**1.** **(1 pt) Library/Rochester/setLinearAlgebra4InverseMatrix-/ur_Ch2_1_4.pg**

Are the following matrices invertible? Enter "Y" or "N".
You must get all of the answers correct to receive credit.

___1. $\begin{bmatrix} -4 & 0 \\ 0 & 0 \end{bmatrix}$
___2. $\begin{bmatrix} 7 & 0 \\ 0 & -6 \end{bmatrix}$
___3. $\begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix}$
___4. $\begin{bmatrix} -2 & 4 \\ -4 & -5 \end{bmatrix}$

**2.** **(1 pt) Library/Rochester/setLinearAlgebra4InverseMatrix-/ur_la_4_2.pg**

The matrix $\begin{bmatrix} 2 & -6 \\ -5 & k \end{bmatrix}$ is invertible if and only if $k \neq$___.

**3.** **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_7.pg**

The vectors
$v = \begin{bmatrix} -4 \\ -9 \\ -5 \end{bmatrix}$, $u = \begin{bmatrix} -3 \\ -9 \\ -12+k \end{bmatrix}$, and $w = \begin{bmatrix} 3 \\ 11 \\ 8 \end{bmatrix}$.
are linearly independent if and only if $k \neq$ _____.

**4.** **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_10.pg**

Express the vector $v = \begin{bmatrix} 14 \\ -26 \end{bmatrix}$ as a linear combination of $x = \begin{bmatrix} 4 \\ -5 \end{bmatrix}$ and $y = \begin{bmatrix} -5 \\ 2 \end{bmatrix}$.
$v =$ ___ $x+$ ___ $y$.

**5.** **(1 pt) Library/TCNJ/TCNJ_BasesLinearlyIndependentSet-/problem5.pg**

Let $W_1$ be the set: $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$.

Determine if $W_1$ is a basis for $\mathbb{R}^3$ and check the correct answer(s) below.

- A. $W_1$ is not a basis because it does not span $\mathbb{R}^3$.
- B. $W_1$ is a basis.
- C. $W_1$ is not a basis because it is linearly dependent.

Let $W_2$ 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 $W_2$ is a basis for $\mathbb{R}^3$ and check the correct answer(s) below.

- A. $W_2$ is not a basis because it is linearly dependent.
- B. $W_2$ is not a basis because it does not span $\mathbb{R}^3$.
- C. $W_2$ is a basis.

**6.** **(1 pt) Library/TCNJ/TCNJ_LinearIndependence/problem3.pg**

If $k$ is a real number, then the vectors $(1,k),(k,k+56)$ are linearly independent precisely when
$k \neq a,b$,
where $a =$_____, $b =$ _____, and $a < b$.

**7.** **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem1.pg**

Determine whether the following system has no solution, an infinite number of solutions or a unique solution.

? 1. $\begin{aligned} 7x - 7y &= 7 \\ 2x - 7y &= 2 \\ -11x + 21y &= -11 \end{aligned}$

? 2. $\begin{aligned} 7x - 7y &= 7 \\ 2x - 7y &= 2 \\ -11x + 21y &= -13 \end{aligned}$

? 3. $\begin{aligned} 16x + 12y &= -4 \\ 12x + 9y &= -3 \\ -28x - 21y &= 7 \end{aligned}$

**8.** **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem2.pg**

Determine whether the following system has no solution, an infinite number of solutions or a unique solution.

? 1. $\begin{aligned} -10x + 15y + 20z &= 0 \\ -8x + 12y + 16z &= 0 \end{aligned}$

? 2. $\begin{aligned} 5x + 8y - 7z &= 8 \\ -3x + 9y - 2z &= 9 \end{aligned}$

? 3. $\begin{aligned} -10x + 15y + 20z &= 0 \\ -8x + 12y + 16z &= 3 \end{aligned}$

**9.** **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem3.pg**

Give a geometric description of the following systems of equations

? 1. $$\begin{array}{rcrcr} -20x & + & 25y & = & -5 \\ -8x & + & 10y & = & -2 \\ 24x & - & 30y & = & 6 \end{array}$$

? 2. $$\begin{array}{rcrcr} 3x & - & 5y & = & 7 \\ 6x & + & 3y & = & 3 \\ -3x & - & 21y & = & 16 \end{array}$$

? 3. $$\begin{array}{rcrcr} 3x & - & 5y & = & 7 \\ 6x & + & 3y & = & 3 \\ -3x & - & 21y & = & 15 \end{array}$$

**10.** **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem4.pg**

Give a geometric description of the following system of equations

? 1. $$\begin{array}{rcrcrcr} 2x & + & 4y & - & 6z & = & 12 \\ -x & + & 5y & - & 9z & = & 1 \end{array}$$

? 2. $$\begin{array}{rcrcrcr} 2x & + & 4y & - & 6z & = & 12 \\ -3x & - & 6y & + & 9z & = & 16 \end{array}$$

? 3. $$\begin{array}{rcrcrcr} 2x & + & 4y & - & 6z & = & -12 \\ -3x & - & 6y & + & 9z & = & 18 \end{array}$$

**11.** **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem11.pg**

Give a geometric description of the following systems of equations.

? 1. $$\begin{array}{rcrcr} -6x & - & 6y & = & 0 \\ 15x & + & 15y & = & 1 \end{array}$$

? 2. $$\begin{array}{rcrcr} -6x & - & 6y & = & 0 \\ 15x & + & 15y & = & 0 \end{array}$$

? 3. $$\begin{array}{rcrcr} -3x & + & 9y & = & 3 \\ 4x & - & 6y & = & -5 \end{array}$$

**12.** **(1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem4.pg**

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

? 1. What does $Ax$ mean?

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

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

? 1. $\begin{bmatrix} 3 \\ -1 \\ 1 \end{bmatrix}, \begin{bmatrix} -7 \\ 5 \\ 5 \end{bmatrix}, \begin{bmatrix} -19 \\ 12 \\ 8 \end{bmatrix}$

? 2. $\begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}, \begin{bmatrix} 4 \\ 6 \\ -1 \end{bmatrix}, \begin{bmatrix} 6 \\ 9 \\ -2 \end{bmatrix}, \begin{bmatrix} 14 \\ 21 \\ -3 \end{bmatrix}$

? 3. $\begin{bmatrix} -1 \\ -3 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 6 \\ -3 \end{bmatrix}$

? 4. $\begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}, \begin{bmatrix} -3 \\ 6 \\ 4 \end{bmatrix}$

**14.** **(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. $u = \begin{bmatrix} -1 \\ -3 \\ -2 \end{bmatrix}, v = \begin{bmatrix} 2 \\ 8 \\ 6 \end{bmatrix}$,

? 2. $u = \begin{bmatrix} -4 \\ -5 \\ 5 \end{bmatrix}, v = \begin{bmatrix} 15 \\ 20 \\ -22 \end{bmatrix}$,

? 3. $u = \begin{bmatrix} 4 \\ 2 \\ -2 \end{bmatrix}, v = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$,

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

**15.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.8.pg**

Let $\mathbf{a}_1 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 3 \\ 6 \end{bmatrix}$.

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

- A. Yes, $\mathbf{b}$ is in the span.
- B. No, $\mathbf{b}$ is not in the span.
- C. We cannot tell if $\mathbf{b}$ is in the span.

