PRACTICE EXAM 16: FUNDAMENTALS OF SURVEYING SIMULATION (110 QUESTIONS)

This practice exam contains 110 questions. Allow 5 hours and 20 minutes of testing time. Select the single best answer for each question. Use the current NCEES FS Reference Handbook and an approved calculator. NCEES reports results as pass or fail and does not publish a fixed passing score.

1. Apply the controlling surveying concept to the following: which field procedure best reduces collimation error during precise differential leveling?

A. Use only long foresight distances
B. Hold the rod at an intentional tilt
C. Read the rod before leveling the instrument
D. Use balanced backsight and foresight distances

2. A crew chief asks for the best conclusion in this situation: what is the primary purpose of centering a total station precisely over a control point?

A. To ensure measured directions and distances originate at the intended station
B. To make every target height equal under the stated circumstances
C. To eliminate atmospheric refraction under the stated circumstances
D. To establish the instrument constant under the stated circumstances

3. For this office or field check, identify the correct choice: a level loop closes 0.06 ft high over 3 miles. Using equal correction per mile, what correction is applied after 2 miles?

A. +0.04 ft
B. +0.06 ft
C. −0.04 ft

D. −0.02 ft

4. Use standard surveying practice to resolve this question: before collecting a topographic point with a GNSS rover, which check most directly confirms the setup is producing reliable coordinates?

A. Observe an independent known check point
B. Increase the antenna height entry
C. Disable satellite masks
D. Use the longest available point code

5. In Practice Exam 16, evaluate this field situation: which total-station operation directly establishes the instrument's horizontal orientation?

A. Record the ambient temperature under the stated circumstances
B. Measure the instrument height twice
C. Focus the eyepiece on the reticle
D. Sight a known backsight and set its direction

6. A surveying team must select the technically sound response: a slope distance is 500.00 ft and the zenith angle is 88°00′00″. What is the horizontal distance, nearest 0.01 ft?

A. 500.30 ft
B. 499.70 ft
C. 482.96 ft
D. 17.45 ft

7. During an independent work-product review, determine the answer: why is a prism constant entered in an electronic distance-measuring instrument?

A. To correct the Earth's curvature
B. To convert grid north to true north

C. To account for the reflector's effective optical offset
D. To determine the target elevation automatically

8. Apply the controlling surveying concept to the following: which field note is most important when a GNSS antenna height is measured as a slant height?

A. The color of the survey monument
B. The measurement method and antenna reference point
C. The rover screen brightness
D. The controller battery serial number

9. A crew chief asks for the best conclusion in this situation: what does a two-peg test evaluate?

A. The line-of-sight adjustment of a level
B. The optical plummet centering error
C. The magnetic declination of a compass
D. The additive constant of an EDM

10. For this office or field check, identify the correct choice: a 100.00-ft steel tape is actually 100.04 ft long. A recorded distance is 250.00 ft. What is the corrected distance?

A. 249.90 ft
B. 250.04 ft
C. 251.00 ft
D. 250.10 ft

11. Use standard surveying practice to resolve this question: which observation practice helps detect a blunder in a critical horizontal angle?

A. Change the occupied point designation under the stated circumstances
B. Measure the angle in both direct and reverse faces

C. Use only one telescope face under the stated circumstances
D. Round each direction in the field

12. In Practice Exam 16, evaluate this field situation: what is the purpose of a field-book sketch accompanying numerical observations?

A. To document spatial relationships and support later interpretation
B. To establish legal ownership by itself
C. To remove the need for point descriptions
D. To replace all measured values

13. A surveying team must select the technically sound response: a rod reading on a benchmark is 4.32 ft and the benchmark elevation is 612.48 ft. What is the height of instrument?

A. 608.16 ft
B. 612.48 ft
C. 616.80 ft
D. 617.12 ft

14. During an independent work-product review, determine the answer: when setting a construction stake, why should the cut or fill value be referenced to a clearly described point on the stake?

A. So the design surface can be ignored under the stated circumstances
B. So the stake becomes a boundary monument under the stated circumstances
C. So instrument height need not be recorded under the stated circumstances
D. So the contractor knows the exact location to which the grade value applies

15. Apply the controlling surveying concept to the following: which condition is most likely to degrade optical distance measurements?

A. Strong heat shimmer along a near-ground sight line

B. A recently charged data collector
C. A clearly labeled control point
D. A centered circular bubble under the stated circumstances

16. A crew chief asks for the best conclusion in this situation: what is the best immediate response when a check shot differs materially from its published control value?

A. Average the check into the control value
B. Delete the check without notation under the stated circumstances
C. Continue because production points are unaffected
D. Stop production and investigate the setup, control, and data

17. For this office or field check, identify the correct choice: a backsight is 5.18 ft and a foresight is 3.76 ft. What is the elevation change from the backsight point to the foresight point?

