Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 1 (Marks: 1)

Let $\mathbb{R}^3$ have the Euclidean inner product. Then $u=(2,1,3), v=(1,7,k)$ are orthogonal for

Choices:

- $k=9$
- $k=-3$

APPROVED

- $k=-9$
- $k=3$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 2 (Marks: 1)

Let $\mathbb{R}^3$ have the Euclidean inner product. Then $u=(k,-3,1), v=(-3,5,6)$ are orthogonal for

Choices:

- $k=2$
- $k=-2$
- $k=3$
- $k=-3$

APPROVED ✓

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 3 (Marks: 1)

Which one is the numerical method used for approximation of dominant eigenvalue of a matrix.

Choices:

- Power method

APPROVED ✓

- Jacobi's method
- Guass Seidal method
- Gram Schmidt process

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 4 (Marks: 1)

The QR-Decomposition of a 3×3 matrix A gives

Choices:

- matrix Q of order 3×1 and R of order 3×1
- matrix Q of order 3×3 and R of order 3×1
- matrix Q of order 3×3 and R of order 3×3

APPROVED

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 5 (Marks: 1)

The matrix equation $A^T A\hat{x} = A^T b$ represents a system of linear equations commonly referred to as the

Choices:

- normal equations for x
- normal equations for $\hat{x}$
- normal equations for A
- normal equations for b

APPROVED

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 6 (Marks: 1)

If u,v and w are vectors in a real inner product space, and k is any scalar , then which one of the following is not a property for the inner product space

Choices:

- $\langle u, kv \rangle = k\langle u, v \rangle$
- $\langle ku, v \rangle = k\langle u, v \rangle$
- $\langle u, v \rangle = k^2\langle u, v \rangle$

APPROVED

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 7 **(Marks: 1)**

$\|u+v+w\| \leq \|u\|+\|v\|+\|w\|$ for all vectors $u, v \, and \, w$ in an inner product space.

Choices:

- True

APPROVED

- False

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 8 (Marks: 1)

If a square matrix has orthonormal columns, then it also has ________.

Choices:

orthonormal rows

APPROVED

orthonormal diagonal

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 9 (Marks: 1)

If two rows are orthogonal, they are ____________.

Choices:

- linearly independent

APPROVED

- linearly dependent

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 10 (Marks: 1)

If a matrix U has orthonormal columns, then ________ = I

Choices:

- UU^T

APPROVED

- UU
- U^{-1}
- $U+U^T$

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 11 (Marks: 1)

The set of vectors {(1, 2, 3), (1, 2, 1),(1, 2, 4),(0,0,0)}is

Choices:

- Linearly independent

APPROVED

- Linearly dependent
- Basis for R^4
- Standard basis for R^3

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 12 (Marks: 1)

$$2x+3y=3$$
$$6x+9y=7$$

The given system has

Choices:

- ○ Unique solution
- ○ Infinitely many solutions
- ○ No solution

  APPROVED ✓

- ○ None of these

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 13 (Marks: 1)

Let A have eigenvalues 2, 5, 0,-7, and -2. Then the dominant eigenvalue for A is

Choices:

- $\lambda = 5$
- $\lambda = 0$
- $\lambda = -7$ ✓
- $\lambda = 2$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: **14** (Marks: 1)

If two rows are ________, they are linearly independent.

Choices:

- orthogonal

APPROVED

- symmetric
- orthonormal
- parallel

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 15 (Marks: 1)

If $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ and $\bar{x} \in \text{Row}(A)$, then which of the following is the most appropriate option ?

Choices:

- $\bar{x} = c_1(1,3) + c_2(2,4)$ ✓
- $\bar{x} = c_1(1,2) + c_2(3,4)$
- $\bar{x} = c_1(1,4) + c_2(3,2)$
- $\bar{x} = c_1(2,3) + c_2(4,1)$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 16 (Marks: 1)

If $B=\{\vec{b}_1, \vec{b}_2\}$ and $C=\{\vec{c}_1, \vec{c}_2\}$ are two basis, let $\vec{x}=2\vec{b}_1+3\vec{b}_2$ and $\vec{x}=5\vec{c}_1-3\vec{c}_2$; then which of the following is the value of $[\vec{x}]_C$?