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

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

**16.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.31.pg**

Let $A = \begin{bmatrix} 3 & 6 \\ -4 & 17 \\ -7 & 5 \end{bmatrix}$.

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

**17.** **(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 no column of $A$ is a scalar multiple of another column.
- B. 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.
- 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 the columns of $A$ span $\mathbb{R}^n$.
- E. none of the above

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

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

**20.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.3.40.pg**

Let $\mathbf{S}$ be a set of $m$ vectors in $\mathbb{R}^n$ with $m > n$.

Select the best statement.

- A. The set $\mathbf{S}$ is linearly independent.
- B. The set $\mathbf{S}$ is linearly independent, as long as it does not include the zero vector.
- C. The set $\mathbf{S}$ is linearly dependent.
- D. The set $\mathbf{S}$ could be either linearly dependent or linearly independent, depending on the case.
- E. The set $\mathbf{S}$ is linearly independent, as long as no vector in $\mathbf{S}$ is a scalar multiple of another vector in the set.
- F. none of the above

**21.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.3.41.pg**

Let $A$ be a matrix with more rows than columns.

Select the best statement.

- A. The columns of $A$ must be linearly dependent.
- B. The columns of $A$ are linearly independent, as long as no column is a scalar multiple of another column in $A$
- C. The columns of $A$ are linearly independent, as long as they does not include the zero vector.
- D. The columns of $A$ could be either linearly dependent or linearly independent depending on the case.
- E. The columns of $A$ must be linearly independent.
- F. none of the above

**22.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.3.42.pg**

Let $A$ be a matrix with more columns than rows.

Select the best statement.

- A. The columns of $A$ are linearly independent, as long as they does not include the zero vector.
- B. The columns of $A$ are linearly independent, as long as no column is a scalar multiple of another column in $A$
- C. The columns of $A$ could be either linearly dependent or linearly independent depending on the case.
- D. The columns of $A$ must be linearly dependent.
- E. none of the above

**23.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.3.46.pg**

Let $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ be a linearly dependent set of vectors.

Select the best statement.

- A. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is a linearly independent set of vectors unless $\mathbf{u}_4$ is a linear combination of other vectors in the set.

- B. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ could be a linearly independent or linearly dependent set of vectors depending on the vectors chosen.
- C. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is always a linearly independent set of vectors.
- D. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is always a linearly dependent set of vectors.
- E. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is a linearly independent set of vectors unless $\mathbf{u}_4 = \mathbf{0}$.
- F. none of the above

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**24.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.3.47.pg**

Let $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ be a linearly independent set of vectors. Select the best statement.

- A. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ could be a linearly independent or linearly dependent set of vectors depending on the vectors chosen.
- B. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is never a linearly independent set of vectors.
- C. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is always a linearly independent set of vectors.
- D. none of the above

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**25.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/3.3.42.pg**

$A$ must be a square matrix to be invertible. [?]

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**26.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.22.pg**

Find the null space for $A = \begin{bmatrix} 1 & 2 \\ 3 & 8 \end{bmatrix}$.

What is null$(A)$?

- A. span$\left\{ \begin{bmatrix} 1 \\ 3 \end{bmatrix} \right\}$
- B. span$\left\{ \begin{bmatrix} -2 \\ 1 \end{bmatrix} \right\}$
- C. $\mathbb{R}^2$
- D. $\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 1 \\ 2 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} -3 \\ 1 \end{bmatrix} \right\}$
- G. span$\left\{ \begin{bmatrix} 3 \\ 1 \end{bmatrix} \right\}$
- H. none of the above

.

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**27.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.27.pg**

Find the null space for $A = \begin{bmatrix} 3 & -4 \\ 2 & 2 \\ 1 & -7 \end{bmatrix}$.

What is null$(A)$?

- A. $\mathbb{R}^2$
- B. span$\left\{ \begin{bmatrix} 3 \\ -4 \end{bmatrix} \right\}$
- C. span$\left\{ \begin{bmatrix} +4 \\ 3 \end{bmatrix} \right\}$
- D. $\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix} \right\}$
- F. $\mathbb{R}^3$
- G. span$\left\{ \begin{bmatrix} -4 \\ 3 \end{bmatrix} \right\}$
- H. span$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$
- I. none of the above

.

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**28.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.28.pg**

Find the null space for $A = \begin{bmatrix} 1 & -2 \\ 4 & -8 \\ -7 & 14 \end{bmatrix}$.

What is null$(A)$?

- A. span$\left\{ \begin{bmatrix} 1 \\ 4 \\ -7 \end{bmatrix} \right\}$
- B. $\mathbb{R}^2$
- C. span$\left\{ \begin{bmatrix} +2 \\ 1 \end{bmatrix} \right\}$
- D. span$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} 14 \\ -7 \end{bmatrix} \right\}$
- G. $\mathbb{R}^3$
- H. none of the above

.

**29.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.30.pg**

Find the null space for $A = \begin{bmatrix} 3 & -1 & 3 \\ -6 & -3 & -21 \\ 2 & 2 & 10 \end{bmatrix}$.

What is null($A$)?

- A. span$\left\{ \begin{bmatrix} 3 \\ -1 \\ 3 \end{bmatrix}, \begin{bmatrix} -6 \\ -3 \\ -21 \end{bmatrix} \right\}$
- B. $\mathbb{R}^3$
- C. span$\left\{ \begin{bmatrix} 3 \\ -1 \\ 3 \end{bmatrix} \right\}$
- D. span$\left\{ \begin{bmatrix} -2 \\ -3 \\ 1 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 3 \\ -6 \\ 2 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$
- G. none of the above

.

**30.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.3.47.pg**

Indicate whether the following statement is true or false.

? 1. If $A$ and $B$ are equivalent matrices, then col($A$) = col($B$).

**31.** **(1 pt) Library/maCalcDB/setLinearAlgebra3Matrices/ur_la_3_6.pg**

If $A$ and $B$ are $3 \times 6$ matrices, and $C$ is a $7 \times 3$ matrix, which of the following are defined?

- A. $BC$
- B. $BA^T$
- C. $C^T$
- D. $CA$
- E. $B+A$
- F. $A+C$

**32.** **(1 pt) Library/maCalcDB/setLinearAlgebra4InverseMatrix-/ur_la_4_8.pg**

Determine which of the formulas hold for all invertible $n \times n$ matrices $A$ and $B$

- A. $A+B$ is invertible
- B. $(AB)^{-1} = A^{-1}B^{-1}$
- C. $AB = BA$
- D. $(A+B)^2 = A^2 + B^2 + 2AB$
- E. $A^6$ is invertible
- F. $(I_n + A)(I_n + A^{-1}) = 2I_n + A + A^{-1}$

**33.** **(1 pt) UI/Fall14/lin_span2.pg**

Which of the following sets of vectors span $R^3$?

