

Maths

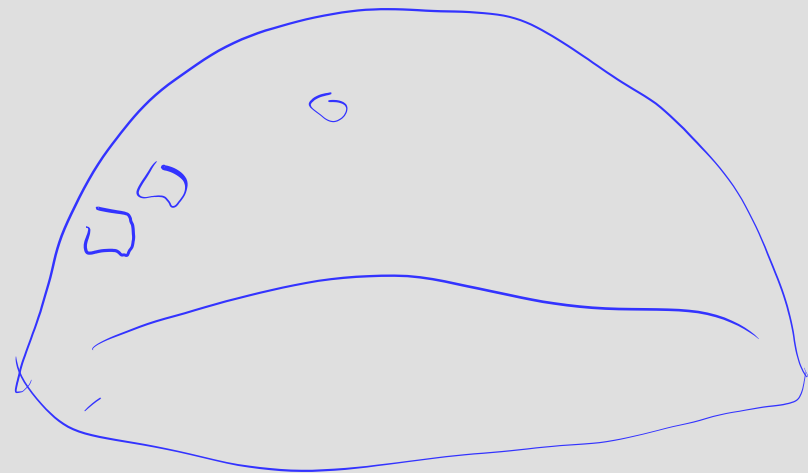
✓ Vectors

✓ Matrices

✓ LS of

✓ Derivatives

✓ Spherical Integrals



Vectors

→ list of real numbers

~~repr of Cayley construction of super complex~~

direction → magnitude

$(3, -2, \frac{1}{2}, 8)$

row
 $[3 \quad -2 \quad \frac{1}{2} \quad 8]$

column

$\begin{bmatrix} 3 \\ -2 \\ \frac{1}{2} \\ 8 \end{bmatrix}$

element-wise op

$$(x, y, z) + (a, b, c) \rightarrow (x+a, y+b, z+c)$$

Scaling

$$S(x, y, z) \rightarrow (sx, sy, sz) \text{ — normalizing} = \frac{1}{\|v\|}$$

Dot (inner)
Product
(cross)

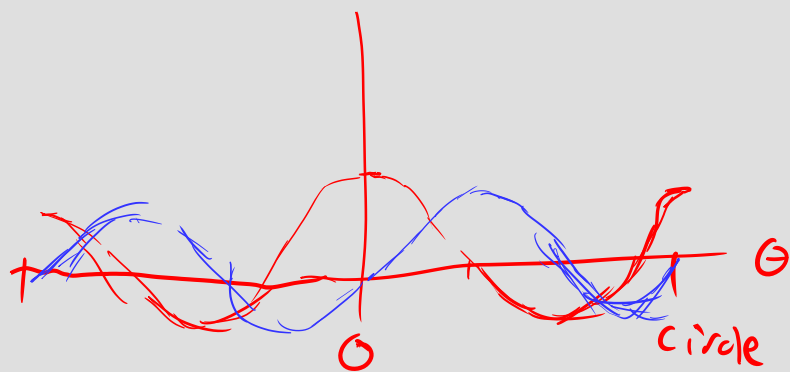
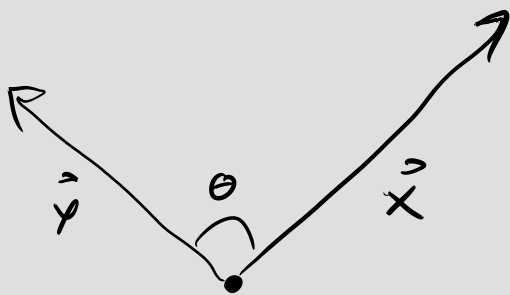
and
level

$$\begin{matrix} \text{Vec} & & \text{Vec} & & \text{real number} \\ (x, y, z) \cdot (a, b, c) \rightarrow xa + yb + zc \end{matrix}$$

