PRACTICE EXAM 9: NYSTCE GRADES 1-6 MATHEMATICS (222) - 100 QUESTIONS

This independently written expanded practice exam contains 100 selected-response questions aligned to the official NYSTCE Field 222 Mathematics selected-response competencies. The actual Part Two: Mathematics test contains 40 selected-response items and 1 constructed-response item, provides 2 hours 15 minutes of testing time, uses a passing score of 520, and provides a standard 4-function on-screen calculator. Choose the single best answer for each item before consulting the answer key and explanations.

1. A quality-control display reads 48.30567 kilograms. What value does the digit 6 contribute to this measurement?

A. 0.00006 kilogram
B. 0.0006 kilogram
C. 0.006 kilogram
D. 6 kilograms

2. A theatre workshop has 12 5/8 yards of fabric. After 4 7/12 yards are used, how many yards remain?

A. 7 23/24 yards
B. 8 5/24 yards
C. 9 1/24 yards
D. 8 1/24 yards

3. A 14.49-liter batch of solution is portioned equally into 4.2-liter allotments. How many allotments does the batch contain?

A. 0.345 allotment
B. 3.45 allotments
C. 3.05 allotments
D. 60.858 allotments

4. Three rotating signs repeat their patterns every 16 seconds, 20 seconds, and 28 seconds. What is the least number of seconds before all three patterns begin together again?

A. 112 seconds
B. 280 seconds
C. 560 seconds
D. 1,120 seconds

5. A surveyor records four below-reference elevations: -1.37, -11/8, -1.402, and -1.39. Which reading represents the lowest elevation?

A. -1.37
B. -1.402
C. -11/8
D. -1.39

6. A scoring rule is represented by 96 ÷ 12 + 2(9 - 5)^2. What score does the rule produce?

A. 24
B. 32
C. 40
D. 72

7. Seven equal donations are combined, then $18 is removed for supplies, leaving $87. How many dollars was each donation?

A. x = 9.86
B. x = 13
C. x = 105
D. x = 15

8. A measurement is recorded as 0.875 of a unit. Which fraction expresses the same amount in simplest form?

A. 7/8
B. 7/10
C. 8/9
D. 14/25

9. Fifteen identical notebooks cost $28.05 altogether. What is the unit price for one notebook?

A. $1.78
B. $1.97
C. $1.87
D. $2.05

10. During a 5.25-hour delivery shift, an odometer records 315 miles of travel. Which rate gives miles traveled for each hour?

A. 52.5 miles per hour
B. 63 miles per hour
C. 1,653.75 miles per hour
D. 60 miles per hour

11. A display uses silver and teal cards in the ratio 7:9. If 56 silver cards are used, how many teal cards preserve the ratio?

A. 72
B. 63
C. 64
D. 81

12. Thirty diners will receive soup prepared at a rate of 5 cups of stock for every 12 diners. Determine the stock needed for the larger group.

A. 10 cups
B. 12.5 cups
C. 13 cups
D. 72 cups

13. A museum records that 18% of 750 visitors attend a special exhibit. How many visitors attend the exhibit?

A. 75
B. 135
C. 125
D. 615

14. A $125 backpack is marked down by 24%. What sale price remains before tax?

A. $30.00
B. $101.00
C. $95.00
D. $155.00

15. A registration charge begins at $180. Organizers add a surcharge equal to 15% of the original charge. What final amount is collected?

A. $153.00
B. $195.00
C. $270.00
D. $207.00

16. A storage tank drops from 1,500 liters to 1,230 liters. What percent decrease occurred?

A. 18%
B. 15%
C. 22%
D. 82%

17. The proportion 5/8 = x/56 is true. What value must x have?

A. 28
B. 40
C. 35
D. 89.6

18. Red, blue, and gold tokens are mixed in the ratio 2:5:3. If the container holds 120 tokens, how many are blue?

A. 60
B. 24
C. 36
D. 50

19. Each loaf requires a 7/16-pound portion of dough. Starting with 5 1/4 pounds, how many full loaf portions can be measured?

A. 7 loaves
B. 12 loaves
C. 10 loaves
D. 21 loaves

20. A cistern is 5/6 full. A maintenance crew drains 2/5 of the water currently inside. What fraction of the cistern's total capacity is drained?

A. 2/11
B. 3/10
C. 7/10
D. 1/3

21. A drone begins 62 meters above a reference level, descends 89 meters, and then rises 18 meters. What is its final position relative to the reference level?

A. -45 meters
B. 9 meters
C. -9 meters
D. 169 meters

22. A weather station records -11.5°C before dawn and 4.75°C in the afternoon. By how many degrees did the temperature increase?

A. 16.25°C
B. 6.75°C
C. 15.25°C
D. -16.25°C

23. A research elevator changes vertical position by -14 meters per minute for 9 minutes. What is the total change in position?

A. -23 meters
B. 126 meters
C. -1.56 meters
D. -126 meters

24. Take the distance from zero of -31. From that amount subtract the distance separating -4 and 9. What number remains?

A. -18
B. 18
C. 31
D. 44

25. A digital archive contains 2.4 × 10^4 records. A second archive contains 3 × 10^3 times as many. How many records are in the second archive, in scientific notation?

A. 7.2 × 10^7
B. 7.2 × 10^6
C. 7.2 × 10^8
D. 5.4 × 10^7

26. Compute (9.6 × 10^8) ÷ (3.2 × 10^4) and write the quotient in normalized scientific notation.

A. 3 × 10^3
B. 3 × 10^12
C. 3 × 10^4
D. 6.4 × 10^4

27. Which decimal is the best approximation of $\sqrt{83}$ to the nearest tenth?

A. 8.3
B. 9.8
C. 41.5
D. 9.1

28. A cube has volume 1,728 cubic units. How many units long is each edge?

A. 6 units
B. 12 units
C. 24 units
D. 576 units

29. Among the four choices, which value does not belong to the set of rational numbers?

A. -1.125
B. 5/7
C. $\sqrt{23}$
D. 0.121212...

30. The repeating decimal 0.363636... has the block 36 repeated indefinitely. Which fraction is equivalent to it?

A. 9/25
B. 18/55
C. 11/36
D. 4/11

31. Use the quotient rule for exponents to evaluate $7^9 \div 7^4$.

A. 7^{13}
B. 7^5
C. 7^{36}
D. 7^4

32. Decompose 840 completely into prime factors. Which option displays the resulting product of primes?

A. $2^3 \times 3 \times 5 \times 7$
B. $2^2 \times 3 \times 5 \times 7$
C. $2^3 \times 3^2 \times 5$
D. $2^4 \times 3 \times 5 \times 7$

33. Two repeating signals have cycle lengths of 18 seconds and 35 seconds. What is the first positive elapsed time that belongs to both schedules?

