13.2, number 11: **Find** $\vec{\boldsymbol{r}}(t)$ **if** $\frac{d\vec{\boldsymbol{r}}}{dt} = -t\,\vec{\boldsymbol{i}} - t\,\vec{\boldsymbol{j}} - t\,\vec{\boldsymbol{k}}$ **and** $\vec{\boldsymbol{r}}(0) = \vec{\boldsymbol{i}} + 2\,\vec{\boldsymbol{j}} + 3\,\vec{\boldsymbol{k}}$**.**

Answer:

$$\begin{aligned}\vec{\boldsymbol{r}}(t) &= \int \frac{d\vec{\boldsymbol{r}}}{dt}dt \\ &= \int(-t\,\vec{\boldsymbol{i}} - t\,\vec{\boldsymbol{j}} - t\,\vec{\boldsymbol{k}})dt \\ &= \frac{-t^2}{2}\,\vec{\boldsymbol{i}} + \frac{-t^2}{2}\,\vec{\boldsymbol{j}} + \frac{-t^2}{2}\,\vec{\boldsymbol{k}} + \vec{\boldsymbol{c}}\end{aligned}$$

Use the initial condition to find $\vec{\boldsymbol{c}}$:

$$\vec{\boldsymbol{i}} + 2\,\vec{\boldsymbol{j}} + 3\,\vec{\boldsymbol{k}} = \vec{\boldsymbol{r}}(0) = \vec{\boldsymbol{c}}.$$

We conclude that

$$\boxed{\vec{\boldsymbol{r}}(t) = (\tfrac{-t^2}{2} + 1)\,\vec{\boldsymbol{i}} + (\tfrac{-t^2}{2} + 2)\,\vec{\boldsymbol{j}} + (\tfrac{-t^2}{2} + 3)\,\vec{\boldsymbol{k}}.}$$