MATH2101

- 1. matrix & determinant
- 2. system of linear equation
- 3. vector subspace
  - vector space
    - Df: addition, scalar multiplication s.t. several property
    - zero vector
    - Exp: column vector, matrices: Mat_n*m function
  - vector subspace
    - Pf: vector subspace zero vector exist closed under addition closed under scalar multiplication
    - "zero vector space" is also "zero vector subspace"
    - vector subspace => vector space
  - span: span(S)
    - span(S) => vector subspace
    - span(S) := minimal vector space containing all vectors in S
    - col(A) := column space = span({v1,v2,..vn})
      - v in col(A) <=> v = Ax
    - spanning set: Span(S) = V
      - Pf: span(S) = V <=> Ax=u (any u in V) A invertible >>consistent>>span
  - linear independence
    - dependence: exist non-zero independence: any {v...}, only trival
    - Pf: linear independence homo system linear Eqn => RREF
  - basis and dimension
    - Df: linearly independence + span
      - standard basis (ei)
      - basis of spanning set
        - S independence => S is basis of span(S)
        - S dependent => basis?
      - S smaller than basis => span(S)!=V S larger than basis => S dependent
      - v = unique combination of basis
        - existence (by Df basis) + uniqueness
    - dimension
      - (assume basis is finite set, though having counter exp - poly)
      - basis has largest # of id vectors <=> | id set | <= | basis |
      - dimension determines | basis | <=> 2 bases have same size
      - Df: dim(V) := | basis |
        - dim(R^n) = n
        - S id => dim(span(S)) = | S |
        - dim(vector subspace) <= dim(vector space)
        - # of linearly dependent vector bounded by dim(vector space)
    - construction of a basis
      - extension
        - add v (in V) if not in span(S)
      - | S | = dim(V) & S independence => S is a basis
        - S dependent , span(S) =V => exist some v in S , st. span(S\{v}) = V
      - reduction
      - span(V) ???
  - compare: linearly independence spanning set dimension
- 4.
- 5.

from

- ways to calculate matrix multiplication A*B
  - element(i, j) = row_i(A) * col_j(B) **sum numbers together respectively**
  - row_i(C) = a_i1*row_1(B) + a_i2*row_2(B) + ... **A i-th row as parameter**
  - col_j(C) = b_1j*col_1(A) + b_2j*col_2(A) **B j-th col as parameter**
- multiply elementary matrix to represent row operation
  - EA : row operation AE: col operation
- convert unkown to known (given condition)