A. 53 seconds
B. 630 seconds
C. 315 seconds
D. 1,260 seconds

34. What is the maximum number of identical no-leftover groups that can be formed from 168 pencils and 252 erasers?

A. 42 kits
B. 56 kits
C. 84 kits
D. 420 kits

35. A 24.3-meter cable is cut into equal sections that are 0.6 meter long. How many sections are produced?

A. 4.05 sections
B. 14.58 sections
C. 243 sections
D. 40.5 sections

36. After a 25% increase, a theater club has 625 members. How many members did it have before the increase?

A. 500
B. 468.75
C. 600
D. 781.25

37. In a proportional relationship, $x = 8$ corresponds to $y = 22$. What is the constant of proportionality k in $y = kx$?

A. 2.75
B. 0.36
C. 14
D. 176

38. For every nonzero input in a proportional relationship, the quotient y/x equals $5/6$, and the graph includes the origin. Select its equation.

A. $y = (6/5)x$
B. $y = x + 5/6$
C. $x = y + 5/6$
D. $y = (5/6)x$

39. A copy center prints 108 brochures in 9 minutes at a constant rate. How many brochures will it print in 18 minutes?

A. 117 brochures
B. 198 brochures
C. 216 brochures
D. 972 brochures

40. A blueprint key says 4 centimeters corresponds to 26 actual meters. A particular wall spans 11 centimeters on the drawing. Determine the wall's real length.

A. 28.6 meters
B. 71.5 meters
C. 66 meters
D. 286 meters

41. A hiking route is 4.75 kilometers long. What is the same distance in meters?

A. 475 meters
B. 47,500 meters
C. 0.00475 meter
D. 4,750 meters

42. In a collection, the ratio of copper tokens to all tokens is 9:25. What fraction of the collection is copper?

A. 9/16
B. 16/25
C. 9/25
D. 25/9

43. Place -5/6, -0.81, -0.805, and -4/5 on a number line. Which option lists them from leftmost to rightmost?

A. -5/6, -0.81, -0.805, -4/5
B. -4/5, -0.805, -0.81, -5/6
C. -0.81, -5/6, -4/5, -0.805
D. -5/6, -0.805, -0.81, -4/5

44. Follow the nesting and sign rules in the numerical expression -3[8 - 2(-4)] + 7. Which integer results?

A. -17
B. -41
C. 41
D. 55

45. Evaluate the product 3^4 × 3^2 by first combining powers with the same base.

A. 3^2
B. 3^8
C. 9^6
D. 3^6

46. A school garden harvest rises from 640 pounds to 752 pounds. What is the percent increase?

A. 14.9%
B. 17%
C. 17.5%
D. 85.1%

47. A number m satisfies m ÷ 8 = 11. What is m?

A. 3
B. 88
C. 19
D. 88/8

48. The expression 6p + 7 must produce an output of 79. Which proposed value of p generates that output?

A. p = 12
B. p = 10
C. p = 13
D. p = 86

49. Which listed value makes the inequality 4x - 9 > 27 true?

A. x = 9.5
B. x = 8
C. x = 9
D. x = 7

50. For a = -4 and b = 5, what is the value of 3a^2 + 2b?

A. -38
B. 58
C. 26
D. 106

51. Simplify 5(3x - 4) - 2x by distributing and combining like terms.

A. 15x - 22
B. 13x - 4
C. 13x - 20
D. 17x - 20

52. Which algebraic expression means 'three times n, decreased by seven'?

A. 7 - 3n
B. 3(n - 7)
C. 7n - 3
D. 3n - 7

53. Which expression is equivalent to 4(2y - 3) + 3y after the parentheses are removed and all like terms are collected?

A. 8y - 9
B. 11y - 12
C. 11y - 3
D. 15y - 12

54. A point has coordinates (7, -5). In which quadrant is the point located?

A. Quadrant IV
B. Quadrant I
C. Quadrant II
D. Quadrant III

55. On the line y = -2, one marker is positioned at x = -12 and another at x = 4. What horizontal separation is between the markers?

A. 8 units
B. 10 units
C. 16 units
D. 14 units

56. Floor covering fills the inside of a rectangle 16.5 feet long and 3.2 feet wide. How many square feet are covered?

A. 19.7 square feet
B. 39.6 square feet
C. 105.6 square feet
D. 52.8 square feet

57. A triangle has a 22-meter side chosen as its base and a 9-meter perpendicular altitude to that side. Determine the area enclosed.

A. 99 square meters
B. 31 square meters
C. 198 square meters
D. 279 square meters

58. Cutting and rearranging a parallelogram would form a rectangle with base 8.4 centimeters and height 7.5 centimeters. What area is preserved?

A. 15.9 square centimeters
B. 63 square centimeters
C. 31.5 square centimeters
D. 126 square centimeters

59. For a trapezoid, average the parallel side lengths 12 inches and 20 inches, then multiply by a 6.5-inch height. What area results?

A. 80 square inches
B. 130 square inches
C. 104 square inches
D. 208 square inches

60. A straight segment through the center of a circle measures 18 centimeters from edge to edge. Express the circle's boundary length in terms of pi.

A. 9π centimeters
B. 36π centimeters
C. 81π centimeters
D. 18π centimeters

61. The center-to-edge distance of a circular garden is 7 meters. Express the number of square meters inside the circle in terms of pi.

A. 14π square meters
B. 49π square meters
C. 28π square meters
D. 98π square meters

62. A carton has an 11-inch by 6-inch rectangular base and rises 4 inches. How many cubic inches of space are inside?

A. 264 cubic inches
B. 21 cubic inches
C. 132 cubic inches
D. 528 cubic inches

63. A prism has a 12-centimeter by 10-centimeter rectangular base and contains 720 cubic centimeters. What perpendicular height gives that volume?

A. 5 centimeters
B. 60 centimeters
C. 86.4 centimeters
D. 6 centimeters

64. What is the total surface area of a rectangular prism measuring 5 cm by 7 cm by 9 cm?

A. 143 square centimeters
B. 315 square centimeters
C. 286 square centimeters
D. 630 square centimeters

65. One angle in a linear pair measures 124°. What is the measure of the other angle?

A. 56°
B. 34°
C. 66°
D. 124°

66. A right angle is divided into two angles. One measures 37°. What is the measure of the other angle?

A. 43°
B. 63°
C. 143°
D. 53°

67. A triangular frame already uses angles of 58 degrees and 64 degrees. What measure must the remaining corner contribute so the frame closes?

