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1. **(1 pt) Library/ASU-topics/set119MatrixAlgebra/p13.pg**
Consider the following two systems.
(a)

$$\begin{cases} x+4y &= 3 \\ -3x-9y &= -3 \end{cases}$$

(b)

$$\begin{cases} x+4y &= -2 \\ -3x-9y &= 4 \end{cases}$$

(i) Find the inverse of the (common) coefficient matrix of the two systems.

$$A^{-1} = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix}$$

(ii) Find the solutions to the two systems by using the inverse, i.e. by evaluating $A^{-1}B$ where B represents the right hand side (i.e. $B = \begin{bmatrix} 3 \\ -3 \end{bmatrix}$ for system (a) and $B = \begin{bmatrix} -2 \\ 4 \end{bmatrix}$ for system (b)).
Solution to system (a): $x =$ _____ , $y =$_____
Solution to system (b): $x =$ _____ , $y =$_____

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2. **(1 pt) Library/NAU/setLinearAlgebra/m1.pg**
Find the inverse of AB if
$A^{-1} = \begin{bmatrix} 4 & 4 \\ -5 & 3 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 3 & -2 \\ -2 & 5 \end{bmatrix}$.

$$(AB)^{-1} = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix}$$

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3. **(1 pt) Library/Rochester/setAlgebra34Matrices/cubing_2x2.pg**
Given the matrix $A = \begin{bmatrix} 3 & 3 \\ 0 & 3 \end{bmatrix}$, find A^3.

$$A^3 = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix}.$$

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4. **(1 pt) Library/Rochester/setAlgebra34Matrices/scalarmult3.pg**
If $A = \begin{bmatrix} -1 & 1 & 0 \\ -3 & 4 & 1 \\ 3 & -2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 4 & -4 \\ -3 & 2 & -4 \\ -1 & 2 & -4 \end{bmatrix}$, then

$$3A-4B = \begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$ and

$$A^T = \begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}.$$

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5. **(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. $\begin{bmatrix} 6 & -2 \\ 3 & -6 \end{bmatrix}$
___2. $\begin{bmatrix} 32 & -3 \\ 0 & 0 \end{bmatrix}$
___3. $\begin{bmatrix} -8 & -3 \\ 32 & 12 \end{bmatrix}$
___4. $\begin{bmatrix} -2 & -8 \\ -6 & -4 \end{bmatrix}$

---

6. **(1 pt) Library/Rochester/setLinearAlgebra4InverseMatrix-/ur_la_4_2.pg**
The matrix $\begin{bmatrix} 4 & -6 \\ 9 & k \end{bmatrix}$ is invertible if and only if $k \neq$___.

---

7. **(1 pt) Library/Rochester/setLinearAlgebra4InverseMatrix-/ur_la_4_11.pg**
If $A = \begin{bmatrix} 5e^{3t}\sin(9t) & 5e^{4t}\cos(9t) \\ 4e^{3t}\cos(9t) & -4e^{4t}\sin(9t) \end{bmatrix}$
then $A^{-1} = \begin{bmatrix} \_\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_ \\ \_\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_ \end{bmatrix}$.

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8. **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_7.pg**

The vectors
$v = \begin{bmatrix} -2 \\ -4 \\ -4 \end{bmatrix}$, $u = \begin{bmatrix} 4 \\ 0 \\ -18+k \end{bmatrix}$, and $w = \begin{bmatrix} 4 \\ 2 \\ -4 \end{bmatrix}$.
are linearly independent if and only if $k \neq$ _____.

---

9. **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_10.pg**
Express the vector $v = \begin{bmatrix} 22 \\ 16 \end{bmatrix}$ as a linear combination of $x = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$ and $y = \begin{bmatrix} 3 \\ 6 \end{bmatrix}$.
$v =$ ___ $x+$ ___ y.

---

10. **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_2.pg**
Find the eigenvalues of the matrix

$$M = \begin{bmatrix} 30 & -40 \\ -40 & -30 \end{bmatrix}.$$

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

11. **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_3.pg**

The matrix

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

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

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

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

13. **(1 pt) Library/TCNJ/TCNJ_LinearIndependence/problem3.pg**

If k is a real number, then the vectors $(1,k),(k,3k+40)$ are linearly independent precisely when
$k \neq a,b$,
where $a =$___, $b =$ ___, and $a < b$.

