mass ⟺ Energy

No create   No destroy
↳ move ✓✓ - change ✓✓ - dissipate

1. KE
2. GPE
3. che
4. NUC
5. ELS
6. ww
7. thermal.

Atoms → Nucleus
→ electrons

Force → Push
→ PuLL

upthrust floating

motion → horizontal speed -

sinking weight.

vibrating

Speed   acceleration   graphs

mass - weight - density

forces (Newton laws)
circular motion
moments
momentum -

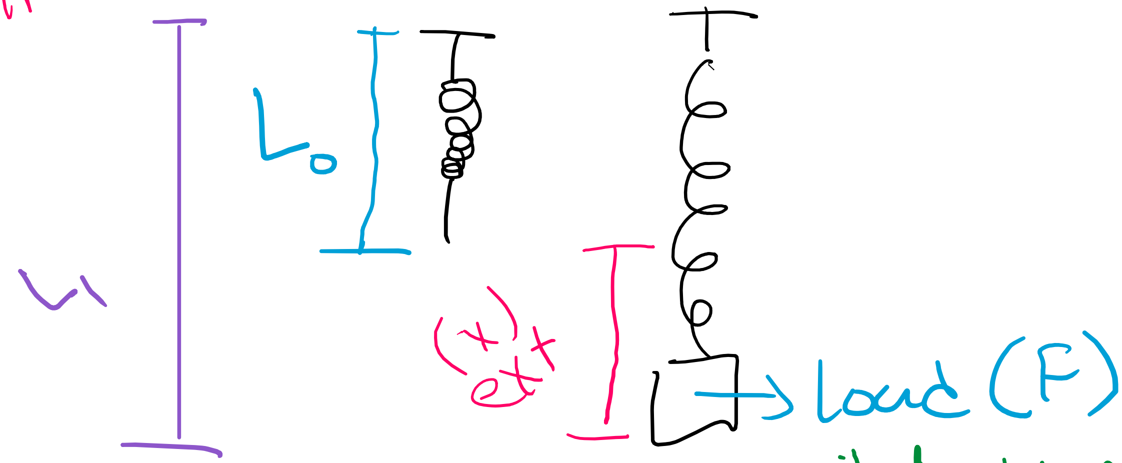
Hookes law springs

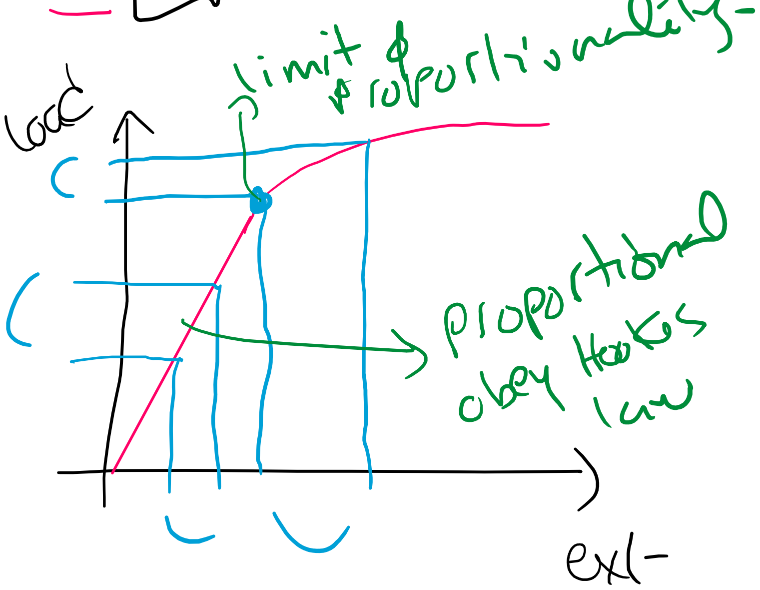
$$\boxed{K = \frac{F}{X}}$$

F → load - weight - force

X → extension
stretched length - original.

K: spring constant





$F \propto ext$

$$\boxed{K = \frac{f}{x}}$$

$$30 = \frac{60}{5-3}$$

Graphical.

