TMSCA MIDDLE SCHOOL MATHEMATICS

TEST #12 ©

FEBRUARY 18, 2023

GENERAL DIRECTIONS

1. About this test:
   A. You will be given 40 minutes to take this test.
   B. There are 50 problems on this test.

2. All answers must be written on the answer sheet/Scantron form/Chatsworth card provided. If you are using an answer sheet be sure to use **BLOCK CAPITAL LETTERS**. Clean erasures are necessary for accurate grading on Scantrons and Chatsworth cards.

3. If you are using a Chatsworth or Scantron card, please follow the specific instructions given at your particular meet.

4. You may write anywhere on the test itself. You must write only answers on the answer sheet.

5. You may use additional scratch paper provided by the contest director.

6. All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.

7. Calculators **MAY NOT** be used on this test.

8. All problems answered correctly are worth **FIVE** points. **TWO** points will be deducted for all problems answered incorrectly. No points will be added or subtracted for problems not answered.

9. In case of ties, percent accuracy will be used as a tie breaker.

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1. $(75 + 19) + (11 + 39) =$ _____
A. 216   B. 144   C. 156   D. 136   E. 154

2. $74.31 - 45.87 =$ _____
A. 29.54   B. 29.44   C. 28.44   D. 28.94   E. 28.74

3. $24 \times 6 \times 4 =$ _____
A. 576   B. 486   C. 524   D. 564   E. 582

4. $891 \div 0.5 =$ _____ (nearest hundred)
A. 2,000   B. 1,900   C. 1,800   D. 1,700   E. 1,600

5. 9.8 kilograms = _____ centigrams
A. 980,000   B. 98,000,000   C. 98,000   D. 980   E. 9,800,000

6. Find the value of $a + b + c + d$, if $1,680 = 2^a \times 3^b \times 5^c \times 7^d$.
A. 8   B. 7   C. 9   D. 12   E. 13

7. What is the measure of $\angle A$ in the picture below?
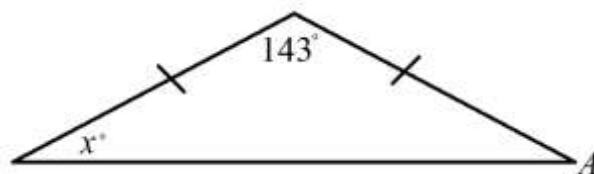
A. $29°$ B. $37°$ C. $14.5°$ D. $16.5°$ E. $18.5°$

8. What is the GCF of the numbers 120, 300, and 420?
A. 120   B. 20   C. 15   D. 60   E. 30

9. If $A = 1$, $B = 2$, $C = 3$, …, $Y = 25$, and $Z = 26$, what is the sum of the letters of the expression *TMSCA IS FUN*?
A. 133   B. 117   C. 118   D. 125   E. 93

10. Simplify: $|6^2 - 7^2| - |12 - 19|$
A. 6   B. -7 C. 4   D. -20 E. 20

11. 4.8 hours = _____ minutes
A. 384   B. 230   C. 288   D. 115   E. 115.2

12. $4^3 + 6^3 =$ _____ (Roman numeral)
A. CCCLX   B. CCXXX   C. CCLXVIII   D. CCXLVI   E. CCLXXX

13. Which list of angle measures could be the angles measures of a triangle?
A. $60°, 55°, 105°$ B. $90°, 85°, 65°$ C. $10°, 40°, 140°$ D. $5°, 15°, 150°$ E. $5°, 10°, 165°$

14. Billy is 4.5 feet tall and casts a 6 feet shadow. At the exact same time, how tall is a tree that casts a 20 feet shadow?
A. 18 feet   B. 15 feet   C. 21 feet   D. 16 feet   E. 20 feet

15. A dodecagonal prism has how many edges?
A. 20   B. 26   C. 36   D. 24   E. 30

16. What is the sum of the digits of 78^2?
A. 25   B. 22   C. 30   D. 18   E. 15

17. What is the probability of rolling a pair of dice and getting a sum divisible by 4 or divisible by 5?
A. $\frac{4}{9}$ B. $\frac{5}{6}$ C. $\frac{5}{9}$ D. $\frac{7}{12}$ E. $\frac{5}{18}$

18. A bagel shop sells 9 cinnamon bagels for every 5 plain bagels. If 441 cinnamon bagels are sold in one weekend, how many plain bagels are sold in that one weekend?
A. 275   B. 265   C. 255   D. 245   E. 235

19. What is the solution to the inequality $8 - \frac{n}{3} > 2$?
A. $n < 14$ B. $n > 14$ C. $n < -2$ D. $n > 18$ E. $n < 18$

20. A square and a regular pentagon share a common side to create a heptagon. If the area of the square is equal to 81 in^2, what is the perimeter of the heptagon?

