PHYS 2010 LECTURE 2

Announce "~~student beliefs~~ CLASS" survey ~~[illegible]~~ on web page

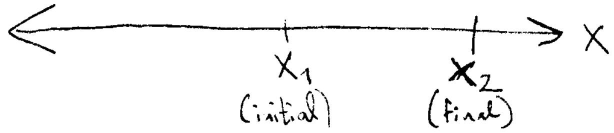
(Quickly review velocity, speed)

If speed & velocity can vary with time, we can define

<u>instantaneous</u> vs. <u>average</u> (mean) velocity.

Average velocity $= \bar{V} = \dfrac{\text{change in position}}{\text{change in time}} = \dfrac{\Delta x}{\Delta t}$

$$= \frac{X_{final} - X_{initial}}{t_{final} - t_{initial}}$$

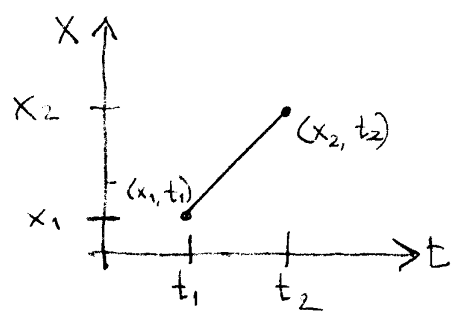


$$\bar{V} = \frac{X_2 - X_1}{t_2 - t_1}$$

so if X_1 had been final position and x_2 initial, $\bar{V}$ would change signs.

$\Delta x = X_{final} - X_{init}$ = "displacement"

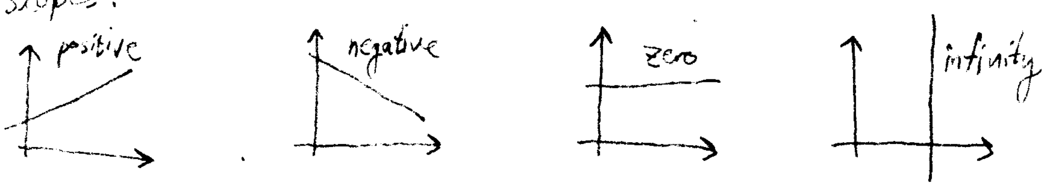
Now, think of plotting X vs. t: <u>note x is the vertical axis here.</u>



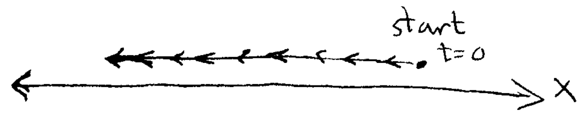
Recall slope $= \dfrac{\text{rise}}{\text{run}} = \dfrac{x_2 - x_1}{t_2 - t_1}$

So $\bar{V}$ is the slope of the line connecting (x_1, t) with (x_2, t_2).

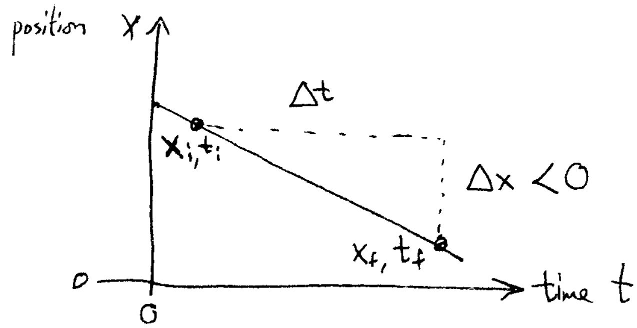
slopes:



Now, plot an object traveling at constant $v < 0$ (i.e. constant speed in the $-x$ direction):



The plot has negative slope:



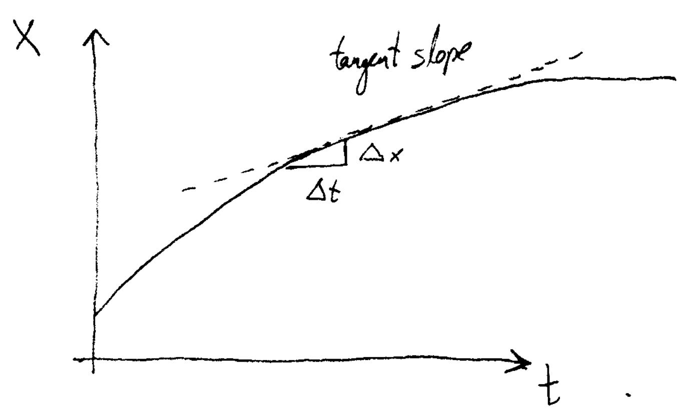
Constant v: straight line!

[Concept test 2-2:]

Now, velocity can change smoothly in time too.

[Concept test 2-3]

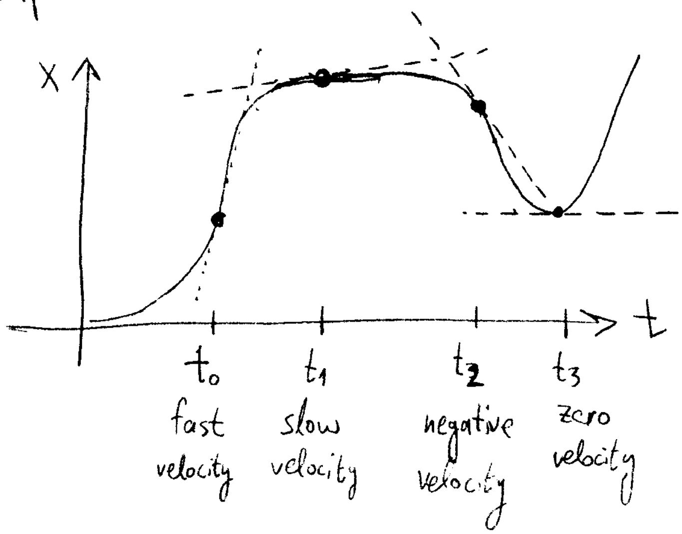
Look more closely at the plot in previous concept test:



The slope of the curve at a given t is the <u>instantaneous</u> velocity of the object at that time! (average v over a very short time)

$$v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \text{slope of line tangent to the curve.}$$

Examples:



[Concept test 2-5]