me me **ft-uiowa-math2550**

Assignment Hw4fall14 due 09/18/2014 at 11:59pm CDT

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1. **(1 pt) local/Library/UI/LinearSystems/mformsHint.pg**

Determine the following equivalent representations of the following system of equations:

$$3x + 8y = -7$$

$$-8x + 7y = -38$$

a. Find the augmented matrix of the system.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

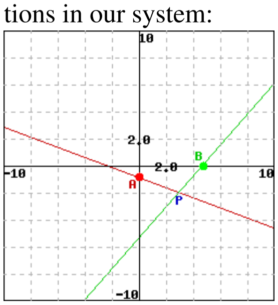
b. Find the matrix form of the system.

$$\begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

c. Find matrices that satisfy the following matrix equation.

$$x \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix} + y \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

d. The graph below shows the lines determined by the two equations in our system:



Find the coordinates of

P =(___,___)

Find the coordinates of y-intercept of the red line.

A =(0, ___)

Find the coordinates of x-intercept of the green line.

B =(___,0)

Hint: *(Instructor hint preview: show the student hint after 1 attempts. The current number of attempts is 0.)*

For part d, note that you are given the equations of the red and green lines. If a point lies on a line, it must satisfy the equation for that line.

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2. **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_10.pg**

Express the vector $v = \begin{bmatrix} 26 \\ 13 \end{bmatrix}$ as a linear combination of $x = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$ and $y = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$.

$v =$ ___ $x +$ ___ y.

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3. **(1 pt) local/Library/UI/LinearSystems/linearCombHW4.pg**

Let $A = \begin{bmatrix} 1 & -1 & -3 \\ 4 & -2 & -10 \\ -2 & 1 & 5 \end{bmatrix}$ and $b = \begin{bmatrix} -1 \\ -11 \\ 5 \end{bmatrix}$

[?] 1. Determine if b is a linear combination of a_1, a_2 and a_3, the columns of the matrix A.

If it is a linear combination, determine a non-trivial linear relation - (a non-trivial relation is three numbers which are not all three zero.) Otherwise, enter 0's for the coefficients.

____ $a_1 +$ ____ $a_2 +$ ____ $a_3 = b$.

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4. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/2.2.8.pg**

Let $\mathbf{a}_1 = \begin{bmatrix} -6 \\ -1 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} -24 \\ -4 \end{bmatrix}$.

Is $\mathbf{b}$ in the span of of $\mathbf{a}_1$?

- A. No, **b** is not in the span.
- B. Yes, **b** is 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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5. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.10.pg**

Let $\mathbf{a}_1 = \begin{bmatrix} -6 \\ 4 \\ 7 \end{bmatrix}$, $\mathbf{a}_2 = \begin{bmatrix} -7 \\ 2 \\ 9 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} -31 \\ 18 \\ 37 \end{bmatrix}$.

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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6. **(1 pt) local/Library/UI/LinearSystems/spanHW4.pg**

Let $A = \begin{bmatrix} 1 & -2 & 5 \\ 5 & -11 & 27 \\ 1 & -5 & 12 \end{bmatrix}$, and $b = \begin{bmatrix} -4 \\ 2 \\ -4 \end{bmatrix}$.

Denote the columns of A by a_1, a_2, a_3, and let $W = span\{a_1, a_2, a_3\}$.

[?] 1. Determine if b is in $\{a_1, a_2, a_3\}$

[?] 2. Determine if b is in W

How many vectors are in $\{a_1, a_2, a_3\}$? (For infinitely many, enter -1) _____

How many vectors are in W? (For infinitely many, enter -1) _____

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7. **(1 pt) Library/TCNJ/TCNJ_VectorEquations/problem4.pg**

Let $u = \begin{bmatrix} -1 \\ 5 \\ -3 \end{bmatrix}$ and $v = \begin{bmatrix} 1 \\ -7 \\ 4 \end{bmatrix}$

Find two vectors in $span\{u, v\}$ that are not multiples of u or v and show the weights on u and v used to generate them.

___ $u+$ ___ $v =$ _______

___ $u+$ ___ $v =$ _______

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8. **(1 pt) Library/TCNJ/TCNJ_VectorEquations/problem6.pg**

Let $\vec{u} = \begin{bmatrix} 5 \\ -1 \\ 1 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} -10 \\ 1 \\ 0 \end{bmatrix}$. Find a vector $\vec{w}$ **not** in span$\{\vec{u}, \vec{v}\}$.

$\vec{w} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

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9. **(1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem4.pg**

Let $A = \begin{bmatrix} -1 & 1 & 5 \\ -2 & 3 & 3 \\ -2 & -3 & 1 \end{bmatrix}$ and $x = \begin{bmatrix} 2 \\ -2 \\ 4 \end{bmatrix}$.

[?] 1. What does Ax mean?

