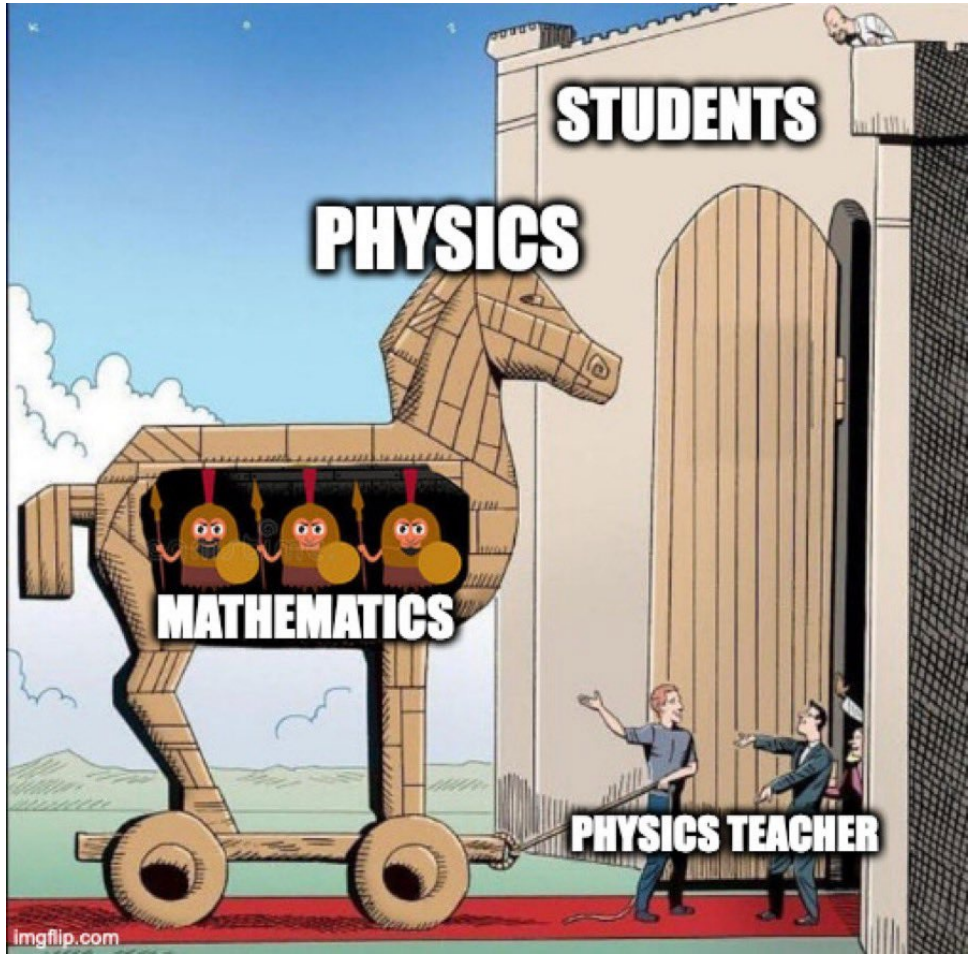
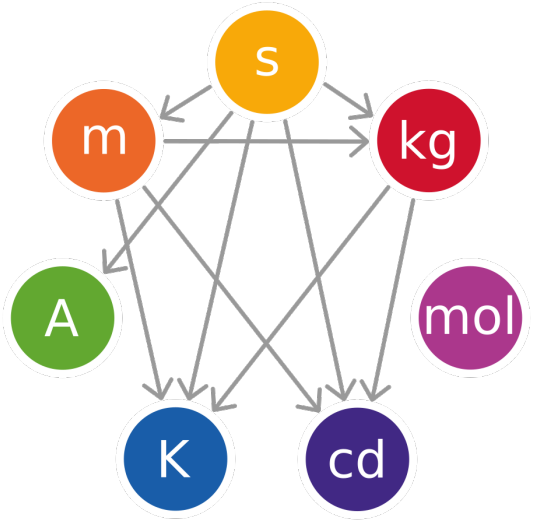
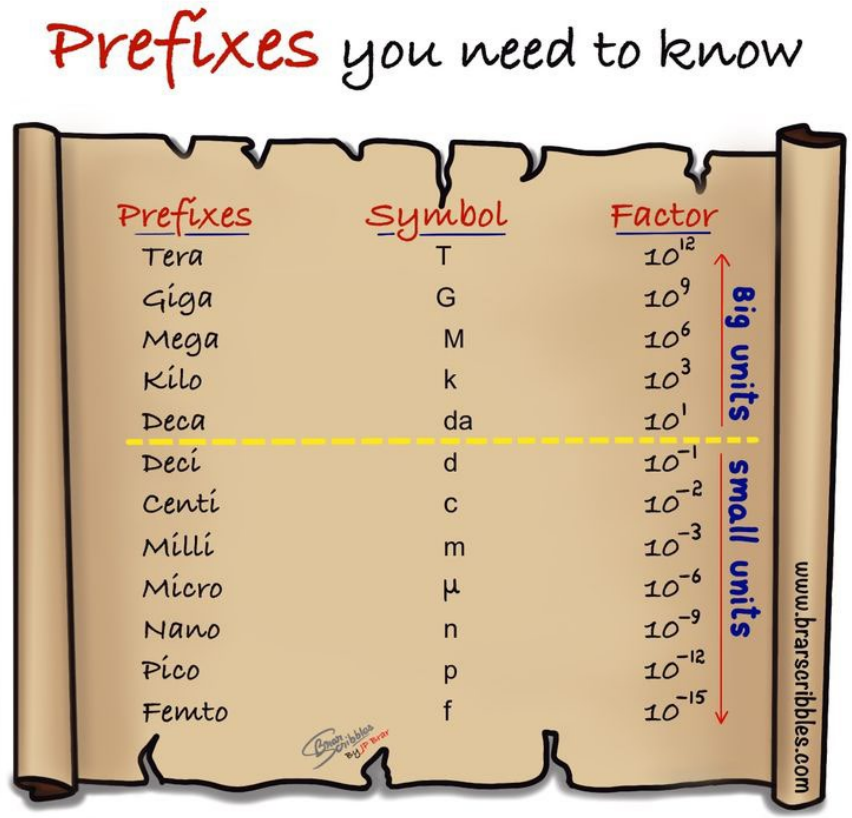
Matematika - Vektoranalízis



Name	Symbol	Quantity	Definition other units	Definition SI base units
radian	rad	plane angle		–
steradian	sr	solid angle		–
hertz	Hz	frequency		s^{-1}
newton	N	force, weight		$m \cdot kg \cdot s^{-2}$
pascal	Pa	pressure, stress	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$
joule	J	energy, work, heat	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
watt	W	power, radiant flux	J/s	$m^2 \cdot kg \cdot s^{-3}$
coulomb	C	electric charge		$s \cdot A$
volt	V	voltage, electrical potential difference, electromotive force	W/A J/C	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
farad	F	electrical capacitance	C/V	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
ohm	Ω	electrical resistance, impedance, reactance	V/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
siemens	S	electrical conductance	1/Ω	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
weber	Wb	magnetic flux	J/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
tesla	T	magnetic field strength	Wb/m^2 $V \cdot s/m^2$ $N/(A \cdot m)$	$kg \cdot s^{-2} \cdot A^{-1}$
henry	H	inductance	Wb/A V·s/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
degree Celsius	°C	temperature relative to 273.15 K	$T_K - 273.15$	K
lumen	lm	luminous flux	cd·sr	cd
lux	lx	illuminance	lm/m^2	$m^{-2} \cdot cd$
becquerel	Bq	radioactivity (decays per unit time)		s^{-1}
gray	Gy	absorbed dose (of ionizing radiation)	J/kg	$m^2 \cdot s^{-2}$
sievert	Sv	equivalent dose (of ionizing radiation)	J/kg	$m^2 \cdot s^{-2}$
katal	kat	catalytic activity		$s^{-1} \cdot mol$

SI





Tenzori jelleg

(11)

SCALAR

t

5
1.5
2

Column Vector
(shape 3x1)

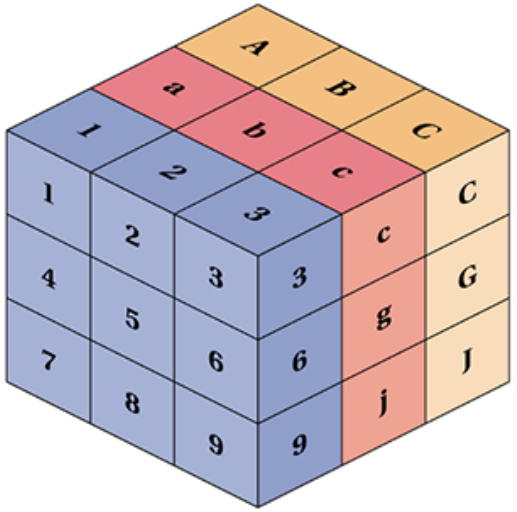
$\mathbf{r}$ / $\vec{r}$ / $\underline{r}$

