MATH208 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

This test: 100 point(s)
This question: 4 point(

Determine if the given set is a subspace of $\mathbb{P}_n$. Justify your answer.

The set of all polynomials in $\mathbb{P}_n$ such that $p(0) = 0$

Choose the correct answer below.

- ○ A. The set is a subspace of $\mathbb{P}_n$ because $\mathbb{P}_n$ is a vector space spanned by the given set.
- ◉ B. The set is a subspace of $\mathbb{P}_n$ because the set contains the zero vector of $\mathbb{P}_n$, the set is closed under vector addition, and the set is closed under multiplication by scalars.
- ○ C. The set is not a subspace of $\mathbb{P}_n$ because the set does not contain the zero vector of $\mathbb{P}_n$.
- ○ D. The set is not a subspace of $\mathbb{P}_n$ because the set is not closed under multiplication by scalars.
- ○ E. The set is not a subspace of $\mathbb{P}_n$ because the set is not closed under vector addition.

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Test: Final Exam Question 2 of 25

This test: 100 point(s) possible
This question: 4 point(s) possi

Is $\lambda = 7$ an eigenvalue of $\begin{bmatrix} 6 & 0 & -3 \\ 3 & 6 & 6 \\ -4 & 2 & 1 \end{bmatrix}$? If so, find one corresponding eigenvector.

Select the correct choice below and, if necessary, fill in the answer box within your choice.

(●) A. Yes, $\lambda = 7$ is an eigenvalue of $\begin{bmatrix} 6 & 0 & -3 \\ 3 & 6 & 6 \\ -4 & 2 & 1 \end{bmatrix}$. One corresponding eigenvector is $\boxed{\begin{bmatrix} -3 \\ -3 \\ 1 \end{bmatrix}}$.
(Type a vector or list of vectors. Type an integer or simplified fraction for each matrix element.)

( ) B. No, $\lambda = 7$ is not an eigenvalue of $\begin{bmatrix} 6 & 0 & -3 \\ 3 & 6 & 6 \\ -4 & 2 & 1 \end{bmatrix}$.

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MATH208 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

This test: 100 point(s) pos
This question: 4 point(s) p

Suppose a 7×9 matrix A has four pivot columns. What is nullity A? Is Col A $= \mathbb{R}^4$? Why or why not?

nullity A = $\boxed{5}$ (Simplify your answer.)

Is Col A $= \mathbb{R}^4$? Why or why not?

- (●) A. No, because Col A is a subspace of $\mathbb{R}^7$
- ( ) B. Yes, because the number of pivot positions in A is 4
- ( ) C. Yes, because rank A = 4
- ( ) D. No, because Col A is a subspace of $\mathbb{R}^9$

MATH208 13360 - W22 - Introduction To Linear Algebra

Balance the chemical equation

$Au + HCl + HNO_3 \rightarrow AuCl_3 + NO + H_2O$

Assume the coefficient of H_2O is 2. What is the balanced equation?

$\boxed{1}Au + \boxed{3}HCl + \boxed{1}HNO_3 \rightarrow \boxed{1}AuCl_3 + \boxed{1}NO + \boxed{2}H_2O$

MATH208 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

This test: 100 point(s) poss
This question: 4 point(s) p

Let W be the set of all vectors of the form $\begin{bmatrix} 5s+5t \\ 5s \\ 4s \\ 2t \end{bmatrix}$ Show that W is a subspace of $\mathbb{R}^4$ by finding vectors **u** and **v** such that W = Span{**u**,**v**}

Write the vectors in W as column vectors.

$$\begin{bmatrix} 5s+5t \\ 5s \\ 4s \\ 2t \end{bmatrix} = s\begin{bmatrix} 5 \\ 5 \\ 4 \\ 1 \end{bmatrix} + t\begin{bmatrix} 5 \\ 0 \\ 0 \\ 2 \end{bmatrix} = s\mathbf{u} + t\mathbf{v}$$

What does this imply about W?

- A. W = s + t
- B. W = **u** + **v**
- C. W = Span{s,t}
- D. W = Span{**u**,**v**}

Explain how this result shows that W is a subspace of $\mathbb{R}^4$. Choose the correct answer below.

