Chapter 4   Problem 31 [†]

Given

$\vec{r}(t) = \cos(1.0t)\,\hat{i} + \sin(1.0t)\,\hat{j} + t\,\hat{k}$

Solution

a) Find the velocity vector.

Velocity is defined as the time derivative of the position function. Therefore,

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d}{dt}\left(\cos(1.0t)\,\hat{i} + \sin(1.0t)\,\hat{j} + t\,\hat{k}\right)$$

$$\vec{v} = -\sin(1.0t)\,\hat{i} + \cos(1.0t)\,\hat{j} + 1.0\,\hat{k}$$

b) Acceleration is defined as the time derivative of the velocity function. Therefore,

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d}{dt}\left(-\sin(1.0t)\,\hat{i} + \cos(1.0t)\,\hat{j} + 1.0\,\hat{k}\right)$$

$$\vec{a} = -\cos(1.0t)\,\hat{i} - \sin(1.0t)\,\hat{j}$$

[†]Problem from University Physics by Ling, Sanny and Moebs (OpenStax)