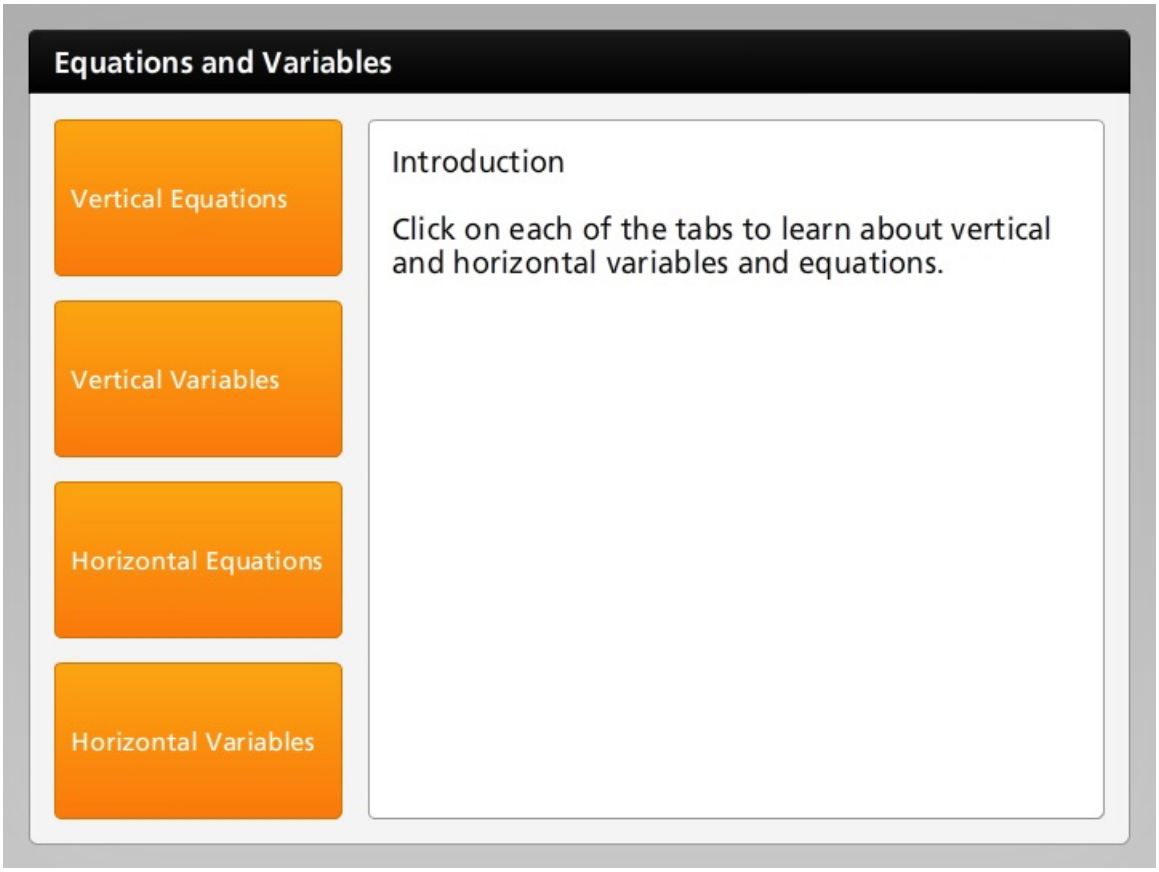
Module 3: Motion in Two Dimensions

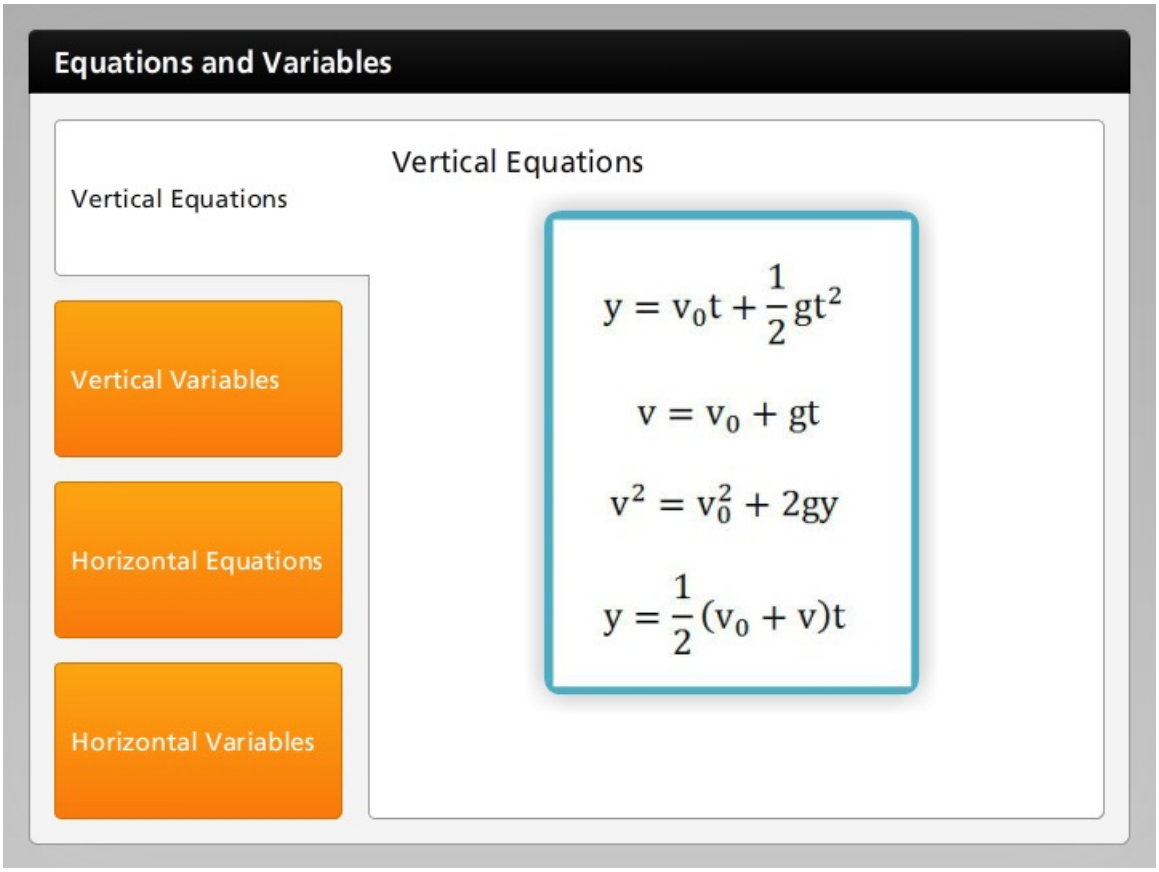
Topic 3 Content: Equations and Variables Notes Sheet



Click on each of the tabs to learn about vertical and horizontal variables and equations.

