

Name:
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Date:

Dr. Clontz

MASTERY QUIZ DAY 8

Math 237 – Linear Algebra

Version 2

Fall 2017

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.

Standard E1.	Mark:
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Write an augmented matrix corresponding to the following system of linear equations.

$$x + 3y - 4z = 5$$

$$3x + 9y + z = 0$$

$$x - z = 1$$

Solution:

$$\left[\begin{array}{ccc|c} 1 & 3 & -4 & 5 \\ 3 & 9 & 1 & 0 \\ 1 & 0 & -1 & 1 \end{array} \right]$$

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Standard E3.	Mark:
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Solve the system of equations

$$x + 3y - 4z = 5$$

$$3x + 9y + z = 2$$

Standard E4.	Mark:
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Find a basis for the solution set of the system ...

Standard V1.	Mark:
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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 $c \in \mathbb{R}$,

$$x \oplus y = x + y - 3$$

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

Determine if V is a vector space or not.

Solution: Let $x, y \in V$, $c, d \in \mathbb{R}$.

- 1) Real addition is associative, so \oplus is associative.
- 2) $x \oplus 3 = x + 3 - 3 = x$, so 3 is the additive identity.
- 3) $x \oplus (6 - x) = x + (6 - x) - 3 = 3$, so $6 - x$ is the additive inverse of x .
- 4) Real addition is commutative, so \oplus is commutative.
- 5)

$$\begin{aligned}
 c \odot (d \odot x) &= c \odot (dx - 3(d - 1)) \\
 &= c(dx - 3(d - 1)) - 3(c - 1) \\
 &= cdx - 3(cd - 1) \\
 &= (cd) \odot x
 \end{aligned}$$

- 6) $1 \odot x = x - 3(1 - 1) = x$
- 7)

$$\begin{aligned}
 c \odot (x \oplus y) &= c \odot (x + y - 3) \\
 &= c(x + y - 3) - 3(c - 1) \\
 &= cx - 3(c - 1) + cy - 3(c - 1) - 3 \\
 &= (c \odot x) \oplus (c \odot y)
 \end{aligned}$$

- 8)

$$\begin{aligned}
 (c + d) \odot x &= (c + d)x - 3(c + d - 1) \\
 &= cx - 3(c - 1) + dx - 3(d - 1) - 3 \\
 &= (c \odot x) \oplus (d \odot x)
 \end{aligned}$$

Therefore V is a vector space.

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