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191 ENG 061005

Mechanical Engineering

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

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

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

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

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

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

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

$$\text{At } t = 1$$

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

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

$$\left| \frac{dr}{dt} \right| = \sqrt{(\cancel{3})^2 + (3)^2 + (3)^2 + (2)^2} = \sqrt{22}$$

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

$$\left| \frac{dr}{dt} \right| = \sqrt{22}$$