

## Problem 8

In each of Problems 7 through 12:

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

$$f(t) = \begin{cases} 1, & 0 \leq t < 1, \\ -1, & 1 \leq t < 2, \\ 1, & 2 \leq t < 3, \\ -1, & 3 \leq t < 4, \\ 0, & t \geq 4. \end{cases}$$

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### Solution

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

$$\begin{aligned} f(t) &= 1[H(t) - H(t-1)] - 1[H(t-1) - H(t-2)] + 1[H(t-2) - H(t-3)] - 1[H(t-3) - H(t-4)] \\ &= H(t) - 2H(t-1) + 2H(t-2) - 2H(t-3) + H(t-4) \\ &= u_0(t) - 2u_1(t) + 2u_2(t) - 2u_3(t) + u_4(t) \end{aligned}$$

