

## Math 1553 Worksheet §3.1, 3.2

If you don't have a computer, find someone who does.

1. 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  $w$  in  $\text{Span}\{v_1, v_2\}$ ?

- Formulate this question as a vector equation.
  - Formulate this question as a system of linear equations.
  - Formulate this question as an augmented matrix.
  - Answer the question using the [interactive demo](#).
  - Answer the question using row reduction.
2. Consider the system of linear equations

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

**Question:** Does this system have a solution? If so, what is the solution set?

- Formulate this question as an augmented matrix.
  - Formulate this question as a vector equation.
  - What does this mean in terms of spans?
  - Answer the question using the [interactive demo](#).
  - Answer the question using row reduction.
3. Consider the vector equation

$$x \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} + y \begin{pmatrix} -2 \\ -1 \\ -1 \end{pmatrix} + z \begin{pmatrix} 3 \\ 0 \\ 4 \end{pmatrix} = \begin{pmatrix} -5 \\ -1 \\ -2 \end{pmatrix}.$$

**Question:** Is there a solution? If so, what is the solution set?

- Formulate this question as an augmented matrix.
- Formulate this question as a system of linear equations.
- What does this mean in terms of spans?
- Answer the question using the [interactive demo](#).
- Answer the question using row reduction.

4. Consider the augmented matrix

$$\left( \begin{array}{ccc|c} 2 & -2 & 2 & 0 \\ 1 & -3 & -4 & -9 \\ 3 & -1 & 8 & 9 \end{array} \right)$$

**Question:** Does the corresponding linear system have a solution? If so, what is the solution set?

- a) Formulate this question as a vector equation.
  - b) Formulate this question as a system of linear equations.
  - c) What does this mean in terms of spans?
  - d) Answer the question using the [interactive demo](#).
  - e) Answer the question using row reduction.
  - f) Find a **different** solution in parts (e) and (d).
5. 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.