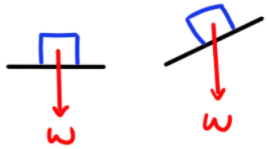
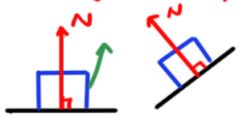
Forces < magnitude, direction

- Gravitational Force (weight)



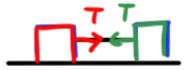
$w = m.g$

- Normal or Contact Force (Reaction)



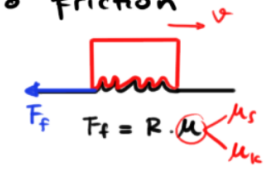
$\Sigma F = 0$ $\Sigma F = ma$

- Tension

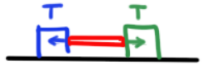


$\Sigma F = 0$
$\Sigma F = ma$

- Friction



- thrust force



observation

Forces

- constant v
- at rest

Newton 1st law

$\Sigma F = 0$

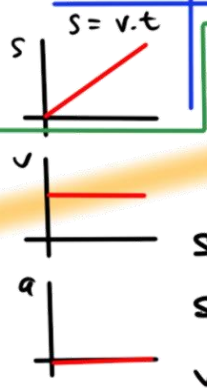
- constant a

Newton 2nd law

$\Sigma F = ma$

Motion

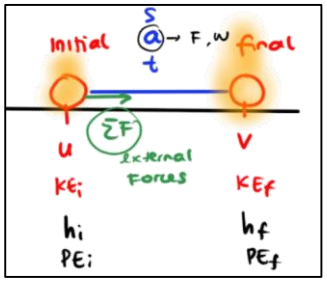
Constant v	Constant a	variable a
$s = v.t$	$s = ut + \frac{1}{2}at^2$	
	$s = \frac{u+v}{2}.t$	
	$v = u + at$	
	$v^2 = u^2 + 2as$	



$s \rightarrow$ vector
$u \rightarrow$ vector
$v \rightarrow$ vector
$a \rightarrow$ vector
$t \rightarrow$ scalar

- derivatives
- integrations

Energy



no external forces

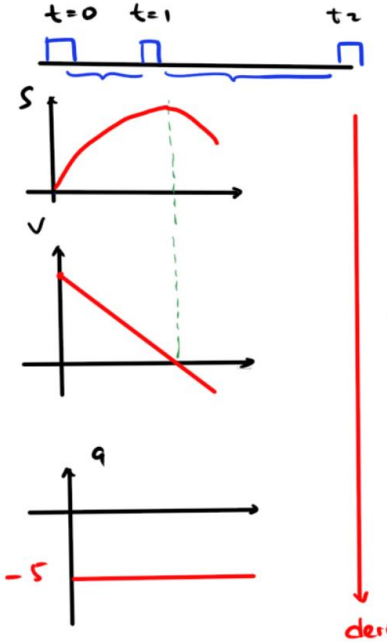
$PE_i + KE_i = PE_f + KE_f$

with external forces

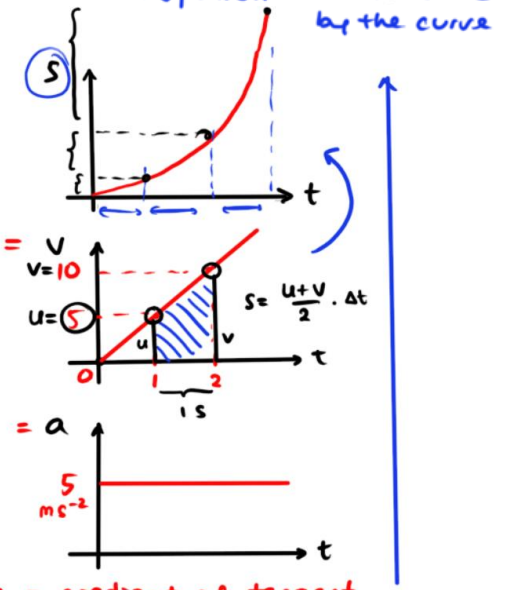
$PE_i + KE_i \pm W_{external} = PE_f + KE_f$

Work: $W = F.s$

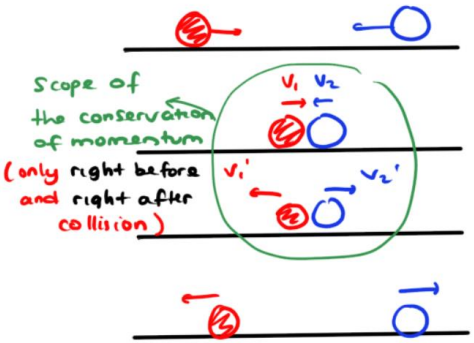
Power: $P = \frac{W}{t} = F.v$ (only if $a = 0$)



derivative = gradient of tangent



momentum



Conservation of momentum

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

Coefficient of restitution

$$e = -\frac{v_2' - v_1'}{v_2 - v_1}$$

- Fully elastic collision ($e = 1$)
  - ↳ no energy loss
- coalesce (totally inelastic), $e = 0$
  $v_1' = v_2'$ (two objects join & move together)