CONTESTANT ID #: _____

GRADE LEVEL :_____

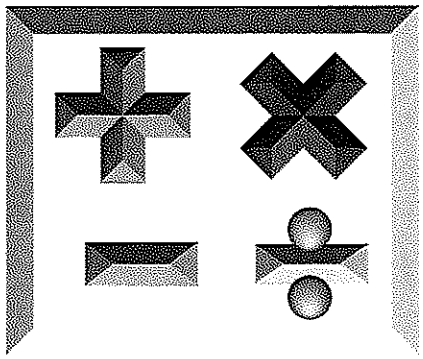
Place Contestant ID label here BEFORE Contest Begins

PSIA
Private Schools Interscholastic Association

Mathematics

State Contest

Grades 6-8



2023

FINAL SCORE: _____

(Please do not open test until the signal is given to begin.)

Directions: Choose the best answer to each problem. For answers not listed as choices, choose "E. NOT" for "None of these".

1. Evaluate: $\frac{3}{4} \times (17 + 15) - 6^2 \div (20 - 4 \times 2)$

   A. 21 B. 37 C. 1 D. −144 E. NOT

2. Find the area of a square whose sides measure 14 cm.

   A. 28 cm^2 B. 56 cm^2 C. 196 cm^2 D. 392 cm^2 E. NOT

3. If June 1st falls on a Tuesday, what is the last date of the month that falls on a Sunday (same month)?

   A. 27th B. 28th C. 29th D. 30th E. NOT

4. $6\frac{2}{3} - 3\frac{7}{12} =$

   A. $2\frac{5}{6}$ B. $2\frac{11}{12}$ C. $3\frac{1}{2}$ D. $3\frac{1}{6}$ E. NOT

5. What percent of 120 is 75?

   A. 60% B. $62\frac{1}{2}\%$ C. 64% D. $66\frac{2}{3}\%$ E. NOT

6. What is the remainder when 873489 is divided by 25?

   A. 9 B. 14 C. 18 D. 19 E. NOT

7. How many seconds are there in $1\frac{1}{3}$ hours?

   A. 80 B. 800 C. 4800 D. 1600 E. NOT

8. The average of five distinct integers is 37. The two largest numbers are 45 and 48. What is the smallest possible number?

A. 5 B. 3 C. 9 D. 7 E. NOT

9. MCDLXXIV = _____ (Arabic numerals)

A. 1676 B. 1476 C. 1674 D. 1474 E. NOT

10. Three sticks of length 3 feet, 4 feet, and 5 feet are laid on the ground to form a triangle. What is the enclosed area?

A. 8 ft^2 B. 6 ft^2 C. 10 ft^2 D. 12 ft^2 E. NOT

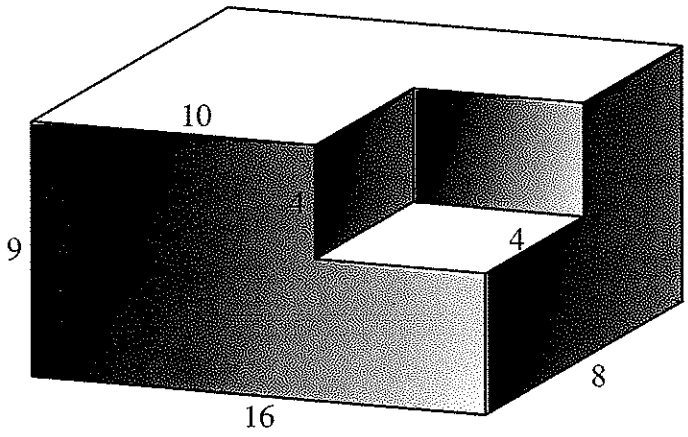
11. $17 \times \frac{19}{21} =$

A. $16\frac{1}{21}$ B. $16\frac{4}{21}$ C. $15\frac{4}{21}$ D. $15\frac{8}{21}$ E. NOT

12. If $p = 9$, $q = 3p$, and $r = p + q$, what is the value of $5p - 2q + 3r$?

A. 63 B. 99 C. 120 D. 144 E. NOT

13. Find the volume of the solid.



A. 1042
B. 1048
C. 1056
D. 1064
E. NOT

14. What is the sum of the positive integral divisors of 24?

A. 48 B. 52 C. 56 D. 60 E. NOT

15. A rhombus has diagonals measuring 14 cm and 48 cm. What is the perimeter of the rhombus?

A. 124 cm B. 116 cm C. 108 cm D. 100 cm E. NOT

16. $2\frac{4}{5} + 7.88 - \frac{47}{20} =$

A. 7.93 B. 8.16 C. 8.33 D. 8.58 E. NOT

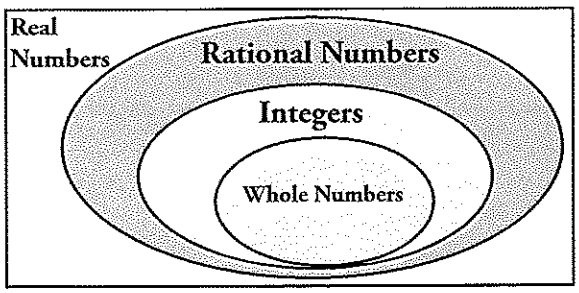
17. 47 (base 10) = _____ (base 7)