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10. **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_8.pg**

Let $v_1 = \begin{bmatrix} 2 \\ 4 \\ -1 \end{bmatrix}$, $v_2 = \begin{bmatrix} -2 \\ -6 \\ -1 \end{bmatrix}$, and $y = \begin{bmatrix} 2 \\ 10 \\ h \end{bmatrix}$.

For what value of h is y in the plane spanned by v_1 and v_2?

$h =$ __________

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11. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.31.pg**

Let $A = \begin{bmatrix} 3 & 3 \\ 5 & 4 \\ -3 & 8 \end{bmatrix}$.

We want to determine if the system $A\mathbf{x} = \mathbf{b}$ has a solution for every $\mathbf{b} \in \mathbb{R}^3$.

Select the best answer.

- A. There is a solution for every $\mathbf{b} \in \mathbb{R}^3$ but we need to row reduce A to show this.
- B. There is a solution for every $\mathbf{b} \in \mathbb{R}^3$ since $2 < 3$
- C. There is a not solution for every $\mathbf{b} \in \mathbb{R}^3$ but we need to row reduce A to show this.
- D. There is not a solution for every $\mathbf{b} \in \mathbb{R}^3$ since $2 < 3$.
- E. We cannot tell if there is a solution for every $\mathbf{b} \in \mathbb{R}^3$.

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12. **(1 pt) Library/TCNJ/TCNJ_VectorEquations/problem5.pg**

Let $H = span\{u, v\}$. For each of the following sets of vectors determine whether H is a line or a plane.

[?] 1. $u = \begin{bmatrix} -8 \\ -3 \\ -1 \end{bmatrix}$, $v = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$,

[?] 2. $u = \begin{bmatrix} 4 \\ 4 \\ 4 \end{bmatrix}$, $v = \begin{bmatrix} -16 \\ -15 \\ -13 \end{bmatrix}$,

[?] 3. $u = \begin{bmatrix} 2 \\ -1 \\ -3 \end{bmatrix}$, $v = \begin{bmatrix} -8 \\ 4 \\ 12 \end{bmatrix}$,

[?] 4. $u = \begin{bmatrix} 5 \\ 1 \\ -2 \end{bmatrix}$, $v = \begin{bmatrix} 13 \\ 2 \\ -2 \end{bmatrix}$,

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13. **(1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem13.pg**

Do the following sets of vectors span $\mathbb{R}^3$?

[?] 1. $\begin{bmatrix} -1 \\ 2 \\ -2 \end{bmatrix}$, $\begin{bmatrix} -3 \\ 6 \\ -7 \end{bmatrix}$, $\begin{bmatrix} -7 \\ 14 \\ -16 \end{bmatrix}$, $\begin{bmatrix} -11 \\ 22 \\ -26 \end{bmatrix}$

[?] 2. $\begin{bmatrix} 3 \\ -2 \\ 3 \end{bmatrix}$, $\begin{bmatrix} -3 \\ 2 \\ -4 \end{bmatrix}$, $\begin{bmatrix} -3 \\ 2 \\ -5 \end{bmatrix}$

[?] 3. $\begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix}$, $\begin{bmatrix} -3 \\ -3 \\ 7 \end{bmatrix}$

[?] 4. $\begin{bmatrix} 1 \\ -3 \\ 3 \end{bmatrix}$, $\begin{bmatrix} -7 \\ 5 \\ 7 \end{bmatrix}$, $\begin{bmatrix} -12 \\ 7 \\ 17 \end{bmatrix}$

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14. **(1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem1.pg**

Show that the vectors

$$\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 4 \\ 1 \end{bmatrix}$$

do not span $\mathbb{R}^3$ by giving a vector not in their span.

$\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

If a linear system has four equations and seven variables, then it must have infinitely many solutions.

- A. True
- B. False

Every linear system with free variables has infinitely many solutions.

- A. True
- B. False

Any linear system with more variables than equations cannot have a unique solution.

- A. True
- B. False

If a linear system has the same number of equations and variables, then it must have a unique solution.

- A. True
- B. False

A vector b is a linear combination of the columns of a matrix A if and only if the equation $Ax = b$ has at least one solution.

- A. True
- B. False

If the columns of an $m \times n$ matrix, A span $\mathbb{R}^m$, then the equation, $Ax = b$ is consistent for each b in $\mathbb{R}^m$.

- A. True
- B. False

If A is an $m \times n$ matrix and if the equation $Ax = b$ is inconsistent for some b in $\mathbb{R}^m$, then A cannot have a pivot position in every row.

- A. True
- B. False

Any linear combination of vectors can always be written in the form Ax for a suitable matrix A and vector x.

- A. True
- B. False

If the equation $Ax = b$ is inconsistent, then b is not in the set spanned by the columns of A.

- A. True
- B. False

If A is an $m \times n$ matrix whose columns do not span $\mathbb{R}^m$, then the equation $Ax = b$ is inconsistent for some b in $\mathbb{R}^m$.