14. **(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. $\begin{array}{rrcr} -5x & -3y & = & 9 \\ 6x & +2y & = & 6 \\ 7x & +1y & = & 18 \end{array}$

? 2. $\begin{array}{rrcr} -5x & -3y & = & 9 \\ 6x & +2y & = & 6 \\ 7x & +1y & = & 21 \end{array}$

? 3. $\begin{array}{rrcr} 8x & -16y & = & -8 \\ -6x & +12y & = & 6 \\ 14x & -28y & = & -14 \end{array}$

15. **(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. $\begin{array}{rcrcrcr} 30x & + & 18y & - & 24z & = & 18 \\ 10x & + & 6y & - & 8z & = & 8 \end{array}$

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

? 3. $\begin{array}{rcrcrcr} 30x & + & 18y & - & 24z & = & 18 \\ 10x & + & 6y & - & 8z & = & 6 \end{array}$

16. **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem3.pg**

Give a geometric description of the following systems of equations

? 1. $\begin{array}{rcrcr} -7x & - & 3y & = & 3 \\ -2x & - & 3y & = & 5 \\ -3x & + & 3y & = & -8 \end{array}$

? 2. $\begin{array}{rcrcr} -20x & - & 8y & = & -8 \\ -15x & - & 6y & = & -6 \\ 35x & + & 14y & = & 14 \end{array}$

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

17. **(1 pt) Library/TCNJ/TCNJ_LinearSystems/problem4.pg**

Give a geometric description of the following system of equations

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

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

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

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18. (1 pt) Library/TCNJ/TCNJ_LinearSystems/problem11.pg

Give a geometric description of the following systems of equations.

? 1. $\begin{array}{rcrcr} x & - & 9y & = & -2 \\ -6x & - & 6y & = & 3 \end{array}$

? 2. $\begin{array}{rcrcr} 2x & - & 10y & = & -10 \\ 5x & - & 25y & = & -25 \end{array}$

? 3. $\begin{array}{rcrcr} 2x & - & 10y & = & -10 \\ 5x & - & 25y & = & -28 \end{array}$

---

19. (1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem4.pg

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

? 1. What does Ax mean?

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20. (1 pt) Library/TCNJ/TCNJ_MatrixEquations/problem13.pg

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

? 1. $\begin{bmatrix} -2 \\ -3 \\ -3 \end{bmatrix}, \begin{bmatrix} -6 \\ -9 \\ -8 \end{bmatrix}, \begin{bmatrix} -10 \\ -15 \\ -13 \end{bmatrix}, \begin{bmatrix} 14 \\ 21 \\ 18 \end{bmatrix}$

? 2. $\begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}, \begin{bmatrix} -4 \\ -6 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$

? 3. $\begin{bmatrix} -2 \\ 3 \\ 3 \end{bmatrix}, \begin{bmatrix} 5 \\ -5 \\ 7 \end{bmatrix}, \begin{bmatrix} -4 \\ 2 \\ -10 \end{bmatrix}$

? 4. $\begin{bmatrix} -3 \\ 3 \\ -2 \end{bmatrix}, \begin{bmatrix} -9 \\ 9 \\ -7 \end{bmatrix}$

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21. (1 pt) Library/TCNJ/TCNJ_MatrixInverse/problem1.pg

If

$$A = \begin{bmatrix} -5 & -6 \\ -3 & 1 \end{bmatrix},$$

then

$A^{-1} = \begin{bmatrix} \_\_\_\_ & \_\_ \\ \_\_\_\_ & \_\_ \end{bmatrix}$.

Given $\vec{b} = \begin{bmatrix} -1 \\ -1 \end{bmatrix}$, solve $A\vec{x} = \vec{b}$.

$\vec{x} = \begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \end{bmatrix}$.

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22. (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. $u = \begin{bmatrix} -2 \\ -1 \\ -5 \end{bmatrix}, v = \begin{bmatrix} -7 \\ -2 \\ -7 \end{bmatrix}$,

? 2. $u = \begin{bmatrix} -1 \\ -3 \\ -2 \end{bmatrix}, v = \begin{bmatrix} 3 \\ 9 \\ 6 \end{bmatrix}$,

? 3. $u = \begin{bmatrix} 5 \\ -5 \\ 3 \end{bmatrix}, v = \begin{bmatrix} 20 \\ -19 \\ 11 \end{bmatrix}$,

? 4. $u = \begin{bmatrix} 8 \\ 5 \\ 3 \end{bmatrix}, v = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$,

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23. (1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.8.pg

Let $\mathbf{a}_1 = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 21 \\ 12 \end{bmatrix}$.