4	19	8
16	3	5

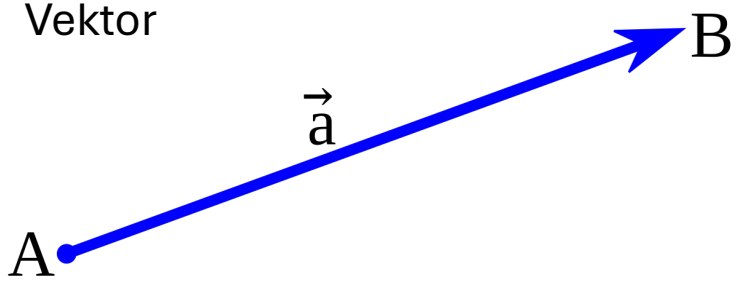
MATRIX

$\underline{\underline{\mathcal{E}}}$

TENSOR



Vektor



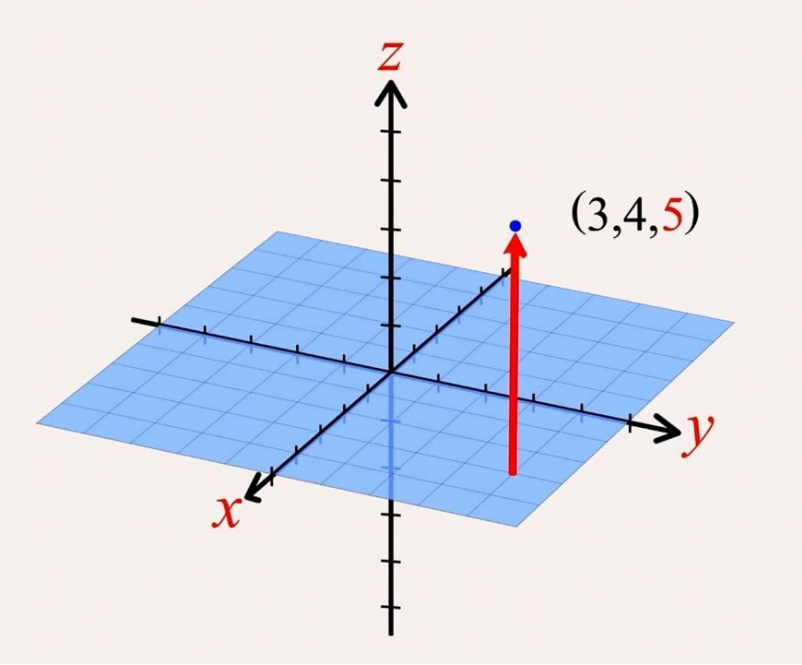
Mátrix – vektor szorzás

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} ax + by \\ cx + dy \end{bmatrix}$$

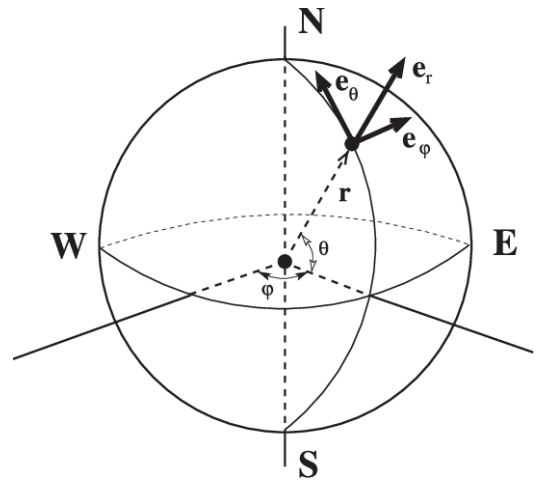
$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} ax + by + cz \\ dx + ey + fz \\ gx + hy + iz \end{bmatrix}$$

