Name:______________________________ Studio Section:__________

Math 1553 Quiz 3, Spring 2020 (10 points, 10 minutes)
Jankowski, Lecture C1-C4 (11:15 AM)

Solutions

Unless specified otherwise, show your work or you may receive little or no credit, even if your answer is correct.

1. **a)** (2 points) Complete the following definition (be mathematically precise!):
Let $w, v_1, v_2, \dots, v_p$ be vectors in $\mathbf{R}^n$. We say w is a *linear combination* of $v_1, v_2, \dots, v_p$ if...

$$w = c_1 v_1 + \cdots + c_p v_p \qquad \text{for some scalars } c_1, \dots, c_p.$$

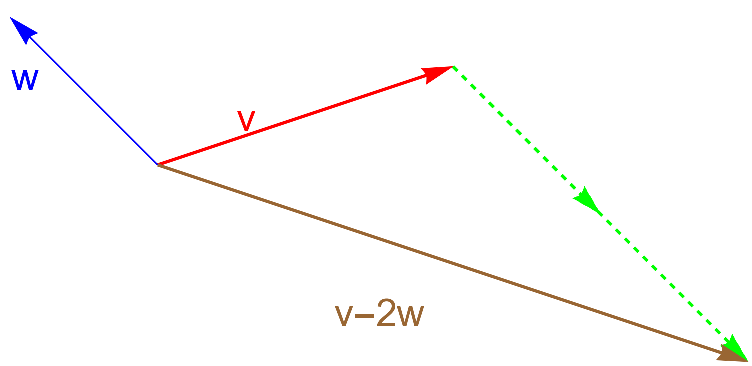
It is fine if the student uses different symbols than "c_i" or writes "real numbers" rather than "scalars" in the definition.

b) (1 point) Determine whether the following statement is true or false. Clearly circle your answer (you do not need to show work or justify your answer):
If v_1 and v_2 are vectors in $\mathbf{R}^3$ and $v_1 \neq v_2$, then Span$\{v_1, v_2\}$ must be a plane.

TRUE $\boxed{\text{FALSE}}$ For example, $v_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $v_2 = \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix}$.

2. (3 points) Let v and w be the vectors labeled below. Draw $v - 2w$ as an arrow.

Solution: We use the tip of v and take two steps *backward* in the direction of w.



turn over for problem 3!

3. (4 points) Find all real numbers h (if there are any) so that the following vector equation has infinitely many solutions:

$$x_1\begin{pmatrix}1\\2\end{pmatrix}+x_2\begin{pmatrix}-1\\h\end{pmatrix}=\begin{pmatrix}2\\4\end{pmatrix}.$$

We set up the augmented matrix and row-reduce:

$$\left(\begin{array}{cc|c}1 & -1 & 2\\2 & h & 4\end{array}\right)\xrightarrow{R_2=R_2-2R_1}\left(\begin{array}{cc|c}1 & -1 & 2\\0 & h+2 & 0\end{array}\right).$$

From the above, we see the system is guaranteed to be consistent, and it will have infinitely many solutions if the second column fails to have a pivot. Thus $h+2=0$, so $\boxed{h=-2}$.