PRACTICE EXAM 16: TSIA2 FULL DIAGNOSTIC MATH SIMULATION

QUANTITATIVE REASONING (Questions 1–12)

1. A family spent $1,260 on groceries in 6 weeks. What is the average weekly grocery cost?

A. $190

B. $200

C. $210

D. $220

2. A phone originally priced at $560 is on sale for 15% off. What is the sale price?

A. $476

B. $490

C. $500

D. $515

3. A machine produces 144 parts in 8 hours. How many parts does it produce per hour?

A. 15

B. 16

C. 17

D. 18

4. Which number is equivalent to 7/20?

A. 0.28

B. 0.35

C. 0.45

D. 0.72

5. A worker earns $18.50 per hour and works 32 hours in a week. Her gross pay is:

A. $592

B. $580

C. $600

D. $620

6. A map scale shows 1 inch = 25 miles. Two cities are 4 inches apart on the map. How far apart are they in reality?

A. 50 miles

B. 75 miles

C. 90 miles

D. 100 miles

7. A recipe calls for a ratio of 2:3 of oil to vinegar. If 12 cups of vinegar are used, how much oil is needed?

A. 4 cups

B. 6 cups

C. 8 cups

D. 10 cups

8. A student's test scores are 78, 82, and 92. To average 85, what must she score on the fourth test?

A. 85

B. 88

C. 90

D. 92

9. What is 45% of 200?

A. 60

B. 75

C. 80

D. 90

10. A runner completes a 10K race in 50 minutes. Her pace per kilometer is:

A. 5 minutes

B. 6 minutes

C. 7 minutes

D. 8 minutes

11. A shirt's price rose from $40 to $50. What is the percent increase?

A. 10%

B. 20%

C. 25%

D. 30%

12. A contractor bought materials for $1,800 and sold them for $2,250. What was the profit percentage?

A. 20%

B. 25%

C. 30%

D. 40%

ALGEBRAIC REASONING (Questions 13–24)

13. Solve: $6x - 5 = 3x + 13$.

A. 6

B. 5

C. 4

D. 3

14. Factor: $x^2 - 9x + 18$.

A. $(x - 2)(x - 7)$

B. $(x + 3)(x - 6)$

C. $(x - 9)(x + 2)$

D. $(x - 3)(x - 6)$

15. The slope of the line through $(-1, 3)$ and $(4, 13)$ is:

A. 1

B. 1.5

C. 2

D. 2.5

16. If $f(x) = 2x^2 + 1$, what is $f(3)$?

A. 13

B. 19

C. 25

D. 31

17. Simplify: $3(x - 4) + 2(x + 5)$.

A. $5x - 2$

B. $5x + 2$

C. $5x - 7$

D. $5x + 22$

18. Solve the inequality: $-4x + 1 \geq 9$.

A. $x \leq -2$

B. $x \geq -2$

C. $x \leq 2$

D. $x \geq 2$

19. The y-intercept of the line $3x - 2y = 12$ is:

A. 4

B. 6

C. −6

D. −4

20. Solve: $x^2 - 10x + 21 = 0$.

A. $x = 1$ or $x = 21$

B. $x = 2$ or $x = 5$

C. $x = 4$ or $x = 6$

D. $x = 3$ or $x = 7$

21. Simplify: $(x^2 - 25)/(x - 5)$.

A. $x - 5$

B. $x + 5$

C. $x^2 - 5$

D. $x + 25$

22. The point (2, k) lies on $y = 3x - 4$. What is k?

A. 2

B. 4

C. 6

D. 8

23. Solve: $3(2x + 1) - 5 = 16$.

A. 2

B. 4

C. 3

D. 6

24. Which of the following is a linear function?

A. $y = x^2$

B. $y = 1/x$

C. $y = 2^x$

D. $y = 3x - 1$

GEOMETRIC AND SPATIAL REASONING (Questions 25–36)

