

mth212 List of Questions

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Q1 The homogeneous system $AX = 0$ has a non-trivial solution if and only if

- ☐ $\dim(U) = 0$
- ☐ $\text{Ker}(U) = 0$
- ☐ $|A| = 0$
- ☐ $\text{field}(U) = 0$

Q2 A linear transformation $T : U \rightarrow V$ is diagonalizable if and only if

- ☐ V has only one basis
- ☐ V has a basis consisting of two pairs eigenvectors of t
- ☐ V has a basis consisting of eigenvalues only
- ☒ V has a basis consisting of eigenvectors of t

Q3 Every square matrix satisfies its

- ☐ diagonalization
- ☐ linear transformation
- ☐ linear dependency
- ☒ characteristic polynomial

Q4 Cayley-Hamilton theorem to find the $\det(A)$ of a matrix

- ☐ determinant
- ☒ inverse
- ☐ dimension
- ☐ kernel

Q5 A scalar λ is an eigenvalue of a matrix A if and only if

- ☒ it is a root of the matrix A
- ☐ it is a root is a polynomial of order T
- ☐ it is inverse root of the matrix A
- ☐ it is not root of the characteristic matrix A

Q6 The minimal polynomial and the characteristic polynomial of a linear transformation

- ☐ have no roots
- ☐ have different roots
- ☒ have equal roots
- ☐ are known as minimal transformation

Q7 A linear transformation (or matrix) is diagonalizable if

- ☐ its eigenvectors are distinct.
- ☒ its eigenvalues are distinct.
- ☐ its eigenvalues are complex numbers
- ☐ its eigenvectors are complex numbers

Q8 Eigenvectors of a linear transformation (or matrix) corresponding to distinct eigenvalues are

- ☐ linearly dependent
- ☒ linearly independent
- ☐ linear transformation

- ☐ diagonalizable

Q9 A scalar γ is an eigenvalue of a linear transformation T if and only if

- ☐ it is not root of the characteristic polynomial of T
- ☐ it is the square root of the characteristic polynomial of T
- ☐ it is a root of the characteristic polynomial of T
- ☐ it is not a root of the characteristic polynomial of the eigen vector

Q10 Cayley-Hamilton theorem is related to

- ☐ Pythagoras theorem
- ☐ characteristic equation of a matrix
- ☐ inverse of a matrix
- ☐ equation of a vector quantity

Q11 Let U and V be finite- dimensional vector spaces over F and $T : U \rightarrow V$ be a linear transformation , then $\text{rank}(T) + \text{nullity}(T) =$

- ☐ $\dim(U)$
- ☐ $\ker(U)$
- ☐ $\text{Field}(U)$
- ☐ zero

Q12 A linear transformation T on a finite-dimensional vector space V is if and only if there exists a basis of V consisting of eigenvector of T.

- ☐ finite-dimensional
- ☐ linear transformation
- ☐ diagonalizable
- ☐ transformative

Q13 theorem states that "Every square matrix satisfies its characteristics polynomial".

- ☐ Polynomial
- ☐ Isomorphic
- ☐ Dual
- ☐ Cayley-Hamilton

Q14 Let U and V be vector spaces over a field F. A linear transformation $T : U \rightarrow V$ that is one - to-one is called

- ☐ surjective
- ☐ injective
- ☐ subjective
- ☐ objective

Q15 Let U and V be vector spaces over a field F and $\dim U = n$. Let $T : U \rightarrow V$ be a linear operator, then $\text{rank}(T) + \text{nullity}(T) =$

- ☐ n
- ☐ U
- ☐ V
- ☐ nU

Q16 Let U, V be vector spaces over a field F of dimensions m and n respectively, then $L(U, V)$ is a vector space of dimension

- ☐ mn
- ☐ m+n
- ☐ m
- ☐ n

Q17 Let U and V be vector spaces over a field F . Let $T : U \rightarrow V$ be a one-one and onto linear transformation, then T is called $\diamond\diamond\diamond\diamond\diamond$ between U and V

- ☐ monomorphism
- ☒ isomorphism
- ☐ dual
- ☐ kernel

Q18 If $T(\alpha_1 u_1 + \alpha_2 u_2) = \alpha_1 T(u_1) + \alpha_2 T(u_2)$, for $\alpha_1, \alpha_2 \in F$ and $u_1, u_2 \in U$ then the linear transformation $T : U \rightarrow F$ is known as $\diamond\diamond\diamond\diamond\diamond$.

- ☐ finite-dimensional
- ☐ isomorphic
- ☐ linear transformation
- ☒ linear functional

Q19 The space $L(U, F)$ is the $\diamond\diamond\diamond\diamond\diamond$ of U given that U is a vector space over F

- ☒ dual
- ☐ isomorphic
- ☐ linear functional
- ☐ kernel

Q20 A linear transformation is invertible if it is $\diamond\diamond\diamond\diamond\diamond\diamond\diamond$.

