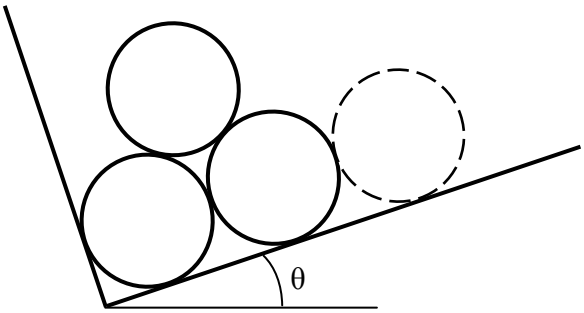
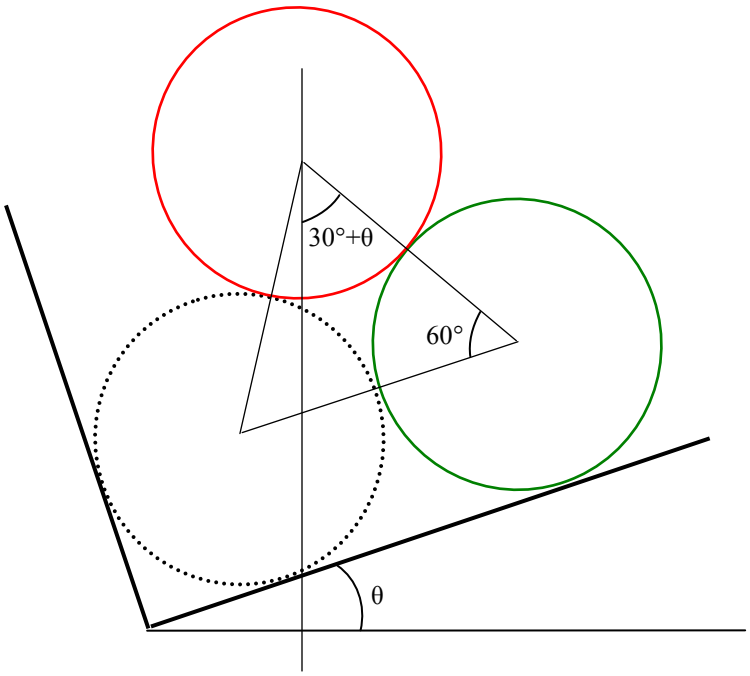
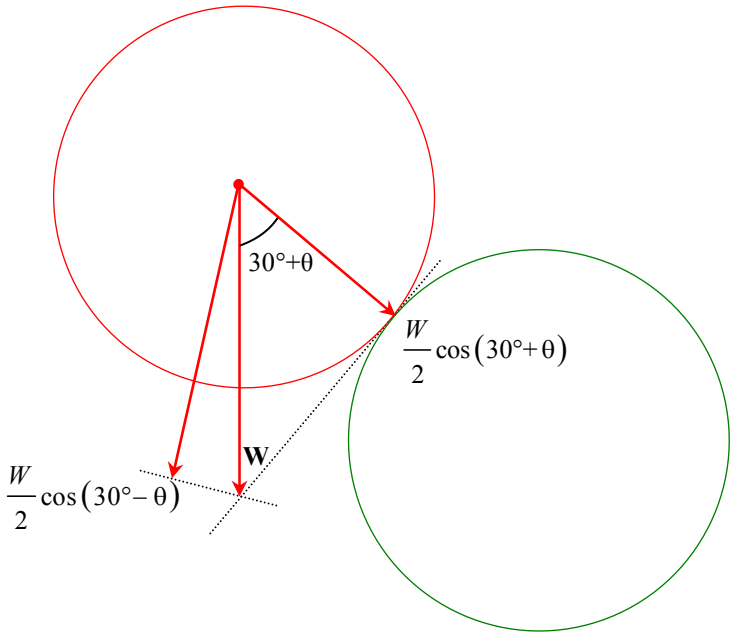
three logs

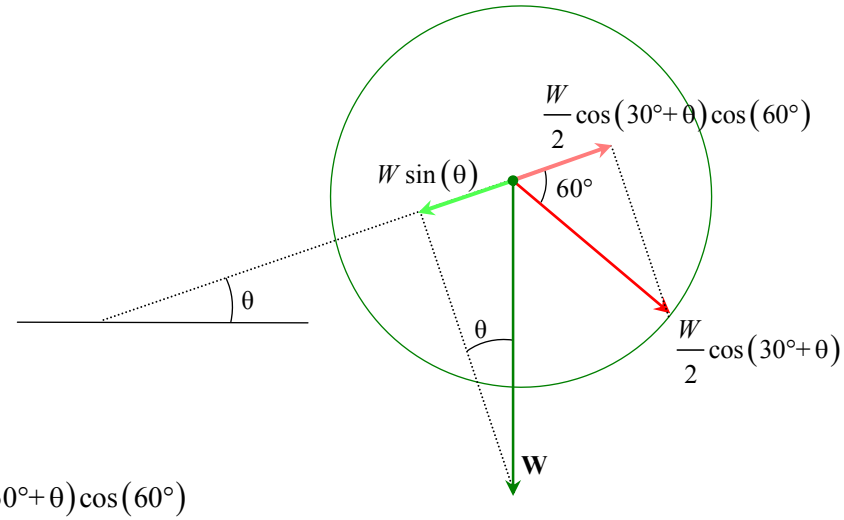


Smooth, identical logs are piled in a stake truck. The truck is forced off the highway and comes to rest on an even keel lengthwise but with the bed at an angle θ with the horizontal. As the truck is unloaded, the removal of the log shown dotted leaves the remaining three in a condition where they are just ready to slide, that is, if θ were any smaller, the logs would fall down. Find θ.

Solution by Michael A. Gottlieb *(notes)*







$$W\sin(\theta)=\frac{W}{2}\cos(30°+\theta)\cos(60°)$$

$$\sin(\theta)=\frac{1}{4}\left(\frac{\sqrt{3}}{2}\cos(\theta)-\frac{1}{2}\sin(\theta)\right)$$

$$\frac{9}{8}\sin(\theta)=\frac{\sqrt{3}}{8}\cos(\theta)$$

$$\tan(\theta)=\frac{\sqrt{3}}{9}=\frac{1}{3\sqrt{3}}$$

$$\therefore\theta=\tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)$$