

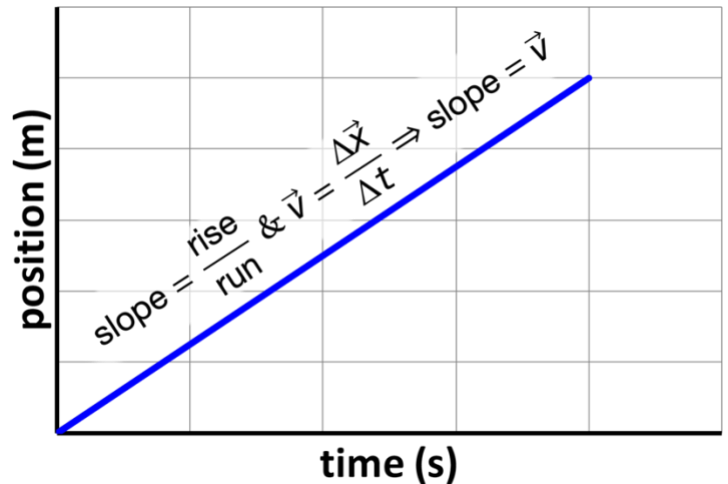
Whenever you have a graph, you should always know what the slope of a line on the graph represents and what the area “under” a curve on that graph represents.

Let’s begin with the basic equation for velocity:

$$\vec{v} = \frac{\Delta \vec{x}}{\Delta t}$$

We also know $\text{slope} = \frac{\text{rise}}{\text{run}}$

Therefore, if position is on the vertical axis and time is on the horizontal axis, then we know the slope of a line on that graph represents velocity.



We can do the same thing with acceleration: $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$

If velocity is on the vertical axis and time is on the horizontal axis, then the slope a line on that graph represents acceleration.

This is a pattern which repeats itself many times in physics. For example, Newton’s second law:

$$\sum \vec{F} = \frac{\Delta \vec{p}}{\Delta t}$$

If vertical axis is linear momentum and horizontal axis is time, slope of a line represents net force.

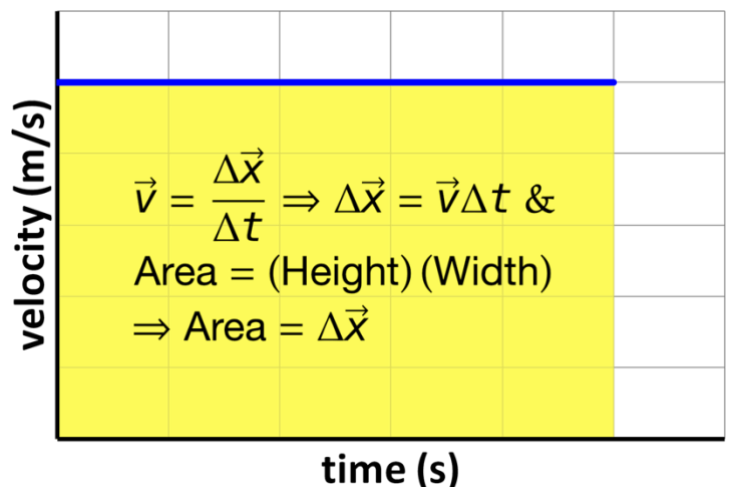
We can also rearrange these equations:

$$\vec{v} = \frac{\Delta \vec{x}}{\Delta t} \Rightarrow \Delta \vec{x} = \vec{v} \Delta t$$

And we know the equation for the area of a rectangle¹:

Area = (Height) (Width)

Therefore, if velocity is on the vertical axis and time is on the horizontal axis, then the area “under” a curve on that graph represents change in position or displacement.



¹ I know not all areas “under” curves will be in the shape of a rectangle. The true derivation of this involves calculus. You are welcome to [learn about that from me](#) if you want to!

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

If acceleration is on the vertical axis and time is on the horizontal axis, the area “under” a curve on that graph represents change in velocity.

$$\sum \vec{F} = \frac{\Delta \vec{p}}{\Delta t} \Rightarrow \vec{J} = \Delta \vec{p} = \sum \vec{F} \Delta t$$

If net force is on the vertical axis and time is on the horizontal axis, the area “under” a curve on that graph represents change in linear momentum or impulse

Please remember that area above the horizontal axis is positive and area below the horizontal axis is negative, that is what the quotation marks mean in the phrase area “under” the curve.

There are clearly a lot more examples like the ones I just went through here, which is why I created a table for you to fill out. Enjoy!