12.1, 12.2 #14

$$\begin{cases} \dfrac{d\vec{r}}{dt} = \langle t, t^2, t^3 \rangle \\ \vec{r}(0) = \langle 1, 2, 3 \rangle \end{cases}$$

$$\int \langle t, t^2, t^3 \rangle \, dt = \left\langle \tfrac{1}{2}t^2 + c_1, \tfrac{1}{3}t^3 + c_2, \tfrac{1}{4}t^4 + c_3 \right\rangle$$

At $t=0$: $\langle 1, 2, 3 \rangle = \langle 0 + c_1, 0 + c_2, 0 + c_3 \rangle$

$$\langle c_1, c_2, c_3 \rangle = \langle 1, 2, 3 \rangle.$$

$$\vec{r}(t) = \left\langle \tfrac{1}{2}t^2 + 1, \tfrac{1}{3}t^3 + 2, \tfrac{1}{4}t^4 + 3 \right\rangle$$

So at $t=1$, the particle is at point $\left(\tfrac{3}{2}, \tfrac{7}{3}, \tfrac{13}{4}\right)$.