2010 F=ma Exam: Problem 24

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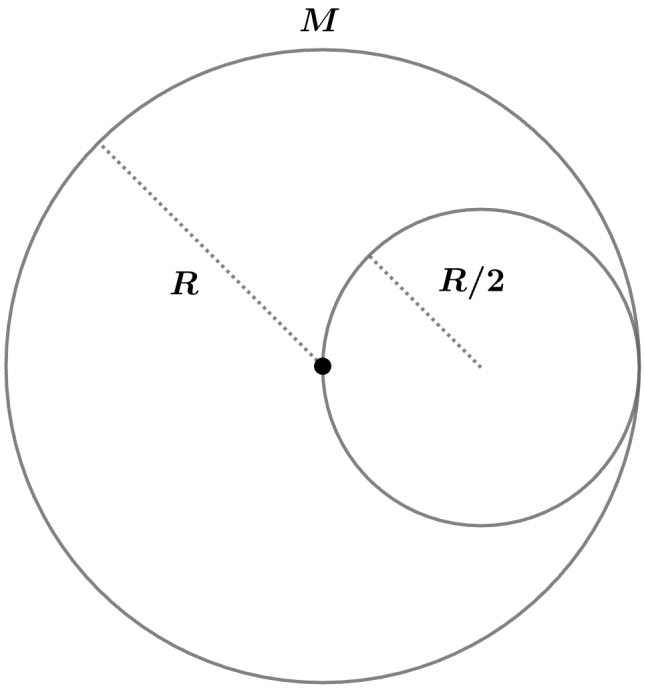

The moment of inertia of the original disk is

$$I_0 = \frac{1}{2}MR^2$$

To calculate the moment of inertia of the removed disk, note that since $M \propto R^2$, it has radius $r = R/2$ and mass $m = M/4$. Its moment of inertia around the axis (through its edge) is

$$I_1 = \frac{1}{2}mr^2 + mr^2 = \frac{3}{2}mr^2 = \frac{3}{2}\frac{M}{4}\left(\frac{R}{2}\right)^2 = \frac{3}{32}MR^2$$

where we used the parallel-axis theorem. Thus, the moment of inertia of the remaining object is

$$I = I_0 - I_1 = \frac{1}{2}MR^2 - \frac{3}{32}MR^2 = \frac{13}{32}MR^2$$

so the answer is $\boxed{\text{B}}$.