ENGR 3323: Signals and Systems

HW 2_Ch1

1) For the systems described by the following equations, with the input *x(t)* and output *y(t)*, determine which of the systems are linear and which are nonlinear.

(a) $\frac{dy(t)}{dt} + 2y(t) = x^2(t)$ (b) $\frac{dy(t)}{dt} + 3ty(t) = t^2x(t)$ (c) $\frac{dy(t)}{dt} + y^2(t) = x(t)$

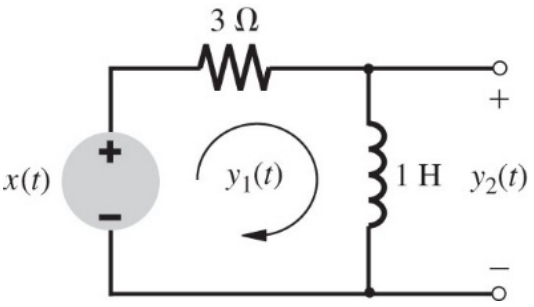
2) For the systems described by the following equations, with the input *x(t)* and output *y(t)*, explain with reasons which of the systems are time-invariant parameter systems and which are time-varying-parameter systems.

a) $y(t) = x(t-2)$ **b)** $y(t) = x(-t)$ **c)** $y(t) = x(at)$ **d)** $y(t) = tx(t-2)$

3) For the systems described by the following equations, with the input *x(t)* and output *y(t)*, determine which are causal and which are noncausal.

a) $y(t) = x(t-2)$ **b)** $y(t) = x(-t)$ **c)** $y(t) = x(at)$ $a > 1$ **d)** $y(t) = x(at)$ $0 < a < 1$

4) For the circuit depicted below, find the differential equations relating outputs $y_1(t)$ and $y_2(t)$ to the input $x(t)$.



5) A simplified (one-dimensional) model of an automobile suspension system is shown below. In this case, the input is not a force but a displacement $x(t)$ (the road contour). Find the differential equation relating the output $y(t)$ (auto body displacement) to the input $x(t)$ (the road contour).