

8.1: Position

Let's consider the motion of a *particle*—that is, a point mass. In one dimension, a particle is constrained to move back and forth along the x axis. At any given time t , we can specify the *position* of the particle by giving its x coordinate. Giving the x coordinate for all times t provides all the information we need for a complete description of the motion.

We are free to define the coordinate system however we want; the coordinate system is a mathematical construction that we define for our own convenience, and it won't affect the physics. For one-dimensional motion, we align the x axis with the direction of the motion, and we are free to choose the origin at any place that's convenient. Also, we will generally be free to choose the zero time $t = 0$ to be whenever is convenient.

Related to position is the concept of displacement. If a particle is at position x_1 at some time t_1 , then at position x_2 at some later time t_2 , then the particle has undergone a displacement

$$\Delta x = x_2 - x_1. \quad (8.1.1)$$

Note that the displacement depends only on the beginning and ending positions of the particle, not on what happens in between. For example, if the particle starts out at position $x_1 = 3$ m, then moves to 50 m, then back to $x_2 = 3$ m again, the displacement $\Delta x = 0$. The displacement is not the same as the total distance traveled—it is the net distance traveled.

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