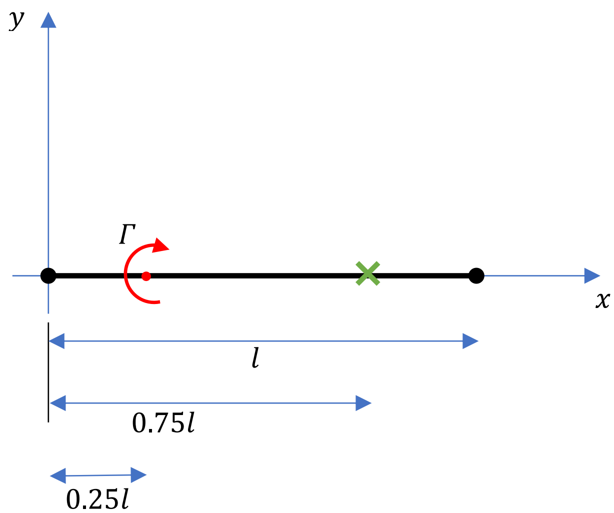
Project #1 **MEAM 5450 - Fall 2022**
Assigned: 11/17/2022, Due: 11/30/2022

Velocity at a point (x,y) due to a lumped vorticity panel (Lumped vortex at $0.25l$ from upstream panel edge. Collocation point at $0.75l$ from upstream panel edge) in panel coordinate frames

$$u_p = \frac{\Gamma}{2\pi} \frac{y}{(y)^2 + (x - 0.25l)^2}$$
$$v_p = -\frac{\Gamma}{2\pi} \frac{x - 0.25l}{(y)^2 + (x - 0.25l)^2}$$



For thin airfoil assumptions, using the above equations, solve for the below cases and comment on your observations

1.) Show that cl = 2*pi*alpha for a symmetric thin airfoil (flat panel)
    a. Vary the number of panels from 1 to N (take your pick at maximum number)
2.) Show that cl = 2*pi + cl0 for a cambered thin airfoil (2% camber)
    a. Vary the number of panels from 2 to N (take your pick at maximum number)
3.) For a symmetric thin airfoil for alpha = 5.0 deg. compare the circulation against the analytical solution.
4.) Compare the panel method gamma distribution for a cambered airfoil against that of the symmetric airfoil.
5.) Lift (individual + total) + flowfield of a two airfoil system operating at a.) 120 knots level flight b.) 120 knots horizontal speed + 1000 ft/min climb rate and c.) 120 knots horizontal speed + 1000 ft/min descent rate (vary number of panels from 1 to N)
    a. Upstream airfoil:
        i. Symmetric
        ii. 5 deg angle of attack (with respect to the free stream)
        iii. 1.5 ft chord
    b. Downstream airfoil:
        i. Symmetric
        ii. 8 deg angle of attack (with respect to the free stream)
        iii. 1.5 ft chord
        iv. Leading edge is 0.1 ft below and 1.25 ft aft of upstream airfoil quarter chord