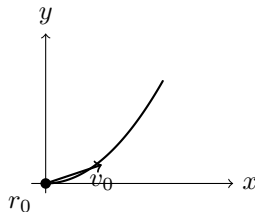


Question 7

A particle has acceleration $\vec{a}(t) = \langle 2, 6t, e^t \rangle$, initial velocity $\vec{v}(0) = \langle 1, -1, 0 \rangle$, and initial position $\vec{r}(0) = \langle 2, 0, 3 \rangle$. Determine $\vec{v}(t)$ and $\vec{r}(t)$.

Question 7 – Solution

Strategy Integrate twice and use each vector initial condition to determine constants.



Velocity

$$\vec{v}(t) = \langle 2t + C_1, 3t^2 + C_2, e^t + C_3 \rangle.$$

Using $\vec{v}(0) = \langle 1, -1, 0 \rangle$ gives

$$\boxed{\vec{v}(t) = \langle 2t + 1, 3t^2 - 1, e^t - 1 \rangle}.$$

Position Integrating again and applying $\vec{r}(0) = \langle 2, 0, 3 \rangle$,

$$\boxed{\vec{r}(t) = \langle t^2 + t + 2, t^3 - t, e^t - t + 2 \rangle}.$$

Verification Differentiating the final position recovers $\vec{v}$, and differentiating once more recovers the given acceleration.