A. −8.94 ft
B. +1.42 ft
C. −1.42 ft
D. +8.94 ft

18. Use standard surveying practice to resolve this question: what does a map scale of 1:24,000 mean?

A. Twenty-four thousand map units equal one ground unit
B. The map covers exactly 24,000 acres under the stated circumstances
C. One map unit represents 24,000 of the same ground units
D. One inch always represents 24,000 feet under the stated circumstances

19. In Practice Exam 16, evaluate this field situation: which contour pattern normally indicates a steep slope?

A. Widely spaced contour lines

B. Concentric contours with equal elevations
C. Contours crossing without a depression symbol
D. Closely spaced contour lines

20. A surveying team must select the technically sound response: what is the principal function of a map projection?

A. Replace the horizontal datum under the stated circumstances
B. Eliminate every type of distortion under the stated circumstances
C. Transform positions from a curved reference surface to a plane
D. Convert elevations into bearings under the stated circumstances

21. During an independent work-product review, determine the answer: which GIS data model is best suited to representing parcel boundaries and road centerlines?

A. Vector features
B. A continuous elevation grid only
C. A photographic histogram
D. Unclassified raster cells

22. Apply the controlling surveying concept to the following: in photogrammetry, what does stereoscopic overlap permit?

A. Removal of all lens distortion
B. Three-dimensional measurement from paired images
C. Direct determination of legal title
D. Elimination of ground control

23. A crew chief asks for the best conclusion in this situation: what does orthorectification primarily remove from an aerial image?

A. Geometric displacement caused by terrain and sensor perspective
B. The need for a coordinate system
C. Every difference in ground reflectance
D. All shadows cast by buildings

24. For this office or field check, identify the correct choice: which product is a regularly spaced grid of bare-earth elevations?

A. Planimetric line file
B. Uncontrolled photo mosaic
C. Parcel index map
D. Digital terrain model

25. Use standard surveying practice to resolve this question: what is the purpose of map metadata?

A. Guarantee that every feature is current
B. Replace quality-control testing under the stated circumstances
C. Document the dataset's source, accuracy, dates, and limitations
D. Convert raster data to vector data

26. In Practice Exam 16, evaluate this field situation: which north reference is defined by the direction of grid coordinate lines?

A. Astronomic latitude
B. Grid north
C. Magnetic north
D. Geodetic zenith

27. A surveying team must select the technically sound response: a 2.50-inch line on a 1:600 map represents what ground distance?

A. 250 ft
B. 1,500 ft
C. 50 ft
D. 125 ft

28. During an independent work-product review, determine the answer: which cartographic element identifies the meaning of symbols and line types?

A. Neatline
B. Scale denominator
C. Legend
D. Projection origin

29. Apply the controlling surveying concept to the following: why are breaklines included in a digital terrain model?

A. To assign a map projection
B. To preserve abrupt changes in surface slope
C. To define ownership automatically
D. To smooth every ridge and channel

30. A crew chief asks for the best conclusion in this situation: what is a principal advantage of lidar for terrain mapping?

A. It rapidly collects dense three-dimensional point measurements
B. It requires no calibration or control
C. It produces distortion-free imagery without processing
D. It determines land title directly

31. For this office or field check, identify the correct choice: which check best evaluates a finished orthophoto's horizontal accuracy?

A. Count the image pixels
B. Inspect only the file name
C. Compare independent check-point coordinates with image positions
D. Compare the image brightness to a paper map

32. Use standard surveying practice to resolve this question: what does a north arrow on a rotated site plan communicate?

A. The surveyor's license status under the stated circumstances
B. The plan's orientation relative to its stated north reference
C. The parcel's legal area under the stated circumstances
D. The contour interval under the stated circumstances

33. In Practice Exam 16, evaluate this field situation: in a boundary retracement, which evidence generally receives greatest weight when found undisturbed?

A. The original monument called for in the conveyance
B. A recent occupation line of unknown origin
C. A calculated coordinate not in the conveyance
D. A later scaled map distance

34. A surveying team must select the technically sound response: what is an easement?

A. Absolute ownership of the servient parcel
B. A revocable survey license in every case
C. A tax assessment description under the stated circumstances
D. A nonpossessory right to use land owned by another

35. During an independent work-product review, determine the answer: which deed description begins at a stated point and follows successive courses and distances?

A. Metes-and-bounds description
B. Assessor's valuation record
C. Lot-and-block index only
D. Government lot acreage table

36. Apply the controlling surveying concept to the following: what is the servient estate?

A. The public agency recording deeds
B. The monument controlling a subdivision
C. The parcel receiving an easement benefit
D. The parcel burdened by an easement

37. A crew chief asks for the best conclusion in this situation: under the senior-rights principle, what usually occurs when sequential conveyances overlap?

A. The later conveyance always controls
B. The earlier conveyance generally has priority
C. Both parcels automatically split the overlap
D. The tax map determines ownership

38. For this office or field check, identify the correct choice: what is adverse possession intended to address?

A. Automatic relocation of recorded easements
B. Correction of every survey measurement error
C. Acquisition of title through possession meeting statutory elements
D. Creation of a federal land patent

39. Use standard surveying practice to resolve this question: which document most directly gives constructive notice of a recorded land transfer?

A. A private verbal statement under the stated circumstances
B. The instrument filed in the public land records
C. A temporary construction stake under the stated circumstances
D. An unfiled field sketch under the stated circumstances

40. In Practice Exam 16, evaluate this field situation: what is an encroachment?

A. A recorded right of access
B. A subdivision monument under the stated circumstances
C. A transfer of mineral title
D. An improvement extending unlawfully onto another's land

41. A surveying team must select the technically sound response: when a deed calls to a natural monument and gives a conflicting distance, what normally controls?

