This print-out should have 9 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001　10.0 points

Determine a so that the vector

$$\mathbf{u} = \begin{bmatrix} 1 \\ 7 \end{bmatrix}$$

is a linear combination $\mathbf{u} = a\mathbf{v} + b\mathbf{w}$ of vectors

$$\mathbf{v} = \begin{bmatrix} 1 \\ -3 \end{bmatrix}, \qquad \mathbf{w} = \begin{bmatrix} -2 \\ 1 \end{bmatrix}.$$

1. $a = -1$

2. $a = 1$

3. $a = -3$

4. $a = -2$

5. $a = 3$

002　10.0 points

Given

$$\mathbf{v_1} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \quad \mathbf{v_2} = \begin{bmatrix} 2 \\ 4 \\ 2 \end{bmatrix}, \quad \mathbf{v_3} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix},$$

determine all values of λ for which

$$\mathbf{w} = \begin{bmatrix} -3 \\ 1 \\ \lambda \end{bmatrix}$$

is a vector in $\mathrm{Span}\{\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3}\}$?

1. $\lambda = -4$

2. $\lambda = -2$

3. $\lambda = 4, -2$

4. $\lambda = 4, -4$

5. $\lambda = 4$

6. $\lambda = -4, -2$

003　10.0 points

Under what conditions on b_1, b_2 does the equation

$$\begin{bmatrix} -3 & -2 \\ -12 & -8 \end{bmatrix} \mathbf{x} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

not have a solution in $\mathbb{R}^2$?

1. $-3b_2 + 2b_1 = 0$

2. $-3b_2 - 2b_1 = 0$

3. $b_2 - 4b_1 = 0$

4. $-3b_2 - 2b_1 \neq 0$

5. $b_2 - 4b_1 \neq 0$

6. $b_2 + 4b_1 \neq 0$

004　5.0 points

Any five vectors in $\mathbb{R}^6$ span $\mathbb{R}^6$.

True or False?

1. FALSE

2. TRUE

005　5.0 points

If the equation $A\mathbf{x} = \mathbf{b}$ is consistent, then $\mathbf{b}$ is in the set spanned by the columns of A.

True or False?

1. TRUE

2. FALSE

006　5.0 points

For an $m \times n$ matrix A the equation $A\mathbf{x} = \mathbf{b}$ is inconsistent for some $\mathbf{b}$ in R^m if A has a pivot position in every row.

True or False?

1. TRUE

2. FALSE

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007   10.0 points

Find the solution set of the following homogeneous system in parametric vector form.

$$4x_1 + 3x_2 - 2x_3 = 0$$
$$-x_1 + x_2 - 3x_3 = 0$$
$$-2x_1 - 2x_3 = 0$$

1.

$$\mathbf{x} = \begin{bmatrix} 2 \\ -6 \\ 7 \end{bmatrix}$$

2.

$$\mathbf{x} = s \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$$

3.

$$\mathbf{x} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

4.

$$\mathbf{x} = s \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$$

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008   10.0 points

Describe the solution set to the system $A\mathbf{x} = 0$ in parametric vector form, given that A is row equivalent to the matrix

$$\begin{bmatrix} 2 & -2 & 0 & 4 \\ 3 & -3 & -1 & 9 \\ -2 & 2 & -1 & -1 \end{bmatrix}$$

1.

$$\mathbf{x} = s \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 2 \\ -3 \\ 0 \end{bmatrix}$$

2.

$$\mathbf{x} = s \begin{bmatrix} 1 \\ -1 \\ 0 \\ 2 \end{bmatrix} + t \begin{bmatrix} 0 \\ 0 \\ 1 \\ -3 \end{bmatrix}$$

3.

$$\mathbf{x} = s \begin{bmatrix} 2 \\ 3 \\ -2 \end{bmatrix} + t \begin{bmatrix} 0 \\ -1 \\ -1 \end{bmatrix}$$

4.

$$\mathbf{x} = s \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} -2 \\ 0 \\ 3 \\ 1 \end{bmatrix}$$

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009   10.0 points

Describe the solution set to the system $A\mathbf{x} = 0$ in parametric vector form, given that A is row equivalent to the matrix

$$\begin{bmatrix} 1 & 2 & 3 & 0 & 3 & 4 \\ 0 & 0 & 1 & 0 & -2 & -5 \\ 0 & 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

1.

$$\mathbf{x} = r \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} + s \begin{bmatrix} 3 \\ 1 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 3 \\ -2 \\ 1 \\ 0 \end{bmatrix}$$

2.

$$\mathbf{x} = r \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + s \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 8 \\ 0 \\ -1 \\ 0 \\ -3 \\ 1 \end{bmatrix}$$

3.

$$\mathbf{x} = s \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 8 \\ 0 \\ -1 \\ 0 \\ -3 \\ 1 \end{bmatrix}$$

4.

$$\mathbf{x} = r \begin{bmatrix} 2 \\ 0 \\ 0 \\ 0 \end{bmatrix} + s \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 4 \\ -5 \\ 3 \\ 0 \end{bmatrix}$$