- A. $\begin{bmatrix} -3 \\ -8 \\ -4 \end{bmatrix}, \begin{bmatrix} 0 \\ 5 \\ -6 \end{bmatrix}, \begin{bmatrix} 7 \\ 2 \\ 9 \end{bmatrix}$
- B. $\begin{bmatrix} -1 \\ -8 \end{bmatrix}, \begin{bmatrix} -7 \\ 1 \end{bmatrix}$
- C. $\begin{bmatrix} -5 \\ 4 \\ 8 \end{bmatrix}, \begin{bmatrix} 7 \\ 5 \\ -9 \end{bmatrix}, \begin{bmatrix} -12 \\ -1 \\ 17 \end{bmatrix}$
- D. $\begin{bmatrix} 8 \\ -4 \end{bmatrix}, \begin{bmatrix} 4 \\ -2 \end{bmatrix}$
- E. $\begin{bmatrix} 8 \\ 7 \end{bmatrix}, \begin{bmatrix} 5 \\ -9 \end{bmatrix}, \begin{bmatrix} -4 \\ 2 \end{bmatrix}$
- F. $\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} -5 \\ 9 \end{bmatrix}$

Which of the following sets of vectors are linearly independent?

- A. $\begin{bmatrix} -3 \\ -8 \\ -4 \end{bmatrix}, \begin{bmatrix} 0 \\ 5 \\ -6 \end{bmatrix}, \begin{bmatrix} 7 \\ 2 \\ 9 \end{bmatrix}$
- B. $\begin{bmatrix} -1 \\ -8 \end{bmatrix}, \begin{bmatrix} -7 \\ 1 \end{bmatrix}$
- C. $\begin{bmatrix} -5 \\ 4 \\ 8 \end{bmatrix}, \begin{bmatrix} 7 \\ 5 \\ -9 \end{bmatrix}, \begin{bmatrix} -12 \\ -1 \\ 17 \end{bmatrix}$
- D. $\begin{bmatrix} 8 \\ -4 \end{bmatrix}, \begin{bmatrix} 4 \\ -2 \end{bmatrix}$
- E. $\begin{bmatrix} 8 \\ 7 \end{bmatrix}, \begin{bmatrix} 5 \\ -9 \end{bmatrix}, \begin{bmatrix} -4 \\ 2 \end{bmatrix}$
- F. $\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} -5 \\ 9 \end{bmatrix}$

**34.** **(1 pt) UI/Fall14/lin_span.pg**

Let $A = \begin{bmatrix} 14 \\ 3 \\ 32 \end{bmatrix}$, $B = \begin{bmatrix} -2 \\ 1 \\ -6 \end{bmatrix}$, and $C = \begin{bmatrix} -2 \\ -1 \\ -4 \end{bmatrix}$.

Which of the following best describes the span of the above 3 vectors?

- A. 0-dimensional point in $R^3$
- B. 1-dimensional line in $R^3$
- C. 2-dimensional plane in $R^3$
- D. $R^3$

Determine whether or not the three vectors listed above are linearly independent or linearly dependent.

- A. linearly dependent
- B. linearly independent

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.
____$A+$ ____$B+$ ____$C = 0$.

**35.** **(1 pt) local/Library/Rochester/setLinearAlgebra3Matrices-/ur_la_3_14.pg**
Find the ranks of the following matrices.

$$rank\begin{bmatrix} 0 & 6 & 0 & 0 \\ 0 & 0 & -5 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix} = \_\_\_$$

$$rank\begin{bmatrix} 5 & -7 \\ 10 & -14 \end{bmatrix} = \_\_\_$$

$$rank\begin{bmatrix} 7 & 1 & -7 \\ 0 & -7 & 0 \\ -5 & 0 & 5 \end{bmatrix} = \_\_\_$$

**36.** **(1 pt) local/Library/TCNJ/TCNJ_BasesLinearlyIndependentSet-/3.pg**
Check the true statements below:

- A. If $B$ is an echelon form of a matrix $A$, then the pivot columns of $B$ form a basis for $ColA$.
- B. A basis is a spanning set that is as large as possible.
- C. The column space of a matrix $A$ is the set of solutions of $Ax = b$.
- D. The columns of an invertible $n \times n$ matrix form a basis for $\mathbb{R}^n$.
- E. If $H = Span\{b_1, ..., b_p\}$, then $\{b_1, ..., b_p\}$ is a basis for $H$.

**37.** **(1 pt) local/Library/TCNJ/TCNJ_LinearSystems/problem6.pg**
Give a geometric description of the following systems of equations

? 1.
$$\begin{array}{rcrcrcr} -5x & - & 15y & - & 36z & = & 7 \\ 5x & + & 14y & + & 33z & = & 3 \\ 5x & + & 15y & + & 35z & = & 6 \end{array}$$

? 2.
$$\begin{array}{rcrcrcr} 3x & + & 5y & + & 3z & = & -5 \\ -x & + & 2y & + & 4z & = & 2 \\ -11x & - & 33y & - & 31z & = & 17 \end{array}$$

? 3.
$$\begin{array}{rcrcrcr} 3x & + & 5y & + & 3z & = & -5 \\ -x & + & 2y & + & 4z & = & 2 \\ -11x & - & 33y & - & 31z & = & 20 \end{array}$$

? 4.
$$\begin{array}{rcrcrcr} -3x & + & 3y & - & 6z & = & 3 \\ 4x & - & 4y & + & 8z & = & -4 \\ 6x & - & 6y & + & 12z & = & -6 \end{array}$$

**Hint:** *(Instructor hint preview: show the student hint after 1 attempts. The current number of attempts is 0. )*
Reduce the augmented matrix and solve for it. If it has unique solutions, three planes intersect at a point; no solutions indicates no common intersection; one free variable shows intersection on a line; two free variables means identical planes.

**38.** **(1 pt) local/Library/UI/2.3.49.pg**

Let $\mathbf{u}_4$ be a linear combination of $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$.
Select the best statement.

- A. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is always a linearly independent set of vectors.
- B. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is never a linearly dependent set of vectors.
- C. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ is never a linearly independent set of vectors.
- D. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ could be a linearly dependent or linearly independent set of vectors depending on the vectors chosen.
- E. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is a linearly dependent set of vectors.
- F. $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is a linearly dependent set of vectors unless one of $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ is the zero vector.
- G. none of the above

**39.** **(1 pt) local/Library/UI/4.1.23.pg**

Find the null space for $A = \begin{bmatrix} 1 & 0 & -6 \\ 0 & 1 & 3 \end{bmatrix}$.
What is null$(A)$?

- A. $\mathbb{R}^3$
- B. span$\left\{ \begin{bmatrix} 1 \\ 0 \\ +6 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ -3 \end{bmatrix} \right\}$
- C. span$\left\{ \begin{bmatrix} -3 \\ +6 \end{bmatrix} \right\}$
- D. $\mathbb{R}^2$
- E. span$\left\{ \begin{bmatrix} +6 \\ -3 \\ 1 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} +6 \\ -3 \end{bmatrix} \right\}$
- G. span$\left\{ \begin{bmatrix} -3 \\ +6 \\ 1 \end{bmatrix} \right\}$
- H. none of the above

.