25. A triangle has base 16 and height 9. Its area is:

A. 25

B. 50

C. 144

D. 72

26. A right triangle has legs of 8 and 15. What is the hypotenuse?

A. 16

B. 17

C. 18

D. 20

27. How many feet are in 96 inches?

A. 8 feet

B. 10 feet

C. 12 feet

D. 14 feet

28. A square has area 144 cm^2. Its perimeter is:

A. 12 cm

B. 36 cm

C. 48 cm

D. 144 cm

29. A cylinder has radius 5 and height 12. Its volume is:

A. 60π

B. 150π

C. 200π

D. 300π

30. A 30-60-90 triangle has a hypotenuse of 10. The side opposite 30° is:

A. 2

B. 5

C. $5\sqrt{3}$

D. $10\sqrt{3}$

31. A circle has circumference 10π. Its radius is:

A. 5

B. 10

C. 20

D. 25

32. A rectangular room is 12 ft by 9 ft. How many square feet of carpet are needed?

A. 21

B. 42

C. 108

D. 216

33. A cube has a volume of 216 cubic inches. Its side length is:

A. 4 in

B. 5 in

C. 7 in

D. 6 in

34. Two parallel lines are cut by a transversal. Corresponding angles are:

A. equal in measure

B. supplementary

C. complementary

D. always right angles

35. A cone has radius 3 and height 5. Its volume is:

A. 5π

B. 10π

C. 15π

D. 45π

36. A right triangle has legs of 6 and 8. Its area is:

A. 14

B. 24

C. 48

D. 60

PROBABILISTIC AND STATISTICAL REASONING (Questions 37–48)

