Chapter 4

Motion in Two and Three Dimensions

In this chapter, we will study the motion in two and three dimensions. Examples of two dimention motion include projectile motion and uniform circular motion

4-2 | Position and Displacement

Position Vector The location of a particle relative to the origin of a coordinate system is given by a *position vector* $\vec{r}$, which in unit-vector notation is

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}. \qquad (4\text{-}1)$$

Here $x\hat{i}$, $y\hat{j}$, and $z\hat{k}$ are the vector components of position vector $\vec{r}$, and x, y, and z are its scalar components

Fig. 4-1 shows a particle with position vector

$$\vec{r} = (-3\text{ m})\hat{i} + (2\text{ m})\hat{j} + (5\text{ m})\hat{k}$$

and rectangular coordinates (-3 m, 2 m, 5 m). Along the x axis the particle is 3 m from the origin, in the $-\hat{i}$ direction. Along the y axis it is 2 m from the origin, in the $+\hat{j}$ direction. Along the z axis it is 5 m from the origin, in the $+\hat{k}$ direction.

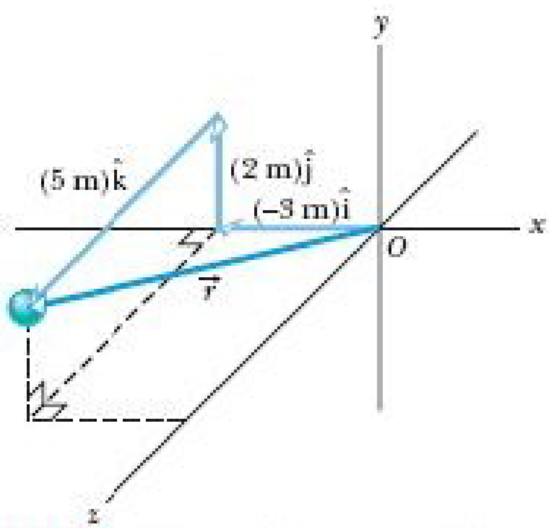

FIG. 4-1 The position vector $\vec{r}$ for a particle is the vector sum of its vector components.