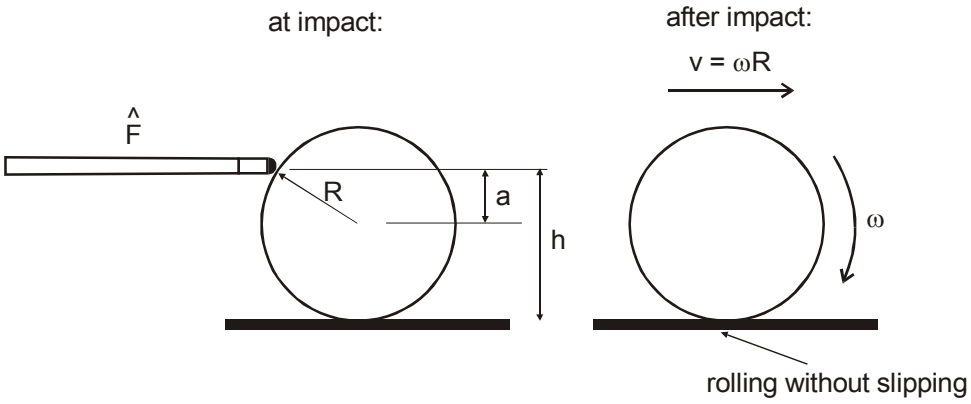
TP 4.2
Center of percussion of the cue ball

from:
"The Illustrated Principles of Pool and Billiards"
www.engr.colostate.edu/pool
by David G. Alciatore, PhD, PE ("Dr. Dave")



ball mass: m ball moment of inertia about its center: $I := \frac{2}{5} \cdot m \cdot R^2$

Horizontal impulse between the cue stick and cue ball:

F'

Linear impulse equals the change in linear momentum:

$$F' = mv \qquad (1)$$

Angular impulse equals the change in angular momentum:

$$F' \cdot a = I \cdot \omega \qquad (2)$$

For impact at the center of percussion, the ball rolls without slipping immediately, so:

$$v = \omega \cdot R \qquad (3)$$

Using Equations 1 and 2 in Equation 3 gives:

$$\frac{F'}{m} = \frac{F' \cdot a \cdot R}{I} \qquad (4)$$

Using the equation for I above in Equation 4 gives:

$$a = \frac{2}{5}R$$

Therefore, the center of percussion is at:

$$h = R + a = \frac{7}{5} \cdot R = \frac{7}{10} \cdot D$$