

MIDTERM
MTH501 (Linear Algebra)
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Total marks 40

Objective: 20 marks (20 Mcq's)

Subjective: 20 marks (6 Questions)

Question: 1 (Marks: 1)

Which of the following is the simplified form of $-1[-1 \ 2] + [2 \ 3]$?

Choices:

$[3 \ -1]$

$[-3 \ 1]$

$[3 \ 1]$

$[-3 \ -1]$

Question: 2 (Marks: 1)

The solution of $Ax = b$ exists if and only if b can be written as a linear combination of _____ of A .

Choices:

columns



rows



both columns and rows



elements



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Question: 3 (Marks: 1)

If \vec{v}_1, \vec{v}_2 and \vec{v}_3 are in \mathbb{R}^m then which of the following is equivalent to

$$[\vec{v}_1 \ \vec{v}_2 \ \vec{v}_3] \begin{bmatrix} 2 \\ -7 \\ 5 \end{bmatrix}$$

?

Choices:

$2\vec{v}_1 - 7\vec{v}_2 + 5\vec{v}_3$

.....

$5\vec{v}_1 - 7\vec{v}_2 + 2\vec{v}_3$

.....

$5\vec{v}_1 + 2\vec{v}_2 - 7\vec{v}_3$

.....

$2\vec{v}_1 + 5\vec{v}_2 - 7\vec{v}_3$

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Question: 4 (Marks: 1)

If $v_1 = (2, 2, 2)$, $v_2 = (0, 0, 3)$ and $v_3 = (0, 1, 1)$ span \mathbb{R}^3 , then which of the following is true for any arbitrary $\vec{b} = (b_1, b_2, b_3) \in \mathbb{R}^3$?

Choices:

$(0, 1, 1) = k_1(b_1, b_2, b_3) + k_2(2, 2, 2) + k_3(0, 0, 3)$

$(b_1, b_2, b_3) = k_1(2, 2, 2) + k_2(0, 0, 3) + k_3(0, 1, 1)$

$(0, 0, 3) = k_1(2, 2, 2) + k_2(b_1, b_2, b_3) + k_3(0, 1, 1)$

$(0, 1, 1) = k_1(2, 2, 2) + k_2(0, 0, 3) + k_3(b_1, b_2, b_3)$

Question: 5 (Marks: 1)

If a homogeneous system $Ax=0$ has a trivial solution, then which of the following is (are) the value(s) of the vector x ?

Choices:

-1



.....

0



.....

1



.....

2



.....

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Question: 6 (Marks: 1)

If $\vec{v}_1 = (2, 1)$, $\vec{v}_2 = (3, 4)$ and $\vec{v}_3 = (7, 8)$ then which of the following is true?

Choices:

$\{\vec{v}_1, \vec{v}_2, \vec{v}_3\}$ is linearly dependent.

$\{\vec{v}_1, \vec{v}_2, \vec{v}_3\}$ is linearly independent.



The vector equation has trivial solution.

$\vec{v}_1 = \frac{2}{3} \vec{v}_2$

Question: 7 (Marks: 1)

If A be the standard matrix of linear transformation $T: R^n \rightarrow R^m$, then which of the following is true for the mapping from R^n onto R^m ?

Choices:

The columns of A span R^n .



The columns of A span R^m .



The columns of A are linearly independent.



The columns of A are identical.



Question: 8 (Marks: 1)

Since every linear transformation $T: \mathbb{R}^n \rightarrow \mathbb{R}^m$ is actually a matrix transformation, then which of the following is the alternate notation for the transformation ?

Choices:

$$Ax = x$$



$$Ax = T(x)$$



$$x = Ax$$



$$T(x) = Ax$$



If T be a transformation, then which of the following is true for its linearity?

Choices:

$T(c\hat{u} + d\hat{v}) = cT(\hat{u}) + dT(\hat{v})$; where c and d are scalars

$T(c\hat{u} + d\hat{v}) = cT(\hat{u}) + dT(\hat{v})$; where c and d are scalars



$T(c\hat{u} \times d\hat{v}) = cT(\hat{u}) \times dT(\hat{v})$; where c and d are scalars

$T(c\hat{u} + d\hat{v}) = dT(\hat{u}) + cT(\hat{v})$; where c and d are scalars

Question: **10** (Marks: 1)

Which of the following is the most appropriate operation(s) for the linear transformation ?

Choices:

Scalar multiplication



Vector addition and scalar multiplication



Vector addition



Vector and scalar multiplications



Question: 11 (Marks: 1)

$$A = \begin{bmatrix} 2 & 1 \\ 4 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1+1 & 2-1 \\ 2+2 & 4-1 \end{bmatrix}$$

If A and B are equal matrices, then which of the following is true for A and B ?