A. The newest tax parcel number
B. The conflicting distance without qualification
C. The identified natural monument
D. The acreage statement alone

42. During an independent work-product review, determine the answer: what is the primary purpose of recording a subdivision plat?

A. Create a public record of lots, streets, and dedications
B. Replace every individual deed under the stated circumstances
C. Set property taxes permanently under the stated circumstances
D. Guarantee all improvements are built under the stated circumstances

43. Apply the controlling surveying concept to the following: which PLSS line runs east-west and is used with a principal meridian?

A. Base line
B. Range line
C. Standard parallel offset
D. Guide meridian

44. A crew chief asks for the best conclusion in this situation: in the PLSS, a standard township is nominally how large?

A. Thirty-six miles by thirty-six miles
B. One mile by one mile
C. Six chains by six chains
D. Six miles by six miles

45. For this office or field check, identify the correct choice: what is a riparian right?

A. A federal rectangular-survey correction under the stated circumstances
B. A right created solely by a tax map
C. A right associated with land bordering a river or stream
D. A right based only on mineral ownership

46. Use standard surveying practice to resolve this question: what is the point of beginning in a closed legal description?

A. The first monument found in fieldwork
B. The point where the boundary traverse starts and returns
C. The center of every parcel under the stated circumstances
D. The location of the recorder's office

47. In Practice Exam 16, evaluate this field situation: which evidence best supports the location of a missing original corner?

A. A recent fence built for convenience
B. Reliable accessories, witness evidence, and original survey records
C. A single unverified handheld coordinate
D. A proportional position used before searching

48. A surveying team must select the technically sound response: what distinguishes a simultaneous conveyance from a sequential conveyance?

A. The deeds contain no monument calls
B. The parcels cannot share a boundary
C. The parcels are always conveyed on the same day
D. The parcels are created together under a common plan

49. During an independent work-product review, determine the answer: what is fee simple ownership?

A. A temporary construction license under the stated circumstances
B. A nonpossessory access right only
C. The broadest private ownership interest recognized by law
D. A surveyor's certification of coordinates

50. Apply the controlling surveying concept to the following: which action is essential before giving a boundary opinion?

A. Reconcile record evidence with physical and testimonial evidence
B. Ignore occupation inconsistent with the deed
C. Accept the tax map as conclusive
D. Set monuments from coordinates without research

51. A crew chief asks for the best conclusion in this situation: what is an avulsion in water-boundary law?

A. A gradual wearing away of bank
B. A sudden, perceptible change in a watercourse
C. A recorded transfer of shore rights
D. A gradual buildup of soil

52. For this office or field check, identify the correct choice: what is a reversionary interest?

A. A present easement appurtenant under the stated circumstances
B. A survey correction factor under the stated circumstances
C. A recorded mortgage release under the stated circumstances
D. A future interest returning property to a grantor or successor

53. Use standard surveying practice to resolve this question: why should a surveyor avoid expressing a legal conclusion beyond surveying competence?

A. Boundary evidence can be reported without practicing law
B. Field notes have no legal relevance
C. Surveyors may never interpret deeds
D. Only attorneys may measure property

54. In Practice Exam 16, evaluate this field situation: what is a horizontal datum?

A. A magnetic declination table
B. A parcel ownership index
C. A reference framework for horizontal coordinates
D. A benchmark elevation only

55. A surveying team must select the technically sound response: what is geoid height?

A. The separation between the geoid and reference ellipsoid
B. The slope distance to a satellite

C. The elevation above a local benchmark only
D. The antenna phase-center offset under the stated circumstances

56. During an independent work-product review, determine the answer: if ellipsoid height is 250.4 ft and geoid height is −92.7 ft, what is orthometric height using h = H + N?

A. 250.4 ft
B. 157.7 ft
C. −343.1 ft
D. 343.1 ft

57. Apply the controlling surveying concept to the following: what does differential GNSS use to improve rover positions?

A. A longer prism pole under the stated circumstances
B. Corrections derived from a receiver at a known position
C. A local contour interval under the stated circumstances
D. A magnetic compass correction under the stated circumstances

58. A crew chief asks for the best conclusion in this situation: what is map convergence?

A. The difference between slope and horizontal distance
B. The angle from zenith to a satellite
C. The angle between grid north and geodetic north
D. The closure of a level loop

59. For this office or field check, identify the correct choice: which quantity is most directly described by precision?

A. Age of the instrument
B. Closeness to the true value only

C. Legal acceptability of a monument
D. Repeatability of measurements

60. Use standard surveying practice to resolve this question: why are redundant observations valuable?

A. They permit error detection and adjustment
B. They make calibration unnecessary
C. They establish property title
D. They eliminate every systematic error

61. In Practice Exam 16, evaluate this field situation: what is an orthometric height measured relative to?

A. The reference ellipsoid exclusively
B. The map projection origin
C. The geoid or an adopted mean-sea-level surface
D. The local magnetic field

62. A surveying team must select the technically sound response: what does a state plane coordinate system provide?

A. A single magnetic bearing basis
B. Planar coordinates designed for limited regional distortion
C. A nationwide cadastral title system
D. A replacement for vertical datums

63. During an independent work-product review, determine the answer: a grid distance is 2,000.00 ft and the combined scale factor is 0.99990. What is the ground distance?

