

4.2: Position, Time Interval, and Displacement

Position

Consider a point-like object moving in one dimension. We denote the **position coordinate** of the object *with respect to the choice of origin* by $x(t)$. The position coordinate is a function of time and can be positive, zero, or negative, depending on the location of the object. The position of the object with respect to the origin has both direction and magnitude, and hence is a vector (Figure 4.2.1), which we shall denote as the **position vector** (or simply position) and write as

$$\vec{\mathbf{r}}(t) = x(t)\hat{\mathbf{i}}$$

We denote the position coordinate at $t = 0$ by the symbol $x_0 \equiv x(t = 0)$. The SI unit for position is the meter [m].

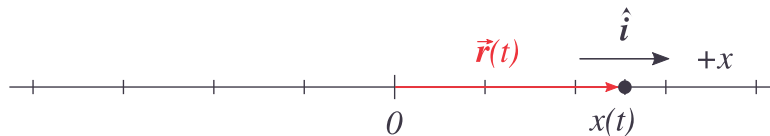


Figure 4.2.1: The position vector, with reference to a chosen origin. (CC BY-NC; Ümit Kaya)

Time Interval

Consider a closed interval of time $[t_1, t_2]$. We characterize this time interval by the difference in endpoints of the interval,

$$\Delta t = t_2 - t_1.$$

The SI units for time intervals are seconds [s].

Displacement

The **displacement** of a body during a time interval $[t_1, t_2]$ (Figure 4.2.2) is defined to be the change in the position of the body

$$\Delta \vec{\mathbf{r}} \equiv \vec{\mathbf{r}}(t_2) - \vec{\mathbf{r}}(t_1) = (x(t_2) - x(t_1))\hat{\mathbf{i}} \equiv \Delta x(t)\hat{\mathbf{i}}$$

Displacement is a vector quantity.

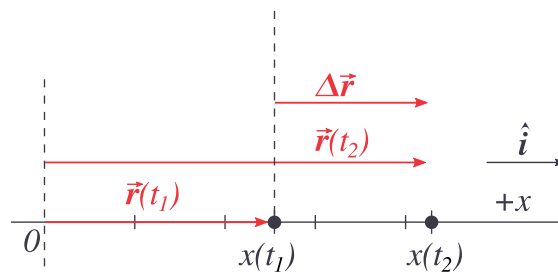


Figure 4.2.2: The displacement vector of an object over a time interval is the vector difference between the two position vectors. (CC BY-NC; Ümit Kaya)

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