A. 48°
B. 58°
C. 68°
D. 122°

68. A quadrilateral is known to be a square. Which property is guaranteed no matter how large the square is or how it is oriented?

A. It has exactly one pair of parallel sides.
B. Its diagonals always have different lengths.
C. It has four right angles and four congruent sides.
D. It has no lines of symmetry.

69. A rectangle on a blueprint measures 5 cm by 8 cm. Every dimension is enlarged by a scale factor of 2.5. What are the new dimensions?

A. 7.5 cm by 10.5 cm
B. 10 cm by 16 cm
C. 12.5 cm by 20 cm
D. 25 cm by 40 cm

70. Reflect the point (-6, 4) across the y-axis. What are the coordinates of its image?

A. (-6, -4)
B. (6, -4)
C. (-4, 6)
D. (6, 4)

71. A board is 8 feet 5 inches long. How many inches long is the board?

A. 85 inches
B. 101 inches
C. 96 inches
D. 113 inches

72. A session starts when the clock shows 10:37 a.m. and finishes at 1:12 p.m. Express the entire duration as a number of minutes.

A. 155 minutes
B. 135 minutes
C. 145 minutes
D. 175 minutes

73. Five reading logs contain 22, 27, 35, 19, and 32 pages. What is the mean number of pages?

A. 25 pages
B. 27 pages
C. 28 pages
D. 135 pages

74. After arranging 11, 4, 20, 7, 15, 9, and 13 in increasing order, which observation occupies position four?

A. 9
B. 12
C. 13
D. 11

75. For the readings 42, 18, 57, 33, 24, and 49, subtract the smallest reading from the largest. What spread is obtained?

A. 39
B. 24
C. 33
D. 75

76. The five scores 68, 76, 82, 88, and 96 are pooled and then divided equally among five positions. What equal-share value results?

A. 80
B. 84
C. 82
D. 410

77. A bag contains 24 counters, and 9 are purple. If one counter is selected at random, what is the probability of selecting purple?

A. 3/5
B. 3/8
C. 5/8
D. 9/16

78. Flowering and not flowering are complementary outcomes. If the chance of flowering is 0.73, what chance belongs to the other outcome?

A. 0.17
B. 0.37
C. 0.27
D. 1.73

79. An outcome is formed by pairing one of 5 spinner sections with one of 6 number-cube faces. How many distinct ordered pairs can occur?

A. 30
B. 11
C. 25
D. 36

80. A player wins 21 times in 70 trials of a game. What is the experimental probability of a win?

A. 3/7
B. 7/10
C. 21/50
D. 3/10

81. Six numbers must average 24. Five entries are 18, 20, 25, 27, and 31. Which missing entry makes the required average?

A. 19
B. 24
C. 23
D. 29

82. Split 2, 6, 8, 10, 13, 17, 19, 25 into two four-number halves. Subtract the lower-half median from the upper-half median. What result is obtained?

A. 7
B. 14
C. 23
D. 11

83. Five ribbon marks show lengths 1/4, 1/2, 3/4, 1, and 1 1/2 meters. What length is obtained when all five are added?

A. 4 meters
B. 3 meters
C. 3 1/2 meters
D. 4 1/2 meters

84. First find the mean of 3, 5, 7, 7, and 8. Then average the absolute distances of the five values from that mean. What value results?

A. 1.2
B. 1.6
C. 2
D. 8

85. Using 4, 6, 6, 9, and 10, compute the average absolute distance of the data values from their arithmetic mean.

A. 1.4
B. 2.5
C. 2
D. 7

86. Score-band counts are 5 for 60-69, 8 for 70-79, 11 for 80-89, and 6 for 90-99. How many students are in the top two bands combined?

A. 17
B. 11
C. 19
D. 25

87. A climbing gym charges a \$9 admission fee plus \$3 for each route attempted. A visitor spends \$30 in all. How many routes were attempted?

A. 3 routes
B. 7 routes
C. 10 routes
D. 13 routes

88. A rectangle's length and width are $x + 4$ and $x - 2$. Because its perimeter is 36, the sum of length and width is 18. Which x satisfies these conditions?

A. $x = 5$
B. $x = 9$
C. $x = 16$
D. $x = 8$

89. A third grader computes 34×6 as 42 by treating the 3 tens in 34 as 3 ones. Which teacher response best develops place-value understanding?

A. Tell the student to memorize that multiplication answers must have more digits than either factor.
B. Use an area or base-ten model to show 6 groups of 30 and 6 groups of 4, then combine the partial products.
C. Ask the student to add 34 and 6 repeatedly without discussing tens and ones.
D. Replace the problem with 3×6 so the place-value issue no longer appears.

90. A student adds 2/3 + 1/4 and writes 3/7 by adding numerators and denominators. Which intervention most directly addresses the misconception?

A. Confirm 3/7 because both numerators and denominators should always be added in fraction addition.
B. Have the student convert both fractions to whole numbers before adding them.
C. Teach the student to choose whichever denominator is larger and keep it unchanged.
D. Use fraction strips for thirds and fourths to create equivalent twelfths before combining the represented parts.

91. A learner claims 3.2 × 10 = 3.20 because adding a zero leaves the value unchanged. What instructional move best builds conceptual understanding?

A. Tell the learner to append a zero after every decimal multiplication problem regardless of the multiplier.
B. Have the learner round 3.2 to 3 before multiplying so decimals are avoided.
C. Use a place-value chart to show each digit shifting one place toward a value ten times as large, producing 32.
D. Explain that multiplication by 10 changes only the decimal point symbol, not the value of any digit.

92. A sixth grader sees the relationship y = 3x and says that every output is found by adding 3 to the input. Which task best challenges that reasoning?

A. Build a table for several x-values and compare both y - x and y/x so the constant multiplicative ratio becomes visible.
B. Ask the student to copy y = 3x ten times until the notation becomes familiar.
C. Replace x and y with different letters so the student cannot associate the equation with addition.
D. Tell the student that all equations with two variables represent multiplication without examining values.

93. On a thermometer-style number line, a learner places -0.60 to the right of -0.45 because 60 exceeds 45. Which representation best repairs the comparison?

