

**Example 3.19** (Ideal integrator). Determine whether the system  $\mathcal{H}$  is causal, where

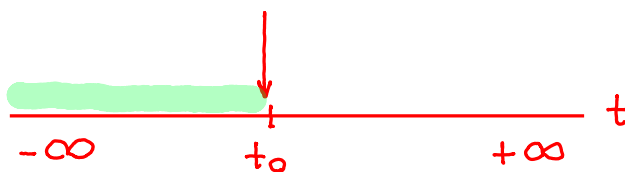
$$\mathcal{H}x(t) = \int_{-\infty}^t x(\tau) d\tau.$$

*Solution.* Consider the calculation of  $\mathcal{H}x(t_0)$  for arbitrary  $t_0$ . We have

$$\mathcal{H}x(t_0) = \int_{-\infty}^{t_0} x(\tau) d\tau.$$

Thus, we can see that  $\mathcal{H}x(t_0)$  depends only on  $x(t)$  for  $-\infty < t \leq t_0$ . Since all of the values in this interval are less than or equal to  $t_0$ , the system is causal. ■

Consider computation  
of output at this point



at what points must  
input be known?