3-vectors

$$\begin{matrix} \text{Vec} & & \text{Vec} & & \text{probably - lookup} \\ (x, y, z) \times (a, b, c) \rightarrow (yc - bz, \quad xc + za, \quad xb - ya) \\ \text{Vec} & & \text{Vec} & & \text{Vec} \end{matrix}$$

$$\|\vec{x}\| \equiv \sqrt{\vec{x} \cdot \vec{x}}$$



— bits if point same direct

$$\vec{x} \cdot \vec{y} = \|\vec{x}\| \cdot \|\vec{y}\| \cdot \cos(\theta)$$

— bits if perp

$$\|\vec{x} \times \vec{y}\| = \|\vec{x}\| \cdot \|\vec{y}\| \cdot \sin(\theta)$$

dir $\vec{x} \times \vec{y}$ = perp to both \vec{x} & \vec{y}
(use right hand rule)

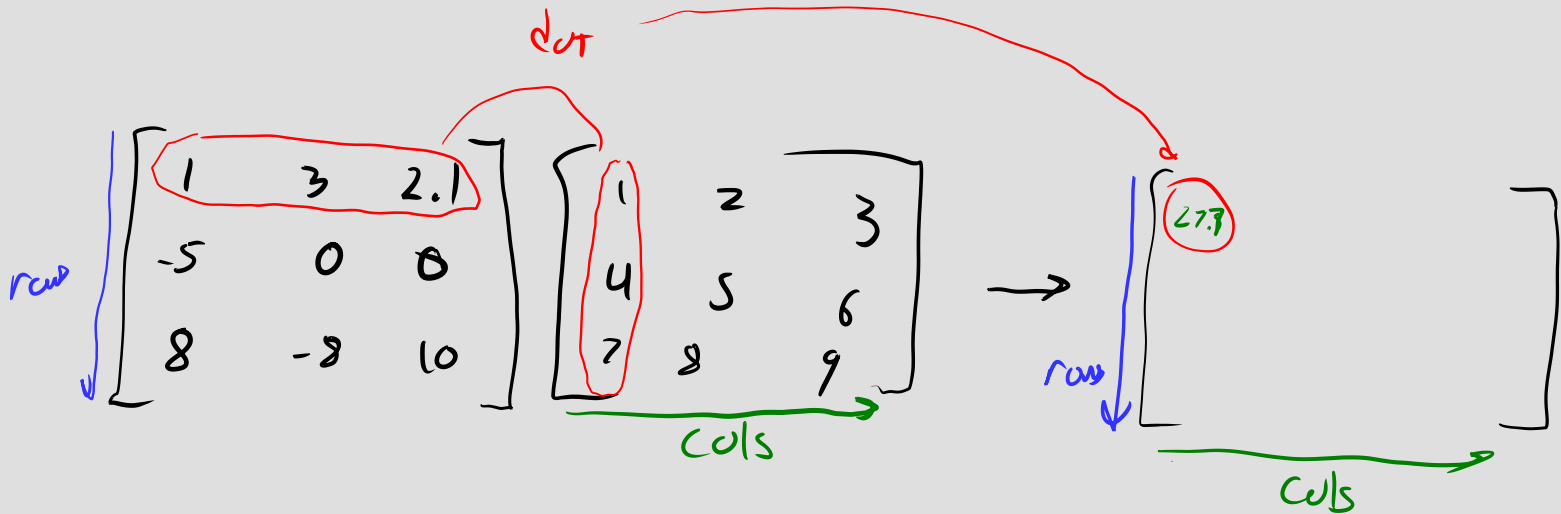
Normal \rightarrow perpendicular
#

normal \rightarrow length 1 \leftarrow unit

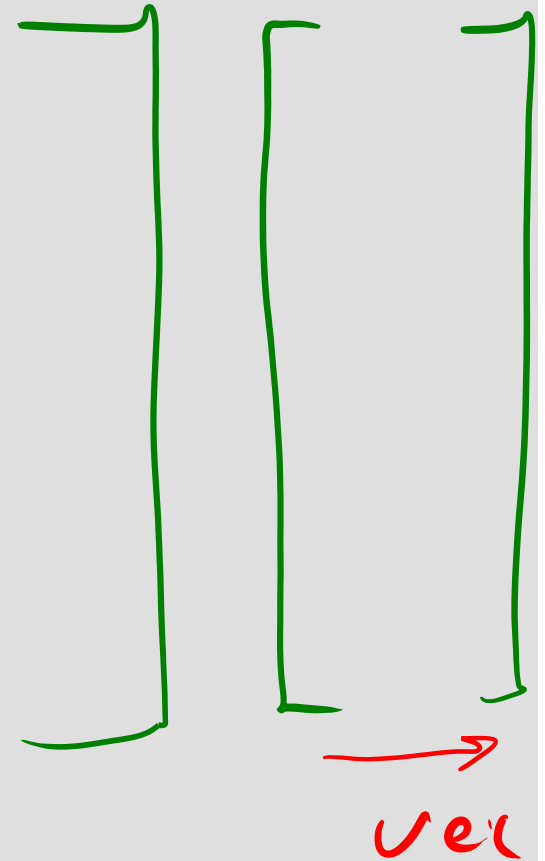
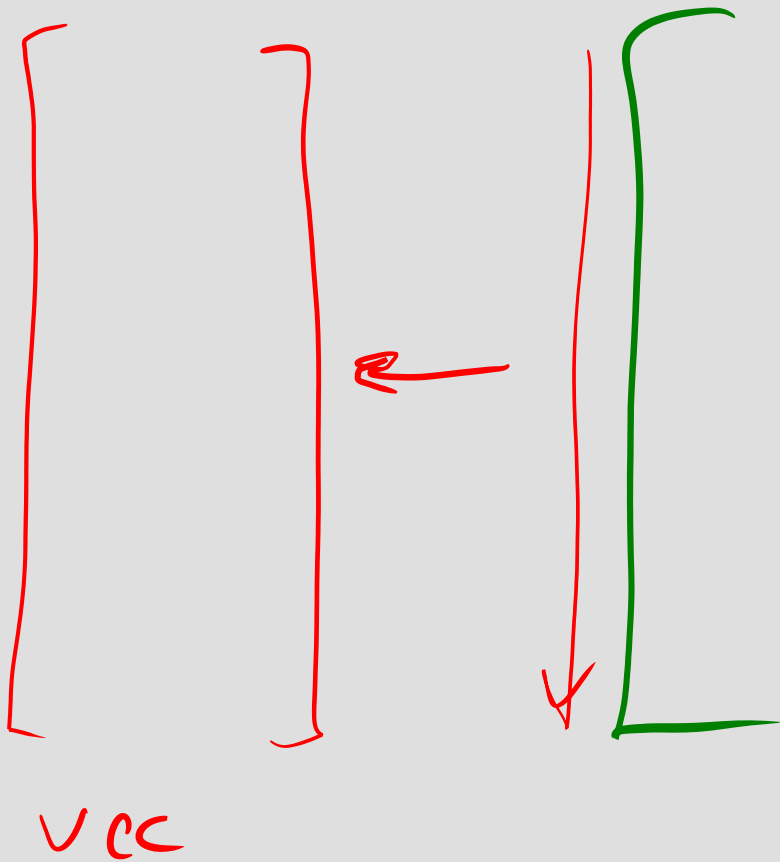
Matrices