A. 62 B. 63 C. 64 D. 65 E. NOT

18. $0.5333\ldots \times 24 =$

A. 12.8 B. 13.2 C. 10.8 D. 11.2 E. NOT

19. When the number $\sqrt{3}$ is placed in the diagram, which section should it be placed in?



A. Whole Numbers B. Integers C. Rational Numbers D. Real Numbers E. NOT

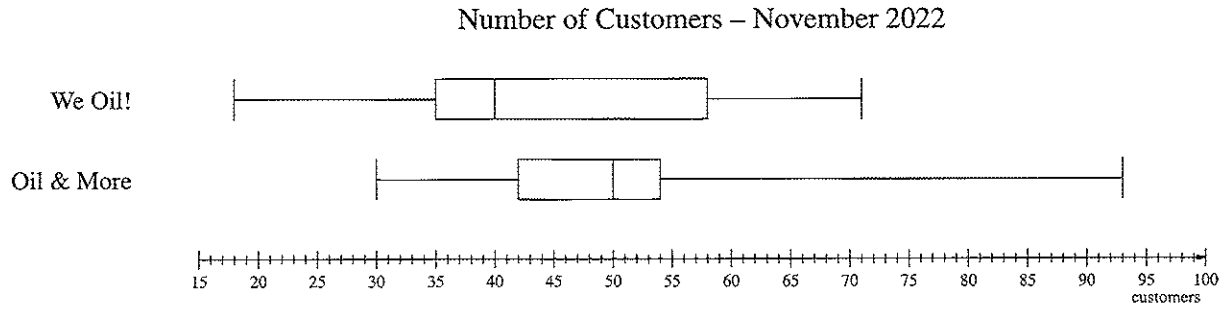
20. The area of a rectangle is 140 square meters. Its length is 1 meter shorter than triple its width. What is its perimeter?

A. 54 m B. 48 m C. 60 m D. 44 m E. NOT

21. If $A \cup B$ has 60 elements, $A \cap B$ has 14 elements, and A has 27 elements, how many elements does B have?

A. 51 B. 49 C. 53 D. 47 E. NOT

22. Using the box-and-whiskers plot giving the number of customers each day in November for these two companies, which of the following statements is true?



A. The mean number of customers at We Oil! was 40.
B. Most days in November saw over 54 customers visit Oil & More.
C. For half of the days in November, We Oil! had between 35 and 58 customers, inclusive.
D. Oil & More had more customers than We Oil! in the month of November.
E. NOT

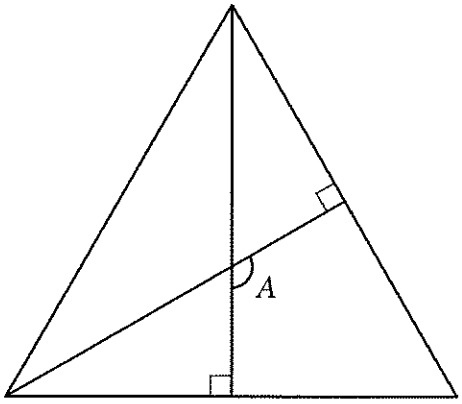
23. A farmer has a rectangular field 180 feet long by 60 feet wide. He plans to put up a fence around the field with posts on the corners and then every 30 inches apart on the sides. How many posts will he need?