- A. Since **u** and **v** are in $\mathbb{R}^4$ and W = **u** + **v**, W is a subspace of $\mathbb{R}^4$
- B. Since **u** and **v** are in $\mathbb{R}^4$ and W = Span{**u**,**v**}, W is a subspace of $\mathbb{R}^4$
- C. Since s and t are in $\mathbb{R}$ and W = Span{**u**,**v**}, W is a subspace of $\mathbb{R}^4$
- D. Since s and t are in $\mathbb{R}$ and W = **u** + **v**, W is a subspace of $\mathbb{R}^4$

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Test: Final Exam

This test: 100 point(s) possi
This question: 4 point(s) pos

Assume that A is row equivalent to B. Find bases for Nul A, Col A, and Row A.

$$A=\begin{bmatrix} -2 & 6 & -2 & -6 \\ 2 & -9 & -4 & 3 \\ -3 & 12 & 3 & -6 \end{bmatrix},\quad B=\begin{bmatrix} 1 & 0 & 7 & 6 \\ 0 & 3 & 6 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

A column vector basis for Nul A is $\left\{\begin{bmatrix} -7 \\ 2 \\ 1 \\ 0 \end{bmatrix},\begin{bmatrix} -6 \\ -1 \\ 0 \\ 1 \end{bmatrix}\right\}$

(Use a comma to separate vectors as needed.)

A column vector basis for Col A is $\left\{\begin{bmatrix} -2 \\ 2 \\ -3 \end{bmatrix},\begin{bmatrix} 6 \\ 9 \\ -12 \end{bmatrix}\right\}$

(Use a comma to separate vectors as needed.)

A row vector basis for Row A is $\left\{\begin{bmatrix} 1 \\ 0 \\ 7 \\ 6 \end{bmatrix},\begin{bmatrix} 0 \\ 1 \\ -2 \\ 1 \end{bmatrix}\right\}$

(Use a comma to separate vectors as needed.)

MATH208 13360 - W22 - Introduction To Linear Algebra

Determine if $\mathbf{w} = \begin{bmatrix} 4 \\ 3 \\ -1 \end{bmatrix}$ is in Nul A, where $A = \begin{bmatrix} 1 & -3 & 3 \\ 9 & -5 & 1 \\ -7 & 2 & -4 \end{bmatrix}$

Is w in Nul A? Select the correct choice below and fill in the answer box to complete your choice.

(Simplify your answer.)

○ A. Yes, because Aw = ☐

◉ B. No, because $A\mathbf{w} = \begin{bmatrix} -8 \\ 20 \\ -18 \end{bmatrix}$

MATH208 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

This test: 100 point(s) possib…
This question: 4 point(s) pos…

Let $\mathbf{v}_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, $\mathbf{v}_2 = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$, $\mathbf{v}_3 = \begin{bmatrix} 10 \\ 3 \\ 5 \end{bmatrix}$, and $\mathbf{w} = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$

a. Is $\mathbf{w}$ in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? How many vectors are in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

b. How many vectors are in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

c. Is $\mathbf{w}$ in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Why?

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a. Is $\mathbf{w}$ in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

- ○ A. Vector $\mathbf{w}$ is in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the subspace generated by $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$ is $\mathbb{R}^3$
- ○ B. Vector $\mathbf{w}$ is not in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is not a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ○ C. Vector $\mathbf{w}$ is in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ◉ D. Vector $\mathbf{w}$ is not in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is not $\mathbf{v}_1$, $\mathbf{v}_2$, or $\mathbf{v}_3$

How many vectors are in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ◉ A. The number of vectors in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ is $\boxed{3}$
- ○ B. There are infinitely many vectors in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$

b. How many vectors are in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ○ A. The number of vectors in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ is ☐
- ◉ B. There are infinitely many vectors in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$

c. Is $\mathbf{w}$ in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

- ○ A. Vector $\mathbf{w}$ is not in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because $\mathbf{w}$ is not a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ○ B. Vector $\mathbf{w}$ is not in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the rightmost column of the augmented matrix of the system $x_1\mathbf{v}_1 + x_2\mathbf{v}_2 + x_3\mathbf{v}_3 = \mathbf{w}$ is a pivot column
- ◉ C. Vector $\mathbf{w}$ is in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because $\mathbf{w}$ is a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$, which can be seen because any echelon form of the augmented matrix of the system has no row…
- ○ D. Vector $\mathbf{w}$ is in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the subspace generated by $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$ is $\mathbb{R}^3$