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.

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

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24. (1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/2.2.31.pg

Let $A = \begin{bmatrix} -5 & 20 \\ 5 & -32 \\ 1 & -9 \end{bmatrix}$.

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 $\mathbf{b} \in \mathbb{R}^3$ but we need to row reduce A to show this.
- C. There is a solution for every $\mathbf{b} \in \mathbb{R}^3$ since $2 < 3$
- 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 $\mathbf{b} \in \mathbb{R}^3$.

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25. (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. 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.
- D. There is no easy test to determine if the equation will have a solution for all $\mathbf{b}$ in $\mathbb{R}^n$.
- E. none of the above

26. **(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. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ always 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 the zero vector.
- 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. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ never spans $\mathbb{R}^3$.
- E. There is no easy way to determine if $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ spans $\mathbb{R}^3$.
- F. none of the above

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

28. **(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 dependent.
- B. 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.
- C. The set $\mathbf{S}$ is linearly independent.
- 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 it does not include the zero vector.
- F. none of the above

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

30. **(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 could be either linearly dependent or linearly independent depending on the case.
- 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 must be linearly dependent.
- E. none of the above

31. **(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 dependent set of vectors.
- D. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ is a linearly independent set of vectors unless $\mathbf{u}_4 = \mathbf{0}$.
- E. $\{\mathbf{u}_1,\mathbf{u}_2,\mathbf{u}_3,\mathbf{u}_4\}$ is always a linearly independent set of vectors.

- F. none of the above

32. **(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

33. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/3.3.42.pg**

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

34. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.22.pg**

Find the null space for $A = \begin{bmatrix} 9 & 2 \\ 7 & 6 \end{bmatrix}$.

What is null(A)?

- A. span$\left\{ \begin{bmatrix} 7 \\ 9 \end{bmatrix} \right\}$
- B. span$\left\{ \begin{bmatrix} -2 \\ 9 \end{bmatrix} \right\}$
- C. span$\left\{ \begin{bmatrix} 9 \\ 2 \end{bmatrix} \right\}$
- D. span$\left\{ \begin{bmatrix} 9 \\ 7 \end{bmatrix} \right\}$
- E. $\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$
- F. $\mathbb{R}^2$
- G. span$\left\{ \begin{bmatrix} -7 \\ 9 \end{bmatrix} \right\}$
- H. none of the above

.

35. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.27.pg**

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

What is null(A)?

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

.

36. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.28.pg**

Find the null space for $A = \begin{bmatrix} 3 & -15 \\ 2 & -10 \\ 5 & -25 \end{bmatrix}$.

What is null(A)?

- A. span$\left\{ \begin{bmatrix} -25 \\ 5 \end{bmatrix} \right\}$
- B. $\mathbb{R}^2$
- C. $\mathbb{R}^3$
- D. span$\left\{ \begin{bmatrix} +5 \\ 1 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$
- G. span$\left\{ \begin{bmatrix} 3 \\ 2 \\ 5 \end{bmatrix} \right\}$
- H. none of the above

.

37. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.30.pg**

Find the null space for $A = \begin{bmatrix} 1 & 2 & 9 \\ -6 & -2 & -24 \\ -1 & 4 & 9 \end{bmatrix}$.

What is null(A)?

- A. span$\left\{ \begin{bmatrix} 1 \\ -6 \\ -1 \end{bmatrix} \right\}$
- B. span$\left\{ \begin{bmatrix} 1 \\ 2 \\ 9 \end{bmatrix} \right\}$

- C. $\mathbb{R}^3$
- D. span$\left\{ \begin{bmatrix} -3 \\ -3 \\ 1 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 1 \\ 2 \\ 9 \end{bmatrix}, \begin{bmatrix} -6 \\ -2 \\ -24 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$
- G. none of the above

.

38. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.2.32a.pg**

Find a basis for the null space of matrix A.

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

$$\text{Basis } = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$$

39. **(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).

40. **(1 pt) Library/maCalcDB/setLinearAlgebra3Matrices/ur_la_3_6.pg**

If A and B are 4×9 matrices, and C is a 2×4 matrix, which of the following are defined?

