Board Exam Desk

# Aeronautical Engineering Reviewer

Aeronautical Engineering Licensure Examination | PRC | 120 original questions

2026 Edition | Updated November 2026

Original board-style practice questions with an answer key.

## Practice questions

### Mathematics

**1. Given $f(x) = x^3 - 4x^2 + 7$, what is the value of $f'(3)$?**

A. 3
B. -2
C. 10
D. 15

**2. Evaluate the definite integral of $(3x^2 + 2x)\,dx$ from $x = 0$ to $x = 2$.**

A. 16
B. 12
C. 8
D. 6

**3. What is the larger root of the equation $2x^2 - 7x + 3 = 0$?**

A. 0.5
B. 3.5
C. 3
D. 1.5

**4. Find the area of the region bounded by the parabola $y = x^2$ and the horizontal line $y = 4$.**

A. 10.67 square units
B. 5.33 square units
C. 8.00 square units
D. 21.33 square units

**5. Two fair six-sided dice are rolled. What is the probability that the sum of the faces is 9?**

A. 1/6
B. 1/9
C. 5/36
D. 1/12

**6. What is the determinant of the 3×3 matrix with rows (2, 1, 0), (3, −1, 4) and (1, 2, 5)?**

A. -15
B. -10
C. 37
D. -37

**7. What is the Laplace transform of $f(t) = e^{(-3t)}$?**

A. $1/(s - 3)$
B. $1/(s + 3)$
C. $3/(s + 3)$
D. $s/(s + 3)$

**8. A quantity obeys dy/dt = −0.2y with y(0) = 50. What is y when t = 5?**

A. 16.38
B. 18.39
C. 40.00
D. 30.33

**9. What is the magnitude of the complex product (3 + 4j)(1 − j)?**

A. 7.000
B. 5.000
C. 7.071
D. 6.414

**10. Two sides of a triangle measure 7 cm and 9 cm, and the angle between them is 50°. How long is the third side?**

A. 14.53 cm
B. 7.00 cm
C. 11.40 cm
D. 9.46 cm

**11. A geometric progression has first term 3 and common ratio 2. What is the sum of its first six terms?**

A. 192
B. 189
C. 96
D. 93

**12. Evaluate the limit of sin(5x)/(2x) as x approaches 0.**

A. 2.5
B. 0.4
C. 5
D. 1

**13. What is the population standard deviation of the data set 4, 8, 6, 10, 12?**

A. 3.162
B. 8.000
C. 2.828
D. 2.400

**14. For $f(x, y) = x^2y + 3xy^3$, what is $\partial f/\partial y$ at the point (1, 2)?**

A. 37
B. 40
C. 13
D. 28

**15. The region under $y = \sqrt{x}$ from x = 0 to x = 4 is revolved about the x-axis. What is the volume generated?**

A. 16.76 cubic units
B. 25.13 cubic units
C. 12.57 cubic units
D. 50.27 cubic units

**16. What is the angle between the vectors A = 2i + 3j + 6k and B = i − 2j + 2k?**

A. 22.4°
B. 80.6°
C. 67.6°
D. 55.2°

**17. What is the maximum value of f(x) = −2x² + 12x + 5?**

A. 23
B. 3
C. 41
D. 18

**18. Solve for x: 3^x = 50.**

A. 16.667
B. 0.281
C. 1.304
D. 3.561

**19. In the Maclaurin series of e^(2x), what is the coefficient of x³?**

A. 1.333
B. 0.333
C. 2.667
D. 1.000

**20. Apply one Newton-Raphson iteration to f(x) = x² − 5 starting from x■ = 2. What is x■?**

A. 2.250
B. 1.750
C. 2.500
D. 2.236

## Engineering Sciences

**21. A projectile is launched from level ground at 40 m/s and 30° above the horizontal. Neglecting air resistance, what is its horizontal range?**

A. 141.2 m
B. 81.5 m
C. 163.1 m
D. 70.6 m

**22. An object is dropped from rest from a height of 80 m. Neglecting drag, how long does it take to reach the ground?**

A. 8.15 s
B. 2.86 s
C. 4.04 s
D. 16.31 s

**23. What is the kinetic energy of a 1,200 kg vehicle moving at 25 m/s?**

A. 750 kJ
B. 30 kJ
C. 15 kJ
D. 375 kJ

**24. A 250 N force is applied at the end of a 0.4 m wrench, making an angle of 60° with the wrench handle. What moment does it produce about the bolt?**

A. 86.6 N·m
B. 100.0 N·m
C. 50.0 N·m
D. 173.2 N·m

**25. A block slides down a 25° incline with a coefficient of kinetic friction of 0.30. What is its acceleration along the slope?**

A. 4.15 m/s²
B. 6.81 m/s²
C. 7.65 m/s²
D. 1.48 m/s²

**26. A solid round bar 20 mm in diameter carries an axial tensile load of 30 kN. What is the normal stress in the bar?**

A. 23.9 MPa
B. 191.0 MPa
C. 95.5 MPa
D. 75.0 MPa

**27. A steel rod 2 m long with a cross-sectional area of 150 mm² carries a tensile load of 20 kN. With E = 200 GPa, what is its elongation?**

A. 0.667 mm
B. 1.333 mm
C. 13.333 mm
D. 0.133 mm

**28. Treating air as an ideal gas with R = 287 J/(kg·K), what is its density at 101.325 kPa and 15 °C?**

A. 1.225 kg/m³
B. 0.024 kg/m³
C. 0.042 kg/m³
D. 1.293 kg/m³

**29. Water flows at 3 m/s in a pipe 100 mm in diameter that reduces to 50 mm. What is the velocity in the smaller section?**