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MATH208 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

Question 7 of 25

This test: 100 point(s) possible
This question: 4 point(s) possible

Previous question

Determine if $\mathbf{w} = \begin{bmatrix} 4 \\ 3 \\ -1 \end{bmatrix}$ is in Nul A, where $A = \begin{bmatrix} 1 & -3 & 3 \\ 9 & -5 & 1 \\ -7 & 2 & -4 \end{bmatrix}$

Is w in Nul A? Select the correct choice below and fill in the answer box to complete your choice.

(Simplify your answer.)

- A. Yes, because Aw = ☐
- B. No, because $A\mathbf{w} = \begin{bmatrix} -8 \\ 20 \\ -18 \end{bmatrix}$

Time R

MATH208 13360 - W22 - Introduction To Linear Algebra

Let $\mathbf{v}_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, $\mathbf{v}_2 = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$, $\mathbf{v}_3 = \begin{bmatrix} 10 \\ 3 \\ 5 \end{bmatrix}$, and $\mathbf{w} = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$

a. Is $\mathbf{w}$ in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? How many vectors are in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

b. How many vectors are in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

c. Is $\mathbf{w}$ in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Why?

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a. Is $\mathbf{w}$ in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

- ○ A. Vector $\mathbf{w}$ is in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the subspace generated by $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$ is $\mathbb{R}^3$
- ○ B. Vector $\mathbf{w}$ is not in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is not a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ○ C. Vector $\mathbf{w}$ is in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ◉ D. Vector $\mathbf{w}$ is not in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because it is not $\mathbf{v}_1$, $\mathbf{v}_2$, or $\mathbf{v}_3$

How many vectors are in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ◉ A. The number of vectors in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ is $\boxed{3}$
- ○ B. There are infinitely many vectors in $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$

b. How many vectors are in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ○ A. The number of vectors in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ is
- ◉ B. There are infinitely many vectors in Span$\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$

c. Is $\mathbf{w}$ in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$?

- ○ A. Vector $\mathbf{w}$ is not in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because $\mathbf{w}$ is not a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$
- ○ B. Vector $\mathbf{w}$ is not in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the rightmost column of the augmented matrix of the system $x_1\mathbf{v}_1 + x_2\mathbf{v}_2 + x_3\mathbf{v}_3 = \mathbf{w}$ is a pivot column
- ◉ C. Vector $\mathbf{w}$ is in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because $\mathbf{w}$ is a linear combination of $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$ which can be seen because any echelon form of the augmented matrix of the system has no row of the
- ○ D. Vector $\mathbf{w}$ is in the subspace spanned by $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ because the subspace generated by $\mathbf{v}_1$, $\mathbf{v}_2$, and $\mathbf{v}_3$ is $\mathbb{R}^3$

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MATH208 13360 - W22 - Introduction To Linear Algebra

Joseph

Test: Final Exam

Question 9 of 25

This test: 100 point(s) possible
This question: 4 point(s) possible

For this exercise assume that the matrices are all $n \times n$. The statement in this exercise is an implication of the form "If "statement 1", then "statement 2"." Mark an implication as True if the truth of "statement 2" always follows whenever "statement 1" happens to be true. Mark the implication as False if "statement 2" is false but "statement 1" is true. Justify your answer.

If the linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ maps $\mathbb{R}^n$ into $\mathbb{R}^n$, then A has n pivot positions.

Choose the correct answer below.

- (●) A. The statement is false. The linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ will always map $\mathbb{R}^n$ into $\mathbb{R}^n$ for any $n \times n$ matrix. According to the Invertible Matrix Theorem, A has n pivot positions only if $\mathbf{x} \mapsto A\mathbf{x}$ maps $\mathbb{R}^n$ onto $\mathbb{R}^n$.
- ( ) B. The statement is true. The linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ will always map $\mathbb{R}^n$ into $\mathbb{R}^n$ for any $n \times n$ matrix. Therefore, according to the Invertible Matrix Theorem, A has n pivot positions.
- ( ) C. The statement is false. According to the Invertible Matrix Theorem, if $\mathbf{x} \mapsto A\mathbf{x}$ maps $\mathbb{R}^n$ into $\mathbb{R}^n$, then A has $n-2$ pivot positions.
- ( ) D. The statement is true. According to the Invertible Matrix Theorem, if $\mathbf{x} \mapsto A\mathbf{x}$ maps $\mathbb{R}^n$ into $\mathbb{R}^n$, then A is invertible, and if a matrix is invertible it has n pivot positions.

