4) c) $y(t) = \sin(u(t))$

Let $u(\tau) = \alpha t$

$y_1 = y(u(t)) = \sin(\alpha t)$

$y(u(t-t_0)) = \sin(\alpha(t-t_0)) = \sin(\alpha t - \alpha t_0)$

$y_1(t-t_0) = \sin(\alpha t - t_0)$

$y(u(t-t_0)) \neq y(u(t)-t_0)$

Time Invariant $\forall t_0 \neq \pm n2\pi$, $n = 0, 1, \ldots$

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d) $\dot{y} = -t\,y(t) + u(t)$, $t \geq 0$, $y(0) = 0$

state coefficient is not constant

$A(t) = t \Rightarrow$ Time-Invariant