Matrices

grid of numbers
linear operation



Mat • Vec
↑
column
2nd



Vec → Vec

Mat . Vec \rightarrow Means

|

linear
operator

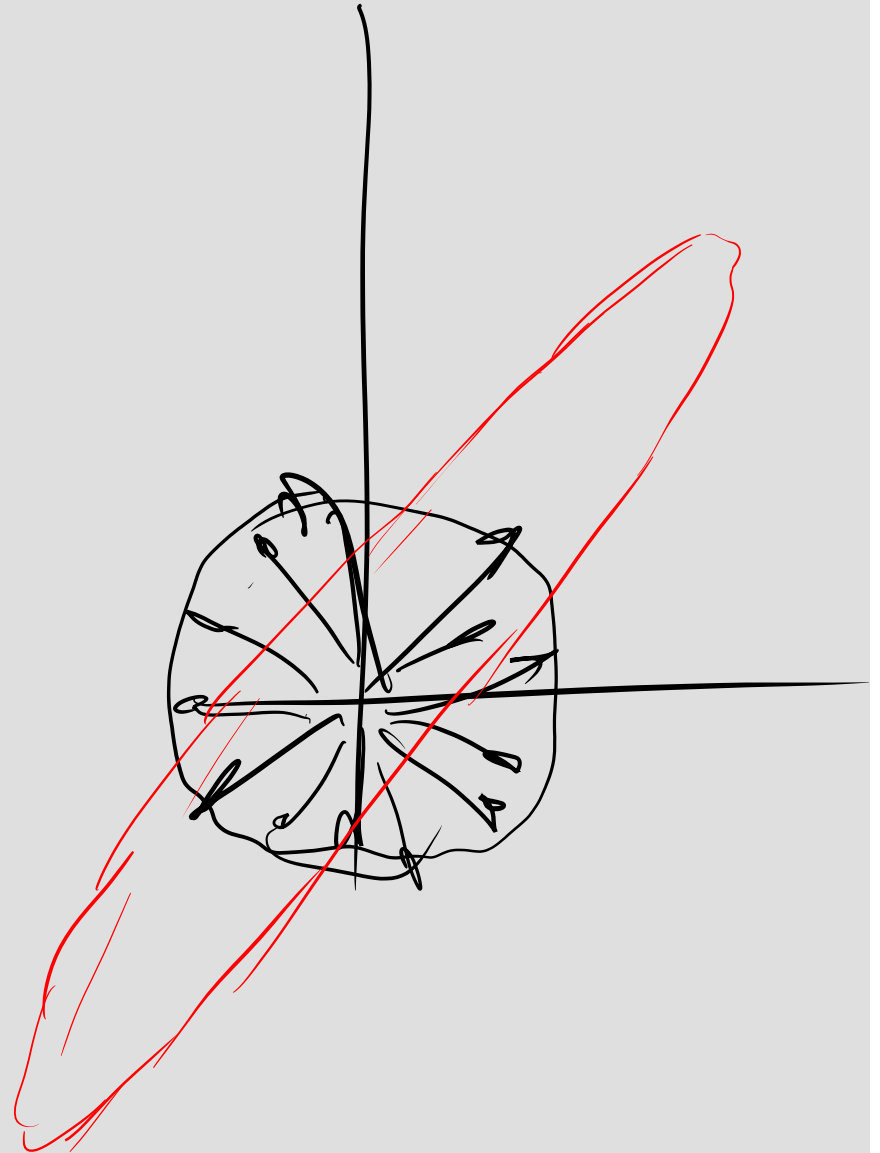
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Squash

