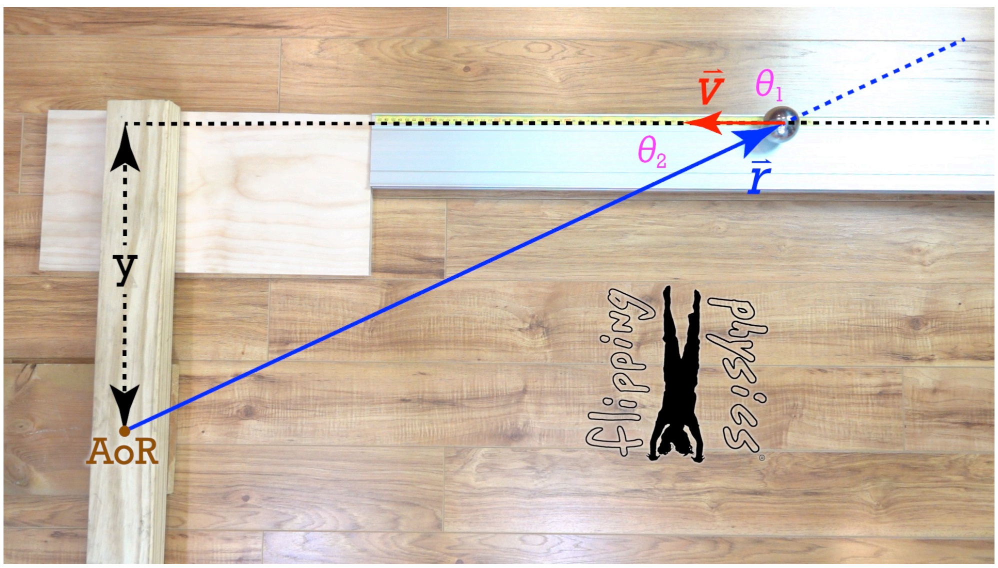
Flipping Physics Lecture Notes:

Common Point Particle Angular Momentum Triangle

In our previous lesson we used a wooden board mounted on a Lazy Susan to introduce the equation for the angular momentum of a point particle: $L = rmv\sin\theta$

- r is the vector pointing from the axis of rotation to the center of mass of the point particle.
- m is the mass of the point particle.
- v is the velocity of the point particle.
- θ is the angle between the direction of the r vector and the velocity of the point particle.

In this lesson we are going to introduce a common triangle used when a point particle is moving towards a rigid object with shape. In this example, the point particle is moving toward the wooden board and will collide with the board. During that collision, angular momentum is conserved and an important piece to understand is what the angular momentum of the point particle is *before* it strikes the wooden board.



The angle in the angular momentum equation is the angle between the direction of the r vector and the velocity vector, so it is θ_1 however, because θ_1 and θ_2 are supplementary angled (they add up to 180°) the sines of those two angles are equal:

$$\theta_1 + \theta_2 = 180° \Rightarrow \sin\theta_1 = \sin\theta_2 \ (\text{supplementary angles})$$

Therefore, when using the angular momentum equation, we can use either angle.

$$\sin\theta = \frac{O}{H} = \frac{y}{r} \Rightarrow y = r\sin\theta = \text{constant}$$

This means while both r and θ change as a function of position, the distance y is constant. That means that, if the point particle is moving at a constant velocity, the angular momentum of the point particle is also constant.

$$L = rmv\sin\theta = mvy = \text{constant} \ (\text{when } v = \text{constant})$$

This basic concept is used frequently when solving conservation of angular momentum problems involving a point particle and a rigid object with shape.