Board Exam Desk

Electrical Engineering Reviewer

Electrical 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. What is the product of the roots of the equation $3x^2 + 5x - 12 = 0$?

A. –5/3
B. 5/3
C. 4
D. –4

2. If $y = x^3 \ln x$, what is dy/dx evaluated at $x = e$?

A. 29.56
B. 14.78
C. 7.39
D. 22.17

3. Evaluate the definite integral of $\sin^2 x\, dx$ from $x = 0$ to $x = \pi/2$.

A. 1
B. $\pi/4$
C. $\pi/2$
D. 1/2

4. Find the determinant of the 3×3 matrix whose rows are (2, 1, 3), (0, 4, –1) and (5, 2, 1).

A. –39
B. 53
C. –43
D. –53

5. Simplify the product $(3 + j4)(1 - j2)$.

A. –5 + j10
B. 11 – j2
C. –5 – j2
D. 11 + j2

6. Express the complex number $10\angle 150°$ in rectangular form.

A. 8.66 + j5.00
B. –8.66 + j5.00
C. –5.00 + j8.66
D. 8.66 – j5.00

7. Two fair dice are rolled once. What is the probability that the sum of the faces is 8?

A. 1/6
B. 5/36
C. 1/9
D. 7/36

8. In how many ways can a 4-member committee be chosen from 9 qualified engineers if order does not matter?

A. 36
B. 3024
C. 84
D. 126

9. Find the sum of the first 25 terms of the arithmetic progression 7, 11, 15, 19, …

A. 1,325
B. 1,375
C. 103
D. 1,425

10. What is the sum of the infinite geometric series 18 + 12 + 8 + …?

A. 54
B. 27
C. 36
D. 45

11. Find the perpendicular distance from the point (3, –2) to the line 4x – 3y + 7 = 0.

A. 3.57
B. 25.0
C. 5.0
D. 2.6

12. What is the radius of the circle $x^2 + y^2 – 6x + 8y – 11 = 0$?

A. √11
B. 3.74
C. 6
D. 5

13. Determine the eccentricity of the ellipse $x^2/25 + y^2/16 = 1$.

A. 0.75
B. 1.25
C. 0.60
D. 0.80

14. What is the Laplace transform of f(t) = e^(–2t) sin 3t?

A. $(s + 2)/[(s + 2)^2 + 9]$
B. $3/[(s + 2)^2 + 9]$
C. $3/[(s – 2)^2 + 9]$
D. $3/[(s + 2)^2 – 9]$

15. A quantity grows according to dy/dt = 0.04y, with t in years and y(0) = 500. What is y after 10 years?

A. 745.9
B. 700.0
C. 520.4
D. 740.1

16. In triangle ABC, side a = 7 cm, side b = 9 cm and the included angle C = 60°. Find side c.

A. 13.89 cm
B. 8.19 cm
C. 11.40 cm
D. 9.92 cm

17. A triangular lot has sides of 13 m, 14 m and 15 m. What is its area?

A. 72 m²
B. 105 m²
C. 91 m²
D. 84 m²

18. Evaluate the limit of (1 − cos 4x)/x² as x approaches 0.

A. 2
B. 8
C. 16
D. 4

19. A rectangle has a fixed perimeter of 60 m. What is the largest area it can enclose?

A. 200 m²
B. 225 m²
C. 900 m²
D. 216 m²

20. Find the volume of a right circular cone with base radius 6 cm and height 10 cm.

A. 62.8 cm³
B. 565.5 cm³
C. 377.0 cm³
D. 1,131.0 cm³

21. Solve for x: 3^(2x − 1) = 81.

A. 2.5
B. 1.5
C. 2
D. 3

22. What is the larger eigenvalue of the 2×2 matrix with rows (4, 1) and (2, 3)?

A. 5
B. 2
C. 6
D. 7

23. For f(x, y) = x²y³, find the mixed partial derivative ∂²f/∂x∂y at the point (1, 2).

A. 24
B. 8
C. 48
D. 12

24. Evaluate the integral of x·e■ dx from x = 0 to x = 1.

A. e − 2
B. e
C. 1
D. e − 1

25. Find the area of the region bounded by the parabola y = x² and the line y = 4.

A. 16.00 square units
B. 5.33 square units
C. 10.67 square units
D. 21.33 square units

26. A periodic waveform satisfies f(t + T/2) = −f(t). Which harmonics can appear in its Fourier series?

A. Cosine terms only
B. Odd harmonics only
C. Even harmonics only
D. DC term and even harmonics

27. Treating the values 4, 8, 6, 5 and 7 as an entire population, what is their standard deviation?

A. 2.500
B. 1.581
C. 1.414
D. 2.000

28. Each item from a process is defective with probability 0.10, independently. In a sample of 6 items, what is the probability that exactly 2 are defective?

A. 0.0984
B. 0.1500
C. 0.0797
D. 0.0066

29. PHP 50,000 is deposited at 8% nominal annual interest compounded quarterly. How much is in the account after 5 years?