A. 2,000.20 ft
B. 2,000.00 ft
C. 2,020.20 ft

D. 1,999.80 ft

64. Apply the controlling surveying concept to the following: what is the role of a vertical datum?

A. Define parcel ownership
B. Orient magnetic bearings
C. Classify lidar returns
D. Provide a common reference for elevations

65. A crew chief asks for the best conclusion in this situation: which GNSS error is reduced by using observations from multiple satellite geometries over time?

A. A leveling rod graduation error
B. Incorrect parcel ownership
C. Poor satellite geometry
D. A prism constant error

66. For this office or field check, identify the correct choice: what is a systematic error?

A. A purely random fluctuation
B. A repeatable bias following a predictable pattern
C. A legal-description ambiguity under the stated circumstances
D. Any large blunder under the stated circumstances

67. Use standard surveying practice to resolve this question: what does a confidence interval express?

A. A guaranteed maximum error under the stated circumstances
B. A range associated with a stated level of statistical confidence
C. A legal boundary tolerance under the stated circumstances
D. An instrument's serial number under the stated circumstances

68. In Practice Exam 16, evaluate this field situation: a line has latitude +300 ft and departure +400 ft. What is its length?

A. 700 ft
B. 100 ft
C. 350 ft
D. 500 ft

69. A surveying team must select the technically sound response: coordinates change from N 1000, E 500 to N 1120, E 660. What is the line length?

A. 200 ft
B. 240 ft
C. 280 ft
D. 160 ft

70. During an independent work-product review, determine the answer: a rectangular parcel measures 330 ft by 660 ft. What is its area in acres?

A. 2.50 acres
B. 10.00 acres
C. 5.00 acres
D. 15.00 acres

71. Apply the controlling surveying concept to the following: a circular curve has radius 600 ft and central angle 30°. What is its arc length?

A. 628.32 ft
B. 157.08 ft
C. 300.00 ft
D. 314.16 ft

72. A crew chief asks for the best conclusion in this situation: for a 4% grade over 250 ft, what is the elevation change?

A. 6.25 ft
B. 10.0 ft
C. 62.5 ft
D. 1.0 ft

73. For this office or field check, identify the correct choice: a triangular parcel has base 240 ft and perpendicular height 150 ft. What is its area?

A. 18,000 sq ft
B. 9,000 sq ft
C. 36,000 sq ft
D. 39,000 sq ft

74. Use standard surveying practice to resolve this question: a level run begins at elevation 500.00 ft, with total backsights 18.42 ft and foresights 16.97 ft. What is the ending elevation?

A. 535.39 ft
B. 498.55 ft
C. 501.45 ft
D. 500.73 ft

75. In Practice Exam 16, evaluate this field situation: a closed traverse has total length 4,000 ft and linear misclosure 0.40 ft. What is its relative precision?

A. 1:10,000
B. 1:4,000
C. 1:16,000
D. 1:1,000

76. A surveying team must select the technically sound response: a cut area averages 120 sq ft over a 50-ft interval. Using average end area, what is the volume?

A. 2,400 cu ft
B. 8,500 cu ft
C. 6,000 cu ft
D. 17,000 cu ft

77. During an independent work-product review, determine the answer: what is the tangent length of a simple curve with radius 500 ft and central angle 40°?

A. 419.55 ft
B. 181.99 ft
C. 171.01 ft
D. 349.07 ft

78. Apply the controlling surveying concept to the following: a bearing is N 35° E. What azimuth does it represent?

A. 215°
B. 325°
C. 145°
D. 35°

79. A crew chief asks for the best conclusion in this situation: an azimuth is 220°. What is its quadrant bearing?

A. N 40° E
B. S 50° E
C. N 50° W
D. S 40° W

80. For this office or field check, identify the correct choice: a line rises 12 ft over a horizontal distance of 300 ft. What is its percent grade?

A. 4.0%
B. 25.0%
C. 2.5%
D. 12.0%

81. Use standard surveying practice to resolve this question: two endpoint elevations are 100 ft and 112 ft. At the midpoint of a uniform grade, what is the elevation?

A. 108 ft
B. 212 ft
C. 106 ft
D. 104 ft

82. In Practice Exam 16, evaluate this field situation: a square parcel contains 10 acres. What is its side length, nearest foot?

A. 436 ft
B. 660 ft
C. 1,320 ft
D. 4,356 ft

83. A surveying team must select the technically sound response: a point is 80 ft east and 60 ft north of another. What is the horizontal distance?

A. 140 ft
B. 20 ft
C. 70 ft
D. 100 ft

84. During an independent work-product review, determine the answer: a 600-ft line has a slope angle of 5°. What is its vertical component, nearest 0.1 ft?

A. 597.7 ft
B. 605.2 ft
C. 52.3 ft
D. 10.5 ft

85. Apply the controlling surveying concept to the following: a traverse correction of −0.20 ft is distributed by Bowditch over a 500-ft course in a 2,000-ft traverse. What is the course correction?