Koordináta rendszerek

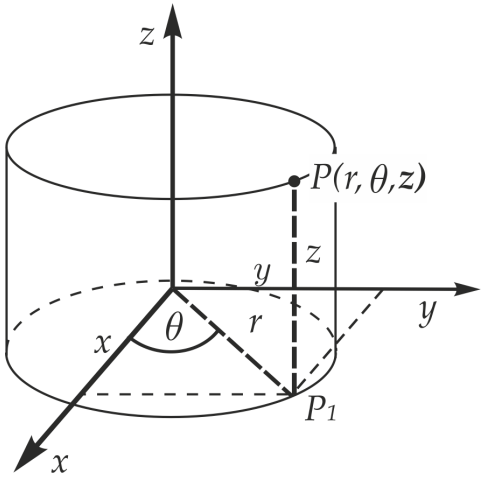
Descartes-féle koordináta-rendszer



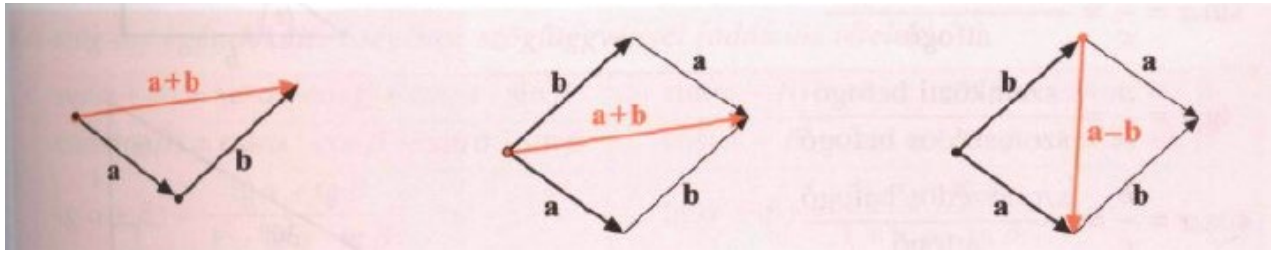
Gömbi koordináta-rendszer

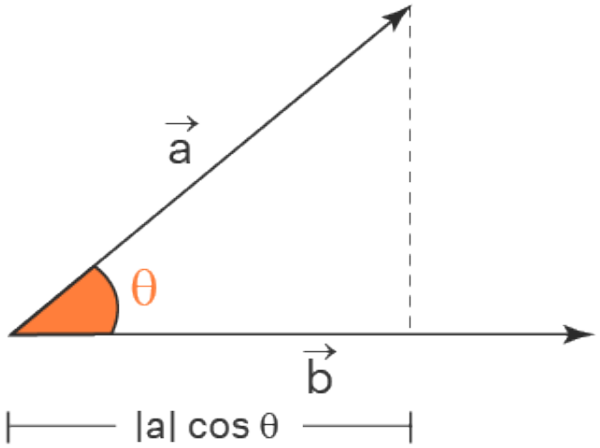


Henger koordináta-rendszer

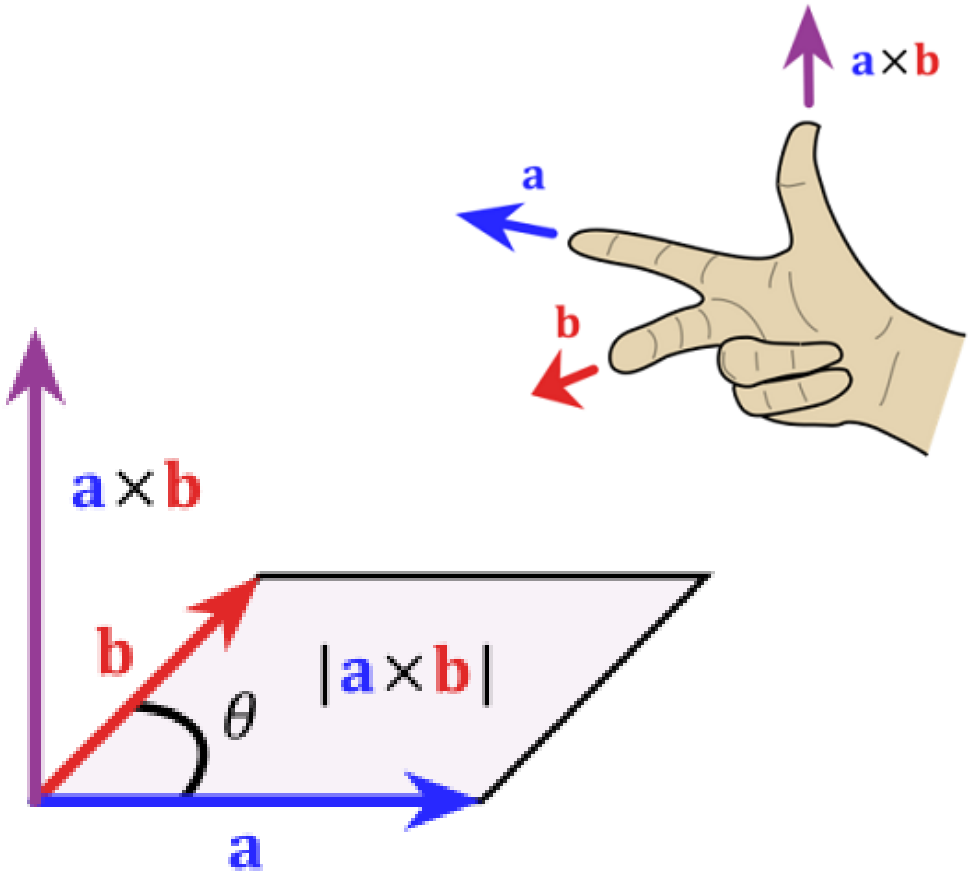


Vektor műveletek

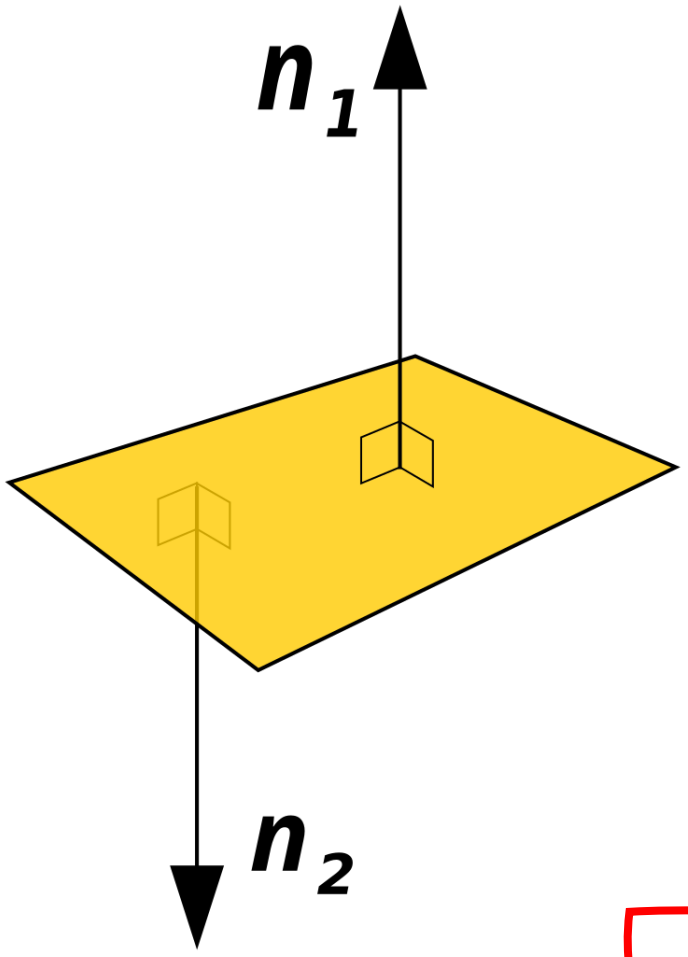


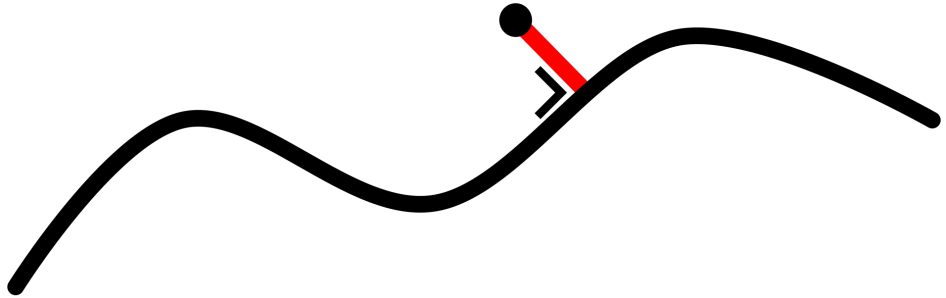


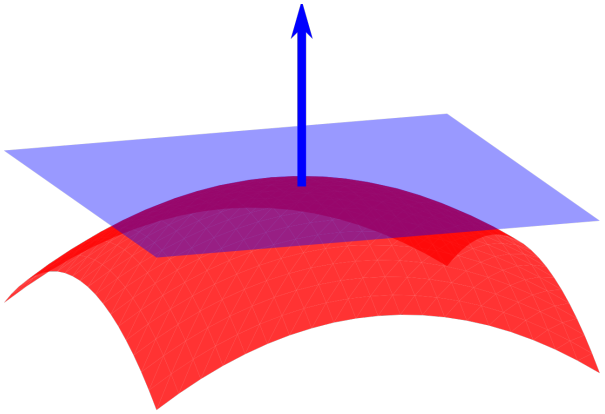
$$\vec{a} \cdot \vec{b} = |a|\,|b| \cos\theta$$