**40.** **(1 pt) local/Library/UI/Fall14/HW7_4.pg**

Determine if the subset of $\mathbb{R}^2$ consisting of vectors of the form $\begin{bmatrix} a \\ b \end{bmatrix}$, where $a$ and $b$ are integers, is a subspace.
Select true or false for each statement.
The set contains the zero vector

- A. True
- B. False

This set is closed under vector addition

- A. True
- B. False

This set is closed under scalar multiplications

- A. True
- B. False

This set is a subspace

- A. True
- B. False

---

**41.** **(1 pt) local/Library/UI/Fall14/HW7_5.pg**

Determine if the subset of $\mathbb{R}^3$ consisting of vectors of the form $\begin{bmatrix} a \\ b \\ c \end{bmatrix}$, where $a \geq 0$, $b \geq 0$, and $c \geq 0$ is a subspace.
Select true or false for each statement.
The set contains the zero vector

- A. True
- B. False

This set is closed under vector addition

- A. True
- B. False

This set is closed under scalar multiplications

- A. True
- B. False

This set is a subspace

- A. True
- B. False

---

**42.** **(1 pt) local/Library/UI/Fall14/HW7_6.pg**

If $A$ is an $n \times n$ matrix and $\mathbf{b} \neq 0$ in $\mathbb{R}^n$, then consider the set of solutions to $A\mathbf{x} = \mathbf{b}$.
Select true or false for each statement.
The set contains the zero vector

- A. True
- B. False

This set is closed under vector addition

- A. True
- B. False

This set is closed under scalar multiplications

- A. True
- B. False

This set is a subspace

- A. True
- B. False

---

**43.** **(1 pt) local/Library/UI/Fall14/HW7_11.pg**
Find all values of $x$ for which rank$(A) = 2$.

$$A = \begin{bmatrix} 2 & 2 & 0 & 5 \\ 4 & 7 & x & 19 \\ -6 & -9 & -3 & -24 \end{bmatrix}$$

$x =$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

**44.** **(1 pt) local/Library/UI/Fall14/HW7_12.pg**
Suppose that $A$ is a $5 \times 6$ matrix which has a null space of dimension 6. The rank of $A$=

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

**45.** **(1 pt) local/Library/UI/Fall14/HW7_25.pg**
Indicate whether the following statement is true or false?
If $S = \text{span} u_1, u_2, u_3$, then $dim(S) = 3$ .

- A. True
- B. False

---

**46.** **(1 pt) local/Library/UI/Fall14/HW7_27.pg**
Determine the rank and nullity of the matrix.

$$\begin{bmatrix} 2 & -1 & 0 & 1 \\ 5 & 2 & 1 & -4 \\ -1 & -4 & -1 & 6 \\ -8 & -5 & -2 & 9 \end{bmatrix}$$

The rank of the matrix is

- A. -4
- B. -3
- C. -2
- D. -1

- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

The nullity of the matrix is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

**47.** **(1 pt) local/Library/UI/Fall14/HW8_2.pg**
Evaluate the following $3 \times 3$ determinant. Use the properties of determinants to your advantage.

$$\begin{vmatrix} -8 & 0 & -4 \\ -1 & 0 & 10 \\ -4 & 0 & 3 \end{vmatrix}$$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Does the matrix have an inverse?

- A. No
- B. Yes

---

**48.** **(1 pt) local/Library/UI/Fall14/HW8_3.pg**

Given the matrix $\begin{bmatrix} -4 & 0 & 1 \\ 0 & -2 & 3 \\ 3 & 0 & 0 \end{bmatrix}$
(a) find its determinant

- A. 6
- B. -5
- C. -4
- D. -2
- E. -1
- F. 0
- G. 1
- H. 3
- I. 5
- J. 7
- K. None of those above

(b) Does the matrix have an inverse?

- A. No
- B. Yes

---

**49.** **(1 pt) local/Library/UI/Fall14/HW8_4.pg**
If $A$ and $B$ are $4 \times 4$ matrices, $\det(A) = 1$, $\det(B) = 2$, then $\det(AB) =$

- A. -15
- B. 2
- C. -11
- D. -8
- E. -5
- F. 0
- G. 3
- H. 6
- I. 8
- J. 12
- K. None of those above

$\det(-3A) =$

- A. -40
- B. 81
- C. -28
- D. -21
- E. -10
- F. -1
- G. 10
- H. 21
- I. 28
- J. 36
- K. 40
- L. None of those above

$\det(A^T) =$

- A. -3
- B. -2
- C. -1
- D. 0

- E. 1
- F. 2
- G. 3
- H. 4
- I. None of those above

$\det(B^{-1}) =$

- A. -0.4
- B. -0.5
- C. 0
- D. 0.4
- E. 0.5
- F. 1
- G. None of those above

$\det(B^4) =$

- A. -81
- B. -36
- C. -12
- D. 0
- E. 12
- F. 36
- G. 81
- H. 16
- I. 1024
- J. None of those above

---

**50.** **(1 pt) local/Library/UI/Fall14/HW8_5.pg**

Find the determinant of the matrix

$$A = \begin{bmatrix} -6 & 0 & 0 & 0 \\ -1 & 2 & 0 & 0 \\ -8 & 1 & 3 & 0 \\ -6 & -3 & 1 & 3 \end{bmatrix}.$$

$\det(A) =$

- A. -400
- B. -360
- C. -288
- D. -120
- E. 0
- F. 120
- G. -108
- H. 240
- I. 360
- J. 400
- K. None of those above

---

**51.** **(1 pt) local/Library/UI/Fall14/HW8_7.pg**

Suppose that a $4 \times 4$ matrix $A$ with rows $v_1$, $v_2$, $v_3$, and $v_4$ has determinant $\det A = -4$. Find the following determinants:

$B = \begin{bmatrix} v_1 \\ 9v_2 \\ v_3 \\ v_4 \end{bmatrix}$ $\det(B) =$

- A. -18
- B. -15
- C. -12
- D. -36
- E. -9
- F. 0
- G. 9
- H. 12
- I. 15
- J. 18
- K. None of those above

$C = \begin{bmatrix} v_2 \\ v_1 \\ v_4 \\ v_3 \end{bmatrix}$ $\det(C) =$

- A. -18
- B. -4
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

$D = \begin{bmatrix} v_1 + 3v_3 \\ v_2 \\ v_3 \\ v_4 \end{bmatrix}$

$\det(D) =$

- A. -18
- B. -4
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

**52.** **(1 pt) local/Library/UI/Fall14/HW8_8.pg**

Use determinants to determine whether each of the following sets of vectors is linearly dependent or independent.

$\begin{bmatrix} -9 \\ 6 \end{bmatrix}, \begin{bmatrix} 4 \\ -5 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} 1 \\ 5 \\ 1 \end{bmatrix}, \begin{bmatrix} -3 \\ -18 \\ -1 \end{bmatrix}, \begin{bmatrix} 7 \\ 44 \\ -1 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} -5 \\ -10 \end{bmatrix}, \begin{bmatrix} 3 \\ 6 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} 2 \\ 4 \\ 4 \end{bmatrix}, \begin{bmatrix} -4 \\ -8 \\ -8 \end{bmatrix}, \begin{bmatrix} 10 \\ 20 \\ 20 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

**53.** **(1 pt) local/Library/UI/Fall14/HW8_10.pg**

$$A = \begin{bmatrix} -8 & 6 & 0 & 3 \\ -4 & -2 & 0 & 0 \\ 0 & -7 & 0 & 0 \\ 8 & -2 & -4 & 8 \end{bmatrix}$$

The determinant of the matrix is

- A. -1890
- B. -1024
- C. -630
- D. 336
- E. -210
- F. 0
- G. 324
- H. 630
- I. 1024
- J. None of those above

**Hint:** Find a good row or column and expand by minors.

**54.** **(1 pt) local/Library/UI/Fall14/HW8_11.pg**

Find the determinant of the matrix

$$M = \begin{bmatrix} -3 & 0 & 0 & -2 & 0 \\ -3 & 0 & 3 & 0 & 0 \\ 0 & -3 & 0 & 0 & -2 \\ 0 & 0 & 0 & -3 & 2 \\ 0 & -2 & -2 & 0 & 0 \end{bmatrix}.$$

$\det(M) =$

- A. -48
- B. -35
- C. -20
- D. 180
- E. -5
- F. 5
- G. 18
- H. 20
- I. 81
- J. None of those above

**55.** **(1 pt) local/Library/UI/Fall14/HW8_12.pg**

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \end{bmatrix}$$

And now for the grand finale: The determinant of the matrix is

- A. -362880
- B. -5
- C. 0
- D. 5
- E. 20
- F. 30
- G. 40
- H. 362880
- I. None of the above

**Hint:** Remember that a square linear system has a unique solution if the determinant of the coefficient matrix is non-zero.

