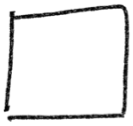
M-GP General Physics Week 24 3/20

Forces Force Diagram



Force = mass * acceleration

$F = ma$ (Newton's 2nd Law)

$kg \cdot m/s^2 = N$ (Newton)

Net forces - sum of all vector forces

1 N ⇒ [1 kg] ⟶

$a = ?$

$a = 1\ m/s^2$

$\frac{F}{m} = \frac{ma}{m}$

$a = \frac{F}{m} = \frac{1\ kg\ m/s^2}{1\ kg}$

2N ⇒ □ ⇐ 3N

1N ⇐ □

$2N + (-3N) = -1N$

3N ⇓

[4kg]

5N ⇑

$F = ma$

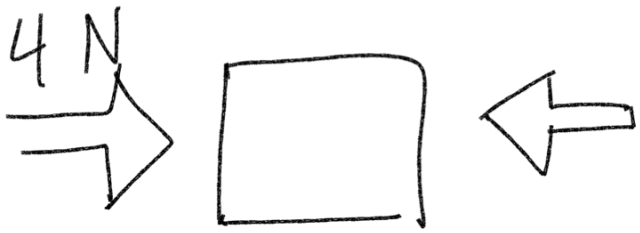
$a = \frac{F}{m}$

$a = ?$

2N ⇑

[4kg]

$\frac{2\ kg\ m/s^2}{4\ kg} = \frac{1}{2}\ m/s^2$



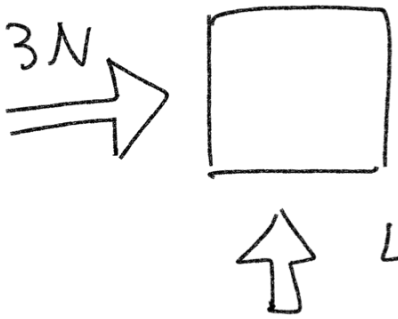
Net force = 0 N

Acceleration = 0 m/s^2

can we have a velocity? Yes!

constant velocity → 0 acceleration

Force is a <u>vector quantity</u>



Net force

$r = \sqrt{x^2 + y^2}$

$\sqrt{3^2 + 4^2}$

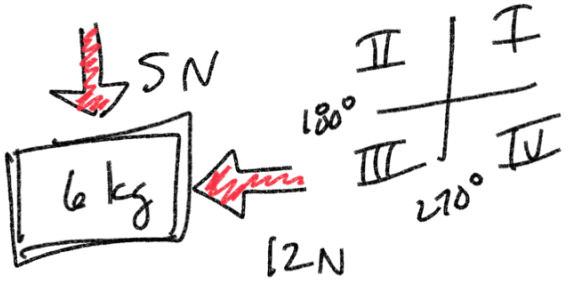
$\sqrt{9+16} = \sqrt{25} = 5$

$\theta = \tan^{-1} \frac{y}{x} = \tan^{-1} \frac{4}{3} = 53.1°$

magnitude, direction

5N, 53.1°

1.) Find the net force on the object



$$r = \sqrt{x^2 + y^2}$$

$$= \sqrt{(-12)^2 + (-5)^2}$$

$$\sqrt{144 + 25} = \sqrt{169} = 13N$$

$$\theta = \tan^{-1}\frac{-5}{-12} = 22.6^\circ$$

$$+180$$

$$202.6^\circ$$

2.) Find the acceleration

13N, 202.6°

$$\frac{F = ma}{m \quad m} \qquad a = \frac{F}{m} = \frac{13N}{6\,kg} = 2.16\ m/s^2$$

Equilibrium → sum of all forces equals zero

$F_{net} = 0$ "constant velocity"

still moving

Contact

centrifugal force

normal force

opposite force

tension

friction

spring force

Applied

Distance

gravitational force

magnetic force

electrical force

weak forces (radiation)

nuclear force — keeps nucleus together

Newton's 1st Law

An object in motion stays in motion unless acted upon by an outside force.

Conversely an object at rest remains at rest unless acted upon by an outside force.

Inertia → resistance to movement

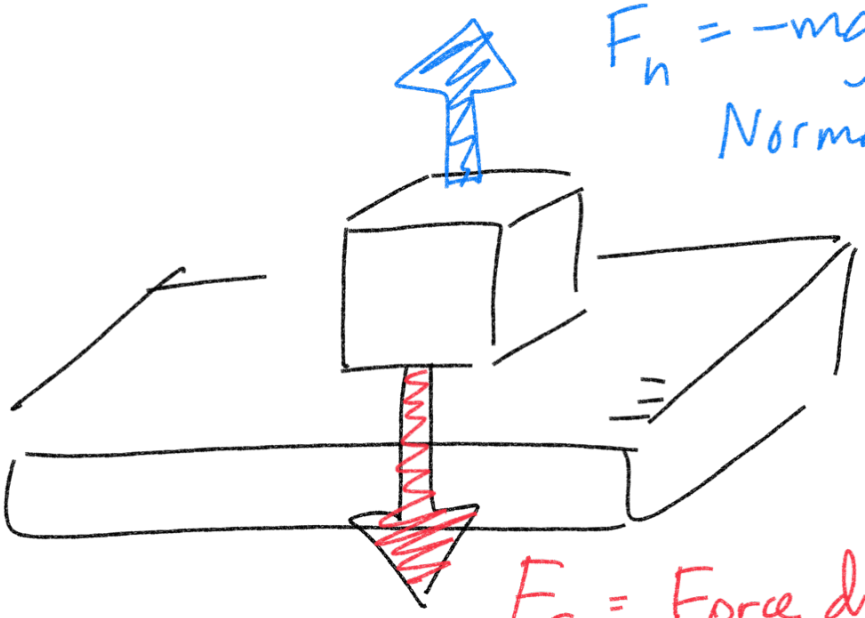
mass → proportional to an objects resistance to movement.

Newton's 2nd Law – $F = ma$

Newton's 3rd Law –

Every force is met with an equal and opposite force.

Normal force – a force perpendicular to the surface.



$F_n = -mg$

Normal force

F_G = Force due to gravity

$F_G = mg$

If $F_G > F_N$ table breaks

If $F_G < F_N$ block is shot into space

$F_G = F_N$

$F_{net} = 0$