# Contents



# 1 Things to Study For Quiz

## 1.1 Basic Vector and Matrix Operations

### 1.1.1 Multiplication

- Vector-Vector multiplication
- Vector-Matrix multiplication
- Matrix-Matrix multiplication
- Matrix-Vector multiplication

### 1.1.2 Finding Matrix Inverse

- For 2x2 Matrix:

  If A =

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

  $A^{-1}$ =

  1/det(A) *

$$\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

### 1.1.3 Determinant

The factor by which a linear transformation changes the "area/volume" of a unit square/cube in a grid

If negative, then the unit square is "flipped" over its axis. (Like a square on paper after flipping the piece of paper)

- If A =

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

**det(A) = ad - bc**

- For calculating 3x3 matrices, go along the top row, and for a, b, c, cover the current row and column of a, b, c and multiply the a, b, c with the determinant of the uncovered numbers.
  - For the "a" term, it's positive
  - For the "b" term, it's negative
  - For the "c" term, it's positive
- If M =

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

A =

$$\begin{bmatrix} e & f \\ h & i \end{bmatrix}$$

B =

$$\begin{bmatrix} d & f \\ g & i \end{bmatrix}$$

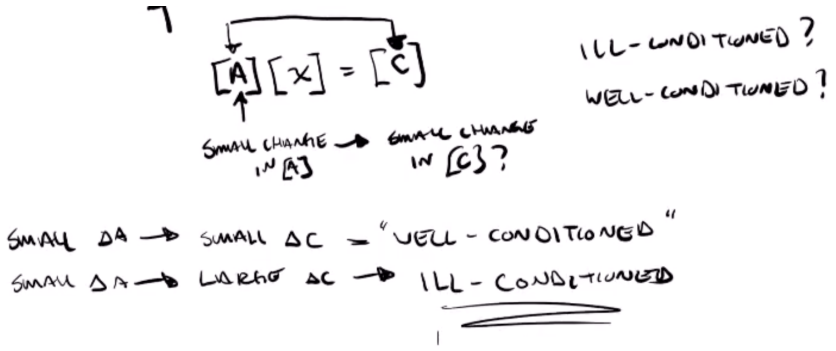
C =

$$\begin{bmatrix} d & e \\ g & h \end{bmatrix}$$

**det(M) = a*det(A) - b*det(B) + c*det(C)**

### 1.1.4 Condition Number

This is a measure of how much a small change in the transformation matrix or the output would affect the input vector




- If condition(A) $\cong 1.0 \rightarrow$ "Well Conditioned"
- If condition(A) $> 1.0 \rightarrow$ "Ill Conditioned"
- Condition(A): $\kappa(A) = ||A|| * ||A^{-1}||$

## 1.2 Vector Norms

- $l_\infty$ Norm:
  $max_i|x_i|$
- $l_p$ Norm:
  $\Sigma_{i=1}^{n} (|n|^p)^{1/p}$

## 1.3 Vector Derivatives

- General Derivatives

| | | |
|---|---|---|
| Logarithms | $\ln(x)$ | $1/x$ |
| | $\log_a(x)$ | $1 / (x \ln(a))$ |
| Trigonometry (x is in radians) | $\sin(x)$ | $\cos(x)$ |
| | $\cos(x)$ | $-\sin(x)$ |
| | $\tan(x)$ | $\sec^2(x)$ |
| Inverse Trigonometry | $\sin^{-1}(x)$ | $1/\sqrt{(1-x^2)}$ |
| | $\cos^{-1}(x)$ | $-1/\sqrt{(1-x^2)}$ |
| | $\tan^{-1}(x)$ | $1/(1+x^2)$ |
| | | |

## 1.4 Machine Learning Basics

1. Regression
2. Classification
3. Clustering
4. Dimensionality Reduction
5. Activations functions (Logistic, ReLU, Leaky ReLU...)
6. Convex functions

## 1.5 Topics not on the Quiz

- Neural Networks