

Problem 12

In each of Problems 7 through 12:

- Sketch the graph of the given function.
- Express $f(t)$ in terms of the unit step function $u_c(t)$.

$$f(t) = \begin{cases} t, & 0 \leq t < 2, \\ 2, & 2 \leq t < 5, \\ 7 - t, & 5 \leq t < 7, \\ 0, & t \geq 7. \end{cases}$$

Solution

Write $f(t)$ in terms of the Heaviside function, $H(t)$, which is defined to be 1 if $t > 0$ and 0 if $t < 0$.

$$\begin{aligned} f(t) &= t[H(t) - H(t - 2)] + 2[H(t - 2) - H(t - 5)] + (7 - t)[H(t - 5) - H(t - 7)] \\ &= tH(t) + (2 - t)H(t - 2) + (5 - t)H(t - 5) - (7 - t)H(t - 7) \\ &= tu_0(t) + (2 - t)u_2(t) + (5 - t)u_5(t) - (7 - t)u_7(t) \end{aligned}$$