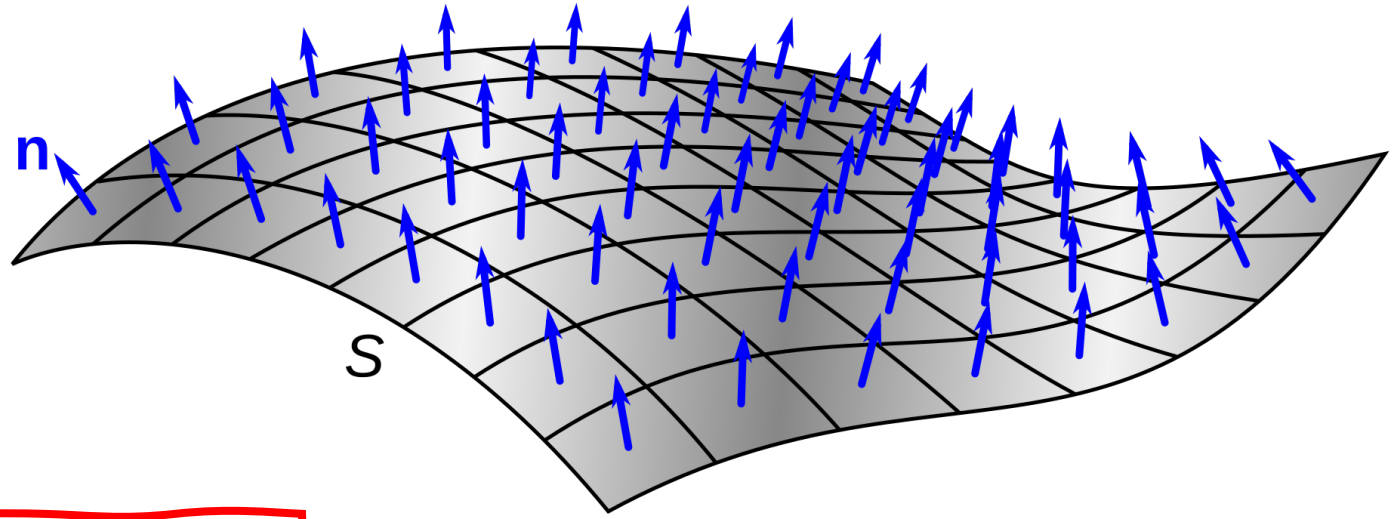


Normál vektor





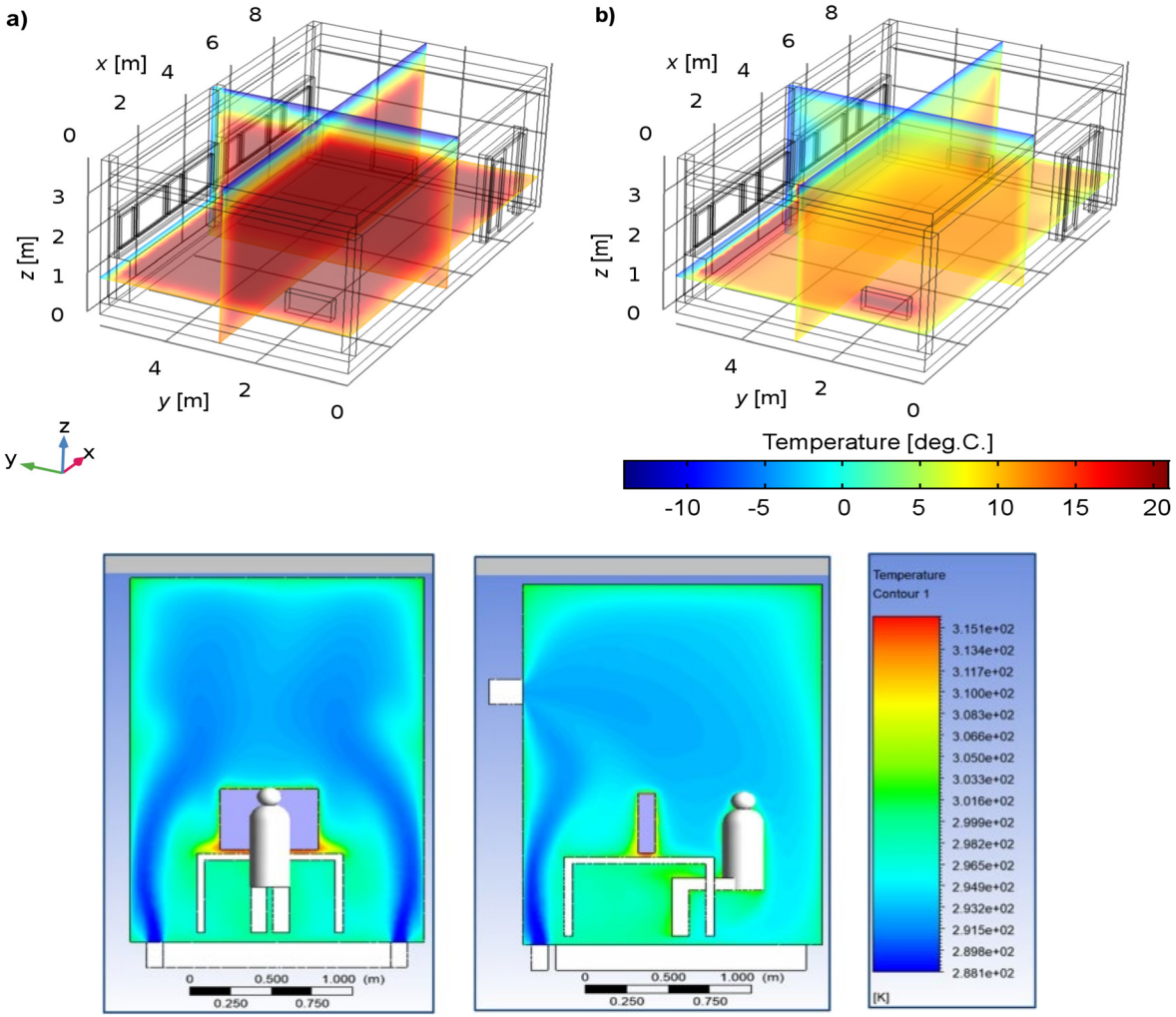


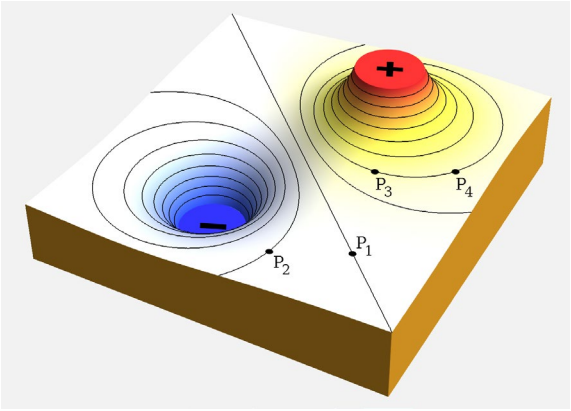


$$\mathbf{A} = A \cdot \mathbf{n}$$

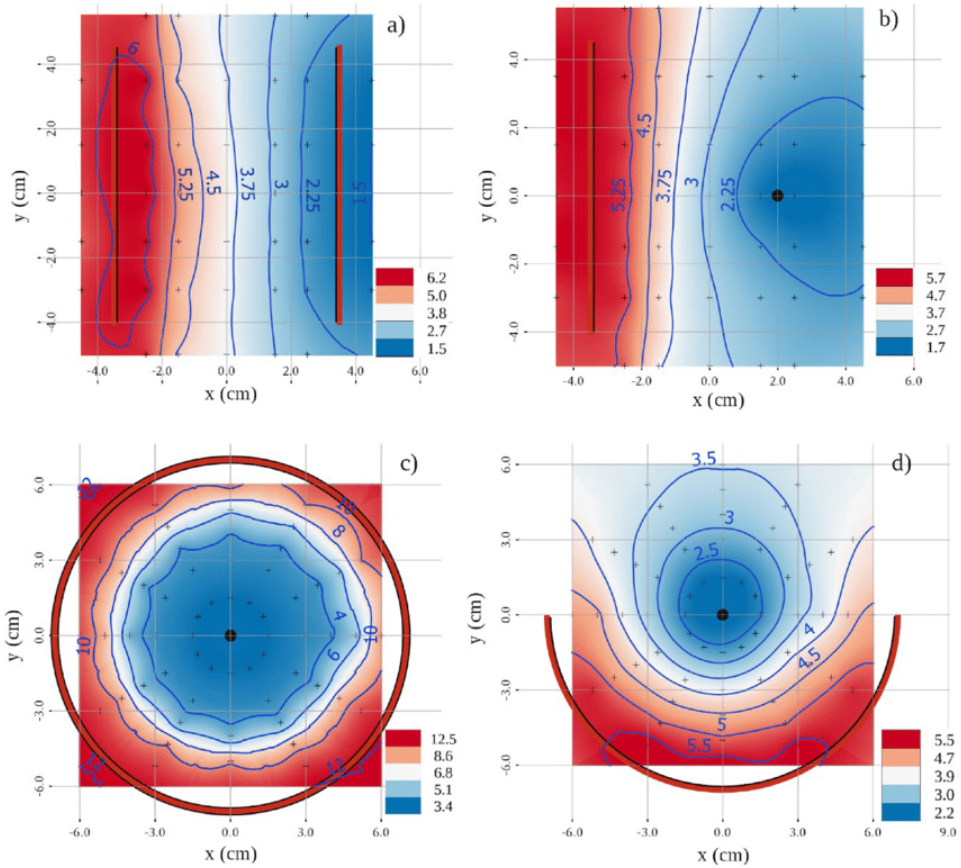
Skalártér

Hőmérséklet (T(**r**))



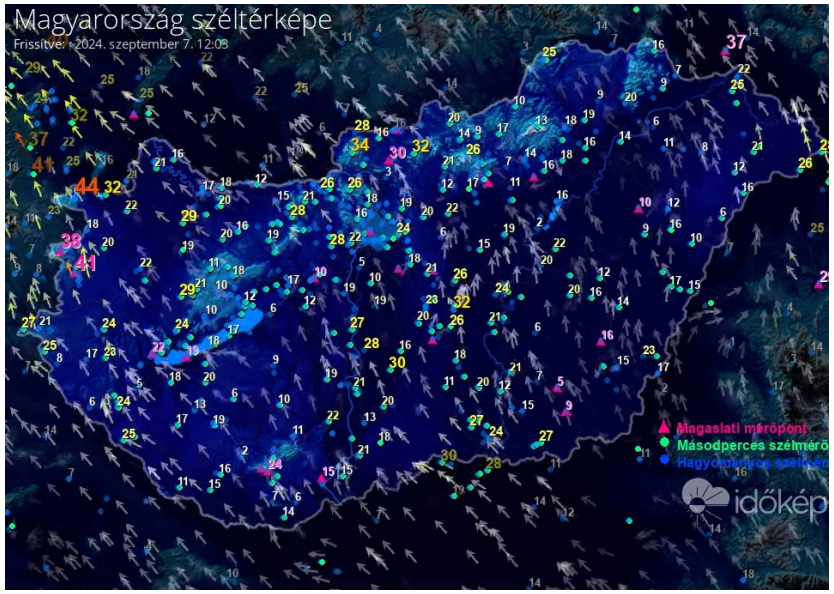


Elekromos potenciál (U(**r**))

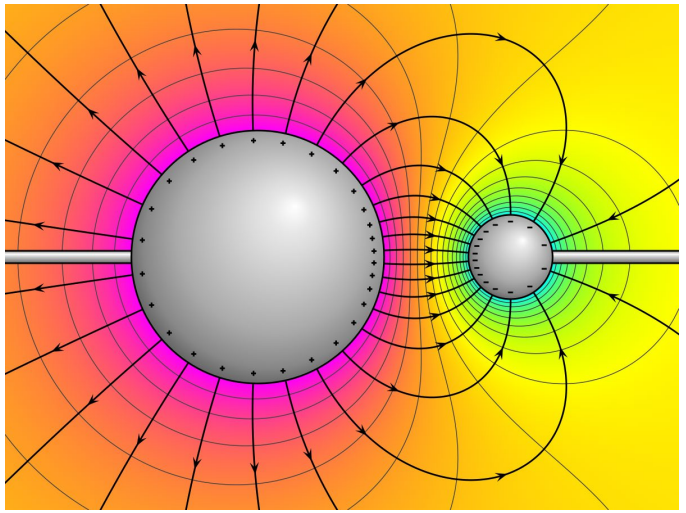


Vektortér

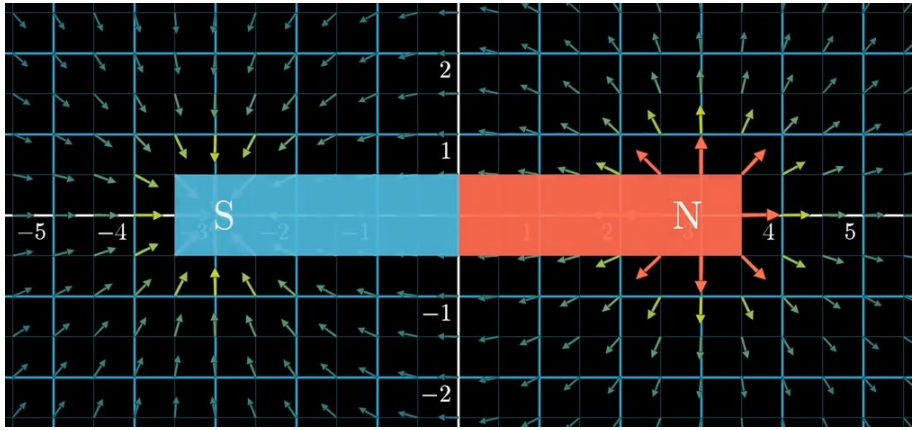
Széltérkép($\underline{\mathbf{v}}(\underline{\mathbf{r}})$)