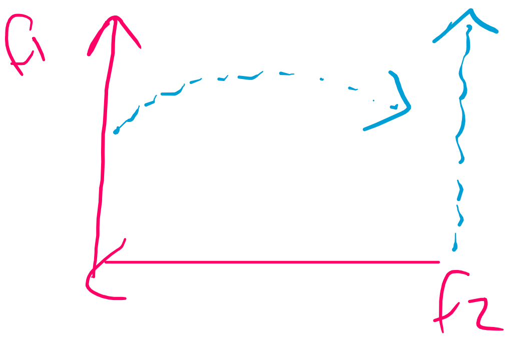
(1) drawing to scale.

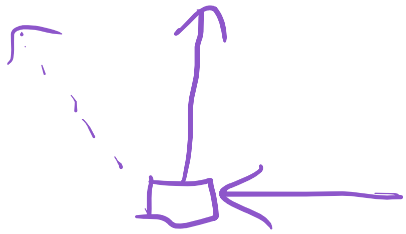
3 km IRL : 3 cm on paper

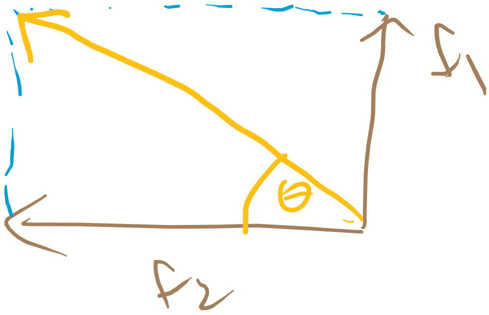
3 N : 3 cm

3 m/s : 3 cm.

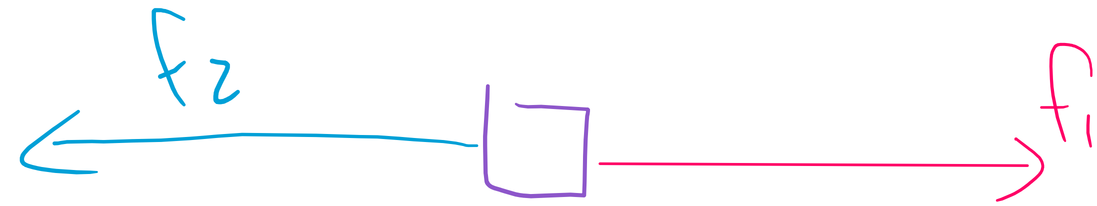
(2) rearrange arrows such that their tails are together.