Choices:

A and B are equal matrices.

A is the transpose of B .

B is the transpose of A .

B is the multiplicative inverse of A .

Question: 12 (Marks: 1)

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Which of the following is true for the matrix ?

.....

Choices:

It is a null matrix.



It is a scalar matrix.



It is a diagonal matrix.



It is an identity matrix.



Question: **13** (Marks: 1)

What is the maximum possible number of pivots in a 6×6 matrix ?

Choices:

0



2



4



6



confirm it !

Question: 14 (Marks: 1)

If $A\mathbf{x} = \mathbf{b}$ and factorization of A is LU , then which of the following pair of equations can be used to solve $LU\mathbf{x} = \mathbf{b}$ for value of \mathbf{x} , ?

Choices:

$U\mathbf{x} = \mathbf{y}$ and $L\mathbf{y} = \mathbf{b}$

$L\mathbf{x} = \mathbf{y}$ and $U\mathbf{y} = \mathbf{b}$

$U\mathbf{b} = \mathbf{y}$ and $L\mathbf{y} = \mathbf{x}$

$L\mathbf{b} = \mathbf{y}$ and $U\mathbf{y} = \mathbf{x}$

Question: **15** (Marks: 1)

If a system of equations is solved using the Gauss-Seidel method, then which of the following is NOT true about the matrix M that is derived from the coefficient matrix ?

Choices:

All of its entries below the diagonal must be zero .



All of its entries above the diagonal must be zero .

Its determinant is non-zero .

It is an invertible matrix .

+

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Question: **16** (Marks: 1)

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & k & 1 \end{bmatrix}$$

If _____, then which of the following is true for the matrix ?

Choices:

$\det(A) = 1$



confirm it !

$\det(A) = k - 1$



$\det(A) = k$



$\det(A) = k + 1$



Question: 17 (Marks: 1)

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

If $\det(A) = -1$, then which of the following is true for A^{-1} ?

Choices:

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



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



$$\det(A^{-1}) = 0$$



$$\det(A^{-1}) = \pm 1$$



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Question: **18** (Marks: 1)

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

If $\det(A) = 24$, then which of the following is the value of $\det(A)$?

Choices:

6



18



24



36



Question: **19** (Marks: 1)

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

If the determinant of the matrix A is -1 and the matrix B is obtained by adding 2 times of the second row in the first row of the matrix A , then which of the

Choices:

Its determinant is -1 .



.....

Its determinant is 1 .



.....

Its determinant can not be evaluated.



.....

The information is not sufficient to calculate the determinant.



Question: 20 (Marks: 1)

$$A = \begin{bmatrix} 4 & 3 & 5 \\ 3 & 1 & 1 \\ 5 & 7 & 7 \end{bmatrix}$$

If the determinant of the matrix A is 32 and the matrix B is obtained by multiplying any row of A with an integer value 4 , then which of the following is true

Choices:

Its determinant is 18 .

Its determinant is -32 .

Its determinant is 128 .

The information is not sufficient to calculate the determinant.

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Question: **21** (Marks: 2)

$$A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

If _____ and _____, then compute AB ?

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Question: **23** (Marks: 3)

$$A = \begin{bmatrix} 2 & -4 & -3 \\ 3 & 4 & -5 \end{bmatrix} \quad B = \begin{bmatrix} 4 & -5 & -6 \\ 2 & 7 & 10 \end{bmatrix}$$

If _____ and _____, then calculate $(A+B)^t$.

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Question: **24** (Marks: 3)

Construct partitions of the following matrix into three 2×2 blocks :

$$B = \begin{bmatrix} 1 & 2 & 3 & 4 & 1 & 3 \\ 3 & 4 & 5 & 6 & 3 & 4 \end{bmatrix}$$

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Question: **25** (Marks: 5)

Show that the transformation $L: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ defined by $L(x, y, z) = (2y+z, x)$ is linear.

Linear Algebra (MTH501)

Question: **26** (Marks: 5)

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

Find an LU - decomposition of the matrix .

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Question: **22** (Marks: 2)

$$A = \left[\begin{array}{cc|cc} 1 & 3 & 2 & 4 \\ 2 & 4 & 1 & 3 \\ 5 & 3 & 2 & 4 \\ 9 & 8 & 6 & 5 \end{array} \right]$$

$$B = \begin{bmatrix} 2 & 1 \\ 1 & 3 \\ 3 & 6 \\ 4 & 5 \end{bmatrix}$$

If , then make a partition of so that AB must be possible.