AEM 313: Exam 2 C Name:_____

3rd Nov 2016 75 minutes 6 Pages Open book, Open notes, Calculator

100 total points **Read, think, plan, and then write.**

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Signature:_____

Date:_____

Multiple Choice Problems: Circle **EVERY** correct answer [4 pts each]

1. Estimate C_{L_α} at $C_L = 2.0$ for a flat elliptical wing with an aspect ratio of 1 using Prandtl Lifting Line

A. 2π	B. $2\pi/3$	C. $1/\pi$	D. 0.01	E. Not Valid

2. A flat elliptical wing has an aspect ratio of 6. What is C_{D_i} at $C_L = -2.0$? Note the negative lift!

A. $-2/3\pi$	B. 2122 counts	C. 0	D. 0.106	E. None of the above

3. A flat tapered wing has an aspect ratio of 8 and taper ratio of 0.8. What is C_{D_i} at $C_L = 0.5$?

A. $1/32\pi$	B. 96 counts	C. 0	D. 0.103	E. None of the above

4. For a subsonic flat linearly tapered wing, which taper ratio gives the lowest induced drag?

1. 0.0	2. 0.35	3. 0.5	4. 1.0	1.5

5. Compute the induced drag described by an upstream velocity of u=10 ft/s at SSL and a downstream velocity defined by:

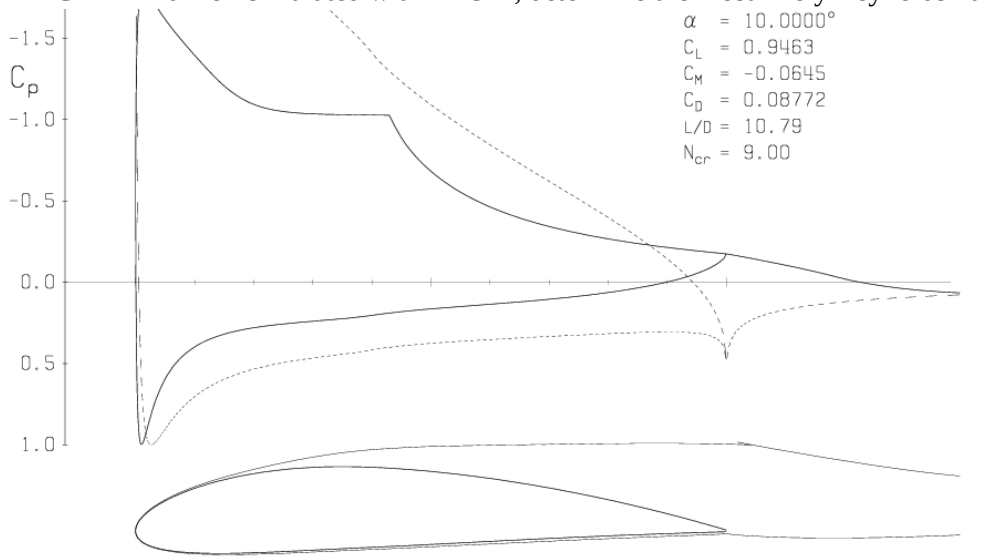
$$v^2 + w^2 = \begin{cases} x & 0 < x < 1 \quad 0 < y < 1 \\ 0 & otherwise \end{cases}$$

A. $\pi\rho$	B. 5 counts	C. $\rho/4$	D. $\frac{2\pi}{100}$	E. None of the above

6. Which XFOIL command sequence would simulate an NACA 0012 at Re=60000 at AOA=5?

A. naca 0012 oper visc 60000 alfa 5 hard	B. naca 0012 oper visc 60000 alpha 5	C. load naca0012 ppar 280 oper visc 60000 alpha 5	D. naca 0012 ppar N 280 oper visc 60000 aseq 5	E. None of the above

7. For an NACA 4414 airfoil simulated with XFOIL, determine the most likely Reynolds number?



A. Inviscid	B. 60000	C. 600000	D. $6.0\cdot10^{6}$	E. $6.0\cdot10^{7}$

8. Where is the shed vorticity in the wake highest?

A. Where Γ is highest	B. At a wing geometry change	C. At the wingtip	D. Where $\lvert d\Gamma / dy \rvert$ is largest	E. None of the above

9. For a delta wing, increasing the leading edge sweep angle from 50 to 70 degrees tends to

A. Increase $C_{L\max}$	B. Increase C_{L_α}	C. Increase induced drag	D. Increase Aspect Ratio	E. Increase the vortex burst AOA

10. For a transport aircraft with flaps up at low altitudes, where are contrails likely to 1st occur?

A. Wing tips	B. Jet exhausts	C. Strakes	D. Wing root	E. Flap tips

11. What is the velocity vector at (x,y,z)=(1,0,1) consistent with an infinite vortex of strength 2π along the x axis (i.e. positive vortex about positive x direction)?

