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Maths 102.

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

$$r = xi + yj + zk$$

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

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

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

$$ii) \quad \text{Acceleration} = \frac{d^2r}{dt^2} = 48ti + 24tj + 0$$

$$\text{Acceleration} = 48ti + 24tj$$

$$2) \quad x = 3t, \quad y = t^3, \quad z = t^2$$

$$r = xi + yj + zk$$

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

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

$$t = 1; \quad \frac{dr}{dt} = 3i + 3j + 2k$$

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

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

$$= \sqrt{22}$$

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

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