

AEM 368: Practice Exam 1      Name: \_\_\_\_\_

18 Feb 2017                      120 minutes                      6 Pages                      Open book, Open notes, Calculator

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

University of Alabama Academic Honor Pledge:

*I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University.*

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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Multiple Choice Problems: Circle **EVERY** correct answer [2 pts each]

1. Given  $\alpha = 0^\circ$  and  $\beta = 5^\circ$  for a freestream flow of  $V_\infty = 100$  ft/s, compute the body-frame y velocity.

A.	B.	C.	D.	E. Not Valid
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2. Twisting the wingtips TED is called

A. Washin	B. Washout	C. Elliptical	D. Spoilers	E. None of the above
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3. Compute the density of dry air at 100 F and 14.7 psi.

A.	B.	C.	D.	E. None of the above
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4. For a Tropic Standard Atmosphere, what is the pressure ratio  $\delta$  at 52493 ft?

A.	B.	C.	D.	E. None of the above
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5. Which aircraft instrument only uses static pressure

A. Airspeed	Altimeter	B. VOR	C. Mach meter	D. None of the above
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6. If the static port becomes clogged (i.e. closed) at 5000 ft and 100 kts, which value would the vertical speed indicator show for a 1500 fpm climb (assuming the static port remains closed and does not leak)?

A. 0 fpm	B. 1500 fpm	C. -1500 fpm	D. Not enough information	E. None of the above
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7. Compute the lift coefficient of a 300 ft<sup>2</sup> wing generating 7000 lbs of lift at 100 ft/s at SSL.

A.	B.	C.	D.	E.
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8. Given a surface temperature of 30 C and a dewpoint of 25 C, estimate the altitude where the clouds form (the cloud base).

A. 0 ft	B. 2000 ft	C. 4000 ft	D. 4500 ft	E. None of the above
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9. One knot is how many miles per hour?

A. 0	B. 0.86	C. 1	D. 1.15	E. None of the above
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10. Given a 200 kt aircraft with a West heading flying in a 40 kt wind from 195 degrees, what is the groundspeed?

A.	B.	C.	D.	E. None of the above
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11. On a standard day at 35000 ft, the IAS is 800 kts. If  $CAS=IAS+5$ , what is the true airspeed?

A.	B.	C.	D.	E. None of the above
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12. A 5 ft diameter propeller develops 300 lbf of thrust at 60 mph, what is the propulsive efficiency?

A.	B.	C.	D.	E. None of the above
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13. A Piper Commanche has 400 hp at SSL. Estimate the horsepower at 24000 ft on a standard day.

A.	B.	C.	D.	E. None of the above
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14. Compute the efficiency of a 10 inch propeller at 30 mph at 6000 rpm. The propeller is generating 4 lbs of thrust and requires 746 Watts (i.e. 1 hp) at SSL.

A.	B.	C.	D.	E. None of the above
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15. Decreasing the pressure ratio for a piston engine

A. Increases Thermodynamic Efficiency	B. Decreases Thermodynamic Efficiency	C. No change	D. None of the above
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16. Estimate the power of a 2000 hp (at SSL) turboprop engine operating at 10000 ft and Mach 0.6.

A.	B.	C. 2000	D.	E. None of the above
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17. For a propulsive efficiency of 50%, which of the following is true?

A.	B.	C.	D.	E. Not possible
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18. Which is most likely to be the SFC [lb/hr/hp] for a piston engine?

A.	B.	C.	D.	E. None of the above
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19. A particle moves along the path  $s(t) = \begin{pmatrix} x(t) \\ y(t) \end{pmatrix} = \begin{pmatrix} e^t \\ t \end{pmatrix}$ . Compute the radius of curvature at  $t = 1$ .

A.	B.	C.	D.	E. None of the above
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20. For an aircraft operating 10 kts slower than the minimum power airspeed, which is true?

F. Front side of power curve	G. The aircraft is speed stable	H. Two velocities are possible at the power setting	I. $\left(\frac{C_L}{C_D}\right)_{\max}$	J. Faster than minimum thrust airspeed
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[60 pts] Multipart Aircraft Performance Questions based on the Lockheed P-80, the first operational US jet fighter.

- 4600 lbf turbojet.
- Wingspan 39 ft
- Wing area 234 sq-ft
- Oswald Efficiency  $e=0.8$
- Gross weight 12000 lbf
- 3000 pounds JetA
- Zero lift drag coefficient 0.0134
- $CL_{max} = 2.0$



21. [10 pts] Estimate the maximum SSL airspeed.
22. [10 pts] Estimate the range in nautical miles (6076 feet = 1 nm) at 19000 ft.
23. [10 pts] Estimate the balanced field length for a 50 foot obstacle
24. [10 pts] Estimate the absolute ceiling
25. [10 pts] Estimate the time to climb from SSL to 19000 ft