A. Remove the negative signs and compare only 0.60 with 0.45.
B. Tell the student that the decimal with more digits is always smaller.
C. Place both values on a number line and compare their positions relative to zero.
D. Round both values to -1 so the student sees them as equal.

94. Students are sorting angles, and one student labels a 92° angle as acute because it looks narrow. What teacher move best strengthens angle-measure reasoning?

A. Compare the angle with a constructed 90° benchmark and use a protractor to connect the visual comparison to its measured size.
B. Accept the classification because angle type should be based mainly on appearance.
C. Tell students that every angle drawn with short rays is acute.
D. Have students memorize the word obtuse without measuring or comparing any angles.

95. Students survey only members of the school soccer team to estimate how often all sixth graders exercise after school. What should the teacher emphasize?

A. Soccer players automatically represent the entire grade because they attend the same school.
B. The sample may be biased, so students should collect responses from a broader random or representative group of sixth graders.
C. Surveying more soccer players removes the bias even if no other students are included.
D. The class should generalize the team results to all sixth graders without qualification.

96. A student solves 7 + 5 = □ + 4 by putting 12 in the box because 7 + 5 equals 12. Which representation best develops the relational meaning of the equal sign?

A. Tell the student that the equal sign always means 'write the answer next.'

B. Erase everything after the equal sign so the student can focus on 7 + 5.

C. Replace the equal sign with an arrow pointing toward the box.

D. Use a balance model showing 12 on the left and require the right side to total 12, leading to 8 + 4.

97. To plot (4, -2), a learner moves 2 units left and then 4 units up. Which teacher prompt most directly reconnects each coordinate with its axis?

A. Tell the student that either coordinate may be used first because ordered pairs are interchangeable.

B. Ask which coordinate controls horizontal movement, move first to x = 4, and then move vertically to y = -2.

C. Have the student change both numbers to positive values before graphing.

D. Ask the student to add 4 and -2 and place the point at 2 on the x-axis.

98. A class needs vans for 53 students, and each van holds 8 students. A learner divides and says 6 vans are enough because 53 ÷ 8 = 6 remainder 5. What is the best next step?

A. Accept 6 because remainders are always discarded in division word problems.

B. Round 53 down to 48 before dividing so the quotient has no remainder.

C. Use counters or a grouping diagram to show six full vans plus five students still needing a seventh van.

D. Tell the learner to write 6.625 vans and stop without interpreting the context.

99. A student labels the volume of a box as 48 square centimeters after counting 48 unit cubes. Which activity best clarifies the appropriate unit?

A. Compare covering one face with square tiles to filling the box with unit cubes, and discuss why filling uses cubic units.

B. Tell the student that square units and cubic units are interchangeable for three-dimensional objects.

C. Have the student memorize the abbreviation cm^3 without using any physical model.

D. Ask the student to count only the cubes touching the bottom face and call that the volume.

100. During a property-based quadrilateral sort, a learner places every rhombus outside the parallelogram group because all four rhombus sides are equal. Which activity best develops the correct hierarchy?

A. Teach rhombi and parallelograms as unrelated categories because they have different names.

B. Classify quadrilaterals only by how wide or narrow they appear in a drawing.

C. Use one prototype of each shape and require students to match new figures by visual resemblance alone.

D. Sort quadrilaterals by defining properties and show that every rhombus has two pairs of parallel opposite sides, satisfying the definition of a parallelogram.

Practice Exam 9: Answer Key and Explanations

1. A — The digit 6 is in the hundred-thousandths place, five positions to the right of the decimal point. Its value is therefore six hundred-thousandths, written 0.00006. Moving the digit one or two places left would produce the larger decimal distractors, while treating it as a whole-number digit gives 6. The original conditions support the result.

2. D — Use a common denominator of 24. Twelve and five eighths is 303/24, and four and seven twelfths is 110/24. Subtracting gives 193/24, which converts to 8 1/24 yards. The nearby distractors can result from subtracting numerators and denominators separately or from regrouping incorrectly. The original conditions support the result. A final substitution confirms the answer.

3. B — The number of allotments is found by dividing the total amount by the size of each allotment. Computing 14.49 ÷ 4.2 gives 3.45. Multiplying 3.45 by 4.2 returns 14.49, so the quotient is consistent.

Decimal-placement errors or multiplication instead of division produce the other choices. The original conditions support the result.

4. C — The desired time is the least common multiple of 16, 20, and 28. Their prime factors require 2^4, 5, and 7, so the least common multiple is 16 × 5 × 7 = 560. Smaller choices omit a needed prime factor, while 1,120 is a common multiple but not the least.

5. B — Convert -11/8 to -1.375 and compare all four numbers. For negative values, the number farthest left is the smallest. Among -1.37, -1.375, -1.402, and -1.39, the smallest is -1.402. The comparison must use numerical value rather than simply comparing the visible digits after the decimal point. The original conditions support the result.

6. C — Apply order of operations. First, 9 - 5 = 4, then 4^2 = 16, and 2 × 16 = 32. Separately, 96 ÷ 12 = 8. Adding 8 and 32 gives 40. The incorrect options come from skipping the exponent, multiplying before completing parentheses, or combining terms prematurely. The original conditions support the result.

7. D — Undo the subtraction first by adding 18 to both sides, giving 7x = 105. Dividing both sides by 7 gives x = 15. Substitution verifies the solution because 7(15) - 18 = 87. The other choices result from dividing too early or failing to use inverse operations on both sides.

8. A — Write 0.875 as 875/1000. Dividing numerator and denominator by 125 gives 7/8, which is in simplest form. Although 35/40 is equivalent to 7/8, it is not reduced, so it does not meet the question's requirement. Converting 7/8 back to a decimal gives 0.875 and confirms the equivalence. The original conditions support the result.

9. C — A unit price is total cost divided by the number of equal items. The calculation 28.05 ÷ 15 = 1.87 gives $1.87 per notebook. Multiplying $1.87 by 15 reconstructs $28.05. The distractors reflect digit reversal, rounding, or dividing by an incorrect number of notebooks. The original conditions support the result.

10. D — Average speed equals distance divided by time. Dividing 315 miles by 5.25 hours gives 60 miles per hour. Multiplying 60 by 5.25 returns 315, confirming the rate. The largest distractor comes from multiplying distance and time, while the remaining choices reflect inaccurate division or estimation. The original conditions support the result.

11. A — Fifty-six silver cards represent 8 groups of 7. To preserve the 7:9 ratio, the teal cards must also use 8 corresponding groups, giving 8 × 9 = 72. The ratio 56:72 simplifies by 8 to 7:9. Adding a fixed amount instead of scaling both quantities would break proportionality. The original conditions support the result.