A. PHP 74,297
B. PHP 55,204
C. PHP 70,000
D. PHP 73,466

30. What is the effective annual interest rate of 12% compounded monthly?

A. 12.55%
B. 12.75%
C. 12.68%
D. 12.00%

31. Find the present worth of PHP 10,000 received at the end of each year for 10 years if money is worth 6% per year.

A. PHP 100,000
B. PHP 131,808
C. PHP 55,839
D. PHP 73,601

32. Equipment costs PHP 800,000, has a salvage value of PHP 80,000 and a life of 12 years. Using straight-line depreciation, what is its book value at the end of year 5?

A. PHP 500,000
B. PHP 300,000
C. PHP 560,000
D. PHP 466,667

33. A product sells for PHP 250 per unit with a variable cost of PHP 130 per unit. Fixed costs are PHP 300,000 per year. What is the break-even volume?

A. 792 units
B. 2,500 units
C. 1,200 units
D. 2,308 units

34. What is the value of sinh(1)?

A. 0.8415
B. 0.7616
C. 1.5431
D. 1.1752

35. Evaluate (1 + j)■.

A. j16
B. 256
C. –16
D. 16

36. Find the angle between the vectors A = 3i + 4j and B = 4i + 3j.

A. 45.00°
B. 73.74°
C. 43.83°
D. 16.26°

37. A constant force F = (2i + 3j – k) N moves a particle through the displacement d = (4i + j + 2k) m. How much work is done?

A. 7 J
B. 13 J
C. 11 J
D. 9 J

38. Applying one iteration of Newton's method to f(x) = x² – 5 with initial guess x■ = 2, what is x■?

A. 2.24
B. 1.75
C. 2.25
D. 2.50

39. Find the inverse Laplace transform of F(s) = 5/[s(s + 5)].

A. 5(1 – e^(–5t))
B. e^(–5t)
C. 1 – e^(–5t)
D. 5e^(–5t)

40. How many diagonals does a convex polygon with 12 sides have?

A. 132
B. 48
C. 66
D. 54

Engineering Sciences and Allied Subjects

41. A ball is thrown horizontally at 15 m/s from the top of a building 20 m high. How far from the base of the building does it land? Neglect air resistance.

A. 61.16 m
B. 21.42 m
C. 30.29 m
D. 15.14 m

42. An object is released from rest and falls freely through 45 m. What is its speed just before impact? Use g = 9.81 m/s².

A. 21.01 m/s
B. 44.15 m/s
C. 29.71 m/s
D. 88.29 m/s

43. A 12-kg crate on a level floor is pulled by a 60-N horizontal force. The coefficient of kinetic friction is 0.25. What is the acceleration of the crate?

A. 7.45 m/s²
B. 4.75 m/s²
C. 2.55 m/s²
D. 5.00 m/s²

44. A spring with stiffness 800 N/m is compressed 0.15 m from its free length. How much energy is stored in it?

A. 18.0 J
B. 60.0 J
C. 9.0 J
D. 120.0 J

45. A pump raises 500 kg of water through a height of 12 m in 20 s. What minimum power output is required?

A. 8,175 W
B. 58,860 W
C. 300 W
D. 2,943 W

46. A 2-kg cart moving at 6 m/s strikes and couples to a stationary 4-kg cart. What is their common velocity right after the collision?

A. 1.5 m/s
B. 2.0 m/s
C. 6.0 m/s
D. 3.0 m/s

47. A 1,200-kg car rounds a flat curve of 50 m radius at a constant 15 m/s. What centripetal force acts on the car?

A. 5,400 N
B. 360 N
C. 2,700 N
D. 18,000 N

48. A 6-m simply supported beam carries a single 30-kN point load located 2 m from the left support. What is the reaction at the left support?

A. 30 kN
B. 10 kN
C. 15 kN
D. 20 kN

49. A 3-m cantilever beam carries a uniformly distributed load of 4 kN/m over its full length. What is the maximum bending moment?

A. 36 kN·m
B. 9 kN·m
C. 12 kN·m
D. 18 kN·m

50. A steel rod 20 mm in diameter carries an axial tensile load of 50 kN. What is the normal stress in the rod?

A. 125.0 MPa
B. 636.6 MPa
C. 39.8 MPa
D. 159.2 MPa

51. A 2-m bar with a cross-sectional area of 300 mm² is loaded axially by 40 kN. If E = 200 GPa, what is the elongation?

A. 2.667 mm
B. 0.667 mm
C. 13.33 mm
D. 1.333 mm

52. A 25-m steel rail with a coefficient of linear expansion of 12 × 10■■ per °C undergoes a 30 °C temperature rise. By how much does it lengthen if unrestrained?

A. 3.6 mm
B. 90.0 mm
C. 9.0 mm
D. 0.9 mm

53. A solid circular shaft 50 mm in diameter transmits a torque of 2 kN·m. What is the maximum shearing stress?

A. 40.7 MPa
B. 81.5 MPa
C. 163.0 MPa
D. 651.9 MPa

54. What is the gauge pressure at a depth of 8 m in seawater having a specific gravity of 1.03?

A. 182.2 kPa
B. 8.2 kPa
C. 78.5 kPa
D. 80.8 kPa

55. A 0.20-m³ block of wood with specific gravity 0.60 floats in fresh water. What volume of the block is submerged?

A. 0.12 m³
B. 0.33 m³
C. 0.20 m³
D. 0.08 m³

56. Water flows at 2 m/s in a 100-mm pipe that reduces to 50 mm in diameter. What is the velocity in the smaller pipe?

A. 8 m/s
B. 1 m/s
C. 4 m/s
D. 16 m/s

57. An open tank has a small orifice 5 m below the free water surface. What is the theoretical jet velocity?

A. 9.90 m/s
B. 98.10 m/s
C. 7.00 m/s
D. 49.05 m/s

58. A Carnot engine operates between a hot reservoir at 500 K and a cold reservoir at 300 K. What is its thermal efficiency?

