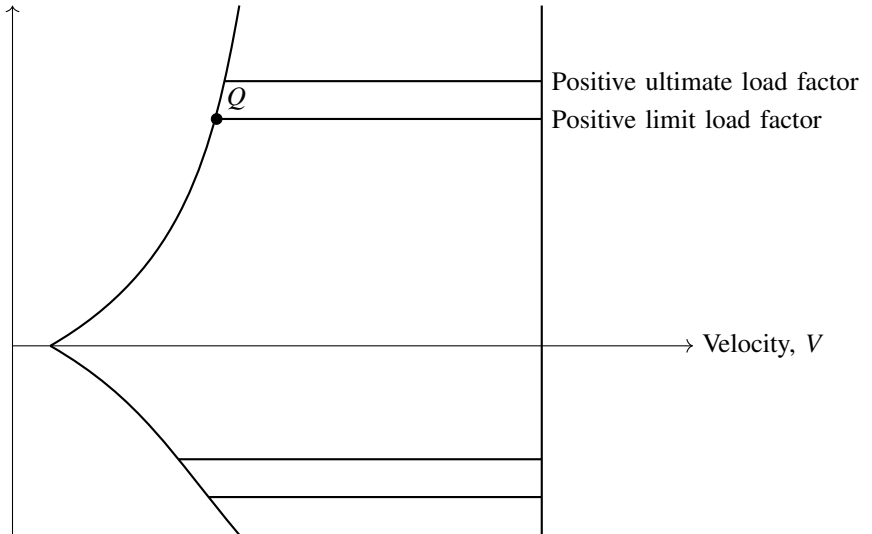


- 1) In a conventional configuration airplane, the rudder can be used: 2024-AE
- to overcome adverse yaw during a turning maneuver
 - to overcome yawing moment due to failure of one engine in a multi engine airplane
 - for landing the airplane in crosswind conditions
 - for enhancing longitudinal stability
- 2) Which of the following statements about a general aviation aircraft, while operating at point Q in the $V - n$ diagram, is/are true? 2024-AE

Load factor, n



- The aircraft has the highest turn rate
 - The aircraft has the smallest turn radius
 - The aircraft is flying with minimum drag
 - The aircraft is operating at $C_{L,max}$
- 3) Two fair dice with numbered faces are rolled together. The faces are numbered from 1 to 6. The probability of getting odd numbers on both the dice is (rounded off to 2 decimal places). 2024-AE
- 4) A particle acted upon by a constant force $4\hat{i} + \hat{j} - 3\hat{k}$ N is displaced from point A with position vector $\hat{i} + 2\hat{j} + 3\hat{k}$ m to point B with position vector $5\hat{i} + 4\hat{j} + \hat{k}$ m. The work done by this force isJ (answer in integer).
- 5) Using Trapezoidal rule with one interval, the approximate value of the definite

integral:

2024-AE

$$\int_1^2 \frac{dx}{1+x^2} =$$

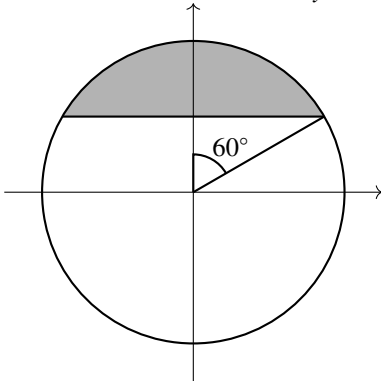
(rounded off to 2 decimal places).

- 6) A material has Poisson's ratio $\nu = 0.5$ and Young's modulus $E = 2500$ MPa. The percentage change in its volume when subjected to a hydrostatic stress of magnitude 10 MPa is (answer in integer). 2024-AE
- 7) An airplane experiences a net vertical ground reaction of 15000 N during landing. The weight of the airplane is 10000 N. The landing vertical load factor, defined as the ratio of inertial load to the weight of the aircraft, is (rounded off to 1 decimal place). 2024-AE
- 8) An aircraft with a turbojet engine is flying with 250 m/s speed at an altitude, where the density of air is 1 kg/m^3 . The inlet area of the engine is 1 m^2 . The average velocity of the exhaust gases at the exit of the nozzle, with respect to aircraft, is 550 m/s. Assume the engine exit pressure is equal to the ambient pressure and the fuel-air ratio is negligible. The uninstalled thrust produced by the engine at these conditions is N (rounded off to the nearest integer). 2024-AE
- 9) Using thin airfoil theory, the lift coefficient of a NACA 0012 airfoil placed at 5° angle of attack in a uniform flow is (rounded off to 2 decimal places). 2024-AE
- 10) Given $y = e^{px} \sin(qx)$, where p and q are non-zero real numbers, the value of the differential expression 2024-AE

$$\frac{d^2y}{dx^2} - 2p \frac{dy}{dx} + (p^2 + q^2)y$$

is

- a) 0
b) 1
c) $p^2 + q^2$
d) pq
- 11) The volume of the solid formed by a complete rotation of the shaded portion of the circle of radius R about the y -axis is $k\pi R^3$. The value of k is: 2024-AE



- a) $\frac{5}{12}$
- b) $\frac{5}{24}$
- c) $\frac{7}{12}$
- d) $\frac{7}{24}$

12) As per the International Standard Atmosphere model, which one of the following options about density variation with increase in altitude in the isothermal layer is correct? 2024-AE

- a) remains constant
- b) increases linearly
- c) decreases linearly
- d) decreases exponentially

13) At a point in the trajectory of an unpowered space vehicle moving about the Earth, the altitude above the mean sea level is 600 km, and the speed with reference to a coordinate system fixed to the center of mass of the Earth is 9 km/s. Assume that the Earth is a sphere with a radius 6400 km and $GM_{\text{Earth}} = 3.98 \times 10^{14} \text{ m}^3/\text{s}^2$, where G is the universal gravitational constant and M_{Earth} is the mass of the Earth. The trajectory is: 2024-AE

- a) Circular
- b) Elliptic
- c) Parabolic
- d) Hyperbolic