

1. Determine the Laplace transform of the following functions:

a)
$$f(t) = \begin{cases} 0 & \text{if } 0 \leq t < 3 \\ t-3; & \text{if } 3 \leq t < 5 \\ 3; & \text{if } t \geq 5 \end{cases}$$

b)
$$f(t) = u_3(t)(t^2 + 2t - 7)$$

c)
$$f(t) = u_3(t)e^{2t}$$

d) $f(t) = e^{-2(t-1)} \sin(3t-3)u_1(t)$

2. Determine the inverse Laplace transform of the following:

a) $F(s) = \frac{e^{-4s}(s+3)}{s^2-6s+13}$

b) $F(s) = \frac{50e^{-3s}}{(s+1)^2(s^2+4)}$

3. Use Laplace transform to solve the following:

a) $y' + 3y = f(t), y(0) = 1$ where $f(t) = \begin{cases} 1, & 0 \leq t < 1 \\ 0, & t \geq 1 \end{cases}$

b) $y'' - y' - 2y = 1 - 3u_2(t); \quad y(0) = 1, \quad y'(0) = -2$

c) $y'' + 3y' + 2y = 10u_{\pi/4}(t) \sin\left(t - \frac{\pi}{4}\right); y(0) = 1; y'(0) = 0$