

*You may work with others to figure out how to do questions, and you are welcome to look for answers in the book, online, by talking to someone who had the course before, etc. However, you must write the answers on your own. You must also show your work (you may, of course, quote any result from the book).*

1. Find a basis for each space. Verify that it is a basis.

(a) The subspace  $M = \{a + bx + cx^2 + dx^3 \mid a - 2b + c - d = 0\}$  of  $\mathcal{P}_3$ .

(b) This subspace of  $\mathcal{M}_{2 \times 2}$ .

$$W = \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \mid a - c = 0 \right\}$$

2. Give two different bases for  $\mathbb{R}^3$ . Verify that each is a basis.

3. Represent the vector with respect to each of the two bases.

$$\vec{v} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \quad B_1 = \left\langle \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \end{pmatrix} \right\rangle, \quad B_2 = \left\langle \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 3 \end{pmatrix} \right\rangle$$