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physical applications):

Time (t)	الزمن
Displacement (s(t))	الازاحة
Velocity (v(t))	السرعة
Acceleration ((a(t))	التعجيل

Note :

1- السرعة = مشتقة الازاحة $(s'(t) = v(t))$

2- التعجيل = مشتقة السرعة $(v'(t) = a(t))$

Example :1- A body moves on a straight line according to the hall $s(t)=t^3 + 3t^2 + 4t + 1$, where it is measured (s) in meters and time in minutes. It is very localized, fast, and accelerated . After 5 minutes, the movement began.

Sol:- \\\

$$S(5) = (5)^3 + 3(5)^2 + 4(5) + 1 = 125 + 75 + 20 + 1 = 221m$$

$$V(t) = s'(t) = 3t^2 + 6t + 4$$

$$V(5) = 3(5)^2 + 6(5) + 4 = 75 + 30 + 4 = 109$$

$$a(t) = v'(t) = 6t + 6$$

$$a(5) = 6(5) + 6 = 36$$

Example2 :- A body moves on a straight line along the hall $s(t)=t^2 - 20t - 20t + 120$, where the distance is measured in kilometers and the time in hours is :

1-lts speed after five hours .

2-After that , when its speed becomes zero .

Sol:\\

$$1- v(t) = s'(t) = 2t - 20$$

$$V(5) = 2(5) - 20 = 10 - 20 = -10$$

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$$2- v(t) = 0, 2t-20 = 0, 2t=20, t=10$$

$$S(10) = 102-20(10) + 120 = 100 - 200 + 120 = 20$$

Example 3:- For a body moving in a straight line, according to the relationship $s(t) = \sqrt{2t+1}$, find the time it takes for it to reach a velocity of $1/3$ m/s

Sol:

$$V(t) = s'(t) = \frac{1}{\sqrt{2t+1}}$$

$$V(t) = \frac{1}{3}$$

$$\frac{1}{\sqrt{2t+1}} = \frac{1}{3}$$

$$\sqrt{2t+1} = 3$$

$$2t+1 = 9$$

$$2t = 9-1$$

$$2t = 8$$

$$t = 4$$

Example 4:- if a body moves according to the relationship $s(t) = t^3 - 3t^2 + 18t + 12$ where s is measured in meters and the time is in seconds, calculate the distance of the body from the starting point of the movement and its velocity when the acceleration becomes zero.

$$V(t) = s'(t) = 3t^2 - 6t + 18$$

$$a(t) = v'(t) = 6t - 6$$

$$6t - 6 = 0$$

$$6t = 6, t = 1$$

$$s(1) = (1)^3 - 3(1)^2 + 18(1) + 12 = 1 - 3 + 18 + 12 = -16 + 30 = 14$$

$$v(1) = 3(1)^2 - 6(1) + 18 = 3 - 6 + 18 = 15$$