

### Math 1553 Worksheet §1.3

1. Is it possible to write

$$b = \begin{pmatrix} -3 \\ -9 \\ 7 \end{pmatrix} \text{ as a linear combination of } \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 3 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix}, \text{ and } \begin{pmatrix} -1 \\ -5 \\ -6 \end{pmatrix}?$$

If your answer is no, justify why not. If your answer is yes, write  $b$  as a linear combination of those four vectors.

2. Let

$$A = \begin{pmatrix} 1 & 0 & 5 \\ -2 & 1 & -6 \\ 0 & 2 & 8 \end{pmatrix}, \quad b = \begin{pmatrix} 2 \\ -1 \\ 6 \end{pmatrix}$$

Is  $b$  in the span of the columns of  $A$ ? Justify your answer.

3. Decide if each of the following statements is true or false. If it is true, prove it; if it is false, provide a counterexample.

a) Every set of four or more vectors in  $\mathbf{R}^3$  will span  $\mathbf{R}^3$ .

b) The span of any set contains the zero vector.

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

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

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 by only moving in the directions given by  $v_1$ ,  $v_2$ , and  $v_3$ .