A. 40%
B. 67%
C. 25%
D. 60%

59. How much heat is required to raise 2 kg of water from 20 °C to 80 °C? Take c = 4.187 kJ/kg·K.

A. 502.4 kJ
B. 2956 kJ
C. 669.9 kJ
D. 251.2 kJ

60. An ideal gas in a rigid container is at 200 kPa absolute and 27 °C. It is heated to 177 °C. What is the final absolute pressure?

A. 1,311 kPa
B. 133 kPa
C. 300 kPa
D. 350 kPa

61. An ideal gas initially at 100 kPa and 0.2 m³ expands isothermally to three times its original volume. How much work does the gas do?

A. 7.32 kJ
B. 21.97 kJ
C. 40.00 kJ
D. 65.92 kJ

62. A closed system receives 150 kJ of heat and does 60 kJ of work on its surroundings. What is the change in its internal energy?

A. –90 kJ
B. +90 kJ
C. +60 kJ
D. +210 kJ

63. How many moles are contained in 49 g of sulfuric acid, H■SO■ (molar mass 98 g/mol)?

A. 0.50 mol
B. 0.25 mol
C. 2.00 mol
D. 1.00 mol

64. What is the pH of a 0.001 M solution of hydrochloric acid, assuming complete dissociation?

A. 4
B. 3
C. 11
D. 1

65. A current of 5 A passes through a copper(II) sulfate cell for 1 hour. What mass of copper is deposited? Take Cu = 63.55 g/mol and F = 96,485 C/mol.

A. 11.86 g
B. 0.099 g
C. 2.96 g
D. 5.93 g

66. What volume do 2 moles of an ideal gas occupy at 0 °C and 1 atm?

A. 11.2 L
B. 44.8 L
C. 22.4 L
D. 49.2 L

67. Which of the following materials has a negative temperature coefficient of resistance near room temperature?

A. Intrinsic germanium
B. Hard-drawn aluminum
C. Annealed copper
D. Pure silver

68. Within the proportional limit of a material, the ratio of normal stress to normal strain is called the:

A. Bulk modulus
B. Modulus of elasticity
C. Poisson's ratio
D. Modulus of rupture

69. What is the free-space wavelength of a 60-Hz electromagnetic wave?

A. 5,000 km
B. 18,000 km
C. 500 km
D. 50 km

70. Light in air strikes a glass surface (n = 1.5) at an angle of incidence of 30°. What is the angle of refraction?

A. 20.00°
B. 19.47°
C. 48.59°
D. 45.00°

71. If the intensity of a sound is doubled, by how much does its intensity level increase?

A. About 3 dB
B. About 6 dB
C. About 2 dB
D. About 10 dB

72. Which management function involves comparing actual performance with established standards and taking corrective action?

A. Planning
B. Controlling
C. Staffing
D. Organizing

73. In a project network analyzed by the critical path method, an activity on the critical path has a total float of:

A. One time unit
B. The project duration
C. Zero
D. Its full duration

74. What is the decimal equivalent of the binary number 10110110?

A. 108
B. 180
C. 182
D. 214

75. What is the 8-bit two's complement representation of −44?

A. 00101100
B. 10101100
C. 11010011
D. 11010100

76. A flywheel with a moment of inertia of 5 kg·m² spins at 600 rpm. What is its rotational kinetic energy?

A. 9,870 J
B. 19,739 J
C. 250 J
D. 900,000 J

77. What is the period of a simple pendulum 1.5 m long at a location where g = 9.81 m/s²?

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

78. A block rests on a plank whose incline is slowly increased. If the coefficient of static friction is 0.35, at what angle does the block start to slide?

A. 19.29°
B. 31.50°
C. 20.49°
D. 69.51°

79. A wall 0.20 m thick with thermal conductivity 0.8 W/m·K has an area of 10 m². Its faces are held at temperatures differing by 25 °C. What is the steady heat flow through it?

A. 1,000 W
B. 4,000 W
C. 250 W
D. 40 W

80. Point charges of +4 μC and −6 μC are 0.30 m apart in air. What is the magnitude of the force between them?

A. 9.99 N
B. 0.719 N
C. 2.40 N
D. 0.60 N

Electrical Engineering Professional Subjects

81. Resistors of 10 Ω, 20 Ω and 30 Ω are connected in series across a 120-V DC supply. How much power does the 30-Ω resistor dissipate?