- A. B^T
- B. $C - A$
- C. $A - B$
- D. CB
- E. AB^T
- F. AC

41. **(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^2B^9 is invertible
- B. $(A + A^{-1})^4 = A^4 + A^{-4}$
- C. $(I_n - A)(I_n + A) = I_n - A^2$
- D. $(A + B)(A - B) = A^2 - B^2$
- E. $AB = BA$
- F. $A + I_n$ is invertible

42. **(1 pt) UI/DIAGtfproblem1.pg**

A, P and D are $n \times n$ matrices.

Check the true statements below:

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

43. **(1 pt) UI/Fall14/lin_span2.pg**

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

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

Which of the following sets of vectors are linearly independent?

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

---

44. **(1 pt) UI/Fall14/lin_span.pg**

Let $A = \begin{bmatrix} 1 \\ 1 \\ -4 \end{bmatrix}$, $B = \begin{bmatrix} 4 \\ -1 \\ -21 \end{bmatrix}$, and $C = \begin{bmatrix} -1 \\ 0 \\ 5 \end{bmatrix}$.

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.

$\_\_\_\_A + \_\_\_\_B + \_\_\_\_C = 0$.

---

45. **(1 pt) UI/orthog.pg**

All vectors and subspaces are in $\mathbb{R}^n$.

Check the true statements below:

- A. If $\mathbf{v}$ and $\mathbf{w}$ are both eigenvectors of A and if A is symmetric, then $\mathbf{v} \cdot \mathbf{w} = 0$.
- B. If x is not in a subspace W, then $x - \text{proj}_W(x)$ is not zero.
- C. 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.
- D. If $A\mathbf{v} = r\mathbf{v}$ and $A\mathbf{w} = s\mathbf{w}$ and $r \neq s$, then $\mathbf{v} \cdot \mathbf{w} = 0$.
- 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. 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.
- G. If A is symmetric, $A\mathbf{v} = r\mathbf{v}$, $A\mathbf{w} = s\mathbf{w}$ and $r \neq s$, then $\mathbf{v} \cdot \mathbf{w} = 0$.

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46. **(1 pt) local/Library/Rochester/setLinearAlgebra3Matrices-/ur_la_3_14.pg**

Find the ranks of the following matrices.

$$rank \begin{bmatrix} 4 & -5 \\ -8 & 10 \end{bmatrix} = \_\_\_$$

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

$$rank \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 8 & 0 \end{bmatrix} = \_\_\_$$

---

47. **(1 pt) local/Library/TCNJ/TCNJ_BasesLinearlyIndependentSet-/3.pg**

Check the true statements below:

- A. The column space of a matrix A is the set of solutions of $Ax = b$.
- B. A basis is a spanning set that is as large as possible.
- C. If B is an echelon form of a matrix A, then the pivot columns of B form a basis for $ColA$.
- 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.

---

48. **(1 pt) local/Library/TCNJ/TCNJ_LinearSystems/problem6.pg**

Give a geometric description of the following systems of equations

[?] 1.
$$\begin{aligned} 5x + 15y + 49z &= 3 \\ -x - 2y - 7z &= 3 \\ 4x + 12y + 40z &= 0 \end{aligned}$$

[?] 2.
$$\begin{aligned} 9x + 12y + 9z &= 15 \\ 15x + 20y + 15z &= 25 \\ -18x - 24y - 18z &= -30 \end{aligned}$$

[?] 3.
$$\begin{aligned} 5x - y + 3z &= -5 \\ 4x + 4y - 5z &= 4 \\ -23x - 5y + z &= 7 \end{aligned}$$

[?] 4.
$$\begin{aligned} 5x - y + 3z &= -5 \\ 4x + 4y - 5z &= 4 \\ -23x - 5y + z &= 8 \end{aligned}$$

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.

---

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

---

50. **(1 pt) local/Library/UI/4.1.23.pg**

Find the null space for $A = \begin{bmatrix} 1 & 0 & 9 \\ 0 & 1 & -8 \end{bmatrix}$.
What is null(A)?

