

A faint, stylized illustration of a man in a hat and a car, serving as a background for the chapter title. The man is wearing a cap and a jacket, and the car is a classic sedan. The entire illustration is rendered in a light gray, sketchy style.

Chapter 3: Describing Motion

Velocity

- Track stars are always asked the same questions:
- What distance do you run.
- And what was your time.



In physics we ask the same question:
How far and how long did it take?



Measuring Distance

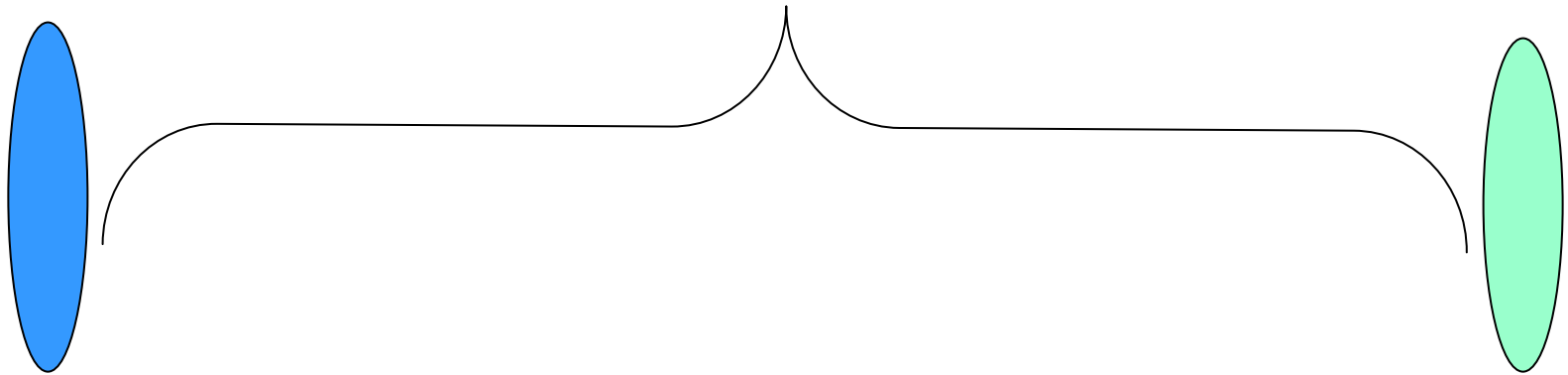
In order to know how far away something is, you have to say where you are starting from...

The starting point could be called your Reference Point.

It doesn't really matter where you choose your point to be, as long as you chose one.

So If We Have a Reference Point

And we know the Position of an object,
then we know what the separation
distance is between them



Finding the Average Velocity



Velocity is simply how far you went divided by the time it took you to get there.

So the calculation is something like this:

$$V = \frac{D}{T}$$

$$V = \frac{\Delta D}{\Delta T} = \frac{D_2 - D_1}{T_2 - T_1}$$



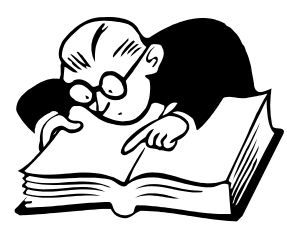
Calculating Acceleration

Acceleration is the rate of change in velocity.

So the calculation is something like this:

$$\text{Acceleration (a)} = \frac{\text{Final velocity (v}_f\text{)} - \text{Initial velocity (v}_i\text{)}}{\text{Time (t)}}$$

$$a = \frac{\Delta v}{t}$$

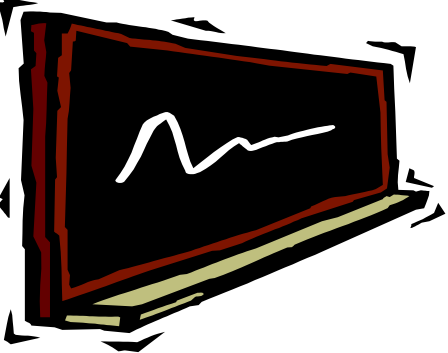


Review of Dimensional Analysis

If you have a given value in one unit and you want to change it to another, then simply multiply it by an appropriate fraction

$$\cancel{(2 \text{ min})} \left(\frac{60 \text{ s}}{\cancel{1 \text{ min}}} \right) = 120 \text{ s}$$

Change 2 minutes into its equivalent in seconds.

