

Opia Favour Oghesteran o

19/FNG 06/052

Mechanical =

### Question 1

A particle moves along a curve  $x = 8t^3$ ,  $y = 4t^3 - 7t$  and  $z = t + 3$ , where  $t$  is time, find its:

- i Velocity
- ii acceleration

### Solution

$$r = 8t^3 i + (4t^3 - 7t)j + (t + 3)k$$

i Velocity =  $\frac{dr}{dt}$

$$\frac{dr}{dt} = 24t^2 i + (12t^2 - 7)j + k$$

$\therefore$  Velocity =  $24t^2 i + (12t^2 - 7)j + k$

ii acceleration =  $\frac{d^2 r}{dt^2}$

$$\frac{d^2 r}{dt^2} = 48t i + 24t j$$

$\therefore$  acceleration =  $48t i + 24t j$

### Question 2

Find the unit tangent vector to the space curve  $x = 3t$ ,  $y = t^3$  and  $z = t^2$  at  $t = 1$

### Solution

$$r = 3t i + t^3 j + t^2 k$$

$$\frac{dr}{dt} = 3i + 3t^2 j + 2t k$$

$$\text{at } t = 1 = 3i + 3j + 2k$$

$$\left| \frac{dr}{dt} \right| = \sqrt{3^2 + 3^2 + 2^2} = \sqrt{9 + 9 + 4} = \sqrt{22}$$

$$\text{Unit Tangent Vector } (T) = \frac{dr/dt}{|dr/dt|} = \frac{3i + 3j + 2k}{\sqrt{22}}$$