- A. True
- B. False

The equation $Ax = b$ is consistent if the augmented matrix $[\ A\ b\ ]$ has a pivot position in every row.

- A. True
- B. False

If the augmented matrix $[\ A\ b\ ]$ has a pivot position in every row, then the equation $Ax = b$ is inconsistent.

- A. True
- B. False

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16. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.56.pg**

What conditions on a matrix A insures that $A\mathbf{x} = \mathbf{b}$ has a solution for all $\mathbf{b}$ in $\mathbb{R}^n$?

Select the best statement. (The best condition should work with any positive integer n.)

- A. The equation will have a solution for all $\mathbf{b}$ in $\mathbb{R}^n$ as long as the columns of A do not include the zero column.
- B. The equation will have a solution for all $\mathbf{b}$ in $\mathbb{R}^n$ as long as the columns of A span $\mathbb{R}^n$.
- C. There is no easy test to determine if the equation will have a solution for all $\mathbf{b}$ in $\mathbb{R}^n$.
- D. The equation will have a solution for all $\mathbf{b}$ in $\mathbb{R}^n$ as long as no column of A is a scalar multiple of another column.

- E. none of the above

17. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.57.pg**

Assume $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3\}$ spans $\mathbb{R}^3$.
Select the best statement.

- A. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$ unless $\mathbf{u}_4$ is the zero vector.
- B. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ always spans $\mathbb{R}^3$.
- C. There is no easy way to determine if $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$.
- D. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ never spans $\mathbb{R}^3$.
- E. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$ unless $\mathbf{u}_4$ is a scalar multiple of another vector in the set.
- F. none of the above

18. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.58.pg**

Assume $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3\}$ does not span $\mathbb{R}^3$.
Select the best statement.

- A. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ may, but does not have to, span $\mathbb{R}^3$.
- B. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ never spans $\mathbb{R}^3$.
- C. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$ unless $\mathbf{u}_4$ is a scalar multiple of another vector in the set.
- D. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$ unless $\mathbf{u}_4$ is the zero vector.
- E. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ always spans $\mathbb{R}^3$.
- F. none of the above

19. **(1 pt) Library/TCNJ/TCNJ_SolutionSetsLinearSystems-/problem8.pg**

Suppose the solution set of a certain system of equations can be described as $x_1 = 4-6t$, $x_2 = 4+6t$, $x_3 = 4t-3$, $x_4 = -6-4t$, where t is a free variable. Use vectors to describe this solution set as a line in $\mathbb{R}^4$.

$$L(t) = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} + t \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}.$$

20. **(1 pt) Library/NAU/setLinearAlgebra/HomLinEq.pg**

Solve the equation

$$-6x-2y+9z=0$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = s\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} + t\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$

21. **(1 pt) local/Library/UI/LinearSystems/ur_la_1_19AxB.pg**

Solve the system

$$\begin{cases} 4x_1-3x_2+4x_3+4x_4 = 0 \\ -x_1+x_2+3x_3+3x_4 = 0 \\ 3x_1-2x_2+7x_3+7x_4 = 0 \\ 3x_1-3x_2-9x_3-9x_4 = 0 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} s + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} t.$$

Solve the system

$$\begin{cases} 4x_1-3x_2+4x_3+4x_4 = 3 \\ -x_1+x_2+3x_3+3x_4 = 4 \\ 3x_1-2x_2+7x_3+7x_4 = 7 \\ 3x_1-3x_2-9x_3-9x_4 = -12 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} s + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} t.$$

If the matrix A corresponds to the coefficient matrix for the above system of equations, then given any vector $\vec{b}$, the matrix equation $A\vec{x} = \vec{b}$ will always has an infinite number of solutions.

- A. True
- B. False

22. **(1 pt) local/Library/UI/LinearSystems/ur_la_1_20vv3.pg**

Solve the system

$$\begin{cases} x_1+4x_2+2x_3 \quad +2x_5-2x_6 = 0 \\ -x_4+4x_5-4x_6 = 0 \\ x_1+4x_2 \quad +6x_5-4x_6 = 0 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} s + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} t + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} u.$$

Solve the system

$$\begin{cases} x_1 + 4x_2 + 2x_3 \quad + 2x_5 - 2x_6 = 1 \\ \qquad\qquad - x_4 + 4x_5 - 4x_6 = 7 \\ x_1 + 4x_2 \qquad\quad + 6x_5 - 4x_6 = 5 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \end{bmatrix} + \begin{bmatrix} \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \end{bmatrix} s + \begin{bmatrix} \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \end{bmatrix} t + \begin{bmatrix} \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \end{bmatrix} u.$$

If the matrix A corresponds to the coefficient matrix for the above system of equations, then given any vector $\vec{b}$, the matrix equation $A\vec{x} = \vec{b}$ will always has an infinite number of solutions.

- A. True
- B. False