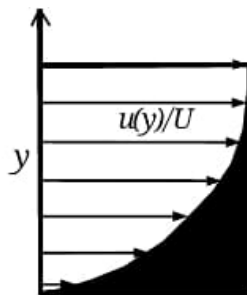


# 2018-AE-14-26

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- 1) A jet aircraft is initially flying steady and level at its maximum endurance condition. For the aircraft to fly steady and level, but faster at the same altitude, the pilot should
  - a) increase thrust alone
  - b) increase thrust and increase angle to attack
  - c) increase thrust and reduce angle to attack
  - d) reduce angle of attack alone
- 2) The pilot of a conventional airplane that is flying steady and level at some altitude, deflects the port side aileron up and starboard aileron down. The aircraft will then
  - a) pitch, nose up.
  - b) roll with the starboard wing up.
  - c) pitch, nose down.
  - d) roll with the port wing up.
- 3) A NACA 0012 airfoil has a trailing edge flap. The airfoil is operating at an angle of attack of 5 degree with un-deflected flap. If the flap is now deflected by 5 degrees downwards, the  $c_L$  versus  $\alpha$  curve
  - a) shifts right and slope increases.
  - b) shifts left and slope increases.
  - c) shifts left and slope stays the same
  - d) shifts right and slope stays the same.
- 4) An airplane requires a longer ground roll to lift-off on hot summer days because
  - a) the thrust is directly proportional to free-stream density
  - b) the thrust is directly proportional to weight of the aircraft
  - c) the lift-off distance is directly proportional to free-stream density
  - d) the runway friction is high on hot summer days
- 5) The velocity profile is an incompressible, laminar boundary layer is shown in the figure below.  $U$  is the free-stream velocity,  $u(y)$  is the stream-wise velocity component. The area of the black shaded region in the figure below represents the
  - a) boundary layer thickness
  - b) momentum thickness
  - c) displacement thickness
  - d) shape factor



- 6) The tangential velocity component ' $V$ ' of a spacecraft, which is in a circular orbit of radius ' $R$ ' around a spherical Earth ( $\mu = GM \rightarrow$  gravitational parameter of Earth) is given by the following expression
- $V = \sqrt{\frac{\mu}{2R}}$
  - $V = \sqrt{\frac{\mu}{R}}$
  - $V = \frac{2\pi}{\sqrt{\mu}} R^{\frac{3}{2}}$
  - $V = \frac{2\pi}{\sqrt{\mu}} R^{\frac{2}{3}}$
- 7) Equation of the trajectory of a typical space object around any planet, in polar coordinates  $(r, \theta)$  (i.e. a general conic) is given as follows.  $h$  is angular momentum,  $\mu$  is gravitational parameter,  $e$  is the eccentricity,  $r$  is radial distance from the planet center,  $\theta$  is the angle between vector  $\mathbf{e}$  and  $\mathbf{r}$ .
- $r = \frac{\frac{h^2}{\mu}}{1 - e \cos \theta}$
  - $r = \frac{\frac{h^2}{\mu}}{e - \cos \theta}$
  - $r = \frac{\frac{h^2}{\mu}}{1 + e \cos \theta}$
  - $r = \frac{\frac{h^2}{\mu}}{e + \cos \theta}$
- 8) In an elliptic orbit around any planet, the location at which a spacecraft has the maximum angular velocity is
- apoapsis
  - periapsis
  - a point at  $+45^\circ$  from periapsis
  - a point at  $-90^\circ$  from apoapsis.
- 9) The pitching moment of a positively cambered NACA airfoil about its leading edge at zero-lift angle of attack is
- negative
  - positive
  - indeterminate
  - zero
- 10) In a low-speed wind tunnel, the angular location(s) from the front stagnation point on a circular cylinder where the static pressure equals the free-stream static pressure, is
- $\pm 38^\circ$
  - $\pm 30^\circ$
  - $\pm 60^\circ$
  - $\pm 0^\circ$
- 11) A thermocouple, mounted flush in an insulated flat surface in a supersonic laminar flow of air measures the
- static temperature
  - temperature greater than static but less than total temperature
  - total temperature
  - temperature greater than total temperature
- 12) A shock wave is moving into still air in a shock tube. Which one of the following happens to the air ?
- static temperature increases, total temperature remains constant
  - static temperature increases, total temperature increases.
  - static temperature increases, total temperature decreases
  - static pressure increases, total temperature remains constant
- 13) The highest limit load factor experienced by a civil transport aircraft is in the range

- a) 0.0-2.0
- b) 2.0-5.0
- c) 5.0-8.0
- d) 8.0-10.0