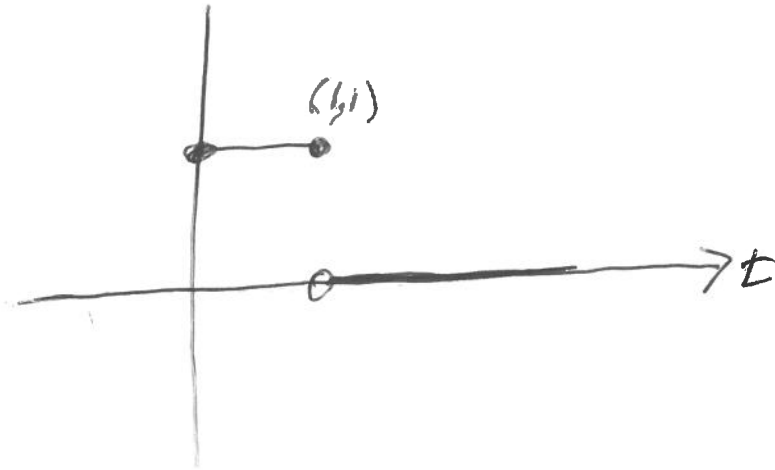


Problem 7 in Section 7.1.

Compute the Laplace transform of the function $f(t)$ whose picture is on the next page.

7.1 Problem 7 Picture



Solution. We see that

$$f(t) = \begin{cases} 1 & \text{if } 0 \leq t \leq 1 \\ 0 & \text{if } 1 < t. \end{cases}$$

Recall that $\mathcal{L}(f(t)) = \int_0^\infty e^{-st} f(t) dt$. We compute

$$\begin{aligned} \mathcal{L}(f(t)) &= \int_0^\infty e^{-st} f(t) dt \\ &= \int_0^1 e^{-st} f(t) dt + \int_1^\infty e^{-st} f(t) dt \\ &= \int_0^1 e^{-st} 1 dt + \int_1^\infty e^{-st} 0 dt \\ &= \frac{1}{-s} e^{-st} \Big|_0^1 + 0 \\ &= \frac{1}{-s} e^{-s} - \frac{1}{-s} e^{-s(0)} \\ &= \boxed{\frac{1}{-s} e^{-s} - \frac{1}{-s}} \end{aligned}$$