12. B — The scale factor from 12 servings to 30 servings is 30/12 = 2.5. Multiply the stock amount by the same factor: 5 × 2.5 = 12.5 cups. Equivalently, solve the proportion 5/12 = x/30. The distractors come from adding rather than scaling or from multiplying the wrong quantities. The original conditions support the result.

13. B — Convert 18% to 0.18 and multiply by 750 to obtain 135. A mental check uses 10% = 75 and 8% = 60, giving 135 altogether. The answer must be less than one fifth of 750 because 18% is less than 20%, which also eliminates the largest distractor. The original conditions support the result.

14. C — A 24% discount means the buyer pays 76% of the original price. Multiplying 125 by 0.76 gives $95.00. Another method finds the discount, 0.24 × 125 = $30, and subtracts it from $125. The $30 choice is only the amount saved, not the final sale price. The original conditions support the result.

15. D — A 15% increase adds 15% of the original amount. Fifteen percent of $180 is $27, so the new fee is $180 + $27 = $207. Multiplying by 1.15 gives the same result. Subtracting the percent or adding only $15 would not represent a 15% increase. The original conditions support the result.

16. A — The decrease is 1,500 - 1,230 = 270 liters. Percent decrease compares the change with the original amount, so 270/1,500 = 0.18, or 18%. Using the new amount as the denominator would answer a different question, and 82% represents the portion remaining rather than the portion lost. The original conditions support the result.

17. C — Multiply 56 by 5/8 to preserve the proportion. Since 56 ÷ 8 = 7, multiplying 7 by 5 gives x = 35. Cross-multiplication gives the same equation, 8x = 280. Substituting 35 produces 5/8 = 35/56, confirming that both ratios simplify to the same value. The original conditions support the result.

18. A — The ratio contains 2 + 5 + 3 = 10 equal parts. Blue tokens account for 5 of those 10 parts, or one half of the total. One half of 120 is 60. The other choices correspond to using one of the other ratio parts or dividing the total by an incorrect number of parts.

19. B — Convert 5 1/4 to 21/4 and divide by 7/16. Dividing by a fraction means multiplying by its reciprocal: 21/4 × 16/7 = 12. Therefore twelve complete loaf portions fit exactly. The distractors come from multiplying the fractions directly, failing to invert the divisor, or using only the whole-number part. The original conditions support the result.

20. D — The crew drains 2/5 of the amount present, not 2/5 of the entire empty capacity. Multiply 5/6 by 2/5 to get 10/30, which simplifies to 1/3. The common factor of 5 cancels immediately. Adding the fractions would describe neither the portion present nor the portion drained. The original conditions support the result.

21. C — Represent upward positions and rises as positive changes and descents as negative changes. Starting at 62 gives 62 - 89 = -27, and then -27 + 18 = -9. The negative sign means the drone finishes 9 meters below the reference level. Ignoring signs would produce an incorrect positive total.

22. A — An increase from a negative value to a positive value crosses zero. Subtract the initial temperature from the final temperature: 4.75 - (-11.5) = 4.75 + 11.5 = 16.25°C. The negative distractor gives the direction incorrectly, while the smaller positive choices fail to account for the full distance across zero.

23. D — A constant change of -14 meters each minute repeated for 9 minutes is represented by multiplication. The product -14 × 9 = -126 meters. The negative sign indicates downward change.

Adding 14 and 9, dropping the sign, or dividing instead of multiplying does not represent nine equal negative changes. The original conditions support the result.

24. B — Absolute value measures distance from zero. Thus $|-31| = 31$, while $-4 - 9 = -13$ and $|-13| = 13$. Subtracting gives $31 - 13 = 18$. Treating absolute value signs as ordinary parentheses or preserving negative signs after taking absolute value leads to the incorrect choices. The original conditions support the result.

25. A — Multiply the coefficients and add the exponents: $2.4 \times 3 = 7.2$ and $10^4 \times 10^3 = 10^7$. The product is 7.2×10^7, already in normalized scientific notation. Changing the exponent by multiplication rather than addition, or adding coefficients, produces the distractors. The original conditions support the result. A final substitution confirms the answer.

26. C — Divide the coefficients, $9.6 \div 3.2 = 3$, and subtract the powers of ten, $10^8 \div 10^4 = 10^4$. The quotient is therefore 3×10^4. Adding exponents is used for multiplication, not division, and subtracting coefficients is not a valid scientific-notation rule. The original conditions support the result. A final substitution confirms the answer.

27. D — Because $9^2 = 81$ and $10^2 = 100$, $\sqrt{83}$ is only slightly greater than 9. A calculator gives approximately 9.1104, which rounds to 9.1 to the nearest tenth. The other choices are not consistent with the neighboring perfect squares or confuse the square root with unrelated operations. The original conditions support the result.

28. B — For a cube with edge length s, volume is s^3. Since $12 \times 12 \times 12 = 1{,}728$, the cube root of 1,728 is 12. Dividing the volume by 3 or taking an ordinary square root does not reverse cubing. Substituting 12 into the volume formula confirms the result exactly.

29. C — The square root of 23 is irrational because 23 is not a perfect square, so its decimal expansion does not terminate or repeat. The other choices are rational: -1.125 is terminating, 5/7 is explicitly a ratio of integers, and 0.121212... is repeating and can be written as a fraction. The original conditions support the result.

30. D — Let $x = 0.363636...$. Multiplying by 100 gives $100x = 36.363636...$. Subtracting the original equation yields $99x = 36$, so $x = 36/99 = 4/11$ after reduction. The terminating fraction 36/100 equals 0.36, not the repeating decimal, and the reciprocal is also incorrect. The original conditions support the result. A final substitution confirms the answer.

31. B — When powers with the same nonzero base are divided, subtract the exponents. Thus $7^9 \div 7^4 = 7^{(9-4)} = 7^5$. Adding the exponents is the product rule, multiplying exponents is not appropriate here, and simply keeping the denominator exponent does not account for cancellation of common factors. The original conditions support the result.

32. A — Repeated division gives $840 = 84 \times 10 = (2^2 \times 3 \times 7)(2 \times 5)$, so the prime factorization is $2^3 \times 3 \times 5 \times 7$. Every factor in a prime factorization must itself be prime, and multiplying the correct factors reconstructs exactly 840 rather than a nearby multiple or divisor.

