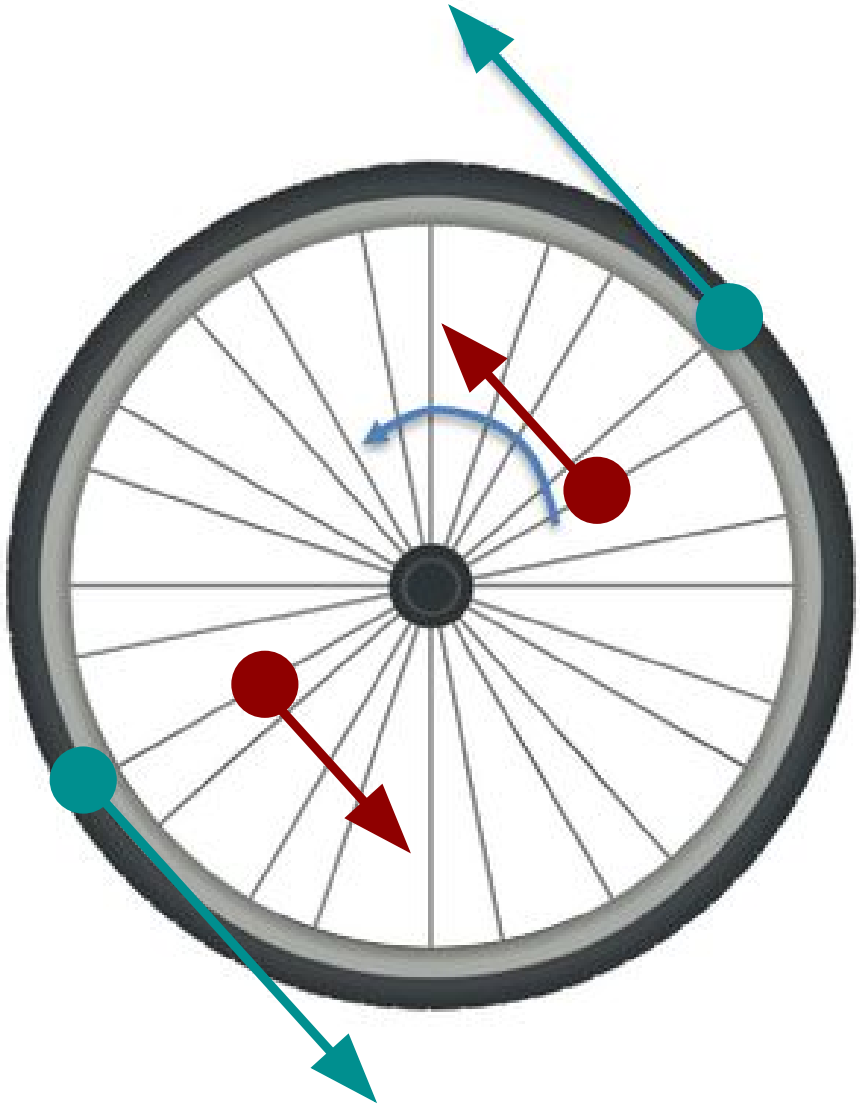
How Did We Get $KE_{rot} = \frac{1}{2}mv_{cm}^2 + \frac{1}{2}I\omega_{cm}^2$? 1

1. The angular velocity about the CM, ω_{cm}, is the same for all points on the wheel.
2. At equal $|\vec{r}_i|$ values, $|\vec{v}_T|$ are equal.
3. All points at the same $|\vec{r}_i|$ value have a symmetric partner 180° around the circle where the direction of the velocity is reversed.
4. Those pairs cancel out in the kinetic energy.



Why Did The Disk Win? 2

1. The rotational inertia is $I = \sum \Delta m_i r_i^2 = \int r^2 dm$.
2. The ring's mass is concentrated at large $|\vec{r}_i|$ so I_{ring} was larger.
3. The ring is heavier to rotate so it accelerated more slowly.
4. Consider what happens when the same force pushes on two different masses. The heavy one is slower.