

### EXAM 3 (267)

**Problem 1.** Solve the initial value problem

$$y'' + 4y' + 8y = 2\delta(t - 1) \quad y(0) = 0, \quad y'(0) = 1.$$

**Problem 2.** Find the Laplace transform of the function

$$g(t) = \begin{cases} 1 + t & \text{for } t \in (0, 2\pi) \\ 1 - t & \text{for } t \in [2\pi, +\infty) \end{cases}$$

**Problem 3.** Find the inverse Laplace transform for the function

$$G(s) = \frac{s}{(1 + s)(1 + s^2)}.$$

**Problem 4.** We consider the mass- spring-dashpot system with  $m = 1$ ,  $c = 6$ ,  $k = 9$  and external force  $f(t)$ ,

$$x'' + 20x' + 100x = f(t) \quad x(0) = 0, \quad x'(0) = 1,$$

where

$$f(t) = \begin{cases} t & \text{for } t \in [0, 2) \\ 0 & \text{for } t \in [2, +\infty) \end{cases}$$

Find  $x(t)$ .