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1. (1 point)
Let
$\mathbf{u} = \begin{bmatrix} 9 \\ 3 \\ 1 \end{bmatrix}, \mathbf{v} = \begin{bmatrix} 5 \\ 4 \\ 0 \end{bmatrix}, \mathbf{w} = \begin{bmatrix} 0 \\ 9 \\ 5 \end{bmatrix}$

Compute $8\mathbf{u} - 3\mathbf{v} - 4\mathbf{w} = \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}$

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2. (1 point)
Express the following system of linear equations as a vector equation.

$$3x_1 + 5x_2 + 8x_3 = -9$$

$$5x_1 + 6x_2 + 2x_3 = -8$$

$$1x_1 - 8x_2 + 5x_3 = 9$$

$\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} x_1 + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} x_2 + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} x_3 = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

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3. (1 point)
Express the following vector equation as a system of linear equations.

$$x_1 \begin{bmatrix} 4 \\ -3 \end{bmatrix} + x_2 \begin{bmatrix} 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 9 \\ -4 \end{bmatrix}$$

(Keep the equations in order.)
___ $x_1 +$ ___ $x_2 =$ ___.
___ $x_1 +$ ___ $x_2 =$ ___.

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4. (1 point)
Let $\mathbf{a}_1 = \begin{bmatrix} 2 \\ 2 \end{bmatrix}, \mathbf{a}_2 = \begin{bmatrix} 2 \\ -3 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} -4 \\ 16 \end{bmatrix}$.
Is $\mathbf{b}$ a linear combination of $\mathbf{a}_1$ and $\mathbf{a}_2$?

- A. **b** is not a linear combination.
- B. Yes **b** is a linear combination.
- C. We cannot tell if **b** is a linear combination.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.
$\mathbf{b} =$ ___ $\mathbf{a}_1 +$ ___ $\mathbf{a}_2$

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5. (1 point)
Let $\mathbf{a}_1 = \begin{bmatrix} -7 \\ 6 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 14 \\ -12 \end{bmatrix}$.
Is $\mathbf{b}$ in the span of of $\mathbf{a}_1$?

- A. Yes, **b** is in the span.
- B. No, **b** is not in the span.
- C. We cannot tell if **b** is in the span.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.
$\mathbf{b} =$ ___ $\mathbf{a}_1$

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6. (1 point)
Let $\mathbf{a}_1 = \begin{bmatrix} 3 \\ 5 \\ 1 \end{bmatrix}, \mathbf{a}_2 = \begin{bmatrix} -9 \\ -14 \\ -8 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} 3 \\ 6 \\ -3 \end{bmatrix}$.
Is $\mathbf{b}$ a linear combination of $\mathbf{a}_1$ and $\mathbf{a}_2$?

- A. Yes, **b** is a linear combination.
- B. No, **b** is not a linear combination.
- C. We cannot tell if **b** is a linear combination.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.
$\mathbf{b} =$ ___ $\mathbf{a}_1 +$ ___ $\mathbf{a}_2$

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7. (1 point)
Let $\mathbf{a}_1 = \begin{bmatrix} -9 \\ 6 \\ 8 \end{bmatrix}, \mathbf{a}_2 = \begin{bmatrix} 6 \\ 2 \\ 5 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} -57 \\ 26 \\ 30 \end{bmatrix}$.
Is $\mathbf{b}$ in the span of of $\mathbf{a}_1$ and $\mathbf{a}_2$?

- A. Yes, **b** is in the span.
- B. No, **b** is not in the span.
- C. We cannot tell if **b** is in the span.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.
$\mathbf{b} =$ ___ $\mathbf{a}_1 +$ ___ $\mathbf{a}_2$

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8. (1 point)
Let $\mathbf{a}_1 = \begin{bmatrix} -2 \\ 7 \\ -9 \end{bmatrix}, \mathbf{a}_2 = \begin{bmatrix} -7 \\ 3 \\ -2 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} 13 \\ -24 \\ 30 \end{bmatrix}$.
Is $\mathbf{b}$ in the span of of $\mathbf{a}_1$ and $\mathbf{a}_2$?

- A. Yes, **b** is in the span.
- B. No, **b** is not in the span.
- C. We cannot tell if **b** is in the span.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.
$\mathbf{b} =$ ___ $\mathbf{a}_1 +$ ___ $\mathbf{a}_2$

9. (1 point)
Let $\mathbf{u}_1 = \begin{bmatrix} 4 \\ -4 \end{bmatrix}$, and $\mathbf{u}_2 = \begin{bmatrix} -20 \\ 25 \end{bmatrix}$.
Select all of the vectors that are in the span of $\{\mathbf{u}_1, \mathbf{u}_2\}$. (Check every statement that is correct.)

- A. The vector $7\begin{bmatrix} -20 \\ 25 \end{bmatrix} - 3\begin{bmatrix} 4 \\ -4 \end{bmatrix}$ is in the span.
- B. The vector $-3\begin{bmatrix} 4 \\ -4 \end{bmatrix}$ is in the span.
- C. All vectors in $\mathbb{R}^2$ are in the span.
- D. The vector $\begin{bmatrix} -20 \\ 25 \end{bmatrix}$ is in the span.
- E. The vector $\begin{bmatrix} 4 \\ -4 \end{bmatrix}$ is in the span.
- F. The vector $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ is in the span.
- G. We cannot tell which vectors are in the span.

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10. (1 point) Evaluate the following matrix product.

$$\begin{bmatrix} -3 & -4 & 0 \\ -4 & -1 & 3 \\ -3 & 1 & -4 \end{bmatrix} \begin{bmatrix} -5 \\ 4 \\ -5 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$

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11. (1 point)
Find A, and $\mathbf{b}$ such that $A\mathbf{x} = \mathbf{b}$ corresponds to the given linear system.

$$5x_1 - 3x_2 - 1x_3 = -5$$

$$9x_1 + 7x_2 - 2x_3 = 8$$

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

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12. (1 point)
Find A and $\mathbf{b}$ such that $A\mathbf{x} = \mathbf{b}$ corresponds to the given linear system.

$$2x_1 - 1x_2 - 8x_3 = -8$$

$$1x_1 + 6x_2 + 8x_3 = 9$$

$$-3x_1 + 9x_2 + 4x_3 = -3$$

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$