Module 3: Motion in Two Dimensions

Topic 3 Content: Equations and Variables Notes Sheet

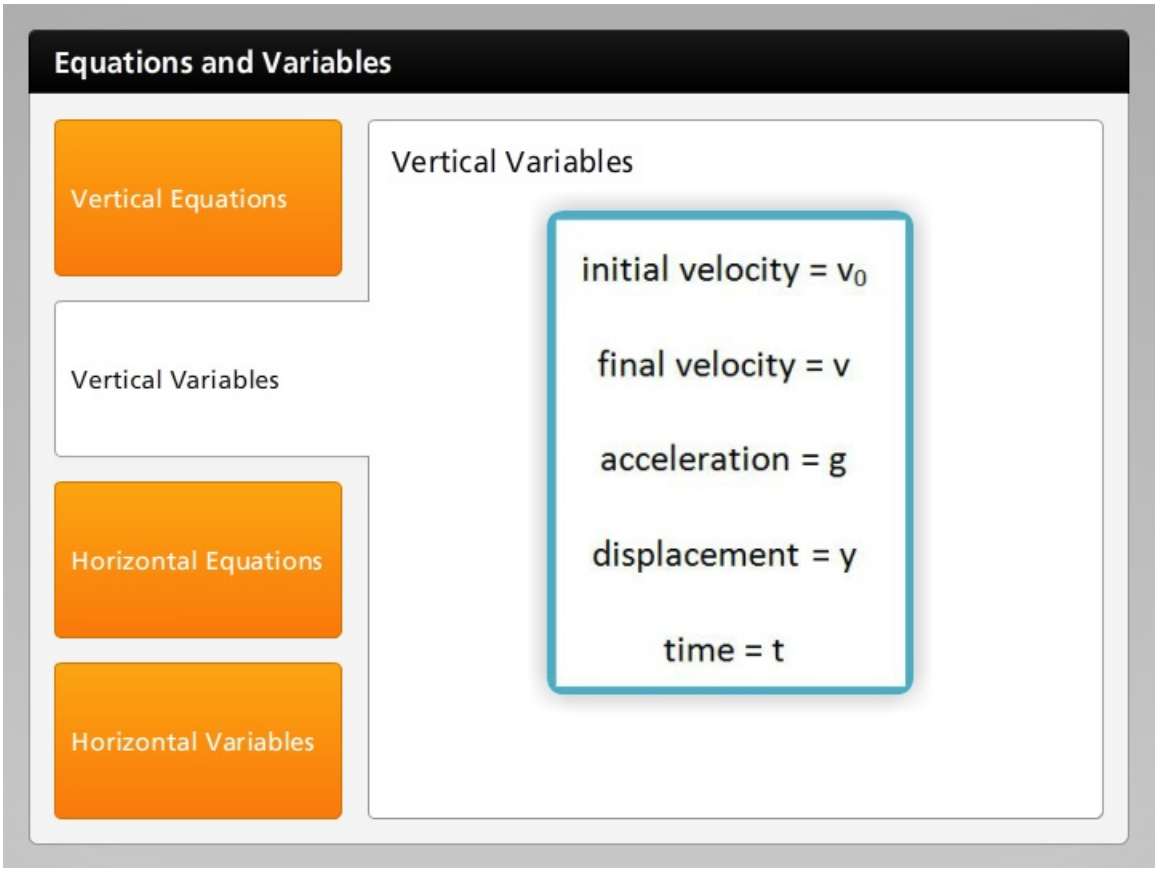


In the vertical direction, we are once again dealing with free fall, which you have already learned to analyze.