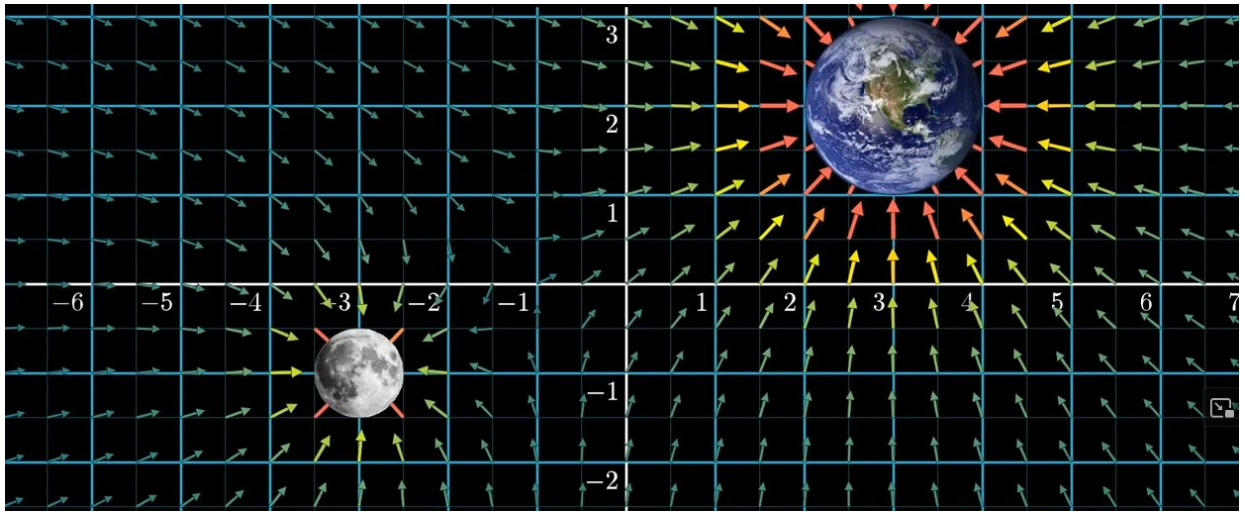
Elekromos tér ($\underline{\mathbf{E}}(\underline{\mathbf{r}})$)



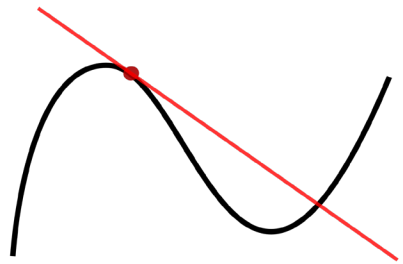
Mágneses tér ($\underline{\mathbf{B}}(\underline{\mathbf{r}})$)

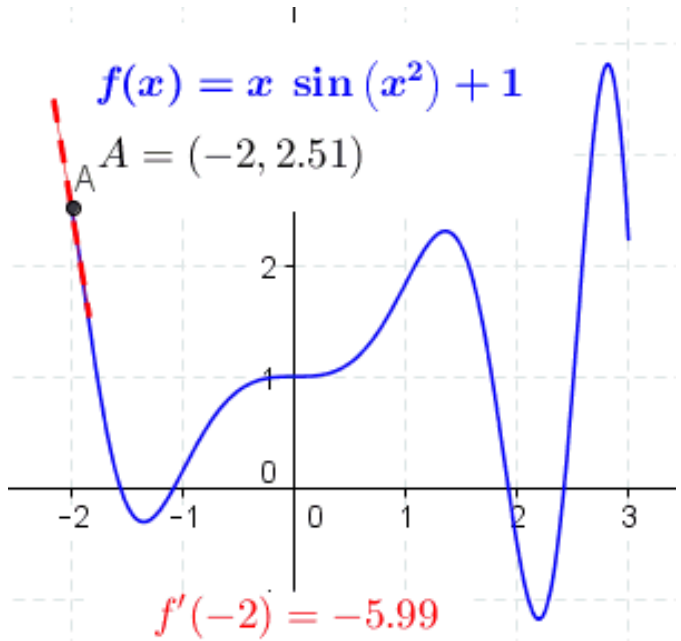


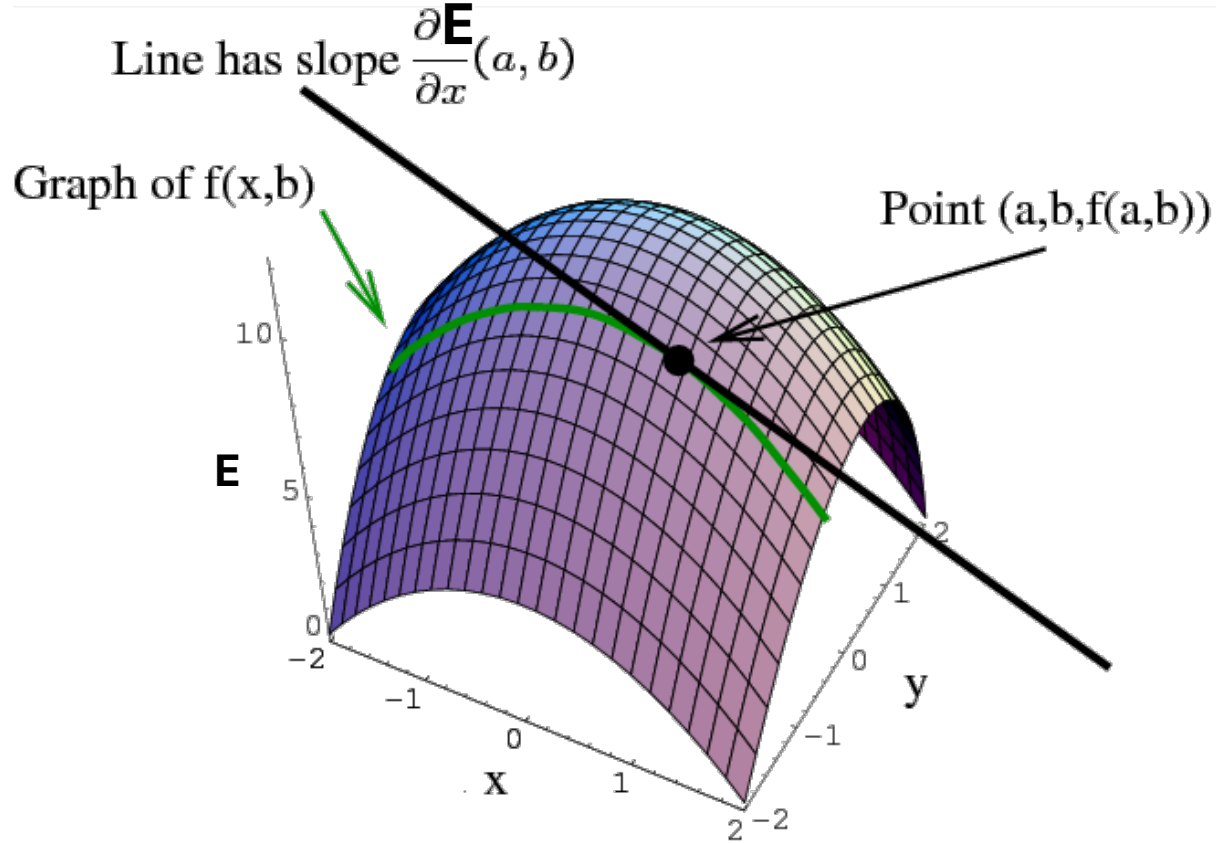
Gravitációs erőtér ($\underline{\mathbf{F}}_{\mathbf{g}}(\underline{\mathbf{r}})$)