Stretch

rotate

flip



Matrix inverse

$$2x + 3y = 11$$

$$-2x + 18y = 3$$



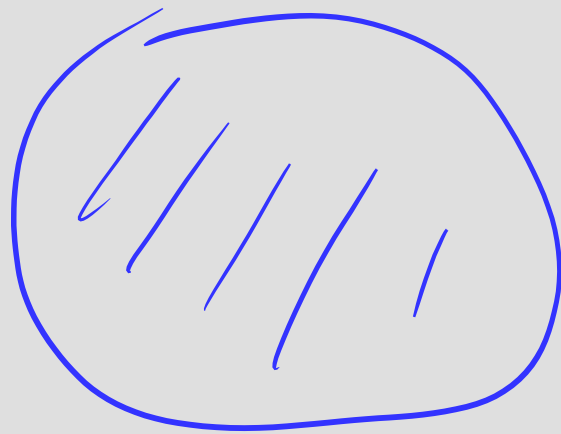
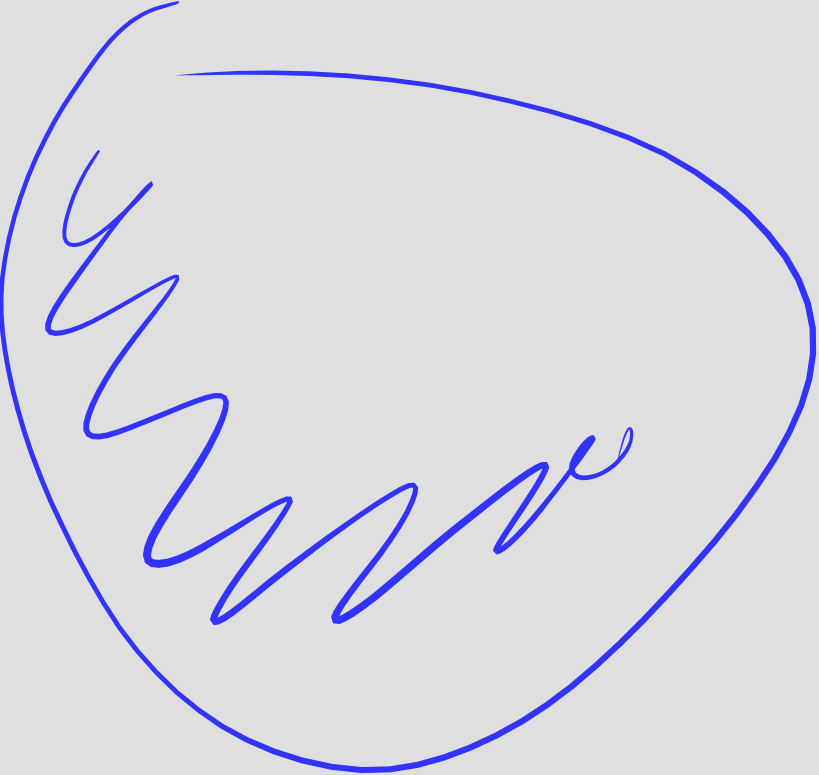
$$\begin{bmatrix} 2 & 3 \\ -2 & 18 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 11 \\ 3 \end{bmatrix}$$

