

PRACTICE EXAM 10: TRANSPORTATION CIVIL PE SIMULATION (100 QUESTIONS)

This expanded practice exam contains 100 questions aligned with the NCEES PE Civil-Transportation specification effective April 2024. The official computer-based exam contains 80 questions and provides 8 hours of examination time within a 9-hour appointment. For this 100-question simulation, allow 10 hours to preserve the official six-minutes-per-question pace. Use SI and U.S. customary units as stated. NCEES does not publish a fixed passing percentage; evaluate performance by domain and review every explanation.

1. During a final engineering review, a future rehabilitation cost of \$680,000 occurs in 4 years. Using an annual discount rate of 7.6%, what is its present worth? Select the nearest listed value.

- A. 405,835.30
- B. 608,752.94
- C. 507,294.12
- D. 760,941.18

2. For an interstate corridor project, a contractor assigns 4 identical crews for 31 days. Each crew installs 335 linear feet per day. What total length can be installed? Select the nearest listed value.

- A. 33,232.00
- B. 41,540.00
- C. 49,848.00
- D. 62,310.00

3. During a network performance study, a roadway pay item has an estimated quantity of 2,000 units and a unit price of \$58.00 per unit. What is the estimated item cost? Select the nearest listed value.

- A. 116,000.00
- B. 92,800.00
- C. 139,200.00
- D. 174,000.00

4. For a community mobility improvement, a grading operation includes 6,750 cubic yards. At a sustained production rate of 510 cubic yards per day, how many working days are required? Select the nearest listed value.

- A. 10.59
- B. 15.89
- C. 19.86
- D. 13.24

5. During a preconstruction technical audit, a future rehabilitation cost of \$720,000 occurs in 5 years. Using an annual discount rate of 8.4%, what is its present worth? Select the nearest listed value.

- A. 481,045.42
- B. 384,836.34
- C. 577,254.50
- D. 721,568.13

6. During a final engineering review, a contractor assigns 5 identical crews for 35 days. Each crew installs 355 linear feet per day. What total length can be installed? Select the nearest listed value.

- A. 49,700.00
- B. 74,550.00
- C. 62,125.00
- D. 93,187.50

7. For an interstate corridor project, a roadway pay item has an estimated quantity of 2,160 units and a unit price of \$66.00 per unit. What is the estimated item cost? Select the nearest listed value.

- A. 114,048.00
- B. 142,560.00
- C. 171,072.00
- D. 213,840.00

8. During a network performance study, a grading operation includes 7,350 cubic yards. At a sustained production rate of 550 cubic yards per day, how many working days are required? Select the nearest listed value.

- A. 10.69
- B. 16.03
- C. 20.04
- D. 13.36

9. For a community mobility improvement, a future rehabilitation cost of \$760,000 occurs in 6 years. Using an annual discount rate of 9.2%, what is its present worth? Select the nearest listed value.

- A. 358,564.88
- B. 537,847.32
- C. 672,309.15
- D. 448,206.10

10. During a preconstruction technical audit, a segment experienced 36 crashes during 58 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.50
- B. 0.74
- C. 0.62
- D. 0.93

11. During a final engineering review, current daily traffic is 13,900 vehicles. With compound annual growth of 4.4% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 22,321.34
- B. 17,857.07
- C. 26,785.61
- D. 33,482.01

12. For an interstate corridor project, during the peak hour, 1200 vehicles are counted, and the highest 15-minute volume is 320 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.75
- B. 0.94
- C. 1.13
- D. 1.41

13. During a network performance study, a freeway lane carries 2025 vehicles per hour at an average speed of 50 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 40.50
- B. 32.40
- C. 48.60
- D. 60.75

14. For a community mobility improvement, a segment experienced 40 crashes during 66 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.49
- B. 0.73
- C. 0.92
- D. 0.61

15. During a preconstruction technical audit, current daily traffic is 14,300 vehicles. With compound annual growth of 4.8% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 19,160.21
- B. 23,950.26
- C. 28,740.31
- D. 35,925.39

16. During a final engineering review, during the peak hour, 1280 vehicles are counted, and the highest 15-minute volume is 340 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.75
- B. 1.13
- C. 0.94
- D. 1.41

17. For an interstate corridor project, a freeway lane carries 2125 vehicles per hour at an average speed of 46 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 36.96
- B. 55.44
- C. 46.20
- D. 69.30

18. During a network performance study, a segment experienced 44 crashes during 74 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.47
- B. 0.71
- C. 0.89
- D. 0.59

19. For a community mobility improvement, current daily traffic is 14,700 vehicles. With compound annual growth of 5.2% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 20,539.06
- B. 25,673.82
- C. 30,808.58
- D. 38,510.73

20. During a preconstruction technical audit, during the peak hour, 1360 vehicles are counted, and the highest 15-minute volume is 360 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.94
- B. 0.75
- C. 1.13
- D. 1.41

