

This print-out should have 15 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

MatrixOpsTF01b
001 10.0 points

When

$$A = [\mathbf{a}_1 \ \mathbf{a}_2 \ \dots \ \mathbf{a}_n]$$

and B are matrices such that the product AB is defined, then

$$AB = [B\mathbf{a}_1 \ B\mathbf{a}_2 \ \dots \ B\mathbf{a}_n].$$

True or False?

1. TRUE

2. FALSE

$$\text{so } A^{-1} = BI = B.$$

3. Add A^{-1} to both sides of the equation $I = BA$. Then

$$I + A^{-1} = BA + A^{-1},$$

$$\text{so } A^{-1} = BI = B.$$

4. Left-multiply each side of the equation $I = BA$ by A^{-1} . Then

$$A^{-1} = A^{-1}BA = BI = B,$$

$$\text{so } B = A^{-1}.$$

InverseProp01a
002 10.0 points

Which of the following shows that if A is an invertible $n \times n$ matrix and B is any $n \times n$ matrix such that $BA = I$, then $B = A^{-1}$.

1. Right-multiply each side of the equation $I = BA$ by A^{-1} . Then

$$A^{-1} = BAA^{-1} = BI = B,$$

$$\text{so } B = A^{-1}.$$

2. Subtract A^{-1} from both sides of the equation $I = BA$. Then

$$I - A^{-1} = BA - A^{-1},$$

InverseTF02a
003 10.0 points

If A is an $n \times n$ invertible matrix, then the same sequence of elementary row operations that row reduces A to the identity I_n also reduces A^{-1} to I_n .

True or False?

1. FALSE

2. TRUE

5. None of these.

6. All of these.

Invertible01
004 10.0 points

A is an $n \times n$ matrix. Which of the following statements are equivalent to A being invertible?

- (i) A^T is an invertible matrix.
- (ii) The equation $A\mathbf{x} = \mathbf{b}$ has multiple solutions for each \mathbf{b} in \mathbb{R}^n .
- (iii) The columns of A do not span \mathbb{R}^n .

1. ii

2. i

3. ii and iii

4. i and iii

LUDecomp2x3b
005 10.0 points

Determine the Lower Triangular matrix L in an LU -Decomposition of

$$A = \begin{bmatrix} -3 & 5 & 0 \\ -15 & 25 & -5 \end{bmatrix}.$$

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

2. $L = \begin{bmatrix} 1 & 0 \\ -5 & 1 \end{bmatrix}$

3. $L = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$

4. $L = \begin{bmatrix} -3 & 0 \\ -15 & -5 \end{bmatrix}$

5. $L = \begin{bmatrix} -3 & 0 \\ 5 & -5 \end{bmatrix}$

6. $L = \begin{bmatrix} -3 & 0 \\ 15 & -5 \end{bmatrix}$

NullSpace01a
006 10.0 points

Find a matrix A so that $\text{Nul}(A)$ is the set of all vectors

$$H = \left\{ \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} : \begin{array}{l} a - 2b = 3c, \\ 4a = c - d, \end{array} \right\}$$

in \mathbb{R}^4 .

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

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

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

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

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

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

Rank02b
007 10.0 points

Determine the rank of the matrix

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

1. $\text{rank}(A) = 1$

2. $\text{rank}(A) = 3$

3. $\text{rank}(A) = 2$

4. $\text{rank}(A) = 5$

5. $\text{rank}(A) = 4$

DetInverseT/F01a
009 10.0 points

The matrix

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

is invertible.

True or False?

1. FALSE
2. TRUE

DetElemOps01TF
008 10.0 points

When the matrix

$$B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

is obtained from

$$A = \begin{bmatrix} c & d \\ a & b \end{bmatrix}$$

by interchanging rows, then

$$\det[B] = \det[A].$$

True or False?

1. FALSE
2. TRUE

SubspaceTF01
010 10.0 points

Let H be the set of points inside and on the unit circle in the xy -plane. That is, let

$$H = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x^2 + y^2 \leq 1 \right\}.$$

H is a subspace of \mathbb{R}^2 . True or false?

1. TRUE
2. FALSE

BasisNull02a
011 10.0 points

Find a basis for the Null space of the matrix

$$A = \begin{bmatrix} 2 & 4 & 6 & -16 \\ 1 & 5 & 9 & -17 \\ -3 & -4 & -5 & 18 \end{bmatrix}.$$

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

LinIndSetsTF01b
012 10.0 points

When $\mathbf{b}_1, \mathbf{b}_2, \dots, \mathbf{b}_p$ are vectors in \mathbb{R}^n and

$$H = \text{Span}\{\mathbf{b}_1, \mathbf{b}_2, \dots, \mathbf{b}_p\},$$

then $\{\mathbf{b}_1, \mathbf{b}_2, \dots, \mathbf{b}_p\}$ is a basis for H .

True or False?

1. FALSE
2. TRUE

CoordVec01a
013 10.0 points

Find the vector \mathbf{x} in \mathbb{R}^2 having coordinate vector

$$[\mathbf{x}]_{\mathcal{B}} = \begin{bmatrix} 8 \\ -5 \end{bmatrix}$$

with respect to the basis

$$\mathcal{B} = \left\{ \begin{bmatrix} 4 \\ 5 \end{bmatrix}, \begin{bmatrix} 6 \\ 7 \end{bmatrix} \right\}$$

for \mathbb{R}^2 .

1. $\mathbf{x} = \begin{bmatrix} -2 \\ -5 \end{bmatrix}$

2. no such \mathbf{x} exists

3. $\mathbf{x} = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$

4. $\mathbf{x} = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$

5. $\mathbf{x} = \begin{bmatrix} -5 \\ -2 \end{bmatrix}$

DimSubspace01a
014 10.0 points

Determine the dimension of the subspace

$$\text{Span} \left\{ \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 9 \\ 4 \\ -2 \end{bmatrix}, \begin{bmatrix} -7 \\ -3 \\ 1 \end{bmatrix} \right\}$$

of \mathbb{R}^3 .

1. $\dim = 3$

2. $\dim = 1$

3. $\dim = 4$

4. $\dim = 2$

5. $\dim = 5$

RankTF06b
015 10.0 points

If B is an echelon form of an $m \times n$ matrix A , and if B has three nonzero rows, then the first three row of A form a basis for $\text{Row}(A)$.

True or False?

1. TRUE

2. FALSE