81 in²
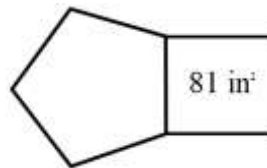
A. 108 inches   B. 72 inches   C. 81 inches   D. 54 inches   E. 63 inches

21. In her closet, Ella must choose from six different pairs of socks, four different skirts and ten different shirts. If she must choose one of each, how many combinations of clothes can Ella choose from?
A. 24   B. 60   C. 400   D. 260   E. 240

22. A 24-inch candle burns at a rate of ½ inch per hour. How tall will the candle be after 8 hours of burning?
A. 16 inches   B. 18 inches   C. 20 inches   D. 14 inches   E. 12 inches

23. If 3 A's are equal to 8 B's and 6 B's are equal to 11 C's, how many C's are equal to 9 A's?
A. 33   B. 44   C. 36   D. 66   E. 56

24. $0.4\overline{3} =$ _____ (fraction)
A. $\frac{13}{30}$ B. $\frac{43}{90}$ C. $\frac{43}{99}$ D. $\frac{26}{30}$ E. $\frac{7}{90}$

25. $\{12, 14, 16, 18, 20\} \cap \{17, 18, 19, 20, 21\} \cup \{1, 2, 3\} = A$. What is the sum of the elements of A?
A. 137   B. 143   C. 131   D. 44   E. 80

26. What is the surface area of a cube with an inner diagonal of 4 inches?
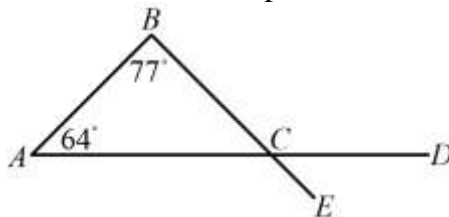A. 32 in^2 B. 64 in^2 C. 16 in^2 D. 96 in^2 E. 48 in^2

27. $198\ ft/sec =$ _____ mi/hr
A. 135   B. 130   C. 155   D. 145   E. 140

28. $2112_3 =$ _____ (base 9)

A. 68　　　　　　　　B. 67　　　　　　　　C. 73　　　　　　　　D. 71　　　　　　　　E. 75

29. What is the measure of the supplement to $\angle ECD$ in the picture below?

A. $116°$　　　　　　　B. $141°$　　　　　　　C. $103°$　　　　　　　D. $139°$　　　　　　　E. $159°$

30. Simplify: $4 - \left(\frac{1}{4}\right)^{-1} + \left(\frac{1}{16}\right)^{-2}$

A. 256　　　　　　　　B. 128　　　　　　　　C. 16　　　　　　　　D. 0　　　　　　　　E. -16

31. Marlene goes to the store and buys a sweater for a discounted price of $45.00. If the original cost of the sweater was $75.00, what percent discount did Marlene receive?

A. 30%　　　　　　　　B. 40%　　　　　　　　C. 35%　　　　　　　　D. 45%　　　　　　　　E. 37.5%

32. If y varies directly as x, and $y = 8$ when $x = \frac{1}{2}$, find the value of x when y is 320.

A. 160　　　　　　　　B. 16　　　　　　　　C. 80　　　　　　　　D. 20　　　　　　　　E. 40

33. What is the slope of the line passing though the points $(\frac{1}{2}, 2)$ and $(1, \frac{3}{4})$

A. -2.5　　　　　　　B. -1.5　　　　　　　C. -2.25　　　　　　　D. -1.25　　　　　　　E. -1.75

34. The midpoint of $\overline{AB}$ is point C, with coordinates $(4, 7)$. If point A has coordinates $(-6, -1)$, what are the coordinates of point B?