21. During a final engineering review, a freeway lane carries 2225 vehicles per hour at an average speed of 50 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 44.50
- B. 35.60
- C. 53.40
- D. 66.75

22. For an interstate corridor project, a segment experienced 48 crashes during 82 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.47
- B. 0.71
- C. 0.89
- D. 0.59

23. During a network performance study, current daily traffic is 15,100 vehicles. With compound annual growth of 5.6% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 21,997.34
- B. 27,496.67
- C. 32,996.00
- D. 41,245.00

24. For a community mobility improvement, a recoverable roadside slope descends 2 foot vertically over 66 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

- A. 26.40
- B. 39.60
- C. 33.00
- D. 49.50

25. During a preconstruction technical audit, a sidewalk segment is 330 feet long and 6 feet wide. What plan area must be constructed? Select the nearest listed value.

- A. 1,584.00
- B. 1,980.00
- C. 2,376.00
- D. 2,970.00

26. During a final engineering review, a traveled lane is 12 feet wide with a uniform cross slope of 3.0%. What is the elevation drop from crown to lane edge? Select the nearest listed value.

- A. 0.29
- B. 0.43
- C. 0.54
- D. 0.36

27. For an interstate corridor project, a cross section has 2 lanes, each 12 feet wide, plus two 8-foot shoulders. What is the total paved width? Select the nearest listed value.

- A. 32.00
- B. 48.00
- C. 40.00
- D. 60.00

28. During a network performance study, a recoverable roadside slope descends 3 foot vertically over 74 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

- A. 24.67
- B. 19.74
- C. 29.60
- D. 37.01

29. For a community mobility improvement, a sidewalk segment is 370 feet long and 7 feet wide. What plan area must be constructed? Select the nearest listed value.

- A. 2,590.00
- B. 2,072.00
- C. 3,108.00
- D. 3,885.00

30. During a preconstruction technical audit, a traveled lane is 12 feet wide with a uniform cross slope of 2.0%. What is the elevation drop from crown to lane edge? Select the nearest listed value.

- A. 0.19
- B. 0.29
- C. 0.36
- D. 0.24

31. During a final engineering review, a cross section has 3 lanes, each 12 feet wide, plus two 9-foot shoulders. What is the total paved width? Select the nearest listed value.

- A. 43.20
- B. 64.80
- C. 54.00
- D. 81.00

32. For an interstate corridor project, a recoverable roadside slope descends 4 foot vertically over 82 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

- A. 16.40
- B. 20.50
- C. 24.60
- D. 30.75

33. During a network performance study, a sidewalk segment is 410 feet long and 5 feet wide. What plan area must be constructed? Select the nearest listed value.

- A. 1,640.00
- B. 2,050.00
- C. 2,460.00
- D. 3,075.00

34. For a community mobility improvement, for a circular curve with radius 1330 feet and central angle 56 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 124.54
- B. 186.82
- C. 233.52
- D. 155.68

35. During a preconstruction technical audit, for a circular curve with radius 1365 feet and central angle 58 degrees, what is the long chord? Select the nearest listed value.

- A. 1,058.82
- B. 1,588.24
- C. 1,323.53
- D. 1,985.30

36. During a final engineering review, a simple circular curve has radius 1400 feet and central angle 60 degrees. What is its arc length? Select the nearest listed value.

- A. 1,466.08
- B. 1,172.86
- C. 1,759.30
- D. 2,199.12

37. For an interstate corridor project, a simple circular curve has radius 1435 feet and intersection angle 62 degrees. What is the tangent length? Select the nearest listed value.

- A. 862.23
- B. 689.78
- C. 1,034.68
- D. 1,293.35

38. During a network performance study, for a circular curve with radius 1470 feet and central angle 64 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 178.70
- B. 223.37
- C. 268.04
- D. 335.06

39. For a community mobility improvement, for a circular curve with radius 1505 feet and central angle 66 degrees, what is the long chord? Select the nearest listed value.

- A. 1,311.49
- B. 1,967.23
- C. 1,639.36
- D. 2,459.04

40. During a preconstruction technical audit, a simple circular curve has radius 1540 feet and central angle 68 degrees. What is its arc length? Select the nearest listed value.

- A. 1,462.17
- B. 2,193.25
- C. 2,741.57
- D. 1,827.71

41. During a final engineering review, a simple circular curve has radius 1575 feet and intersection angle 70 degrees. What is the tangent length? Select the nearest listed value.

- A. 1,102.83
- B. 882.26
- C. 1,323.40
- D. 1,654.24

42. For an interstate corridor project, for a circular curve with radius 1610 feet and central angle 72 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 245.98
- B. 368.98
- C. 461.22
- D. 307.48

43. During a network performance study, for a circular curve with radius 1645 feet and central angle 74 degrees, what is the long chord? Select the nearest listed value.

- A. 1,583.98
- B. 2,375.96
- C. 1,979.97
- D. 2,969.95

44. For a community mobility improvement, a simple circular curve has radius 1680 feet and central angle 76 degrees. What is its arc length? Select the nearest listed value.

