VECTORS

2 vectors equal <-> same magnitude + same direction

norm/magnitude/length of vector $||v|| = \text{sqrt}(v_1^2 + ... + v_n^2)$

unit vector -> ||v|| = 1. (v / ||v||)

||cv|| = |c| ||v||

distance d(u,v) = ||u-v||

Dot product u•v = (u_1v_1 + ... + u_nv_n)

n cos(theta) = u•v / (||u|| ||v||)

u&v are orthagonal when dot(u,v) = u•v = 0

Equations of Lines/Planes

vector form	**x** = **x_0** + t**v**
parametric in R^2	x = x_0 + ta, y = y_0 + tb
parametric in R^3	x = x_0 + ta, y = y_0 + tb, z = z_0 +tc
General form of plane R^3	Ax + By + Cz = D
point normal eq of a plane	**n** • (**x** - **x_0**)
vector eq of a plane	**x** = **x_0** + s**v_1** + t**v_2**

Inverse Matrices

Inversion Algorithm

> $[A | I] \to ... [|] ... \to [I | A^{-1}]$

Invertible Matrix Theorem

Invertible Matrix Theorem

Invertible Matrix Theorem (cont)

If A is an n x n matrix, and if T_A is the linear operator on R^n with standard matrix A, then the following statements are equivalent.

1. A is invertible.
2. The RREF of A is Identity matrix.
3. A can be written as a product of elementary matrices.
4. A**x** = **0** has only the trivial solution: **x** = **0**
5. A**x** = **b** has exactly one solution for every vector **b** in R^n: **x** = A^{-1}**b**.
6. A**x** = **b** is consisten for every vector **b** in R^n.
7. The column vectors of A are linearly independent.
8. The row vectors of A are linearly independent.
9. det(a) ≠ 0.
10. λ = 0 is not an eigenvalue of A.
11. T_A is one-to-one.
12. T_A is onto.
13. The column vectors of A span R^n.
14. The row vectors of A span R^n.
15. The column vectors of A form a basis for R^n.
16. The row vectors of A form a basis for R^n.
17. rank(A) = n
18. nullity(A) = 0
19. A has full column rank.

EigenSTUFF

The scalar lambda(λ) is called an Eigenvalue of A when there is a nonzero vector x such that Ax = λx.

Vector x is an Eigenvector of A corresponding to λ.

The set of all eigenvectors with the zero vector is a subspace of R^n called the eigenspace of λ.

1. Find Eigenvalues: det(λI - A) = 0

2. Find Eigenvectors: (λI - A)x = 0

If A is a triangular matrix then its eigenvalues are on its main diagonal