A uniform disc of radius $R$ and mass $m$, mounted on its center by a universal bearing, rotates originally in a horizontal plane with angular velocity $\omega$ shown in the figure below. An object of mass $m$ with speed $v = \omega R / 2$ directed along the $z$-axis collides with the edge of the disc and rebounds with an equal but oppositely directed velocity.

(a) What is the angular momentum of the disc and of the object taken about the center of mass of the disc before the collision?

(b) What angular impulses are imparted to the disc and to the object as a result of the collision?

(c) What is the angular momentum of the disc taken about the center of mass of the disc after the collision?