Choices:

- $\begin{bmatrix}2\\3\end{bmatrix}$
- $\begin{bmatrix}3\\2\end{bmatrix}$
- $\begin{bmatrix}5\\-3\end{bmatrix}$
- $\begin{bmatrix}-3\\5\end{bmatrix}$

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 17 (Marks: 1)

If the general term of a typical signal is $(0.6)^k$, then determine which of the following is the signal for $k=2$?

Choices:

- $(0.6)^2 = 0$
- $(0.6)^2 = 0.36$

APPROVED

- $(0.6)^2 = 3.6$
- $(0.6)^2 = (0.6)^{-2}$

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 18 (Marks: 1)

If the characteristic polynomial of matrix C is $\lambda^2+3\lambda-10$, then which of the following are the Eigenvalues of C ?

Choices:

- -2 and -5
- 2 and -5

- -2 and 5
- 2 and 5

TIME LEFT

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 19 (Marks: 1)

Suppose that $B=\{b_1, b_2, b_3\}$ is a basis for V and $C=\{c_1, c_2, c_3\}$ is a basis for W.
Let $T: V \rightarrow W$ be a linear transformation with the property that
$T(b_1)=5c_1-2c_2+3c_3$, $T(b_2)=4c_1-c_2+7c_3$ and $T(b_3)=c_1-c_2+2c_3$. Determine the value of $[T(b_3)]_C$?

Choices:

- $\begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$

APPROVED

- $\begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$
- $\begin{bmatrix} 4 \\ -1 \\ 7 \end{bmatrix}$
- $\begin{bmatrix} 5 \\ -2 \\ 3 \end{bmatrix}$

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 19 (Marks: 1)

Suppose that $B=\{b_1, b_2, b_3\}$ is a basis for V and $C=\{c_1, c_2, c_3\}$ is a basis for W.

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the value of $[T(b_3)]_C$?

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 21 (Marks: 1)

Let A be $n \times n$ matrix whose entries are real. Then

Choices:

- $\overline{Ax} \neq A\overline{x}$
- $\overline{Ax} = A^t\overline{x}$
- $\overline{Ax} = A\overline{x}$

APPROVED

- $\overline{Ax} = Ax$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 22 (Marks: 1)

If two characteristic vectors correspond with different eigenvalues, then these characteristic vectors are ____________.

Choices:

- linear dependent
- linear independent

APPROVED

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 23 (Marks: 1)

Let $v = (1, -2, 2, 0)$. The unit vector in the same direction as v has magnitude

Choices:

- 3
- 1
- 2
- -1

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 24 (Marks: 1)

Let $v = (0,2,2,1)$. The unit vector in the same direction as v is

Choices:

- $\left(0, \frac{2}{3}, \frac{2}{3}, \frac{-1}{3}\right)$
- $\left(0, \frac{-2}{3}, \frac{2}{3}, \frac{-1}{3}\right)$
- $\left(0, \frac{2}{3}, \frac{2}{3}, \frac{1}{3}\right)$ APPROVED
- $\left(0, \frac{-2}{3}, \frac{2}{3}, \frac{1}{3}\right)$

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 25 (Marks: 1)

The orthogonal projection of y onto u is a scalar multiple of

Choices:

- u
- y
- neither u nor y
- both u and y

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 26 (Marks: 1)

The dimensions of the column space and the row space of an $m \times n$ matrix A are equal. This common dimension, the rank of A, also equals the number of pivot positions in A and satisfies the equation ______.

