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MTH501 FINAL TERM SOLVED MCQs

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Question No: 1 (Marks: 1) - Please choose one

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

Reduced echelon form of the matrix is

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

▶

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

▶

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

▶

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

▶

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Question No: 2 (Marks: 1) - Please choose one

A matrix that results from applying a single elementary row operation to an identity matrix is called

► **Invertible matrix**

► Singular matrix

► Scalar matrix

► Elementary matrix

Question No: 3 (Marks: 1) - Please choose one

For an n×n matrix $(A^t)^t$ =

► A^t

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► **A**

► A^{-1}

► $(A^{-1})^{-1}$

Question No: 4 (Marks: 1) - Please choose one

What is the largest possible number of pivots a 4×6 matrix can have?

► 4

► 6

► 10

► 0

Question No: 5 (Marks: 1) - Please choose one

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The characteristic polynomial of a 5×5 matrix is $\lambda^5 - 4\lambda^4 - 45\lambda^3 = 0$,the eigenvalues are

► 0,-5, 9

► 0,0,0,5,9

► 0,0,0,-5,9

► 0,0,5,-9

Question No: 6 (Marks: 1) - Please choose one

Find the characteristic equation of the given matrix

$$\begin{bmatrix} 6 & 8 & 5 & 4 \\ 0 & 2 & -8 & 7 \\ 0 & 0 & 9 & 6 \\ 0 & 0 & 0 & 6 \end{bmatrix}$$

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- $(6-\lambda)(2-\lambda)(9-\lambda)=0$

- $(6-\lambda)(8-\lambda)(5-\lambda)(4-\lambda)=0$

- $(6-\lambda)^2(2-\lambda)(9-\lambda)=0$

- $(6-\lambda)(6-\lambda)(7-\lambda)(4-\lambda)=0$

Question No: 7 (Marks: 1) - Please choose one

A is diagonalizable if $A=PDP^{-1}$ Where

- D is any matrix and P is an invertible matrix

- D is a diagonal matrix and P is any matrix

- D is a diagonal matrix and P is invertible matrix

- D is a invertible matrix and P is any matrix

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from book
A square matrix *A* is said to be diagonalizable if *A* is similar to a diagonal matrix. i.e. if *A* = $P^{-1}DP$ for some invertible matrix *P* and some diagonal matrix *D*.

Question No: 8 (Marks: 1) - Please choose one

The inverse of an invertible lower triangular matrix is

► lower triangular matrix

► upper triangular matrix

► diagonal matrix

The standard operations on triangular matrices conveniently preserve the triangular form: the sum and product of two upper triangular matrices is again upper triangular. The inverse of an upper triangular matrix is also upper triangular, and of course we can multiply an upper triangular matrix by a constant and it will still be upper triangular. This means that the upper triangular matrices form a subalgebra of the ring of square matrices for any given size. The analogous result holds for lower triangular matrices. Note, however, that the product of a *lower* triangular with an *upper* triangular matrix does *not* preserve triangularity.

http://en.wikipedia.org/wiki/Triangular_matrix

Question No: 9 (Marks: 1) - Please choose one

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If P is a parallelepiped in R^3, then

{volume of T (P)} = |detA|. {volume of P}

► Where T is determined by a 2×2 matrix A

► Where T is determined by a 2×3 matrix A

► **Where T is determined by a 3×3 matrix** A not conf.

► Where T is determined by a 3×2 matrix A

Question No: 10 (Marks: 1) - Please choose one

Let A be a $n\times m$ matrix of rank r then row space of A has dimension

► $m-r$

► $n-r$

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► r

► nm

Main article: Rank (linear algebra)

The dimension of the row space is called the **rank** of the matrix. This is the same as the maximum number of linearly independent rows that can be chosen from the matrix. For example, the 3 × 3 matrix in the example above has rank two.

The rank of a matrix is also equal to the dimension of the column space. The dimension of the null space is called the **nullity** of the matrix, and is related to the rank by the following equation:

$$\operatorname{rank}(A) + \operatorname{nullity}(A) = n,$$

where n is the number of columns of the matrix A. The equation above is known as the rank-nullity theorem.

[edit]

Question No: 11 (Marks: 1) - Please choose one

The dimension of the vector space P_4 is

► 4

► 3

► 5

► 1

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The dimension of the vector space P_4 is 4. FALSE It's 5.