33. B — The next simultaneous flash occurs after the least common multiple of 18 and 35. Since $18 = 2 \times 3^2$ and $35 = 5 \times 7$ share no prime factors, their least common multiple is $18 \times 35 = 630$ seconds. The smaller multiple is not divisible by both intervals.

34. C — The greatest number of identical no-leftover kits is the greatest common factor of 168 and 252. Their common prime factors produce 84. Dividing gives 2 pencils and 3 erasers per kit, confirming that 84 divides both totals exactly. Smaller common factors work but do not create the greatest possible number of kits.

35. D — Divide the total cable length by the length of each section: $24.3 \div 0.6 = 40.5$. Multiplying 40.5 by 0.6 returns 24.3, confirming the quotient. Moving both decimals one place gives the equivalent division $243 \div 6$, which makes the computation easier without changing the value. The original conditions support the result.

36. A — After a 25% increase, the new amount is 125% of the original, or 1.25 times the original. Divide 625 by 1.25 to obtain 500. Checking forward, 25% of 500 is 125 and $500 + 125 = 625$. Subtracting 25% of the new value would use the wrong base. The original conditions support the result.

37. A — For $y = kx$, divide the output by the corresponding input: $k = 22/8 = 11/4 = 2.75$. Multiplying 8 by 2.75 returns 22, so the constant is correct. Subtracting the coordinates or reversing the division produces quantities that do not satisfy the defining proportional equation. The original conditions support the result.

38. D — A proportional relationship through the origin has the form $y = kx$. Here the constant ratio y/x is $5/6$, so $k = 5/6$ and the equation is $y = (5/6)x$. Reversing the ratio changes the slope, while adding $5/6$ creates an additive relationship with a nonzero intercept. The original conditions support the result.

39. C — The unit rate is $108 \div 9 = 12$ brochures per minute. Over 18 minutes, the center prints $12 \times 18 = 216$ brochures. The time doubles from 9 to 18 minutes, so the output should also double from 108 to 216. Adding time or multiplying the original quantities directly gives incorrect results.

40. B — The scale represents $26/4 = 6.5$ actual meters for each model centimeter. Multiplying 11 by 6.5 gives 71.5 meters. A proportion, $4/26 = 11/x$, gives the same result. The model measurement is larger by a factor of $11/4$, so the actual length must scale by that factor too. The original conditions support the result.

41. D — One kilometer equals 1,000 meters. Therefore 4.75 kilometers equals $4.75 \times 1{,}000 = 4{,}750$ meters. Converting to the smaller unit increases the numerical count because many meters fit in one kilometer. Shifting the decimal the wrong number of places produces the distractors. The original conditions support the result. A final substitution confirms the answer.

42. C — The wording states copper tokens to all tokens as 9:25, so the desired part-to-whole fraction is directly $9/25$. The denominator must represent the entire collection, not only the non-copper tokens. The reciprocal reverses the relationship, and $9/16$ incorrectly uses the difference between the two ratio numbers as the whole. The original conditions support the result.

43. A — Convert the fractions for comparison: -5/6 is about -0.8333 and -4/5 is -0.8. From least to greatest, the numbers are -0.8333, -0.81, -0.805, and -0.8. Negative numbers farther left are smaller, so the ordering cannot be determined by comparing absolute values alone. The original conditions support the result. A final substitution confirms the answer.

44. B — Inside the brackets, 2(-4) = -8, so 8 - (-8) = 16. Multiplying by -3 gives -48, and adding 7 produces -41. The double negative inside the brackets is essential. Treating 8 - (-8) as zero or losing the outside negative sign leads to the distractors. The original conditions support the result.

45. D — When multiplying powers with the same base, add the exponents: 3^4 × 3^2 = 3^(4+2) = 3^6. Numerically, 3^6 = 729. Subtracting exponents is used for division, while multiplying exponents or changing the base does not represent the product rule for exponents. The original conditions support the result. A final substitution confirms the answer.

46. C — The increase is 752 - 640 = 112 pounds. Divide the change by the original amount: 112/640 = 0.175. Converting to a percent gives 17.5%. Using the new amount as the denominator gives a different percentage, while 85.1% is closer to the portion represented by the original amount relative to the new total.

47. B — Multiplication undoes division. If m ÷ 8 = 11, then multiplying both sides by 8 gives m = 88. Checking, 88 ÷ 8 = 11. Adding 8 and 11 or dividing 11 by 8 does not reverse the original operation, so those approaches cannot produce the required value. The original conditions support the result.

48. A — Subtract 7 from both sides to isolate the term containing p, giving 6p = 72. Dividing by 6 gives p = 12. Substitution confirms the result: 6(12) + 7 = 72 + 7 = 79. The distractors reflect incomplete inverse operations or combining the constants incorrectly. The original conditions support the result.

49. A — Solving 4x - 9 > 27 gives 4x > 36 and therefore x > 9. Among the listed choices, only 9.5 is greater than 9. Substituting each option is also a direct check. The value 9 makes the expression equal 27, but the inequality requires a strictly greater result. The original conditions support the result.

50. B — Square a before multiplying: (-4)^2 = 16. Then 3 × 16 = 48 and 2 × 5 = 10. Adding gives 58. The negative sign disappears when -4 is squared. Treating -4^2 as the same as (-4)^2 without the stated parentheses or changing operation order produces incorrect values. The original conditions support the result.

51. C — Distribute 5 to both terms inside the parentheses: 5(3x - 4) = 15x - 20. Then combine the like x-terms, 15x - 2x = 13x, leaving 13x - 20. The constant -20 cannot combine with x-terms, and the outside multiplication must apply to both terms. The original conditions support the result.

52. D — Three times n is represented by 3n. The phrase 'decreased by seven' means subtract 7 from that entire quantity, giving 3n - 7. Writing 3(n - 7) would subtract 21 after distribution, while reversing the subtraction or switching the coefficient and constant changes the stated relationship. The original conditions support the result.

53. B — Distribute 4 first: $4(2y - 3) = 8y - 12$. Then combine 8y and 3y to obtain 11y, while the constant remains -12. The simplified expression is $11y - 12$. The distractors result from failing to distribute to the constant or combining unlike terms. The original conditions support the result.

54. A — The x-coordinate is positive, so the point lies to the right of the y-axis. The y-coordinate is negative, so it lies below the x-axis. Points with positive x and negative y are in Quadrant IV. Quadrant names depend on the signs of both coordinates, not on their magnitudes. The original conditions support the result.