A. 6 m/s
B. 12 m/s
C. 1.5 m/s
D. 24 m/s

**30. What is the gauge pressure at a depth of 12 m in fresh water of density 1000 kg/m³?**

A. 219.0 kPa
B. 117.7 kPa
C. 12.0 kPa
D. 58.9 kPa

**31. A Carnot engine operates between reservoirs at 900 K and 300 K. What is its thermal efficiency?**

A. 66.7%
B. 33.3%
C. 75.0%
D. 50.0%

**32. A wall 0.2 m thick with k = 0.8 W/(m·K) and an area of 10 m² has a 25 °C temperature difference across it. What is the steady conduction heat rate?**

A. 40 W
B. 4,000 W
C. 1,000 W
D. 200 W

**33. A 900 kg car rounds a flat curve of 60 m radius at 15 m/s. What friction force is needed to keep it on the curve?**

A. 3,375 N
B. 225 N
C. 8,829 N
D. 13,500 N

**34. In a tension test, which material property is represented by the slope of the linear portion of the stress-strain curve?**

A. Ultimate tensile strength
B. Modulus of elasticity
C. Modulus of toughness
D. Percent elongation

**35. The Reynolds number of a flow represents the ratio of which two effects?**

A. Pressure forces to inertial forces
B. Inertial forces to viscous forces
C. Viscous forces to gravity forces
D. Inertial forces to elastic forces

**36. A 0.2 kg ball moving at 30 m/s is brought to rest in 0.01 s. What average force acts on it?**

A. 60 N
B. 6 N
C. 300 N
D. 600 N

**37. What is the period of a simple pendulum 1.5 m long for small oscillations?**

A. 16.07 s
B. 2.46 s
C. 1.23 s
D. 0.39 s

**38. A solid circular shaft 50 mm in diameter transmits a torque of 1.2 kN·m. What is the maximum shear stress?**

A. 48.9 MPa
B. 24.4 MPa
C. 97.8 MPa
D. 6.1 MPa

**39. A hoist lifts a 500 kg load through 20 m at constant speed in 10 s. What useful power is required?**

A. 1.00 kW
B. 98.10 kW
C. 0.49 kW
D. 9.81 kW

**40. Air at 300 K is compressed isentropically through a pressure ratio of 8. Taking $\gamma = 1.4$, what is the final temperature?**

A. 1324.9 K
B. 2400.0 K
C. 689.2 K
D. 543.4 K

## Aerodynamics

**41. A wing of 16 m² area flies at 60 m/s in sea-level air ($\rho = 1.225$ kg/m³) with a lift coefficient of 0.5. How much lift does it generate?**

A. 17,640 N
B. 35,280 N
C. 294 N
D. 1,102 N

**42. An airplane weighing 10,000 N has a wing area of 15 m² and a maximum lift coefficient of 1.6. What is its stall speed at sea level ($\rho = 1.225$ kg/m³)?**

A. 26.1 m/s
B. 28.9 m/s
C. 18.4 m/s
D. 33.0 m/s

**43. What is the dynamic pressure on an aircraft flying at 80 m/s where the air density is 0.90 kg/m³?**

A. 2,880 Pa
B. 5,760 Pa
C. 36 Pa
D. 72 Pa

**44. An aircraft flies at 250 m/s where the air temperature is −50 °C. Using $\gamma = 1.4$ and R = 287 J/(kg·K), what is its Mach number?**

A. 0.735
B. 1.764
C. 0.835
D. 0.988

**45. A rectangular-planform wing has a span of 12 m and an area of 18 m². What is its aspect ratio?**

A. 8.0
B. 1.5
C. 0.67
D. 6.0

**46. A wing with aspect ratio 8 and span efficiency factor 0.8 operates at a lift coefficient of 0.6. What is its induced drag coefficient?**

A. 0.0298
B. 0.0143
C. 0.0115
D. 0.0179

**47. An airplane has the drag polar $C_D = 0.025 + 0.04C_L^2$. What is its maximum lift-to-drag ratio?**

A. 31.62
B. 0.79
C. 15.81
D. 7.91

**48. A wing with a 1.5 m chord moves at 50 m/s through air with kinematic viscosity 1.46 × 10■■ m²/s. What is the chord Reynolds number?**

A. 3.42 × 10■
B. 4.19 × 10■
C. 5.14 × 10■
D. 7.71 × 10■

**49. According to thin airfoil theory, what is the lift coefficient of a symmetric airfoil at a 4° angle of attack?**

A. 25.133
B. 0.439
C. 0.219
D. 0.140

**50. The aerodynamic center of an airfoil is the point about which the**

A. resultant aerodynamic force always acts
B. pitching moment coefficient is independent of angle of attack
C. lift coefficient reaches its maximum value
D. boundary layer first separates from the surface

**51. Air at Mach 2.0 passes through a normal shock ($\gamma = 1.4$). What is the Mach number immediately downstream?**

A. 0.500
B. 0.707
C. 0.577
D. 0.567

**52. Air at a static temperature of 250 K moves at Mach 2.0. With $\gamma = 1.4$, what is the stagnation temperature?**

A. 350 K
B. 500 K
C. 450 K
D. 1,250 K

**53. An airplane stalls at 100 km/h in straight and level flight. What is its stall speed in a level, coordinated turn at 60° bank?**

A. 200.0 km/h
B. 141.4 km/h
C. 115.5 km/h
D. 50.0 km/h

**54. What is the radius of a level coordinated turn flown at 70 m/s with a 30° bank angle?**

A. 865 m
B. 999 m
C. 288 m
D. 499 m

**55. A glider with a lift-to-drag ratio of 12 starts from 1,500 m above flat terrain in still air. How far can it glide?**

