Year 2 Applied Chp 8 – Further Kinematics

Vectors + Location

To describe the motion of a particle you can use the equation:

$$\boldsymbol{r} = \boldsymbol{r}_0 + \boldsymbol{v}t$$

$\boldsymbol{r}_0$ = initial position (vector)
$\boldsymbol{v}$ = velocity (vector)
t = time (scalar)

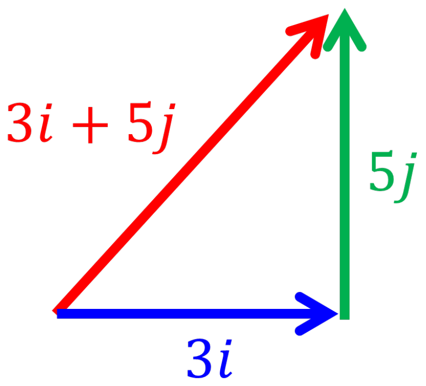
Vectors + SUVAT

use $\boldsymbol{r}$ instead of $\boldsymbol{s}$ for displacement

$$\boldsymbol{r} = \boldsymbol{u}t + \frac{1}{2}\boldsymbol{a}t^2$$

$$\boldsymbol{v} = \boldsymbol{u} + \boldsymbol{a}t$$

Vectors + Projectiles



Resultant Velocity $= 3i + 5j\ ms^{-1}$

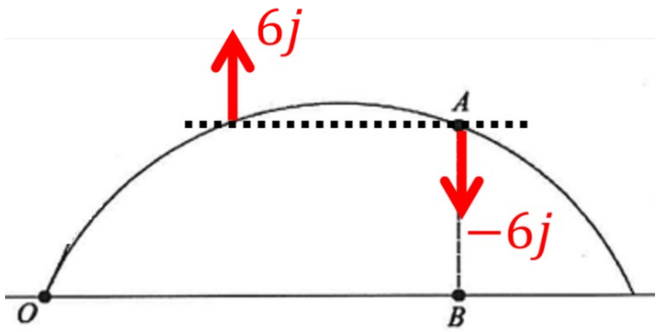
Resultant Speed $= \sqrt{3^2 + 5^2}$
$= \sqrt{34}\ ms^{-1}$

Horizontal Velocity $= 3\ ms^{-1}$

Vertical Velocity $= 5\ ms^{-1}$

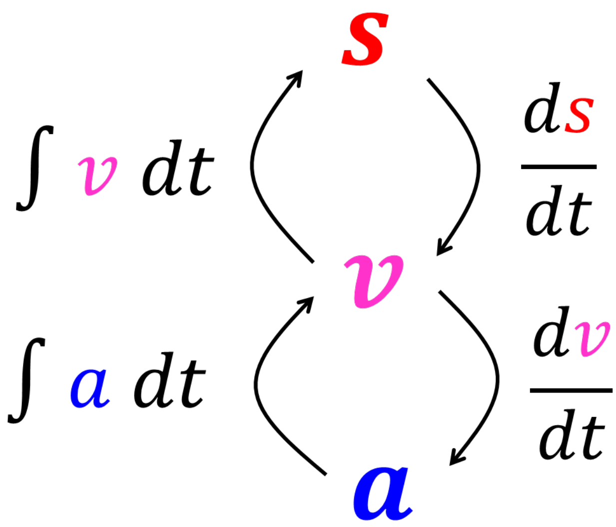
Vertical Speed

Up and Down



Variable Acceleration

If you have variable acceleration, then **do not use** SUVAT formulae.



Remember:

$$\frac{d}{dx}e^{kx} = ke^{kx}$$

Distance Travelled

$$= \int_{start\ time}^{finish\ time} v\ dt$$

Variable Acceleration

Differentiate the
$\boldsymbol{i}$ and $\boldsymbol{j}$ components
separately.

$$s = 3t\boldsymbol{i} + 4t^2\boldsymbol{j}$$

$$v = 3\ \boldsymbol{i} + 8t\ \ \boldsymbol{j}$$

Integrate the
$\boldsymbol{i}$ and $\boldsymbol{j}$ components
separately.
Both components will have
their own $\boldsymbol{C}$ value.

$$\int 3t\boldsymbol{i} + \frac{1}{2}t^2\boldsymbol{j}$$

$$= (\frac{3}{2}t^2 + C)\boldsymbol{i} + (\frac{1}{6}t^3 + C)\boldsymbol{j}$$