A system of equations can have exactly 2 solution.

- A. True
- B. False

---

A system of linear equations can have exactly 2 solution.

- A. True
- B. False

---

A system of linear equations has no solution if and only if the last column of its augmented matrix corresponds to a pivot column.

- A. True
- B. False

---

A system of linear equations has an infinite number of solutions if and only if its associated augmented matrix has a column corresponding to a free variable.

- A. True
- B. False

---

If a system of linear equations has an infinite number of solutions, then its associated augmented matrix has a column corresponding to a free variable.

- A. True
- B. False

---

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

---

Every linear system with free variables has infinitely many solutions.

- A. True
- B. False

---

**72.** **(1 pt) local/Library/UI/Fall14/quiz2_2.pg**

Find the area of the triangle with vertices $(1,-2)$, $(8,-5)$, and $(3,2)$.
Area =

- A. 2
- B. 5
- C. 6
- D. 8
- E. 9
- F. 12
- G. 17
- H. 20
- I. 25
- J. None of those above

Hint: The area of a triangle is half the area of a parallelogram. Find the vectors that determine the parallelogram of interest. If you have difficulty, visualizing the problem may be helpful: plot the 3 points.

---

**73.** **(1 pt) local/Library/UI/Fall14/quiz2_6.pg**

Determine if $v$ is an eigenvector of the matrix $A$.

1. $A = \begin{bmatrix} 8 & -4 & 15 \\ -7 & 5 & -15 \\ -6 & 4 & -13 \end{bmatrix}, v = \begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$

- A. Yes
- B. No

2. $A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & -2 & 0 \\ 5 & -1 & -1 \end{bmatrix}, v = \begin{bmatrix} 6 \\ 6 \\ -1 \end{bmatrix}$

- A. Yes
- B. No

3. $A = \begin{bmatrix} -8 & -4 & -1 \\ 13 & 3 & -5 \\ -10 & -4 & 1 \end{bmatrix}, v = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$

- A. Yes
- B. No

4. $A = \begin{bmatrix} 6 & 5 & -16 \\ 6 & 5 & -16 \\ 3 & 5 & -13 \end{bmatrix}, v = \begin{bmatrix} 7 \\ 9 \\ 1 \end{bmatrix}$

- A. Yes
- B. No

---

**74.** **(1 pt) local/Library/UI/Fall14/quiz2_7.pg**

Given that $v_1 = \begin{bmatrix} -3 \\ -1 \end{bmatrix}$ and $v_2 = \begin{bmatrix} 8 \\ 3 \end{bmatrix}$ are eigenvectors of the matrix $A = \begin{bmatrix} 62 & -168 \\ 21 & -57 \end{bmatrix}$, determine the corresponding eigenvalues.

a. $\lambda_1 =$

- A. -6
- B. -5
- C. -4
- D. -3
- E. -2
- F. -1
- G. 6
- H. 0
- I. 1
- J. 2
- K. None of those above

b. $\lambda_2 =$

- A. -5
- B. -4
- C. -3
- D. -2
- E. 0
- F. -1
- G. 1
- H. 2
- I. 3
- J. None of those above

---

**75.** **(1 pt) local/Library/UI/Fall14/volume1.pg**

Find the volume of the parallelepiped determined by vectors $\begin{bmatrix} 4 \\ 0 \\ 1 \end{bmatrix}$, $\begin{bmatrix} 0 \\ -4 \\ 0 \end{bmatrix}$, and $\begin{bmatrix} -2 \\ -2 \\ -5 \end{bmatrix}$

- A. 72
- B. -5
- C. -4
- D. -2
- E. -1
- F. 0
- G. 1
- H. 3
- I. 5
- J. 7
- K. None of those above

---

Suppose a 3 x 5 augmented matrix contains a pivot in every row. Then the corresponding system of equations has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution, or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Given the following augmented matrix,

$$A = \begin{bmatrix} 2 & 0 & 3 & -2 & 4 \\ 0 & -5 & 4 & -6 & 4 \\ 0 & 0 & 0 & 0 & 5 \end{bmatrix},$$

the corresponding system of equations has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Given the following augmented matrix,

$$A = \begin{bmatrix} -1 & -3 & 3 & -3 & 7 \\ 0 & -3 & 3 & 3 & 2 \\ 0 & 0 & 0 & -2 & -8 \end{bmatrix},$$

the corresponding system of equations has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose an augmented matrix contains a pivot in the last column. Then the corresponding system of equations has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose a coefficient matrix $A$ contains a pivot in the last column. Then $A\vec{x} = \vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose a coefficient matrix $A$ contains a pivot in every row. Then $A\vec{x} = \vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

Suppose a coefficient matrix $A$ contains a pivot in every column. Then $A\vec{x}=\vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A\vec{x}=\vec{0}$ has an infinite number of solutions, then given a vector $\vec{b}$ of the appropriate dimension, $A\vec{x}=\vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A\vec{x}=\vec{b}$ has an infinite number of solutions, then $A\vec{x}=\vec{0}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A\vec{x}=\vec{0}$ has a unique solution, then given a vector $\vec{b}$ of the appropriate dimension, $A\vec{x}=\vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A\vec{x}=\vec{b}$ has a unique solution, then $A\vec{x}=\vec{0}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A\vec{x}=\vec{b}$ has no solution, then $A\vec{x}=\vec{0}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A$ is a square matrix and $A\vec{x}=\vec{0}$ has a unique solution, then given a vector $\vec{b}$ of the appropriate dimension, $A\vec{x}=\vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions
- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

Suppose $A$ is a square matrix and $A\vec{x}=\vec{0}$ has an infinite number of solutions, then given a vector $\vec{b}$ of the appropriate dimension, $A\vec{x}=\vec{b}$ has

- A. No solution
- B. Unique solution
- C. Infinitely many solutions
- D. at most one solution
- E. either no solution or an infinite number of solutions
- F. either a unique solution or an infinite number of solutions

- G. no solution, a unique solution or an infinite number of solutions, depending on the system of equations
- H. none of the above

---

**90.** **(1 pt) local/Library/UI/LinearSystems/spanHW4.pg**

Let $A = \begin{bmatrix} -5 & 5 & 0 \\ 5 & -7 & 4 \\ -3 & 5 & -3 \end{bmatrix}$, and $b = \begin{bmatrix} -2 \\ 2 \\ -3 \end{bmatrix}$.

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) ____

---

**91.** **(1 pt) local/Library/UI/MatrixAlgebra/Euclidean/2.3.43.pg**

Let $A$ be a matrix with linearly independent columns.
Select the best statement.

