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19/ENG 021014

MATH 102

$$1) r = (8t^3)i + (4t^3 - 7t)j + (t + 3)k$$

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

$$\text{Acceleration} = \frac{d^2r}{dt^2} = 48t + 24tj + 0$$

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

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

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

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

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

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

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