(1) Consider the generic AR(2) process:

$$\left(1-\phi_1 B-\phi_2 B^2\right) y_t = e_t \quad ; \quad e_t \sim N(0,\sigma^2)$$

What conditions or constraints can be imposed on ϕ_1 and ϕ_2 to ensure stationarity in the series generated by this process?

(2) The series generated by the process $\left(1-2B\right) y_t = e_t$ is clearly non-stationary, why?

What are the consequences of using such a model for forecasting?

Find a function $f(B)$ which makes the series generated by this process y_t stationary, i.e. such that $f(B) y_t = z_t$ where z_t is stationary. Having found this function, write down an estimate for the parameter ϕ such that $\left(1-\phi B\right) z_t = e_t$. Furthermore, what would be the standard error in this estimate in terms of σ given that $e_t \sim N(0,\sigma^2)$. [note: this last question regarding the s.e. only is related to Noel's MLE question, but it can be solved using other procedures]

(3) Write down why you think a series should be made stationary before attempting to fit an ARMA model.