Math 2210Q-008 - Applied Linear Algebra | Quiz 8
Name: | Fall 2018

Show ALL work to receive full credit.

1. (3 points each) If the statement is always true, circle True. If the statement is sometimes false, circle False. In each case, write a careful and clear **justification** or **counterexample**.

   (a) $\mathbf{v} = \begin{bmatrix} 6 \\ 9 \end{bmatrix}$ is in Nul$\left(\begin{bmatrix} 6 & -4 \\ 9 & -5 \end{bmatrix}\right)$. True **(False)**

   $$\begin{bmatrix} 6 & -4 \\ 9 & -5 \end{bmatrix}\begin{bmatrix} 6 \\ 9 \end{bmatrix} = \begin{bmatrix} 36-36 \\ 54-45 \end{bmatrix} = \begin{bmatrix} 0 \\ 9 \end{bmatrix} \neq \vec{0}$$

   (b) $\mathbf{v} = \begin{bmatrix} 6 \\ 9 \end{bmatrix}$ is in Col$\left(\begin{bmatrix} 6 & -4 \\ 9 & -5 \end{bmatrix}\right)$. **(True)** False

2. (5 points) Show that $S = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x \geq y \right\}$ is closed under addition, but is not a subspace of $\mathbb{R}^2$.

   $$\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x+x' \\ y+y' \end{bmatrix}$$

   $x \geq y$, $y' \geq x'$

   $\Rightarrow x + x' \geq y + y'$

   so this is still in H

   if $x > y$ and $c < 0$ then $cx < cy$

   ex. $c = -1$ $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ $\quad -1 \cdot \begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} -2 \\ -1 \end{bmatrix}$

   $-2 \not\geq -1$

3. (5 points) Show $H = \left\{ \begin{bmatrix} a & 2a \\ 3a & 4a \end{bmatrix} : a \text{ is real} \right\}$ is a subspace of $M_{2\times 2}$.

   $a = 0$ gives $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

   $$\begin{bmatrix} a & 2a \\ 3a & 4a \end{bmatrix} + \begin{bmatrix} b & 2b \\ 3b & 4b \end{bmatrix} = \begin{bmatrix} a+b & 2(a+b) \\ 3(a+b) & 4(a+b) \end{bmatrix}$$ in H

   $$c\begin{bmatrix} a & 2a \\ 3a & 4a \end{bmatrix} = \begin{bmatrix} ac & 2(ac) \\ 3(ac) & 4(ac) \end{bmatrix}$$

   Another way

   $$H = \left\{ \begin{bmatrix} a & 2a \\ 3a & 4a \end{bmatrix} : a \text{ real} \right\} = \left\{ a\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} : a \text{ real} \right\} = \text{Span}\left\{ \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \right\}$$

   since Span of a vector is a subspace this is a subspace.

Math 2210Q-004 - Applied Linear Algebra — Quiz 8
Name: — Fall 2018

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1. (3 points each) If the statement is always true, circle True. If the statement is sometimes false, circle False. In each case, write a careful and clear **justification** or **counterexample**.

   (a) $\mathbf{v} = \begin{bmatrix} 6 \\ 9 \end{bmatrix}$ is in $\text{Nul}\left(\begin{bmatrix} 6 & -4 \\ 9 & -5 \end{bmatrix}\right)$. True False

   (b) $\mathbf{v} = \begin{bmatrix} 6 \\ 9 \end{bmatrix}$ is in $\text{Col}\left(\begin{bmatrix} 6 & -4 \\ 9 & -5 \end{bmatrix}\right)$. True False

2. (5 points) Show that $S = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x \geq y \right\}$ is closed under addition, but is not a subspace of $\mathbb{R}^2$.

3. (5 points) Show $H = \left\{ \begin{bmatrix} a & 2a \\ 3a & 4a \end{bmatrix} : a \text{ is real} \right\}$ is a subspace of $M_{2\times 2}$.

This Survey is Anonymous

3-2-1 Survey

3. List (up to) 3 concepts that you learned this week.

2. List (up to) 2 concepts that were not clear.

1. What 1 thing would you like to see as a follow up to this week's lessons?

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