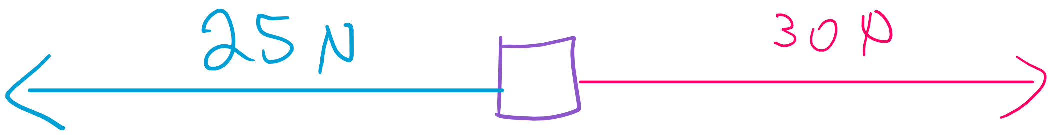




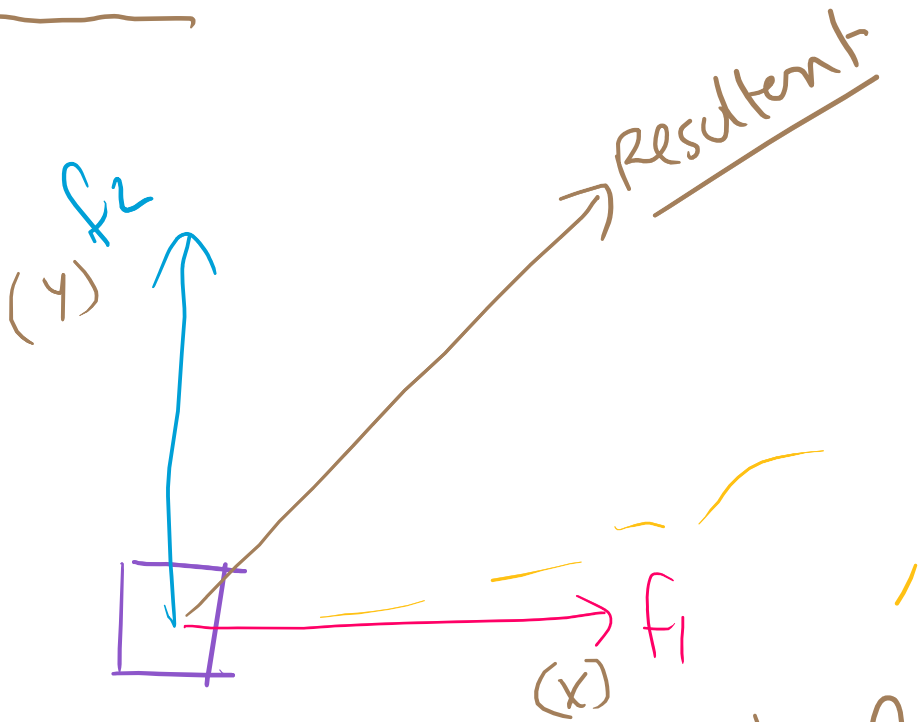


(3) measure Resultant size & angle





net force = $f_1 - f_2 = 30 - 25 = 5N$



calculation

graphical

net force $= \sqrt{f_1^2 + f_2^2}$

$$\theta = \tan^{-1}\left(\frac{Y}{X}\right)$$

mass

force $\boxed{F = m a}$ acceleration

$$\boxed{a = \frac{v - u}{t}}$$

new v

time.