A. 18 km
B. 125 m
C. 12 km
D. 1.5 km

**56. For a wing of fixed area generating the same lift, increasing the aspect ratio mainly**

A. raises the stall angle of attack
B. reduces the induced drag
C. lowers the skin friction drag
D. increases the critical Mach number

**57. A pitot-static tube in low-speed sea-level air ($\rho = 1.225$ kg/m³) reads a difference of 1,500 Pa between total and static pressure. What is the airspeed?**

A. 35.0 m/s
B. 24.5 m/s
C. 49.5 m/s
D. 54.8 m/s

**58. The critical Mach number of an airfoil is the free-stream Mach number at which**

A. sonic flow first appears somewhere on the surface
B. the drag coefficient reaches its absolute peak
C. a normal shock stands ahead of the leading edge
D. the free-stream flow itself becomes sonic

**59. A wing swept back 30° flies at Mach 0.85. By simple sweep theory, what Mach number component acts normal to the leading edge?**

A. 0.736
B. 0.425
C. 0.981
D. 0.638

**60. An airfoil has a low-speed lift coefficient of 0.40. Using the Prandtl-Glauert rule, what is its lift coefficient at Mach 0.6 and the same angle of attack?**

A. 0.320
B. 0.625
C. 0.400
D. 0.500

## Aircraft Structures and Design

**61. An airplane weighing 12,000 N has a wing area of 16 m². What is its wing loading?**

A. 1,333 N/m²
B. 192,000 N/m²
C. 75 N/m²
D. 750 N/m²

**62. A rectangular spar section 50 mm wide and 120 mm deep carries a bending moment of 15 kN·m. What is the maximum bending stress?**

A. 300 MPa
B. 250 MPa
C. 125 MPa
D. 62.5 MPa

**63. A cylindrical pressurized fuselage has a radius of 1.8 m, a skin thickness of 1.6 mm and a cabin pressure differential of 55 kPa. What is the hoop stress in the skin?**

A. 30.9 MPa
B. 61.9 MPa
C. 123.8 MPa
D. 6.2 MPa

**64. A pin-ended aluminum strut 1.2 m long has E = 70 GPa and a least moment of inertia of 5 × 10■■ m■. What is its Euler buckling load?**

A. 6.00 kN
B. 95.95 kN
C. 28.79 kN
D. 23.99 kN

**65. Airworthiness standards commonly apply a factor of safety of 1.5 to limit loads. If the limit maneuvering load factor is 3.8, what is the ultimate load factor?**

A. 2.53
B. 5.3
C. 5.7
D. 7.6

**66. A closed thin-walled torque box encloses an area of 0.05 m² and has a 1 mm wall. If it carries a torque of 2 kN·m, what is the shear stress in the wall?**

A. 40 MPa
B. 10 MPa
C. 20 kPa
D. 20 MPa

**67. A T-section has a 100 mm × 10 mm flange sitting on top of a 10 mm × 90 mm vertical web (total depth 100 mm). How far is its centroid from the bottom of the web?**

A. 28.7 mm
B. 50.0 mm
C. 70.0 mm
D. 71.3 mm

**68. What is the second moment of area of a 40 mm wide by 80 mm deep rectangle about its horizontal centroidal axis?**

A. 0.427 × 10■ mm■
B. 1.707 × 10■ mm■
C. 6.827 × 10■ mm■
D. 0.569 × 10■ mm■

**69. An aircraft has an empty weight of 6,000 N with its CG 2.2 m aft of the datum. A 800 N pilot is placed at 1.8 m and 1,200 N of fuel at 2.5 m. Where is the loaded CG?**

A. 2.167 m aft of datum
B. 2.940 m aft of datum
C. 2.450 m aft of datum
D. 2.205 m aft of datum

**70. In a semi-monocoque fuselage, which arrangement carries the loads?**

A. A welded steel-tube truss with fabric covering
B. An unstiffened skin carrying every load alone
C. Skin reinforced by stringers, frames and bulkheads
D. A single heavy keel beam with a light fairing

**71. A plot of alternating stress amplitude against the number of cycles to failure is used mainly to assess**

A. creep rate at high temperature
B. fracture toughness of a crack
C. fatigue life of a material
D. hardness after heat treatment

**72. Aluminum alloy 7075, widely used for highly stressed airframe parts, has which principal alloying element?**

A. Copper
B. Magnesium and silicon
C. Manganese
D. Zinc

**73. An aluminum member ($\alpha$ = 23 × 10■■ /°C, E = 70 GPa) is fully restrained at both ends and heated by 40 °C. What thermal stress develops?**

A. 32.2 MPa
B. 1.61 MPa
C. 64.4 MPa
D. 184.0 MPa

**74. Based on the strength and density values given, which material has the highest specific strength?**

A. Aluminum alloy (500 MPa, 2,800 kg/m³)
B. Alloy steel (1,400 MPa, 7,850 kg/m³)
C. Titanium alloy (900 MPa, 4,430 kg/m³)
D. Magnesium alloy (250 MPa, 1,800 kg/m³)

**75. A jet cruises at 230 m/s with L/D = 16 and TSFC = 0.6 per hour. Using the Breguet equation, what range results if the initial-to-final weight ratio is 1.25?**

A. 5,520 km
B. 1,369 km
C. 2,140 km
D. 4,927 km

**76. In a first-pass sizing, crew plus payload is 2,000 kg, the empty-weight fraction is 0.55 and the fuel fraction is 0.30. What is the estimated takeoff mass?**