A. 184 B. 188 C. 192 D. 196 E. NOT

24. $\sqrt{78\frac{1}{36}} =$

A. $8\frac{1}{6}$ B. $8\frac{5}{6}$ C. $8\frac{1}{3}$ D. $8\frac{2}{3}$ E. NOT

25. Two medians are drawn in an equilateral triangle. What is the measure of angle A?



A. 120°
B. 100°
C. 130°
D. 110°
E. NOT

26. If $xy = 18$ and $x^2 + y^2 = 40$, with $x > 0$ and $y > 0$, then what is the value of $x + y$?

A. $3\sqrt{15}$ B. $2\sqrt{19}$ C. $3\sqrt{21}$ D. $6\sqrt{7}$ E. NOT

27. Define $A \oplus B = \frac{3A - 1}{2B}$. Find the value of $11 \oplus (3 \oplus 1)$.

A. 2 B. 3 C. 4 D. 5 E. NOT

28. If 36% of S is 48% of T, what is the ratio $T : S$?

A. $\frac{4}{3}$ B. $\frac{3}{4}$ C. $\frac{2}{3}$ D. $\frac{3}{2}$ E. NOT

29. Erin earned \$36,000 last year. Her income tax rate is 12%. What did she have left after paying income tax?

A. \$31080 B. \$31280 C. \$31480 D. \$31680 E. NOT

30. If $f(x) = x^2 - 6x + 10$, what is the value of $f(15)$?

A. 149 B. 161 C. 170 D. 145 E. NOT

31. What is the 18th term in the sequence 5, 22, 39, 56, ...?

A. 290 B. 292 C. 294 D. 296 E. NOT

32. What is the ten's digit in the product of 8147 and 23?

A. 0 B. 9 C. 8 D. 7 E. NOT

33. Tiles numbered 1 through 20 are in a bag. Two tiles are drawn out without replacement. What is the probability both tiles are factors of 20?

A. $\frac{3}{38}$ B. $\frac{9}{95}$ C. $\frac{9}{100}$ D. $\frac{2}{95}$ E. NOT

34. Find the vertex of $y = -3x^2 - 12x + 17$.

A. $(-2, 29)$ B. $(-2, 17)$ C. $(-4, 17)$ D. $(-4, 29)$ E. NOT

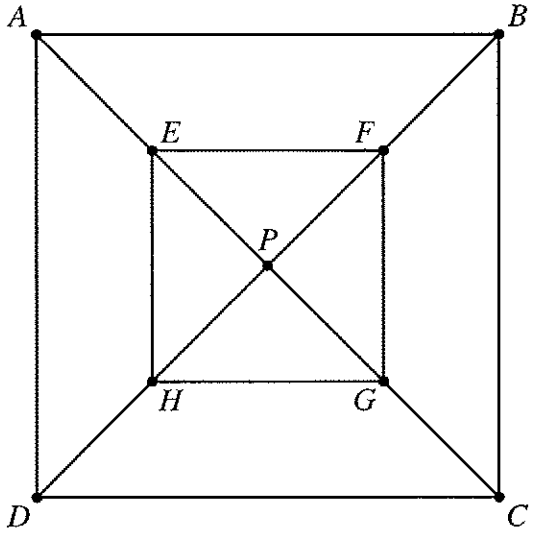
35. $48 \times 53 - 24 \times 16 =$

A. 2080 B. 2160 C. 2280 D. 2360 E. NOT

36. If $2x + 3y = 24$, how many different ordered pair (x, y) solutions are there with $x \geq 0$ and $y \geq 0$?

A. 5 B. 4 C. 3 D. 2 E. NOT

37. In square $ABCD$, points E, F, G, and H are midpoints of segments $\overline{AP}$, $\overline{BP}$, $\overline{CP}$, and $\overline{DP}$, respectively. What is the ratio of the area of $EFGH$ to the area of $ABCD$?



A. $1:\sqrt{2}$
B. $1:2\sqrt{2}$
C. $1:2$
D. $1:4$
E. NOT

38. A hive started with 300 bees. The population of bees doubles every 4 months. Which function gives the population B of the bee hive after t months?

A. $B = 300(2)^{t/4}$ B. $B = 300(2)^{4t}$ C. $B = 300\left(\frac{1}{2}\right)^{t}$ D. $B = 300(8)^{t}$ E. NOT

39. Find the x-coordinate of the solution to the system $\begin{cases} x + y = 88 \\ x - y = 48 \end{cases}$

A. 64 B. 66 C. 68 D. 70 E. NOT

40. What is the remainder when $x^3 - 5x^2 + 7x - 3$ is divided by $x - 1$?

A. -11 B. -5 C. -3 D. 0 E. NOT

41. The current in a wire varies directly as the voltage and inversely as the resistence. If the current is 18 amps when the voltage is 90 volts and the resistence is 10 ohms, what is the current when the voltage is 60 volts and the resistence is 5 ohms?

