

2.2 Velocity

Velocity is the **rate of change** of displacement-velocity tells us how an object's position is changing in time.

$$\text{velocity} = \frac{\text{change in position}}{\text{change in time}}$$

Or, in symbols (for motion along only the x axis):

$$v = \frac{\Delta x}{\Delta t} \quad (2.1)$$

Because position is a vector, velocity is also a vector. The direction of the velocity vector is the direction of motion. When working with one-dimensional motion, a positive or negative sign indicates direction; for two-dimensional motion we'll use vector notation. For two-dimensional motion, we use

the **rate of change** of each component of the position:

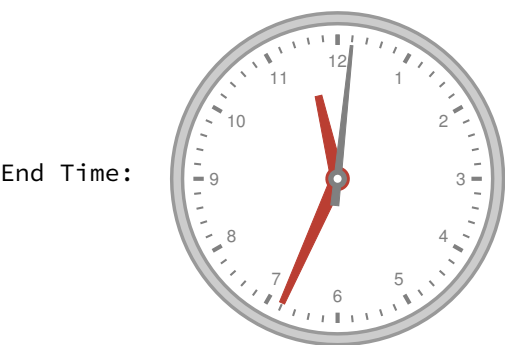
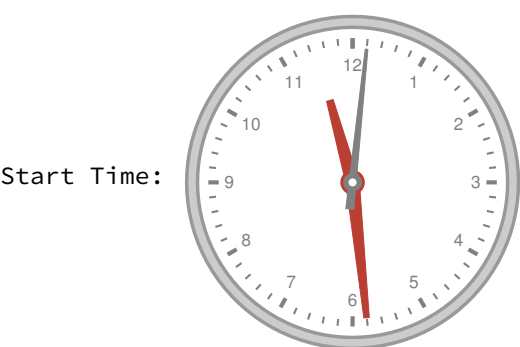
$$\vec{v} = \left(\frac{\Delta x}{\Delta t} \right) \hat{x} + \left(\frac{\Delta y}{\Delta t} \right) \hat{y} \quad (2.2)$$

The magnitude of an object's velocity is its speed:

$$|\vec{v}| = \text{speed}$$

The SI unit for velocity (and speed) is meters per second (m/s).

Example 2.3



$$\Delta t = 5, \quad \Delta x = -2, \quad \Delta y = 8$$

$$\vec{v} = \left(\frac{\Delta x}{\Delta t} \right) \hat{x} + \left(\frac{\Delta y}{\Delta t} \right) \hat{y} = \left(\frac{-2}{5} \right) \hat{x} + \left(\frac{8}{5} \right) \hat{y}$$

$$|\vec{v}| = \sqrt{\left(\frac{-2}{5} \right)^2 + \left(\frac{8}{5} \right)^2}$$

