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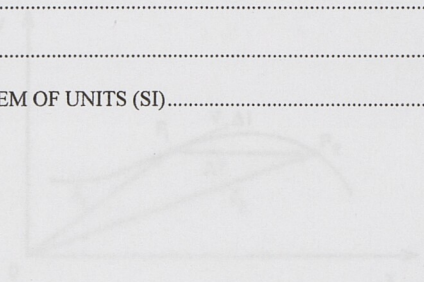


Figure 1-1

The vector  $\Delta r$  is called the **displacement vector**. It is defined as the vector representing change in position of a particle,  $\Delta r = r_2 - r_1$ . This vector represents the displacement during the time interval  $\Delta t = t_2 - t_1$ . In vector notation the both vectors can be expressed (in general, for three dimensions),  $r_1 = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$  where  $x_1, y_1$  and  $z_1$  are coordinates of the point  $P_1$  and  $\hat{i}, \hat{j}$  and  $\hat{k}$  are unit vectors of unit length along the chosen coordinate axes (mutually perpendicular). Similarly,  $r_2 = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$ .

Hence

$$\Delta r = r_2 - r_1 = (x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j} + (z_2 - z_1)\hat{k} \tag{1-1}$$

The **average velocity vector** over the time interval  $\Delta t = t_2 - t_1$  is defined as

$$v_{av} = \frac{\Delta r}{\Delta t} = \frac{r_2 - r_1}{t_2 - t_1} \tag{1-2}$$

where  $\Delta t$  is the change in the position vector during time interval  $\Delta t$ .

Note that the magnitude of the average velocity vector in Fig. 1-1 is not equal to the average speed