Solve the system.

$$\begin{aligned} x_1 \quad\quad\quad - 3x_3 &= 10 \\ 2x_1 + 2x_2 + 9x_3 &= 2 \\ x_2 + 5x_3 &= -4 \end{aligned}$$

Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

- (•) A. The unique solution of the system is $(\boxed{4}, \boxed{5}, \boxed{-2})$.
  (Type integers or simplified fractions.)
- ( ) B. The system has infinitely many solutions.
- ( ) C. The system has no solution.

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MATH203 13360 - W22 - Introduction To Linear Algebra

Test: Final Exam

Question 11 of 25

This test: 100 point(s) possible
This question: 4 point(s) possible

Find the coordinate vector $[\mathbf{x}]_{\mathcal{B}}$ of $\mathbf{x}$ relative to the given basis $\mathcal{B} = \{\mathbf{b}_1, \mathbf{b}_2\}$.

$$\mathbf{b}_1 = \begin{bmatrix} 1 \\ -3 \end{bmatrix}, \quad \mathbf{b}_2 = \begin{bmatrix} \text{[illegible]} \\ -7 \end{bmatrix}, \quad \mathbf{x} = \begin{bmatrix} 3 \\ -12 \end{bmatrix}$$

$$[\mathbf{x}]_{\mathcal{B}} = \begin{bmatrix} -3 \\ 3 \end{bmatrix}$$

(Simplify your answer.)

Time Remaining

Let $B=\{\mathbf{b}_1, \mathbf{b}_2\}$ and $C=\{\mathbf{c}_1, \mathbf{c}_2\}$ be bases for a vector space V, and suppose $\mathbf{b}_1 = -4\mathbf{c}_1 + 5\mathbf{c}_2$ and $\mathbf{b}_2 = 6\mathbf{c}_1 - 8\mathbf{c}_2$.

a. Find the change-of-coordinates matrix from B to C.
b. Find $[\mathbf{x}]_C$ for $\mathbf{x} = -9\mathbf{b}_1 + 4\mathbf{b}_2$. Use part (a).

a. $\underset{C \leftarrow B}{P} = \boxed{\begin{bmatrix} -4 & 6 \\ 5 & -8 \end{bmatrix}}$

b. $[\mathbf{x}]_C = \boxed{\begin{bmatrix} 60 \\ -77 \end{bmatrix}}$

(Simplify your answer.)

MATH208 13360 - W22 - Introduction To Linear Algebra

Josep

Test: Final Exam

This test: 100 point(s) possible
This question: 4 point(s) possible

Use the factorization $A = PDP^{-1}$ to compute A^k, where k represents an arbitrary positive integer

$$\begin{bmatrix} 11 & -40 \\ 2 & -7 \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} -1 & 5 \\ 1 & -4 \end{bmatrix}$$

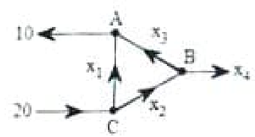
$$A^k = \begin{bmatrix} -4+5\cdot 3^k & 20-20\cdot 3^k \\ -1+1\cdot 3^k & 5-4\cdot 3^k \end{bmatrix}$$

Use the factorization $A = PDP^{-1}$ to compute A^k, where k represents an arbitrary positive integer

$$\begin{bmatrix} 11 & -40 \\ 2 & -7 \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} -1 & 5 \\ 1 & -4 \end{bmatrix}$$

$$A^k = \begin{bmatrix} -4+5\cdot 3^k & 20-20\cdot 3^k \\ -1+1\cdot 3^k & 5-4\cdot 3^k \end{bmatrix}$$

Find the general flow pattern of the network shown in the figure. Assuming that the flows are all nonnegative, what is the largest possible value for x_3?



