

Student's Name:

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AE 3310
Final Exam

July 30, 2001

Problems
Open Book
Available Time: 110 minutes

Problems:

1. Consider a generic airplane configuration defined by $W = 14,000$ lb, $S = 750$ ft², $C_{D,0} = 0.0158$, $K = 0.061$, $C_L^{\max+} = 1.35$ and $C_L^{\max-} = -0.9$, flying at 6,000 ft. The positive structural limit load factor is 3.6 and the negative one is -2.3 . The lift curve slope for the entire aircraft is $C_L^\alpha = 4.8$.
 - a. Sketch the drag polar for this airplane.
 - b. What is the stall speed at this altitude? What is the indicated stall speed at this altitude?
 - c. Determine $\left(\frac{L}{D}\right)_{\max}$.
 - d. What is the value of C_L under (c)?
 - e. Determine V_∞ at $\left(\frac{L}{D}\right)_{\max}$.
 - f. Sketch the "thrust required" curve (superimposed: first term, second term, combination).
 - g. Determine the minimum value of "thrust required".
 - h. Indicate the "stable speed" and the "unstable speed" regimes.
 - i. Assuming a sea level jet thrust $T_{\max} = 3900$ lb, determine the maximum speed at 6000 ft.
 - j. What is the maximum value of $\frac{\sqrt{C_L}}{C_D}$? How about for the case of $\frac{\sqrt{C_L^3}}{C_D}$?
 - k. What are the corresponding values of V_∞ ? What do they correspond to for a piston engine/propeller airplane? How about for the case of a jet propelled airplane?
 - l. What is the maximum rate of climb at this altitude? What is the corresponding value of V_∞ ?

- m. What are the minimum turn radius and maximum turn rate of this airplane?
- n. Sketch the V-n diagram for this airplane, assuming $V_{NE} = 0.87 V_{\max}$
- o. Sketch the gust response for an upward vertical gust of 50 fps. What is the structural cruising speed?
- p. Assuming this is a civilian airplane, what should be the indicated obstacle clearance speed during take-off and during landing?

Remark: Please box-in your final numerical results for each question.