**1.** **(1 point)** `Library/Rochester/setLinearAlgebra1Systems/ur_la_1_22.pg`

The reduced row-echelon forms of the augmented matrices of four systems are given below. How many solutions does each system have?

(1) $\left[\begin{array}{cc|c} 1 & 0 & 3 \\ 0 & 1 & -13 \end{array}\right]$

- A. No solutions
- B. Unique solution
- C. Infinitely many solutions
- D. None of the above

(2) $\left[\begin{array}{ccc|c} 0 & 1 & 0 & -7 \\ 0 & 0 & 1 & 10 \end{array}\right]$

- A. No solutions
- B. Unique solution
- C. Infinitely many solutions
- D. None of the above

(3) $\left[\begin{array}{ccc|c} 1 & 0 & 17 & 0 \\ 0 & 1 & 16 & 0 \\ 0 & 0 & 0 & 1 \end{array}\right]$

- A. No solutions
- B. Infinitely many solutions
- C. Unique solution
- D. None of the above

(4) $\left[\begin{array}{ccc|c} 1 & 0 & 0 & 14 \\ 0 & 0 & 1 & -9 \end{array}\right]$

- A. Unique solution
- B. Infinitely many solutions
- C. No solutions
- D. None of the above

**2.** **(1 point)** `Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/2.3.13.pg`

Let $A = \begin{bmatrix} -5 & -25 \\ 4 & 19 \end{bmatrix}$.

We want to determine if the equation $A\mathbf{x} = \mathbf{0}$ has nontrivial solutions.
To do that we row reduce $A$.

To do this we add ___ times the first row to the second.
We conclude that

- A. The equation has no nontrivial solutions.
- B. The equation has nontrivial solutions.
- C. We cannot tell if the equation has nontrivial solutions or not.

**3.** **(1 point)** `Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/2.3.2.pg`

Let $\mathbf{u} = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$, and $\mathbf{v} = \begin{bmatrix} -2 \\ -2 \end{bmatrix}$.

We want to determine if $\{\mathbf{u}, \mathbf{v}\}$ is linearly independent. To do that we write the vectors as columns of a matrix $A$ and row reduce that matrix.

To check this we add ___ times the first row to the second.

We conclude that

- A. The set $\{\mathbf{u}, \mathbf{v}\}$ is linearly dependent.
- B. The set $\{\mathbf{u}, \mathbf{v}\}$ is linearly independent.
- C. We cannot tell if the set $\{\mathbf{u}, \mathbf{v}\}$ is linearly independent or not.

**4.** **(1 point)** `Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/2.3.5.pg`

Let $\mathbf{u} = \begin{bmatrix} 4 \\ -2 \\ 3 \end{bmatrix}$, $\mathbf{v} = \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}$, and $\mathbf{w} = \begin{bmatrix} -12 \\ -14 \\ -22 \end{bmatrix}$.

We want to determine if $\{\mathbf{u}, \mathbf{v}, \mathbf{w}\}$ is linearly independent. To do that we write the vectors as columns of a matrix $A$ and row reduce that matrix.

To check this we add ___ times the first row to the second.
We then add ___ times the first row to the third.
We then add ___ times the new second row to the new third row.
We conclude that

- A. The set $\{\mathbf{u}, \mathbf{v}, \mathbf{w}\}$ is linearly dependent.
- B. The set $\{\mathbf{u}, \mathbf{v}, \mathbf{w}\}$ is linearly independent.
- C. We cannot tell if the set $\{\mathbf{u}, \mathbf{v}, \mathbf{w}\}$ is linearly independent or not.

**5.** **(1 point)** `Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/2.1.27.pg`

Let $\mathbf{a}_1 = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$, $\mathbf{a}_2 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} 0 \\ -12 \end{bmatrix}$.

Is $\mathbf{b}$ a linear combination of $\mathbf{a}_1$ and $\mathbf{a}_2$?

- A. Yes $\mathbf{b}$ is a linear combination.
- B. $\mathbf{b}$ is not a linear combination.
- C. We cannot tell if $\mathbf{b}$ is a linear combination.

Either fill in the coefficients of the vector equation, or enter "NONE" if no solution is possible.

$\mathbf{b} =$ ___ $\mathbf{a}_1 +$ ___ $\mathbf{a}_2$

**6. (1 point)** `Library/Hope/Multi1/03-03-Linear-combinations/Lin_combi_08.pg`

If possible, write $2x-4-2x^2$ as a linear combination of $x-x^2, 2x-x^2$ and $2x-1-x^2$. Otherwise, enter *DNE* in all answer blanks.

$$2x-4-2x^2 = \_\_\_\ (x-x^2)+\_\_\_\ (2x-x^2)+\_\_\_\ (2x-1-x^2).$$

**7. (1 point)** `Library/Rochester/setLinearAlgebra11Eigenvalues/ur_la_11_17.pg`

The matrix
$$A = \begin{bmatrix} -7 & 2 \\ -2 & -11 \end{bmatrix}$$
has one eigenvalue of multiplicity 2. Find this eigenvalue and the dimension of its associated eigenspace.

The eigenvalue ____ has an associated eigenspace with dimension ____.

