

Chapter 2: Describing Motion in One Dimension

Lecture 1A

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2-1] Reference Frames and Displacement



student ① : standing on the ground (NOT moving)

student ② : sitting in the bus.

student ③ : moving to the right inside the bus

bus : moving to the right at 10 m/s.

How can we describe the motion of each?

A] From the point of view of student ①
(This means how he sees the others moving)

student ②: moving to the right at 10 m/s.

student ③: moving to the right at $10 + 3 = 13$ m/s.

B] From point of view of student ②

student ①: moves to the left at 10 m/s.

student ③: moves to the right at 3 m/s.

Note that the speed of student ③ (for example) is different depending on the observer (student ① or student ②).

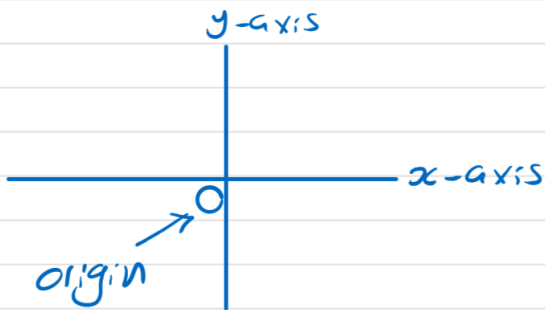
To specify velocity we need a frame of reference

In case A above we are in the frame of reference of student ①.

In case B above we are in the frame of reference of student ②.

What does a frame of reference consist of?

In two dimensions it consists of the x and y axes.



Cartesian Coordinate System in two dimensions.

In frame of reference of student ①, means that

this student is at rest at the origin and gives positions with respect to the origin.

He also measures velocities with respect to this set of axes (x and y).

2-2] Average Velocity

Student ①

→ 3 m/s
○
|
└

Student ②

← 3 m/s
○
|
└

Both ① and ② have the same speed.

speed gives how fast some one or an object is moving.

If you move a distance of 9 m in 3 s \Rightarrow

we define average speed \bar{s} as :

$$\bar{s} = \frac{\text{total distance covered}}{\text{time elapsed}}$$

$$\bar{s} = \frac{9}{3} = 3 \text{ m/s.}$$