- A. 1,782.75
- B. 2,228.44
- C. 2,674.13
- D. 3,342.66

45. During a preconstruction technical audit, a tangent begins at elevation 554.00 feet and rises at 3.80% for 480 feet. What is the ending elevation? Select the nearest listed value.

- A. 457.79
- B. 686.69
- C. 858.36
- D. 572.24

46. During a final engineering review, an overhead structure has a low-chord elevation of 18.40 feet above a datum. The roadway surface is at elevation 5.50 feet. What is the vertical clearance? Select the nearest listed value.

- A. 10.32
- B. 12.90
- C. 15.48
- D. 19.35

47. For an interstate corridor project, a vertical curve connects grades of 0.50% and +5.50%. What is the algebraic grade difference A ? Select the nearest listed value.

- A. 5.00
- B. 4.00
- C. 6.00
- D. 7.50

48. During a network performance study, a vertical curve is 1125 feet long and has an algebraic grade difference of 5%. What is its K value? Select the nearest listed value.

- A. 180.00
- B. 270.00
- C. 225.00
- D. 337.50

49. For a community mobility improvement, a tangent begins at elevation 566.00 feet and rises at 4.20% for 520 feet. What is the ending elevation? Select the nearest listed value.

- A. 470.27
- B. 587.84
- C. 705.41
- D. 881.76

50. During a preconstruction technical audit, an overhead structure has a low-chord elevation of 18.80 feet above a datum. The roadway surface is at elevation 6.50 feet. What is the vertical clearance? Select the nearest listed value.

- A. 9.84
- B. 14.76
- C. 12.30
- D. 18.45

51. During a final engineering review, a vertical curve connects grades of 0.90% and +6.10%. What is the algebraic grade difference A? Select the nearest listed value.

- A. 5.20
- B. 4.16
- C. 6.24
- D. 7.80

52. For an interstate corridor project, a vertical curve is 1225 feet long and has an algebraic grade difference of 4%. What is its K value? Select the nearest listed value.

- A. 245.00
- B. 367.50
- C. 459.38
- D. 306.25

53. During a network performance study, a tangent begins at elevation 578.00 feet and rises at 4.60% for 560 feet. What is the ending elevation? Select the nearest listed value.

- A. 483.01
- B. 603.76
- C. 724.51
- D. 905.64

54. For a community mobility improvement, an overhead structure has a low-chord elevation of 19.20 feet above a datum. The roadway surface is at elevation 4.50 feet. What is the vertical clearance? Select the nearest listed value.

- A. 14.70
- B. 11.76
- C. 17.64
- D. 22.05

55. During a preconstruction technical audit, a vertical curve connects grades of 1.30% and +6.70%. What is the algebraic grade difference A? Select the nearest listed value.

- A. 4.32
- B. 6.48
- C. 5.40
- D. 8.10

56. During a final engineering review, a channelized intersection uses a circular curb return with radius 81 feet through 88 degrees. What is the curb-return arc length? Select the nearest listed value.

- A. 99.53
- B. 149.29
- C. 186.62
- D. 124.41

57. For an interstate corridor project, an arterial intersection has 3 through lanes in each direction, 12-foot lanes, and a 35-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

- A. 107.00
- B. 85.60
- C. 128.40
- D. 160.50

58. During a network performance study, a vehicle approaches an intersection at 70 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

- A. 492.80
- B. 616.00
- C. 739.20
- D. 924.00

59. For a community mobility improvement, a left-turn bay must store 29 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

- A. 580.00
- B. 870.00
- C. 1,087.50
- D. 725.00

60. During a preconstruction technical audit, a channelized intersection uses a circular curb return with radius 89 feet through 92 degrees. What is the curb-return arc length? Select the nearest listed value.

- A. 114.33
- B. 171.49
- C. 142.91
- D. 214.37

61. During a final engineering review, an arterial intersection has 4 through lanes in each direction, 12-foot lanes, and a 39-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

- A. 108.00
- B. 135.00
- C. 162.00
- D. 202.50

62. For an interstate corridor project, a vehicle approaches an intersection at 78 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

- A. 549.12
- B. 823.68
- C. 1,029.60
- D. 686.40

63. During a network performance study, a left-turn bay must store 33 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

- A. 825.00
- B. 660.00
- C. 990.00
- D. 1,237.50

64. For a community mobility improvement, a channelized intersection uses a circular curb return with radius 97 feet through 96 degrees. What is the curb-return arc length? Select the nearest listed value.

- A. 130.02
- B. 195.04
- C. 162.53
- D. 243.80

65. During a preconstruction technical audit, an arterial intersection has 2 through lanes in each direction, 12-foot lanes, and a 43-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

- A. 91.00
- B. 72.80
- C. 109.20
- D. 136.50

66. During a final engineering review, a pedestrian must cross 96 feet. Using a 7-second start interval and walking speed of 3.5 feet per second, what total pedestrian timing is required? Select the nearest listed value.

