Workshop 1: Vector Equations

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1. Compute the following linear combination.

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

2. Determine the linear system whose solution set is identical to this vector equation.

$$x_1 \begin{bmatrix} 1 \\ 2 \\ -4 \end{bmatrix} + x_2 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} - x_3 \begin{bmatrix} 7 \\ 5 \\ 0 \end{bmatrix} + x_4 \begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 3 \end{bmatrix}$$

3. Draw the following vectors.

$$\begin{bmatrix} 1 \\ 2 \end{bmatrix} \qquad 2 \begin{bmatrix} 1 \\ 2 \end{bmatrix} \qquad 3 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + 2 \begin{bmatrix} -1 \\ -1 \end{bmatrix}$$

4. Can $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ be written as a linear combination of $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} -4 \\ -6 \end{bmatrix}$? Justify your answer.

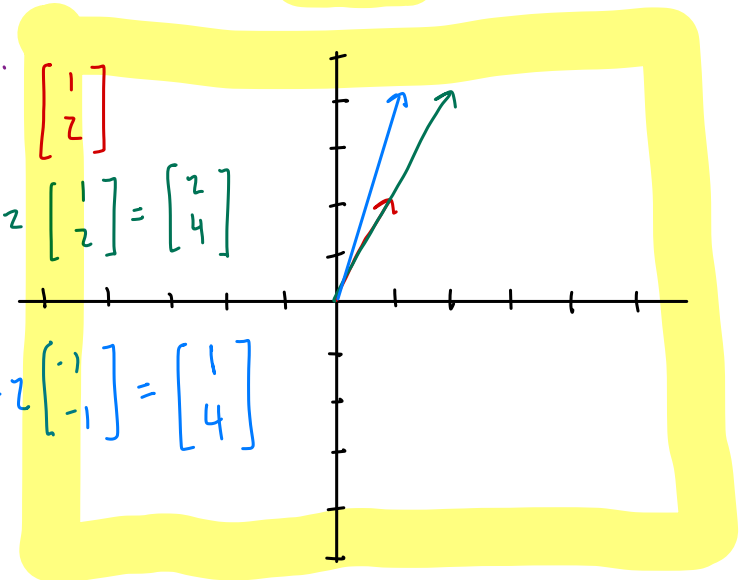
5. Determine if $\begin{bmatrix} 2 \\ 3 \end{bmatrix} \in \text{span}\left\{ \begin{bmatrix} -4 \\ 3 \end{bmatrix}, \begin{bmatrix} -9 \\ 7 \end{bmatrix} \right\}$. If so, write it as a linear combination.

6. For what values of h and k is $\begin{bmatrix} 3 \\ k \end{bmatrix} \notin \text{span}\left\{ \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} h \\ -5 \end{bmatrix} \right\}$?

Write your solutions below and on the back on this page.

1. $\begin{bmatrix} 1 \\ 2 \\ -4 \end{bmatrix} + 3 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} - 3 \begin{bmatrix} 7 \\ 5 \\ 0 \end{bmatrix} = \begin{bmatrix} 1+0-21 \\ 2+0-15 \\ -4+3-0 \end{bmatrix} = \begin{bmatrix} -20 \\ -13 \\ -1 \end{bmatrix}$

2. $$\begin{aligned} x_1 - 7x_3 + x_4 &= 4 \\ 2x_1 - 5x_3 + x_4 &= 0 \\ -4x_1 + x_2 - x_4 &= 3 \end{aligned}$$

3. 

4. $x_1\begin{bmatrix}2\\3\end{bmatrix} + x_2\begin{bmatrix}-4\\-6\end{bmatrix} = \begin{bmatrix}1\\2\end{bmatrix}$ $\quad \begin{bmatrix}2 & -4 & 1\\3 & -6 & 2\end{bmatrix} \sim \begin{bmatrix}6 & -12 & 3\\6 & -12 & 4\end{bmatrix}$

$\sim \begin{bmatrix}6 & -12 & 3\\0 & 0 & 1\end{bmatrix}$

inconsistent

NO

5. $\begin{bmatrix}-4 & -9 & 2\\3 & 7 & 3\end{bmatrix} \sim \begin{bmatrix}-12 & -27 & 6\\12 & 28 & 12\end{bmatrix}$ (−12, −27, +6)

$\begin{bmatrix}-4 & -9 & 2\\0 & 1 & 18\end{bmatrix}$ (+9, +162)

$\sim \begin{bmatrix}-4 & 0 & 164\\0 & 1 & 18\end{bmatrix}$

$\sim \begin{bmatrix}1 & 0 & -41\\0 & 1 & 18\end{bmatrix}$

$-41\begin{bmatrix}-4\\3\end{bmatrix} + 18\begin{bmatrix}-9\\7\end{bmatrix} =$

$\begin{bmatrix}164 + -162\\-123 + 126\end{bmatrix} = \begin{bmatrix}2\\3\end{bmatrix}$

6. $\begin{bmatrix}1 & h & 3\\2 & -5 & k\end{bmatrix} \sim \begin{bmatrix}1 & h & 3\\0 & -5-2h & k-6\end{bmatrix}$

$-5 - 2h = 0$

$k - 6 \neq 0$

$h = -2/5$

$k \neq 6$