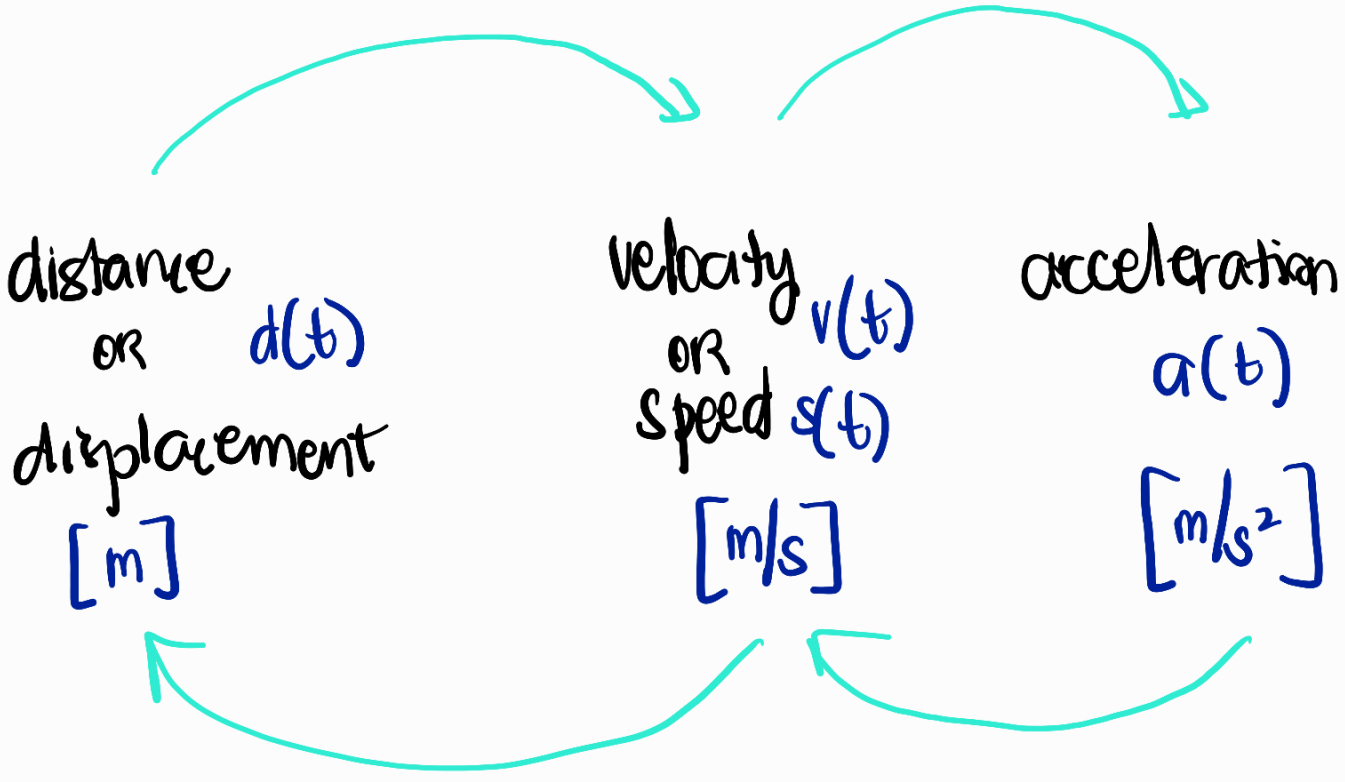
Kinematics

- motion problems



② Ex 1

1. $t = 4 \quad v(t) = 6$

2. $m = \dfrac{6-0}{3-0} = 2$

$2 m/s$

3. $A = \frac{1}{2}(3)(6) + (2)(6) + \frac{1}{2}(4)(6)$

$= 39 m$

④ Ex 2

1. GDC

2. $\int_0^3 |5te^{-1.2t}| \, dt = 3.04 \, m$

3. acceleration is zero when velocity is maximum

max : $v(0.833) = 1.53 \, m/s$

⑥ Ex 3

1. $v(0) = 3(0) + 1$

$= 1 \text{ m/s}$

2. $a(t) = v'(t)$

$= 3 \text{ m/s}^2$

3, $v(t) = 0$, no change in direction

4, $d(t) = \int_0^1 3t + 1 \, dt + \int_1^8 2\sqrt{t} - \frac{1}{t^2} + 3 \, dt$

$= 5.15 \text{ cm}$

⑨ Ex 4

1. $S = 5 + \int_0^6 (\sin 3t - \cos t - 2)\,dt$

$= -63$

2. $v(t) = 0$, 0 m

$0 = \sin 3t - 2\cos t - 2$

$t = 2.32$

3. $v(t) = 0$, so 2 times

4. $a(2) = v'(2)$

$a(t) = v'(t) = 3\cos 3t + 2\sin t$

$a(2) = 3\cos 3(2) + 2\sin(2)$

$= 4.70 \text{ m/s}^2$

5. $v'(t) = 0$

$3\cos 3t + 2\sin t = 0$

$t = 5.85$

$|v(5.85)| = 4.78 \text{ m/s}$

(16) Ex 5

change direction when $v(t)$ changes sign/crosses the x axis

1. $10e^{-\frac{t}{4}} - 5 = 0$

$t \approx 2.773$

$0 \leq t < 2.773 \quad v(t) > 0$

$t > 2.773 \quad v(t) < 0$

2. $a(t) = v'(t)$

$= \frac{d}{dt}\left[10e^{-\frac{t}{4}} - 5\right]$

$= 10e^{-\frac{t}{4}}\left(-\frac{1}{4}\right)$

$= -2.5e^{-t/4}$

$|a(2)| = |-2.5e^{-2/4}|$

≈ 1.516

3. $s(t) = \int v(t)\,dt$ → let u

$= \int 10e^{-t/4} - 5 \; dt$

$= \frac{10e^{-t/4}}{-\frac{1}{4}} - 5t + C$

$= -40e^{-t/4} - 5t + C \qquad s(0) = 0 \quad C = 40$

$= -40e^{-t/4} - 5t + 40$

4. $s(t) = 0$

$0 = 40 - 40e^{-t/4} - 5t$

$t = 0 \text{ or } t \approx 6.374$

GDC

5. $\int_0^{6.37} |v(t)|\,dt$

$= 12.26$

$V(t) = 0$