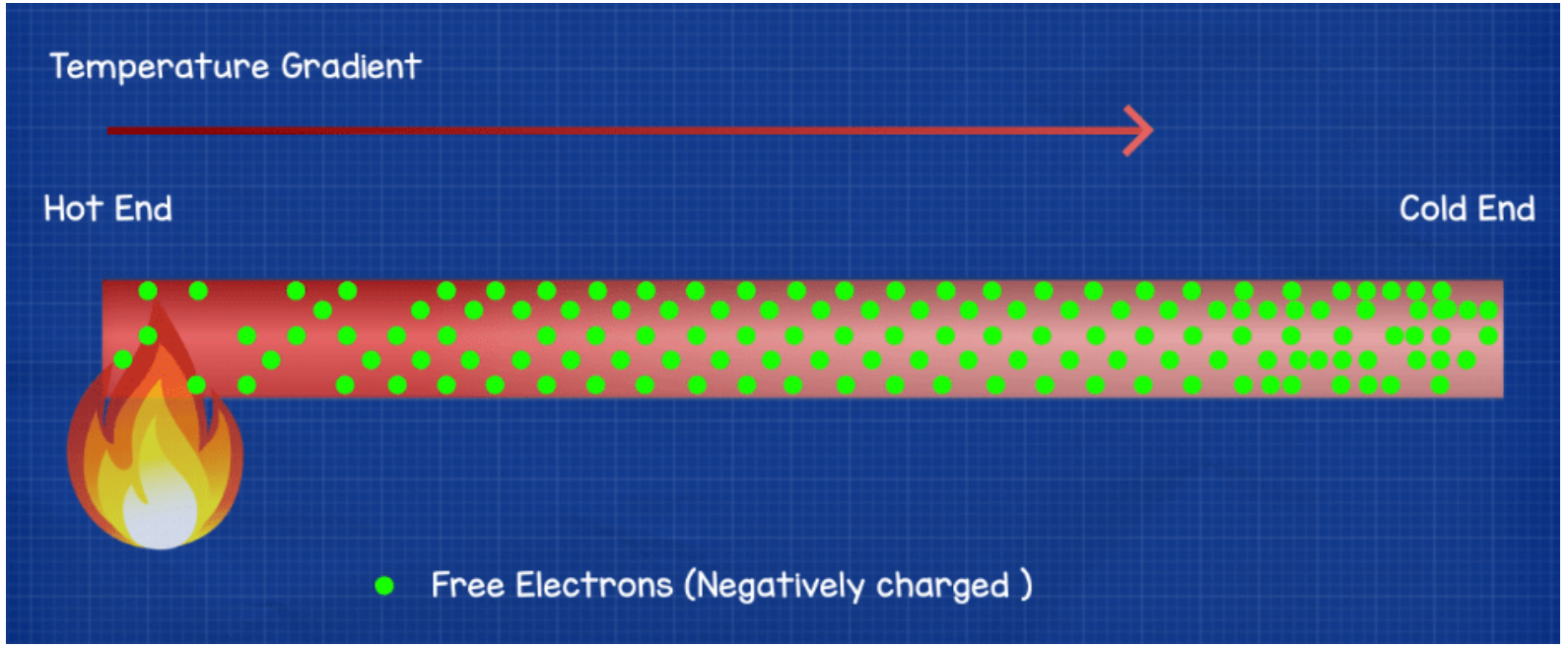
Deriválás

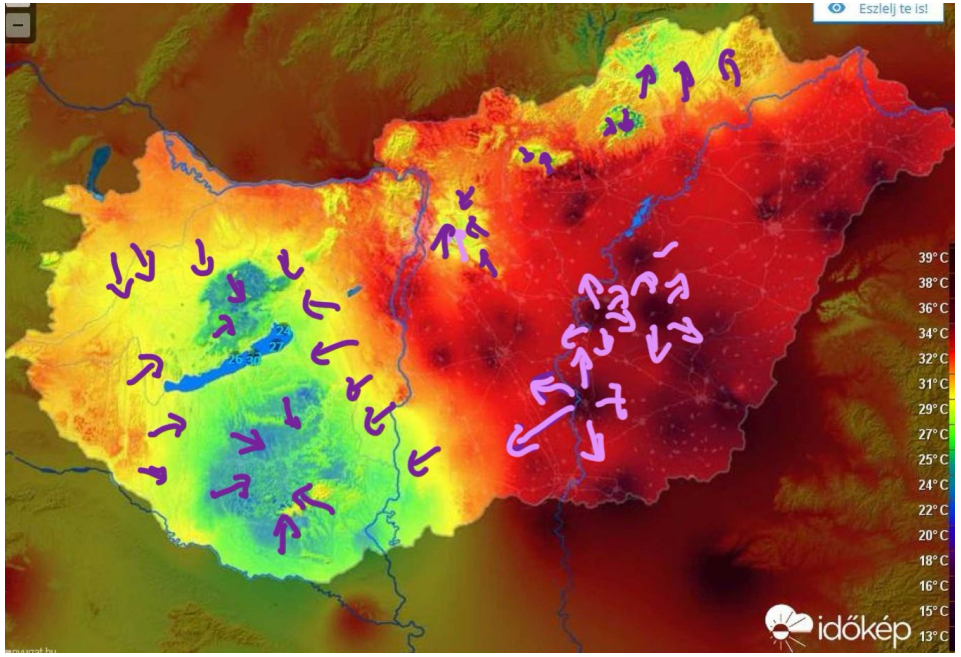



$f(x) = x\ \sin(x^2) + 1$
$A = (-2, 2.51)$
A
2
1
0
-2
-1
0
1
2
3
$f'(-2) = -5.99$

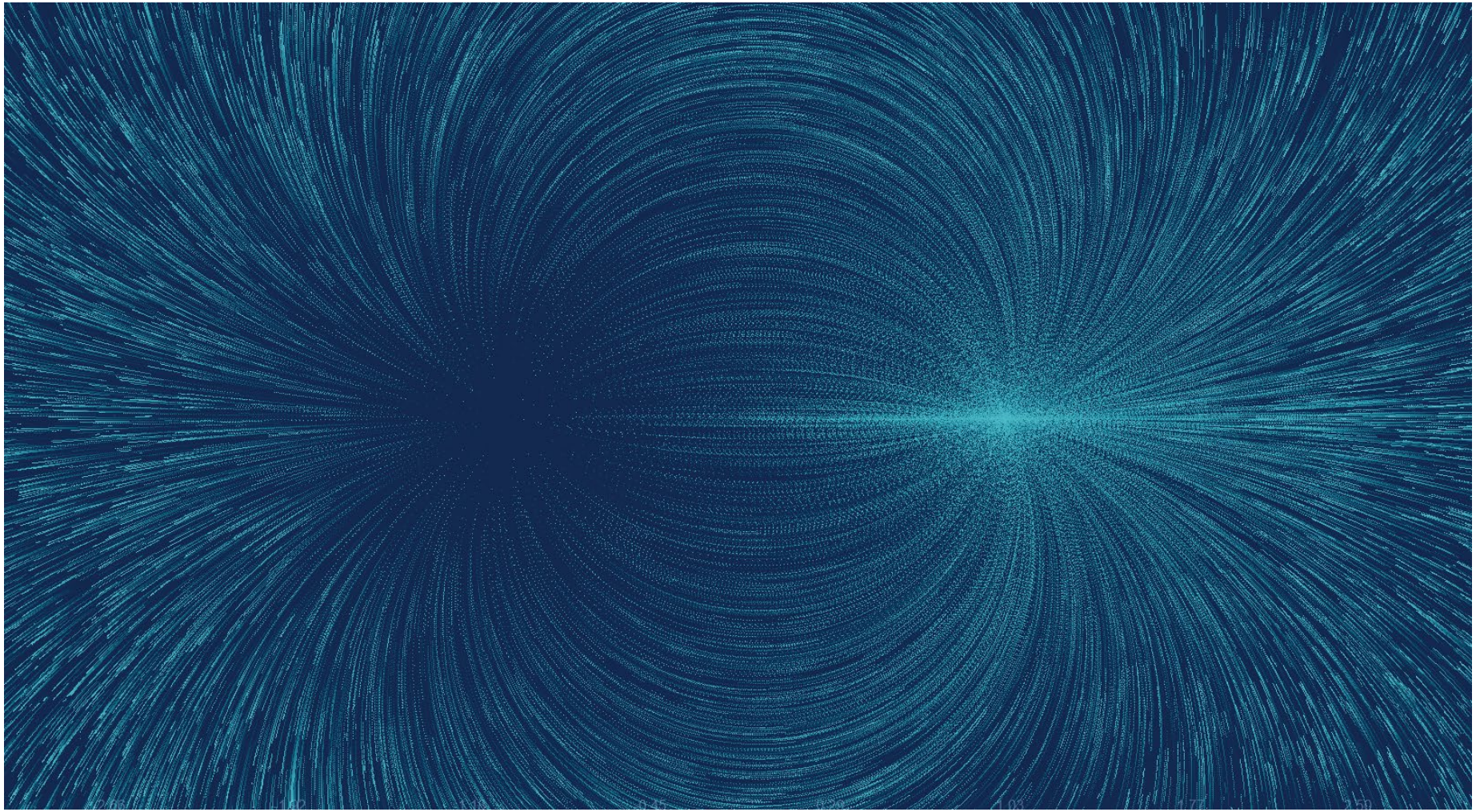

Line has slope $\frac{\partial E}{\partial x}(a, b)$
Graph of f(x,b)
Point (a,b,f(a,b))
E
10
5
0
-2
-1
0
1
2
x
2
1
0
-1
-2
y

