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MATH 102

Mechanical Engineering

(1) $x = 8t^3$, $y = 4t^3 - 7t$, $z = t + 3$,

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

(i) Velocity $\frac{dr}{dt} = 24t^2 i + (12t^2 - 7) j + 1k$

(ii) Acceleration

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

(2)

$$x = 3t, \quad y = t^3, \quad z = t^2 \quad \text{at } t = 1$$

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

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

At $t = 1$

$$3\,i + 3(1)^2 j + 2(1)k$$

$$= 3i + 3j + 2k$$

$$\left|\frac{dr}{dt}\right| = \sqrt{(3)^2 + (3)^2 + (2)^2}$$

$$= \sqrt{22}$$

$$T = \frac{\frac{dr}{dt}}{\left|\frac{dr}{dt}\right|} = \frac{3i + 3j + 2k}{\sqrt{22}}$$