A. 4,444 kg
B. 3,700 kg
C. 13,333 kg
D. 6,667 kg

**77. A horizontal tail of 3.2 m² sits 4.5 m behind the CG. The wing area is 16 m² and the mean aerodynamic chord is 1.6 m. What is the horizontal tail volume coefficient?**

A. 0.900
B. 0.562
C. 0.200
D. 1.778

**78. An aircraft's neutral point is at 35% of the mean aerodynamic chord and its CG is at 25% MAC. What is the static margin, and is the aircraft statically stable in pitch?**

A. 10% MAC, unstable
B. 10% MAC, stable
C. 60% MAC, stable
D. –10% MAC, unstable

**79. A skin panel element has $\sigma x$ = 80 MPa, $\sigma y$ = –20 MPa and $\tau xy$ = 30 MPa. What is the maximum principal stress?**

A. -28.3 MPa
B. 58.3 MPa
C. 88.3 MPa
D. 134.4 MPa

**80. An airplane has a 1-g stall speed of 30 m/s and a positive limit load factor of 3.8. What is its design maneuvering speed on the V-n diagram?**

A. 114.0 m/s
B. 58.5 m/s
C. 71.6 m/s
D. 15.4 m/s

## Aircraft Powerplant

**81. A turbojet ingests 50 kg/s of air at a flight speed of 200 m/s and exhausts it at 600 m/s. Neglecting fuel mass and pressure thrust, what is the net thrust?**

A. 30,000 N
B. 20,000 N
C. 40,000 N
D. 10,000 N

**82. Using the Froude relation, what is the propulsive efficiency of a jet with an exhaust velocity three times its flight velocity?**

A. 33.3%
B. 66.7%
C. 50.0%
D. 75.0%

**83. What is the thermal efficiency of an ideal Brayton cycle with a pressure ratio of 10 ($\gamma$ = 1.4)?**

A. 48.2%
B. 60.2%
C. 90.0%
D. 80.7%

**84. What is the air-standard efficiency of an ideal Otto cycle with a compression ratio of 8 ($\gamma$ = 1.4)?**

A. 44.8%
B. 87.5%
C. 56.5%
D. 94.6%

**85. A propeller producing 3,000 N of thrust at 60 m/s has a propulsive efficiency of 80%. What shaft power must the engine deliver?**

A. 144 kW
B. 180 kW
C. 225 kW
D. 240 kW

**86. A rocket stage has a specific impulse of 300 s and an initial-to-final mass ratio of 4. What ideal velocity change does it achieve?**

A. 4,080 m/s
B. 11,772 m/s
C. 416 m/s
D. 1,772 m/s

**87. An engine burns 0.8 kg/s of fuel while producing 40 kN of thrust. What is its thrust-specific fuel consumption?**

A. 0.020 kg/(N·h)
B. 0.0012 kg/(N·h)
C. 13.889 kg/(N·h)
D. 0.072 kg/(N·h)

**88. A turbofan takes in 300 kg/s of air in total, of which 50 kg/s passes through the core. What is its bypass ratio?**

A. 5.0
B. 6.0
C. 0.17
D. 0.20

**89. A four-cylinder aircraft piston engine has a 100 mm bore and a 90 mm stroke. What is its total displacement?**

A. 0.707 L
B. 11.310 L
C. 2.545 L
D. 2.827 L

**90. Why are most certificated aircraft piston engines fitted with two independent magnetos?**

A. For redundancy and more complete combustion
B. To charge the battery during flight
C. To supply power to the avionics bus
D. To start the engine without a battery

**91. Carburetor icing can form even at outside air temperatures well above freezing mainly because**

A. exhaust heat melts snow that refreezes in the inlet
B. the oil cooler draws heat away from the intake
C. a lean mixture raises the cylinder head temperature
D. fuel evaporation and venturi pressure drop cool the air

**92. A compressor raises 20 kg/s of air from 288 K to 550 K. Taking $c_p$ = 1,005 J/(kg·K) and neglecting kinetic energy changes, what power does it absorb?**

A. 0.263 MW
B. 5.27 MW
C. 3.76 MW
D. 11.05 MW

**93. Air enters a compressor at 288 K and is compressed through a pressure ratio of 6 with an isentropic efficiency of 85% ($\gamma$ = 1.4). What is the actual exit temperature?**

A. 480.5 K
B. 514.5 K
C. 451.7 K
D. 565.3 K

**94. Gas expands in an adiabatic nozzle with a static enthalpy drop of 150 kJ/kg, starting from negligible velocity. What is the exit velocity?**

A. 387.3 m/s
B. 17.3 m/s
C. 300.0 m/s
D. 547.7 m/s

**95. What is the main trade-off of using an afterburner on a turbojet or low-bypass turbofan?**

A. Lower fuel use at the cost of reduced thrust
B. Higher propulsive efficiency at low speed
C. Large thrust gain at much higher fuel consumption
D. Quieter operation with a heavier engine

**96. Why can a simple ramjet not produce thrust when the aircraft is stationary?**

A. Its combustor needs liquid oxygen to ignite
B. It relies on ram compression from forward speed
C. Its turbine cannot spin without a starter
D. Its nozzle is closed until supersonic speed

**97. A 2.0 m diameter propeller turns at 2,400 rpm while the aircraft flies at 50 m/s. What is the advance ratio?**

A. 0.0104
B. 1.250
C. 0.313
D. 0.625

**98. An engine develops a torque of 600 N·m at 2,400 rpm. What brake power does it produce?**

A. 1440.0 kW
B. 150.8 kW
C. 24.0 kW
D. 75.4 kW

**99. A four-stroke piston engine with a total displacement of 5.0 L runs at 2,700 rpm with a brake mean effective pressure of 900 kPa. What is its brake power?**

