

TMSCA MIDDLE SCHOOL MATHEMATICS

TEST #4 ©

NOVEMBER 12, 2022

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.

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1. $735 + 928 =$ _____ (nearest ten)

- A. 1,670 B. 1,660 C. 1,700 D. 1,600 E. 1,680

2. $811 - 89 - 76 =$ _____

- A. 722 B. 735 C. 646 D. 616 E. 682

3. $132 \times (21 - 4) =$ _____

- A. 2,118 B. 2,176 C. 2,254 D. 2,198 E. 2,244

4. $106.4 \div 1.9 =$ _____

- A. 48 B. 42 C. 56 D. 64 E. 54

5. Which list shows the numbers in order from least to greatest?

- A. 0, 3, 4, -5, -6 B. -6, -5, 4, 3, 0 C. -5, -6, 0, 3, 4 D. -6, -5, 0, 3, 4 E. 0, -6, -5, 3, 4

6. How many 3-digit numbers can be formed using the digits 6, 7, and 8, only once?

- A. 3 B. 4 C. 27 D. 6 E. 9

7. How many triangles can be found in the picture below?



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

8. If $A = 1$, $B = 2$, $C = 3$, ..., $Y = 25$, and $Z = 26$, what is the sum of the letters of the phrase *I LOVE MATH*?

- A. 112 B. 113 C. 107 D. 108 E. 105

9. $\frac{1}{2}$ day = _____ minutes

- A. 1,440 B. 720 C. 960 D. 43,200 E. 880

10. How many diagonals can be drawn from one vertex of a regular polygon with 13 sides?

- A. 10 B. 13 C. 65 D. 7 E. 26

11. The number 17 is all of the following except which one?

- A. irrational number B. integer C. natural number D. whole number E. rational number

12. Bella is thinking of two positive integers that sum to 391. If the two integers Bella is thinking of are in a ratio of 11:12, what is the value of the smaller integer?

- A. 176 B. 192 C. 187 D. 204 E. 221

13. $76 + 28 =$ _____ (Roman numeral)

- A. CXIV B. CIV C. MXIV D. MIV E. DIV

14. 45 hectograms = _____ grams

- A. 0.45 B. 4.5 C. 450 D. 0.045 E. 4,500

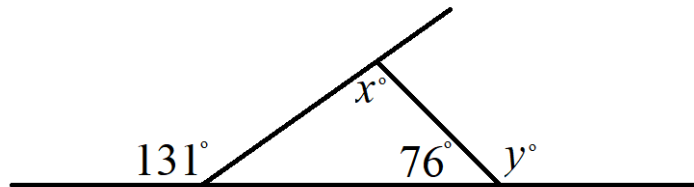
15. If digits cannot repeat, what is the positive difference of the greatest five-digit number and the least five-digit number that can be formed using the digits 4, 7, 1, 8, and 3?

- A. 73,035 B. 73,953 C. 68,670 D. 73,935 E. 73,963

16. The number 3,630 has how many distinct prime factors?

- A. 3 B. 4 C. 5 D. 6 E. 24

17. Using the picture below, what is the value of $x + y$?



- A. 131 B. 153 C. 186 D. 159 E. 207

18. Which integer is in the solution set of the inequality $-6n < 42$?

- A. -7 B. -100 C. -8 D. -10 E. -2

19. What is the product of the number of faces and edges of a pentagonal prism?

- A. 150 B. 70 C. 32 D. 105 E. 22

20. Simplify: $5(n - 3) + 2(1 - n) - 2(n + 2)$

- A. $7n - 5$ B. $3n - 11$ C. $3n - 17$ D. $n - 17$ E. $n - 11$

21. $1,900,000,000,000 = \underline{\hspace{2cm}}$ (scientific notation)

- A. 1.9×10^{12} B. 1.9×10^{11} C. 1.9×10^{-11} D. 1.9×10^{-12} E. 19×10^{11}

22. There are 315 calories in 7 ounces of a soft drink. How many calories are in 12 ounces of the soft drink?

- A. 480 calories B. 620 calories C. 570 calories D. 560 calories E. 540 calories

23. Shaquan is buying candy that costs 8¢ each. Shaquan wants to buy the maximum pieces of candy he can with his \$10 bill. Assuming there is no tax, what is the maximum amount of candy Shaquan can buy?

- A. 800 pieces B. 400 pieces C. 125 pieces D. 145 pieces E. 136 pieces

24. If $f(x) = 10x + 3$, then what is the value of $f(-2)$?

- A. -9 B. -17 C. -23 D. -4 E. 23

25. The probability of it raining tomorrow is $\frac{4}{7}$. What are the odds of it not raining tomorrow?

- A. 3:7 B. 4:7 C. 3:4 D. 4:3 E. 7:3

26. If $\frac{2}{3}$ inch = 8 miles on a map, how many inches would 42 miles measure on the map?

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

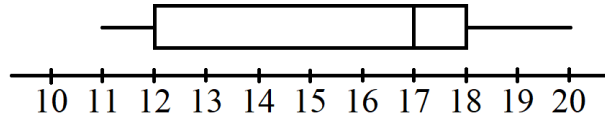
27. What is the value of the lower quartile of the set of numbers 12, 8, 8, 25, 26, 9, 11, 10, 18, 17, and 22?

- A. 13 B. 12 C. 8.5 D. 9 E. 8

28. $115_{10} = \underline{\hspace{2cm}}$ (base 4)
 A. 1223 B. 1323 C. 1233 D. 1313 E. 1303

29. Which value represents a percentage between 63% and 71%?
 A. $\frac{5}{8}$ B. $\frac{3}{4}$ C. $\frac{7}{8}$ D. $\frac{5}{6}$ E. $\frac{2}{3}$

30. What is the range of the data represented by the box-and-whisker plot below?



A. 11 B. 9 C. 6 D. 17 E. 5

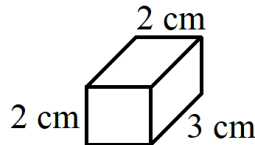
31. $5n^2(2n^4)^3 = \underline{\hspace{2cm}}$
 A. $40n^{14}$ B. $30n^{14}$ C. $40n^9$ D. $30n^{128}$ E. $40n^{66}$

32. What is the slope of any line parallel to the line with an equation of $9x - 3y = 36$?
 A. -3 B. $-\frac{1}{3}$ C. -12 D. 3 E. $\frac{1}{3}$

33. If the number 50 is decreased by 40%, and if that result is then increased by 40%, what is the final result?
 A. 30 B. 70 C. 48 D. 36 E. 42

34. $60 \text{ mi/hr} = \underline{\hspace{2cm}} \text{ ft/sec}$
 A. 74 B. 84 C. 88 D. 90 E. 92

35. The dimensions of the rectangular prism below are dilated by a scale factor of 2. What is the new volume of the dilated rectangular prism?



A. 12 cm^3 B. 24 cm^3 C. 48 cm^3 D. 96 cm^3 E. 36 cm^3

36. Two sides of a triangle measure 5 inches and 11 inches. What is the largest possible integral length for the third side of the triangle?

A. 16 inches B. 15 inches C. 7 inches D. 8 inches E. 17 inches

37. What is the equation for the axis of symmetry of the graph of the quadratic equation $15 = 4x + 13 - 2x^2$?
 A. $x = 1$ B. $x = 2$ C. $x = -2$ D. $x = 4$ E. $x = 3$

38. What is the growth rate of the exponential growth function $f(x) = 4.5(2.3)^x$?
 A. 450% B. 350% C. 230% D. 330% E. 130%

39. $\frac{3}{5x} + \frac{4}{2x} = \underline{\hspace{2cm}}$
 A. $\frac{7}{10x}$ B. $\frac{6}{5x}$ C. $\frac{13}{5x}$ D. $\frac{13}{10x}$ E. $\frac{7}{5x}$

40. A circle with equation $(x + 4)^2 + (y - 7)^2 = 256$ is translated by the rule $(x, y) \rightarrow (x - 9, y + 8)$. What are the new coordinates of the center of the circle after the translation?

- A. $(5, -1)$ B. $(-5, 1)$ C. $(-13, 15)$ D. $(13, -15)$ E. $(-13, -15)$

41. A shape is made of 8 isosceles triangles of equal size. Each isosceles triangle has a base of 6 inches and a height of 4 inches. What is the total area of the shape?

- A. 108 in^2 B. 96 in^2 C. 84 in^2 D. 144 in^2 E. 120 in^2

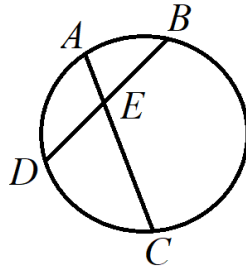
42. Two pens and one high-lighter cost \$3.90. One pen and two high-lighters cost \$4.20. How much would five high-lighters cost?

- A. \$5.50 B. \$6.00 C. \$6.50 D. \$7.00 E. \$7.50

43. Points A , B , and C are collinear, with B between A and C . What is the value of x , if $AB = 3x - 2$, $BC = 2x - 1$, and $AC = 32$?

- A. 7 B. 9 C. 6 D. 8 E. 11

44. In the circle below, $\widehat{AD} = 66^\circ$ and $\widehat{BC} = 156^\circ$. What is the measure of $\angle AED$?



- A. 90° B. 97° C. 111° D. 121° E. 123°

45. How many combinations can be formed from 12 items taken 10 at a time?

- A. 120 B. 60 C. 72 D. 66 E. 240

46. What is the area of the triangle with its vertices located at $(-6, 3)$, $(-3, 1)$, and $(2, 5)$?

- A. 12 units^2 B. 10 units^2 C. 9 units^2 D. 13 units^2 E. 11 units^2

47. What is the sum of the roots of the quadratic equation $-12 = 4x^2 + 18 - 2x$?

- A. $\frac{1}{2}$ B. -15 C. $-\frac{1}{2}$ D. 15 E. $-\frac{1}{3}$

48. Simplify $\frac{6}{\sqrt{6}}$ by rationalizing the denominator.

- A. 1 B. $\frac{1}{\sqrt{6}}$ C. $\sqrt{6}$ D. $6\sqrt{6}$ E. $\frac{1}{6\sqrt{6}}$

49. What is the inverse function of the function $f(x) = 3x - 7$?

- A. $f^{-1}(x) = \frac{x}{3} + 7$ B. $f^{-1}(x) = \frac{x+7}{3}$ C. $f^{-1}(x) = -3x + 7$ D. $f^{-1}(x) = 3x + 7$ E. $f^{-1}(x) = \frac{x}{7} + 3$

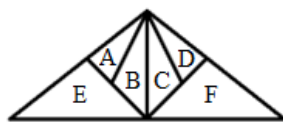
50. $\sqrt{5} + 4(\sqrt{80} + \sqrt{20}) =$ _____

- A. $25\sqrt{5}$ B. $9\sqrt{5} + 8\sqrt{2}$ C. $18\sqrt{5}$ D. $8\sqrt{5} + 9\sqrt{2}$ E. $9\sqrt{5}$

2022 – 2023 TMSCA Middle School Mathematics Test #4 Answer Key

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

7. First, label the picture as shown.



From the labels, we see there are 6 triangles requiring 1 section, A, B, C, D, E, and F.

There are 2 triangles requiring 2 sections, AB and CD. There are 2 triangles requiring 3 sections, ABE and CDF. There is 1 triangle requiring all 6 sections, ABCDEF.

Therefore, there are a total of $6 + 2 + 2 + 1 = 11$ triangles that can be found in the picture.

8. If $A = 1$, $B = 2$, $C = 3$, ..., $Y = 25$, and $Z = 26$, then $I = 9$, $L = 12$, $O = 15$, $V = 22$, $E = 5$, $M = 13$, $A = 1$, $T = 20$, and $H = 8$. Therefore, the sum of the letters of the phrase *I LOVE MATH* is equal to $9 + 12 + 15 + 22 + 5 + 13 + 1 + 20 + 8 = 105$.

14. If 1 hectogram = 100 grams, then 45 hectograms is equal to $45(100) = 4,500$ grams.

16. $3,630 = 2 \times 1815 = 2 \times 3 \times 605 = 2 \times 3 \times 5 \times 121 = 2 \times 3 \times 5 \times 11 \times 11$. Therefore, 3,630 has exactly 4 distinct prime factors.

18. When solving an inequality, if you multiply or divide both sides of the inequality by a negative number, you must “flip” the inequality symbol. To solve the inequality $-6n < 42$, divide both sides of the inequality by -6 , and after flipping the symbol, $n > -7$. Therefore, the only answer choice that is greater than -7 is -2 .

24. If $f(x) = 10x + 3$, then the value of $f(-2) = 10(-2) + 3 = -20 + 3 = -17$.

27. First, list the numbers in order from least to greatest, which is 8, 8, 9, 10, 11, 12, 17, 18, 22, 25, and 26. The lower quartile of a set of numbers is the median of the lower half of the numbers. The median of the entire set is 12. The median of the set of numbers less than 12 is then 9, which is the lower quartile of the numbers.

31. Using the exponent rules $a^m \cdot a^n = a^{m+n}$ and $(a^m)^n = a^{mn}$, $5n^2(2n^4)^3 = 5n^2(8n^{12}) = 40n^{14}$.

34. To change *mi/hr* to *ft/sec*, multiply by $\frac{22}{15}$. Therefore, $60 \text{ mi/hr} = 60 \left(\frac{22}{15}\right) = 88 \text{ ft/sec}$.

37. A quadratic equation in standard form is $Ax^2 + Bx + C = 0$. The given equation is $15 = 4x + 13 - 2x^2$, so to get it into standard form, first, subtract 15 from both sides of the equation and then change it into standard form to get $-2x^2 + 4x - 2 = 0$. The axis of symmetry can be found by $x = -\frac{B}{2A}$. In the new equation, $A = -2$, and $B = 4$. The axis of symmetry of the graph of the equation is therefore $x = -\frac{4}{2(-2)} = \frac{4}{4} = 1$.

38. An exponential growth function is in the form $f(x) = a \cdot b^x$, where b is the growth factor and $b = 1 + r$, where r is the rate, expressed as a decimal. The given function is $f(x) = 4.5(2.3)^x$, so $b = 2.3$. Since $b = 1 + r$, we subtract 1 from b to get r , which gives $2.3 - 1 = r = 1.3$, and 1.3 expressed as a rate is 130%.

48. To rationalize the denominator means to eliminate any radical expressions in the denominator of a fraction.

To rationalize $\frac{6}{\sqrt{6}}$, multiply the fraction by $\frac{\sqrt{6}}{\sqrt{6}}$, which will become $\frac{6}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{6\sqrt{6}}{6}$. Thus, after simplifying, our fraction will become $\frac{6\sqrt{6}}{6} = \frac{\sqrt{6}}{1} = \sqrt{6}$.