Find the general flow pattern of the network shown in the figure. Choose the correct answer below and fill in the answer boxes to complete your choice.

(•) A. $\begin{cases} x_1 = \boxed{10 - x_3} \\ x_2 = \boxed{10 + x_3} \\ x_3 \text{ is free} \\ x_4 = \boxed{10} \end{cases}$

( ) B. $\begin{cases} x_1 = \square \\ x_2 \text{ is free} \\ x_3 \text{ is free} \\ x_4 \text{ is free} \end{cases}$

( ) C. $\begin{cases} x_1 = \square \\ x_2 = \square \\ x_3 = \square \\ x_4 = \square \end{cases}$

( ) D. $\begin{cases} x_1 \text{ is free} \\ x_2 = \square \\ x_3 \text{ is free} \\ x_4 = \square \end{cases}$

Assuming that the flows are all nonnegative, what is the largest possible value for x_3?

The largest possible value for x_3 is $\boxed{10}$

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MATH208 13360 - W22 - Introduction To Linear Algebra

Joseph Malo

Test: Final Exam

Question 15 of 25

This test: 100 point(s) possible
This question: 4 point(s) possible

Matrix A is factored in the form PDP^{-1}. Use the Diagonalization Theorem to find the eigenvalues of A and a basis for each eigenspace.

$$A = \begin{bmatrix} 5 & 0 & -5 \\ 2 & 6 & 10 \\ 0 & 0 & 6 \end{bmatrix} = \begin{bmatrix} -5 & 0 & -1 \\ 0 & 1 & 2 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 6 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 5 \end{bmatrix} \begin{bmatrix} 0 & 0 & 1 \\ 2 & 1 & 10 \\ -1 & 0 & -5 \end{bmatrix}$$

Select the correct choice below and fill in the answer boxes to complete your choice.

(Use a comma to separate vectors as needed.)

- A. There is one distinct eigenvalue, $\lambda = \square$. A basis for the corresponding eigenspace is $\{\square\}$.
- B. In ascending order, the two distinct eigenvalues are $\lambda_1 = \boxed{5}$ and $\lambda_2 = \boxed{6}$. Bases for the corresponding eigenspaces are $\left\{\begin{bmatrix} -1 \\ 2 \\ 0 \end{bmatrix}\right\}$ and $\left\{\begin{bmatrix} -5 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}\right\}$, respectively.
- C. In ascending order, the three distinct eigenvalues are $\lambda_1 = \square$, $\lambda_2 = \square$, and $\lambda_3 = \square$. Bases for the corresponding eigenspaces are $\{\square\}$, $\{\square\}$, and $\{\square\}$, respectively.

Let A be a 4×6 matrix. What must a and b be in order to define $T: \mathbb{R}^a \rightarrow \mathbb{R}^b$ by $T(\mathbf{x}) = A\mathbf{x}$?

a = $\boxed{6}$
(Simplify your answer.)

b = $\boxed{4}$
(Simplify your answer.)

For this exercise assume that the matrices are all $n \times n$. The statement in this exercise is an implication of the form "If "statement 1", then "statement 2"." Mark an implication as True if the truth of "statement 2" always happens to be true. Mark the implication as False if "statement 2" is false but "statement 1" is true. Justify your answer.

If the columns of A span $\mathbb{R}^n$, then the columns are linearly independent.

Choose the correct answer below.

- ○ A. The statement is true. The Invertible Matrix Theorem states that if the linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ does not map $\mathbb{R}^n$ into $\mathbb{R}^n$, then A is invertible. Therefore, the columns are linearly independent.
- ○ B. The statement is false. The Invertible Matrix Theorem states that if the columns of A span $\mathbb{R}^n$, then matrix A is not invertible. Therefore, the columns are linearly dependent.
- ◉ C. The statement is true. The Invertible Matrix Theorem states that if the columns of A span $\mathbb{R}^n$, then matrix A is invertible. Therefore, the columns are linearly independent.
- ○ D. The statement is false. The Invertible Matrix Theorem states that if the linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ maps $\mathbb{R}^n$ into $\mathbb{R}^n$, then A is not invertible. Therefore, the columns are linearly dependent.