A. 101.25 kW
B. 202.5 kW
C. 6,075 kW
D. 50.62 kW

**100. An engine delivers 100 kW of brake power while burning 25 kg/h of fuel with a heating value of 43 MJ/kg. What is its brake thermal efficiency?**

A. 0.6%
B. 9.3%
C. 66.5%
D. 33.5%

## Air Law and Aircraft Maintenance

**101. Which law created the Civil Aviation Authority of the Philippines (CAAP)?**

A. Republic Act No. 776
B. Republic Act No. 1570
C. Republic Act No. 9497
D. Republic Act No. 9184

**102. The International Civil Aviation Organization (ICAO) was established under which treaty?**

A. Warsaw Convention of 1929
B. Tokyo Convention of 1963
C. Paris Convention of 1919
D. Chicago Convention of 1944

**103. In which city is the headquarters of ICAO located?**

A. Montreal
B. Geneva
C. Chicago
D. Vienna

**104. Civil aircraft registered in the Philippines carry which nationality mark?**

A. RP
B. PH
C. PI
D. RPH

**105. Which ICAO Annex to the Chicago Convention deals with the airworthiness of aircraft?**

A. Annex 8
B. Annex 1
C. Annex 6
D. Annex 13

**106. Which ICAO Annex sets the standards for aircraft accident and incident investigation?**

A. Annex 7
B. Annex 2
C. Annex 11
D. Annex 13

**107. Under the freedoms of the air, the first freedom is the privilege of**

A. landing in a foreign state for refueling only
B. carrying traffic between two foreign states
C. carrying passengers within a foreign state
D. flying across a foreign state without landing

**108. Which international treaty, concluded in 1999, governs air carrier liability for passengers, baggage and cargo on international flights?**

A. Chicago Convention
B. Tokyo Convention
C. Montreal Convention
D. Hague Convention

**109. Which convention addresses offences and certain other acts committed on board aircraft in flight?**

A. Tokyo Convention of 1963
B. Montreal Convention of 1999
C. Chicago Convention of 1944
D. Rome Convention of 1952

**110. What distinguishes an Airworthiness Directive from a manufacturer's service bulletin?**

A. The directive applies only to engines and propellers
B. The directive is a voluntary product improvement
C. The directive is issued only by the operator
D. Compliance with the directive is legally mandatory

**111. What is the purpose of a Minimum Equipment List (MEL)?**

A. Listing tools a mechanic must carry on board
B. Listing items that may be inoperative for dispatch
C. Listing spare parts stored at each station
D. Listing the minimum crew for each flight

**112. Liquid (dye) penetrant inspection can detect only which kind of defect?**

A. Voids deep inside a casting
B. Delaminations inside composite layups
C. Changes in alloy heat-treat condition
D. Discontinuities open to the surface

**113. Magnetic particle inspection is suitable only for parts made of**

A. aluminum and its alloys
B. titanium and its alloys
C. carbon-fiber composites
D. ferromagnetic materials such as steel

**114. Eddy current inspection requires that the test material be**

A. ferromagnetic
B. transparent to X-rays
C. electrically conductive
D. coated with a dye

**115. Corrosion that develops where aluminum is in electrical contact with stainless steel in the presence of moisture is called**

A. filiform corrosion
B. galvanic corrosion
C. fretting corrosion
D. intergranular corrosion

**116. Thread-like corrosion that travels in worm-shaped tracks beneath a paint film is known as**

A. pitting corrosion
B. exfoliation corrosion
C. stress corrosion cracking
D. filiform corrosion

**117. Alclad aluminum sheet is protected against corrosion by**

A. a chromate primer baked at high heat
B. a thin surface layer of pure aluminum
C. an electroplated layer of cadmium
D. a sprayed zinc-rich organic coating

**118. Under the ATA 100 / iSpec 2200 chapter numbering used in maintenance manuals, chapter 32 covers which system?**

A. Fuel
B. Hydraulic power
C. Landing gear
D. Flight controls

**119. A maintenance process in which a component is removed at a fixed time interval regardless of its condition is called**

A. on-condition
B. condition monitoring
C. hard time
D. reliability centered

**120. A torque wrench 0.30 m long is fitted with a 0.06 m straight extension in line with the handle. To apply 50 N·m at the bolt, what should the wrench dial read?**

A. 60.0 N·m
B. 40.0 N·m
C. 44.0 N·m
D. 41.7 N·m

# Answer key

Aeronautical Engineering

**1. A. 3**

f′(x) = 3x² – 8x, so f′(3) = 27 – 24 = 3.

**2. B. 12**

The antiderivative is x³ + x²; at x = 2 it equals 8 + 4 = 12, and at 0 it is zero.

**3. C. 3**

x = [7 ± √(49 – 24)]/4 = (7 ± 5)/4, giving 3 and 0.5; the larger root is 3.

**4. A. 10.67 square units**

Area = ∫ from –2 to 2 of (4 – x²) dx = 16 – 16/3 = 32/3 ≈ 10.67 square units.

**5. B. 1/9**

The pairs (3,6), (4,5), (5,4), (6,3) give 4 favorable outcomes out of 36, or 1/9.

**6. D. -37**

Expanding along the first row: 2(–5 – 8) – 1(15 – 4) + 0 = –26 – 11 = -37.

**7. B. 1/(s + 3)**

L{e^(at)} = 1/(s – a); with a = –3 the transform is 1/(s + 3).