A. −0.02 ft
B. −0.05 ft
C. +0.05 ft
D. −0.20 ft

86. A crew chief asks for the best conclusion in this situation: a point elevation is 725.60 ft and design grade is 723.85 ft. What cut is required?

A. 1.75 ft cut
B. 2.25 ft fill
C. 1.75 ft fill
D. 2.25 ft cut

87. For this office or field check, identify the correct choice: what is the primary purpose of a written scope of services?

A. Transfer all professional liability
B. Replace technical quality control
C. Guarantee no project changes occur
D. Define deliverables, responsibilities, assumptions, and exclusions

88. Use standard surveying practice to resolve this question: which action best manages a request outside the contracted scope?

A. Document the change and obtain authorization before proceeding
B. Perform it without recording time
C. Reject every client request under the stated circumstances
D. Remove an original deliverable silently

89. In Practice Exam 16, evaluate this field situation: what does professional liability insurance generally address?

A. Employee payroll obligations under the stated circumstances
B. Claims arising from alleged professional errors or omissions
C. Routine equipment wear under the stated circumstances
D. Every intentional unlawful act under the stated circumstances

90. A surveying team must select the technically sound response: which safety practice is most appropriate before roadside surveying?

A. Park equipment in the travel lane under the stated circumstances
B. Assume drivers will avoid the crew under the stated circumstances
C. Complete a hazard assessment and implement an approved traffic-control plan
D. Rely only on high-visibility clothing under the stated circumstances

91. During an independent work-product review, determine the answer: what is the purpose of quality assurance?

A. Inspect only the final deliverable under the stated circumstances
B. Eliminate professional judgment under the stated circumstances
C. Establish processes that prevent defects and promote consistent quality
D. Reduce all project documentation under the stated circumstances

92. Apply the controlling surveying concept to the following: which record best supports defensible project billing?

A. Equipment serial numbers alone under the stated circumstances
B. An undocumented verbal estimate under the stated circumstances
C. A reconstructed total months later
D. Contemporaneous time entries tied to tasks and authorization

93. A crew chief asks for the best conclusion in this situation: a project fee is $24,000 and 35% is budgeted for fieldwork. What is the fieldwork budget?

A. $8,400
B. $12,600
C. $15,600
D. $6,000

94. For this office or field check, identify the correct choice: what is a conflict of interest?

A. Any technical disagreement under the stated circumstances
B. A competing interest that may impair or appear to impair professional judgment
C. Every project schedule change under the stated circumstances
D. A routine equipment rental under the stated circumstances

95. Use standard surveying practice to resolve this question: which communication is best after discovering a material survey error?

A. Assign blame before investigation under the stated circumstances
B. Conceal it until project closeout under the stated circumstances
C. Promptly notify responsible parties with verified facts and a correction plan
D. Alter records without an audit trail under the stated circumstances

96. In Practice Exam 16, evaluate this field situation: what should a project manager compare during cost control?

A. Equipment age against deed dates under the stated circumstances
B. Map scale against insurance limits under the stated circumstances
C. Employee titles against parcel acreage under the stated circumstances
D. Actual cost and earned progress against the approved budget

97. A surveying team must select the technically sound response: what is the best basis for delegating a technical task?

A. The worker's demonstrated competence and appropriate supervision
B. The lowest billing rate alone
C. Availability without training under the stated circumstances
D. A client's informal preference only

98. During an independent work-product review, determine the answer: why should project files preserve decision history?

A. To avoid communicating with clients under the stated circumstances
B. To replace final deliverables under the stated circumstances
C. To show what was decided, why, by whom, and from what evidence
D. To prevent every future dispute under the stated circumstances

99. Apply the controlling surveying concept to the following: what is the ethical response to pressure to certify unverified work?

A. Delegate the signature to unlicensed staff
B. Decline certification until adequate review supports it
C. Remove limiting notes from the deliverable
D. Certify if the deadline is urgent

100. A crew chief asks for the best conclusion in this situation: what is the arithmetic mean of 10.2, 10.4, 10.3, and 10.5?

A. 10.30
B. 10.35
C. 10.40
D. 10.45

101. For this office or field check, identify the correct choice: for a normal distribution, approximately what percentage lies within one standard deviation of the mean?

A. 68%
B. 99.7%
C. 50%
D. 95%

102. Use standard surveying practice to resolve this question: what is the median of 3, 8, 5, 11, and 6?

A. 6.6
B. 8
C. 5
D. 6

103. In Practice Exam 16, evaluate this field situation: if independent random errors have standard deviations 0.03 ft and 0.04 ft, what is the combined standard deviation?

A. 0.01 ft
B. 0.05 ft
C. 0.035 ft
D. 0.07 ft

104. A surveying team must select the technically sound response: solve 3x + 7 = 25.?

A. x = 10
B. x = 4
C. x = 8
D. x = 6

105. During an independent work-product review, determine the answer: a right triangle has legs 9 and 12. What is the hypotenuse?

A. 18
B. 21
C. 15
D. 13

106. Apply the controlling surveying concept to the following: convert 2.5 radians to degrees, nearest 0.1°.?

A. 143.2°
B. 57.3°
C. 90.0°
D. 159.2°

107. A crew chief asks for the best conclusion in this situation: what does standard deviation measure?

A. Legal tolerance automatically
B. Dispersion of observations around their mean
C. The largest observation only
D. Systematic bias from truth

108. For this office or field check, identify the correct choice: a measurement has weight 4 and another has weight 1. What fraction of their weighted mean comes from the first measurement?