$$\underbrace{A^{-1}A}_{I} \vec{x} = A^{-1}\vec{b}$$
$$\vec{x} = A^{-1}\vec{b}$$

$$M \quad M^{-1}$$

$$M \cdot M^{-1} = I$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

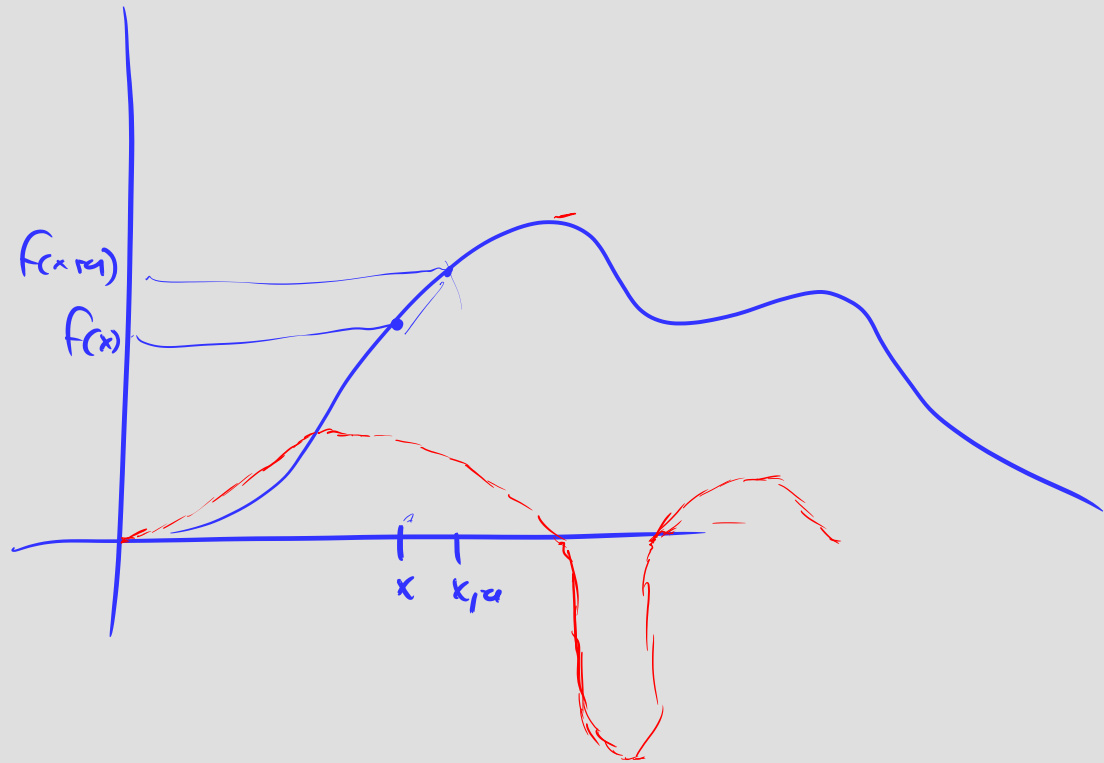


derivative

• Graph of slopes

$$\frac{f(x+a) - f(x)}{a}$$

for very small a



Motion

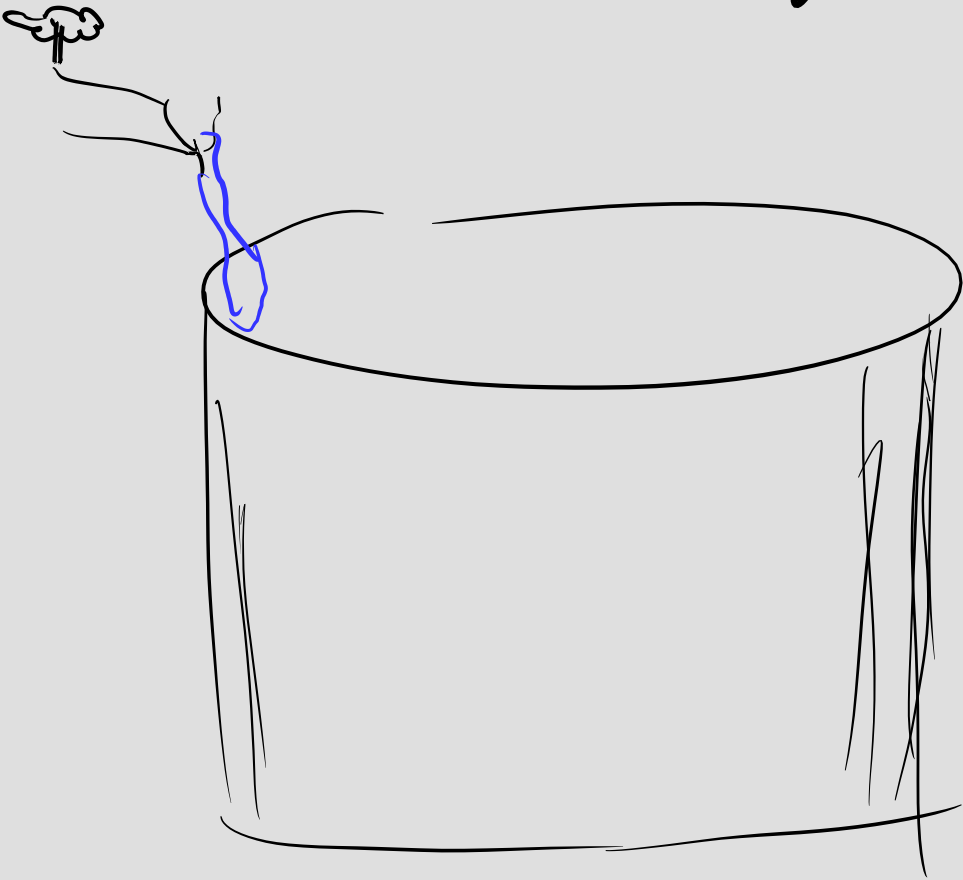
pos (time)

