

MA 1111/1212: Linear Algebra  
Tutorial problems, November 4, 2015

In problems 1–5, determine whether, for the given  $n$ , the vectors  $\{v_i\}$  in  $\mathbb{R}^n$

(i) are linearly independent;

(ii) span  $\mathbb{R}^n$ ;

(iii) form a basis of  $\mathbb{R}^n$ .

1.  $n = 2$ ,  $v_1 = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$ ,  $v_2 = \begin{pmatrix} 7 \\ -7 \end{pmatrix}$ .

2.  $n = 2$ ,  $v_1 = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$ ,  $v_2 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ .

3.  $n = 2$ ,  $v_1 = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$ ,  $v_2 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ ,  $v_3 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ .

4.  $n = 3$ ,  $v_1 = \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}$ ,  $v_2 = \begin{pmatrix} -1 \\ 2 \\ -1 \end{pmatrix}$ ,  $v_3 = \begin{pmatrix} -1 \\ -1 \\ 2 \end{pmatrix}$ .

5.  $n = 3$ ,  $v_1 = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$ ,  $v_2 = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$ ,  $v_3 = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$ .

*Optional question (if you have some time left).* Several vectors in  $\mathbb{R}^3$  form pairwise obtuse angles (strictly greater than  $90^\circ$ ). Show that if we consider the set of vectors obtained by removing any one of them, the rest are linearly independent.