A. 40 W
B. 240 W
C. 120 W
D. 480 W

82. What is the equivalent resistance of 6 Ω, 12 Ω and 4 Ω resistors connected in parallel?

A. 3.0 Ω
B. 2.0 Ω
C. 7.3 Ω
D. 22.0 Ω

83. A 24-V source feeds a 3-kΩ resistor in series with a 5-kΩ resistor. What is the voltage across the 5-kΩ resistor?

A. 40 V
B. 9 V
C. 15 V
D. 12 V

84. A 12-V ideal source in series with 4 Ω feeds a pair of terminals, and a 12-Ω resistor is connected directly across those terminals. What is the maximum power that can be delivered to a load connected to the terminals?

A. 9.00 W
B. 27.00 W
C. 6.75 W
D. 3.00 W

85. A copper coil measures 20.0 Ω at 20 °C. Taking α■■ = 0.00393 per °C, what is its resistance at 75 °C?

A. 15.68 Ω
B. 75.00 Ω
C. 25.90 Ω
D. 24.32 Ω

86. What is the resistance of a 100-m copper conductor with a 2.0-mm² cross section? Take ρ = 1.72 × 10■■ Ω·m.

A. 8.60 Ω
B. 0.43 Ω
C. 0.86 Ω
D. 1.72 Ω

87. A sinusoidal voltage has a peak value of 170 V. What is its RMS value?

A. 120.2 V
B. 108.2 V
C. 85.0 V
D. 240.4 V

88. What is the average value of a full-wave rectified sine wave whose peak is 100 V?

A. 70.71 V
B. 63.66 V
C. 50.00 V
D. 31.83 V

89. What is the inductive reactance of a 50-mH inductor at 60 Hz?

A. 3.00 Ω
B. 18,850 Ω
C. 0.053 Ω
D. 18.85 Ω

90. What is the capacitive reactance of a 100-μF capacitor at 60 Hz?

A. 53.05 Ω
B. 26.53 Ω
C. 0.0377 Ω
D. 166.67 Ω

91. A coil with 30 Ω resistance and 40 Ω inductive reactance is connected to a 230-V, 60-Hz supply. What real power does it absorb?

A. 1,058.0 W
B. 846.4 W
C. 1,763.3 W
D. 634.8 W

92. A series RLC circuit has L = 20 mH and C = 50 μF. What is its resonant frequency?

A. 318.3 Hz
B. 1,000 Hz
C. 159.2 Hz
D. 225.1 Hz

93. A series RLC circuit has R = 10 Ω, L = 0.1 H and C = 10 μF. What is its quality factor at resonance?

A. 1
B. 100
C. 0.1
D. 10

94. A plant draws 50 kW at 0.75 power factor lagging. How much capacitive kVAR is needed to raise the power factor to 0.95 lagging?

A. 27.7 kVAR
B. 44.1 kVAR
C. 17.5 kVAR
D. 60.5 kVAR

95. A load has V = 240∠0° V and I = 10∠–30° A. What reactive power does it absorb?

A. 2,400 var
B. –1,200 var
C. 1,200 var
D. 2,078 var

96. A balanced wye-connected load of 20 Ω pure resistance per phase is supplied from a 400-V (line-to-line) three-phase system. What is the total power drawn?

A. 13.86 kW
B. 24.00 kW
C. 8.00 kW
D. 2.67 kW

97. In the two-wattmeter method on a balanced three-phase load, the meters read 8 kW and 4 kW. What is the load power factor?

A. 0.667
B. 0.949
C. 0.866
D. 0.500

98. A 50-kVA, 2,400/240-V single-phase transformer operates at rated load. What is the secondary current?

A. 208.3 A
B. 20.83 A
C. 166.7 A
D. 120.3 A

99. A 100-kVA transformer has a core loss of 600 W and a full-load copper loss of 1,500 W. What is its efficiency at full load and 0.8 power factor?

A. 99.26%
B. 98.16%
C. 97.94%
D. 97.44%

100. For the same 100-kVA transformer with 600 W core loss and 1,500 W full-load copper loss, at what load does maximum efficiency occur?

A. 40.0 kVA
B. 63.2 kVA
C. 100.0 kVA
D. 158.1 kVA

101. A 4-pole, lap-wound DC generator has 600 armature conductors and a flux of 0.02 Wb per pole, and is driven at 1,200 rpm. What EMF is generated?

A. 480 V
B. 240 V
C. 960 V
D. 60 V

102. A 230-V DC shunt motor has an armature resistance of 0.25 Ω and draws an armature current of 40 A. What is the back EMF?

A. 210 V
B. 240 V
C. 220 V
D. 229 V

103. A 6-pole, 60-Hz induction motor runs at 1,164 rpm. What is its slip?

A. 35.3%
B. 3.0%
C. 2.9%
D. 3.6%

104. An induction motor fed from a 60-Hz supply runs with 4% slip. What is the frequency of the rotor currents?

A. 15.0 Hz
B. 57.6 Hz
C. 0.04 Hz
D. 2.4 Hz

105. Compared with direct-on-line starting at the same supply voltage, a star-delta starter reduces the starting line current of a delta-run induction motor to about what fraction?