Determine if the columns of the matrix form a linearly independent set

$$\begin{bmatrix} 1 & 3 & -3 & 2 \\ 3 & 10 & -6 & 0 \\ 2 & 9 & 6 & -20 \end{bmatrix}$$

Select the correct choice below and, if necessary, fill in the answer box(es) within your choice.

- A. The columns of the matrix do not form a linearly independent set because there are more entries in each vector ☐ than there are vectors in the set ☐
  (Type whole numbers.)
- B. The columns of the matrix do not form a linearly independent set because the set contains more vectors $\boxed{4}$ than there are entries in each vector $\boxed{3}$
  (Type whole numbers.)
- C. Let A be the given matrix. Then the columns of the matrix form a linearly independent set since the vector equation $Ax = 0$ has only the trivial solution
- D. The columns of the matrix form a linearly independent set because at least one vector in the set is a constant multiple of another

Describe all solutions of $A\mathbf{x} = \mathbf{0}$ in parametric vector form, where A is row equivalent to the given matrix

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

$$\mathbf{x} = x_3\begin{bmatrix} 1 \\ -4 \\ 1 \\ 0 \end{bmatrix} + x_4\begin{bmatrix} 4 \\ 4 \\ 0 \\ 1 \end{bmatrix}$$

(Type an integer or fraction for each matrix element.)

Describe all solutions of Ax = 0 in parametric vector form, where A is row equivalent to the given matrix

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

$$\mathbf{x} = x_3 \begin{bmatrix} 1 \\ -4 \\ 1 \\ 0 \end{bmatrix} + x_4 \begin{bmatrix} 4 \\ 4 \\ 0 \\ 1 \end{bmatrix}$$

(Type an integer or fraction for each matrix element.)

Compute each matrix sum or product if it is defined. If an expression is undefined, explain why. Let $A = \begin{bmatrix} 1 & 0 & -1 \\ 4 & -6 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 7 & -4 & 2 \\ 1 & -4 & -3 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$, and $D = \begin{bmatrix} 3 & 5 \\ -2 & 3 \end{bmatrix}$.

$-2A$, $B-2A$, AC, CD

Compute the matrix product $-2A$. Select the correct choice below and, if necessary, fill in the answer box within your choice.

- A. $-2A = \begin{bmatrix} -2 & 0 & 2 \\ -8 & 12 & -4 \end{bmatrix}$ (Simplify your answer.)
- B. The expression $-2A$ is undefined because matrices cannot have negative coefficients.
- C. The expression $-2A$ is undefined because matrices cannot be multiplied by numbers.
- D. The expression $-2A$ is undefined because A is not a square matrix.

Compute the martrix sum $B-2A$. Select the correct choice below and, if necessary, fill in the answer box within your choice.

- A. $B-2A = \begin{bmatrix} 5 & -4 & 4 \\ -7 & 8 & -1 \end{bmatrix}$ (Simplify your answer.)
- B. The expression $B-2A$ is undefined because A is not a square matrix.
- C. The expression $B-2A$ is undefined because B and A have different sizes.
- D. The expression $B-2A$ is undefined because B and $-2A$ have different sizes.

Compute the matrix product AC. Select the correct choice below and, if necessary, fill in the answer box within your choice.

- A. AC = ☐ (Simplify your answer.)
- B. The expression AC is undefined because the number of rows in A is not equal to the number of columns in C.
- C. The expression AC is undefined because the number of columns in A is not equal to the number of rows in C.
- D. The expression AC is undefined because the number of rows in A is not equal to the number of rows in C.

Compute the matrix product CD. Select the correct choice below and, if necessary, fill in the answer box within your choice.

Time Remaining

MATH208 13360 - W22 - Introduction To Linear Algebra

Joseph

Test: Final Exam ‹ **Question 20 of 25** ›

This test: 100 point(s) possible
This question: 4 point(s) possible

Compute each matrix sum or product if it is defined. If an expression is undefined, explain why. Let $A = \begin{bmatrix} 1 & 0 & -1 \\ 4 & -6 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 7 & -4 & 2 \\ 1 & -4 & -3 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$ and $D = \begin{bmatrix} 3 & 5 \\ -2 & 3 \end{bmatrix}$

$-2A$, $B-2A$, AC, CD

○ D. The expression $-2A$ is undefined because A is not a square matrix

Compute the martrix sum $B-2A$. Select the correct choice below and, if necessary, fill in the answer box within your choice.

