L 3.111 Determine whether each system $\mathcal{H}$ given below is time invariant.
(a) $\mathcal{H}x(t) = \int_{-4}^{4} x(\tau)d\tau$;
(b) $\mathcal{H}x(t) = \mathcal{D}\{x^2\}(t)$, where $\mathcal{D}$ denotes the derivative operator;
(c) $\mathcal{H}x(t) = tu(t)x(t)$;
(d) $\mathcal{H}x(t) = \int_{-\infty}^{\infty} x(\tau)x(t-\tau)d\tau$;
(e) $\mathcal{H}x(t) = 3x(3t+3)$;
(f) $\mathcal{H}x(t) = x(t) + x(t-1)$; and
(g) $\mathcal{H}x(t) = e^t x(t)$.

Short Answer. (a) not time invariant; (b) time invariant; (c) not time invariant; (d) not time invariant; (e) not time invariant; (f) time invariant; (g) not time invariant