Speed (time) = derivative of position

acceleration = derivative of speed

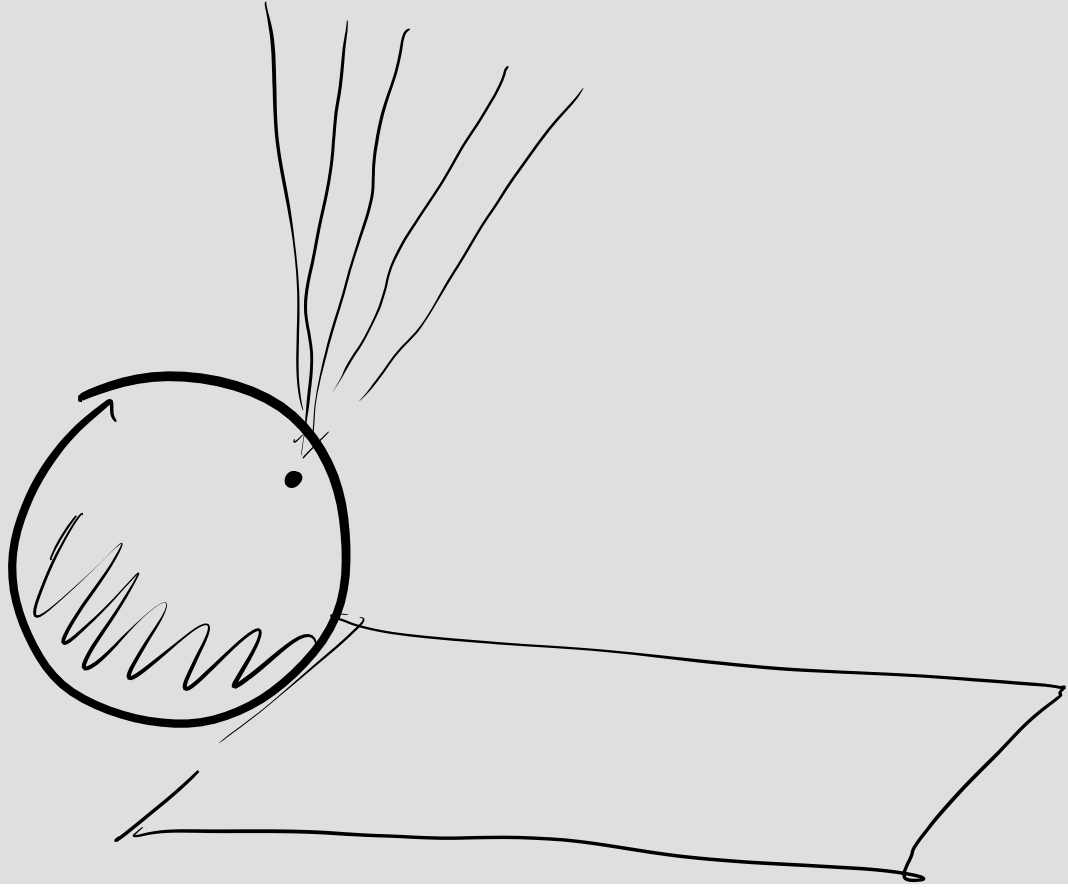
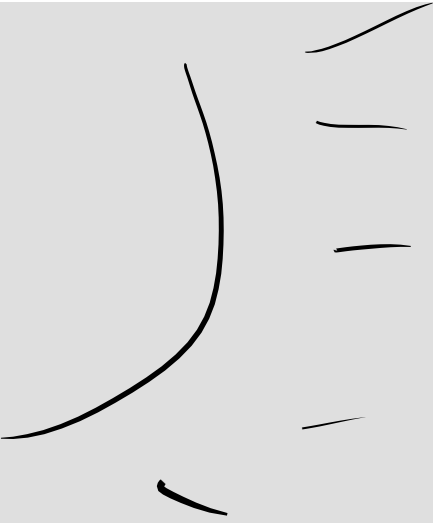
Jerk = derivative of accel

