

Math 1553 Worksheet §2.1, §2.2

1. Consider the system of linear equations

$$\begin{aligned}x + 2y &= 7 \\2x + y &= -2 \\-x - y &= 4.\end{aligned}$$

Question: What are the solutions (if there are any) to the system?

- a) Formulate this question as a question about an augmented matrix.

- b) Formulate this question as a vector equation.

- c) What does this question mean in terms of spans?

- d) Answer part (c) using the [interactive demo](#).

- e) Answer the question using row reduction.

2. a) Write a set of **three** different vectors whose span is a **line** in \mathbf{R}^3 .

b) Write a set of **three** different vectors whose span is a **plane** in \mathbf{R}^3 .

c) Write a set of **three** vectors whose span is only a single **point** in \mathbf{R}^3 .

d) In each of the above questions, if you form the matrix A whose columns are the three vectors, how many pivots does A have?

- 3.** Jameson Locke has challenged you to find a 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 using

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

By decoding the message, you have discovered that the first and second coordinates of the treasure's location 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 using v_1 , v_2 , and v_3 . Can you do the same to get the treasure by just using v_1 and v_2 ?

4. Let $v_1 = \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$ $v_2 = \begin{pmatrix} -2 \\ -3 \\ -1 \end{pmatrix}$ $w = \begin{pmatrix} 2 \\ -4 \\ 8 \end{pmatrix}$.

Question: Is w a linear combination of v_1 and v_2 ? In other words, is w in $\text{Span}\{v_1, v_2\}$?

a) Formulate this question as a vector equation.

b) Answer the question using the [interactive demo](#).