It will be helpful to review these equations because they will govern the motion of projectiles that occurs in the vertical direction.

Module 3: Motion in Two Dimensions

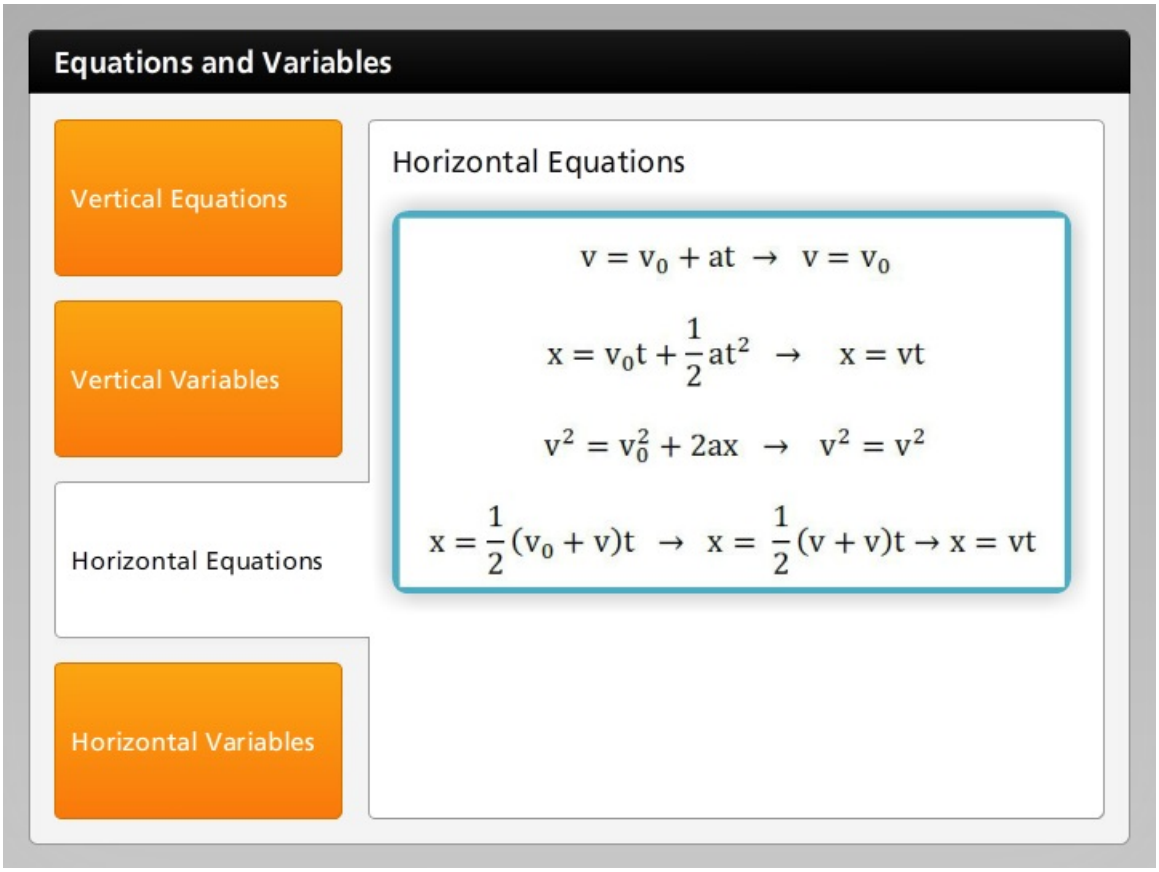
Topic 3 Content: Equations and Variables Notes Sheet