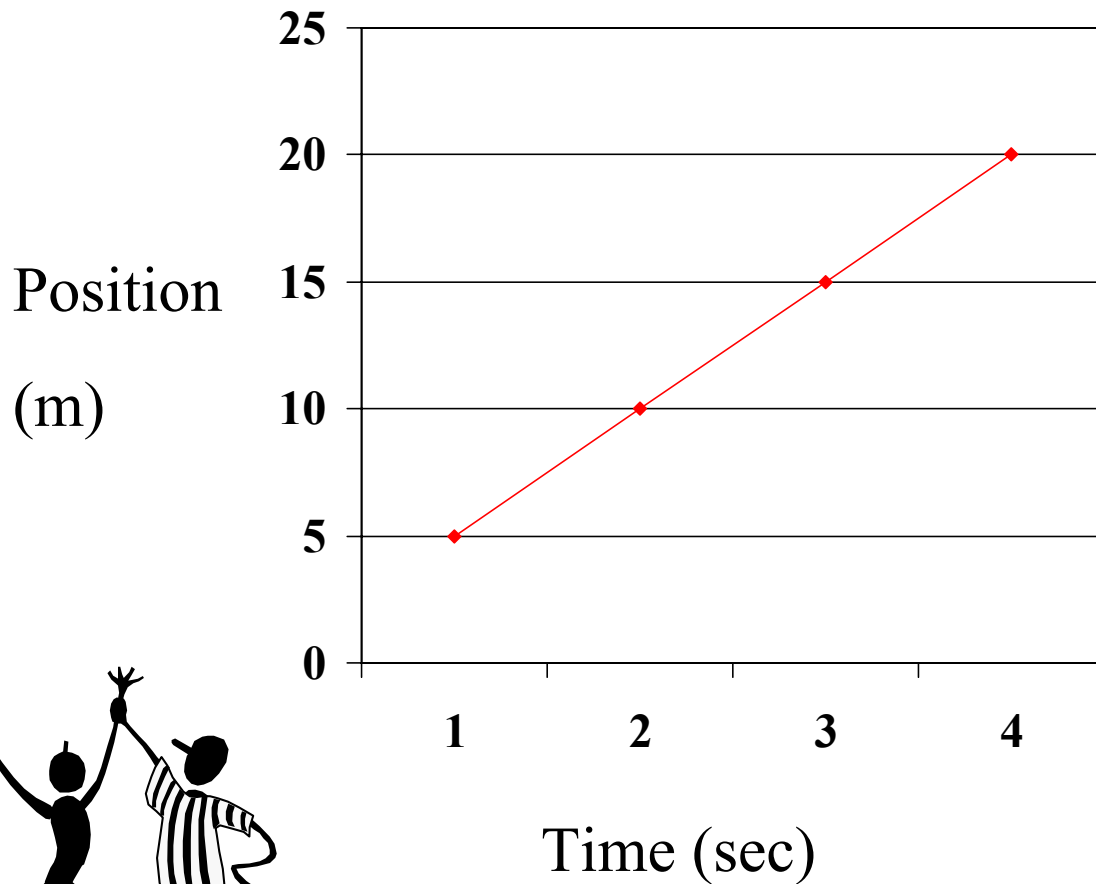


Velocity Continued

Velocity can only be measured for a given time interval not just in general...

If the average velocity of an object is the same for all time intervals, the object is in constant velocity

Position Versus Time



What is the slope of this graph?

$$m = \frac{\text{Position}}{\text{Time}}$$

Velocity



Force and Motion

- A force is a push or pull one body exerts on another
- Forces balance if the forces are equal in size and opposite in direction

Inertia

- An object will tend to do whatever it is doing unless a force is applied to it.
 - If it is resting it will tend to stay resting
 - If it is moving it will keep moving with the same speed and same direction

(Newton's First Law)

- Why do we not see this happening all the time in the “real world”?

Friction and Gravity

- Friction is caused when 2 objects are moving and are touching each other
- Gravity is the force that every object in the universe feels and causes (depending in the mass of the object and the distance between)