old v

$m = 1.2\ \text{kg}$

$u = 2\ \text{m/s}$

$v = 5\ \text{m/s}$

$F = 4\ \text{N}$

$F = ma$

$\frac{F}{m} = a = \frac{4}{1.2}$

$= 3.34\ \text{m/s}^2$

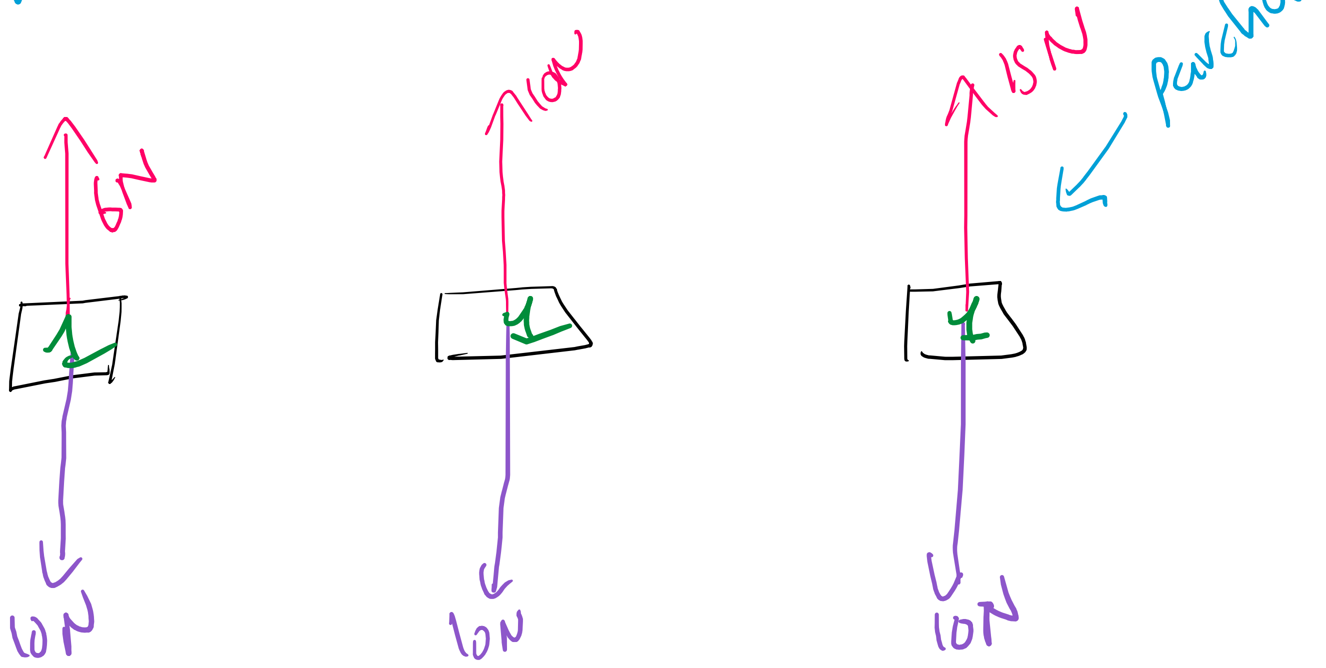
$a = \frac{v-u}{t}$

$t = \frac{v-u}{a}$

$= \frac{5-2}{3.34}$

$$= \frac{3}{3.34} = \boxed{0.9\ s}$$

AR ↑ ∝ speed ↑



net force = $10 - 6 = 4$

$F = ma$

$4 = 1 \times a$

$\boxed{a = 4}$ ✓

speeding up

net = $10 - 10 = 0$

$0 = 1 \times a$

$\boxed{a = 0}$

const speed
terminal

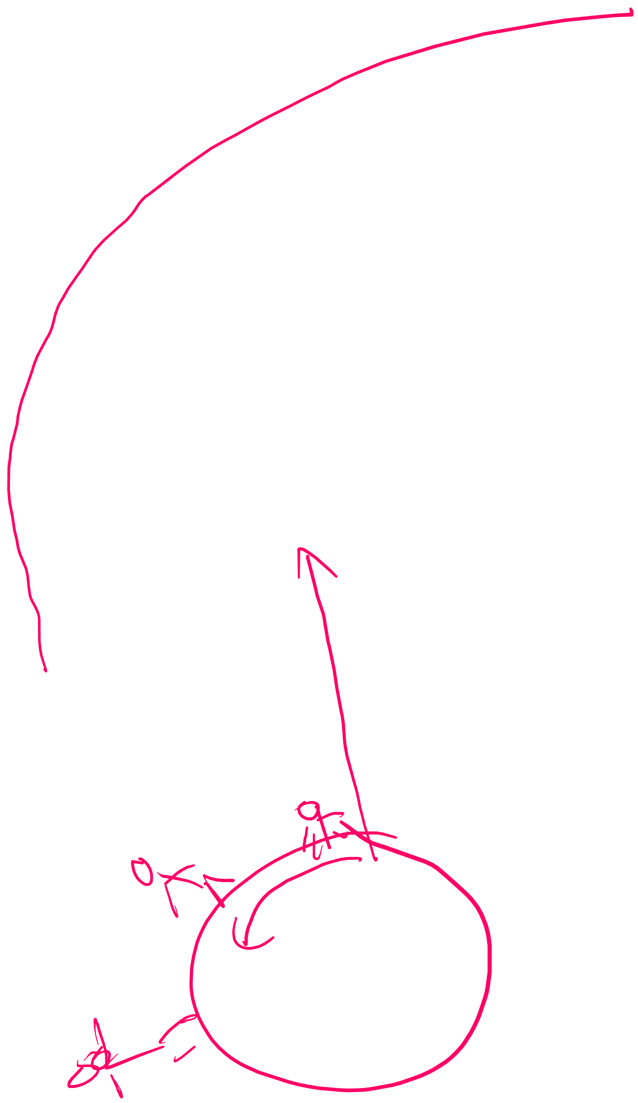
net = $10 - 15$
$= -5$

$-5 = 1 \times a$

$\boxed{a = -5}$

deceleration
speed decreasing

$F = ma$



Rules

Resultant: $R = \sqrt{X^2 + Y^2}$

$\tan\theta = \dfrac{Y}{X}$

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motion

u = initial v
v = final v

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{av speed} = \frac{\text{total dist}}{\text{total time}} = \frac{v_1 + v_2}{2}$$

$$\text{acceleration} = \frac{\Delta v}{\Delta t} = \frac{v - u}{t}$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

weight = mass x g
↓
9.8

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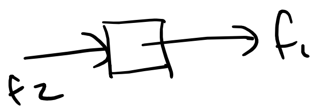
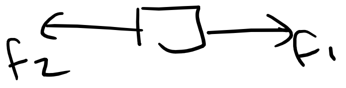
net force = mass x acceleration