We still maintain the five different kinematics variables for motion, which are initial velocity, final velocity, acceleration, displacement and time.

Module 3: Motion in Two Dimensions

Topic 3 Content: Equations and Variables Notes Sheet



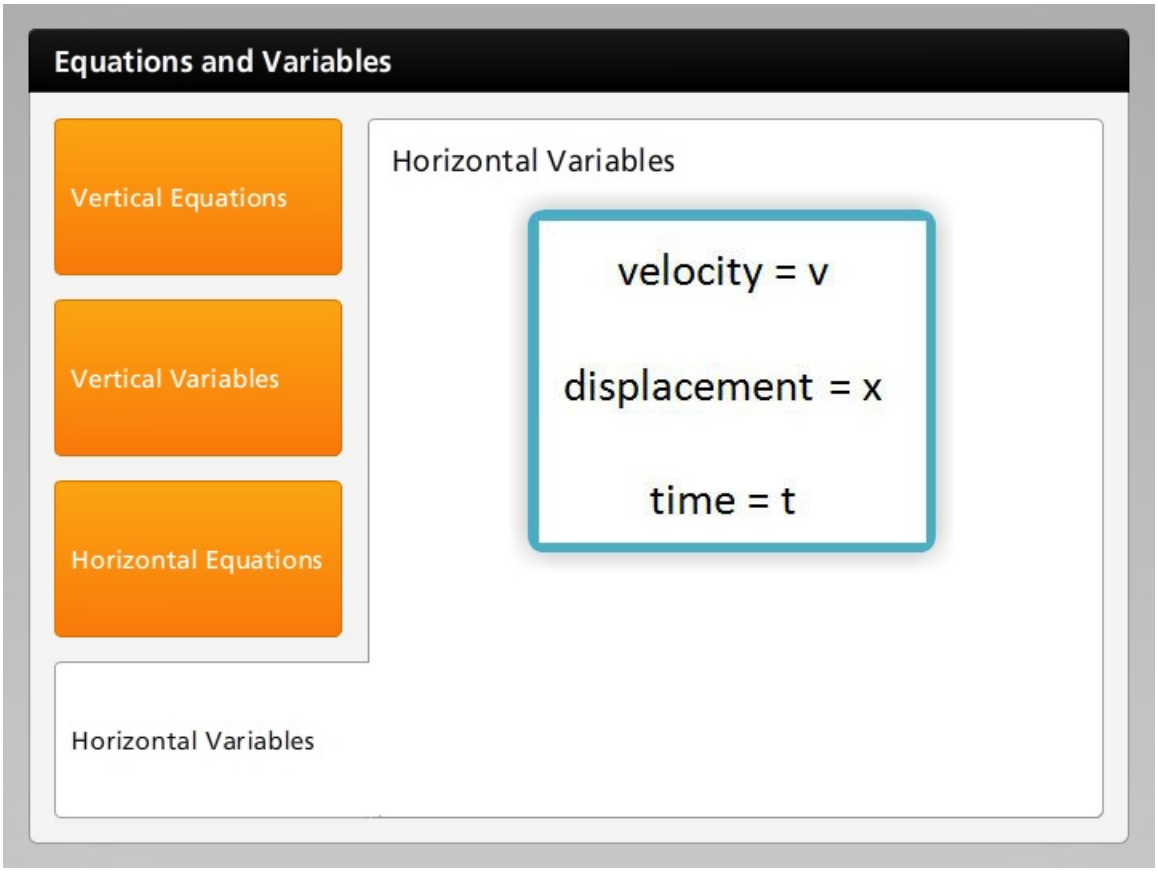
In the horizontal direction, there is no acceleration, which simplifies our analysis.

With no acceleration, our first equation simplifies to v equals v zero, or final velocity equals initial velocity. In other words, velocity is constant.