A. $(-2, 6)$　　　　　B. $(-1, 3)$　　　　　C. $(14, 15)$　　　　　D. $(10, 6)$　　　　　E. $(8, 14)$

35. Find the value of 7^n, if $7^{n+2} = 147$.

A. -5　　　　　　　　B. 6　　　　　　　　C. -4　　　　　　　　D. 2.5　　　　　　　　E. 3

36. $(5.4 \times 10^{-4})(8.5 \times 10^{11}) =$ _____ (scientific notation)

A. 1.39×10^7　　　B. 4.59×10^7　　　C. 3.1×10^9　　　D. 4.59×10^8　　　E. 4.59×10^{-44}

37. Square A has an area of 100 in^2 and square B has an area of 169 in^2. If the two squares are placed side by side where they are touching on one side, what is the perimeter of the hexagon that is created?

A. 72 inches　　　　B. 76 inches　　　　C. 62 inches　　　　D. 92 inches　　　　E. 84 inches

38. If $f(x) = 2x^2$ and $g(x) = -2x^3$, what is the value of $f\left(g(f(-1))\right)$?

A. 32,768　　　　　　B. 512　　　　　　　C. 1,024　　　　　　D. 256　　　　　　　E. 128

39. The sum of four consecutive positive odd integers is 104. What is the product of the least and greatest of the four integers?

A. 575　　　　　　　　B. 621　　　　　　　　C. 675　　　　　　　　D. 783　　　　　　　　E. 667

40. What is the conjugate of the expression $1 + \sqrt{3}$?

A. $-1 - \sqrt{3}$ B. $1 - \sqrt{3}$ C. $\frac{1}{\sqrt{3}}$ D. $-\sqrt{3}$ E. $\sqrt{1 + \sqrt{3}}$

41. $\frac{11\pi}{12}$ radians = _____ (degrees)

A. 135 B. 145 C. 155 D. 165 E. 175

42. $\frac{1}{90} + \frac{1}{110} + \frac{1}{132} = $ _____

A. $\frac{3}{112}$ B. $\frac{1}{36}$ C. $\frac{1}{45}$ D. $\frac{3}{94}$ E. $\frac{3}{98}$

43. What is the value of the x-coordinate of the solution to the system of equations $\begin{cases} 9x + 2y = 4 \\ -3x - y = -3 \end{cases}$?

A. $-\frac{1}{2}$ B. $-\frac{3}{4}$ C. $\frac{4}{3}$ D. $\frac{1}{3}$ E. $-\frac{2}{3}$

44. If $a^{\frac{1}{2}} \times a^{\frac{3}{2}} \times \left(a^{\frac{5}{2}}\right)^{\frac{1}{2}} \times a^{\frac{9}{4}} = a^n$, then what is the value of $2n$?

A. 11 B. 9 C. 15 D. 13 E. 21

45. Point A has coordinates $(17, 3)$. What are the new coordinates of A if A is rotated $270°$ counterclockwise about the origin?

A. $(3, -17)$ B. $(-17, 3)$ C. $(-17, -3)$ D. $(-3, 17)$ E. $(-3, -17)$

46. $(2 + \sqrt{3})(5 + \sqrt{18})(2 - \sqrt{3}) = $ _____

A. $1 + \sqrt{3}$ B. $1 - \sqrt{2}$ C. $1 + 3\sqrt{2}$ D. $5 + 3\sqrt{2}$ E. $5 + 2\sqrt{3}$

47. What is the value of the mean absolute deviation for the data set 80, 115, 145, 20 and 50?
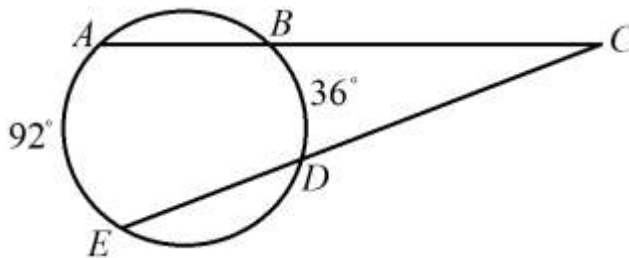
A. 36.8 B. 40.4 C. 38.4 D. 36.6 D. 44.2

48. What is the range of the graph of the quadratic function $g(x) = 3x^2 - 18x + 7$?

A. $y \leq 3$ B. $y \geq 3$ C. $y \leq 24$ D. $y \leq -20$ E. $y \geq -20$

49. In three dimensions, what is the measure of the diameter of the sphere that has the equation $x^2 + y^2 + z^2 + 2x - 2y - 6z - 14 = 0$?