Choices:

- rank $A = n$
- dim Nul $A = n$
- rank A + dim Nul $A = n$

APPROVED

- rank A - dim Nul $A = n$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 27 (Marks: 1)

If $B=\left\{\begin{pmatrix}0\\1\end{pmatrix},\begin{pmatrix}2\\0\end{pmatrix}\right\}$ for R^2 and an $\vec{x}\in R^2$ has coordinate vector $[\vec{x}]_B=\begin{pmatrix}1\\3\end{pmatrix}$, then which of the following is the value of $\vec{x}$?

Choices:

- $\vec{x}=\begin{pmatrix}6\\1\end{pmatrix}$

APPROVED

- $\vec{x}=\begin{pmatrix}2\\0\end{pmatrix}$
- $\vec{x}=\begin{pmatrix}0\\1\end{pmatrix}$
- $\vec{x}=\begin{pmatrix}1\\3\end{pmatrix}$

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 28 (Marks: 1)

Which of the following is the set of standard basis for R^3 ?

Choices:

- $\{(1,1,0),(0,1,0),(1,0,1)\}$
- $\{(1,0,0),(0,1,0),(0,0,1)\}$ ✓

APPROVED

- $\{(1,0,0),(1,1,0),(0,0,1)\}$
- $\{(1,0,0),(0,1,0),(1,1,1)\}$

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 29 (Marks: 1)

If the magnitudes of eigenvalues are greater than 1, then what can we say about the origin ?

Choices:

- The origin is a Saddle point.
- The origin is a Repellor.

APPROVED

- The origin is an Attractor.

TIME LEFT

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 30 (Marks: 1)

If the magnitudes of eigenvalues are less than 1, then what can we say about the origin ?

Choices:

- The origin is a Saddle point.
- The origin is a Repellor.
- The origin is an Attractor.

APPROVED

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 33 (Marks: 1)

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

Which of the following are the Eigenvalues of the matrix ?

Choices:

- (2,1)

  APPROVED ✓

- (2,3)
- (3,2)
- (2,5)

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 31 (Marks: 1)

Differential operator is ________ operator.

Choices:

a linear

APPROVED

not a linear

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 32 (Marks: 1)

If the eigen value of a square matrix is zero then A is not ___________.

Choices:

- symmetric
- diagonalizable
- invertible
- singular

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 34 (Marks: 1)

The eigenvalues of the matrix $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 2 & 5 \\ 0 & 0 & 1 \end{bmatrix}$ are ________ .

Choices:

- 0, 2, 5
- 2, 1, 5
- 0, 2, 1 APPROVED
- 0, 0, 1

TIME LEFT

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 35 (Marks: 1)

An $n \times n$ matrix with n distinct eigenvalues is diagonalizable.

Choices:

True

APPROVED

False

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 36 (Marks: 1)

The vectors: ------- are orthogonal in $\mathbb{R}^2$?

Choices:

- $\begin{pmatrix}1\\0\end{pmatrix}, \begin{pmatrix}2\\0\end{pmatrix}$
- $\begin{pmatrix}1\\1\end{pmatrix}, \begin{pmatrix}2\\0\end{pmatrix}$
- $\begin{pmatrix}1\\0\end{pmatrix}, \begin{pmatrix}0\\2\end{pmatrix}$ ✓

  APPROVED
- $\begin{pmatrix}0\\1\end{pmatrix}, \begin{pmatrix}0\\2\end{pmatrix}$

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 37 (Marks: 1)

Which statement is FALSE.

Choices:

- If $Ax = \lambda x$ for some real number λ then λ is known as eigenvalue of the matrix A.
- The eigenvalues of any matrix are the elements on its main diagonal.
- In order to find the eigenvalues we solve the equation $|A - \lambda I| = 0$
- The eigenvalues of triangular matrix are the elements on its main diagonal..

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Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 38 (Marks: 1)

Let A be an $n \times n$ matrix whose distinct eigenvalues are $\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_p$. The matrix A is diagonalizable if the sum of the dimensions of the distinct eigenspaces equals ....

