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Mechanical Engineering

S/N: 37.

MAT 102

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

Let $r = 8t^3\hat{i} + (4t^3 - 7t)\hat{j} + (t + 3)\hat{k}$

Since $t = \text{time}$

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

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

2) Given $x = 3t$, $y = t^3$, $z = t^2$

Let $r = 3t\hat{i} + t^3\hat{j} + t^2\hat{k}$

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

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

$$\left| \frac{dr}{dt} \right|_{t=1} = \sqrt{(3)^2 + (3)^2 + (2)^2}$$

$$= \sqrt{9 + 9 + 4} = \sqrt{22}$$

Hence the Unit tangent $T_2 = \frac{\frac{dr}{dt}}{\left| \frac{dr}{dt} \right|}$

$$T_2 = \frac{3\hat{i} + 3\hat{j} + 2\hat{k}}{\sqrt{22}}$$