A. 10 units B. 12 units C. 14 units D. 6 units E. 5 units

50. Using the picture below, what is the measure of the complement of $\angle C$?

A. $28°$ B. $56°$ C. $62°$ D. $112°$ E. $14°$

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2022 – 2023 TMSCA Middle School Mathematics Test #12 Answer Key

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

10. $|6^2 - 7^2| - |12 - 19| = |36 - 49| - |12 - 19| = 13 - 7 = 6$.

15. A dodecagonal prism has 14 faces, 24 vertices and 36 edges.

16. $78^2 = 78(78) = 6,084$. Therefore, the sum of the digits of 78^2 is equal to $6 + 0 + 8 + 4 = 18$.

21. If there are six different pairs of socks, four different skirts and ten different shirts, and Ella must choose one of each, then there are a total of $(6)(4)(10) = 240$ combinations of clothes Ella can choose from.

26. The formula for finding the surface area of a cube, when given the inner diagonal is $SA = 2d^2$. The given cube has an inner diagonal of 4 inches, so the surface area of the cube is equal to $SA = 2(4)^2 = 2(16) = 32$ in².

32. If y varies directly as x, then this problem is a direct variation, which is in the form $y = kx$, and $k = \frac{y}{x}$. Set up the proportion $\frac{8}{\frac{1}{2}} = \frac{320}{x}$. Because $8(40) = 320$, we can multiply ½ by 40 to get the value of $\frac{1}{2}(40) = 20$. Therefore, $x = 20$ when $y = 320$.

35. Using the exponent rule $a^m \times a^n = a^{m+n}$, 7^{n+2} can be rewritten as $7^n \times 7^2$. So, we can rewrite the original equation as $7^n \times 7^2 = 147$, which simplifies to $7^n \times 49 = 147$. Dividing both sides of the equation by 49 gives the equation $7^n = 147 \div 49 = 3$. Therefore, $7^n = 3$.

38. If $f(x) = 2x^2$ and $g(x) = -2x^3$, then the value of $f(-1) = 2(-1)^2 = 2$, and $g(2) = -2(2)^3 = -16$, and lastly, $f(-16) = 2(-16)^2 = 512$. Therefore, $f\left(g(f(-1))\right) = 512$.

40. The conjugate of the expression $1 + \sqrt{3}$ is equal to $1 - \sqrt{3}$.

44. Using the exponent rules of $a^m \times a^n = a^{m+n}$, and $(a^m)^n = a^{mn}$, $a^{\frac{1}{2}} \times a^{\frac{3}{2}} \times \left(a^{\frac{5}{2}}\right)^{\frac{1}{2}} \times a^{\frac{9}{4}} = a^{\frac{1}{2}} \times a^{\frac{3}{2}} \times a^{\frac{5}{2} \times \frac{1}{2}} \times a^{\frac{9}{4}} = a^{\frac{1}{2}} \times a^{\frac{3}{2}} \times a^{\frac{5}{4}} \times a^{\frac{9}{4}} = a^{\frac{1}{2}+\frac{3}{2}+\frac{5}{4}+\frac{9}{4}} = a^{\frac{11}{2}}$. So, if $a^{\frac{11}{2}} = a^n$, then $n = \frac{11}{2}$. Therefore, $2n$ is equal to $2\left(\frac{11}{2}\right) = 11$.

45. When rotating a point $270°$ counterclockwise about the origin, the point (x, y) becomes $(y, -x)$. Therefore, if point A has coordinates $(17, 3)$, then its coordinates become $(3, -17)$ after it is rotated $270°$ counterclockwise?

48. The standard form of a quadratic function is $f(x) = Ax^2 + Bx + C$. First, to find the x-coordinate of the vertex, use $x = -\frac{B}{2A}$. In the function $g(x) = 3x^2 - 18x + 7$, $A = 3$, $B = -18$, and $C = 7$. The x-coordinate is $x = -\frac{-18}{2(3)} = 3$. To find the y-coordinate, substitute the x-coordinate in for x and solve. The y-coordinate is $y = 3(3)^2 - 18(3) + 7 = -20$. The vertex is then $(3, -20)$. If A is positive, the graph of the quadratic function will open upward. Therefore, since -20 is the minimum value of the function, the range of the function is $y \geq -20$.