A. 4/5
B. 1/2
C. 4
D. 1/5

109. Use standard surveying practice to resolve this question: what is the probability of rolling an even number on a fair six-sided die?

A. 1/6
B. 1/3
C. 2/3
D. 1/2

110. In Practice Exam 16, evaluate this field situation: if y varies directly with x and y = 18 when x = 6, what is y when x = 10?

A. 60
B. 22
C. 30
D. 24

Practice Exam 16: Answer Key and Explanations

1. D — The correct selection is Use balanced backsight and foresight distances because equal sight lengths cause the line-of-sight error to affect backsight and foresight readings nearly equally, so it cancels in the elevation difference. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

2. A — The correct selection is To ensure measured directions and distances originate at the intended station because an offset instrument changes the geometric origin of observations and introduces eccentricity into angles and distances. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

3. C — The correct selection is −0.04 ft because the accumulated correction has the opposite sign of the closure and equals two-thirds of the total misclosure. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

4. A — The correct selection is Observe an independent known check point because an independent known point tests the combined receiver, correction link, datum, localization, and antenna-height setup. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

5. D — The correct selection is Sight a known backsight and set its direction because a known backsight supplies the reference azimuth or bearing from which subsequent horizontal directions are measured. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

6. B — The correct selection is 499.70 ft because horizontal distance equals slope distance times the sine of the zenith angle when zenith is measured from vertical. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

7. C — The correct selection is To account for the reflector's effective optical offset because different reflector assemblies return the signal from an effective point that may be offset from the physical prism center. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

8. B — The correct selection is The measurement method and antenna reference point because processing requires the correct geometric relation between the measured point and the antenna reference point. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

9. A — The correct selection is The line-of-sight adjustment of a level because observations from two positions reveal whether the level's line of sight is truly horizontal when the bubble or compensator is centered. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

10. D — The correct selection is 250.10 ft because a tape that is too long spans more true distance than its nominal graduations indicate, so the recorded distance requires a positive correction. Other options

invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

11. B — The correct selection is Measure the angle in both direct and reverse faces because face-left and face-right observations provide redundancy and cancel or expose several instrumental errors. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

12. A — The correct selection is To document spatial relationships and support later interpretation because a sketch preserves context that coordinates and codes alone may not communicate during processing or retracement. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

13. C — The correct selection is 616.80 ft because height of instrument is the known elevation plus the backsight rod reading. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

14. D — The correct selection is So the contractor knows the exact location to which the grade value applies because grade information is usable only when its physical reference, offset, and intended elevation point are unambiguous. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

15. A — The correct selection is Strong heat shimmer along a near-ground sight line because temperature gradients near the ground bend and destabilize the line of sight, reducing pointing and distance reliability. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

16. D — The correct selection is Stop production and investigate the setup, control, and data because a failed independent check indicates that the reference framework or observation process may be wrong and must be resolved before more work. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

17. B — The correct selection is +1.42 ft because the elevation change for one leveling setup equals backsight minus foresight. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

18. C — The correct selection is One map unit represents 24,000 of the same ground units because a representative fraction is dimensionless and relates identical units on the map and ground. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then

checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

19. D — The correct selection is Closely spaced contour lines because a large elevation change over a short horizontal distance produces close contour spacing. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

20. C — The correct selection is Transform positions from a curved reference surface to a plane because mapping planar coordinates requires a mathematical transformation from an ellipsoid or sphere. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

21. A — The correct selection is Vector features because parcels and centerlines are discrete objects represented efficiently by polygons and lines. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

22. B — The correct selection is Three-dimensional measurement from paired images because common image content viewed from different perspectives creates parallax that supports depth measurement. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

23. A — The correct selection is Geometric displacement caused by terrain and sensor perspective because orthorectification uses orientation and terrain information to produce planimetrically consistent imagery. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

24. D — The correct selection is Digital terrain model because a terrain model represents ground-surface elevations while excluding vegetation and structures when properly classified. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

25. C — The correct selection is Document the dataset's source, accuracy, dates, and limitations because users need lineage, reference-system, accuracy, and currency information to judge appropriate use. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

26. B — The correct selection is Grid north because grid north follows the mapped coordinate grid and may differ from true or geodetic north by convergence. Other options invoke an unrelated principle or

reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

27. D — The correct selection is 125 ft because two and one-half map inches represent 1,500 ground inches, which converts to 125 feet. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

28. C — The correct selection is Legend because the legend translates graphical conventions into the features or categories they represent. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

29. B — The correct selection is To preserve abrupt changes in surface slope because breaklines constrain triangulation along ridges, curbs, channels, and other discontinuities. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

30. A — The correct selection is It rapidly collects dense three-dimensional point measurements because laser ranging combined with position and orientation yields dense elevation samples over broad areas. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

31. C — The correct selection is Compare independent check-point coordinates with image positions because independent, higher-accuracy checkpoints provide measurable residuals against mapped image positions. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

32. B — The correct selection is The plan's orientation relative to its stated north reference because readers must know how drawing directions relate to the chosen north basis. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