- A. The equation $A\mathbf{x} = \mathbf{0}$ has nontrivial solutions precisely when it has more rows than columns.
- B. The equation $A\mathbf{x} = \mathbf{0}$ has nontrivial solutions precisely when it has more columns than rows.
- C. The equation $A\mathbf{x} = \mathbf{0}$ has nontrivial solutions precisely when it is a square matrix.
- D. The equation $A\mathbf{x} = \mathbf{0}$ always has nontrivial solutions.
- E. There is insufficient information to determine if such an equation has nontrivial solutions.
- F. The equation $A\mathbf{x} = \mathbf{0}$ never has nontrivial solutions.
- G. none of the above

---

**92.** **(1 pt) local/Library/UI/MatrixAlgebra/Euclidean/2.3.44.pg**

Let $A$ be a matrix with linearly independent columns.
Select the best statement.

- A. The equation $A\mathbf{x} = \mathbf{b}$ has a solution for all $\mathbf{b}$ precisely when it has more rows than columns.
- B. The equation $A\mathbf{x} = \mathbf{b}$ has a solution for all $\mathbf{b}$ precisely when it has more columns than rows.
- C. There is insufficient information to determine if $A\mathbf{x} = \mathbf{b}$ has a solution for all $\mathbf{b}$.
- D. The equation $A\mathbf{x} = \mathbf{b}$ has a solution for all $\mathbf{b}$ precisely when it is a square matrix.
- E. The equation $A\mathbf{x} = \mathbf{b}$ never has a solution for all $\mathbf{b}$.
- F. The equation $A\mathbf{x} = \mathbf{b}$ always has a solution for all $\mathbf{b}$.
- G. none of the above

---

**93.** **(1 pt) local/Library/UI/problem7.pg**

$A$ and $B$ are $n \times n$ matrices.

Adding a multiple of one row to another does not affect the determinant of a matrix.

- A. True
- B. False

If the columns of $A$ are linearly dependent, then $detA = 0$.

- A. True
- B. False

$det(A+B) = detA + detB$.

- A. True
- B. False

---

Suppose $A$ is a 8 × 6 matrix. If rank of $A$ = 2, then nullity of $A$ =

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

The vector $\vec{b}$ is NOT in $ColA$ if and only if $A\vec{v} = \vec{b}$ does NOT have a solution

- A. True
- B. False

---

The vector $\vec{b}$ is in $ColA$ if and only if $A\vec{v} = \vec{b}$ has a solution

- A. True
- B. False

The vector $\vec{v}$ is in $NulA$ if and only if $A\vec{v} = \vec{0}$

- A. True
- B. False

If the equation $A\vec{x} = \vec{b_1}$ has at least one solution and if the equation $A\vec{x} = \vec{b_2}$ has at least one solution, then the equation $A\vec{x} = 8\vec{b_1} - 7\vec{b_2}$ also has at least one solution.

- A. True
- B. False

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
Is $colA$ a subspace? Is $colA$ closed under linear combinations?

If $\vec{x_1}$ and $\vec{x_2}$ are solutions to $A\vec{x} = \vec{0}$, then $-5\vec{x_1} - 8\vec{x_2}$ is also a solution to $A\vec{x} = \vec{0}$.

- A. True
- B. False

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
Is $NulA$ a subspace? Is $NulA$ closed under linear combinations?

If $\vec{x_1}$ and $\vec{x_2}$ are solutions to $A\vec{x} = \vec{b}$, then $-1\vec{x_1} + 1\vec{x_2}$ is also a solution to $A\vec{x} = \vec{b}$.

- A. True
- B. False

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
Is the solution set to $A\vec{x} = \vec{b}$ a subspace even when $\vec{b}$ is not $\vec{0}$? Is the solution set to $A\vec{x} = \vec{b}$ closed under linear combinations even when $\vec{b}$ is not $\vec{0}$?

Find the area of the parallelogram determined by the vectors $\begin{bmatrix} 2.375 \\ 4 \end{bmatrix}$ and $\begin{bmatrix} 5 \\ 8 \end{bmatrix}$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. 5

Suppose $A$ is a $8 \times 4$ matrix. Then $nul\ A$ is a subspace of $R^k$ where $k =$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Suppose $A$ is a $3 \times 7$ matrix. Then $col\ A$ is a subspace of $R^k$ where $k =$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Calculate the determinant of $\begin{bmatrix} 10.3333333333333 & 7 \\ 5 & 3 \end{bmatrix}$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. 5

Suppose $A \begin{bmatrix} -5 \\ -3 \\ -4 \end{bmatrix} = \begin{bmatrix} 20 \\ 12 \\ 16 \end{bmatrix}$. Then an eigenvalue of $A$ is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2

- H. 3
- I. 4
- J. none of the above

---

**106.** **(1 pt) local/Library/UI/volumn2.pg**
$A$ and $B$ are $n \times n$ matrices.

Check the true statements below:

- A. If $A$ is $3x3$, with columns $a_1$, $a_2$, $a_3$, then $detA$ equals the volume of the parallelpiped determined by the vectors $a_1$, $a_2$, $a_3$.
- B. If $A$ is $3x3$, with columns $a_1$, $a_2$, $a_3$, then the absolute value of $detA$ equals the volume of the parallelpiped determined by the vectors $a_1$, $a_2$, $a_3$.
- C. $detA^T = (-1)detA$.

---

**107.** **(1 pt) UI/DIAGtfproblem1.pg**
$A$, $P$ and $D$ are $n \times n$ matrices.

Check the true statements below:

- A. $A$ is diagonalizable if $A$ has $n$ distinct linearly independent eigenvectors.
- B. If $AP = PD$, with $D$ diagonal, then the nonzero columns of $P$ must be eigenvectors of $A$.
- C. $A$ is diagonalizable if $A = PDP^{-1}$ for some diagonal matrix $D$ and some invertible matrix $P$.
- D. $A$ is diagonalizable if and only if $A$ has $n$ eigenvalues, counting multiplicities.
- E. If there exists a basis for $\mathbb{R}^n$ consisting entirely of eigenvectors of $A$, then $A$ is diagonalizable.
- F. $A$ is diagonalizable if $A$ has $n$ distinct eigenvectors.
- G. If $A$ is diagonalizable, then $A$ has $n$ distinct eigenvalues.
- H. If $A$ is symmetric, then $A$ is orthogonally diagonalizable.
- I. If $A$ is orthogonally diagonalizable, then $A$ is symmetric.
- J. If $A$ is diagonalizable, then $A$ is invertible.
- K. If $A$ is symmetric, then $A$ is diagonalizable.
- L. If $A$ is invertible, then $A$ is diagonalizable.
- M. If $A$ is diagonalizable, then $A$ is symmetric.

