Name:	
J#:	Dr. Clontz
Date:	

Math 237 – Linear Algebra Fall 2017

Version 1

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 together with the operations \oplus and \odot defined by, for any $x,y \in V$ and $c \in \mathbb{R}$,

$$x \oplus y = x + y - 3$$
$$c \odot x = cx - 3(c - 1)$$

- (a) Show that this scalar multiplication \odot is associative.
- (b) Determine if V is a vector space or not. Justify your answer

Does span
$$\left\{ \begin{bmatrix} 2\\-1\\4\\2\\1 \end{bmatrix}, \begin{bmatrix} -1\\3\\5\\2\\0 \end{bmatrix}, \begin{bmatrix} 1\\0\\5\\1\\-3 \end{bmatrix} \right\} = \mathbb{R}^5?$$



 ${\bf Additional\ Notes/Marks}$

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Version 2

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 pairs of real numbers with the operations, for any $(x_1, y_1), (x_2, y_2) \in V, c \in \mathbb{R}$,

$$(x_1, y_1) \oplus (x_2, y_2) = (x_1 + x_2, y_1 + y_2)$$

 $c \odot (x_1, y_1) = (c^2 x_1, c^3 y_1)$

- (a) Show that this scalar multiplication \odot distributes over vector addition \oplus .
- (b) Determine if V is a vector space or not. Justify your answer.

Standard V3.
$$\begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 3 \\ 6 \\ 3 \end{bmatrix}, \begin{bmatrix} 3 \\ -1 \\ 3 \\ -2 \end{bmatrix}, \text{ and } \begin{bmatrix} 7 \\ -1 \\ 8 \\ -3 \end{bmatrix} \text{ span } \mathbb{R}^4.$$

Mark: Standard V4.

Let W be the set of all \mathbb{R}^3 vectors $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$ with terminal points on the plane x+y+z=1. Determine if W is a subspace of \mathbb{R}^3 .

 ${\bf Additional\ Notes/Marks}$

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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 points on the line x + y = 2 with the operations, for any $(x_1, y_1), (x_2, y_2) \in V$, $c \in \mathbb{R}$,

$$(x_1, y_1) \oplus (x_2, y_2) = (x_1 + x_2 - 1, y_1 + y_2 - 1)$$

 $c \odot (x_1, y_1) = (cx_1 - (c - 1), cy_1 - (c - 2))$

- (a) Show that this vector space has an additive identity element.
- (b) Determine if V is a vector space or not. Justify your answer.

Does span
$$\left\{ \begin{bmatrix} 2\\-1\\4\\2\\1 \end{bmatrix}, \begin{bmatrix} -1\\3\\5\\2\\0 \end{bmatrix}, \begin{bmatrix} 1\\0\\5\\1\\-3 \end{bmatrix} \right\} = \mathbb{R}^5?$$

Standard V4.	Mark:

Let W be the set of all complex numbers that are purely real or purely imaginary. Determine if W is a subspace of \mathbb{C} .

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Version 4

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 pairs of real numbers with the operations, for any $(x_1, y_1), (x_2, y_2) \in V, c \in \mathbb{R}$,

$$(x_1, y_1) \oplus (x_2, y_2) = (x_1 + x_2, y_1 + y_2)$$

 $c \odot (x_1, y_1) = (0, cy_1)$

- (a) Show that this scalar multiplication \odot distributes over scalar addition.
- (b) Determine if V is a vector space or not. Justify your answer.

Standard V3.

$$\begin{bmatrix}
2 \\
-1 \\
4
\end{bmatrix}, \begin{bmatrix}
3 \\
12 \\
-9
\end{bmatrix}, \begin{bmatrix}
1 \\
4 \\
-3
\end{bmatrix}, \begin{bmatrix}
-4 \\
2 \\
-8
\end{bmatrix} = \mathbb{R}^3?$$

Standard V4.	Standard V4.	Mark:
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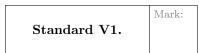
Let W be the set of all complex numbers a+bi where a=2b. Determine if W is a subspace of \mathbb{C} .

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Version 5

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.

Standard V3.

$$\begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}, \begin{bmatrix} 3 \\ 12 \\ -9 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} -4 \\ 2 \\ -8 \end{bmatrix} = \mathbb{R}^3?$$

Standard V4.	Mark:

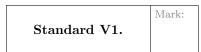
Let W be the set of all polynomials of the form $ax^3 + bx$. Determine if W is a subspace of \mathcal{P}^3 .

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Version 6

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.

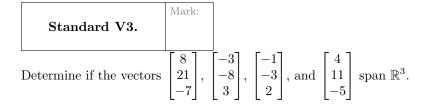


Let V be the set of all polynomials with the operations, for any $f, g \in V$, $c \in \mathbb{R}$,

$$f \oplus g = f' + g'$$
$$c \odot f = cf'$$

(here f' denotes the derivative of f).

- (a) Show that this scalar multiplication \odot distributes over vector addition \oplus .
- (b) Determine if V is a vector space or not. Justify your answer.



Standard V4.	Mark:

Let W be the set of all polynomials of the form $ax^3 + bx$. Determine if W is a subspace of \mathcal{P}^3 .