- A. 27.54
- B. 34.43
- C. 41.32
- D. 51.64

67. For an interstate corridor project, a four-phase signal has 5.40 seconds of lost time per phase. What is the total lost time per cycle? Select the nearest listed value.

- A. 17.28
- B. 25.92
- C. 21.60
- D. 32.40

68. During a network performance study, a signal has a 190-second cycle, 52 seconds of displayed green, and 4 seconds of phase lost time. What effective-green ratio applies to the phase? Select the nearest listed value.

- A. 0.20
- B. 0.30
- C. 0.38
- D. 0.25

69. For a community mobility improvement, a lane group has saturation flow of 1900 vehicles per hour of green and an effective-green ratio of 0.77. What is its capacity? Select the nearest listed value.

- A. 1,170.40
- B. 1,755.60
- C. 2,194.50
- D. 1,463.00

70. During a preconstruction technical audit, a pedestrian must cross 104 feet. Using a 7-second start interval and walking speed of 3.5 feet per second, what total pedestrian timing is required? Select the nearest listed value.

- A. 29.37
- B. 36.71
- C. 44.05
- D. 55.06

71. During a final engineering review, a four-phase signal has 5.80 seconds of lost time per phase. What is the total lost time per cycle? Select the nearest listed value.

- A. 18.56
- B. 27.84
- C. 23.20
- D. 34.80

72. For an interstate corridor project, a signal has a 210-second cycle, 56 seconds of displayed green, and 4 seconds of phase lost time. What effective-green ratio applies to the phase? Select the nearest listed value.

- A. 0.25
- B. 0.20
- C. 0.30
- D. 0.38

73. During a network performance study, a broken lane line extends 2100 feet using a 10-foot stripe and 30-foot gap. Approximately how many complete stripe-gap cycles fit in the segment? Select the nearest listed value.

- A. 42.00
- B. 63.00
- C. 78.75
- D. 52.50

74. For a community mobility improvement, a temporary warning sequence should provide 9 seconds of preview at 64 mph. What advance distance corresponds to that travel time? Select the nearest listed value.

- A. 675.84
- B. 1,013.76
- C. 844.80
- D. 1,267.20

75. During a preconstruction technical audit, for a work-zone taper on a roadway operating at 35 mph, use $L = WS^2/60$ with offset $W = 12$ feet. What taper length results? Select the nearest listed value.

- A. 196.00
- B. 245.00
- C. 294.00
- D. 367.50

76. During a final engineering review, a channelizing line contains 30 devices at 290-foot spacing. What distance separates the first and last device? Select the nearest listed value.

- A. 8,410.00
- B. 6,728.00
- C. 10,092.00
- D. 12,615.00

77. For an interstate corridor project, a broken lane line extends 2300 feet using a 10-foot stripe and 30-foot gap. Approximately how many complete stripe-gap cycles fit in the segment? Select the nearest listed value.

- A. 46.00
- B. 57.50
- C. 69.00
- D. 86.25

78. During a network performance study, a temporary warning sequence should provide 10 seconds of preview at 68 mph. What advance distance corresponds to that travel time? Select the nearest listed value.

- A. 797.86
- B. 1,196.80
- C. 997.33
- D. 1,496.00

79. For a community mobility improvement, for a work-zone taper on a roadway operating at 55 mph, use $L = WS^2/60$ with offset $W = 12$ feet. What taper length results? Select the nearest listed value.

- A. 484.00
- B. 726.00
- C. 907.50
- D. 605.00

80. During a preconstruction technical audit, a soil element contains 0.78 cubic foot of voids and 0.76 cubic foot of solids. What is the void ratio? Select the nearest listed value.

- A. 1.03
- B. 0.82
- C. 1.24
- D. 1.54

81. During a final engineering review, a design lane carries 1280 trucks per day, and the adopted equivalency factor is 2.75 ESAL per truck. What is the daily ESAL loading? Select the nearest listed value.

- A. 2,816.00
- B. 4,224.00
- C. 3,520.00
- D. 5,280.00

82. For an interstate corridor project, compacted soil has moist unit weight 165.00 pcf and water content 18.0%. What is its dry unit weight? Select the nearest listed value.

- A. 139.83
- B. 111.86
- C. 167.80
- D. 209.75

83. During a network performance study, a field dry unit weight is 160.00 pcf and laboratory maximum dry unit weight is 166.00 pcf. What is relative compaction? Select the nearest listed value.

- A. 77.11
- B. 115.67
- C. 144.59
- D. 96.39

84. For a community mobility improvement, a soil element contains 0.86 cubic foot of voids and 0.80 cubic foot of solids. What is the void ratio? Select the nearest listed value.

- A. 0.86
- B. 1.08
- C. 1.30
- D. 1.62

85. During a preconstruction technical audit, a design lane carries 1360 trucks per day, and the adopted equivalency factor is 2.95 ESAL per truck. What is the daily ESAL loading? Select the nearest listed value.

