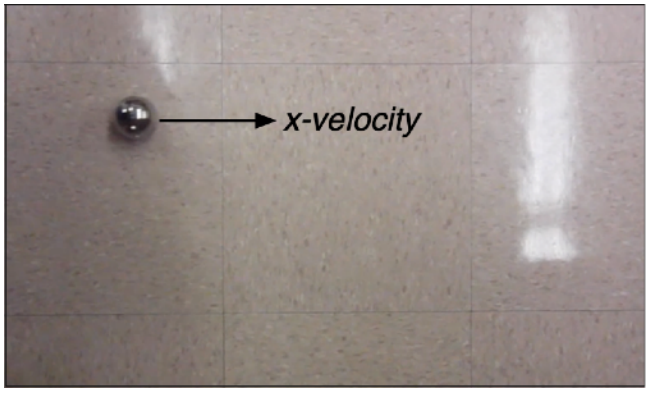
Note 2c Orthogonality

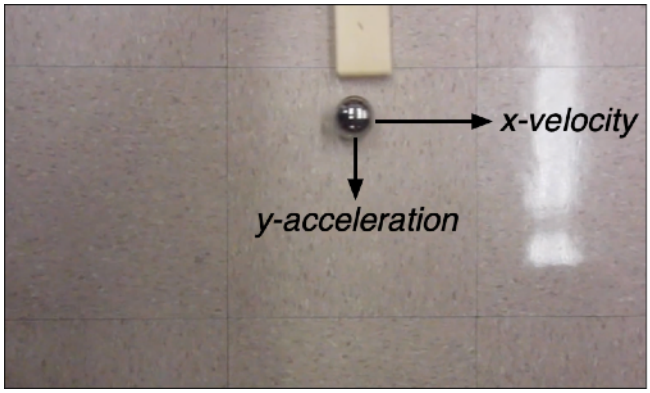
Basic Concept

When a vertical acceleration is applied to an object, it affects only the velocity in the vertical direction. The motions of the two perpendicular directions are independent of each other.

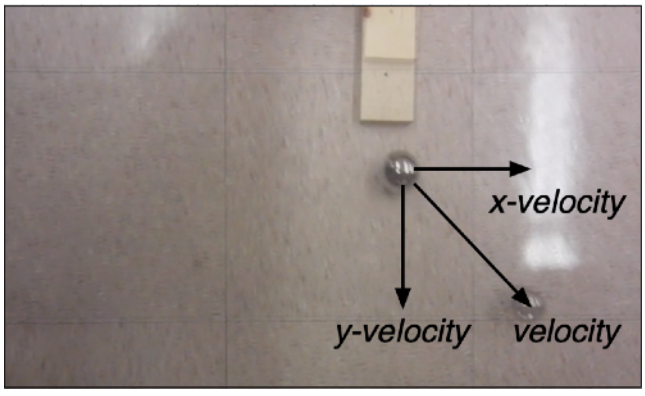
Here is the initial velocity. It is only on the x direction.



A tap in the vertical direction provides an acceleration in the y direction.



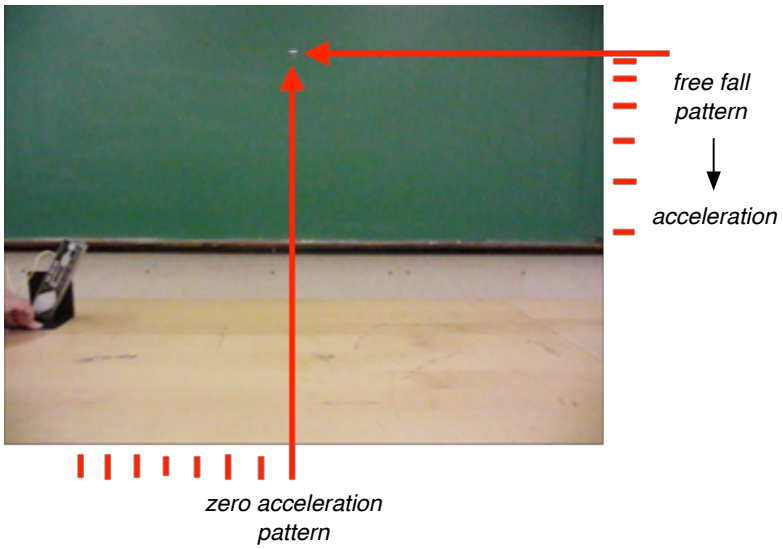
The result is an addition to the velocity but only in the y direction (the direction of the acceleration). The velocity in the x direction remains unchanged.



Projectile Motion

The most common example of two dimensional motion is when the object is in **free-fall**. Free fall is motion under the influence of only gravity. This is also called **projectile motion**. When you drop an object, it undergoes free-fall. When you throw an object through the air, it undergoes free fall.

Here are the positions of a bearing in both perpendicular directions as it flies through the air at equally spaced time intervals. The acceleration in the horizontal direction is zero. The spaces are all the same as velocity is constant. The acceleration in the vertical direction is downward as the spaces increase in that direction.



Here is the second half of the motion. The acceleration in the horizontal direction is still zero. The acceleration in the vertical direction is still downward.