55. C — Because the points share the same y-coordinate, their distance is the absolute difference of their x-coordinates. Compute $|4 - (-12)| = |16| = 16$ units. Crossing from a negative x-value to a positive x-value requires accounting for both distances to zero. Subtracting magnitudes would undercount the separation. The original conditions support the result.

56. D — Area of a rectangle is length times width. Multiplying 16.5 by 3.2 gives 52.8 square feet. The unit is square feet because two linear dimensions are multiplied. Adding the dimensions finds neither area nor perimeter, and doubling the correct product would count the rectangular region twice. The original conditions support the result.

57. A — The area of a triangle is one half of base times perpendicular height. Compute $1/2 \times 22 \times 9 = 11 \times 9 = 99$ square meters. Multiplying base and height without halving gives the area of a related parallelogram, not the triangle itself. Adding the dimensions does not measure area.

58. B — For a parallelogram, area equals base times perpendicular height. Multiplying 8.4 by 7.5 gives 63 square centimeters. The slanted side length is not needed when the perpendicular height is known. Halving the product would use the triangle formula, while doubling it would count two parallelograms. The original conditions support the result.

59. C — Use the trapezoid area formula, one half times the sum of the bases times the height. The base sum is 32; half of 32 is 16; and $16 \times 6.5 = 104$ square inches. Using only one base or forgetting the one-half factor produces the incorrect choices. The original conditions support the result.

60. D — Circumference is π times diameter. With diameter 18 centimeters, $C = \pi(18) = 18\pi$ centimeters. Using the radius would give 9π, doubling the diameter gives 36π, and squaring the radius relates to area rather than circumference. The circumference is a linear measure, so the unit remains centimeters. The original conditions support the result.

61. B — Area of a circle is πr^2. Squaring the radius gives $7^2 = 49$, so the area is 49π square meters. Multiplying $2\pi r$ gives circumference, not area. Because area measures a two-dimensional region, the unit is square meters rather than meters. This method makes the underlying relationship visible and provides a reliable check instead of depending on a memorized shortcut alone.

62. A — Volume of a rectangular prism is length × width × height. Multiplying $11 \times 6 \times 4$ gives 264 cubic inches. The cubic unit reflects the three dimensions being multiplied. Adding dimensions or multiplying only two dimensions measures something different, while doubling the volume has no basis in the stated dimensions.

63. D — Use $V = lwh$ and solve for height: $h = V/(lw)$. The base area is $12 \times 10 = 120$ square centimeters, and $720 \div 120 = 6$ centimeters. Multiplying 12, 10, and 6 returns 720, confirming the missing dimension. Dividing by only one base dimension gives incorrect values. The original conditions support the result.

64. C — A rectangular prism has two faces of each pair of dimensions. Compute $2(5\times7 + 5\times9 + 7\times9) = 2(35 + 45 + 63) = 2(143) = 286$ square centimeters. Using only one of each face gives 143, while multiplying all three dimensions finds volume instead of surface area. The original conditions support the result.

65. A — Angles in a linear pair form a straight angle, so their measures sum to 180°. Subtracting gives $180 - 124 = 56°$. Adding 124 and 56 confirms the straight-angle total. The two angles need not be equal, and using 90° would confuse supplementary angles with complementary angles. The original conditions support the result.

66. D — Two angles that form a right angle are complementary and sum to 90°. Subtract 37 from 90 to obtain 53°. The value 53° combined with 37° gives exactly 90°, confirming the answer. Subtracting from 180° would apply the supplementary-angle relationship instead of the complementary one. The original conditions support the result.

67. B — The interior angles of every triangle sum to 180°. Add the two known angles: $58 + 64 = 122$. Subtracting from 180 gives 58° for the third angle. The result also shows that this triangle has two equal angles. Using 360° or stopping at the known-angle sum would be incorrect.

68. C — A square is a quadrilateral with four congruent sides and four right angles. It also has two pairs of parallel sides, congruent diagonals, and multiple lines of symmetry. Therefore the defining statement about equal sides and right angles is always true, while each distractor contradicts a standard property of squares.

69. C — A scale factor multiplies every corresponding length by the same number. Multiply 5 by 2.5 to get 12.5 centimeters and 8 by 2.5 to get 20 centimeters. Adding 2.5 to each dimension does not preserve similarity, while multiplying by a different factor changes the intended scale. The original conditions support the result.

70. D — Reflection across the y-axis changes the sign of the x-coordinate while keeping the y-coordinate unchanged. Therefore (-6, 4) maps to (6, 4). Changing the y-sign would reflect across the x-axis, and swapping coordinates is not a reflection rule. Equal horizontal distances from the y-axis confirm the image. The original conditions support the result.

71. B — Each foot contains 12 inches. Eight feet equals $8 \times 12 = 96$ inches, and adding the remaining 5 inches gives 101 inches. Writing 85 treats feet and inches like decimal place values, which they are not. Converting the feet first keeps both parts in the same unit before addition.

72. A — From 10:37 a.m. to noon is 1 hour 23 minutes, or 83 minutes. From noon to 1:12 p.m. is another 72 minutes. Adding 83 and 72 gives 155 minutes. Converting both clock times to total minutes and subtracting gives the same result and avoids borrowing errors. The original conditions support the result.

73. B — Add the five values to obtain 135 pages, then divide by 5 observations: $135 \div 5 = 27$ pages. The mean represents the equal-share value if the total were redistributed evenly. The value 135 is only the sum, while the nearby whole-number distractors result from arithmetic or division errors. The original conditions support the result.

74. D — Order the seven values first: 4, 7, 9, 11, 13, 15, 20. With seven observations, the median is the fourth value, which is 11. Median is based on position in an ordered list, not the arithmetic average and not the most frequent or largest value. The original conditions support the result.

75. A — Range is the maximum value minus the minimum value. Here the maximum is 57 and the minimum is 18, so the range is $57 - 18 = 39$. The range measures total spread from one extreme to the other; it is not found by averaging values or subtracting arbitrary neighboring observations.

76. C — The scores total 410. Dividing by the five scores gives $410 \div 5 = 82$. The mean is an equal-share measure, so it should lie between the minimum 68 and maximum 96. The total 410 is not an average, and the nearby distractors reflect incorrect addition or division. The original conditions support the result.

77. B — Probability is favorable outcomes divided by total equally likely outcomes. There are 9 purple counters out of 24, so the probability is 9/24. Dividing numerator and denominator by 3 gives 3/8. The denominator must represent all counters, not only the non-purple counters or a reduced total chosen incorrectly. The original conditions support the result.