- A. 4,012.00
- B. 3,209.60
- C. 4,814.40
- D. 6,018.00

86. During a final engineering review, compacted soil has moist unit weight 173.00 pcf and water content 20.0%. What is its dry unit weight? Select the nearest listed value.

- A. 115.34
- B. 144.17
- C. 173.00
- D. 216.25

87. For an interstate corridor project, a field dry unit weight is 168.00 pcf and laboratory maximum dry unit weight is 174.00 pcf. What is relative compaction? Select the nearest listed value.

- A. 77.24
- B. 115.86
- C. 144.82
- D. 96.55

88. During a network performance study, a soil element contains 0.94 cubic foot of voids and 0.84 cubic foot of solids. What is the void ratio? Select the nearest listed value.

- A. 0.90
- B. 1.34
- C. 1.12
- D. 1.68

89. For a community mobility improvement, a culvert conveys 84.00 cubic feet per second through a flow area of 9.60 square feet. What is mean velocity? Select the nearest listed value.

- A. 8.75
- B. 7.00
- C. 10.50
- D. 13.12

90. During a preconstruction technical audit, a rectangular roadside channel carries water 3.40 feet deep across a bottom width of 27 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 73.44
- B. 110.16
- C. 137.70
- D. 91.80

91. During a final engineering review, using $Q = CiA$, find peak runoff for $C = 0.85$, rainfall intensity $i = 5.20$ inches per hour, and drainage area $A = 38$ acres. Select the nearest listed value.

- A. 134.37
- B. 167.96
- C. 201.55
- D. 251.94

92. For an interstate corridor project, a circular storm drain has inside diameter 4.60 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 13.30
- B. 19.94
- C. 16.62
- D. 24.93

93. During a network performance study, a culvert conveys 92.00 cubic feet per second through a flow area of 10.40 square feet. What is mean velocity? Select the nearest listed value.

- A. 7.08
- B. 8.85
- C. 10.62
- D. 13.27

94. For a community mobility improvement, a rectangular roadside channel carries water 3.80 feet deep across a bottom width of 31 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 117.80
- B. 94.24
- C. 141.36
- D. 176.70

95. During a preconstruction technical audit, using $Q = CiA$, find peak runoff for $C = 0.89$, rainfall intensity $i = 5.60$ inches per hour, and drainage area $A = 42$ acres. Select the nearest listed value.

- A. 167.46
- B. 251.20
- C. 314.00
- D. 209.33

96. During a final engineering review, a circular storm drain has inside diameter 5.00 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 15.70
- B. 23.56
- C. 19.63
- D. 29.45

97. For an interstate corridor project, a culvert conveys 100.00 cubic feet per second through a flow area of 11.20 square feet. What is mean velocity? Select the nearest listed value.

- A. 8.93
- B. 7.14
- C. 10.72
- D. 13.39

98. During a network performance study, a rectangular roadside channel carries water 4.20 feet deep across a bottom width of 35 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 117.60
- B. 176.40
- C. 220.50
- D. 147.00

99. For a community mobility improvement, using $Q = CiA$, find peak runoff for $C = 0.93$, rainfall intensity $i = 6.00$ inches per hour, and drainage area $A = 46$ acres. Select the nearest listed value.

- A. 205.34
- B. 308.02
- C. 256.68
- D. 385.02

100. During a preconstruction technical audit, a circular storm drain has inside diameter 5.40 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 18.32
- B. 22.90
- C. 27.48
- D. 34.35

Practice Exam 10: Answer Key and Explanations

1. **C** — Using the stated data, discounting gives $\$680,000/(1+0.076)^4 = \$507,294.12$. Therefore, the keyed value is the only option consistent with the governing relationship. Present worth converts a future expenditure to an equivalent value at the analysis date. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
2. **B** — Using the stated data, total output is $4 \times 31 \times 335 = 41,540.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Total planned output is the product of crew count, available days, and daily productivity. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
3. **A** — Using the stated data, the cost is quantity times unit price: $2,000 \times \$58.00 = \$116,000.00$. Therefore, the keyed value is the only option consistent with the governing relationship. A quantity takeoff becomes a cost only after multiplication by the applicable bid or planning unit price. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
4. **D** — Using the stated data, duration equals work divided by production, or $6,750/510 = 13.24$ days. Therefore, the keyed value is the only option consistent with the governing relationship. Production-based duration links measured scope to schedule time before logic ties are applied. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
5. **A** — Using the stated data, discounting gives $\$720,000/(1+0.084)^5 = \$481,045.42$. Therefore, the keyed value is the only option consistent with the governing relationship. Present worth converts a future expenditure to an equivalent value at the analysis date. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
6. **C** — Using the stated data, total output is $5 \times 35 \times 355 = 62,125.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Total planned output is the product of crew count, available days, and daily productivity. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
7. **B** — Using the stated data, the cost is quantity times unit price: $2,160 \times \$66.00 = \$142,560.00$. Therefore, the keyed value is the only option consistent with the governing relationship. A quantity takeoff becomes a cost only after multiplication by the applicable bid or planning unit price. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.
8. **D** — Using the stated data, duration equals work divided by production, or $7,350/550 = 13.36$ days. Therefore, the keyed value is the only option consistent with the governing relationship. Production-based duration links measured scope to schedule time before logic ties are applied. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

