# MATH 2802 N1-N3, WORKSHEET 2

(1) **True or False** (Justify your answer)
   If a system of equations has more variables than equations then it must be consistent.

(2) Let $v_1 = \begin{bmatrix} 12 \\ 1 \\ 2 \\ 6 \end{bmatrix}$, $v_2 = \begin{bmatrix} 6 \\ -1 \\ 1 \\ 2 \end{bmatrix}$, $v_3 = \begin{bmatrix} 10 \\ 1 \\ 5 \\ 10 \end{bmatrix}$, $v_4 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ and $v_5 = \begin{bmatrix} -10 \\ -1 \\ -5 \\ -10 \end{bmatrix}$

   (a) What is the shape of $Span\{v_1, v_2, v_3, v_4\}$?
   (b) What is the shape of $Span\{v_1, v_2, v_3, v_5\}$?
   (c) Is it possible to find vectors $w_1, w_2, \ldots, w_p$ in $\mathbb{R}^{p+1}$ that span all $\mathbb{R}^{p+1}$? (Justify your answer)

(3) Consider the following augmented matrices corresponding systems of linear equations (line separating last column missing). Find which ones are consistent, which ones have exactly one solutions; if the system has more than one solution then write down the solution set in parametric vector form.

$$\begin{bmatrix} 1 & 4 & -4 & 3 \\ 0 & 2 & 5 & 4 \\ 0 & 0 & -3 & 5 \end{bmatrix} \quad \begin{bmatrix} 1 & 7 & 0 & 1 \\ 0 & 0 & 2 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 7 & 1 \\ 0 & 1 & -2 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(4) Zander has challenged you to find his hidden treasure, located at some point $(a, b, c)$. He has honestly guaranteed you that the treasure can be found by starting at the origin and taking steps in directions given by

$$v_1 = \begin{bmatrix} 1 \\ -1 \\ -2 \end{bmatrix}, v_2 = \begin{bmatrix} 5 \\ -4 \\ -7 \end{bmatrix}, v_3 = \begin{bmatrix} -3 \\ 1 \\ 0 \end{bmatrix}.$$

By decoding Zander's message, you have discovered that the treasure's first and second entries are (in order) -4 and 3.

   (a) What is the treasure's full location?
   (b) Give instructions for how to find the treasure only moving in the directions given by $v_1, v_2, v_3$.