- A. $\mathbb{R}^2$
- B. span$\left\{ \begin{bmatrix} +8 \\ -9 \\ 1 \end{bmatrix} \right\}$
- C. $\mathbb{R}^3$
- D. span$\left\{ \begin{bmatrix} -9 \\ +8 \end{bmatrix} \right\}$
- E. span$\left\{ \begin{bmatrix} 1 \\ 0 \\ -9 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ +8 \end{bmatrix} \right\}$
- F. span$\left\{ \begin{bmatrix} +8 \\ -9 \end{bmatrix} \right\}$
- G. span$\left\{ \begin{bmatrix} -9 \\ +8 \\ 1 \end{bmatrix} \right\}$
- H. none of the above

.

---

51. **(1 pt) local/Library/UI/4.1.77.pg**

The null space for the matrix $\begin{bmatrix} 1 & 7 & -2 & 14 & 0 \\ 3 & 0 & 1 & -2 & 3 \\ 6 & 1 & -1 & 0 & 4 \end{bmatrix}$

is spanA,B where A = $\begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \end{bmatrix}$ B = $\begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \end{bmatrix}$

---

52. **(1 pt) local/Library/UI/4.3.3.pg**

Find bases for the column space and the null space of matrix A. You should verify that the Rank-Nullity Theorem holds. An equivalent echelon form of matrix A is given to make your work easier.

A = $\begin{bmatrix} 1 & 0 & -4 & -3 \\ -2 & 1 & 15 & 7 \\ 0 & 1 & 7 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -4 & -3 \\ 0 & 1 & 7 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

Basis for the column space of A = $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

Basis for the null space of A = $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

---

53. **(1 pt) local/Library/UI/6a.pg**

The null space for the matrix $\begin{bmatrix} 2 & 0 & 5 \\ -1 & 6 & 2 \\ 4 & 4 & -1 \\ 5 & 1 & 0 \\ 4 & 1 & 1 \end{bmatrix}$

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

---

54. **(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

55. **(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

---

56. **(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

---

57. **(1 pt) local/Library/UI/Fall14/HW7_11.pg**

Find all values of x for which $\text{rank}(A) = 2$.

$$A = \begin{bmatrix} 2 & 2 & 0 & 7 \\ 4 & 8 & x & 21 \\ -6 & -18 & -12 & -42 \end{bmatrix}$$

$x =$

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

---

58. **(1 pt) local/Library/UI/Fall14/HW7_12.pg**

Suppose that A is a 6×7 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

---

59. **(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

---

60. **(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

61. **(1 pt) local/Library/UI/Fall14/HW8_2.pg**
Evaluate the following 3×3 determinant. Use the properties of determinants to your advantage.

$$\begin{vmatrix} -7 & 0 & -4 \\ -7 & 0 & 3 \\ -8 & 0 & 2 \end{vmatrix}$$

- 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

---

62. **(1 pt) local/Library/UI/Fall14/HW8_3.pg**

Given the matrix $\begin{bmatrix} -2 \\ 0 \\ -1 \\ 0 \\ -4 \\ -4 \\ -1 \\ 0 \\ -2 \end{bmatrix}$

(a) find its determinant

- A. -12
- 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

---

63. **(1 pt) local/Library/UI/Fall14/HW8_4.pg**
If A and B are 4×4 matrices, $\det(A) = -4$, $\det(B) = 9$, then $\det(AB) =$

- A. -15
- B. -36
- 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. -324
- 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. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. None of those above

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

- A. -0.5

- B. -0.4
- C. -0.111111111111111
- D. 0
- E. 0.111111111111111
- F. 0.4
- G. 0.5
- H. 1
- I. None of those above

$\det(B^2) =$

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

---

64. **(1 pt) local/Library/UI/Fall14/HW8_5.pg**
Find the determinant of the matrix

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

$\det(A) =$

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

---

65. **(1 pt) local/Library/UI/Fall14/HW8_7.pg**
Suppose that a 4×4 matrix A with rows v_1, v_2, v_3, and v_4 has determinant $\det A = 6$. Find the following determinants:

$$B = \begin{bmatrix} 2v_1 \\ v_2 \\ v_3 \\ v_4 \end{bmatrix} \quad \det(B) =$$

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

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

- A. -18
- B. -6
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

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

$\det(D) =$

- A. -18
- B. 6
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

---

66. **(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.

$$\begin{bmatrix} -1 \\ -4 \end{bmatrix}, \begin{bmatrix} 7 \\ 7 \end{bmatrix},$$

- A. Linearly Dependent
- B. Linearly Independent

$$\begin{bmatrix} 1 \\ 5 \\ 4 \end{bmatrix}, \begin{bmatrix} -2 \\ -8 \\ -6 \end{bmatrix}, \begin{bmatrix} -5 \\ -19 \\ -11 \end{bmatrix},$$