---

**108.** **(1 pt) UI/orthog.pg**
All vectors and subspaces are in $\mathbb{R}^n$.

Check the true statements below:

- A. If $A\mathbf{v} = r\mathbf{v}$ and $A\mathbf{w} = s\mathbf{w}$ and $r \neq s$, then $\mathbf{v} \cdot \mathbf{w} = 0$ .
- B. If $W = Span\{x_1, x_2, x_3\}$ and if $\{v_1, v_2, v_3\}$ is an orthonormal set in $W$, then $\{v_1, v_2, v_3\}$ is an orthonormal basis for $W$.
- C. In a $QR$ factorization, say $A = QR$ (when $A$ has linearly independent columns), the columns of $Q$ form an orthonormal basis for the column space of $A$.
- D. If $x$ is not in a subspace $W$, then $x - \text{proj}_W(x)$ is not zero.
- E. If $\{v_1, v_2, v_3\}$ is an orthonormal set, then the set $\{v_1, v_2, v_3\}$ is linearly independent.
- F. If $\mathbf{v}$ and $\mathbf{w}$ are both eigenvectors of $A$ and if $A$ is symmetric, then $\mathbf{v} \cdot \mathbf{w} = 0$ .
- G. If $A$ is symmetric, $A\mathbf{v} = r\mathbf{v}$, $A\mathbf{w} = s\mathbf{w}$ and $r \neq s$, then $\mathbf{v} \cdot \mathbf{w} = 0$ .

---

**109.** **(1 pt) local/Library/UI/eigenTF.pg**
$A$ is $n \times n$ an matrices.

Check the true statements below:

- A. The vector $\mathbf{0}$ can never be an eigenvector of $A$
- B. 0 can never be an eigenvalue of $A$.
- C. The eigenspace corresponding to a particular eigenvalue of $A$ contains an infinite number of vectors.
- D. 0 is an eigenvalue of $A$ if and only if the columns of $A$ are linearly dependent.
- E. $A$ will have at most $n$ eigenvectors.
- F. The vector $\mathbf{0}$ is an eigenvector of $A$ if and only if $Ax = 0$ has a nonzero solution
- G. There are an infinite number of eigenvectors that correspond to a particular eigenvalue of $A$.
- H. 0 is an eigenvalue of $A$ if and only if det($A$) = 0
- I. $A$ will have at most $n$ eigenvalues.
- J. 0 is an eigenvalue of $A$ if and only if $Ax = 0$ has a nonzero solution
- K. The vector $\mathbf{0}$ is an eigenvector of $A$ if and only if the columns of $A$ are linearly dependent.
- L. The vector $\mathbf{0}$ is an eigenvector of $A$ if and only if det($A$) = 0
- M. 0 is an eigenvalue of $A$ if and only if $Ax = 0$ has an infinite number of solutions

---

Suppose $A = PDP^{-1}$ where $D$ is a diagonal matrix. If $P = [\ \vec{p}_1\ \vec{p}_2\ \vec{p}_3\ ]$, then $2\vec{p}_1$ is an eigenvector of $A$

- A. True
- B. False

---

Suppose $A = PDP^{-1}$ where $D$ is a diagonal matrix. If $P = [\ \vec{p}_1\ \vec{p}_2\ \vec{p}_3\ ]$, then $\vec{p}_1 + \vec{p}_2$ is an eigenvector of $A$

- A. True
- B. False

Suppose $A = PDP^{-1}$ where $D$ is a diagonal matrix. Suppose also the $d_{ii}$ are the diagonal entries of D. If $P = [\ \vec{p}_1\ \vec{p}_2\ \vec{p}_3\ ]$ and $d_{11} = d_{22}$, then $\vec{p}_1 + \vec{p}_2$ is an eigenvector of $A$

- A. True
- B. False

---

Suppose $A = PDP^{-1}$ where $D$ is a diagonal matrix. Suppose also the $d_{ii}$ are the diagonal entries of D. If $P = [\ \vec{p}_1\ \vec{p}_2\ \vec{p}_3\ ]$ and $d_{22} = d_{33}$, then $\vec{p}_1 + \vec{p}_2$ is an eigenvector of $A$

- A. True
- B. False

---

If $\vec{v}_1$ and $\vec{v}_2$ are eigenvectors of $A$ corresponding to eigenvalue $\lambda_0$, then $1\vec{v}_1 + 9\vec{v}_2$ is also an eigenvector of $A$ corresponding to eigenvalue $\lambda_0$ when $1\vec{v}_1 + 9\vec{v}_2$ is not $\vec{0}$ .

- A. True
- B. False

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
Is an eigenspace a subspace? Is an eigenspace closed under linear combinations?
Also, is $1\vec{v}_1 + 9\vec{v}_2$ nonzero?

---

Which of the following is an eigenvalue of $\begin{bmatrix} -8 & -20 \\ 1 & 4 \end{bmatrix}$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

Let $A = \begin{bmatrix} 9 & -1 & 1 \\ 0 & -8 & -4 \\ 0 & 0 & 9 \end{bmatrix}$. Is $A$ = diagonalizable?

- A. yes
- B. no
- C. none of the above

---

Let $A = \begin{bmatrix} -6 & -25 & 40 \\ 0 & -1 & -8 \\ 0 & 0 & -6 \end{bmatrix}$. Is $A$ = diagonalizable?

- A. yes
- B. no
- C. none of the above

---

Let $A = \begin{bmatrix} 1 & 9 \\ 8 & -8 \end{bmatrix}$. Is $A$ = diagonalizable?

- A. yes
- B. no
- C. none of the above

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
You do NOT need to do much work for this problem. You just need to know if the matrix $A$ is diagonalizable. Since $A$ is a 2 x 2 matrix, you need 2 linearly independent eigenvectors of $A$ to form $P$. Does $A$ have 2 linearly independent eigenvectors? Note you don't need to know what these eigenvectors are. You don't even need to know the eigenvalues.

---

Let $A = \begin{bmatrix} -0.416666666666667 & -9.66666666666667 & 5.4166666 \\ -2.04166666666667 & -6.16666666666667 & -3.2916666 \\ -0.583333333333333 & -2.33333333333333 & -7.7 \end{bmatrix}$
and let $P = \begin{bmatrix} -8 & 3 & -4 \\ 2 & 7 & 3 \\ 0 & 7 & 8 \end{bmatrix}$.

Suppose $A = PDP^{-1}$. Then if $d_{ii}$ are the diagonal entries of $D$, $d_{11} =$,

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. 5

**Hint:** *(Instructor hint preview: show the student hint after 0 attempts. The current number of attempts is 0. )*
Use definition of eigenvalue since you know an eigenvector corresponding to eigenvalue $d_{11}$.

---

Calculate the dot product: $\begin{bmatrix} -5 \\ -1 \\ -3 \end{bmatrix} \cdot \begin{bmatrix} -1 \\ -4 \\ 2.66666666666667 \end{bmatrix}$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

Determine the length of $\begin{bmatrix} 2 \\ 3.46410161513775 \end{bmatrix}$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. 5

---

If the characteristic polynomial of $A = (\lambda-6)^5(\lambda-8)(\lambda+9)^8$, then the algebraic multiplicity of $\lambda = 8$ is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

If the characteristic polynomial of $A = (\lambda-7)^7(\lambda-3)(\lambda+8)^3$, then the geometric multiplicity of $\lambda = 3$ is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

If the characteristic polynomial of $A = (\lambda+2)^5(\lambda+5)^2(\lambda-6)^5$, then the algebraic multiplicity of $\lambda = -5$ is

- A. 0
- B. 1
- C. 2
- D. 3
- E. 0 or 1
- F. 0 or 2
- G. 1 or 2
- H. 0, 1, or 2
- I. 0, 1, 2, or 3
- J. none of the above

---

If the characteristic polynomial of $A = (\lambda+1)^8(\lambda+4)^2(\lambda+2)^8$, then the geometric multiplicity of $\lambda = -4$ is

