Consider a thin, symmetric airfoil at 2° angle of attack. From the results of thin airfoil theory, calculate the lift coefficient and the moment coefficient about the leading edge.

\[ C_l = 2\pi \alpha = 2\pi \left( \frac{2\pi}{180} \right) = \frac{4\pi^2}{180} = 0.219 \]

\[ C_{m, L.E.} = -\frac{C_l}{4} = -0.0548 \]

Within the framework of thin airfoil theory, a symmetric airfoil has no thickness and is actually an exact solution for inviscid, incompressible flow over a flat plate at an angle of attack. Given the streamlines pictured below, describe (using a few words or equations) how and why this flat plate is generating lift.

- Over top surface streamlines are seen to be compressed, so from mass conservation within stream tube, velocity is increased.
- Over bottom surface opposite is true.
- From exchange of \( V \) and \( P \) (Bernoulli) pressure must be higher on bottom surface, so net upward force is generated.