**8. B. 18.39**

The solution is y = 50e^(–0.2t); at t = 5, y = 50e^(–1) ≈ 18.39.

**9. C. 7.071**

|z1 z2| = |z1||z2| = 5 × √2 ≈ 7.071.

**10. B. 7.00 cm**

Law of cosines: c² = 49 + 81 – 2(7)(9)cos 50° ≈ 49.01, so c ≈ 7.00 cm.

**11. B. 189**

S = a(r■ – 1)/(r – 1) = 3(64 – 1)/1 = 189.

**12. A. 2.5**

Since sin(5x) ≈ 5x for small x, the ratio tends to 5x/2x = 2.5.

**13. C. 2.828**

The mean is 8; the squared deviations sum to 40, so σ = √(40/5) = √8 ≈ 2.828.

**14. A. 37**

∂f/∂y = x² + 9xy²; at (1, 2) this is 1 + 36 = 37.

**15. B. 25.13 cubic units**

Disk method: V = π∫x dx from 0 to 4 = π(16/2) = 8π ≈ 25.13 cubic units.

**16. C. 67.6°**

A·B = 2 – 6 + 12 = 8, |A| = 7, |B| = 3, so cos θ = 8/21 and θ ≈ 67.6°.

**17. A. 23**

The vertex is at x = –12/(2·–2) = 3, and f(3) = –18 + 36 + 5 = 23.

**18. D. 3.561**

Taking logarithms, x = ln 50 / ln 3 ≈ 3.561.

**19. A. 1.333**

e^(2x) = Σ(2x)■/n!, so the x³ coefficient is 2³/3! = 8/6 ≈ 1.333.

**20. A. 2.250**

x■ = x■ – f(x■)/f′(x■) = 2 – (–1)/4 = 2.25.

**21. A. 141.2 m**

R = v² sin 2θ / g = 1600 × sin 60° / 9.81 ≈ 141.2 m.

**22. C. 4.04 s**

h = ½gt², so t = √(2 × 80 / 9.81) ≈ 4.04 s.

**23. D. 375 kJ**

KE = ½mv² = 0.5 × 1200 × 25² = 375,000 J = 375 kJ.

**24. A. 86.6 N·m**

Only the perpendicular component acts: M = F d sin θ = 250 × 0.4 × sin 60° ≈ 86.6 N·m.

**25. D. 1.48 m/s²**

a = g(sin θ – μ cos θ) = 9.81(0.4226 – 0.3 × 0.9063) ≈ 1.48 m/s².

**26. C. 95.5 MPa**

σ = P/A = 30,000 / (π/4 × 0.020²) ≈ 95.5 MPa.

**27. B. 1.333 mm**

δ = PL/(AE) = 20,000 × 2 / (150×10■■ × 200×10■) ≈ 1.333 mm.

**28. A. 1.225 kg/m³**

ρ = p/(RT) = 101,325 / (287 × 288.15) ≈ 1.225 kg/m³.

**29. B. 12 m/s**

Continuity: V■ = V■(D■/D■)² = 3 × (100/50)² = 12 m/s.

**30. B. 117.7 kPa**

p = ρgh = 1000 × 9.81 × 12 ≈ 117.7 kPa gauge.

**31. A. 66.7%**

η = 1 – T_L/T_H = 1 – 300/900 ≈ 66.7%.

**32. C. 1,000 W**

q = kAΔT/L = 0.8 × 10 × 25 / 0.2 = 1,000 W.

**33. A. 3,375 N**

F = mv²/r = 900 × 225 / 60 = 3,375 N.

**34. B. Modulus of elasticity**

Within the proportional limit, stress divided by strain is constant and equals Young's modulus, a measure of stiffness.

**35. B. Inertial forces to viscous forces**

Re = ρVL/μ compares inertial to viscous forces; high values indicate a tendency toward turbulence.

**36. D. 600 N**

F = Δp/Δt = 0.2 × 30 / 0.01 = 600 N.

**37. B. 2.46 s**

T = 2π√(L/g) = 2π√(1.5/9.81) ≈ 2.46 s.

**38. A. 48.9 MPa**

τ = 16T/(πd³) = 16 × 1200 / (π × 0.05³) ≈ 48.9 MPa.

**39. D. 9.81 kW**

P = mgh/t = 500 × 9.81 × 20 / 10 ≈ 9.81 kW.

**40. D. 543.4 K**

T■ = T■(p■/p■)^((γ–1)/γ) = 300 × 8^0.2857 ≈ 543.4 K.

**41. A. 17,640 N**

L = ½ρV²SC_L = 0.5 × 1.225 × 3600 × 16 × 0.5 = 17,640 N.

**42. A. 26.1 m/s**

V_s = √(2W/(ρSC_Lmax)) = √(20,000 / (1.225 × 15 × 1.6)) ≈ 26.1 m/s.

**43. A. 2,880 Pa**

q = ½ρV² = 0.5 × 0.90 × 80² = 2,880 Pa.

**44. C. 0.835**

a = √(γRT) = √(1.4 × 287 × 223.15) ≈ 299.4 m/s, so M = 250/299.4 ≈ 0.835.

**45. A. 8.0**

AR = b²/S = 144/18 = 8.0.

**46. D. 0.0179**

C_Di = C_L²/(πeAR) = 0.36/(π × 0.8 × 8) ≈ 0.0179.

**47. C. 15.81**

(L/D)max = 1/(2√(C_D0·k)) = 1/(2√0.001) ≈ 15.81.

**48. C. 5.14 × 10■**

Re = Vc/ν = 50 × 1.5 / 1.46×10■■ ≈ 5.14 × 10■.