- A. Linearly Dependent
- B. Linearly Independent

$$\begin{bmatrix} -5 \\ 10 \end{bmatrix}, \begin{bmatrix} 1 \\ -2 \end{bmatrix},$$

- A. Linearly Dependent
- B. Linearly Independent

$$\begin{bmatrix} -1 \\ -5 \\ -1 \end{bmatrix}, \begin{bmatrix} 2 \\ 10 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ 5 \\ 1 \end{bmatrix},$$

- A. Linearly Dependent
- B. Linearly Independent

---

67. **(1 pt) local/Library/UI/Fall14/HW8_10.pg**

$$A = \begin{bmatrix} -9 & 2 & 0 & -4 \\ 1 & -2 & 0 & 0 \\ 0 & -7 & 0 & 0 \\ -5 & 9 & 1 & -6 \end{bmatrix}$$

The determinant of the matrix is

- A. -1890
- B. -1024
- C. -630
- D. -28
- 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.

---

68. **(1 pt) local/Library/UI/Fall14/HW8_11.pg**

Find the determinant of the matrix

$$M = \begin{bmatrix} 3 & 0 & 0 & 2 & 0 \\ 2 & 0 & -3 & 0 & 0 \\ 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 & -1 \\ 0 & 2 & -2 & 0 & 0 \end{bmatrix}.$$

$\det(M) =$

- A. -48
- B. -35
- C. -20
- D. -10
- E. -5
- F. 5
- G. 18
- H. 20
- I. 81
- J. None of those above

---

69. **(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

86. **(1 pt) local/Library/UI/Fall14/quiz2_2.pg**
Find the area of the triangle with vertices $(1,3)$, $(8,5)$, and $(4,9)$.
Area =

- A. 2
- B. 5
- C. 6
- D. 8
- E. 9
- F. 12
- G. 18
- 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.

87. **(1 pt) local/Library/UI/Fall14/quiz2_6.pg**
Determine if v is an eigenvector of the matrix A.

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

- A. Yes
- B. No

2. $A = \begin{bmatrix} -1 & -2 & 0 \\ 0 & -3 & 0 \\ -6 & -2 & 5 \end{bmatrix}$, $v = \begin{bmatrix} 5 \\ 7 \\ -1 \end{bmatrix}$

- A. Yes
- B. No

3. $A = \begin{bmatrix} 0 & -2 & -4 \\ 10 & 2 & -6 \\ -5 & -2 & 1 \end{bmatrix}$, $v = \begin{bmatrix} -1 \\ 2 \\ -1 \end{bmatrix}$

- A. Yes
- B. No

4. $A = \begin{bmatrix} 5 & 1 & 8 \\ 6 & 0 & 8 \\ -3 & -1 & -6 \end{bmatrix}$, $v = \begin{bmatrix} 4 \\ 5 \\ 1 \end{bmatrix}$

- A. Yes
- B. No

88. **(1 pt) local/Library/UI/Fall14/quiz2_7.pg**
Given that $v_1 = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and $v_2 = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$ are eigenvectors of the matrix $A = \begin{bmatrix} 24 & 36 \\ -12 & -18 \end{bmatrix}$, determine the corresponding eigenvalues.
a. $\lambda_1 =$

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

b. $\lambda_2 =$

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

89. **(1 pt) local/Library/UI/Fall14/volume1.pg**
Find the volume of the parallelepiped determined by vectors $\begin{bmatrix} -3 \\ 0 \\ 0 \end{bmatrix}$, $\begin{bmatrix} 0 \\ -2 \\ 0 \end{bmatrix}$, and $\begin{bmatrix} 4 \\ -3 \\ -3 \end{bmatrix}$

- A. 18
- 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,

$$A = \begin{bmatrix} 8 & 5 & -2 \\ 7 & 4 & \\ 0 & -7 & 3 \\ 9 & 6 & \\ 0 & 0 & 0 \\ 0 & 1 & \end{bmatrix},$$

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,

$$A = \begin{bmatrix} -9 & 3 & 0 \\ 1 & -6 & \\ 0 & 7 & 5 \\ -9 & -2 & \\ 0 & 0 & 0 \\ 7 & -4 & \end{bmatrix},$$

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

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104. **(1 pt) local/Library/UI/LinearSystems/spanHW4.pg**

Let $A = \begin{bmatrix} -1 & 2 & 0 \\ 0 & -3 & 3 \\ -5 & 7 & 0 \end{bmatrix}$, and $b = \begin{bmatrix} 6 \\ -5 \\ -1 \end{bmatrix}$.