Choices:

- n^2
- n

  APPROVED
- $n \times n$
- 0

Linear Algebra (MTH501)

Question: 39 (Marks: 1)

If $\hat{y} = \begin{bmatrix} 3 \\ -3 \\ 3 \end{bmatrix}$ and $z = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$, the value of $z.\hat{y} =$ ______.

Choices:

- $\begin{bmatrix} -3 \\ -3 \\ 6 \end{bmatrix}$
- $\begin{bmatrix} 2 \\ -2 \\ 5 \end{bmatrix}$
- 0
- 1

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 40 (Marks: 1)

What is the least eigen value of the matrix: $\begin{bmatrix} 1 & 0 \\ 1 & 2 \end{bmatrix}$

Choices:

- 1
- -1
- 2
- 0

Question: 42 (Marks: 2)

$$x = \begin{bmatrix} 0 \\ -5 \\ 2 \end{bmatrix} \; and \; y = \begin{bmatrix} -4 \\ -1 \\ 8 \end{bmatrix}$$

Find the distance between

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 43 (Marks: 2)

If order of matrix A is 9×11 with a two-dimensional null space , then determine rank of A ?

Question: 45 (Marks: 3)

Construct the normal equation for $\hat{x}$ of the equation $Ax = b$ where

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

Linear Algebra (MTH501)

Question: 48 (Marks: 3)

Assume that the mapping $T : P_2 \to P_2$ defined by

$$T\left(a_0 + a_1 t + a_2 t^2\right) = 3a_0 + \left(5a_0 - 2a_1\right)t - \left(4a_1 + a_2\right)t^2$$

is linear transformation.

Find the matrix representation of T relative to the basis $B = \{1, t, t^2\}$.

Question: **49** (Marks: 5)

$$\hat{x} = \begin{bmatrix} \frac{4}{3} \\ \frac{-1}{3} \end{bmatrix}$$

Compute the least square error associated with the least square solution of the

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

equation $Ax = b$ where

Question: **51** (Marks: 5)

Let $G=\{\bar{g}_1, \bar{g}_2, \bar{g}_3\}$ and $H=\{\bar{h}_1, \bar{h}_2, \bar{h}_3\}$ be basis for a vector space V, also suppose that $\bar{h}_1=2\bar{g}_1-\bar{g}_2+\bar{g}_3$, $\bar{h}_2=2\bar{g}_2+3\bar{g}_3$ and $\bar{h}_3=-2\bar{g}_1+\bar{g}_3$.

(a) Find the change-of -coordinate matrix from H to G.

(b) Find the $[\bar{x}]_G$ for $\bar{x}=2\bar{h}_1-2\bar{h}_2+\bar{h}_3$.

Question: 46 (Marks: 3)

Determine whether the set S = {u_1, u_2, u_3} are orthogonal basis for $\mathbb{R}^3$ also express the

$$\begin{bmatrix} 6 \\ 1 \\ -8 \end{bmatrix}$$

vector as a linear combination of the given set of vectors in S. where

$$u_1 = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}, u_2 = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}, u_3 = \begin{bmatrix} -1/2 \\ -2 \\ 7/2 \end{bmatrix}$$

Linear Algebra (MTH501)

Question: 47 (Marks: 3)

Verify that the signals 2^k and $(-4)^k$ are the solutions of the difference equation $y_{k+2} + 2y_{k+1} - 8y_k = 0$

Question: **50** (Marks: 5)

Determine whether the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ is diagonalizable .If so, find a nonsingular matrix P such that $P^{-1}AP = D$.

Virtual University Overseas Examination System V2.1 (x86)

Linear Algebra (MTH501)

Question: 44 (Marks: 2)

Is the following set of vectors is orthogonal with respect to the Euclidean inner product on $\mathbb{R}^3$?

$$\left(\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}},-\frac{2}{\sqrt{6}}\right),\left(\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}},0\right)$$