Ralph's Accounting Information

This is a continuation of Ralph's Structure. Ralph's background or prior knowledge $\Im$ regarding transactions is described by the following first two moments

$$E\left[y^T \mid \Im\right] = \mu^T = \left[60\,20\,25\,2\,80\,5\,40\,10\,20\,15\right]$$

and

$$Var\left[y \mid \Im\right] = \Sigma = \sigma^2 I = 100I$$

Hence, Ralph knows maximum entropy priors for transactions are normally distributed with the parameters described by the above moments.

Required:

Given the financial statements x and background knowledge $\Im$, identify posterior beliefs regarding transactions. Hint: the posterior distribution for transactions is normally distributed with

$$\begin{aligned} E\left[y^T \mid x, \Im\right] &= \mu + A_0^T \left(A_0 A_0^T\right)^{-1} (x_0 - A_0\mu) \\ &= \mu + A_0^T \left(A_0 A_0^T\right)^{-1} A_0(y^p - \mu) \\ &= \left(I - A_0^T \left(A_0 A_0^T\right)^{-1} A_0\right)\mu + A_0^T \left(A_0 A_0^T\right)^{-1} A_0 y^p \\ &= N^T \left(NN^T\right)^{-1} N\mu + \left(I - N^T \left(NN^T\right)^{-1} N\right) y^p \end{aligned}$$

and

$$Var\left[y \mid x, \Im\right] = \sigma^2 N^T \left(NN^T\right)^{-1} N$$

where A_0 refers to the matrix A after dropping one row. You should find the posterior mean of transactions is consistent with the financial statements, that is, $A\left(E\left[y \mid x, \Im\right]\right) = x$, and there is no residual uncertainty regarding transactions that are not in loops, for example, sales and cost of sales.