



EXERCISE 9.2: The input and output of the time delay system satisfy $y(t) = x(t - t_d)$ where t_d is the delay of the system. Show that the time delay system is a time-invariant system.



Delay system is $y(t) = x(t - t_d)$

Delay the input to get $w(t) = x(t - t_1)$

Then use $w(t)$ as the input to obtain

$$y_w(t) = x(t - t_1 - t_d)$$

Compare to delaying the output by t_1

$$y(t) = x(t - t_d)$$

$$y(t - t_1) = x(t - t_1 - t_d)$$

Thus we see that

$$y_w(t) = y(t - t_1)$$

which verifies that the system is
Time-Invariant