9. D — Using the stated data, discounting gives $\$760,000/(1+0.092)^6 = \$448,206.10$. Therefore, the keyed value is the only option consistent with the governing relationship. Present worth converts a future expenditure to an equivalent value at the analysis date. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

10. C — Using the stated data, the normalized crash rate is $36/58 = 0.62$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

11. A — Using the stated data, compound growth gives $13,900(1+0.044)^{11} = 22,321.34$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

12. B — Using the stated data, $PHF = 1200/(4 \times 320) = 0.94$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

13. A — Using the stated data, density is flow divided by speed: $2025/50 = 40.50$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

14. D — Using the stated data, the normalized crash rate is $40/66 = 0.61$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

15. B — Using the stated data, compound growth gives $14,300(1+0.048)^{11} = 23,950.26$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

16. C — Using the stated data, $PHF = 1280/(4 \times 340) = 0.94$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

17. C — Using the stated data, density is flow divided by speed: $2125/46 = 46.20$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

18. D — Using the stated data, the normalized crash rate is $44/74 = 0.59$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

19. B — Using the stated data, compound growth gives $14,700(1+0.052)^{11} = 25,673.82$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

20. A — Using the stated data, $PHF = 1360/(4 \times 360) = 0.94$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

21. A — Using the stated data, density is flow divided by speed: $2225/50 = 44.50$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

22. D — Using the stated data, the normalized crash rate is $48/82 = 0.59$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

23. B — Using the stated data, compound growth gives $15,100(1+0.056)^{11} = 27,496.67$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

24. C — Using the stated data, the H:V ratio is $66/2 = 33.00$ to 1. Therefore, the keyed value is the only option consistent with the governing relationship. Roadside slopes are commonly described as horizontal distance for each unit of vertical change. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its reciprocal.

25. B — Using the stated data, rectangular area is $330 \times 6 = 1,980.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Plan area supports material quantity calculations when thickness is handled as a separate dimension. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its.

26. D — Using the stated data, drop equals width times decimal slope: $12 \times 0.030 = 0.36$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Cross slope is a dimensionless rise-over-run ratio, so percent must be converted to decimal form. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a.

27. C — Using the stated data, paved width is $2 \times 12 + 2 \times 8 = 40.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Every traveled lane and both shoulders contribute to the full paved platform width. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio.

28. A — Using the stated data, the H:V ratio is $74/3 = 24.67$ to 1. Therefore, the keyed value is the only option consistent with the governing relationship. Roadside slopes are commonly described as horizontal distance for each unit of vertical change. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its reciprocal.

29. A — Using the stated data, rectangular area is $370 \times 7 = 2,590.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Plan area supports material quantity calculations when thickness is handled as a separate dimension. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its.

30. D — Using the stated data, drop equals width times decimal slope: $12 \times 0.020 = 0.24$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Cross slope is a dimensionless rise-over-run ratio, so percent must be converted to decimal form. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a.

31. C — Using the stated data, paved width is $3 \times 12 + 2 \times 9 = 54.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Every traveled lane and both shoulders contribute to the full paved platform width. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio.

32. B — Using the stated data, the H:V ratio is $82/4 = 20.50$ to 1. Therefore, the keyed value is the only option consistent with the governing relationship. Roadside slopes are commonly described as horizontal distance for each unit of vertical change. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its reciprocal.

33. B — Using the stated data, rectangular area is $410 \times 5 = 2,050.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Plan area supports material quantity calculations when thickness is handled as a separate dimension. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its.

34. D — Using the stated data, $M = R[1 - \cos(\delta/2)] = 155.68$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

35. C — Using the stated data, $LC = 2R \sin(\delta/2) = 1323.53$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The long chord directly joins the beginning and end points of the circular curve. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

36. A — Using the stated data, arc length is $\pi(1400)(60)/180 = 1466.08$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

37. A — Using the stated data, $T = R \tan(\delta/2) = 1435 \tan(62/2) = 862.23$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The tangent distance runs from the point of intersection to either tangent point. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve.

38. B — Using the stated data, $M = R[1 - \cos(\delta/2)] = 223.37$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

39. C — Using the stated data, $LC = 2R \sin(\delta/2) = 1639.36$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The long chord directly joins the beginning and end points of the circular curve. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

40. D — Using the stated data, arc length is $\pi(1540)(68)/180 = 1827.71$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

41. A — Using the stated data, $T = R \tan(\delta/2) = 1575 \tan(70/2) = 1102.83$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The tangent distance runs from the point of intersection to either tangent point. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve.