- A. 0
- B. 1
- C. 2
- D. 3
- E. 0 or 1
- F. 0 or 2
- G. 1 or 2
- H. 0, 1, or 2
- I. 0, 1, 2, or 3
- J. none of the above

---

Suppose the orthogonal projection of $\begin{bmatrix} -224 \\ -1 \\ -3 \end{bmatrix}$ onto $\begin{bmatrix} 1 \\ -5 \\ -5 \end{bmatrix}$ is $(z_1, z_2, z_3)$. Then $z_1 =$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Suppose $\begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix}$ is a unit vector in the direction of $\begin{bmatrix} -4 \\ 4 \\ 3.52766841475279 \end{bmatrix}$. Then $u_1 =$

- A. -0.8
- B. -0.6
- C. -0.4
- D. -0.2
- E. 0
- F. 0.2
- G. 0.4
- H. 0.6
- I. 0.8
- J. 1

---

**128.** **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_2.pg**

Find the eigenvalues of the matrix

$$M = \begin{bmatrix} 30 & 50 \\ 50 & 30 \end{bmatrix}.$$

Enter the two eigenvalues, separated by a comma:

____________

Classify the quadratic form $Q(x) = x^T Ax$ :

- A. $Q(x)$ is positive semidefinite
- B. $Q(x)$ is indefinite
- C. $Q(x)$ is positive definite
- D. $Q(x)$ is negative semidefinite
- E. $Q(x)$ is negative definite

---

**129.** **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_3.pg**

The matrix

$$A = \begin{bmatrix} -6 & 0 & 0 \\ 0 & -1.4 & -0.8 \\ 0 & -0.8 & -2.6 \end{bmatrix}$$

has three distinct eigenvalues, $\lambda_1 < \lambda_2 < \lambda_3$,

$\lambda_1 =$___,

$\lambda_2 =$___,

$\lambda_3 =$___.

Classify the quadratic form $Q(x) = x^T Ax$ :

- A. $Q(x)$ is positive semidefinite
- B. $Q(x)$ is negative semidefinite
- C. $Q(x)$ is negative definite
- D. $Q(x)$ is indefinite
- E. $Q(x)$ is positive definite

---

Use Cramer's rule to solve the following system of equations for $x$:

$$-22x + 6y = 8$$
$$-4x + 1y = 0$$

.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

---

**131.** **(1 pt) local/Library/UI/Fall14/quiz2_9.pg**

Supppose $A$ is an invertible $n \times n$ matrix and $v$ is an eigenvector of $A$ with associated eigenvalue 6. Convince yourself that $v$ is an eigenvector of the following matrices, and find the associated eigenvalues:

1. $A^5$, eigenvalue =

- A. 16
- B. 81
- C. 125
- D. 216
- E. 1024
- F. 7776
- G. 2000
- H. None of those above

2. $A^{-1}$, eigenvalue =

- A. -0.5
- B. -0.333
- C. 0.166666666666667
- D. -0.125
- E. 0
- F. 0.125
- G. 0.333
- H. 0.5
- I. None of those above

3. $A + 6I_n$, eigenvalue =

- A. -8
- B. -4
- C. -5
- D. 0
- E. 2

- F. 4
- G. 12
- H. 10
- I. None of those above

4. $9A$, eigenvalue =

- A. -40
- B. -36
- C. -28
- D. 54
- E. -12
- F. 0
- G. 24
- H. 36
- I. None of those above

---

**132. (1 pt) local/Library/UI/Fall14/quiz2_10.pg**

If $v_1 = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$ and $v_2 = \begin{bmatrix} -1 \\ -5 \end{bmatrix}$ are eigenvectors of a matrix $A$ corresponding to the eigenvalues $\lambda_1 = 1$ and $\lambda_2 = -2$, respectively, then

a. $A(v_1 + v_2) =$

- A. $\begin{bmatrix} -3 \\ 5 \end{bmatrix}$
- B. $\begin{bmatrix} -2 \\ 4 \end{bmatrix}$
- C. $\begin{bmatrix} -6 \\ 5 \end{bmatrix}$
- D. $\begin{bmatrix} 10 \\ 6 \end{bmatrix}$
- E. $\begin{bmatrix} 12 \\ 4 \end{bmatrix}$
- F. $\begin{bmatrix} 0 \\ 12 \end{bmatrix}$
- G. None of those above

b. $A(-3v_1) =$

- A. $\begin{bmatrix} -12 \\ -12 \end{bmatrix}$
- B. $\begin{bmatrix} -2 \\ 8 \end{bmatrix}$
- C. $\begin{bmatrix} -6 \\ 4 \end{bmatrix}$
- D. $\begin{bmatrix} 10 \\ 6 \end{bmatrix}$
- E. $\begin{bmatrix} 6 \\ -6 \end{bmatrix}$
- F. $\begin{bmatrix} 12 \\ 4 \end{bmatrix}$
- G. $\begin{bmatrix} 0 \\ 12 \end{bmatrix}$
- H. None of those above

---

**133. (1 pt) local/Library/UI/Fall14/quiz2_11.pg**

Let $v_1 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$, $v_2 = \begin{bmatrix} 3 \\ -1 \\ 0 \end{bmatrix}$, and $v_3 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$ be eigenvectors of the matrix $A$ which correspond to the eigenvalues $\lambda_1 = -3$, $\lambda_2 = 1$, and $\lambda_3 = 2$, respectively, and let $v = \begin{bmatrix} -5 \\ -1 \\ 0 \end{bmatrix}$.

Express $v$ as a linear combination of $v_1$, $v_2$, and $v_3$, and find $Av$.

1. If $v = c_1v_1 + c_2v_2 + c_3v_3$, then $(c_1, c_2, c_3)$=

- A. (1,2,2)
- B. (-3,2,4)
- C. (-4,7,3)
- D. (-2,-1,-2)
- E. (0,1,2)
- F. (4,-1,5)
- G. None of above

2. $Av =$

- A. $\begin{bmatrix} -12 \\ 7 \\ -12 \end{bmatrix}$
- B. $\begin{bmatrix} -2 \\ 12 \\ 8 \end{bmatrix}$
- C. $\begin{bmatrix} -6 \\ 7 \\ 4 \end{bmatrix}$
- D. $\begin{bmatrix} 10 \\ 0 \\ 6 \end{bmatrix}$
- E. $\begin{bmatrix} -7 \\ 7 \\ 10 \end{bmatrix}$
- F. $\begin{bmatrix} 12 \\ 8 \\ 4 \end{bmatrix}$
- G. $\begin{bmatrix} -7 \\ -3 \\ 12 \end{bmatrix}$
- H. None of those above

Suppose $u$ and $v$ are eigenvectors of $A$ with eigenvalue 1 and $w$ is an eigenvector of $A$ with eigenvalue 2. Determine which of the following are eigenvectors of $A$ and their corresponding eigenvalues.

(a.) If $4v$ an eigenvector of $A$, determine its eigenvalue. Else state it is not an eigenvector of $A$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. $4v$ need not be an eigenvector of $A$

(b.) If $2u + 3v$ an eigenvector of $A$, determine its eigenvalue. Else state it is not an eigenvector of $A$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. $2u + 3v$ need not be an eigenvector of $A$

(c.) If $2u + 3w$ an eigenvector of $A$, determine its eigenvalue. Else state it is not an eigenvector of $A$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. $2u + 3w$ need not be an eigenvector of $A$