Rates of Change

Distance (displacement) is a function of time.

$$\text{Distance} = s = f(t) = m$$

$$\text{Speed} = \frac{ds}{dt} = f'(t) = m/s$$

$$\text{Acceleration} = \frac{d^2s}{dt^2} = f''(t) = m/s^2$$

Initial $\Rightarrow t = 0$

At rest $\Rightarrow \frac{ds}{dt} = 0$

$s = t^3 + 6t^2 + 5t + 7$ Find

(i) Initial distance

(ii) speed after 2 secs

(iii) acceleration after 4 seconds.

(i) $t = 0$ $s = 7m$

(ii) $s = t^3 + 6t^2 + 5t + 7$

$\frac{ds}{dt} = 3t^2 + 12t + 5$ $t = 2$

$$\frac{ds}{dt} = 41 \text{ m/s}$$

(iii) $\frac{d^2s}{dt^2} = 6t + 12 \qquad t = 4$

$$6(4) + 12 = 36 \text{ m/s}$$

Distance travelled after brakes are applied is given by $s = 18t - t^2$.
Find distance while at rest.

$$s = 18t - t^2$$

$$\frac{ds}{dt} = 18 - 2t = 0$$

$$t = 9 \text{ sec.}$$

$$s = 18(9) - 9^2$$

$$= 81 \text{ m}$$