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 W

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

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

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

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107. **(1 pt) local/Library/UI/eigenTF.pg**

A is $n \times n$ an matrices.

Check the true statements below:

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

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108. **(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 11×9 matrix. If rank of A = 7, 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

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

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 $A\vec{x} = -6\vec{b_1} - 3\vec{b_2}$ 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 $\vec{v}_1$ and $\vec{v}_2$ are eigenvectors of A corresponding to eigenvalue λ_0, then $2\vec{v}_1 - 5\vec{v}_2$ is also an eigenvector of A corresponding to eigenvalue λ_0 when $2\vec{v}_1 - 5\vec{v}_2$ 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 $2\vec{v}_1 - 5\vec{v}_2$ nonzero?

If $\vec{x}_1$ and $\vec{x}_2$ are solutions to $A\vec{x} = \vec{0}$, then $-8\vec{x}_1 - 9\vec{x}_2$ 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 $6\vec{x}_1 - 7\vec{x}_2$ 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 $\begin{bmatrix} 2.66666666666667 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ 3 \end{bmatrix}$.

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

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

$$\begin{aligned} 38x + 9y &= 32 \\ 4x + 1y &= 4 \end{aligned}$$

.

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

Which of the following is an eigenvalue of $\begin{bmatrix} -4 & 0 \\ 1 & -6 \end{bmatrix}$.

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

Let $A = \begin{bmatrix} 2 & -4 & -5 \\ 0 & -2 & -1 \\ 0 & 0 & 2 \end{bmatrix}$. Is A = diagonalizable?

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

Let $A = \begin{bmatrix} 6 & 0 & 12 \\ 0 & 6 & 3 \\ 0 & 0 & 6 \end{bmatrix}$. Is A = diagonalizable?

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

Let $A = \begin{bmatrix} 2 & 13 \\ 9 & -9 \end{bmatrix}$. 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 $A = \begin{bmatrix} -0.904761904761905 & 6.53571428571429 & -4.857142 \\ 1.22751322751323 & -0.761904761904762 & 1.396825 \\ -2.22222222222222 & 5 & -1.666666 \end{bmatrix}$

and let $P = \begin{bmatrix} 9 & -9 & -6 \\ 4 & -8 & 8 \\ 0 & -6 & -5 \end{bmatrix}$.

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}.

Suppose A is a 7×3 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 2×4 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 dot product: $\begin{bmatrix} 5 \\ 5 \\ 2 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 3 \\ -8 \end{bmatrix}$

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

Calculate the determinant of $\begin{bmatrix} -2.33333333333333 & 6 \\ -4 & 9 \end{bmatrix}$.

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

Suppose $A \begin{bmatrix} 3 \\ 4 \\ -1 \end{bmatrix} = \begin{bmatrix} -3 \\ -4 \\ 1 \end{bmatrix}$. 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

Determine the length of $\begin{bmatrix} -1 \\ 3.87298334620742 \end{bmatrix}$.

- 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 $A = (\lambda+1)^2(\lambda-6)(\lambda-8)^9$, then the algebraic multiplicity of $\lambda = 6$ 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 $A = (\lambda-9)^2(\lambda+3)(\lambda+4)^2$, 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 $A = (\lambda-5)^7(\lambda+3)^2(\lambda-4)^7$, then the algebraic multiplicity of $\lambda = -3$ 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 $A = (\lambda+8)^3(\lambda-8)^2(\lambda+2)^5$, then the geometric multiplicity of $\lambda = 8$ 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 $\begin{bmatrix} -141 \\ 7 \\ -8 \end{bmatrix}$ onto $\begin{bmatrix} 1 \\ -1 \\ -5 \end{bmatrix}$ 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 $\begin{bmatrix} 4 \\ -2 \\ 4.94413232473044 \end{bmatrix}$. 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

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140. **(1 pt) local/Library/UI/volumn2.pg**
A and B are $n \times n$ matrices.

Check the true statements below:

- A. $det A^T = (-1) det A$.
- B. 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.
- C. 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.