With v equal to v zero, and acceleration equal to zero, the next equation simplifies into x equals v times t, or velocity times time. This is what we expect with constant velocity.

The third equation reinforces this by simplifying into v squared equals v squared.

In our final equation, once we recognize that the initial horizontal velocity and final horizontal velocity are the same, we see once again that horizontal displacement equals velocity times time, just like in the second equation.

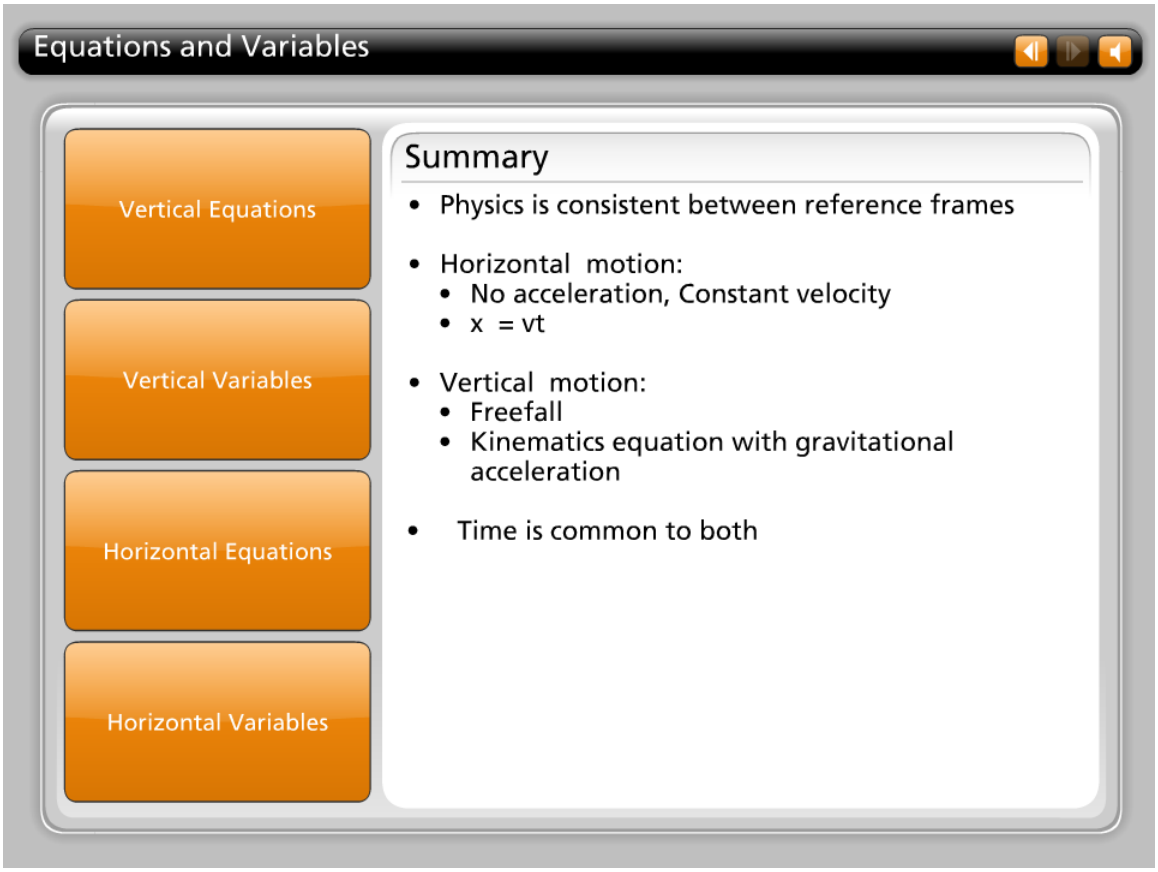


You'll notice that in the horizontal direction, our normal list of five kinematics variables has been reduced to three, velocity, displacement and time.

The only direct link between the variables in the horizontal and vertical direction is the time. When an object moves three seconds horizontally, it also has moved three seconds vertically, so when we need to, we can move this variable, and only this variable between the analyses of horizontal and vertical motion.

Module 3: Motion in Two Dimensions

Topic 3 Content: Equations and Variables Notes Sheet



In summary, since analysis of motion should not change depending on your reference frame, we must be able to separate horizontal and vertical motion.

Horizontal motion is at a constant velocity, with no acceleration. Therefore, we only need to calculate using the equation horizontal displacement equals velocity times time.

Vertical motion is freefall motion, and we analyze it using our kinematic equations adjusted to reflect the acceleration of gravity.