Consider the continuous-time system with excitation $x(t)$ and response $y(t)$

$$x(t) \longrightarrow \boxed{} \longrightarrow y(t)$$

where $y(t) = x(\sin(t))$

(a) is this system causal

No, because the output at some time may depend on future inputs, For instance $y(-\pi) = x(\sin(-\pi)) = x(0)$

so $y(t)$ at $t = -\pi$ is a function of $x(t)$ at $t = 0$

(b) Is this system linear

Let $x_1(t) = g(t) \longrightarrow y_1(t) = g(\sin(t))$

Let $x_2(t) = h(t) \longrightarrow y_2(t) = h(\sin(t))$

Let $x_3(t) = \alpha g(t) + \beta h(t) \longrightarrow y_3(t) = x_3(\sin(t))$

$= \alpha g(\sin(t)) + \beta h(\sin(t))$

therefore, the system is linear

(c) based on (a), the system has memory

(d) The system is time varying

Let $x_1(t) = g(t) \longrightarrow y_1(t) = g(\sin(t))$

Let $x_2(t) = g(t - t_0) \longrightarrow y_2(t) = \underbrace{g(\sin(t) - t_0)}$

this is not the same as

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

(e) If I gave you $y(t)$ and asked you to give me $x(100)$, you couldn't do it because $y(t)$ is only a function of $x(\tau)$ from $-1 < \tau < +1$, so it's not invertable