**49. B. 0.439**

C_L = 2πα with α in radians: 2π × 0.0698 ≈ 0.439.

**50. B. pitching moment coefficient is independent of angle of attack**

By definition, the moment about the aerodynamic center does not change with angle of attack; for thin airfoils it lies near the quarter chord.

**51. C. 0.577**

M■² = [1 + 0.2M■²]/[1.4M■² – 0.2] = 1.8/5.4, so M■ ≈ 0.577.

**52. C. 450 K**

T■ = T(1 + (γ–1)/2 · M²) = 250(1 + 0.2 × 4) = 450 K.

**53. B. 141.4 km/h**

Load factor n = 1/cos 60° = 2, and stall speed scales with √n: 100 × √2 ≈ 141.4 km/h.

**54. A. 865 m**

$R = V^2/(g \tan \phi) = 4900/(9.81 \times 0.5774) \approx 865$ m.

**55. A. 18 km**

Glide distance = (L/D) × height = 12 × 1500 m = 18,000 m.

**56. B. reduces the induced drag**

$C_{Di} = C_L^2/(\pi e AR)$, so a larger aspect ratio weakens the tip vortices and lowers induced drag.

**57. C. 49.5 m/s**

$V = \sqrt{(2\Delta p/\rho)} = \sqrt{(3000/1.225)} \approx 49.5$ m/s.

**58. A. sonic flow first appears somewhere on the surface**

Local flow over the upper surface accelerates, so M = 1 is first reached locally while the free stream is still subsonic.

**59. A. 0.736**

$M_n = M \cos \Lambda = 0.85 \times \cos 30° \approx 0.736$.

**60. D. 0.500**

$C_L = C_{L0}/\sqrt{(1 - M^2)} = 0.40/\sqrt{(1 - 0.36)} = 0.40/0.8 = 0.500$.

**61. D. 750 N/m²**

Wing loading = W/S = 12,000/16 = 750 N/m².

**62. C. 125 MPa**

$\sigma = Mc/I = 6M/(bh^2) = 6 \times 15\times10\blacksquare / (50 \times 120^2) = 125$ MPa.

**63. B. 61.9 MPa**

$\sigma_{hoop} = pr/t = 55{,}000 \times 1.8 / 0.0016 \approx 61.9$ MPa.

**64. D. 23.99 kN**

$P_{cr} = \pi^2 EI/L^2 = \pi^2 \times 70\times10\blacksquare \times 5\times10\blacksquare\blacksquare / 1.2^2 \approx 23.99$ kN.

**65. C. 5.7**

Ultimate load factor = 1.5 × limit load factor = 1.5 × 3.8 = 5.7.

**66. D. 20 MPa**

Bredt-Batho: $q = T/(2A) = 2000/(2 \times 0.05) = 20$ kN/m, and $\tau = q/t = 20{,}000/0.001 = 20$ MPa.

**67. D. 71.3 mm**

■ = (1000 × 95 + 900 × 45)/(1000 + 900) ≈ 71.3 mm.

**68. B. 1.707 × 10■ mm■**

$I = bh^3/12 = 40 \times 80^3/12 \approx 1.707 \times 10\blacksquare$ mm■.

**69. D. 2.205 m aft of datum**

$CG = \Sigma(W \cdot x)/\Sigma W = (13{,}200 + 1{,}440 + 3{,}000)/8{,}000 \approx 2.205$ m.

**70. C. Skin reinforced by stringers, frames and bulkheads**

Semi-monocoque structure shares loads between a stressed skin and longitudinal and transverse stiffening members.

**71. C. fatigue life of a material**

The S-N (Wöhler) curve shows how many load cycles a material survives at a given stress amplitude.

**72. D. Zinc**

The 7xxx series is zinc-based; the 2xxx series, such as 2024, uses copper as the main alloying element.

**73. C. 64.4 MPa**

σ = EαΔT = 70×10■ × 23×10■■ × 40 ≈ 64.4 MPa (compressive).

**74. C. Titanium alloy (900 MPa, 4,430 kg/m³)**

Specific strength = σ/ρ; titanium gives 203 kN·m/kg versus 179, 178 and 139 for the others.

**75. D. 4,927 km**

R = (V/c)(L/D)ln(W■/W■) = (230 / 1.667×10■■ s■¹) × 16 × ln 1.25 ≈ 4,927 km.

**76. C. 13,333 kg**

W■ = (W_crew + W_payload)/(1 – W_e/W■ – W_f/W■) = 2000/0.15 ≈ 13,333 kg.

**77. B. 0.562**

V_H = S_H·l_H/(S·c■) = 3.2 × 4.5 / (16 × 1.6) ≈ 0.562.

**78. B. 10% MAC, stable**

Static margin = x_np – x_cg = 35% – 25% = 10% MAC; a positive margin (CG ahead of the neutral point) means static stability.

**79. C. 88.3 MPa**

σ■ = (σx + σy)/2 + √[((σx – σy)/2)² + τ²] = 30 + √(50² + 30²) ≈ 88.3 MPa.

**80. B. 58.5 m/s**

V_A = V_s√n = 30 × √3.8 ≈ 58.5 m/s.

**81. B. 20,000 N**

F = ■(V_e – V■) = 50 × (600 – 200) = 20,000 N.

**82. C. 50.0%**

η_p = 2/(1 + V_e/V■) = 2/(1 + 3) = 0.50.

**83. A. 48.2%**

η = 1 – r_p^(–(γ–1)/γ) = 1 – 10^(–0.2857) ≈ 48.2%.

**84. C. 56.5%**

η = 1 – 1/r^(γ–1) = 1 – 8^(–0.4) ≈ 56.5%.

