

求下列位置向量之速度、速率與加速度：

(a) $\vec{F}(t) = -\sin(t)\vec{i} + 3e^t\vec{j} - \cos(t)\vec{k}$

(b) $\vec{F}(t) = -\cos(t)\vec{i} - 2e^t\vec{j} - \sin(t)\vec{k}$

<Solution>

(a) The velocity is

$$\vec{v}(t) = -\cos(t)\vec{i} + 3e^t\vec{j} + \sin(t)\vec{k}$$

The acceleration is

$$\vec{a}(t) = \sin(t)\vec{i} + 3e^t\vec{j} - \cos(t)\vec{k}$$

The speed is

$$v(t) = \sqrt{\cos^2(t) + 9e^{2t} + \cos^2(t)}$$

(b) The velocity is

$$\vec{v}(t) = \sin(t)\vec{i} - 2e^t\vec{j} + \cos(t)\vec{k}$$

The acceleration is

$$\vec{a}(t) = \cos(t)\vec{i} - 2e^t\vec{j} - \sin(t)\vec{k}$$

The speed is

$$v(t) = \sqrt{\sin^2(t) + 4e^{2t}(t) + \cos^2(t)}$$