A. 48 amps B. 36 amps C. 12 amps D. 24 amps E. NOT

42. $\dfrac{1+4+9+16+\cdots+225}{1+3+6+10+\cdots+120} =$

A. $\dfrac{29}{15}$ B. $\dfrac{31}{15}$ C. $\dfrac{29}{17}$ D. $\dfrac{31}{17}$ E. NOT

43. Find the distance between the points $(-2,7)$ and $(4,3)$.

A. $\sqrt{57}$ B. $2\sqrt{13}$ C. $\sqrt{31}$ D. $2\sqrt{11}$ E. NOT

44. The sum of three consecutive even integers is 36. What is the product of these integers?

A. 1440 B. 1680 C. 1728 D. 1884 E. NOT

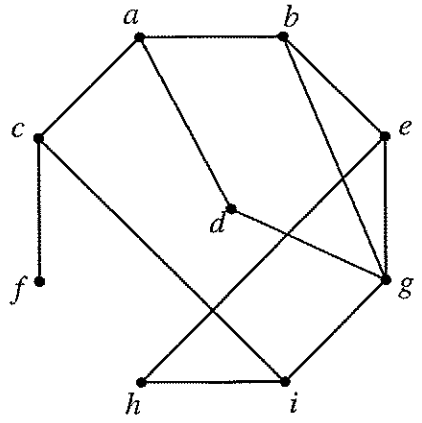
45. The number N has a remainder of 8 when divided by 11 and a remainder of 4 when divided by 5. Which pair of numbers contains a possible value for N?

A. 51 to 60 B. 61 to 70 C. 71 to 80 D. 81 to 90 E. NOT

Graph Theory

Use the graph of G to answer questions 46 through 48.

G :



46. What is the order of G?

A. 12 B. 7 C. 9 D. 10 E. NOT

47. What is the subgraph induced by vertices a, b, d, and g?

A. C_4 B. K_4 C. $K_{2,2}$ D. P_4 E. NOT

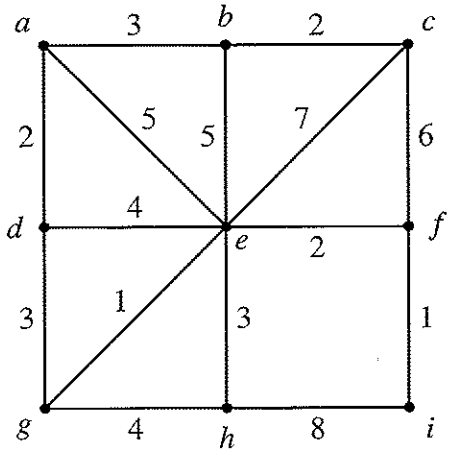
48. A *proper vertex coloring* is one where adjacent vertices are assigned different colors. What is the least number of colors needed to create a proper vertex coloring for G?

A. 2 B. 3 C. 4 D. 5 E. NOT

49. What is the size of the graph $K_{7,5}$?

A. 12 B. 35 C. 7 D. 24 E. NOT

50. Find the distance from a to i in this graph.



A. 7 B. 8 C. 9 D. 10 E. NOT

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State Contest

Contestant Answer Sheet

GRADERS: Write scores and initial.

Score 1: _____ Score 3: _____

Score 2: _____ FINAL: _____

Contestant ID: _____ Grade Level: _____

INSTRUCTIONS: Place the PRINTED CAPITAL letter of each answer choice (A, B, C, D, or E) in the blank corresponding to the test item number. SCORING: +5 for each correct answer; –2 for each incorrect answer; no deduction for skipped or unanswered items. Visible erasures and mark-outs constitute a 2-point deduction ONLY if a correct answer is not written in the answer space.

1. _____	18. _____	35. _____
2. _____	19. _____	36. _____
3. _____	20. _____	37. _____
4. _____	21. _____	38. _____
5. _____	22. _____	39. _____
6. _____	23. _____	40. _____
7. _____	24. _____	41. _____
8. _____	25. _____	42. _____
9. _____	26. _____	43. _____
10. _____	27. _____	44. _____
11. _____	28. _____	45. _____
12. _____	29. _____	46. _____
13. _____	30. _____	47. _____
14. _____	31. _____	48. _____
15. _____	32. _____	49. _____
16. _____	33. _____	50. _____
17. _____	34. _____	

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Mathematics Grades 6-8 *ANSWER KEY*

State 2023

REMINDERS: PRINTED CAPITAL letters only. SCORING: +5 for each correct answer; –2 for each incorrect answer; no deduction for skipped or unanswered items. Visible erasures and mark-outs constitute a 2-point deduction ONLY if a correct answer is not written in the answer space.

1. **A**
2. **C**
3. **A**
4. **E** ($3^1/_{12}$)
5. **B**
6. **B**
7. **C**
8. **A**
9. **D**
10. **B**
11. **D**
12. **B**
13. **C**
14. **D**
15. **D**
16. **C**
17. **D**
18. **A**
19. **D**
20. **A**
21. **D**
22. **C**
23. **C**
24. **B**
25. **A**
26. **B**
27. **C**
28. **B**
29. **D**
30. **D**
31. **C**
32. **C**
33. **A**
34. **A**
35. **B**
36. **A**
37. **D**
38. **A**
39. **C**
40. **D**
41. **D**
42. **D**
43. **B**
44. **B**
45. **C**
46. **C**
47. **A**
48. **B**
49. **B**
50. **B**