**8. (1 point)** `Library/TCNJ/TCNJ_SolutionSetsLinearSystems/problem1.pg`

Find a set of vectors $\{\vec{u},\vec{v}\}$ in $\mathbb{R}^4$ that spans the solution set of the equations
$$\left\{ \begin{array}{rcl} w-x-y-3z & = & 0, \\ 5w+2x+y-3z & = & 0. \end{array} \right.$$
$$\vec{u} = \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}, \vec{v} = \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}.$$
(The components of these vectors appear in alphabetical order: (w,x,y,z) ).

**9. (1 point)** `Library/TCNJ/TCNJ_BasesLinearlyIndependentSet/problem8.pg`

Let $W$ be the set: $\begin{bmatrix} -2 \\ 3 \\ 0 \end{bmatrix}, \begin{bmatrix} 6 \\ -1 \\ 5 \end{bmatrix}$.

Determine if $W$ is a basis for $\mathbb{R}^3$ and check the correct answer(s) below.

- A. $W$ is not a basis because it does not span $\mathbb{R}^3$.
- B. $W$ is not a basis because it is linearly dependent.
- C. $W$ is a basis.

**10. (1 point)** `Library/TCNJ/TCNJ_BasesLinearlyIndependentSet/problem6.pg`

Let $W$ be the set: $\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$.

Determine if $W$ is a basis for $\mathbb{R}^3$ and check the correct answer(s) below.

- A. $W$ is a basis.
- B. $W$ is not a basis because it does not span $\mathbb{R}^3$.
- C. $W$ is not a basis because it is linearly dependent.

**11. (1 point)** `Library/TCNJ/TCNJ_Diagonalization/problem3.pg`

Let $A = \begin{bmatrix} 9 & -2 \\ 6 & 2 \end{bmatrix}$.

Find two different diagonal matrices $D$ and the corresponding matrix $S$ such that $A = SDS^{-1}$.

$$D_1 = \begin{bmatrix} \_\_\_ & 0 \\ 0 & \_\_\_ \end{bmatrix} \quad S_1 = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}.$$
$$D_2 = \begin{bmatrix} \_\_\_ & 0 \\ 0 & \_\_\_ \end{bmatrix} \quad S_2 = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}.$$

**12. (1 point)** `Library/Hope/Multi1/05-04-Diagonalization/DiagR_02.pg`

Let
$$A = \begin{bmatrix} -5 & -4 \\ 8 & 7 \end{bmatrix}.$$
If possible, find an invertible matrix $P$ so that $D = P^{-1}AP$ is a diagonal matrix. If it is not possible, enter the identity matrix for $P$ and the matrix $A$ for $D$. You must enter a number in every answer blank for the answer evaluator to work properly.

$$P = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}.$$
$$D = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}.$$

Is $A$ diagonalizable over $\mathbb{R}$?
- choose
- diagonalizable
- not diagonalizable

Be sure you can explain why or why not.

**13. (1 point)** `Library/Rochester/setLinearAlgebra11Eigenvalues/ur_la_11_19.pg`

The matrix
$$A = \begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & 1 \\ 1 & -1 & -1 \end{bmatrix}$$
has two real eigenvalues, one of multiplicity 1 and one of multiplicity 2. Find the eigenvalues and a basis for each eigenspace.

The eigenvalue $\lambda_1$ is ____ and a basis for its associated eigenspace is $\left\{ \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix} \right\}$.

The eigenvalue $\lambda_2$ is ____ and a basis for its associated eigenspace is $\left\{ \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}, \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix} \right\}$.

**14.** **(1 point)** `Library/TCNJ/TCNJ_LinearIndependence/problem5.pg`

Let $A = \begin{bmatrix} 16 \\ 15 \\ 10 \end{bmatrix}$, $B = \begin{bmatrix} 4 \\ 3 \\ 1 \end{bmatrix}$, and $C = \begin{bmatrix} -4 \\ -4 \\ -3 \end{bmatrix}$
Are $A$,$B$ and $C$ linearly dependent, or are they linearly independent?

- Linearly independent
- Linearly dependent

If they are linearly dependent, determine a non-trivial linear relation. Otherwise, if the vectors are linearly independent, enter 0's for the coefficients, since that relationship **always** holds.
____ $A+$ ____ $B+$ ____ $C = 0$.

**15.** **(1 point)** `Library/WHFreeman/Holt_linear_algebra/Chaps_1-4/4.2.53.pg`
Indicate whether the following statement is true or false?

[?] 1. If $u_1, u_2, u_3$ is a basis for $R^3$, then span$u_1, u_2$ is a plane.

**16.** **(1 point)** `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. $u = \begin{bmatrix} 5 \\ -3 \\ -1 \end{bmatrix}$, $v = \begin{bmatrix} -13 \\ 6 \\ 0 \end{bmatrix}$,

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

[?] 3. $u = \begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$, $v = \begin{bmatrix} 6 \\ 2 \\ -4 \end{bmatrix}$,

[?] 4. $u = \begin{bmatrix} -1 \\ -2 \\ -8 \end{bmatrix}$, $v = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$,