Consultation is fine, but no electronics, please.

A basis for $\mathbb{R}^3$ is $\mathcal{B} = \left\{ \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \right\}$.

(1) A vector $\mathbf{x} \in \mathbb{R}^3$ has the coordinate vector $[\mathbf{x}]_{\mathcal{B}} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$. What is $\mathbf{x}$?

(2) With the basis $\mathcal{B}$, what is the coordinate vector of $\mathbf{y} = \begin{bmatrix} 3 \\ 4 \\ 4 \end{bmatrix}$?

TURN OVER FOR MORE! MORE!

A basis for $\mathcal{P}_3$ is $\mathcal{D} = \{x^3, x^3+1, x^3+x, x^3+x^2\}$.

(3) A polynomial $p(x) \in \mathbb{P}_3$ has $[p(x)]_{\mathcal{D}} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$. What is $p(x)$?

(4) What is the coordinate vector $[x^3+x^2+x+1]_{\mathcal{D}}$?