

Displacement

Standard unit
= meters
m

$$v = \frac{ds}{dt}$$

Velocity

Standard unit
= meters per second
 ms^{-1}

$$s = \int v dt$$

$$a = \frac{dv}{dt}$$

Acceleration

Standard unit
= meters per second per second
 ms^{-2}

$$v = \int a dt$$

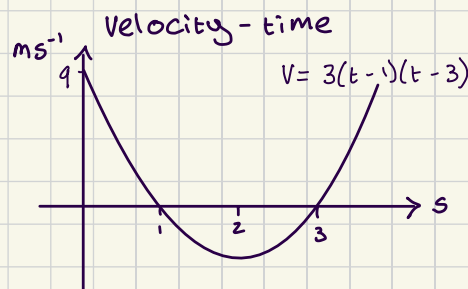
displacement $S = 4t^6 + t^5 + 6t^2 + 4$

Velocity is $v = \frac{ds}{dt} = 6(4t^5) + 5t^4 + 2(6t)$
 $= 24t^5 + 5t^4 + 12t$

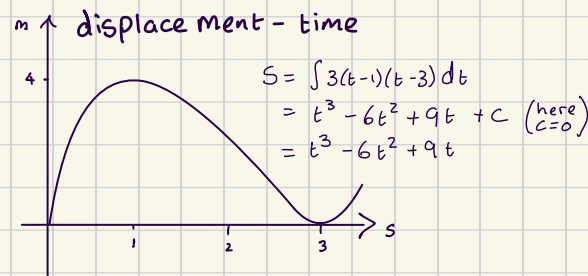
acceleration is $\frac{dv}{dt} = 5(24t^4) + 4(5t^3) + 12$
 $= 120t^4 + 20t^3 + 12$

acceleration $(120t^4 + 20t^3 + 12)ms^{-2}$
at time $t=0$ velocity is $0ms^{-1}$
and displacement is $4m$

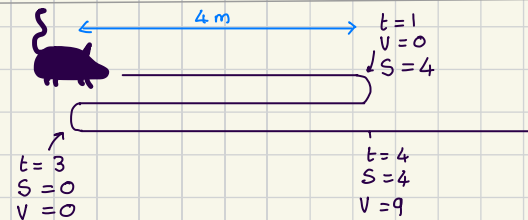
$$\begin{aligned} \Rightarrow v &= \int 120t^4 + 20t^3 + 12 dt \\ &= \frac{120}{5}t^5 + \frac{20}{4}t^4 + \frac{12}{1}t + C \\ &= 24t^5 + 5t^4 + 12t + 0 \quad (\text{at } t=0 \quad v=0 \Rightarrow C=0) \\ &= 24t^5 + 5t^4 + 12t \\ \Rightarrow S &= \int 24t^5 + 5t^4 + 12t dt \\ &= \frac{24}{6}t^6 + \frac{5}{5}t^5 + \frac{12}{2}t^2 + C \\ &= 4t^6 + t^5 + 6t^2 + 4 \quad (\text{at } t=0 \quad S=4 \Rightarrow C=4) \end{aligned}$$



- * For $0 \leq t < 1$ and $3 < t$, v is positive
 $\Rightarrow$ moving forward
- * For $1 < t < 3$, v is negative
 $\Rightarrow$ moving backward



- * For $0 \leq t < 1$ and $t > 3$, s is increasing
 $\Rightarrow$ moving forward
- * For $1 < t < 3$, s is decreasing
 $\Rightarrow$ moving backwards



- * displacement at $t=4$ is
 $4^3 - 6(4)^2 + 9(4) = 4m$
- * distance travelled at $t=4$ is
 $4 + 4 + 4 = 12m$
 $\begin{matrix} \uparrow & \uparrow & \uparrow \\ 0 \leq t \leq 1 & 1 \leq t \leq 3 & 3 \leq t \leq 4 \end{matrix}$