محاضرة رقم (7)

التطبيقات الفزيائية على المشتقة:-

Physical Applications on Derivatives:-

1- displacement:- الازاحة p(t) [m,cm,km]

distance:- المسافة

2- velocity or speed السرعة v(t) [m/s or m/min or km/h]

3- acceleration التعجيل a(t) $[m/s^2 \ or \ m/\min^2 \ or \ km/h^2]$

ملاحظة مهمة جدا:- مشتقة الازاحة تعطي سرعة ومشتقة السرعة تعطي التعجيل:-

السرعة :- مشتقة الازاحة .

التعجيل :- مشتقة للسرعة.

<u>Example</u> (1):- A moving body on a straight line according to the rule $p(t) = \frac{1}{3}t^3 - 2t^2 + 3t - 5$

Where the displacement <u>p(t)</u> is in meters;

Time(t) in seconds;

<u>Find</u> speed <u>v(t)</u>? when acceleration <u>a(t)</u> equals zero

Solution :-

$v(t) = p(t)'$

$p(t) = \frac{1}{3}t^3 - 2t^2 + 3t - 5$

$v(t) = \frac{1}{\cancel{3}} * \cancel{3}t^2 - 4t + 3$

$v(t) = t^2 - 4t + 3 \quad (speed)$

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

$v(t) = t^2 - 4t + 3$

$a(t) = 2t - 4$

$\therefore a(t) = 0$

$2t - 4 = 0 \Rightarrow 2t = 4 \Rightarrow t = \frac{4}{2} = 2$

$t = 2 \text{ sec}$

$v(t) = t^2 - 4t + 3$

$v(2) = (2)^2 - 4(2) + 3$

$v(2) = 4 - 8 + 3$

$v(2) = 4 - 5 = -1\, m/\text{sec}$

<u>Example</u> (2):- Let V (t) speed A moving body on line straight according to the rule $v(t) = 3t^2 - 6t + 9$

Find 1- the velocity at t=2sec.

2- the velocity at acceleration equal zero.

Solution:-

$v(t) = 3t^2 - 6t + 9$

$when :- (t = 2)$

$v(2) = 3(2)^2 - 6(2) + 9$

$v(2) = \cancel{12} - \cancel{12} + 9 = 9 \ cm/sec$

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

$v(t) = 3t^2 - 6t + 9$

$a(t) = 6t - 6$

$a(t) = 0$

$6t - 6 = 0 \Rightarrow 6t = 6 \Rightarrow t = 1$

$v(t) = 3t^2 - 6t + 9$

$v(1) = 3(1)^2 - 6(1) + 9$

$= 3 - 6 + 9$

$= 3 + 3 = 6 \ cm/sec$

Example (3):- Let V (t) cm/sec speed a moving body on line straight According to the rule

$v(t) = t^3 - t^2 + 5$

Find the velocity? when the acceleration equal $8\,cm/\sec^2$

Solution:-

$v(t) = t^3 - t^2 + 5 \quad (velocity)$

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

$a(t) = 3t^2 - 2t$

$a(t) = 8$

$\Rightarrow 3t^2 - 2t = 8$

$\Rightarrow 3t^2 - 2t - 8 = 0$

$\Rightarrow (3t + 4)(t - 2) = 0$

$\Rightarrow (3t + 4) = 0 \Rightarrow 3t = -4 \Rightarrow \cancel{t = -\frac{4}{3}}$

$\Rightarrow (t - 2) = 0 \Rightarrow t = 2$

$v(2) = t^3 - t^2 + 5$

$v(2) = (2)^3 - (2)^2 + 5$

$= 8 - 4 + 5$

$= 9\,cm/\sec$