- "objects in motion"

distance d
displacement s
speed S
velocity v
acc a

Equations of motion

- acc = rate of change of velocity

a = change in velo / time

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

$v = u + at$ ①

- distance = Speed x time

$d = S \times t$ (speed is CONSTANT)

if speed is NOT constant

distance = Average Speed x time
displacement = Average velo. x time

$s = \left(\frac{u+v}{2}\right) \times t$ ②

- 3rd Eq $s = ut + \frac{1}{2}at^2$ derive.

Subs. 'v' from eq ① into eq ②

$v = u + at$

$s = \left(\frac{u+v}{2}\right) \times t$

$s = \left(\frac{u+(u+at)}{2}\right) \times t$

$s = ut + \frac{1}{2}at^2$ ③ ✓

- 4th Eq $v^2 = u^2 + 2as$ derive

make "t" the subject from eq ① & replace it in eq ②

$v = u + at$

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

$s = \left(\frac{u+v}{2}\right) \times t$

$s = \left(\frac{u+v}{2}\right) \times \left(\frac{v-u}{a}\right)$

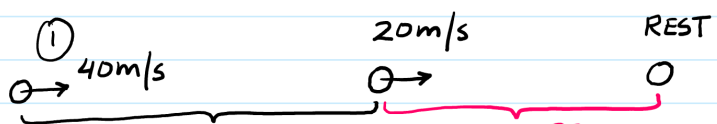
simplify $v^2 = u^2 + 2as$ ④ ✓

These equations are to be used under the following conditions.

① object must be moving in a straight line. (Linear motion)

② The acceleration of the object must be constant.

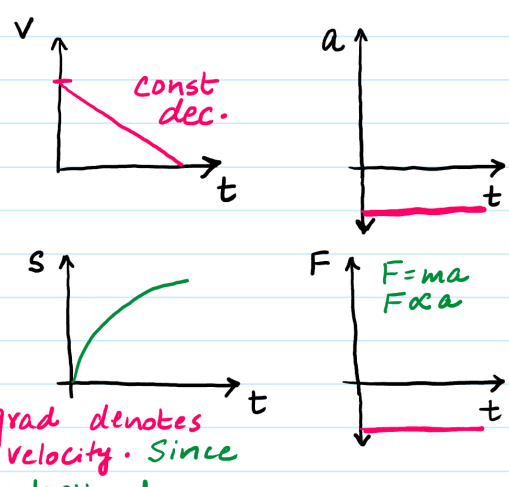
example ①



$v^2 = u^2 + 2as$
$20^2 = 40^2 + 2a(60)$
$a = -10$
const. dec

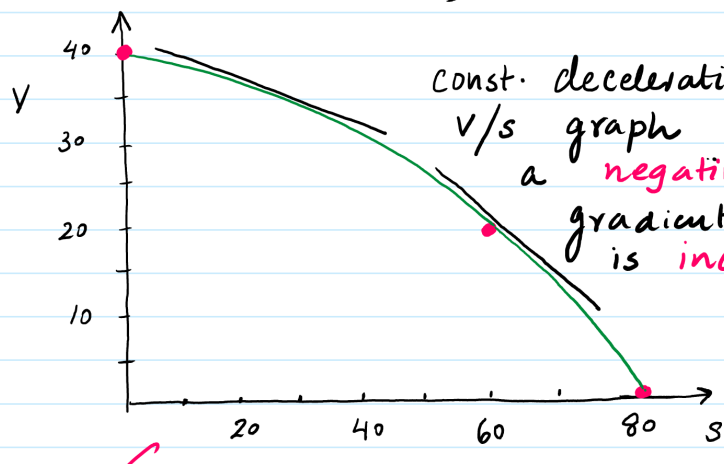
$v^2 = u^2 + 2as$
$0^2 = 20^2 + 2(-10)s$
$s = 20m$

sketch



grad denotes velocity. Since velocity decreases ∴ grad must also decrease

(b) Sketch a velocity against displ graph (v vs s)



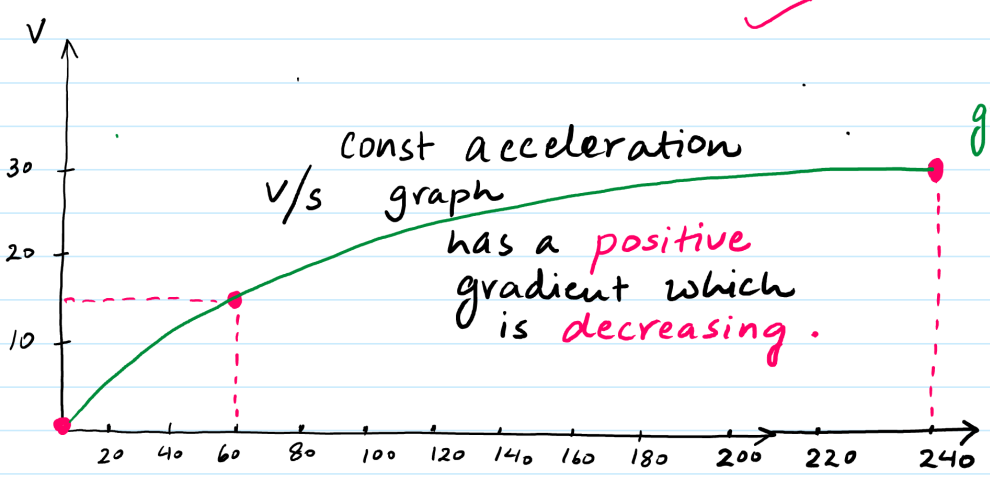
Const. deceleration v/s graph has a negative. gradient which is increasing

Q: rest → 15m/s → 30 m/s

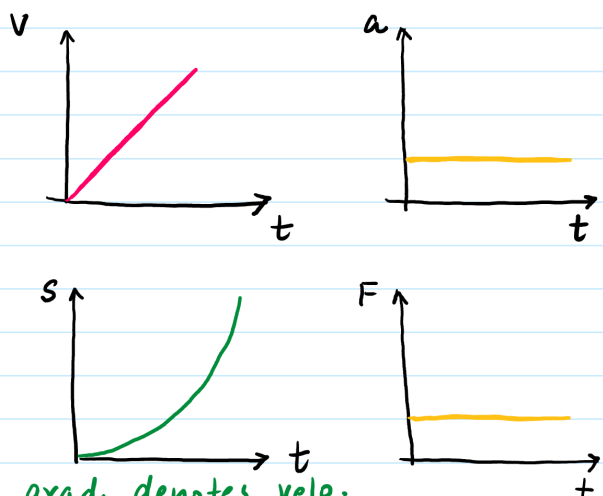
s = 60 m ✓ s = ?? ✓

$v^2 = u^2 + 2as$
$15^2 = 0^2 + 2a(60)$
$a = 1.875\ m/s^2$

$v^2 = u^2 + 2as$
$30^2 = 15^2 + 2(1.875)s$
$s = 180\ m$ ✓



Const acceleration v/s graph has a positive gradient which is decreasing.



grad denotes velo. since v inc. ∴ grad also inc.