Question No: 12 (Marks: 1) - Please choose one

Let $u=(3,-2), v=(4,5)$ .For the weighted Euclidean inner product $\langle u,v\rangle = 4u_1v_1 + 5u_2v_2$

$\langle v,u\rangle =$

► 2

► -2

► 3

► -3

Question No: 13 (Marks: 1) - Please choose one

Let A be $n \times n$ matrix whose entries are real. If λ is an eigenvalue of A with x a corresponding eigenvector in $\mathbb{C}^n$, then

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- ► $A\bar{x} = \lambda \bar{x}$
- ► $A\bar{x} = \bar{\lambda}\bar{x}$
- ► $A\bar{x} = \bar{\lambda}x$
- ► $A\bar{x} = \lambda^{-1}\bar{x}$

Question No: 14 (Marks: 1) - Please choose one

$$A = \begin{bmatrix} 1.25 & -.75 \\ -.75 & 1.25 \end{bmatrix}$$

Suppose that has eigenvalues 2 and 0.5 .Then origin is a

- ► Saddle point
- ► Repellor
- ► Attractor

Question No: 15 (Marks: 1) - Please choose one

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

► Power method

► Jacobi's method

► Guass Seidal method

► Gram Schmidt process

Question No: 16 (Marks: 1) - Please choose one

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

► normal equations for x

► normal equations for $\hat{x}$

► normal equations for A

► normal equations for b

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Question No: 17 (Marks: 1) - Please choose one

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

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

Question No: 18 (Marks: 1) - Please choose one

If W is a subspace of $\mathbb{R}^m$, then the transformation $T : \mathbb{R}^m \to W$ that maps each vector x in $\mathbb{R}^m$ into its orthogonal x in W is called the orthogonal projection of

- ► $\mathbb{R}^m$ in $\mathbb{R}^m$

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- $\mathbb{R}^m$ in W

- $\mathbb{R}^m$ in x

Question No: 19 (Marks: 1) - Please choose one

If $V = \mathbb{R}^n$, $B = \{b_1, b_2\}$ and $C = \{c_1, c_2\}$ then row reduction of $[c_1 \quad c_2 \quad b_1 \quad b_2]$ to $[I \quad P]$ Produces a matrix P that satisfies

- $[x]_B = P[x]_B$ for all x in V

- $[x]_C = P[x]_B$ for all x in V

- $[x]_B = P[x]_C$ for all x in V

- $[x]_B = [x]_C$ for all x in V

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Question No: 20 (Marks: 1) - Please choose one

The Casorati matrix for the signals 1^k, $(-2)^k$ and 3^k is

$$\begin{bmatrix} 1^k & (-2)^k & 3^0 \\ 1^{k+1} & (-2)^{k+1} & 3^1 \\ 1^{k+2} & (-2)^{k+2} & 3^2 \end{bmatrix}$$

►

$$\begin{bmatrix} 1^k_{k+1} & (-2)^k_{k+1} & 3^k_{k+1} \\ 1 & (-2) & 3 \\ 1^{k+2} & (-2)^{k+2} & 3^{k+2} \end{bmatrix}$$ not conf.

►

$$\begin{bmatrix} 1^0 & (-2)^k & 3^k \\ 1^1 & (-2)^{k+1} & 3^{k+1} \\ 1^2 & (-2)^{k+2} & 3^{k+2} \end{bmatrix}$$

►

Question No: 21 (Marks: 2)

Find the characteristic polynomial and all eigenvalues of the given matrix

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$$\begin{bmatrix} a & a \\ a & a \end{bmatrix}$$

Question No: 22 (Marks: 2)

Write the Fourier coefficients $a_k \text{ and } b_k$ to the function $f(t) = 2\pi - t$ on the interval $[0, 2\pi]$.

Question No: 23 (Marks: 2)

The matrix A is followed by a sequence $\{x_k\}$ produced by the power method. Use these data to estimate the largest eigenvalue of A.

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

$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 0.25 \end{bmatrix}, \begin{bmatrix} 1 \\ 0.3158 \end{bmatrix}, \begin{bmatrix} 1 \\ 0.3298 \end{bmatrix}, \begin{bmatrix} 1 \\ 0.3326 \end{bmatrix}$$

Question No: 24 (Marks: 3)

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If $A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$ then find an invertible matrix P such that $P^{-1}AP = D(\textit{diagonal matrix})$

Question No: 25 (Marks: 3)

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

Check whether the matrix has orthonormal columns or not?

Question No: 26 (Marks: 3)

If A is a 6×4 matrix, what is the smallest possible dimension of Null A?

