

Definitions

Notations

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| • $f : \mathcal{D} \rightarrow \mathcal{C}$ | • $\mathbb{R}[x], \mathcal{P}(\mathbb{R})$ | • $\mathcal{L}(V), \mathcal{L}(V, V)$ |
| • $x \mapsto y$ | • $[v]_{\mathcal{B}}, \text{Rep}_{\mathcal{B}}(v)$ | • $\mathcal{L}(V, \mathbb{R})$ |
| • $f \circ g \circ h$ | • $V \cong W$ | • $\text{Im}T$ |
| • $x \sim y$ | • $\text{Col}(A)$ | • $\text{Ker}T$ |
| • S/\sim | • $\text{Row}(A)$ | • $\dim U$ |
| • $\{c_i\}_{i=1}^n$ | • $\text{Nul}(A)$ | • $[T]_{\mathcal{B} \rightarrow \mathcal{C}}, [T]_{\mathcal{C}}^{\mathcal{B}}$ |
| • $\text{span}(v_1, \dots, v_n)$ | • $\text{rank}(A)$ | • $[T]_{\mathcal{B}}$ |
| • $A \times B$ | • A^T | • $\langle \cdot, \cdot \rangle, \langle v_1, v_2 \rangle$ |
| • $U + W$ | • A^{-1} | • $\ \cdot \ , \ x\ $ |
| • $x + U$ | • I_n | • $\text{Proj}_u(v)$ |
| • $M_{m \times n}(\mathbb{R})$ | • $GL_n(\mathbb{R})$ | • SBWOC |
| • $M_n(\mathbb{R})$ | • $\text{id} : S \rightarrow S$ | • TFAE |
| • $\mathbb{R}_n[x], \mathcal{P}_n(\mathbb{R})$ | • $\mathcal{L}(V, W)$ | • iff |

1. A *binary relation* is
2. An *equivalence relation* is
3. Given \sim an equivalence relation on set S , the *equivalence class* with representative $x \in S$ is
4. Given \sim an equivalence relation on set S , S/\sim is
5. A *linear system of equations* is
6. List all three *elementary row operations*.
7. Matrix is in *ref* if ; in *rref* if
8. Describe *Gauss-Jordan elimination*.
9. Let $u, v \in \mathbb{R}^n$. Their addition is defined to be
10. Let $u \in \mathbb{R}^n$ and $k \in \mathbb{R}$. ku is defined to be
11. Let $u, v \in \mathbb{R}^n$. Their *dot product* $u \cdot v$ is
12. Let $A \in M_{m \times n}(\mathbb{R})$ and $v \in \mathbb{R}^n$. Av is defined to be
13. Set V with two operations $+, \cdot$ over field \mathbb{F} is a *vector space* over \mathbb{F} if

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14. Subset U in vector space V is a *subspace* if
 15. A *linear combination* of vectors v_1, \dots, v_n is of the form
 16. A *homogenous system* is
 17. The *span* of v_1, \dots, v_n is the set
 18. Vectors v_1, \dots, v_n are *linearly independent* if
 19. They are *linearly dependent* if
 20. A vector space V is *finite-dimensional* if
 21. An *ordered basis* of a vector space V is
 22. Let \mathcal{B} be an ordered basis for finite dimensional vector space V . For vector $v \in V$, its *coordinate vector* w.r.t. basis \mathcal{B} is
 23. The *standard basis* for \mathbb{R}^n is
 24. The *dimension* of vector space V is
 25. Let $A \in M_{m \times n}(\mathbb{R})$. Define $\text{Col}(A)$, $\text{Nul}(A)$, $\text{Row}(A)$.
 26. Let $A \in M_{m \times n}(\mathbb{R})$ and $B \in M_{n \times p}(\mathbb{R})$. Their product AB is
 27. Let $A, B \in M_{m \times n}(\mathbb{R})$. Their sum $A + B$ is
 28. Let $A \in M_{m \times n}(\mathbb{R})$ and $k \in \mathbb{R}$ then kA is
 29. Let $A \in M_{m \times n}(\mathbb{R})$. Its *transpose*, A^T , is
 30. Function $f : \mathcal{D} \rightarrow \mathcal{C}$ is injective/1-to-1 if, surjective/onto if and bijective/1-to-1 correspondence if
 31. Function T from vector space V to vector space W , both over \mathbb{R} , is a \mathbb{R} -*linear map* if
 32. Let $A \in M_{m \times n}(\mathbb{R})$ then we can define a *linear map associated with A* by
 33. A vector space *isomorphism* is
 34. Two vector spaces are said to be *isomorphic* if
 35. $\mathcal{L}(V, W)$ is used to denote
 36. The *identity map* on set S is
 37. We say linear map $T : V \rightarrow W$ is *invertible* if
 38. *Row rank* of matrix A is
 39. *Column rank* of matrix A is
 40. *Rank* of matrix A is

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41. Let $T \in \mathcal{L}(V, W)$. *Image* of T is and *Kernel* of T is
42. Let $T \in \mathcal{L}(V, W)$. $\text{rank} T$ is defined to be
43. $E \in M_n(\mathbb{R})$ is an *elementary matrix* if
44. Matrix $A \in M_n(\mathbb{R})$ is *invertible* if
45. Let V be a vector space over \mathbb{R} with basis $B = \langle b_1, \dots, b_n \rangle$ and W be a vector space over \mathbb{R} with basis $C = \langle c_1, \dots, c_n \rangle$. Then the *matrix associated with T* with respect to basis B and C , denoted by $[T]_{B \rightarrow C}$ is
46. Let $T \in \mathcal{L}(V, V)$ and let B, C be two different bases for V . We have the identity $[T]_{B \rightarrow B} =$
47. Let B, C be two bases for vector space V . Then the *change of bases matrix* from B to C is given by
48. Let V be a vector space over \mathbb{R} . Function $\langle \cdot, \cdot \rangle : V \times V \rightarrow \mathbb{R}$ is an *inner product* if
49. Let V be a vector space over \mathbb{R} . Function $\| \cdot \| : V \rightarrow \mathbb{R}$ is a *norm* if
50. Given an inner product $\langle \cdot, \cdot \rangle$, the *norm* induced by it is given by
51. Two vectors in inner product space V are said to be orthogonal if
52. Consider vector v and non-zero vector u in inner product space V . The *orthogonal projection* of v onto the direction of u is given by
53. Vectors $\{v_1, \dots, v_n\}$ in inner product space are said to form an *orthonormal set* if
54. An *orthonormal basis* for vector space V is
55. Describe *Gram-Schmidt process*.
56. Let U be a subspace with an orthonormal basis $\{q_1, \dots, q_m\}$ in vector space V . Then for any vector $v \in V$, the *orthogonal projection* of v onto subspace U is given by