◉ A. $B-2A = \begin{bmatrix} 5 & -4 & 4 \\ -7 & 8 & -1 \end{bmatrix}$
(Simplify your answer.)

○ B. The expression $B-2A$ is undefined because A is not a square matrix

○ C. The expression $B-2A$ is undefined because B and A have different sizes

○ D. The expression $B-2A$ is undefined because B and $-2A$ have different sizes

Compute the matrix product AC. Select the correct choice below and, if necessary, fill in the answer box within your choice.

○ A. AC = ☐
(Simplify your answer.)

○ B. The expression AC is undefined because the number of rows in A is not equal to the number of columns in C

◉ C. The expression AC is undefined because the number of columns in A is not equal to the number of rows in C

○ D. The expression AC is undefined because the number of rows in A is not equal to the number of rows in C

Compute the matrix product CD. Select the correct choice below and, if necessary, fill in the answer box within your choice.

◉ A. $CD = \begin{bmatrix} -1 & 11 \\ -8 & -7 \end{bmatrix}$
(Simplify your answer.)

○ B. The expression CD is undefined because square matrices cannot be multiplied

○ C. The expression CD is undefined because the corresponding entries in C and D are not equal

○ D. The expression CD is undefined because matrices with negative entries cannot be multiplied

Time Remai

If T is defined by T(**x**) = A**x**, find a vector **x** whose image under T is **b**, and determine whether **x** is unique. Let $A = \begin{bmatrix} 1 & 4 & 5 \\ 0 & 1 & -2 \\ 4 & -17 & 20 \end{bmatrix}$ and $b = \begin{bmatrix} -4 \\ -12 \\ -2 \end{bmatrix}$

Find a single vector **x** whose image under T is b

$$\mathbf{x} = \begin{bmatrix} -55 \\ -14 \\ -1 \end{bmatrix}$$

Is the vector **x** found in the previous step unique?

- A. No, because there are no free variables in the system of equations
- B. Yes, because there is a free variable in the system of equations
- C. No, because there is a free variable in the system of equations
- D. Yes, because there are no free variables in the system of equations

Final Exam - Personal - Microsoft Edge

https://mylab.pearson.com/Student/PlayerTest.aspx?testId=240786850&centerwin=yes

MATH208 13360 - W22 - Introduction To Linear Algebra

Joseph M

Test: Final Exam

Question 22 of 25

This test: 100 point(s) possible
This question: 4 point(s) possible

Compute the determinant by cofactor expansion. At each step, choose a row or column that involves the least amount of computation.

$$\begin{vmatrix} 3 & 0 & 0 & 4 \\ 2 & 8 & 3 & -8 \\ 2 & 0 & 0 & 0 \\ 9 & 2 & 1 & 8 \end{vmatrix} = \boxed{16}$$ (Simplify your answer.)

$T: \mathbf{R}^2 \to \mathbf{R}^2$, rotates points (about the origin) through $-\frac{\pi}{6}$ radians

$$A = \begin{bmatrix} \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$$

(Type an integer or simplified fraction for each matrix element. Type exact answers, using radicals as needed.)

Find the inverse of the matrix

$$\begin{bmatrix} 8 & 6 \\ 9 & 7 \end{bmatrix}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. The inverse matrix is $\begin{bmatrix} \frac{7}{2} & -3 \\ -\frac{9}{2} & 4 \end{bmatrix}$

  (Type an integer or simplified fraction for each matrix element.)
- B. The matrix is not invertible.

Find the change-of-coordinates matrix from B to the standard basis in $\mathbb{R}^n$.

$$B = \left\{ \begin{bmatrix} 2 \\ 8 \\ 5 \end{bmatrix}, \begin{bmatrix} -3 \\ 0 \\ -6 \end{bmatrix}, \begin{bmatrix} 3 \\ -3 \\ 2 \end{bmatrix} \right\}$$

$$P_B = \begin{bmatrix} 2 & -3 & 3 \\ 8 & 0 & -3 \\ 5 & -6 & 2 \end{bmatrix}$$