# Assignment 12: Papoulis Chapter 9

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June 14, 2022

# Outline

# Question

## Problem 9.53

(a) $\mathrm{E}\{y^2(t)\}$ if $y(0) = y'(0) = 0$ and $y''(t) + 7y'(t) + 10y(t) = x(t)$
$R_x(\tau) = 5\delta(\tau)$

(b) $\mathrm{E}\{y^2(n)\}$ if $y(-1) = y(-2) = 0$ and
$8y(n) - 6y(n-1) + y(n-2) = x(n)$ $R_x(m) = 5\delta(m)$

# Solving a

If $y(0) = y'(0) = 0$ then y($t$) is the output of a system with input x($t$)U($t$) and impulse response h($t$) such that

$h''(t) + 7h'(t) + 10h(t) = \delta(t)$

$h(0^-) = h(0^+) = 0$

$h(t) = \frac{1}{3}\left(e^{-2t} - e^{-5t}\right)U(t)$ and with $q(t) = 5U(t)$

$E\left\{y^2(t)\right\} = \int_0^t \left(e^{-2t} - e^{-5t}\right)^2 d\tau$

# Solving b

If $y(-1) = y'(-2) = 0$ then y($n$) is the output of a system with input x($n$)U($n$) and delta response h($n$) such that

$8h(n) - 6h(n-1) + h(n-2) = \delta(n)$

$h(-1) = h(-2) = 0$

$h(n) = \left(\frac{1}{2^{n+2}} - \frac{1}{2^{2n+3}}\right) U(n)$ and with $q(n) = 5U(n)$

$E\left\{y^2(n)\right\} = 5\Sigma_{k=0}^{n} \left(\frac{1}{2^{n+2}} - \frac{1}{2^{2n+3}}\right)^2$