(1) Define an ordered elementary basis for $M^{2\times 3}$ by going across rows first and then down.

(a) Use coordinate vectors to determine if the set \[
\begin{bmatrix}
1 & 2 & 0 \\
4 & 6 & 7 \\
\end{bmatrix}
, \begin{bmatrix}
1 & 1 & -1 \\
0 & 3 & 0 \\
\end{bmatrix}
, \begin{bmatrix}
1 & 0 & 2 \\
2 & 2 & 4 \\
\end{bmatrix}
, \begin{bmatrix}
0 & 2 & -2 \\
2 & 4 & 3 \\
\end{bmatrix}
\] is linearly dependent or independent.

(b) Identify a basis for the subspace of $M^{2\times 3}$ spanned by the vectors in part (a).

(2) Recall the effect on the determinant of the three row operations. Suppose $A$ is a $4 \times 4$ matrix with $\det(A) = 3$. What is $\det(2A)$? (Don’t say “6;” it’s not 6.)
(3) (a) Let \( p_0 = 1 \), \( p_1 = t \), \( p_2 = \frac{1}{2} (3t^2 - 1) \) and \( p_3 = \frac{1}{2} (5t^3 - 3t) \). Show that \( B = \{ p_0, p_1, p_2, p_3 \} \) is a basis\(^1\) for \( \mathbb{P}_3 \).

(b) Find the coordinate vector \([\mathbf{p}]_B\) for \( \mathbf{p} = -2 + 3t^2 - t^3 \).

(c) If \( \mathbb{P}_3 \) is isomorphic to \( \mathbb{R}^n \), what is \( n \)?

\(^{1}\)These are the first four Legendre polynomials.