33. A — The correct selection is The original monument called for in the conveyance because an original called-for monument physically identifies the position established by the creating survey. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

34. D — The correct selection is A nonpossessory right to use land owned by another because an easement burdens one estate or benefits another without transferring full possessory title. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then

checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

35. A — The correct selection is Metes-and-bounds description because metes and bounds traces the perimeter through calls that return to the point of beginning. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

36. D — The correct selection is The parcel burdened by an easement because the servient estate carries the use restriction while a dominant estate may receive the benefit. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

37. B — The correct selection is The earlier conveyance generally has priority because a grantor normally cannot convey an interest already transferred in an earlier valid conveyance. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

38. C — The correct selection is Acquisition of title through possession meeting statutory elements because jurisdictions may recognize title after possession is actual, open, hostile, continuous, and otherwise compliant for the statutory period. Other options use an unrelated principle or reverse the relationship. Checking the stated facts, units, and practical meaning confirms the keyed response.

39. B — The correct selection is The instrument filed in the public land records because recording statutes make properly indexed public instruments available as legal notice to later parties. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

40. D — The correct selection is An improvement extending unlawfully onto another's land because an encroachment is a physical intrusion, unlike an easement that authorizes a defined use. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

41. C — The correct selection is The identified natural monument because traditional evidence priority favors reliable monuments over measurements because measurements often describe, rather than create, the boundary. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

42. A — The correct selection is Create a public record of lots, streets, and dedications because recordation documents the approved division and provides references for later lot conveyances. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule,

then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

43. A — The correct selection is Base line because a base line is the principal east-west axis from which township tiers are referenced. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

44. D — The correct selection is Six miles by six miles because township and range lines nominally form a six-mile square containing thirty-six sections. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

45. C — The correct selection is A right associated with land bordering a river or stream because riparian doctrine concerns water-boundary interests of land adjoining flowing water. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

46. B — The correct selection is The point where the boundary traverse starts and returns because a closed metes-and-bounds description traces courses from and back to a designated beginning point. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

47. B — The correct selection is Reliable accessories, witness evidence, and original survey records because reestablishment begins with evidence tied to the original corner before resorting to proportionate measurement. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

48. D — The correct selection is The parcels are created together under a common plan because simultaneous parcels derive from one creating scheme, so shortages or excesses may be treated collectively. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

49. C — The correct selection is The broadest private ownership interest recognized by law because fee simple generally includes indefinite duration and broad rights subject to governmental powers and private encumbrances. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

50. A — The correct selection is Reconcile record evidence with physical and testimonial evidence because boundary location is an evidence problem requiring evaluation of the record, monuments,

occupation, and credible testimony. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

51. B — The correct selection is A sudden, perceptible change in a watercourse because avulsion is abrupt, unlike accretion or erosion, and may receive different boundary treatment. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

52. D — The correct selection is A future interest returning property to a grantor or successor because a reversion remains after a grantor conveys a lesser estate that may later terminate. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

53. A — The correct selection is Boundary evidence can be reported without practicing law because professional scope requires distinguishing a survey opinion on location from unauthorized legal advice on title. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

54. C — The correct selection is A reference framework for horizontal coordinates because a horizontal datum defines the reference surface, origin, orientation, and realization supporting positions. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

55. A — The correct selection is The separation between the geoid and reference ellipsoid because geoid height links ellipsoidal and orthometric height through the adopted sign convention. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

56. D — The correct selection is 343.1 ft because rearranging h equals H plus N gives H equals h minus N. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

57. B — The correct selection is Corrections derived from a receiver at a known position because a known base estimates shared satellite, clock, orbit, and atmospheric error components. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

58. C — The correct selection is The angle between grid north and geodetic north because projection geometry causes mapped meridians and grid lines to differ except along special lines. Other options

invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

59. D — The correct selection is Repeatability of measurements because precision concerns agreement among repeated observations, whereas accuracy concerns agreement with truth. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

60. A — The correct selection is They permit error detection and adjustment because more observations than the minimum create checks and allow residual-based evaluation. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

61. C — The correct selection is The geoid or an adopted mean-sea-level surface because orthometric height follows the gravity-related plumb line from the geoid to the point. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

62. B — The correct selection is Planar coordinates designed for limited regional distortion because zones and projections limit scale distortion within defined jurisdictions. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

63. A — The correct selection is 2,000.20 ft because ground distance is grid distance divided by the combined factor under the stated convention. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

64. D — The correct selection is Provide a common reference for elevations because consistent elevations require a realized gravity-related reference surface and benchmark network. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

65. C — The correct selection is Poor satellite geometry because changing constellations can improve dilution of precision and strengthen the position solution. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

66. B — The correct selection is A repeatable bias following a predictable pattern because systematic effects can often be modeled, calibrated, or canceled through observation procedures. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

67. B — The correct selection is A range associated with a stated level of statistical confidence because a confidence interval quantifies uncertainty using the sampling distribution and selected confidence level. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

68. D — The correct selection is 500 ft because line length is the square root of latitude squared plus departure squared. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

69. A — The correct selection is 200 ft because coordinate differences are 120 and 160 feet, forming a 3-4-5 triangle scaled by forty. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

70. C — The correct selection is 5.00 acres because area in square feet divided by 43,560 gives acres. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