37. A bag has 5 red, 3 blue, and 2 green marbles. The probability of drawing blue is:

A. 1/5

B. 3/10

C. 1/3

D. 1/2

38. The mean of {10, 14, 18, 22, 26} is:

A. 14

B. 16

C. 20

D. 18

39. A card is drawn from a standard deck. The probability of drawing a red card is:

A. 1/2

B. 1/4

C. 1/13

D. 3/4

40. The median of {5, 9, 13, 17, 21, 25} is:

A. 13

B. 14

C. 15

D. 17

41. A fair die is rolled. The probability of rolling an even number is:

A. 1/6

B. 1/4

C. 1/3

D. 1/2

42. The range of {12, 18, 24, 30, 36, 42} is:

A. 24

B. 30

C. 36

D. 42

43. The mode of {4, 7, 7, 9, 11, 11, 11, 13} is:

A. 11

B. 9

C. 7

D. 4

44. A coin is flipped. The probability of getting heads is:

A. 0

B. 1/3

C. 1/2

D. 2/3

45. A class of 25 students has 10 who play soccer. What percent play soccer?

A. 10%

B. 25%

C. 35%

D. 40%

46. Two dice are rolled. The probability of rolling a sum of 7 is:

A. 1/6

B. 1/9

C. 1/12

D. 1/4

47. The first quartile of {3, 5, 7, 9, 11, 13, 15, 17} is:

A. 4

B. 5

C. 6

D. 7

48. In a survey of 200 people, 80 prefer tea. What percent prefer tea?

A. 30%

B. 40%

C. 45%

D. 50%

PRACTICE EXAM 16: ANSWER KEY AND EXPLANATIONS

Quantitative Reasoning

1. C — \$210. Dividing the total by the number of weeks gives 1,260 ÷ 6 = \$210 per week. Average cost problems always divide the total expenditure by the number of time periods to find the mean.
2. A — \$476. A 15% discount means paying 85% of the original, so 0.85 × \$560 = \$476. The shortcut method multiplies the original price by the remaining percentage rather than calculating the discount separately.
3. D — 18. Dividing 144 parts by 8 hours gives 144 ÷ 8 = 18 parts per hour. Unit rate problems divide the total quantity by the time to find the per-unit production rate.
4. B — 0.35. Dividing 7 by 20 gives exactly 0.35. Fraction-to-decimal conversions always use numerator divided by denominator to produce the equivalent decimal.
5. A — \$592. Multiplying hourly wage by hours worked gives \$18.50 × 32 = \$592. Gross pay is a rate-times-time calculation using the hourly wage and total hours.
6. D — 100 miles. Multiplying the map distance by the scale factor gives 4 × 25 = 100 miles. Scale drawings convert model distances to actual distances through direct multiplication.
7. C — 8 cups. Setting up the proportion 2/3 = x/12 and cross-multiplying gives 3x = 24, so x = 8 cups. Proportion problems scale quantities while preserving the original ratio between components.
8. B — 88. The required total for a mean of 85 across 4 tests is 340, and subtracting the known scores (78 + 82 + 92 = 252) gives 340 − 252 = 88. Mean problems rearrange the formula to solve for the missing value.
9. D — 90. Calculating 45% of 200 means multiplying 0.45 × 200 = 90. Percent-of calculations convert the percent to a decimal and multiply by the whole quantity.
10. A — 5 minutes. Dividing the total time by the number of kilometers gives 50 ÷ 10 = 5 minutes per kilometer. Pace calculations produce a per-unit measurement by dividing total time by distance covered.
11. C — 25%. The percent change formula gives (50 − 40)/40 × 100 = 10/40 × 100 = 25%. Percent change is always calculated using the original value as the denominator, not the new value.

12. B — 25%. The profit is \$2,250 − \$1,800 = \$450, and dividing by the original cost gives 450/1,800 = 0.25 = 25%. Profit percentage is always calculated relative to the original cost, not the selling price.

Algebraic Reasoning

13. A — 6. Subtracting 3x from both sides gives $3x - 5 = 13$, then adding 5 gives $3x = 18$, so $x = 6$. Linear equations with variables on both sides are solved by collecting variable terms first.

14. D — $(x - 3)(x - 6)$. Two numbers that multiply to 18 and add to −9 are −3 and −6. The factored form $(x - 3)(x - 6)$ expands back to $x^2 - 9x + 18$, confirming the factoring.

15. C — 2. The slope formula $(y_2 - y_1)/(x_2 - x_1)$ gives $(13 - 3)/(4 - (-1)) = 10/5 = 2$. Positive slope indicates the line rises from left to right.

16. B — 19. Substituting $x = 3$ into $f(x) = 2x^2 + 1$ gives $2(9) + 1 = 18 + 1 = 19$. Function evaluation follows order of operations, squaring first and then multiplying.

17. A — $5x - 2$. Distributing gives $3x - 12 + 2x + 10$, and combining like terms produces $5x + (-12 + 10) = 5x - 2$. Simplification combines variable terms and constant terms separately.

18. A — $x \leq -2$. Subtracting 1 from both sides gives $-4x \geq 8$, then dividing by −4 flips the inequality sign: $x \leq -2$. Dividing by a negative number always reverses the inequality direction.

19. C — −6. Setting $x = 0$ in $3x - 2y = 12$ gives $-2y = 12$, so $y = -6$. The y-intercept is the value of y when x equals zero.

20. D — $x = 3$ or $x = 7$. Factoring $x^2 - 10x + 21$ gives $(x - 3)(x - 7) = 0$ because two numbers that multiply to 21 and add to −10 are −3 and −7. The zero product property yields the two solutions.

21. B — $x + 5$. Factoring the numerator as a difference of squares gives $(x + 5)(x - 5)$, and dividing by $(x - 5)$ leaves $x + 5$. This simplification is valid for all $x \neq 5$.

22. A — 2. Substituting $x = 2$ into $y = 3x - 4$ gives $y = 6 - 4 = 2$, so $k = 2$. A point lies on a line only when its coordinates satisfy the equation.

23. C — 3. Distributing gives $6x + 3 - 5 = 16$, which simplifies to $6x - 2 = 16$. Adding 2 gives $6x = 18$, and dividing by 6 gives $x = 3$.

24. D — $y = 3x - 1$. A linear function has the form $y = mx + b$ and produces a straight-line graph. The other options are quadratic, reciprocal, and exponential respectively, none of which are linear.

Geometric and Spatial Reasoning

25. D — 72. The triangle area formula $A = ½bh$ gives $½(16)(9) = 72$. Half the product of base and height always yields triangle area.

