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Tags: [[Linear Algebra]], [[Matrix Determinants]], [[Matrix Invertibility]], [[Rank & Nullity Theorem]], [[Column & Row Space]], [[Fundamental Subspaces]], [[Function & Relations]], [[Basis & Dimension]], [[Vector Spaces]], [[Coordinate Systems]]

Reference:

[[Linear Algebra Test 2 Guide - MATH 2164]]

1. Compute the Determinant of a Matrix

Use for:

- Checking invertibility
- Applying Cramer's Rule
- Verifying properties like `det(AB) = det(A) * det(B)`
- Validating row operation effects

TI-84 Steps:

1. `2nd` → `MATRIX` → `EDIT` → Choose `[A]`, enter matrix.
2. `2nd` → `QUIT` → Return to home screen.
3. `2nd` → `MATH` → Choose `det(`.
4. `2nd` → `MATRIX` → Select `[A]` → Close `)`, then `ENTER`.

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2. Perform Elementary Row Operations (via RREF)

Use for:

- Solving systems
- Finding pivot positions
- Determining linear independence
- Constructing basis from spanning sets

TI-84 Steps:

1. `2nd` → `MATRIX` → `EDIT` → Input matrix `[A]`.
2. On home: `2nd` → `MATRIX` → `MATH` → Select `rref(`.
3. Then `2nd` → `MATRIX` → Choose `[A]`, close `)`, then `ENTER`.

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3. Compute Inverse of a Matrix

Use for:

- Coordinate vector transformations: `[v]_B = M_B⁻¹ * v`
- Change of basis
- Solving systems `x = A⁻¹b`

TI-84 Steps:

1. Store `[A]` via `2nd` → `MATRIX` → `EDIT`.
2. On home screen: `[A]` → `x⁻¹` (via `x⁻¹` button) → `ENTER`.

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4. Multiply Matrices

Use for:

- Matrix equations like `M_B⁻¹ * v` or `M_C⁻¹ * M_B`
- Changing coordinates
- Linear combinations

TI-84 Steps:

1. Input `[A]` and `[B]` into matrices.
2. On home: `[A] * [B]` → `ENTER`.

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5. Multiply Matrix by Scalar

Use for:

- Verifying determinant rules like `det(kA) = kⁿ * det(A)`
- Row/column scaling

TI-84 Steps:

1. Enter scalar → `*` → `2nd` → `MATRIX` → select matrix.
2. `ENTER`.

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6. Use Cramer's Rule

Use for:

- Solving `Ax = b` using `xⱼ = det(Aⱼ) / det(A)`

TI-84 Steps:

1. Compute `det(A)` and `det(Aⱼ)` where you replace j-th column with b.
2. Use steps from #1 to compute each determinant.
3. Divide: `det(Aⱼ)/det(A)` manually.

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7. Solve System via Inverse Matrix

Use for:

- Shortcut solution to `Ax = b`

TI-84 Steps:

1. Enter matrix `[A]` and vector `[B]` (as a column matrix).
2. On home: `[A]⁻¹ * [B]` → `ENTER`.

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8. Find a Basis (from Spanning Set)

Use for:

- Determining independence and dimension
- Finding basis from spanning set using Gaussian elimination

TI-84 Steps:

1. Store vectors as rows in a matrix `[A]`.
2. Perform `rref([A])`.
3. Look at pivot rows/columns to find basis vectors.

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9. Construct Coordinate Vector `[v]_B`

Use for:

- Coordinatization in a non-standard basis

TI-84 Steps:

1. Form matrix `[M_B]` with basis vectors as columns.
2. Compute inverse: `M_B⁻¹`.
3. Multiply: `M_B⁻¹ * v`.

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10. Change of Basis (from B to C)

Use for:

- Computing `[v]_C = M_C⁻¹ * M_B * [v]_B`

TI-84 Steps:

1. Input `M_B` and `M_C` into `[A]`, `[B]`.
2. Compute inverse: `M_C⁻¹ = [B]⁻¹`.
3. Multiply: `M_C⁻¹ * M_B`.

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11. Compute Adjoint (Transpose of Cofactor Matrix)

Use for:

- Inverse via `A⁻¹ = 1/det(A) * adj(A)`

TI-84 Steps: WARNING: TI-84 **cannot compute cofactors or adjoints directly**, but you can:

- Manually input the cofactor matrix as `[C]`.

- Use `2nd` → `MATRIX` → `MATH` → `Transpose(` to get `adj(A)`.

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12. Compute Rank (Number of Pivots)

Use for:

- Applying Rank-Nullity Theorem
- Finding dimension of Column Space or Row Space

TI-84 Steps:

1. Perform `rref([A])`.
2. Count non-zero rows to get rank.

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13. Test Linear Independence

Use for:

- Determining if vectors form a basis

TI-84 Steps:

1. Store vectors as rows of `[A]`.
2. Perform `rref([A])` and see if there are any free variables (non-pivot columns).