# 2025-2026 Spring
# AE306 PH-2

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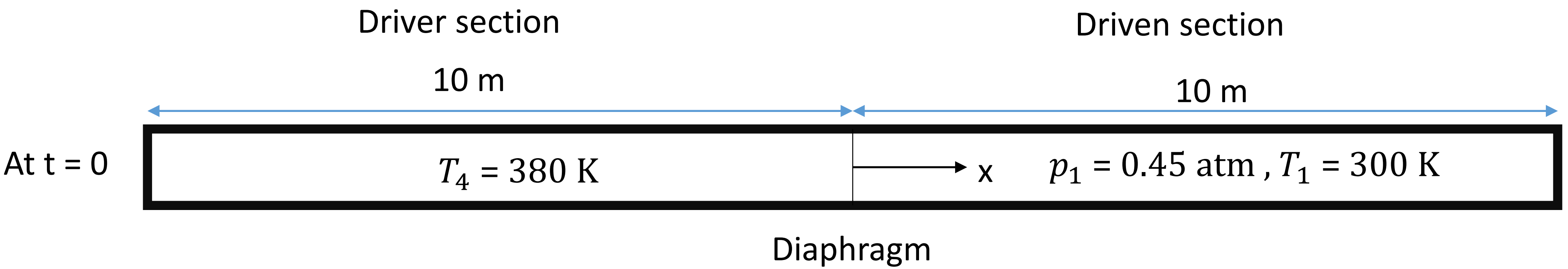
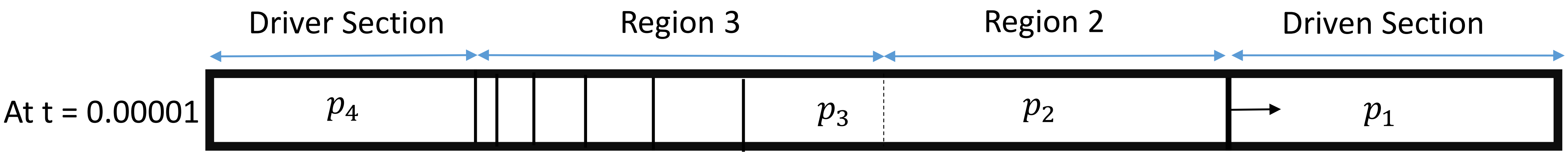
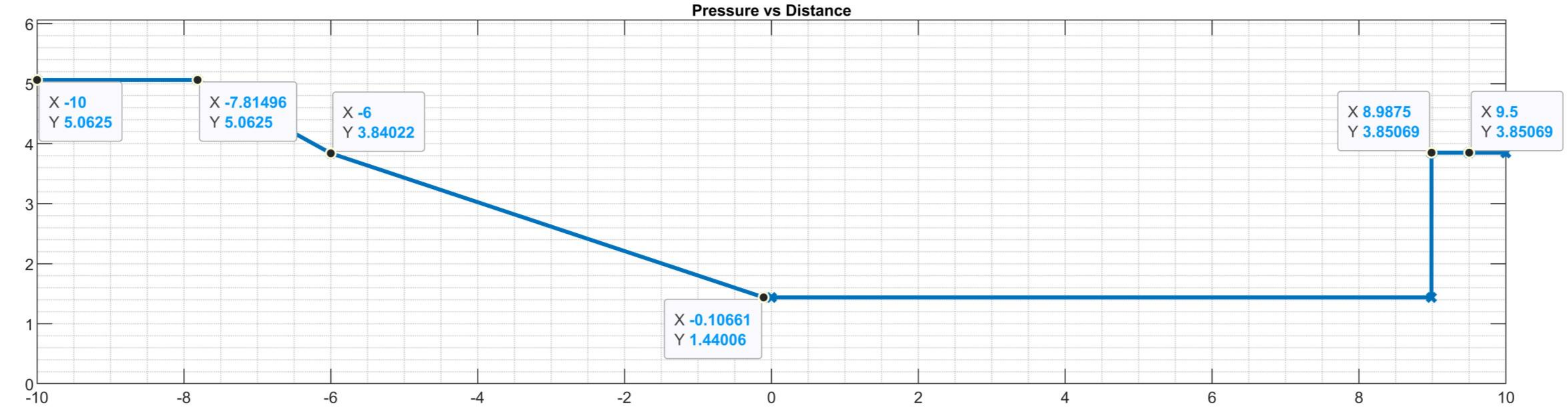
**P1-** Consider the shock tube given in the figure. Two sections are separated with a diaphragm located at the middle of the tube. At a time instant t=0, diaphragms is broken. Pressure ratios between driver and driven sections are high enough to create an incident shock wave, which causes a pressure ratio of $\frac{p_2}{p_1} = 3.2$ as it is travelling towards the right wall. At t = 0.02 s find the velocities and pressures at:

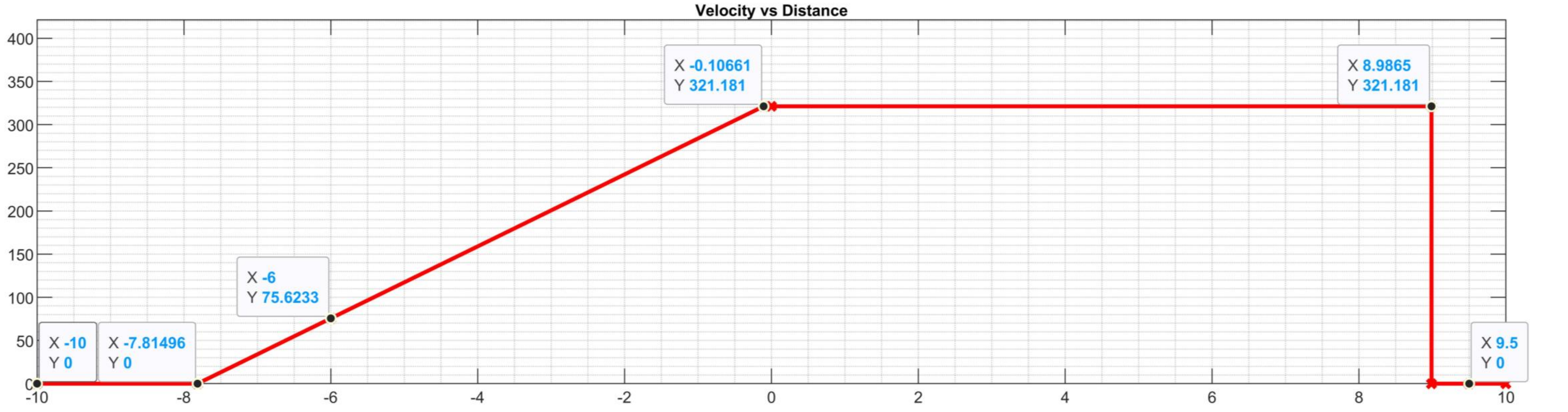
a) x = 9.5 m

b) x = -6 m



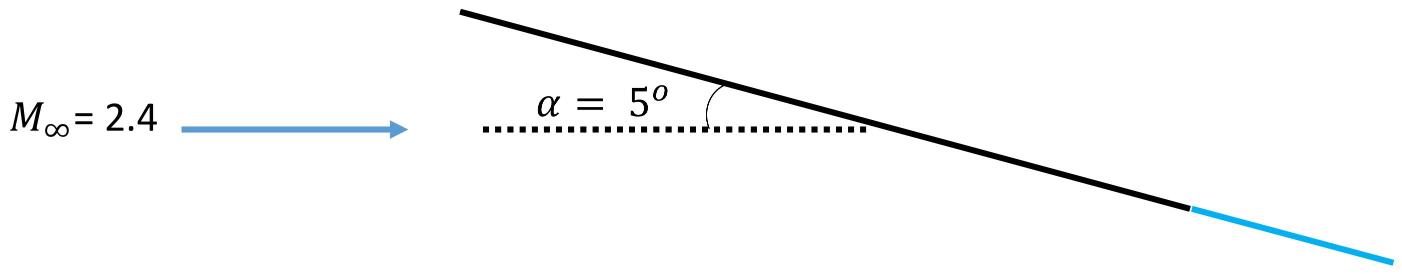

Pressure vs Distance
X -10
Y 5.0625
X -7.81496
Y 5.0625
X -6
Y 3.84022
X -0.10661
Y 1.44006
X 8.9875
Y 3.85069
X 9.5
Y 3.85069

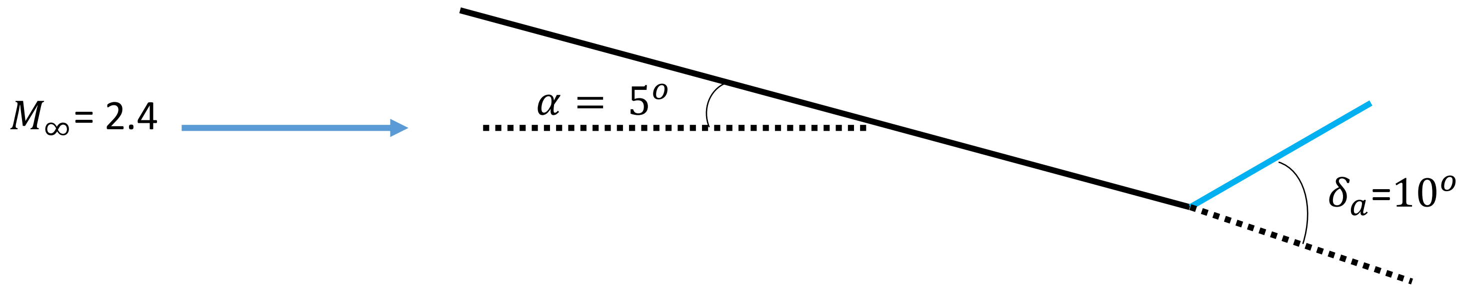

Velocity vs Distance
X -0.10661
Y 321.181
X 8.9865
Y 321.181
X -6
Y 75.6233
X -10
Y 0
X -7.81496
Y 0
X 9.5
Y 0

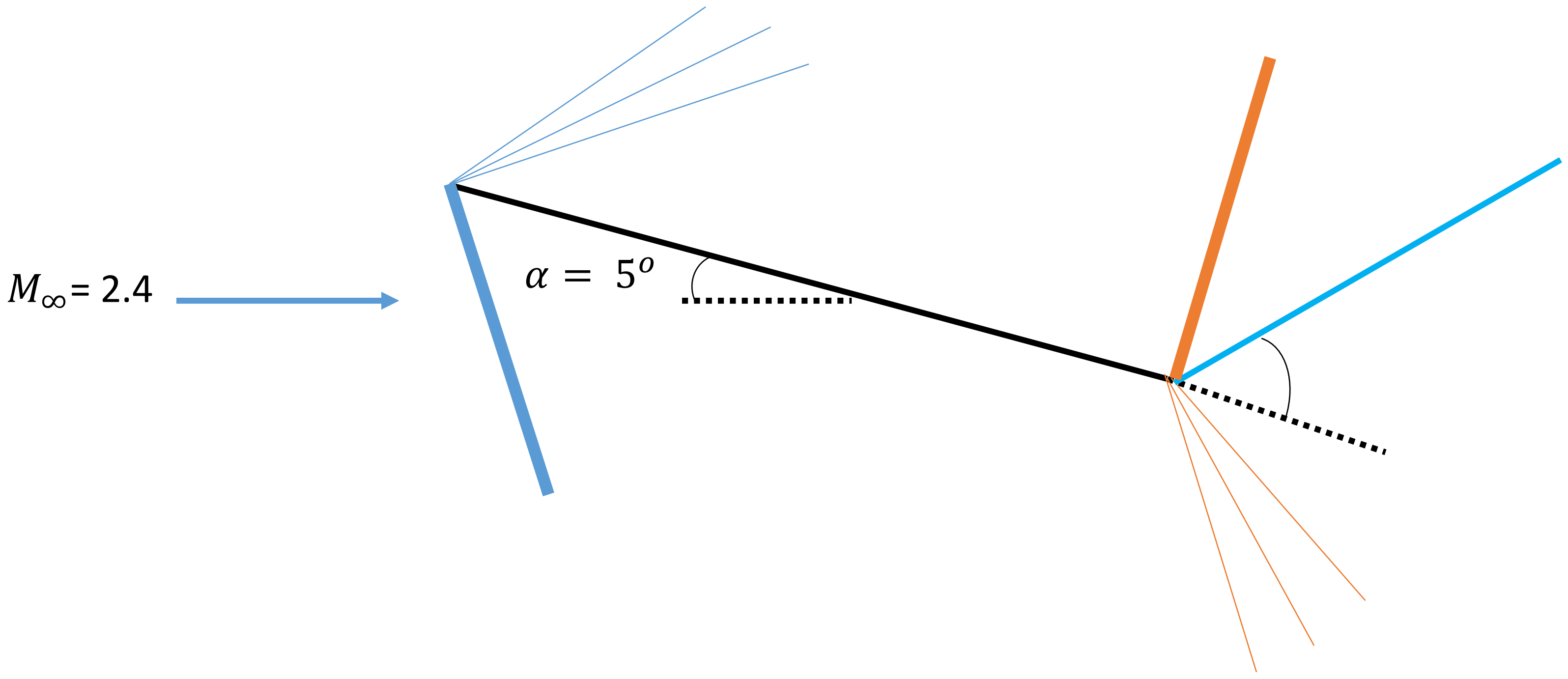
**P2-** A two-dimensional thin flat plate is in an inviscid supersonic freestream with $M_\infty = 2.4$ at an angle of attack $\alpha = 5^o$. A trailing-edge aileron occupies the aft 15% of the chord, so the hinge is located at x/c = 0.85. The aileron is deflected upward by 10 degrees , as shown in the figure. Assuming a calorically perfect gas with γ=1.4 :

