AH Higher derivatives & their application.notebook

Higher Derivatives

The first derivative is represented by f'(x) or dy/dx. The second is represented by f''(x) or $\frac{d^3y}{dx^2}$. The third is f'''(x) or $f^{s}(x)$ or $\frac{d^3y}{dx^3}$ and so on.

How we use higher derivatives.

1. Finding Stationary Points

 $\frac{d^2 y}{dx^2}$ finds the nature of the S.P's. (Rate of change of the gradient).

Recall that $\frac{d^2y}{dx^2} > 0 \Rightarrow \min S.P.$ $\frac{d^2y}{dx^2} < 0 \Rightarrow \max S.P.$

 $\frac{d^2 y}{dx^2} = 0 \Rightarrow Use a nature table$

Stationary Points.

Example: Find the S.P's for $y = 2x^3 - 3x^2 - 12x$ and determine their

at sp's "| = 0 nature. 12x-6 of x=2 12(2)-6=18>0 dydx = bx'-bx−R>0 x-2=0 x==1 12(-1)-6==1820 min s.p. at (2,-20) at (-117)

How we use higher derivatives

2. Displacement, velocity and acceleration

Recall, velocity is the rate of change of displacement with respect to time. $v = \frac{ds}{dt}$ or s'(t)

Acceleration is the rate of change of velocity with respect to time.

$$a = \frac{dv}{dt} = \frac{d^2s}{dt^2} \text{ or } s''(t)$$

If $\frac{d^2s}{dt^2} > 0 \Rightarrow$ acceleration, if $\frac{d^2s}{dt^2} < 0 \Rightarrow$ deceleration.

Displacement, velocity and acceleration

Examples:

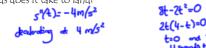
1. A pebble is thrown upwards from a point A. The height of the pebble, s metres above A after t seconds is given by the formula

 $s = 8t - 2t^2$

(a) Calculate the velocity of the pebble at the point at which it is thrown. $S'(k) = \delta - 4k$ to t = 0

5'6)= 8m/s

(b) Calculate the acceleration of the pebble as it lands and after how many seconds does it take to land?



2. The displacement s metres, of point P at time t seconds is given by the formula $s = 4t^3 - t^2 + 20t - 10$

Examples:

Displacement, velocity and acceleration

(a) Find the velocity of P after 5 seconds s'(7) - 12(3)²-2(5)+20 - 3<u>10m</u>/s

(b) Find the time at which the acceleration of P is 22 m/s^{-2}

s"(t)= 24t-2 24t-2=22 24t=24 t<u>=1</u>see