Question No: 27 (Marks: 5)

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Assume that the matrix ***A*** is row equivalent to ***B***. Without calculations, list rank ***A*** and dim Nul ***A***. Then find bases for Col ***A*** and Row ***A***.

$$A=\begin{bmatrix}1 & 2 & -2 & 3\\ 2 & 5 & 0 & -7\\ 3 & 7 & -2 & -4\end{bmatrix} \qquad B=\begin{bmatrix}1 & 2 & -2 & 3\\ 0 & 1 & 4 & -13\\ 0 & 0 & 0 & 0\end{bmatrix}$$

Question No: 28 (Marks: 5)

$$\begin{bmatrix}a & -b\\ b & a\end{bmatrix}$$

Find an invertible matrix P and a matrix C of the form such that the given matrix A has the form $A=PCP^{-1}$.

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

$v=\begin{bmatrix}1+3i\\ 2\end{bmatrix}$ *whichcorrespondstheeigenvalue* $\lambda=2-3i$ with eigenvalue $\lambda=2\pm 3i$ and eigenvector

Question No: 29 (Marks: 5)

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$$u = \begin{bmatrix} 2 \\ -5 \\ -1 \end{bmatrix}, v = \begin{bmatrix} -7 \\ -4 \\ 6 \end{bmatrix}$$

Let .Compute and compare $u.v, \|u\|^2, \|v\|^2 \text{ and } \|u+v\|^2$. Do not use Pythagorean Theorem.

Question No: 30 (Marks: 10)

$$A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 3 \end{bmatrix}, b = \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix}$$

Find a least squares solution of the inconsistent system $Ax = b$ where .

Question No: 31 (Marks: 10)

Determine whether the signals $1^k, 2^k$, and $(-2)^k$ are the solutions of the difference equation

$y_{k+3} - y_{k+2} - 4y_{k+1} + 4y_k = 0$.

The null space of A is the solution set of the equation

Ax = 0. TRUE

The null space of an m _ n matrix is in R_m. False. It's R_n

The column space of A is the range of the mapping x 7! Ax.

TRUE

If the equation Ax = b is consistent, then Col A is R_m.

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FALSE must be consistent for all b

The kernel of a linear transformation is a vector space. TRUE

To show this we show it is a subspace

Col A is the set of a vectors that can be written as Ax for some x. TRUE Remember that Ax gives a linear combination of columns of A using x entries as weights.

The null space is a vector space. TRUE

The column space of an m _ n matrix is in R_m TRUE

Col A is the set of all solutions of Ax = b. FALSE It is the set of all b that have solutions.

Nul A is the kernel of the mapping x 7! Ax. TRUE

The range of a linear transformation is a vector space. TRUE

It's a subspace(check), thus vector space.

The set of all solutions of a homogenous linear di_erential equation is the kernel of a linear transformation. TRUE

A single vector is itself linearly dependent. FALSE unless it in the zero vector

If H =Spanfb_1; : : : ; b_ng then fb_1; : : : ; b_ng is a basis for H.

FALSE They may not be linearly independent.

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The columns of an invertible n _ n matrix form a basis for R^n

TRUE They are linerly independent and span R^n. (why?)

A basis is a spanning set that is as large as possible. FALSE It is is too large, then it is no longer linearly independent.

In some cases, the linear dependence relations among the columns of a matrix can be a_ected by certain elementary row operations on the matrix. FALSE They are not a_ected.

A linearly independent set in a subspace H is a basis for H. FALSE It may not span.

If a _nite set S of nonzero vectors spans a vector space V, the some subset is a basis for V. TRUE by Spanning Set Theorem A basis is a linearly independent set that is as large as possible. TRUE

The standard method for producing a spanning set for Nul A, described in this section, sometimes fails to produce a basis. FALSE It NEVER fails!!!

If B is an echelon form of a matrix A, then the pivot columns of B form a basis for Col A. FALSE Must look at corresponding columns in A.

The number of pivot columns of a matrix equals the

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dimension of its column space. TRUE Remember these columns and linearly independent and span the column space.
A plane in R_3 is a two dimensional subspace of R_3. FALSE unless the plane is through the origin.

The dimension of the vector space P_4 is 4. FALSE It's 5.

If dimV = n and S is a linearly independent set in V, then S is a basis for V. FALSE S must have exactly n elements.

If a set fv1 : : : vng spans a _nite dimensional vector space V and if T is a set of more than n vectors in V, then T is linearly dependent. TRUE The number of linearly independent vectors that span a set is unique.

R_2 is a two dimensional subspace of R_3. FALSE Not a subset, as before.

The number of variables in the equation Ax = 0 equals the dimension of Nul A. FALSE It's the number of free variables.

A vector space is in_nite dimensional is it is spanned by an in_nite set. FALSE It must be impossible to span it by a _nite set.

If dim V = n and if S spans V. then S is a basis for V.
FALSE S must have exactly n elements or be noted as linearly independent.

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The only three dimensional subspace of R_3 is R_3 itself. TRUE

If spanned by three vectors must be all of R_3.

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