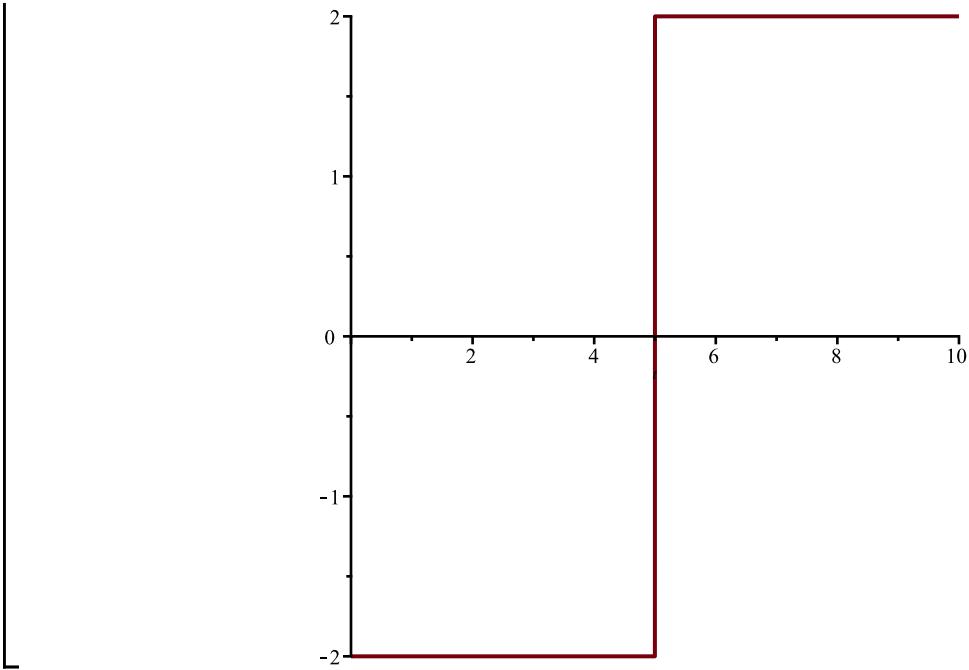
$$\begin{aligned} > F := \frac{(5 \cdot s^2 + 20 \cdot s + 6)}{(s^3 + 2 \cdot s^2 + s)} \\ & \quad F := \frac{5 s^2 + 20 s + 6}{s^3 + 2 s^2 + s} \end{aligned} \tag{4}$$

$$\begin{aligned} > \text{invlaplace}(F, s, t) \\ & \quad 6 + (9 t - 1) e^{-t} \end{aligned} \tag{5}$$

Problem 3

$$\begin{aligned} > p := \text{piecewise}(0 \leq t < 5, -2, t \geq 5, 2) \\ & \quad p := \begin{cases} -2 & 0 \leq t < 5 \\ 2 & 5 \leq t \end{cases} \end{aligned} \tag{6}$$

$$\begin{aligned} > \text{plot}(p, t=0..10) \end{aligned}$$

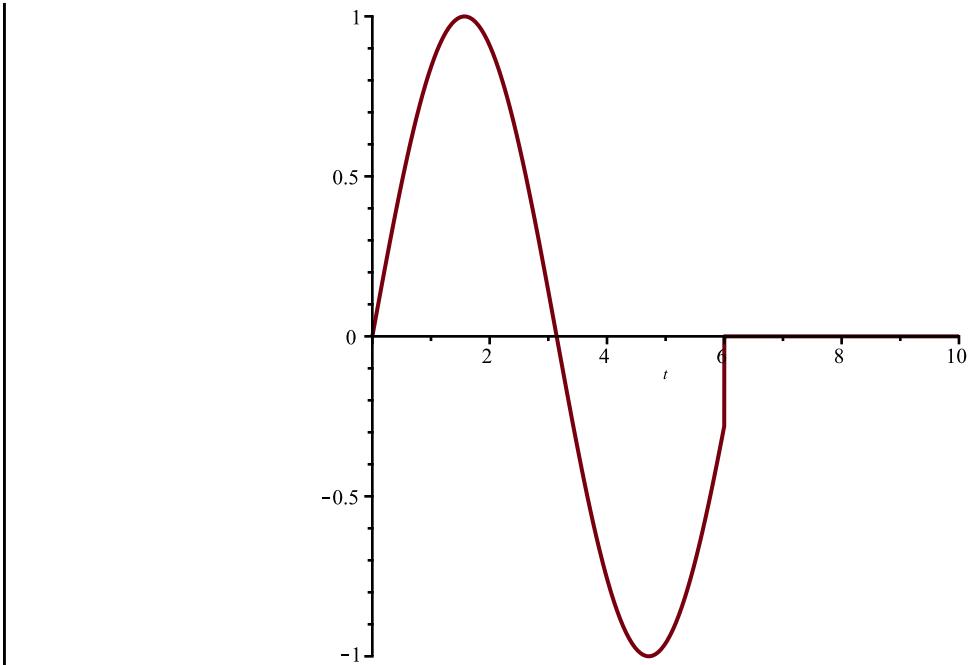


$$\begin{aligned} > \text{laplace}(p, t, s) \\ &= \frac{2(-2e^{-5s} + 1)}{s} \end{aligned} \tag{7}$$

Problem 4

$$\begin{aligned} > q := \text{piecewise}(0 \leq t < 2\cdot3, \sin(t), t \geq 2\cdot3, 0) \\ q := & \begin{cases} \sin(t) & 0 \leq t < 6 \\ 0 & 6 \leq t \end{cases} \end{aligned} \tag{8}$$

$$> \text{plot}(q, t=0..10)$$



> $\text{laplace}(q, t, s)$

$$\frac{1 + e^{-6s} (-\sin(6)s - \cos(6))}{s^2 + 1} \quad (9)$$

Problem 5

$$\begin{aligned} > \text{sol} := \text{diff}(x(t), t, t) + x(t) = \sin(3 \cdot t) \\ & \quad \text{sol} := \frac{d^2}{dt^2} x(t) + x(t) = \sin(3t) \end{aligned} \quad (10)$$

$$\begin{aligned} > y := \text{laplace}(\text{sol}, t, s) \\ & \quad y := s^2 \mathcal{L}(x(t), t, s) - D(x)(0) - s x(0) + \mathcal{L}(x(t), t, s) = \frac{3}{s^2 + 9} \end{aligned} \quad (11)$$

$$\begin{aligned} > y(t) := \text{dsolve}(\text{sol}) \\ & \quad y := t \mapsto \text{dsolve}(\text{sol}) \end{aligned} \quad (12)$$

$$\begin{aligned} > Y := \text{solve}(y, \text{laplace}(x(t), t, s)) \\ & \quad Y := \frac{x(0) s^3 + D(x)(0) s^2 + 9 s x(0) + 9 D(x)(0) + 3}{(s^2 + 9) (s^2 + 1)} \end{aligned} \quad (13)$$

$$\begin{aligned} > \text{invlaplace}(Y, s, t) \\ & \quad x(0) \cos(t) - \frac{\sin(3t)}{8} + \frac{\sin(t) (8 D(x)(0) + 3)}{8} \end{aligned} \quad (14)$$