3) a) $y(t) = t^2 u(t)$ → Linear

$y_1 = y(u_1(t)) = t^2 u_1(t)$

$y_2 = y(u_2(t)) = t^2 u_2(t)$ → satisfies Superposition

$y(\alpha u_1 + \beta u_2) = t^2(\alpha u_1 + \beta u_2)$

$\alpha y_1 + \beta y_2 = t^2(\alpha u_1 + \beta u_2)$

$\alpha y_1 + \beta y_2 \overset{\checkmark}{=} y(\alpha u_1 + \beta u_2)$

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b) $y(t) = 2(u(t))^2$

Let $u(t) = \alpha t$

$y(u(t)) = 2(\alpha t)^2 = 2\alpha^2 t^2$

$y(2u(t)) = 2(2\alpha t)^2 = 8\alpha^2 t^2$

$2y(u(t)) \neq y(2u(t))$

Non-Linear Does not Satisfy Homogeneity