1. $x = 8t^3$ $y = 4t^3 - 7t$, $z = t + 3$ where t is time find its

a. velocity

$r = xi + yj + zk$

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

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

acceleration $= \frac{d^2r}{dt^2} = 48i + 24tj$

2. Find the unit tangent vector to the space curve $x = 3t$, $y = t^3$ $z = t^2$ at $t = 1$.

using $T = \frac{dr/dt}{|dr/dt|}$

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

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

$t = 1$

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

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

$= \sqrt{22}$

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