Integral = sum of everything



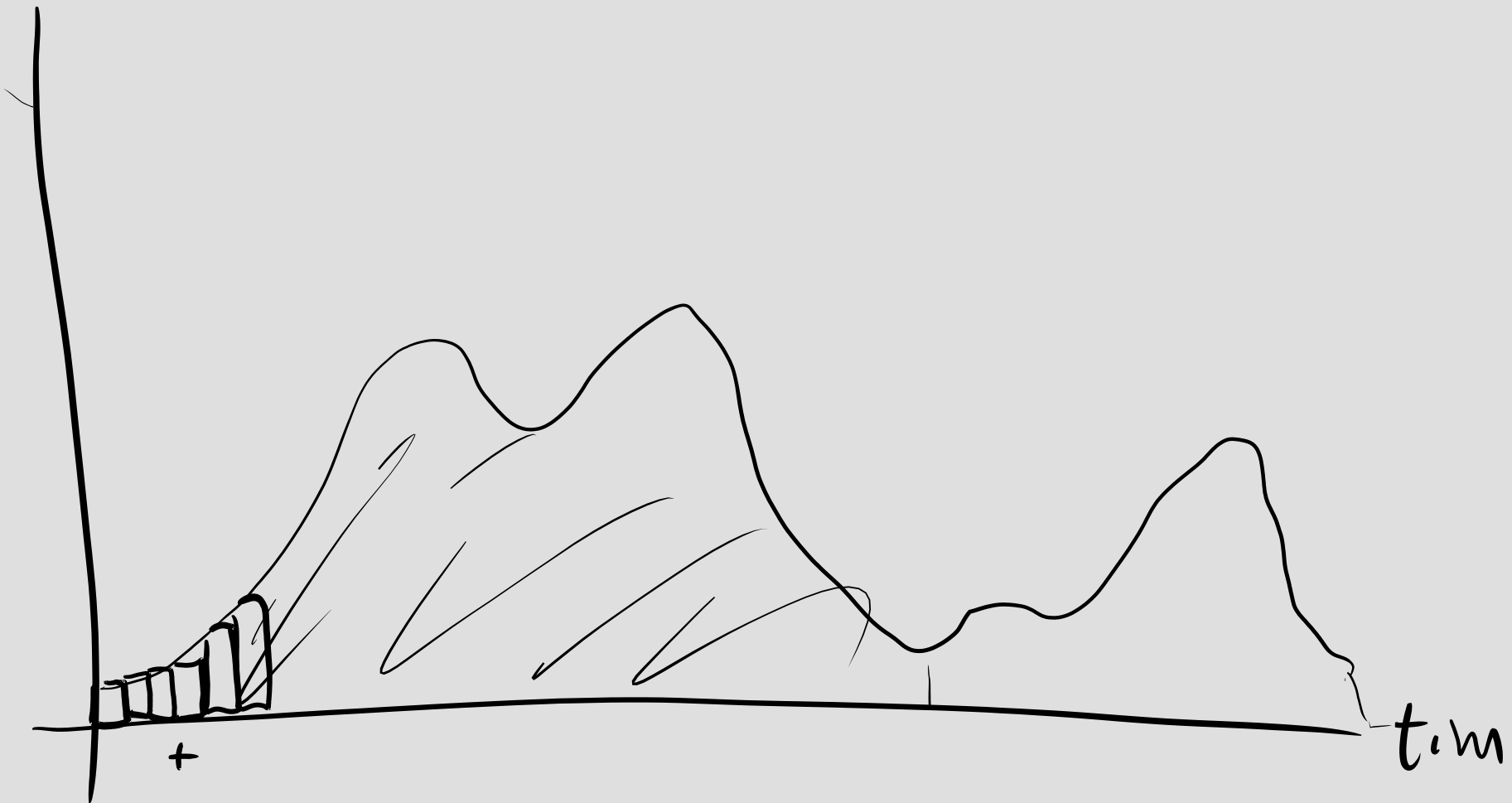
123...80

m, n	Flow
1	2 gal/min
2	1 g/m
3	2 g/m
4	0
5	0
6	8 g/m
13	



Importance Sampling

flow



Chaos

• small diff \rightarrow big

Truly Random — Unpredictable

Which Linux —

fav Song —

Numerical Stability

dec

11

172.13813902...
↑
1

6 dig num - 6 dig num \rightarrow 6 dig num

1.23456 - 1.11111 \rightarrow \downarrow 0.12345

- 1.23465 \rightarrow -0.00009

$$ax^2 + bx + c$$

$$(ax + b)x + c$$

$$x \sqrt{1 + \left(\frac{y}{x}\right)^2}$$