A. Two-thirds
B. 1/√3
C. One-half
D. One-third

106. A synchronous motor operating with its field over-excited behaves, as seen from the supply, like a:

A. Capacitor drawing leading current
B. Inductor drawing lagging current
C. Generator of real power
D. Pure resistance at unity pf

107. A generator's reactance is 0.08 per unit on a 50-MVA, 13.8-kV base. What is it on a 100-MVA, 13.8-kV base?

A. 0.32 pu
B. 0.16 pu
C. 0.04 pu
D. 0.08 pu

108. A 10-MVA transformer with 8% impedance is fed from an infinite bus. Neglecting other impedances, what is the three-phase fault level at its secondary terminals?

A. 80 MVA
B. 125 MVA
C. 0.8 MVA
D. 12.5 MVA

109. A three-phase 69-kV line delivers 10 MW at 0.9 power factor. The resistance of each conductor is 5 Ω. What is the total I^2R loss in the line?

A. 129.7 kW
B. 43.2 kW
C. 389.0 kW
D. 105.0 kW

110. The terminal voltage of a supply is 245 V at no load and 230 V at full load. What is the voltage regulation?

A. 93.88%
B. 6.52%
C. 6.12%
D. 15.00%

111. A substation records a peak demand of 500 kW and delivers 7,200 kWh in one day. What is its daily load factor?

A. 69%
B. 14.4%
C. 72%
D. 60%

112. An industrial building has a connected load of 800 kW and a recorded maximum demand of 560 kW. What is its demand factor?

A. 30%
B. 56%
C. 143%
D. 70%

113. A lamp of 1,500 cd uniform intensity hangs 3 m directly above a work surface. What is the illuminance at the point directly below it?

A. 250.0 lux
B. 13.3 lux
C. 500.0 lux
D. 166.7 lux

114. A 12-V Zener diode regulator is fed from 20 V through a 200-Ω series resistor and supplies a 1-kΩ load. What current flows through the Zener diode?

A. 52 mA
B. 40 mA
C. 28 mA
D. 12 mA

115. A bipolar transistor with β = 100 operates in the active region with a base current of 40 μA. What is its emitter current?

A. 4.04 mA
B. 4.00 mA
C. 3.96 mA
D. 0.40 mA

116. An ideal inverting op-amp amplifier uses Rf = 47 kΩ and Rin = 4.7 kΩ. If the input is +0.3 V DC, what is the output?

A. +3.0 V
B. –3.0 V
C. +3.3 V
D. –3.3 V

117. An uncharged 220-μF capacitor is connected through a 10-kΩ resistor to a 12-V DC source. What is the capacitor voltage 3 s after switching?

A. 8.93 V
B. 7.59 V
C. 3.07 V
D. 6.24 V

118. A PMMC movement with full-scale current 50 mA and internal resistance 2 Ω is to be used as a 0-5 A ammeter. What shunt resistance is needed?

A. 0.0202 Ω
B. 0.0404 Ω
C. 0.0200 Ω
D. 198 Ω

119. Under RA 7920 (New Electrical Engineering Law), which of the following is NOT one of the three professional titles regulated by the law?

A. Registered Electrical Engineer
B. Registered Master Electrician
C. Licensed Electrical Technician
D. Professional Electrical Engineer

120. Under the Philippine Electrical Code, an insulated equipment grounding conductor shall be identified by an outer finish that is:

A. White or natural gray
B. Blue, or blue with white stripes
C. Red with a black tracer
D. Green, or green with yellow stripes

Answer key

Electrical Engineering

1. D. –4

For $ax^2 + bx + c = 0$ the product of roots is $c/a = –12/3 = –4$.

2. A. 29.56

$dy/dx = 3x^2 \ln x + x^2$; at $x = e$ this is $3e^2 + e^2 = 4e^2 \approx 29.56$.

3. B. π/4

Using $\sin^2 x = (1 – \cos 2x)/2$, the integral is $[x/2 – \sin 2x/4]$ from 0 to $\pi/2 = \pi/4$.

4. D. –53

Expanding along row 1: $2(4·1 – (–1)(2)) – 1(0·1 – (–1)(5)) + 3(0·2 – 4·5) = 12 – 5 – 60 = –53$.

5. B. 11 – j2

$(3 + j4)(1 – j2) = 3 – j6 + j4 – j^2 8 = 3 + 8 – j2 = 11 – j2$, since $j^2 = –1$.

6. B. –8.66 + j5.00

$x = 10 \cos 150° = –8.66$ and $y = 10 \sin 150° = 5.00$, so $10\angle 150° = –8.66 + j5.00$.

7. B. 5/36

Favorable outcomes: (2,6), (3,5), (4,4), (5,3), (6,2) = 5 out of 36 equally likely outcomes.

8. D. 126

$C(9, 4) = 9!/(4!·5!) = 126$.

9. B. 1,375

$S = (n/2)[2a + (n – 1)d] = (25/2)[14 + 24(4)] = 1{,}375$.

10. A. 54

The common ratio is $r = 12/18 = 2/3$, so $S = a/(1 – r) = 18/(1/3) = 54$.

11. C. 5.0

$d = |Ax■ + By■ + C|/\sqrt{(A^2 + B^2)} = |12 + 6 + 7|/5 = 5.0$.

12. C. 6

Completing squares: $(x – 3)^2 + (y + 4)^2 = 11 + 9 + 16 = 36$, so $r = 6$.

13. C. 0.60

$a = 5$, $b = 4$, $c = \sqrt{(a^2 – b^2)} = 3$, so $e = c/a = 3/5 = 0.60$.