- ☐ into
- ☐ one-one
- ☒ one-one and onto
- ☐ onto

Q21 The determinant of $\begin{bmatrix} 1 & -2 & 1 \\ x & 5 & 2x \\ 3 & -x & 4 \end{bmatrix}$ is $\diamond\diamond\diamond\diamond\diamond\diamond\diamond$.

- ☐ x^2
- ☒ $x^2 - 4x + 5$
- ☐ $x - 2x$
- ☐ 15

Q22 One of the following is not a property of determinants

- ☐ Non-square matrices have no determinants
- ☒ If two rows or columns are interchanged, the determinant is zero
- ☐ If a row or column of a matrix is multiplied by any constant, the result is the product of the determinant and the constant
- ☐ If two rows or columns are the same, the determinant is zero

Q23 What is the determinant rank of the determinant of $\begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}$

- ☐ 0
- ☒ 1

- ☐ 2
- ☐ 3

Q24 The determinant rank of an $m \times n$ matrix A is equal to the of A .

- ☐ row
- ☒ rank
- ☐ column
- ☐ kernel

Q25 Every matrix can be reduced to a row-reduced echelon matrix by a ... of elementary row operations.

- ☒ finite sequence
- ☐ infinite sequence
- ☐ sequence
- ☐ series

Q26 The ... of a row-reduced echelon matrix is equal to the number of its non-zero rows

- ☐ row
- ☒ rank
- ☐ column
- ☐ kernel

Q27 A square matrix A such that $[a_{ij}] = 0$ for all $i > j$ is called ...

- ☐ lower triangular
- ☒ upper triangular
- ☐ strictly lower triangular
- ☐ strictly upper triangular

Q28 An $m \times n$ matrix A is called a row reduced echelon matrix if

- ☐ the non-zero rows come before the rows
- ☐ In each non-zero row, the first non-zero entry is one
- ☐ the first non-zero entry in every non-zero row (after the first row) is to the right of the first non-zero entry in the preceding row
- ☒ all of the options

Q29 Let $T \in A(V)$, then T is invertible if and only if the constant term in the minimal polynomial of T is ...

- ☒ not zero
- ☐ zero
- ☐ not one
- ☐ one

Q30 Every vector space is isomorphic to its ... dual.

- ☐ first
- ☒ second
- ☐ third
- ☐ fourth

Q31 The determinant of $\begin{bmatrix} x^2+1 & x^5+2x^3 & x^4 \end{bmatrix}$ is ...

- ☒ $\lfloor -2x^3 + x^2 + 24x + 15 \rfloor$
- ☐ $\lfloor x^2 - 4x + 5 \rfloor$
- ☐ $\lfloor x - 2x \rfloor$
- ☐ $\lfloor 15 \rfloor$

[illegible]

- square array of numbers arranged in rows and columns.
- circular array of numbers arranged in rows and columns.
- triangular array of numbers arranged in rows and columns.
- rectangular array of numbers arranged in rows and columns.

Q33 A square matrix whose transpose is equal to the negative of the matrix itself is known as

- ☒ skew-symmetric
- ☐ asymmetric
- ☐ symmetric
- ☐ negative square

Q34 The dimension of the matrix $\begin{bmatrix} 1 & 2 & 5 \\ 3 & 2 & 8 \\ 1 & 0 & -5 \\ -2 & 1 & 0 \end{bmatrix}$ is

- ☐ 4 by 3
- ☒ 3 by 4
- ☐ 3 by 3
- ☐ 12

Q35 $\begin{bmatrix} 0 & -1 & 3 \\ -1 & 2 & 5 \\ 3 & 5 & -4 \end{bmatrix}$ is a .. matrix

- ☐ skew-symmetric
- ☐ asymmetric
- ☒ symmetric
- ☐ square

Q36 Given that U and V are vector spaces over a field F . Let $T : U \rightarrow V$ be a linear transformation, then the set $\{x \in U \mid T(x) = 0\}$ is called the

- ☐ transformation
- ☐ space
- ☒ kernel of T
- ☐ range of T

Q37 For any linear transformation $T : U \rightarrow V$, let the dimension of U be finite ,then Ker T has a $\frac{1}{2}(\dim U + \dim \text{Ker } T)$ dimension

- ☐ finite
- ☐ infinite
- ☐ linear
- ☐ non linear

Q38 The determinant of $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 0 & 0 \\ 7 & 8 & 9 \end{bmatrix}$ is $\diamond? \diamond\diamond? \diamond\diamond\diamond? \diamond\diamond\diamond\diamond? \diamond\diamond\diamond\diamond\diamond? \dots$

- ☐ 12
☐ 3
☐ 1
☒ 0

Q39 The dimension of the kernel of T is the same as the of T

- space

Q40 A matrix whose determinant is zero is called

- ☐ non singular