78. C — An event and its complement have probabilities that add to 1. Subtract 0.73 from 1 to obtain 0.27. Adding the two probabilities gives 1.00, confirming the result. The complement is not found by reversing digits or adding to the original probability, and a probability cannot exceed 1. The original conditions support the result.

79. A — Each of the 5 spinner outcomes can occur with each of the 6 number-cube outcomes. By the multiplication principle, the combined sample space contains $5 \times 6 = 30$ ordered outcomes. Adding 5 and 6 counts only individual outcomes from separate experiments and does not represent all possible pairs. The original conditions support the result.

80. D — Experimental probability is the number of observed successes divided by the total number of trials. The fraction is 21/70, which reduces by 7 to 3/10. The complement 7/10 represents losses if every trial is either win or loss. Using only unsuccessful trials as the denominator gives a different ratio. The original conditions support the result.

81. C — A mean of 24 across six numbers requires a total of $24 \times 6 = 144$. The five known numbers sum to 121. Subtracting gives $144 - 121 = 23$ for the missing number. Including 23 makes the total 144, and dividing that total by 6 returns the stated mean of 24.

82. D — The lower half is 2, 6, 8, 10, whose median is (6 + 8)/2 = 7. The upper half is 13, 17, 19, 25, whose median is (17 + 19)/2 = 18. The interquartile range is Q3 - Q1 = 18 - 7 = 11. The original conditions support the result.

83. A — Convert the fractional lengths to fourths: 1/4 + 2/4 + 3/4 = 6/4 = 1 1/2. Adding the remaining 1 meter and 1 1/2 meters gives 4 meters total. Combining unlike denominators without conversion or omitting one observation leads to the distractors. The original conditions support the result. A final substitution confirms the answer.

84. B — The mean is (3 + 5 + 7 + 7 + 8)/5 = 6. The absolute deviations from 6 are 3, 1, 1, 1, and 2, which sum to 8. Dividing by 5 gives a mean absolute deviation of 1.6. Absolute deviations are never treated as negative when averaging distance from the mean.

85. C — The mean is (4 + 6 + 6 + 9 + 10)/5 = 7. Distances from 7 are 3, 1, 1, 2, and 3. Their total is 10, and 10 ÷ 5 = 2. Mean absolute deviation averages distances from the mean, so each deviation is taken as a nonnegative amount.

86. A — At least 80 includes the 80-89 and 90-99 intervals. Their frequencies are 11 and 6, so the total is 11 + 6 = 17 students. The lower intervals are excluded because their scores are below 80. Reading the frequency column rather than adding interval endpoints is essential. The original conditions support the result.

87. B — Subtract the fixed admission charge before dividing by the per-route cost. The route portion is \$30 - \$9 = \$21, and \$21 ÷ \$3 = 7 routes. Checking gives \$9 + 3(7) = \$30. Dividing the total by \$3 would incorrectly treat the admission fee as a route charge. The original conditions support the result.

88. D — Use P = 2L + 2W: 2(x + 4) + 2(x - 2) = 36. Simplifying gives 4x + 4 = 36, so 4x = 32 and x = 8. Substitution gives dimensions 12 and 6, whose perimeter is 2(12 + 6) = 36. The original conditions support the result.

89. B — The error comes from ignoring the value of the 3 in the tens place. An area or base-ten model decomposes 34 into 30 + 4, so 6 × 30 = 180 and 6 × 4 = 24. Combining the partial products gives 204 while making the place-value structure visible. The original conditions support the result.

90. D — The fractions name parts of different sizes, so the pieces must be expressed in a common unit before addition. Fraction strips show 2/3 = 8/12 and 1/4 = 3/12, giving 11/12. The model explains why denominators are not added and connects the algorithm to equal-sized fractional parts. The original conditions support the result.

91. C — Multiplying by 10 changes each digit's place value by a factor of ten. A place-value chart shows the 3 ones becoming 3 tens and the 2 tenths becoming 2 ones, producing 32. This approach explains the structure instead of relying on the misleading rule to 'add a zero.'. The original conditions support the result.

92. A — A table makes the distinction between additive and multiplicative structure observable. For y = 3x, the ratio y/x remains 3 for nonzero x, while the difference y - x changes. Comparing both quantities helps the student identify proportional reasoning from evidence rather than interpreting the coefficient as a number to add.

93. C — A number line shows that -0.60 lies farther left than -0.45, so -0.60 is the smaller value. The student's whole-number comparison ignores the direction of negative numbers. Connecting each decimal to its position and distance from zero builds meaning for signed comparisons instead of supplying an isolated rule. The original conditions support the result.

94. A — Angle classification depends on measure, not on the apparent length or shape of the rays. A 90° benchmark shows that 92° is slightly larger than a right angle, so it is obtuse. Measuring with a protractor then links the visual benchmark to a numerical measure and corrects appearance-based reasoning. The original conditions support the result.

95. B — Soccer-team members are likely to differ from the full sixth-grade population on after-school exercise, the exact characteristic being studied. That selection can create bias. A random or representative sample drawn from the broader grade gives students a stronger basis for generalizing results and illustrates why sample composition matters as much as sample size.

96. D — The equal sign states that the two expressions have the same value. A balance model makes that relationship visible: the left side totals 12, so the right side must also total 12. Therefore the box must contain 8. This counters the misconception that equality simply signals where an arithmetic answer should be written.

97. B — The student has reversed both coordinate roles and signs. The first coordinate determines horizontal position, so $x = 4$ means four units right. The second coordinate determines vertical position, so $y = -2$ means two units down. Prompting the student to name each coordinate's role connects notation to movement on the coordinate plane.

98. C — The quotient and remainder must be interpreted in context. Six vans hold only 48 students, leaving five students without transportation, so a seventh van is required. A concrete grouping model makes the remainder visible and shows why some division situations require rounding the quotient up rather than discarding the leftover amount.

99. A — Square tiles cover two-dimensional surfaces, so they measure area in square units. Unit cubes fill three-dimensional space, so counting them measures volume in cubic units. Comparing the two actions on the same box connects each unit to the attribute it measures and gives meaning to cm^2 versus cm^3. The original conditions support the result.

100. D — Geometric categories can be nested when one shape satisfies all defining properties of a broader category. A rhombus has four congruent sides and also two pairs of parallel opposite sides, so it is a parallelogram with an additional property. Sorting by definitions helps students reason from attributes rather than from category names or prototypes.