14. B. 3/[(s + 2)² + 9]

$L\{\sin 3t\} = 3/(s^2 + 9)$; multiplying by e^(–2t) shifts s to s + 2, giving $3/[(s + 2)^2 + 9]$.

15. A. 745.9

The solution is $y = 500e^{0.04t}$; at $t = 10$, $y = 500e^{0.4} \approx 745.9$.

16. B. 8.19 cm

$c^2 = a^2 + b^2 – 2ab \cos C = 49 + 81 – 63 = 67$, so $c = 8.19$ cm.

17. D. 84 m²

$s = 21$; $A = \sqrt{[s(s – a)(s – b)(s – c)]} = \sqrt{(21·8·7·6)} = \sqrt{7056} = 84$ m².

18. B. 8

Using $1 - \cos u \approx u^2/2$ for small u: $(16x^2/2)/x^2 = 8$.

19. B. 225 m²

$A = x(30 - x)$ is maximum at x = 15 m, giving a 15 m × 15 m square with area 225 m².

20. C. 377.0 cm³

$V = (1/3)\pi r^2 h = (1/3)\pi(36)(10) = 120\pi \approx 377.0$ cm³.

21. A. 2.5

$81 = 3■$, so $2x - 1 = 4$ and $x = 2.5$.

22. A. 5

The characteristic equation is $\lambda^2 - 7\lambda + 10 = 0$, giving $\lambda = 5$ and $\lambda = 2$; the larger is 5.

23. A. 24

$\partial f/\partial x = 2xy^3$, then $\partial/\partial y$ gives $6xy^2 = 6(1)(4) = 24$.

24. C. 1

By parts, $\int x\, e■\, dx = e■(x - 1)$; from 0 to 1 this is $0 - (-1) = 1$.

25. C. 10.67 square units

$A = \int$ from –2 to 2 of $(4 - x^2)\, dx = 16 - 16/3 = 32/3 \approx 10.67$ square units.

26. B. Odd harmonics only

Half-wave symmetry makes every even harmonic and the DC term vanish, leaving only odd harmonics.

27. C. 1.414

Mean = 6; sum of squared deviations = 10; $\sigma = \sqrt{(10/5)} = \sqrt{2} \approx 1.414$.

28. A. 0.0984

$P = C(6,2)(0.1)^2(0.9)■ = 15 \times 0.01 \times 0.6561 \approx 0.0984$.

29. A. PHP 74,297

$F = P(1 + i)■$ with $i = 0.08/4 = 0.02$ and $n = 20$: $F = 50{,}000(1.02)^2■ \approx$ PHP 74,297.

30. C. 12.68%

$i_{eff} = (1 + 0.12/12)^{12} - 1 = (1.01)^{12} - 1 \approx 12.68\%$.

31. D. PHP 73,601

P = A[1 – (1 + i)^(–n)]/i = 10,000[1 – 1.06^(–10)]/0.06 ≈ PHP 73,601.

32. A. PHP 500,000

Annual depreciation = (800,000 – 80,000)/12 = PHP 60,000; book value = 800,000 – 5(60,000) = PHP 500,000.

33. B. 2,500 units

Break-even Q = fixed cost/(price – variable cost) = 300,000/(250 – 130) = 2,500 units.

34. D. 1.1752

sinh x = (e■ – e^(–x))/2, so sinh 1 = (2.7183 – 0.3679)/2 ≈ 1.1752.

35. D. 16

$1 + j = \sqrt{2}\angle 45°$; raising to the 8th power gives $(\sqrt{2})■\angle 360° = 16\angle 0° = 16$.

36. D. 16.26°

cos θ = A·B/(|A||B|) = 24/(5 × 5) = 0.96, so θ ≈ 16.26°.

37. D. 9 J

W = F·d = 2(4) + 3(1) + (–1)(2) = 8 + 3 – 2 = 9 J.

38. C. 2.25

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

39. C. 1 – e^(–5t)

Partial fractions: 5/[s(s + 5)] = 1/s – 1/(s + 5), whose inverse is 1 – e^(–5t).

40. D. 54

Number of diagonals = n(n – 3)/2 = 12(9)/2 = 54.

41. C. 30.29 m

Fall time t = √(2h/g) = √(40/9.81) = 2.019 s; range = 15 × 2.019 ≈ 30.29 m.

42. C. 29.71 m/s

v = √(2gh) = √(2 × 9.81 × 45) ≈ 29.71 m/s.

43. C. 2.55 m/s²

a = (F – μmg)/m = (60 – 0.25 × 12 × 9.81)/12 ≈ 2.55 m/s².

44. C. 9.0 J

U = ½kx² = 0.5 × 800 × 0.15² = 9.0 J.

45. D. 2,943 W

P = mgh/t = 500 × 9.81 × 12/20 ≈ 2,943 W.

46. B. 2.0 m/s

Momentum is conserved: (2)(6) = (2 + 4)v, so v = 12/6 = 2.0 m/s.

47. A. 5,400 N

F = mv²/r = 1,200 × 15²/50 = 5,400 N.

48. D. 20 kN

Taking moments about the right support: R_L(6) = 30(4), so R_L = 20 kN.

