POTW #01

## The Hexagonal Space Station

Consider a system of identical uniform rigid rods, each of mass m and length $2L$, initially at rest on a frictionless horizontal plane. The rods are connected at their endpoints by frictionless hinges. In each scenario below, an impulse is applied strictly perpendicular to a rod at its center of mass.

Part (a): Three rods form half of a regular hexagon. An impulse J applied to the central rod gives it an initial translational velocity u. Find J in terms of m and u.
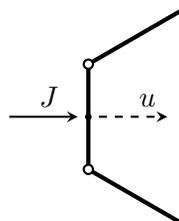
Part (b): Six rods form a regular hexagon. An impulse gives one rod an initial velocity u. Find the resulting initial velocity v_1 of the diametrically opposite rod in terms of u.
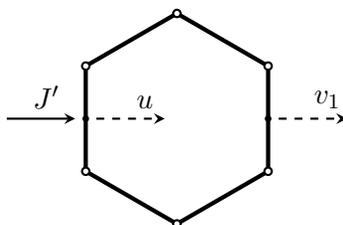
Part (c): Eleven rods form two regular hexagons sharing a single rod. An impulse gives the outermost rod of the first hexagon an initial velocity u. Find the initial velocity v_2 of the outermost rod of the second hexagon in terms of u.
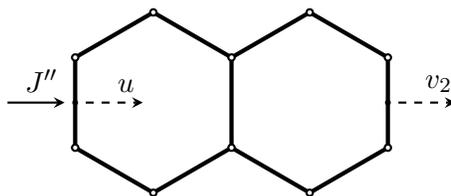
Bonus: For a chain of n such regular hexagons, what is the initial velocity v_n of the outermost rod of the n-th hexagon in terms of u?