26. B — 17. Applying the Pythagorean theorem gives $8^2 + 15^2 = 64 + 225 = 289$, and $\sqrt{289} = 17$. This is one of the standard Pythagorean triples worth memorizing (8-15-17).

27. A — 8 feet. One foot equals 12 inches, so $96 \div 12 = 8$ feet. Length conversions in the U.S. Customary system use the 12-inch-per-foot factor.

28. C — 48 cm. A square with area 144 cm^2 has side length $\sqrt{144} = 12$ cm, and the perimeter is $4 \times 12 = 48$ cm. Square problems often require finding side length first before calculating perimeter.

29. D — 300π. The cylinder volume formula $V = \pi r^2 h$ gives $\pi(25)(12) = 300\pi$. Cylinder volume multiplies the base area by the height.

30. B — 5. In a 30-60-90 triangle, the side opposite the 30° angle is half the hypotenuse. Half of 10 is 5.

31. A — 5. The circumference formula $C = 2\pi r$ gives $10\pi = 2\pi r$, so $r = 5$. Dividing both sides by 2π isolates the radius.

32. C — 108. The area of a rectangle is length × width, so $12 \times 9 = 108$ square feet. Area is always measured in squared units.

33. D — 6 in. The cube volume formula $V = s^3$ gives $s^3 = 216$, so $s = \sqrt[3]{216} = 6$ in. Every cube's volume equals the cube of its edge length.

34. A — equal in measure. When parallel lines are cut by a transversal, corresponding angles (angles in matching positions at each intersection) are always congruent. This relationship is fundamental in parallel-line geometry.

35. C — 15π. The cone volume formula $V = (1/3)\pi r^2 h$ gives $(1/3)\pi(9)(5) = (1/3)(45\pi) = 15\pi$. The 1/3 factor reflects that a cone fits three times into a cylinder of the same base and height.

36. B — 24. The area of a right triangle is $\frac{1}{2}(leg_1)(leg_2)$, so $\frac{1}{2}(6)(8) = 24$. In a right triangle, the two legs serve as base and height.

Probabilistic and Statistical Reasoning

37. B — 3/10. The bag contains $5 + 3 + 2 = 10$ marbles, and 3 are blue. The probability is 3/10 in simplest form.

38. D — 18. Adding the five values gives $10 + 14 + 18 + 22 + 26 = 90$, and dividing by 5 gives 18. The mean is always the sum divided by the count of values.

39. A — 1/2. A standard deck has 26 red cards (hearts and diamonds) out of 52 total, so the probability is $26/52 = 1/2$. Half of every standard deck is red.

40. C — 15. For an even number of values, the median is the average of the two middle values. The middle values are 13 and 17, so the median is $(13 + 17)/2 = 15$.

41. D — 1/2. Even numbers on a die are 2, 4, and 6 — three outcomes out of six. The probability is 3/6 = 1/2.

42. B — 30. The range is maximum minus minimum: 42 − 12 = 30. Range measures the total spread of the data set.

43. A — 11. The mode is the value that appears most frequently, and 11 appears three times while all other values appear at most twice. The mode captures the most common observation.

44. C — 1/2. A fair coin has exactly two equally likely outcomes, so the probability of heads is 1/2. This is the most basic probability calculation in statistics.

45. D — 40%. Dividing 10 by 25 gives 0.4, which converts to 40%. Percent problems divide the part by the whole and multiply by 100.

46. A — 1/6. A sum of 7 can occur with six different combinations: (1,6), (2,5), (3,4), (4,3), (5,2), (6,1). The probability is 6/36 = 1/6, making 7 the most likely sum when rolling two dice.

47. C — 6. The lower half of the ordered data set {3, 5, 7, 9} has median (5 + 7)/2 = 6, which is Q1. Quartiles divide an ordered data set into four equal parts.

48. B — 40%. Dividing 80 by 200 gives 0.4, which converts to 40%. Percent problems always divide the part by the whole and express the result as a percentage.