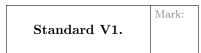
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#### Version 1

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 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 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.	Mark:

Let W be the set of all complex numbers that are purely real (i.e of the form a+0i) or purely imaginary (i.e. of the form 0+bi). Determine if W is a subspace of  $\mathbb{C}$ .

Standard S2.

Mark:

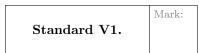
Determine if the set  $\{x^2 + x - 1, 3x^2 - x + 1, 2x - 2\}$  is a basis of  $\mathcal{P}_2$ 

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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 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.

Mark:

$$\begin{bmatrix}
-3 \\
1 \\
1
\end{bmatrix}, \begin{bmatrix}
5 \\
-1 \\
-2
\end{bmatrix}, \begin{bmatrix}
2 \\
0 \\
-1
\end{bmatrix}, \text{ and } \begin{bmatrix}
0 \\
2 \\
-1
\end{bmatrix} \text{ span } \mathbb{R}^3$$

Standard V4.

Mark:

Let W be the set of all  $\mathbb{R}^3$  vectors  $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$  satisfying x+y+z=0 (this forms a plane). Determine if W is a subspace of  $\mathbb{R}^3$ .

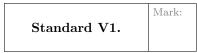
Standard S2.  $\begin{bmatrix} 0 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 0 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 0 \\ -1 \end{bmatrix}$  is a basis of  $\mathbb{R}^4$ .

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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 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 V3.

Determine if the vectors 
$$\begin{bmatrix} -3\\1\\1 \end{bmatrix}$$
,  $\begin{bmatrix} 5\\-1\\-2 \end{bmatrix}$ ,  $\begin{bmatrix} 2\\0\\-1 \end{bmatrix}$ , and  $\begin{bmatrix} 0\\2\\-1 \end{bmatrix}$  span  $\mathbb{R}^3$ 

Standard V4. 
$$\begin{bmatrix} x \\ y \\ 0 \\ z \end{bmatrix} \mid x, y, z \in \mathbb{R}$$
 a subspace of  $\mathbb{R}^4$ .

Standard S2.

Mark:

Determine if the set  $\{x^2 + x - 1, 3x^2 - x + 1, 2x - 2\}$  is a basis of  $\mathcal{P}_2$ 

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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 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.

Mark:

$$\begin{bmatrix} 1 \\ 0 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 1 \\ 0 \\ -3 \end{bmatrix}, \begin{bmatrix} 0 \\ 3 \\ 0 \\ -2 \end{bmatrix}, \text{ and } \begin{bmatrix} -1 \\ 1 \\ -1 \\ -1 \end{bmatrix} \text{ span } \mathbb{R}^4.$$

Standard V4.

Mark:

Let W be the set of all  $\mathbb{R}^3$  vectors  $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$  satisfying x+y+z=0 (this forms a plane). Determine if W is a subspace of  $\mathbb{R}^3$ .

Standard S2.  $\begin{bmatrix} 0 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 0 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 0 \\ -1 \end{bmatrix}$  is a basis of  $\mathbb{R}^4$ .

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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 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.

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  $\mathbb{R}^4$ .

Standard V4.

Mark:

Let W be the set of all  $\mathbb{R}^3$  vectors  $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$  satisfying x+y+z=0 (this forms a plane). Determine if W is a subspace of  $\mathbb{R}^3$ .

Standard S2.

Determine if the set  $\left\{ \begin{bmatrix} 1\\1\\-1 \end{bmatrix}, \begin{bmatrix} 3\\-1\\1 \end{bmatrix}, \begin{bmatrix} 2\\0\\-2 \end{bmatrix} \right\}$  is a basis of  $\mathbb{R}^3$ 

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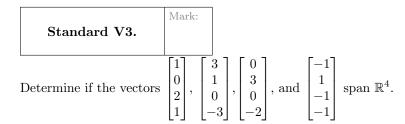
# Version 6

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 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



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

Standard S2.

Mark:

Determine if the set  $\{x^2 + x - 1, 3x^2 - x + 1, 2x - 2\}$  is a basis of  $\mathcal{P}_2$