

Quiz 3, section A02 solutions

The velocity vector of a particle moving in space at time t is given by $\vec{v}(t) = \langle 1, 2t, 4t \rangle$. At time $t=1$, its position vector is $\langle 1, 1, 1 \rangle$. Find the position vector $\vec{r}(t)$.

$$\begin{aligned}\text{Solution: } \vec{r}(t) &= \int \vec{v}(t) dt = \int \langle 1, 2t, 4t \rangle dt \\ &= \langle t + C_1, t^2 + C_2, 2t^2 + C_3 \rangle\end{aligned}$$

$$\langle 1, 1, 1 \rangle = \vec{r}(1) = \langle 1 + C_1, 1 + C_2, 2 + C_3 \rangle$$

$$1 + C_1 = 1 \Rightarrow C_1 = 0$$

$$1 + C_2 = 1 \Rightarrow C_2 = 0$$

$$2 + C_3 = 1 \Rightarrow C_3 = -1$$

$$\vec{r}(t) = \langle t, t^2, 2t^2 - 1 \rangle$$