42. D — Using the stated data, $M = R[1 - \cos(\delta/2)] = 307.48$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

43. C — Using the stated data, $LC = 2R \sin(\Delta/2) = 1979.97$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The long chord directly joins the beginning and end points of the circular curve. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

44. B — Using the stated data, arc length is $\pi(1680)(76)/180 = 2228.44$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

45. D — Using the stated data, elevation change is $0.038 \times 480 = 18.24$ feet, yielding 572.24 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

46. B — Using the stated data, clearance is the elevation difference: $18.40 - 5.50 = 12.90$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Vertical clearance is measured between the roadway surface and the controlling overhead obstruction. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

47. A — Using the stated data, A is the absolute grade difference: $|5.50 - (-0.50)| = 5.00\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

48. C — Using the stated data, K equals length divided by algebraic grade difference: $1125/5 = 225.00$ feet per percent. Therefore, the keyed value is the only option consistent with the governing relationship. K expresses the horizontal length supplied for each percentage point of grade change. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

49. B — Using the stated data, elevation change is $0.042 \times 520 = 21.84$ feet, yielding 587.84 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

50. C — Using the stated data, clearance is the elevation difference: $18.80 - 6.50 = 12.30$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Vertical clearance is measured between the roadway surface and the controlling overhead obstruction. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

51. A — Using the stated data, A is the absolute grade difference: $|6.10 - (0.90)| = 5.20\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

52. D — Using the stated data, K equals length divided by algebraic grade difference: $1225/4 = 306.25$ feet per percent. Therefore, the keyed value is the only option consistent with the governing relationship. K expresses the horizontal length supplied for each percentage point of grade change. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation.

53. B — Using the stated data, elevation change is $0.046 \times 560 = 25.76$ feet, yielding 603.76 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

54. A — Using the stated data, clearance is the elevation difference: $19.20 - 4.50 = 14.70$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Vertical clearance is measured between the roadway surface and the controlling overhead obstruction. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

55. C — Using the stated data, A is the absolute grade difference: $|6.70 - (1.30)| = 5.40\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

56. D — Using the stated data, arc length is $\pi(81)(88)/180 = 124.41$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Curb-return length follows the same circular arc relation used for other horizontal curves. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly without circular conversion.

57. A — Using the stated data, width is $2 \times 3 \times 12 + 35 = 107.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The crossing includes directional traveled ways on both sides plus the central median. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly.

58. B — Using the stated data, distance is $70 \times 1.4667 \times 6 = 616.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The speed conversion from miles per hour to feet per second is required before multiplying by time. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using.

59. D — Using the stated data, storage length is $29 \times 25 = 725.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Queue storage is the product of design vehicle count and the adopted effective space per queued vehicle. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees.

60. C — Using the stated data, arc length is $\pi(89)(92)/180 = 142.91$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Curb-return length follows the same circular arc relation used for other horizontal curves. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly without circular conversion.

61. B — Using the stated data, width is $2 \times 4 \times 12 + 39 = 135.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The crossing includes directional traveled ways on both sides plus the central median. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly.

62. D — Using the stated data, distance is $78 \times 1.4667 \times 6 = 686.40$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The speed conversion from miles per hour to feet per second is required before multiplying by time. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using.

63. A — Using the stated data, storage length is $33 \times 25 = 825.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Queue storage is the product of design vehicle count and the adopted effective space per queued vehicle. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees.

64. C — Using the stated data, arc length is $\pi(97)(96)/180 = 162.53$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Curb-return length follows the same circular arc relation used for other horizontal curves. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly without circular conversion.

65. A — Using the stated data, width is $2 \times 2 \times 12 + 43 = 91.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The crossing includes directional traveled ways on both sides plus the central median. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly.

66. B — Using the stated data, timing is $7 + 96/3.5 = 34.43$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total timing combines the initial interval with the time needed to traverse the crossing distance. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires.

67. C — Using the stated data, cycle lost time is $4 \times 5.40 = 21.60$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total cycle lost time accumulates the startup and clearance losses associated with each phase. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity.

68. D — Using the stated data, effective green ratio is $(52-4)/190 = 0.25$. Therefore, the keyed value is the only option consistent with the governing relationship. Only effective green, after subtracting lost time, contributes to the usable fraction of the cycle. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires multiplication.

69. D — Using the stated data, capacity is saturation flow times green ratio: $1900 \times 0.77 = 1463.00$ vehicles per hour. Therefore, the keyed value is the only option consistent with the governing relationship. Signalized capacity scales the ideal discharge rate by the share of cycle effectively available. The distractors reflect use of displayed rather than effective green, omission of startup time,.

70. B — Using the stated data, timing is $7 + 104/3.5 = 36.71$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total timing combines the initial interval with the time needed to traverse the crossing distance. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires.

71. C — Using the stated data, cycle lost time is $4 \times 5.80 = 23.20$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total cycle lost time accumulates the startup and clearance losses associated with each phase. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity.