↳ $f_1 + f_2$



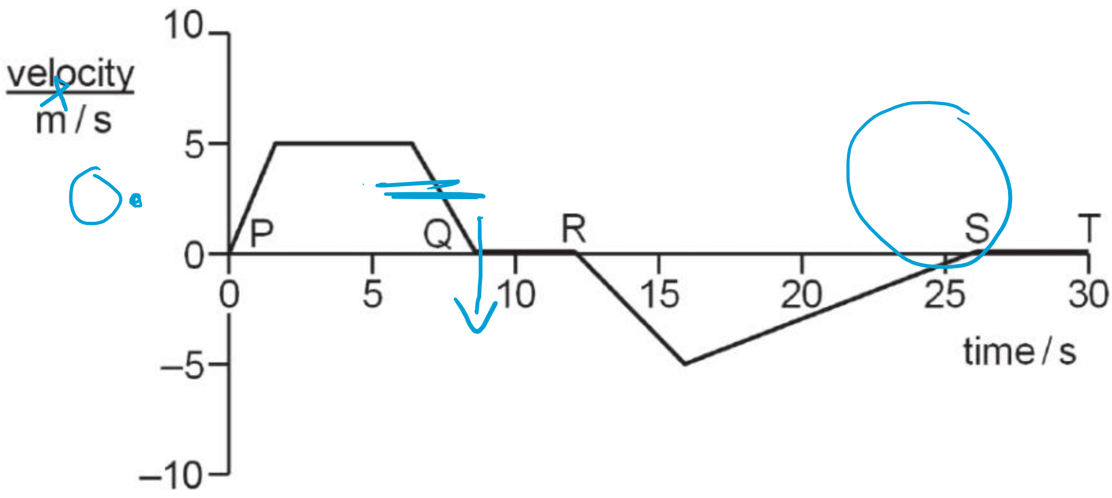
$f_1 - f_2$

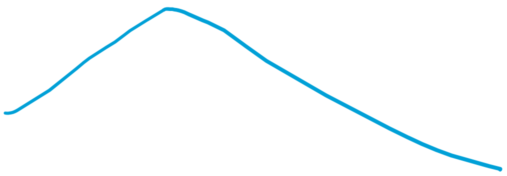


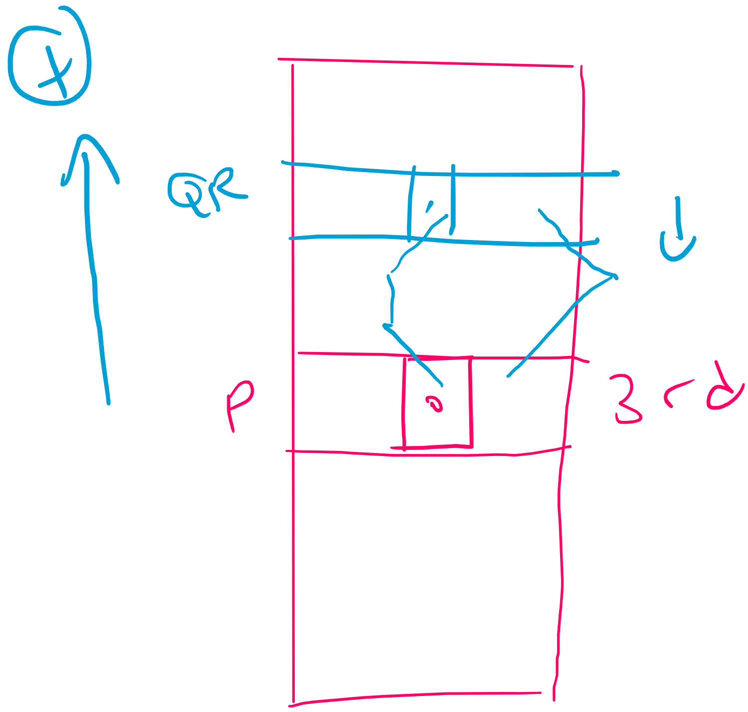
Turning effect (moment)

