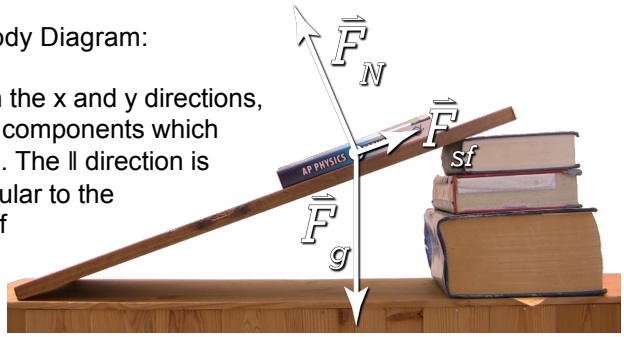
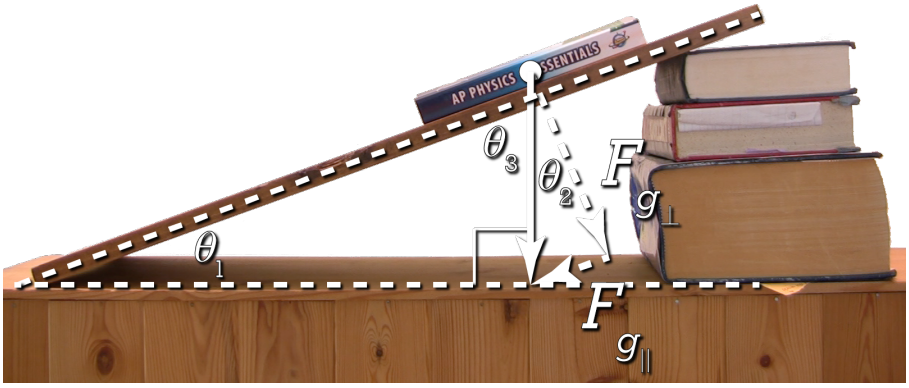
Flipping Physics Lecture Notes:

Breaking the Force of Gravity into its Components on an Incline

A book at rest on an incline has the following Free Body Diagram:



Previously we resolved the vectors into components in the x and y directions, however, on an incline we usually resolve vectors into components which are in the ∥ (parallel) and ⊥ (perpendicular) directions. The ∥ direction is parallel to the incline and the ⊥ direction is perpendicular to the incline. This means we only need to break the Force of Gravity into components and not the Force Normal or the Force of Static Friction.



Before we determine the equations for the Force of Gravity components, we need to discuss the angles.

θ_1 is called the incline angle. θ_2 is the angle between the force of gravity perpendicular and the force of gravity. θ_3 is the angle between the incline and the force of gravity. Because the incline and the force of gravity parallel are parallel to one another, θ_3 is also the angle between the force of gravity parallel and the force of gravity.

$$180° = \theta_1 + 90° + \theta_3 \Rightarrow 90° = \theta_1 + \theta_3 \Rightarrow \theta_1 = 90° - \theta_3 \;\&\; 90° = \theta_2 + \theta_3 \Rightarrow \theta_2 = 90° - \theta_3 = \theta_1$$

So the incline angle and the angle we use to determine the Force of Gravity components are the same.

$$\sin\theta = \frac{O}{H} = \frac{F_{g_\parallel}}{F_g} \Rightarrow F_{g_\parallel} = F_g \sin\theta \Rightarrow \boxed{F_{g_\parallel} = mg\sin\theta}$$

$$\cos\theta = \frac{A}{H} = \frac{F_{g_\perp}}{F_g} \Rightarrow F_{g_\perp} = F_g \cos\theta \Rightarrow \boxed{F_{g_\perp} = mg\cos\theta}$$

And then, of course, we should redraw the Free Body Diagram: