Homework #1 **MEAM 5450 - Fall 2022**
Assigned: 09/15/2022, Due: 09/23/2022

You have been assigned to a group working on the design of an airplane. Your lead engineer has asked you to help with the design of the wing.

Data given to you:

NACA 0012 airfoil coefficient of lift and drag data (Re = 1.8x10^6, from NACA technical note 3361)

Alpha (deg.)	cl
-2.025902479	-0.20812679
0.038772741	0.00652805
2.05982177	0.22331494
6.017645346	0.62902511
9.932239783	1.03258364
14.16254093	1.30984164
14.36464087	1.00359647
17.98442351	0.83948681
22.07932961	0.70332889
26.01754869	0.85200745
27.87918097	0.91454208
31.99647093	1.00542989

Alpha (deg.)	cd
-2.089976895	0.01461567
1.992422036	0.0133942
5.944140922	0.01642706
10.02673838	0.01306375
14.36712245	0.03974506
14.9687569	0.10842129
16.05107354	0.1450775
18.04576819	0.17765562
20.03113208	0.31090063
21.98200201	0.34775267
26.01005432	0.46432308
28.08664113	0.550467
31.93899752	0.68841673

Aircraft design cruise speed = 120 knots (at sea level, standard day)

Design chord = 1.5 ft

Kinematic viscosity $\Rightarrow \nu = \frac{\mu}{\rho} =$ 1.46x10^-5 m^2/sec

Reynolds number $\Rightarrow Re = \frac{\rho V c}{\mu}$

Viscosity $\Rightarrow \mu$, Density $\Rightarrow \rho =$ 0.002378 slug/ft^3

1.) What is the angle of attack required to get a lift distribution of 64 lbs/ft?
2.) What is the drag distribution at that angle of attack?
3.) What is the magnitude of the resultant force distribution acting on the system? What is the normal and axial force distribution (along airfoil mean chord line) acting on the body?
4.) If the vehicle were to see a descent rate of 2000 ft/min (everything else the same as above) what would be the lift and drag distribution
5.) If the chord were to be increased by 20% what would the required angle of attack be for cruise (for the same lift distribution of 64 lbs/ft)? Is the airfoil data still valid for this calculation? Why? (you need to convince your lead engineer)