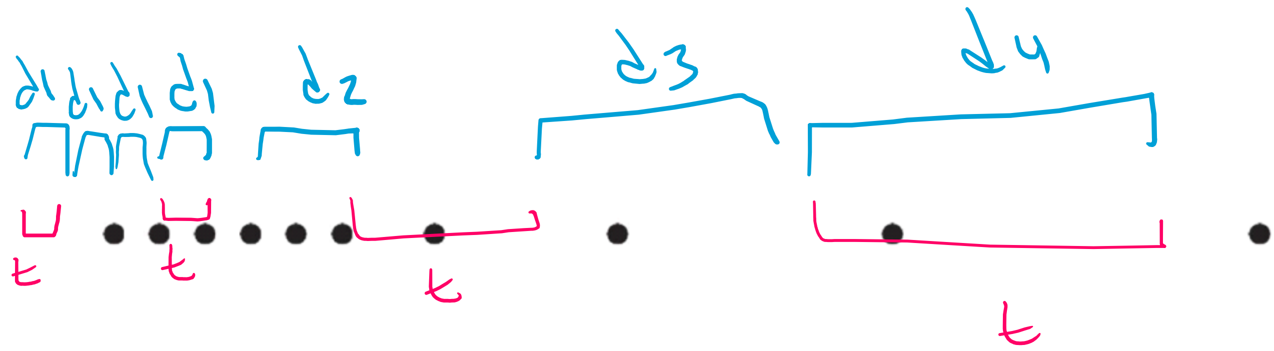
m = f x d (perpendicular)

In equilibrium
net force = zero
net moment = zero (rotation)


velocity m / s
10
5
0
–5
–10
0
5
10
15
20
25
30
time / s
P
Q
R
S
T




QR
P
3rd



$$s = \frac{d}{t}$$

$$s\uparrow = \frac{d\uparrow}{t}$$

t	s
0	0
1	0.75
2	1.5
3	2.25
4	3

+0.75

+0.75

+0.75

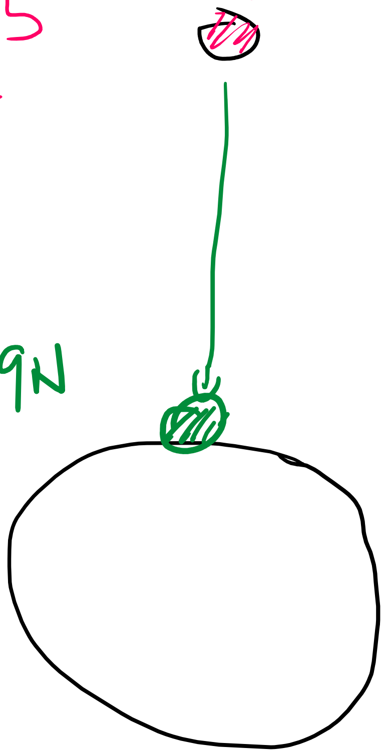
0.75 m/s^2

0.5kg

$W = 3.5$

$g = 7$

$m = \frac{w}{g} = \frac{3.5}{7} = 0.5\ kg.$



$w = 4.9N$

$g = 9.8$

$m = 0.5kg$

$$W = m \times g$$

$$g = \frac{W}{m} = \frac{N}{kg}$$

$\downarrow$

9.8

$$\boxed{9.8} = \frac{9.8 \times 2}{1 \times 2}$$

$$\boxed{9.8} = \frac{19.6}{2}$$

$$\boxed{9.8} = \frac{980 \times 100}{100 \times 100}$$

$$\frac{W}{m}$$

$$W \propto m$$