Gradiens


Temperature Gradient
Hot End
Cold End
Free Electrons (Negatively charged)


Eszlelj te is!
39° C
38° C
36° C
34° C
32° C
31° C
29° C
27° C
25° C
24° C
22° C
20° C
18° C
16° C
15° C
13° C
időkép

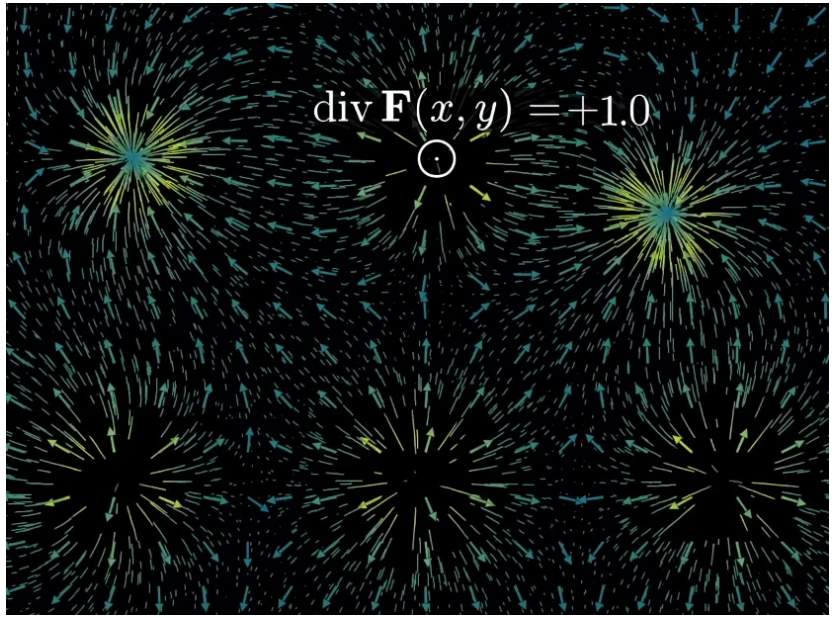
Erővonal ≈ folyadék áramlás

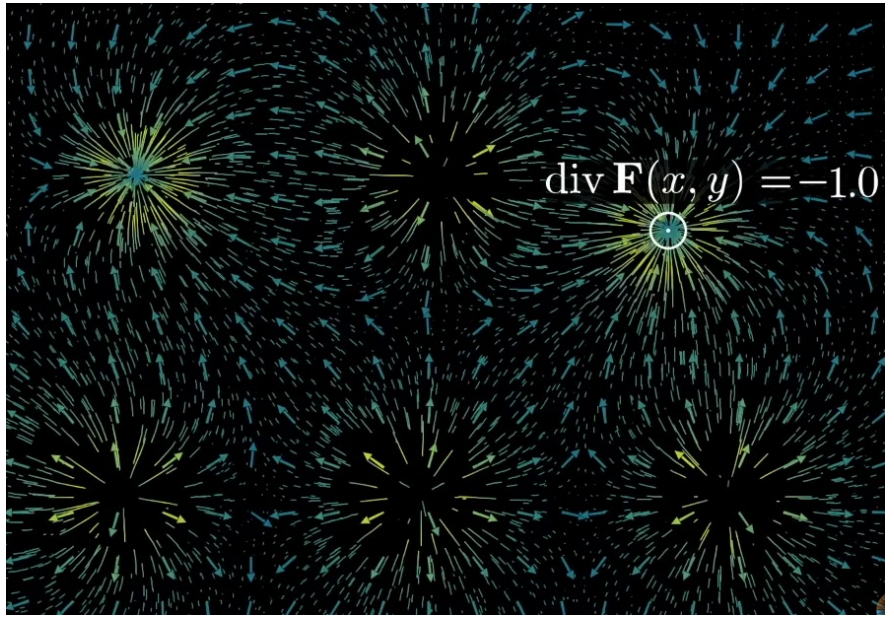


https://anvaka.github.io/fieldplay/

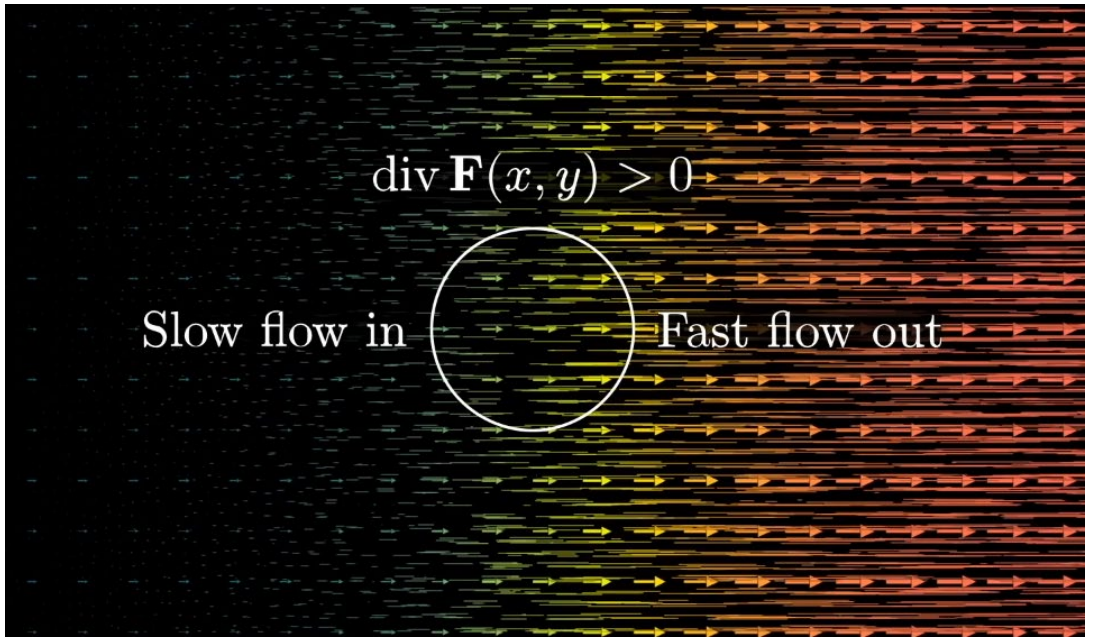
```
// p.x and p.y are current coordinates
// v.x and v.y is a velocity at point p

vec2 E(vec2 p, vec2 pos, float q){
 vec2 r = p - pos;
 float dist = length(r);
 float field = q/(dist*dist);
 return vec2(field * r.x,field * r.y);
}

vec2 get_velocity(vec2 p) {
 vec2 v = vec2(0., 0.);

 // change this to get a new vector field
 vec2 EField =
                E(p, vec2(-1.,1.),1.)
                +E(p, vec2(1.,1.),-1.);
                //+E(p, vec2(1.,-1.),1.)
                //+E(p, vec2(-1.,-1.),-1.);
 v.x = EField.x;
 v.y = EField.y;

 return v;
}
```