49. D. 18 kN·m

For a cantilever with UDL, M_max = wL²/2 = 4 × 3²/2 = 18 kN·m at the fixed end.

50. D. 159.2 MPa

σ = P/A = 50,000/[π(0.010)²] ≈ 159.2 MPa.

51. D. 1.333 mm

δ = PL/(AE) = (40,000)(2)/[(300 × 10■■)(200 × 10■)] ≈ 1.333 mm.

52. C. 9.0 mm

δ = αLΔT = (12 × 10■■)(25,000 mm)(30) = 9.0 mm.

53. B. 81.5 MPa

τ = 16T/(πd³) = 16(2,000)/[π(0.05)³] ≈ 81.5 MPa.

54. D. 80.8 kPa

p = SG·γw·h = 1.03 × 9.81 × 8 ≈ 80.8 kPa.

55. A. 0.12 m³

Weight = buoyant force: 0.60 × 0.20 = 1.0 × V_sub, so V_sub = 0.12 m³.

56. A. 8 m/s

Continuity: v■ = v■(D■/D■)² = 2(100/50)² = 8 m/s.

57. A. 9.90 m/s

Torricelli: v = √(2gh) = √(2 × 9.81 × 5) ≈ 9.90 m/s.

58. A. 40%

η = 1 – Tc/Th = 1 – 300/500 = 0.40 or 40%.

59. A. 502.4 kJ

Q = mcΔT = 2 × 4.187 × 60 ≈ 502.4 kJ.

60. C. 300 kPa

At constant volume, p■ = p■(T■/T■) = 200(450/300) = 300 kPa; temperatures must be absolute.

61. B. 21.97 kJ

W = p■V■ ln(V■/V■) = 100 × 0.2 × ln 3 ≈ 21.97 kJ.

62. B. +90 kJ

First law: ΔU = Q – W = 150 – 60 = +90 kJ.

63. A. 0.50 mol

n = m/M = 49/98 = 0.50 mol.

64. B. 3

[H■] = 1 × 10■³ M, so pH = –log(10■³) = 3.

65. D. 5.93 g

m = ItM/(nF) = (5)(3,600)(63.55)/[(2)(96,485)] ≈ 5.93 g.

66. B. 44.8 L

At STP one mole occupies about 22.4 L, so 2 mol occupy about 44.8 L.

67. A. Intrinsic germanium

In a semiconductor, rising temperature frees more charge carriers so resistance falls; metals show a positive coefficient.

68. B. Modulus of elasticity

Hooke's law σ = Eε defines Young's modulus E as stress divided by strain in the linear region.

69. A. 5,000 km

λ = c/f = (3 × 10■ m/s)/60 Hz = 5 × 10■ m = 5,000 km.

70. B. 19.47°

Snell's law: sin r = sin 30°/1.5 = 0.333, so r ≈ 19.47°.

71. A. About 3 dB

ΔL = 10 log(2) ≈ 3.01 dB.

72. B. Controlling

Controlling measures results against standards and corrects deviations; planning sets the standards in the first place.

73. C. Zero

Critical activities have no slack; any delay in them delays project completion.

74. C. 182

128 + 32 + 16 + 4 + 2 = 182.

75. D. 11010100

+44 = 00101100; invert to 11010011 and add 1 to get 11010100.

76. A. 9,870 J

$\omega = 600 \times 2\pi/60 = 62.83$ rad/s; $KE = \frac{1}{2}I\omega^2 = 0.5 \times 5 \times 62.83^2 \approx 9{,}870$ J.

77. D. 2.46 s

$T = 2\pi\sqrt{(L/g)} = 2\pi\sqrt{(1.5/9.81)} \approx 2.46$ s.

78. A. 19.29°

Sliding impends when $\tan\theta = \mu s$, so $\theta = \arctan(0.35) \approx 19.29°$.

79. A. 1,000 W

Fourier's law: $Q = kA\Delta T/L = 0.8 \times 10 \times 25/0.20 = 1{,}000$ W.

80. C. 2.40 N

F = kq■q■/r² = (8.99 × 10■)(4 × 10■■)(6 × 10■■)/0.09 ≈ 2.40 N (attractive).

81. C. 120 W

I = 120/60 = 2 A; $P = I^2R = 2^2 \times 30 = 120$ W.

82. B. 2.0 Ω

1/R = 1/6 + 1/12 + 1/4 = 6/12, so R = 2.0 Ω.

83. C. 15 V

Voltage divider: $V = 24 \times 5/(3 + 5) = 15$ V.

84. C. 6.75 W

Vth = 12 × 12/16 = 9 V and Rth = 4■12 = 3 Ω; $P_{max} = V_{th}^2/(4R_{th}) = 81/12 = 6.75$ W.

85. D. 24.32 Ω

$R = R■■[1 + \alpha(T - 20)] = 20[1 + 0.00393(55)] \approx 24.32$ Ω.

86. C. 0.86 Ω

$R = \rho L/A = (1.72 \times 10■■)(100)/(2.0 \times 10■■) = 0.86$ Ω.

87. A. 120.2 V

$V_{rms} = V_m/\sqrt{2} = 170/1.414 \approx 120.2$ V.

88. B. 63.66 V

$V_{avg} = 2V_m/\pi = 200/\pi \approx 63.66$ V.

89. D. 18.85 Ω

$X_L = 2\pi fL = 2\pi(60)(0.05) \approx 18.85$ Ω.

90. B. 26.53 Ω

$X_C = 1/(2\pi fC) = 1/[2\pi(60)(100 \times 10■■)] \approx 26.53$ Ω.

91. D. 634.8 W

$Z = \sqrt{(30^2 + 40^2)} = 50$ Ω, $I = 230/50 = 4.6$ A, $P = I^2R = 4.6^2 \times 30 = 634.8$ W.

92. C. 159.2 Hz

f■ = 1/(2π√LC) = 1/[2π√(0.02 × 50 × 10■■)] ≈ 159.2 Hz.

93. D. 10

ω■ = 1/√(LC) = 1,000 rad/s; Q = ω■L/R = 1,000 × 0.1/10 = 10.

94. A. 27.7 kVAR

Qc = P(tan ϕ■ – tan ϕ■) = 50(0.8819 – 0.3287) ≈ 27.7 kVAR.

95. C. 1,200 var

S = VI* = 2,400∠30° VA, so Q = 2,400 sin 30° = 1,200 var (inductive, absorbed).

96. C. 8.00 kW

V_ph = 400/√3 = 230.9 V, I = 11.55 A, P = 3V_ph²/R = 400²/20 = 8.00 kW.

97. C. 0.866

tan ϕ = √3(W■ – W■)/(W■ + W■) = √3(4)/12 = 0.577, so ϕ = 30° and pf = 0.866.

98. A. 208.3 A

I■ = S/V■ = 50,000/240 ≈ 208.3 A.

99. D. 97.44%

η = output/(output + losses) = 80,000/(80,000 + 600 + 1,500) ≈ 97.44%.

100. B. 63.2 kVA

Maximum efficiency occurs when copper loss equals core loss: load = 100√(600/1,500) ≈ 63.2 kVA.

101. B. 240 V

E = PΦZN/(60a) with a = P = 4 for lap winding: E = 4(0.02)(600)(1,200)/(60 × 4) = 240 V.

102. C. 220 V

E_b = V – I_aR_a = 230 – 40(0.25) = 220 V.

103. B. 3.0%

N_s = 120f/P = 120(60)/6 = 1,200 rpm; s = (1,200 – 1,164)/1,200 = 3.0%.

104. D. 2.4 Hz

f_r = s·f = 0.04 × 60 = 2.4 Hz.

105. D. One-third

Each winding sees V/√3 in star, and the line current in star is 1/3 of the delta line current, so starting current and torque fall to 1/3.

106. A. Capacitor drawing leading current

Over-excitation makes the motor supply reactive power, so it draws leading current; this is the basis of the synchronous condenser.

107. B. 0.16 pu

Z_new = Z_old(S_new/S_old)(V_old/V_new)² = 0.08(100/50)(1) = 0.16 pu.

108. B. 125 MVA

Fault MVA = base MVA/Z_pu = 10/0.08 = 125 MVA.

109. A. 129.7 kW

I = 10 × 10■/(√3 × 69,000 × 0.9) ≈ 92.97 A; loss = 3I²R = 3(92.97)²(5) ≈ 129.7 kW.

110. B. 6.52%

VR = (V_NL – V_FL)/V_FL = (245 – 230)/230 ≈ 6.52%.

111. D. 60%

Average demand = 7,200/24 = 300 kW; load factor = 300/500 = 60%.

112. D. 70%

Demand factor = maximum demand/connected load = 560/800 = 70%.

113. D. 166.7 lux

Inverse-square law at normal incidence: E = I/d² = 1,500/3² ≈ 166.7 lux.

114. C. 28 mA

I_s = (20 – 12)/200 = 40 mA; I_L = 12/1,000 = 12 mA; I_Z = 40 – 12 = 28 mA.

115. A. 4.04 mA

I_C = βI_B = 4.00 mA and I_E = I_C + I_B = 4.04 mA.

116. B. –3.0 V

V_o = –(Rf/Rin)V_in = –(47/4.7)(0.3) = –3.0 V.

117. A. 8.93 V

τ = RC = 2.2 s; v = 12(1 – e^(–3/2.2)) ≈ 8.93 V.

118. A. 0.0202 Ω

R_sh = I_mR_m/(I – I_m) = (0.05)(2)/(5 – 0.05) ≈ 0.0202 Ω.

119. C. Licensed Electrical Technician

RA 7920 regulates Professional Electrical Engineers, Registered Electrical Engineers and Registered Master Electricians only.

120. D. Green, or green with yellow stripes

The Code reserves green (or green with one or more yellow stripes) for equipment grounding conductors; white or gray identifies the grounded conductor.

Topics to review

- Circuit analysis, power and three-phase systems
- Electrical machines and transformers
- Protection, grounding and wiring plans
- Electrical code and installation calculations

Online question banks and study resources

Registered electrical engineer - Pass Harbor (Question bank)

Registered master electrician - Pass Harbor (Question bank)

Official PRC board information

Current PRC exam programs

Independent study material prepared by Board Exam Desk.