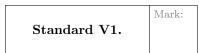
Name:	
J#:	Dr. Clontz
Date:	

## MASTERY QUIZ DAY 12

Math 237 – Linear Algebra Fall 2017

Version 3

Show all work. Answers without work will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.



Let V be the set of all real numbers with the operations, for any  $x, y \in V$ ,  $c \in \mathbb{R}$ ,

$$x \oplus y = \sqrt{x^2 + y^2}$$
$$c \odot x = cx$$

- (a) Show that the vector addition  $\oplus$  is associative.
- (b) Determine if V is a vector space or not. Justify your answer.

**Solution:** Let  $x, y, z \in \mathbb{R}$ . Then

$$(x \oplus y) \oplus z = \sqrt{x^2 + y^2} \oplus z$$

$$= \sqrt{(\sqrt{x^2 + y^2})^2 + z^2}$$

$$= \sqrt{x^2 + y^2 + z^2}$$

$$= \sqrt{x^2 + (\sqrt{y^2 + z^2})^2}$$

$$= x \oplus \sqrt{y^2 + z^2}$$

$$= x \oplus (y \oplus z)$$

However, this is not a vector space, as there is no zero vector.

Determine if the vectors 
$$\begin{bmatrix} 2 \\ 0 \\ -2 \\ 0 \end{bmatrix}$$
,  $\begin{bmatrix} 3 \\ 1 \\ 3 \\ 6 \end{bmatrix}$ ,  $\begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}$ , and  $\begin{bmatrix} 1 \\ 2 \\ 0 \\ 1 \end{bmatrix}$  span  $\mathbb{R}^4$ .

Solution:

$$RREF\left(\begin{bmatrix} 2 & 3 & 0 & 1\\ 0 & 1 & 0 & 2\\ -2 & 3 & 1 & 0\\ 0 & 6 & 1 & 1 \end{bmatrix}\right) = \begin{bmatrix} 1 & 0 & 0 & -\frac{5}{2}\\ 0 & 1 & 0 & 2\\ 0 & 0 & 1 & -11\\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Since there is a zero row, the vectors do not span  $\mathbb{R}^4$ .

Standard V4.	Mark:
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Let W be the set of all 2 by 2 matrices which are not invertible. Determine if W is a subspace of  $M_{2,2}$ .

Solution: W is closed under scalar multiplication, but not under addition.

Additional Notes/Marks