72. A — Using the stated data, effective green ratio is $(56-4)/210 = 0.25$. Therefore, the keyed value is the only option consistent with the governing relationship. Only effective green, after subtracting lost time, contributes to the usable fraction of the cycle. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires multiplication.

73. D — Using the stated data, cycle length is $10+30 = 40$ feet, so count is $2100/40 = 52.50$. Therefore, the keyed value is the only option consistent with the governing relationship. Both the marked stripe and following gap occupy longitudinal distance in each repeating cycle. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

74. C — Using the stated data, distance is $64 \times 1.4667 \times 9 = 844.80$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Preview distance follows from converting operating speed to feet per second and multiplying by available time. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail.

75. B — Using the stated data, $L = 12(35)^2/60 = 245.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The stated low-speed taper relation makes length proportional to offset and to the square of speed. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail to square speed in.

76. A — Using the stated data, there are 29 spaces, so distance is $29 \times 290 = 8410.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The number of intervals between objects is one less than the number of objects. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

77. B — Using the stated data, cycle length is $10 + 30 = 40$ feet, so count is $2300/40 = 57.50$. Therefore, the keyed value is the only option consistent with the governing relationship. Both the marked stripe and following gap occupy longitudinal distance in each repeating cycle. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

78. C — Using the stated data, distance is $68 \times 1.4667 \times 10 = 997.33$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Preview distance follows from converting operating speed to feet per second and multiplying by available time. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail.

79. D — Using the stated data, $L = 12(55)^2/60 = 605.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The stated low-speed taper relation makes length proportional to offset and to the square of speed. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail to square speed in.

80. A — Using the stated data, void ratio is void volume divided by solids volume: $0.78/0.76 = 1.03$. Therefore, the keyed value is the only option consistent with the governing relationship. Void ratio uses solids volume in the denominator, unlike porosity, which uses total volume. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or.

81. C — Using the stated data, daily loading is $1280 \times 2.75 = 3520.00$ ESAL. Therefore, the keyed value is the only option consistent with the governing relationship. Equivalent axle loading converts mixed truck repetitions into a common pavement-damage measure. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

82. A — Using the stated data, dry unit weight is $165.00/(1+0.180) = 139.83$ pcf. Therefore, the keyed value is the only option consistent with the governing relationship. Moist unit weight includes water mass, so dividing by one plus decimal water content isolates dry solids. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing.

83. D — Using the stated data, relative compaction is $100(160.00/166.00) = 96.39\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Relative compaction compares achieved field density directly with the specified laboratory maximum. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

84. B — Using the stated data, void ratio is void volume divided by solids volume: $0.86/0.80 = 1.08$. Therefore, the keyed value is the only option consistent with the governing relationship. Void ratio uses solids volume in the denominator, unlike porosity, which uses total volume. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or.

85. A — Using the stated data, daily loading is $1360 \times 2.95 = 4012.00$ ESAL. Therefore, the keyed value is the only option consistent with the governing relationship. Equivalent axle loading converts mixed truck repetitions into a common pavement-damage measure. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

86. B — Using the stated data, dry unit weight is $173.00/(1+0.200) = 144.17$ pcf. Therefore, the keyed value is the only option consistent with the governing relationship. Moist unit weight includes water mass, so dividing by one plus decimal water content isolates dry solids. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing.

87. D — Using the stated data, relative compaction is $100(168.00/174.00) = 96.55\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Relative compaction compares achieved field density directly with the specified laboratory maximum. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

88. C — Using the stated data, void ratio is void volume divided by solids volume: $0.94/0.84 = 1.12$. Therefore, the keyed value is the only option consistent with the governing relationship. Void ratio uses solids volume in the denominator, unlike porosity, which uses total volume. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or.

89. A — Using the stated data, continuity gives velocity $Q/A = 84.00/9.60 = 8.75$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

90. D — Using the stated data, rectangular flow area is $27 \times 3.40 = 91.80$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.

91. B — Using the stated data, $Q = 0.85 \times 5.20 \times 38 = 167.96$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

92. C — Using the stated data, area is $\pi(4.60)^2/4 = 16.62$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

93. B — Using the stated data, continuity gives velocity $Q/A = 92.00/10.40 = 8.85$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

94. A — Using the stated data, rectangular flow area is $31 \times 3.80 = 117.80$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.

95. D — Using the stated data, $Q = 0.89 \times 5.60 \times 42 = 209.33$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

96. C — Using the stated data, area is $\pi(5.00)^2/4 = 19.63$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

97. A — Using the stated data, continuity gives velocity $Q/A = 100.00/11.20 = 8.93$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

98. D — Using the stated data, rectangular flow area is $35 \times 4.20 = 147.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.

99. C — Using the stated data, $Q = 0.93 \times 6.00 \times 46 = 256.68$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

100. B — Using the stated data, area is $\pi(5.40)^2/4 = 22.90$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.