NAME: ....
ISMT S-136 Time Series Analysis with Python
Part I of Assignment 2

Suppose x_t is a stationary process with mean μ_x and autocovariance function $\gamma_x(h)$, $h = 0, \pm 1, \pm 2, \ldots$

(a) Show that the first difference ∇x_t of a stationary time series x_t is stationary. Express its mean $\mu_{\nabla x}$ and autocovariance function $\gamma_{\nabla x}(h)$ in terms of μ_x and $\gamma_x(h)$.

(b) Use your result in (a) to express the mean $\mu_{\nabla^2 x}$ and autocovariance function $\gamma_{\nabla^2 x}(h)$ of the second difference $\nabla^2 x_t$ in terms of original μ_x and $\gamma_x(h)$.

(c) Let now $y_t = \beta_0 + \beta_1 t + \beta_2 t^2 + x_t$, where β_0, β_1, and β_2 are fixed constants. Show that y_t and ∇y_t are not stationary, but $\nabla^2 y_t$ is stationary. Express the mean $\mu_{\nabla^2 y}$ and autocovariance function $\gamma_{\nabla^2 y}(h)$ of $\nabla^2 y_t$ in terms of μ_x and $\gamma_x(h)$.

SOLUTION: