



TMSCA MIDDLE SCHOOL MATHEMATICS

REGION L TEST ©

MARCH 27, 2021

GENERAL DIRECTIONS

- About this test:
 - You will be given 40 minutes to take this test.
 - There are 50 problems on this test.
- 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.
- If you are using a Chatsworth or Scantron card, please follow the specific instructions given at your particular meet.
- You may write anywhere on the test itself. You must write only answers on the answer sheet.
- You may use additional scratch paper provided by the contest director.
- All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
- Calculators **MAY NOT** be used on this test.
- 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.
- In case of ties, percent accuracy will be used as a tie breaker.

[illegible]

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1. $55\frac{1}{3} - 12\frac{2}{3} =$ _____

- A. $43\frac{1}{3}$ B. $43\frac{2}{3}$ C. $42\frac{2}{3}$ D. $42\frac{1}{3}$ E. $43\frac{2}{9}$

2. $(-714) - (-512) - 41 =$ _____

- A. -161 B. -243 C. -1,185 D. -404 E. -322

3. $(-56) \times (-23) \times (-3) =$ _____

- A. 3,864 B. 3,664 C. -3,824 D. -3,864 E. -3,264

4. $76 \div 7 =$ _____ (nearest hundredth)

- A. 10.85 B. 10.9 C. 10.88 D. 10.76 E. 10.86

5. If $A = 311 - 73$, and $B = 276 + 218$, then $A + B =$ _____ (Roman numeral)

- A. DCCXXXII B. DCCXVII C. DCCVI D. DCCXLIX E. DCCXLII

6. If $A = 1$, $B = 2$, $C = 3$, ..., $X = 24$, $Y = 25$, and $Z = 26$, what is the sum of the letters of the word *FACTOR*?

- A. 63 B. 55 C. 57 D. 61 E. 59

7. What is the area of a rectangle with a length of $8\frac{1}{2}$ cm and a width of $10\frac{1}{4}$ cm?

- A. $80\frac{1}{8}$ cm² B. $84\frac{3}{8}$ cm² C. $85\frac{5}{8}$ cm² D. $85\frac{3}{8}$ cm² E. $87\frac{1}{8}$ cm²

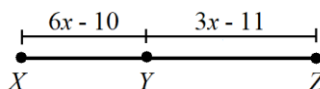
8. 160 is what percent of 64?

- A. 150% B. 175% C. 250% D. 275% E. 225%

9. What is the maximum number of 55¢ stamps Charlene can buy with a \$50 bill?

- A. 91 B. 90 C. 84 D. 112 E. 94

10. If $XZ = 51$ units, find ZY .



- A. 17 units B. 28 units C. 13 units D. 10 units E. 38 units

11. $-3(2m + 4n) - (m - n) + 5(-2m - 3n)$ is equivalent to which of the following?

- A. $-17m - 18n$ B. $-17m - 26n$ C. $-17m + 18n$ D. $-10m - 18n$ E. $-10m - 26n$

12. What is the sum of the digits of the sum of $8,107 + 309 + 2,637 + 1,873$?

- A. 17 B. 18 C. 19 D. 20 E. 21

13. What is the 8th term of the sequence $\frac{1}{2}, \frac{7}{10}, \frac{9}{10}, \dots$?

- A. $1\frac{1}{2}$ B. $2\frac{1}{10}$ C. $1\frac{7}{10}$ D. $1\frac{9}{10}$ E. $2\frac{1}{5}$

14. What is the LCM of the numbers 14, 24, and 30?

- A. 840 B. 630 C. 10,080 D. 672 E. 1,260

15. Evaluate $a^2 + \frac{1}{2}b^2$ for $a = \frac{1}{4}$ and $b = -\frac{1}{2}$?

- A. $\frac{3}{16}$ B. $\frac{3}{4}$ C. $\frac{5}{16}$ D. $\frac{7}{8}$ E. $\frac{3}{8}$

16. A pair of dice is rolled. What is the probability of getting an odd number on each die?

- A. $\frac{1}{3}$ B. $\frac{1}{6}$ C. $\frac{1}{2}$ D. $\frac{1}{4}$ E. $\frac{5}{9}$

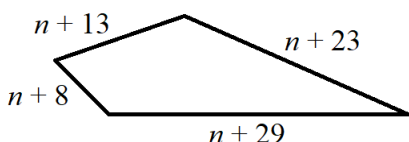
17. If $\sqrt{800}$ lies between two integers, what is the sum of those integers?

- A. 55 B. 56 C. 57 D. 58 E. 54

18. The number 52 can be divided evenly by its unit's digit. How many whole numbers between 20 and 40 can also be divided evenly by their unit's digit?

- A. 9 B. 10 C. 12 D. 7 E. 11

19. If the perimeter of the quadrilateral is 105 units, what is the value of n ?



- A. 12 B. 10 C. 8 D. 6 E. 11

20. $\frac{3}{5}\%$ = _____ (fraction)

- A. $\frac{3}{50}$ B. $\frac{3}{500}$ C. $\frac{3}{5,000}$ D. $\frac{3}{5}$ E. $\frac{3}{100}$

21. On a map, 2.4 inches is equal to 50 miles. How many miles does 2 feet represent?

- A. 250 miles B. 750 miles C. 225 miles D. 500 miles E. 525 miles

22. What is the 51st term of the sequence $-29, -17, -5, 7, \dots$?

- A. 595 B. 571 C. 607 D. 583 E. 587

23. How many three-digit lock combinations can be formed using the digits 0 – 9, inclusive, if the digits cannot be repeated?

- A. 640 B. 1,000 C. 520 D. 760 E. 720

24. What is the product of the number of faces, edges and vertices of a decagonal prism?

- A. 7,200 B. 3,840 C. 12,096 D. 10,648 E. 5,832

25. $15^2 - 14^2 + 13^2 - 12^2 + 11^2 - 10^2 + 9^2 - 8^2 + 7^2 - 6^2 + 5^2 - 4^2 + 3^2 - 2^2 + 1^2 =$ _____

- A. 125 B. 115 C. 120 D. 110 E. 100

26. $215_6 =$ _____ (base 8)

- A. 123 B. 155 C. 143 D. 107 E. 115

27. Point A has coordinates (11, 23). What are the coordinates of point A if it is rotated counter-clockwise about the origin by 90° ?

- A. $(-11, 23)$ B. $(23, 11)$ C. $(23, -11)$ D. $(11, -23)$ E. $(-23, 11)$

28. Samuel has a horse trough that holds 2,880 gallons of water. Sara has a small trough for her pony that holds $\frac{1}{120}$ the amount of Samuel's horse trough. How many cubic inches of water does Sara's water trough hold?
 A. 231 in^3 B. 240 in^3 C. $5,240 \text{ in}^3$ D. $5,082 \text{ in}^3$ E. $5,544 \text{ in}^3$

29. Simplify: $\frac{5^4 + 10^4}{10^4}$
 A. $\frac{17}{16}$ B. $\frac{5}{4}$ C. $\frac{19}{20}$ D. $\frac{20}{19}$ E. $\frac{10}{9}$

30. Leera has 24 times as many pennies as Bridget does. If the number of pennies Bridget has is equal to 8.5×10^3 , how many pennies does Leera have? Answer in scientific notation.
 A. 2.04×10^2 B. 2.4×10^6 C. 2.04×10^5 D. 2.24×10^4 E. 4.02×10^3

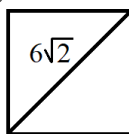
31. What is the value of $(-11 \nabla 13) \nabla (-4)$, if $a \nabla b = -6a - 2b + a - b$?
 A. 16 B. -36 C. 42 D. -112 E. -68

32. Linda is buying a rose bush for \$19.00, a hibiscus plant for \$12.50 and three daisy plants that cost \$4.50 each. If the tax rate is 7%, what will Linda's final price be?
 A. \$47.70 B. \$46.25 C. \$46.75 D. \$48.15 E. \$48.35

33. What is the remainder of dividing the 20th triangular number by 7?
 A. 4 B. 3 C. 2 D. 1 E. 0

34. $\{T, E, X, A, S\} \cap \{T, M, S, C, A\}$ has how many subsets?
 A. 8 B. 128 C. 127 D. 64 E. 32

35. What is the area of the square with the given diagonal?



A. $24\sqrt{2} \text{ units}^2$ B. $36\sqrt{2} \text{ units}^2$ C. $48\sqrt{2} \text{ units}^2$ D. 36 units^2 E. 32 units^2

36. Line A passes through the points $(-11, 3)$ and $(-3, -1)$. Line B passes through the points $(12, 8)$ and $(6, y)$. If lines A and B are perpendicular, what is the value of y?
 A. -2 B. -4 C. 11 D. 5 E. 20

37. What is the value of $\frac{2}{3}x^2 + 8$, if x is the largest root of $2x^2 - 6x - 108 = 0$?
 A. 62 B. 32 C. 104 D. 14 E. 158

38. Using the set of numbers, $-1, 14, -4, -2, 16, 0, 18, -1$, which inequality is true?
 A. mean < mode B. median > mode C. median > mean D. mean < median E. median < mode

39. Factor completely: $5x^3 + 10x^2 - 15x$
 A. $5x(x - 3)(x + 1)$ B. $(5x - 3)(x + 5)$ C. $5x(x + 3)(x - 1)$ D. $5x(x - 10)(x + 5)$ E. $(5x^2 - 3)(x - 1)$

40. What is the simple interest acquired after depositing \$1,250 at 6.2% for 42 months?
 A. \$262.50 B. \$270.75 C. \$271.25 D. \$272.75 E. \$272.25

41. A cone has a radius of 5 cm and a height of 12 cm. If $\pi = 3$, what is the total surface area of the cone?
 A. 270 cm^2 B. 120 cm^2 C. 375 cm^2 D. 210 cm^2 E. 300 cm^2

42. What is the value of the discriminant of the quadratic equation $8x^2 - 18 = -x$?
 A. -31 B. 577 C. 288 D. -356 E. 292

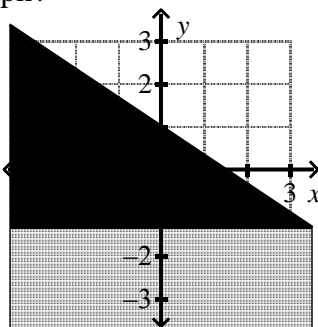
43. Which of the following is equivalent to $\log_2(7^2)$?
 A. $\log_2 14$ B. $\log_2(2^7)$ C. $\log_2(7 + 2)$ D. $7 \log_2 2$ E. $2 \log_2 7$

44. $35_6 \times 15_6 = \underline{\hspace{2cm}}$ (base 6)
 A. 1101 B. 1211 C. 1111 D. 1004 E. 1120

45. If $A = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -2 \\ -3 & 4 \end{bmatrix}$, and $C = \begin{bmatrix} -1 & 6 \\ 4 & -2 \end{bmatrix}$, then find $AB - C$.

A. $\begin{bmatrix} -16 & 30 \\ -8 & 8 \end{bmatrix}$ B. $\begin{bmatrix} -3 & 9 \\ 4 & 6 \end{bmatrix}$ C. $\begin{bmatrix} -10 & 9 \\ 22 & -22 \end{bmatrix}$ D. $\begin{bmatrix} -29 & 42 \\ -28 & 22 \end{bmatrix}$ E. $\begin{bmatrix} -14 & 18 \\ -16 & 12 \end{bmatrix}$

46. Which linear inequality matches the graph?



A. $3x - 2y \leq -3$ B. $2x - 3y \geq -3$ C. $2x + 3y \leq 3$ D. $3x + 2y \leq 3$ E. $2x - 3y \geq 3$

47. If $f(x) = -3x^2 + 5x^2$, find $f(a + b)$.
 A. $2a^2 + 4ab + b^2$ B. $2a^2 + 8ab + 2b^2$ C. $4a^2 + 4ab + b^2$ D. $2a^2 + 4ab + 2b^2$ E. $2a^2 + 4ab + 4b^2$

48. $\left(\frac{36a^{-2}b^3c}{48a^{-4}b^{-1}c^0} \right)^2 \cdot \frac{(3a^{-1}bc^2)^2}{(a^4b^2c)^3} = \underline{\hspace{2cm}}$

A. $\frac{27c^2}{4a^{12}}$ B. $\frac{81b^4c^3}{16a^{10}}$ C. $\frac{81c^2}{16a^{12}}$ D. $\frac{27b^4c^3}{4a^{12}}$ E. $\frac{27b^4c^3}{16a^{12}}$

49. A mathematics test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple-choice questions worth 11 points each. How many multiple-choice questions are on the test?

A. 12 B. 2 C. 5 D. 10 E. 7

50. Simplify: $1 + \frac{1}{1 + \frac{1}{x}}$

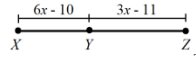
A. $\frac{4x+2}{x+1}$ B. $\frac{2}{x+1}$ C. $\frac{2x}{x+1}$ D. $\frac{4x+1}{x+1}$ E. $\frac{2x+1}{x+1}$

2020 – 2021 TMSCA Middle School Mathematics Regional Test Answer Key

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

5. If $A = 311 - 73$, and $B = 276 + 218$, then $A = 238$, $B = 494$, and $A + B = 238 + 494 = 732$. Using Roman numerals, $732 = \text{DCCXXXII}$.

10. Using the picture,



if $XZ = 51$, then $6x - 10 + 3x - 11 = 51$, which simplifies to $9x - 21 = 51$. Adding 21 to both sides of the equation gives us $9x = 72$. Dividing by 9 to both sides of the equation gives us $x = 8$. We are asked to find ZY , so we must substitute 8 in for x . Therefore, $YZ = 3(8) - 11 = 24 - 11 = 13$.

15. For $a = \frac{1}{4}$ and $b = -\frac{1}{2}$, then $a^2 + \frac{1}{2}b^2 = \left(\frac{1}{4}\right)^2 + \frac{1}{2}\left(-\frac{1}{2}\right)^2 = \frac{1}{16} + \frac{1}{2}\left(\frac{1}{4}\right) = \frac{1}{16} + \frac{1}{8} = \frac{1}{16} + \frac{2}{16} = \frac{3}{16}$.

23. Using the digits 0 – 9, inclusive, if the digits cannot be repeated, then there are $10 \cdot 9 \cdot 8 = 720$ different three-digit lock combinations that can be formed.

24. A decagonal prism has 12 faces, 30 edges, and 20 vertices. Therefore, the product of the number of faces, edges, and vertices of a decagonal prism is equal to $12(20)(30) = 7,200$.

28. Samuel's horse trough holds 2,880 gallons of water. Sara has a small trough for her pony that holds $\frac{1}{120}$ the amount of Samuel's horse trough. So, Sara's horse trough holds $\frac{1}{120}(2,880) = 24$ gallons of water. Because 1 gallon = 231 in³, Sara's trough holds $24(231) = 5,544$ in³ of water.

29. $\frac{5^4 + 10^4}{10^4} = \frac{5^4 + (2 \cdot 5)^4}{(2 \cdot 5)^4} = \frac{5^4 + 2^4 \cdot 5^4}{2^4 \cdot 5^4} = \frac{5^4(1 + 2^4)}{2^4 \cdot 5^4} = \frac{1 + 2^4}{2^4} = \frac{1 + 16}{16} = \frac{17}{16}$.

33. The formula to find the n^{th} triangular number is $\frac{n(n+1)}{2}$. So, the 20th triangular number is then $\frac{20(21)}{2} = 210$. Therefore, since $210 \div 7 = 30$, it has no remainder. The remainder is then 0.

34. $\{T, E, X, A, S\} \cap \{T, M, S, C, A\} = \{T, A, S\}$, which has 3 elements. To find the number of subsets of a set, use 2^n , where n is the number of elements in the set. So, the number of subsets of $\{T, A, S\}$ is equal to $2^3 = 8$.

35. The area of a square given the diagonal is $A = \frac{d^2}{2}$. We are given the square,



, which has a diagonal of $6\sqrt{2}$. Therefore, the area of the square is equal to $A = \frac{(6\sqrt{2})^2}{2} = \frac{(6\sqrt{2})(6\sqrt{2})}{2} = \frac{36 \cdot \sqrt{4}}{2} = \frac{36 \cdot 2}{2} = \frac{72}{2} = 36$ units².

47. If $f(x) = -3x^2 + 5x^2$, then $f(x) = 2x^2$, and $f(a + b) = 2(a + b)^2 = 2(a + b)(a + b) = 2(a^2 + 2ab + b^2) = 2a^2 + 4ab + 2b^2$.

50. $1 + \frac{1}{1 + \frac{1}{x}} = 1 + \frac{1}{\frac{x+1}{x}} = 1 + \frac{1}{\frac{x+1}{x}} = 1 + 1 \div \frac{x+1}{x} = 1 + 1 \cdot \frac{x}{x+1} = 1 + \frac{x}{x+1} = \frac{x+1}{x+1} + \frac{x}{x+1} = \frac{2x+1}{x+1}$.