Divergencia



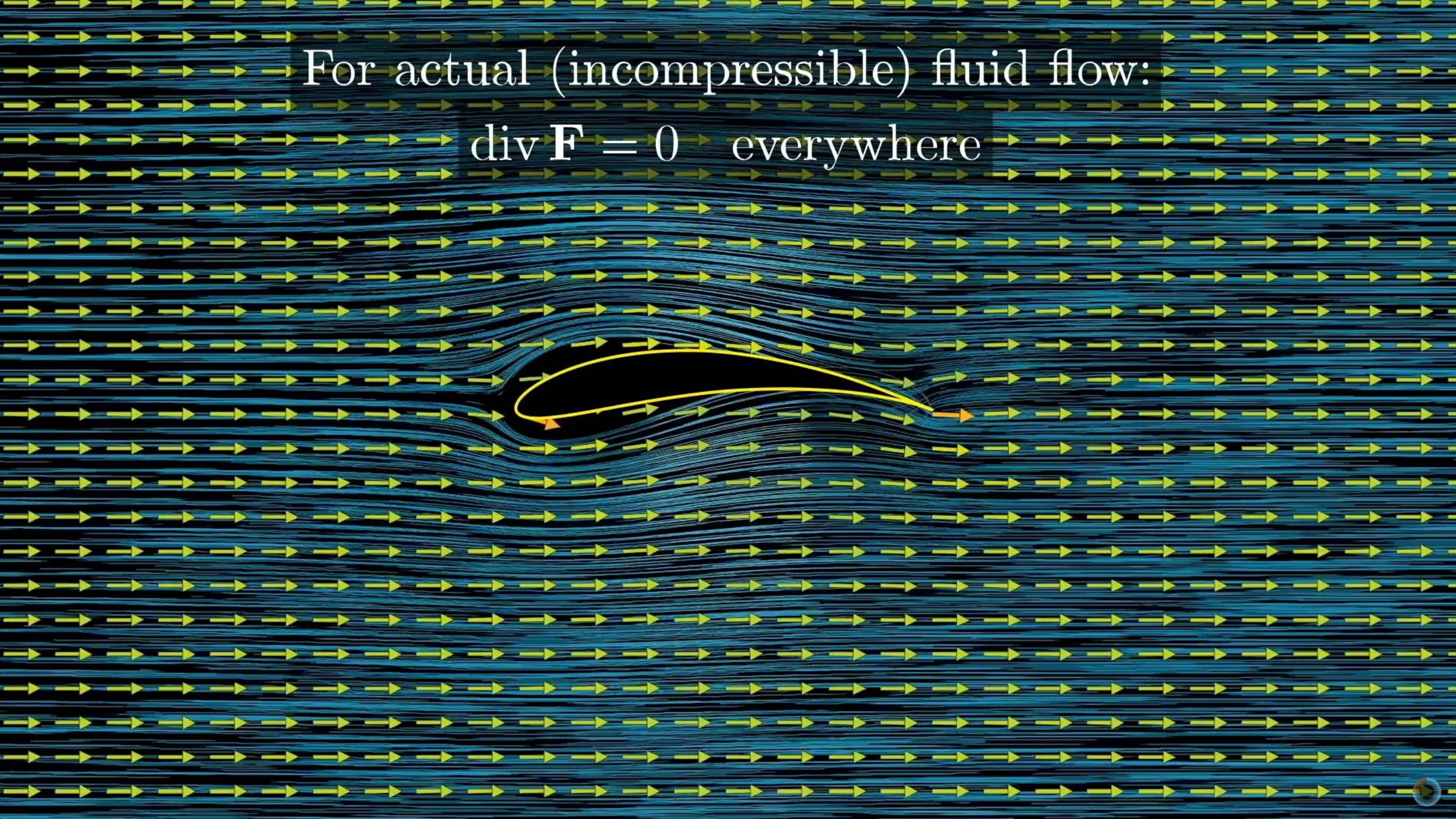


$$\operatorname{div}\mathbf{F} = \nabla\mathbf{F} = \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \end{pmatrix} \cdot \begin{pmatrix} F_x \\ F_y \\ F_z \end{pmatrix} = \frac{\partial F_x}{\partial x} + \frac{\partial F_y}{\partial y} + \frac{\partial F_z}{\partial z}$$



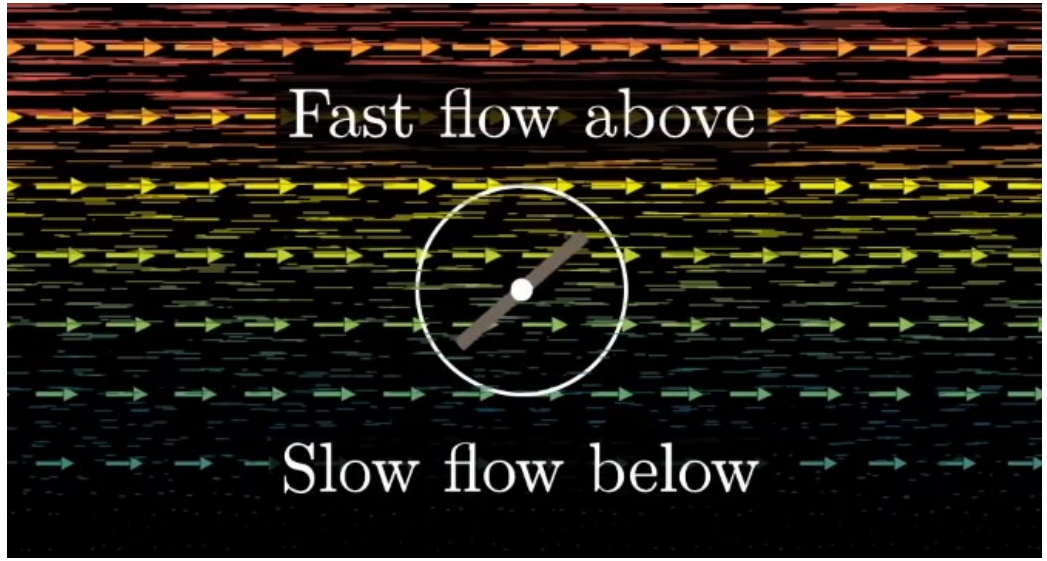
For actual (incompressible) fluid flow:

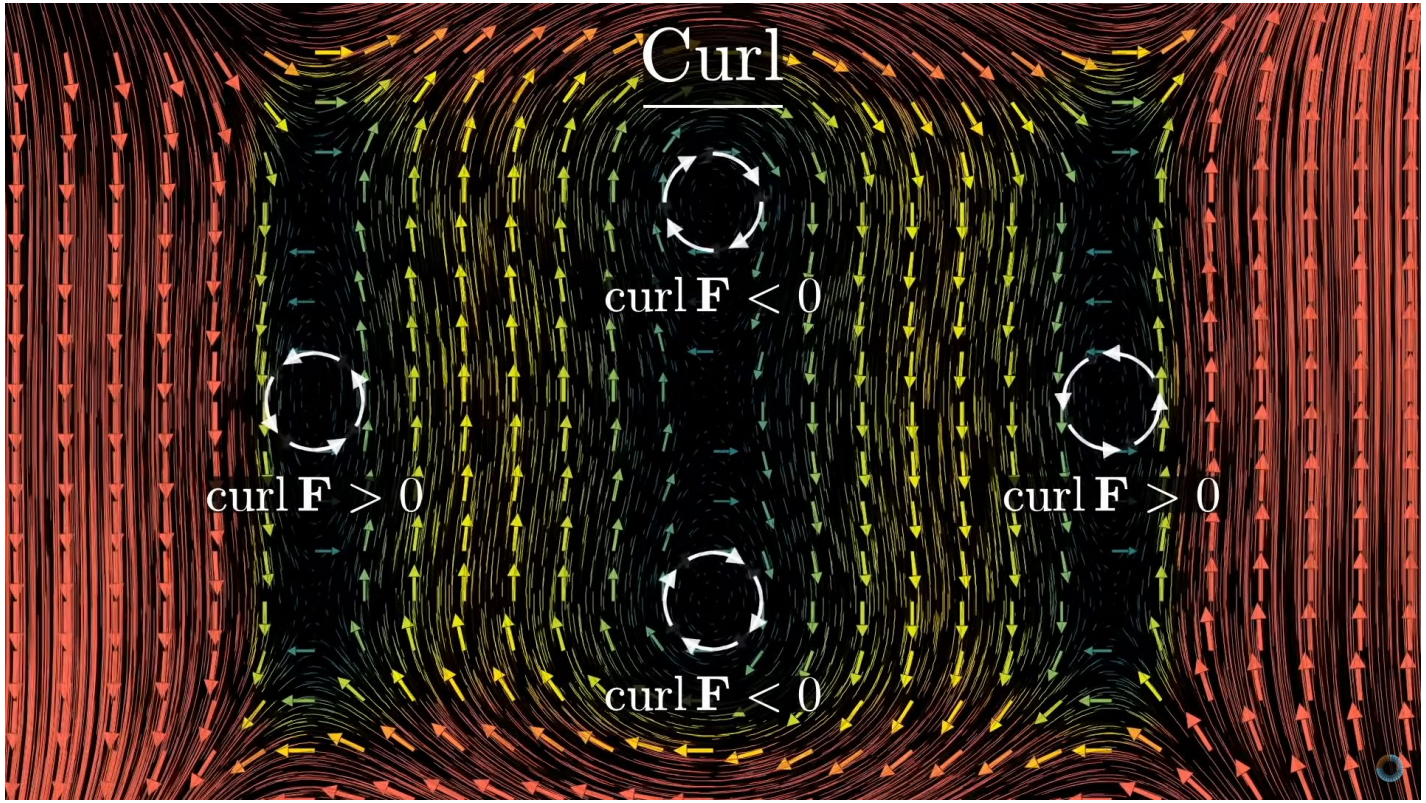
$$\operatorname{div} \mathbf{F} = 0 \quad \text{everywhere}$$



Rotáció

$$\operatorname{rot}\mathbf{F} = \nabla \times \mathbf{F} = \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \end{pmatrix} \times \begin{pmatrix} F_x \\ F_y \\ F_z \end{pmatrix} = \begin{bmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ F_x & F_y & F_z \end{bmatrix} = \begin{pmatrix} \frac{\partial F_z}{\partial y} - \frac{\partial F_y}{\partial z} \\ -\frac{\partial F_z}{\partial x} + \frac{\partial F_x}{\partial z} \\ \frac{\partial F_y}{\partial x} - \frac{\partial F_x}{\partial y} \end{pmatrix}$$





Integrálás

- Skalártér
- Vektortér

- Térfogati
- Vonal menti
- Felületi