a) Use shock-expansion theory to determine the lift and drag coefficients.
   Ans. $C_{l,wing} = 0.1355$ , $C_{l,aileron} = -0.024$ , $C_{d,wing} = 0.012$ , $C_{d,aileron} = 0.00212$ , $C_{l,TOT} = 0.1115$ , $C_{d,TOT} = 0.01412$

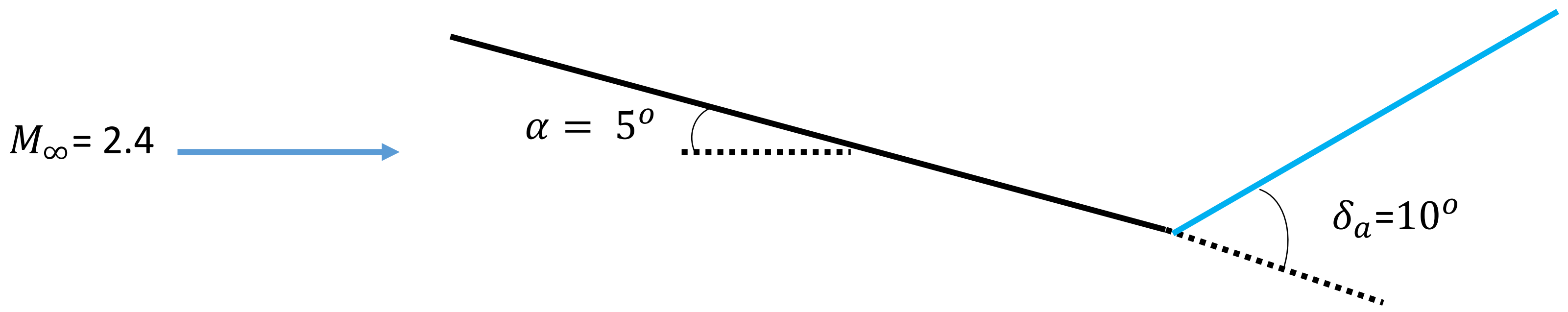
b) Use linearized supersonic theory to determine the lift and drag coefficients
   Ans. $C_{l,wing} = 0.136$ , $C_{l,aileron} = -0.024$ , $C_{d,wing} = 0.0119$ , $C_{d,aileron} = 0.00209$ , $C_{l,TOT} = 0.112$ , $C_{d,TOT} = 0.014$





$M_\infty = 2.4$
$\alpha = 5^o$



$M_\infty = 2.4$
$\alpha = 5^o$
$\delta_a = 10^o$

# Thanks for listening.

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or by visiting my office: HUBF/Room 105