71. D — The correct selection is 314.16 ft because arc length equals radius times the central angle expressed in radians. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

72. B — The correct selection is 10.0 ft because grade as a decimal multiplied by horizontal distance gives elevation change. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

73. A — The correct selection is 18,000 sq ft because triangle area is one-half times base times perpendicular height. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

74. C — The correct selection is 501.45 ft because ending elevation equals beginning elevation plus total backsights minus total foresights. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

75. A — The correct selection is 1:10,000 because relative precision denominator equals total traverse length divided by linear misclosure. Other options invoke an unrelated principle or reverse the necessary

relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

76. C — The correct selection is 6,000 cu ft because volume equals average cross-sectional area multiplied by interval length. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

77. B — The correct selection is 181.99 ft because tangent length equals radius times tangent of one-half the central angle. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

78. D — The correct selection is 35° because a northeast quadrant bearing converts directly to an azimuth measured clockwise from north. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

79. D — The correct selection is S 40° W because an azimuth between 180 and 270 degrees lies southwest and is measured from south. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

80. A — The correct selection is 4.0% because percent grade equals rise divided by horizontal distance times one hundred. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

81. C — The correct selection is 106 ft because a uniform grade changes linearly, so the midpoint elevation is the average of endpoint elevations. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

82. B — The correct selection is 660 ft because ten acres equals 435,600 square feet and the square root gives the side length. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

83. D — The correct selection is 100 ft because the coordinate differences form perpendicular legs and the Pythagorean theorem gives distance. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

84. C — The correct selection is 52.3 ft because vertical component equals slope distance multiplied by sine of the slope angle. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

85. B — The correct selection is −0.05 ft because Bowditch distributes correction in proportion to course length over total traverse length. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

86. A — The correct selection is 1.75 ft cut because existing ground exceeds design grade by 1.75 feet, so material must be removed. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

87. D — The correct selection is Define deliverables, responsibilities, assumptions, and exclusions because a clear scope aligns expectations and provides a basis for schedule, fee, and change management. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

88. A — The correct selection is Document the change and obtain authorization before proceeding because written change control connects added work to revised fee, schedule, responsibility, and client approval. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

89. B — The correct selection is Claims arising from alleged professional errors or omissions because professional liability coverage is designed around negligence allegations in professional services, subject to policy terms. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

90. C — The correct selection is Complete a hazard assessment and implement an approved traffic-control plan because road work requires planned controls, positioning, visibility, communication, and compliance with applicable traffic requirements. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

91. C — The correct selection is Establish processes that prevent defects and promote consistent quality because quality assurance designs the system, while quality control checks particular work products. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

92. D — The correct selection is Contemporaneous time entries tied to tasks and authorization because timely task-level records connect labor and expense to contracted or approved work. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

93. A — The correct selection is $8,400 because the field budget equals the total fee multiplied by thirty-five percent. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

94. B — The correct selection is A competing interest that may impair or appear to impair professional judgment because ethical practice requires disclosure and appropriate management of interests affecting independent judgment. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

95. C — The correct selection is Promptly notify responsible parties with verified facts and a correction plan because timely, factual communication limits harm and supports transparent corrective action. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

96. D — The correct selection is Actual cost and earned progress against the approved budget because cost performance is meaningful when expenditures are evaluated with accomplished work and remaining obligations. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

97. A — The correct selection is The worker's demonstrated competence and appropriate supervision because professional responsibility requires matching task complexity to qualifications while maintaining review and supervision. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

98. C — The correct selection is To show what was decided, why, by whom, and from what evidence because a traceable record supports continuity, quality review, billing, and defensible professional practice. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

99. B — The correct selection is Decline certification until adequate review supports it because a professional certification represents accountable judgment and cannot properly exceed the evidence and review performed. Other options invoke an unrelated principle or reverse the necessary relationship.

Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

100. B — The correct selection is 10.35 because the arithmetic mean is the sum of four observations divided by four. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

101. A — The correct selection is 68% because the empirical rule assigns about sixty-eight percent within one standard deviation. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

102. D — The correct selection is 6 because after sorting the five values, the middle observation is six. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

103. B — The correct selection is 0.05 ft because independent standard deviations combine by the square root of the sum of squares. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

104. D — The correct selection is $x = 6$ because subtracting seven and dividing by three isolates x. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

105. C — The correct selection is 15 because the Pythagorean theorem gives the square root of nine squared plus twelve squared. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

106. A — The correct selection is 143.2° because degrees equal radians multiplied by 180 divided by pi. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

107. B — The correct selection is Dispersion of observations around their mean because standard deviation summarizes the typical spread of observations relative to their mean. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

108. A — The correct selection is 4/5 because the first observation's normalized weight is four divided by the total weight of five. Other options invoke an unrelated principle or reverse the necessary

relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors.

109. D — The correct selection is 1/2 because three of six equally likely outcomes are even, so the probability is one-half. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.

110. C — The correct selection is 30 because direct variation gives a constant ratio of three, so ten maps to thirty. Other options invoke an unrelated principle or reverse the necessary relationship. Stating the controlling rule, then checking units, signs, and practical meaning, confirms the keyed response and eliminates unsupported distractors. This provides a direct reasonableness check.