Problem 9.76:
It has been proposed to use surplus 55 gal oil drums to make simple windmills for underdeveloped countries. Two possible configurations are shown. Estimate which would be better, why, and by how much. The diameter and length of a 55 gal drum are D = 24 in. and H = 29 in.

Given: Windmills to be made from surplus 55 gal oil drums.

D := 24in
H := 29in

Find: Which configuration would be better, why, and by how much?

Solution: Sum moments about pivot, neglecting friction, intercurrence.

Configuration A:
\[ \sum M = \frac{D}{2}(F_u - F_d) \]
\[ \sum M = \frac{D}{2}(C_{du} - C_{dd})A \frac{1}{2} \rho V^2 \]

Configuration B:
\[ \sum M = \frac{H}{2}(F_u - F_d) \]
\[ \sum M = \frac{H}{2}(C_{du} - C_{dd})A \frac{1}{2} \rho V^2 \]

Performance of configuration B will be better because H > D

improvement := \frac{(H - D)}{D}

improvement = 0.208