**85. C. 225 kW**

Shaft power = TV/η_p = 3000 × 60 / 0.8 = 225,000 W.

**86. A. 4,080 m/s**

Δv = I_sp·g■·ln(m■/m_f) = 300 × 9.81 × ln 4 ≈ 4,080 m/s.

**87. D. 0.072 kg/(N·h)**

TSFC = ■_f/F = 0.8/40,000 = 2 × 10■■ kg/(N·s) = 0.072 kg/(N·h).

**88. A. 5.0**

Bypass ratio = bypass flow / core flow = (300 – 50)/50 = 5.0.

**89. D. 2.827 L**

V = 4 × (π/4)(0.1)² × 0.09 m³ ≈ 0.002827 m³ = 2.827 L.

**90. A. For redundancy and more complete combustion**

Dual ignition keeps the engine running if one system fails, and two spark plugs per cylinder burn the charge more completely.

**91. D. fuel evaporation and venturi pressure drop cool the air**

Vaporizing fuel absorbs heat and the venturi expansion lowers temperature, so moisture can freeze in the carburetor throat.

**92. B. 5.27 MW**

P = ■c_pΔT = 20 × 1005 × 262 ≈ 5.27 MW.

**93. B. 514.5 K**

T■s = 288 × 6^0.2857 ≈ 480.5 K; T■ = 288 + (480.5 – 288)/0.85 ≈ 514.5 K.

**94. D. 547.7 m/s**

V = √(2Δh) = √(2 × 150,000) ≈ 547.7 m/s.

**95. C. Large thrust gain at much higher fuel consumption**

Burning extra fuel in the exhaust raises jet velocity and thrust, but specific fuel consumption rises sharply.

**96. B. It relies on ram compression from forward speed**

A ramjet has no compressor; it compresses incoming air only through the ram effect of forward motion.

**97. D. 0.625**

J = V/(nD) with n = 2400/60 = 40 rev/s: J = 50/(40 × 2) = 0.625.

**98. B. 150.8 kW**

P = 2πNT = 2π × 40 rev/s × 600 N·m ≈ 150.8 kW.

**99. A. 101.25 kW**

P = p_me·V_d·N/(2 × 60) = 900,000 × 0.005 × 2700 / 120 ≈ 101.25 kW.

**100. D. 33.5%**

η = P/(■_f·Q) = 100 / (25 × 43,000 / 3600) ≈ 33.5%.

**101. C. Republic Act No. 9497**

RA 9497, the Civil Aviation Authority Act of 2008, created CAAP to replace the former Air Transportation Office.

**102. D. Chicago Convention of 1944**

The Convention on International Civil Aviation signed in Chicago in 1944 created ICAO.

**103. A. Montreal**

ICAO is a United Nations specialized agency headquartered in Montreal, Canada.

**104. A. RP**

Philippine civil aircraft registrations begin with the nationality mark RP, as in RP-C followed by digits.

**105. A. Annex 8**

Annex 8 sets airworthiness standards; Annex 1 covers personnel licensing, Annex 6 operations and Annex 13 accident investigation.

**106. D. Annex 13**

Annex 13 governs accident and incident investigation, whose sole purpose is preventing future accidents rather than assigning blame.

**107. D. flying across a foreign state without landing**

The first freedom is overflight; landing for non-traffic purposes such as refueling is the second freedom.

**108. C. Montreal Convention**

The 1999 Montreal Convention modernized and consolidated the carrier liability rules of the older Warsaw system.

**109. A. Tokyo Convention of 1963**

The 1963 Tokyo Convention gives jurisdiction to the state of registry and powers to the aircraft commander over acts on board.

**110. D. Compliance with the directive is legally mandatory**

An AD is issued by the aviation authority to correct an unsafe condition and must be complied with; a service bulletin is a manufacturer's recommendation.

**111. B. Listing items that may be inoperative for dispatch**

An approved MEL specifies equipment that may be inoperative at dispatch, with any conditions or limitations that apply.

**112. D. Discontinuities open to the surface**

The penetrant must enter the flaw by capillary action, so only surface-breaking cracks and porosity are revealed.

**113. D. ferromagnetic materials such as steel**

The method relies on flux leakage at defects in a magnetized part, so the material must be ferromagnetic.

**114. C. electrically conductive**

Eddy currents are induced only in conductive materials; flaws alter the current flow and the probe's impedance.

**115. B. galvanic corrosion**

Dissimilar metals in an electrolyte form a cell, and the more anodic metal, here aluminum, corrodes.

**116. D. filiform corrosion**

Filiform corrosion is a special form of oxygen-concentration cell corrosion appearing as filaments under coatings.

**117. B. a thin surface layer of pure aluminum**

Alclad bonds high-purity aluminum to both faces of a stronger alloy core; the pure layer resists corrosion and protects the core.

**118. C. Landing gear**

ATA chapter 32 is landing gear; fuel is 28, hydraulic power is 29 and flight controls are 27.

**119. C. hard time**

Hard-time items have a fixed life or overhaul interval, unlike on-condition items that remain in service while inspections show them serviceable.

**120. D. 41.7 N·m**

Reading = $T_{actual} \times L/(L + E) = 50 \times 0.30/0.36 \approx 41.7$ N·m.

## Topics to review

• Aerodynamic forces and flight performance

• Aircraft structures and loading

• Propulsion and aircraft systems

• Maintenance, airworthiness and flight safety

## Online question banks and study resources

Aeronautical Engineering - Pass Harbor (Question bank)

Official PRC board information

Current PRC exam programs

Independent study material prepared by Board Exam Desk.