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

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

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

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

True or False?

1. TRUE

2. FALSE

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*

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

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

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

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

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

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

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

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

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

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

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

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. TRUE

2. FALSE

5. All of these.

6. i and ii

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 columns of A form a linearly dependent set.*
(iii) *A is not row equivalent to the $n \times n$ identity matrix.*

1. i and iii

2. None of these.

3. iii

4. i

LUDecomp2x3b
005 10.0 points

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

$$A = \begin{bmatrix} 4 & 2 & -4 \\ -20 & -10 & 22 \end{bmatrix}.$$

1. $L = \begin{bmatrix} 4 & 0 \\ -20 & 2 \end{bmatrix}$

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

3. $L = \begin{bmatrix} 4 & 0 \\ 5 & 2 \end{bmatrix}$

4. $L = \begin{bmatrix} 4 & 0 \\ -5 & 2 \end{bmatrix}$

5. $L = \begin{bmatrix} 4 & 0 \\ 20 & 2 \end{bmatrix}$

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

NullSpace01a
006 10.0 points

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

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

in $\mathbb{R}^4$.

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

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

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

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

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

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

Rank02b
007 10.0 points

Determine the rank of the matrix

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

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

2. $\mathrm{rank}(A) = 2$

3. $\mathrm{rank}(A) = 4$

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

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

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

DetInverseT/F01a
009 10.0 points

The matrix

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

is invertible.

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. FALSE

2. TRUE

BasisNull02a
011 10.0 points

Find a basis for the Null space of the matrix

$$A = \begin{bmatrix} 3 & -6 & 12 & 0 \\ 1 & -3 & 7 & 1 \\ -1 & 1 & -1 & 1 \end{bmatrix}.$$

1. $\left\{ \begin{bmatrix} 2 \\ -1 \\ 0 \\ 1 \end{bmatrix} \right\}$

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

3. $\left\{ \begin{bmatrix} -2 \\ -1 \\ 0 \\ 1 \end{bmatrix} \right\}$

4. $\left\{ \begin{bmatrix} 2 \\ 3 \\ 1 \\ 0 \end{bmatrix} \right\}$

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

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

LinIndSetsTF01b
012 10.0 points

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

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

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

True or False?

1. TRUE

2. FALSE

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

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

4. no such $\mathbf{x}$ exists

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 $= 2$

3. dim $= 1$

4. dim $= 4$

5. dim $= 5$

RankTF06b
015 10.0 points

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

True or False?

1. FALSE

2. TRUE