A. (0,0,0)	B. (0,-1,0)	C. (0,1,0)	D. (0,-1/2,0)	E. (0,-0.707,0)

12. Which wing geometries tend to have higher C_l loading near the wing root?

A. Aft swept	B. Forward swept	C. Washout	D. Washin	E. Elliptical wings

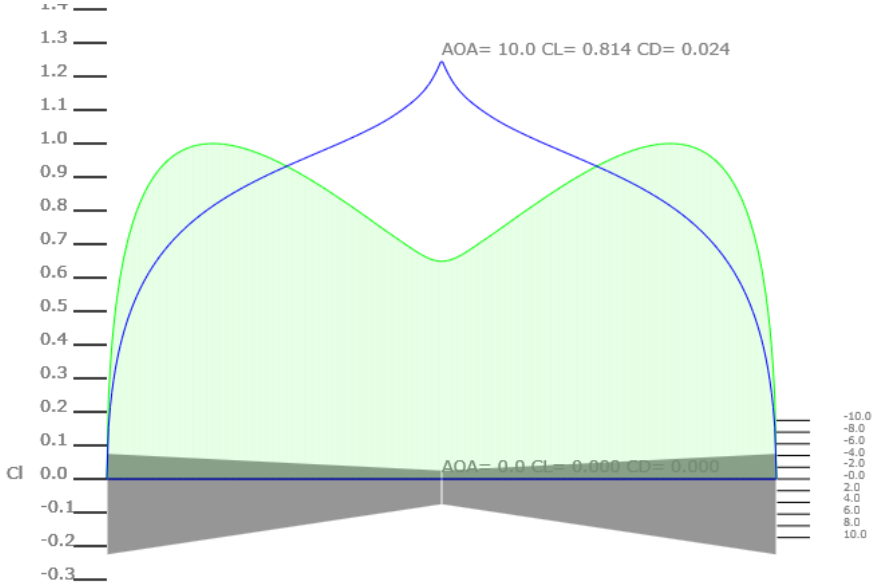
13. Circle the phenomena described: Drag due to lift

A. Induced Drag	B. Adverse Yaw	C. Proverse Yaw	D. Aileron Reversal	E. Not possible

14. If a **flat** non-elliptical $\lambda = 1$ wing is designed to give an Oswald efficiency factor for 1 (i.e. mimicking an elliptical wing), what is true?

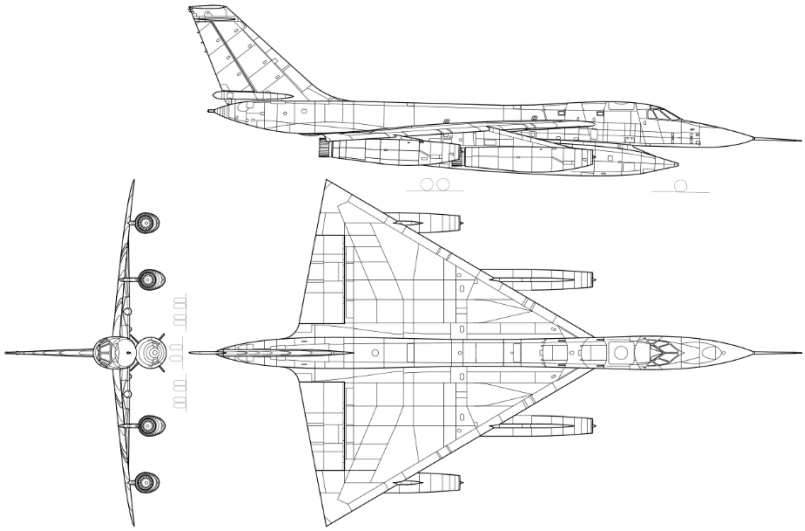
A. Not possible	B. airfoil sections must be thicker at the root	C. The wing twist varies with span.	D. The quarterchord downwash is constant.	E. The zero lift line varies with span

15. Given the following lift distribution at AOA=10 for the following AR=10 wing with CL=0.814, CD=0.024 and $\lambda = 3$, estimate the Oswald Efficiency Factor, e.



A. 0.88	B. 0.93	C. 1.08	D. 1.14	E. None of the above

16. [20 pts] Estimate the takeoff speed in ft/s of a B-58 at 150000 lbf at AOA=14 degrees at SSL. The leading edge sweep is 60˚. The aspect ratio is 2.09. The wing area is 1542 sq-ft. Hint: V>200mph



17. [20 pts] Estimate the lift coefficient of a thin cambered airfoil at AOA=0. The airfoil is composed of two linear parts. The maximum camber is 10% at the quarterchord.