T M S C A M I D D L E S C H O O L

M A T H E M A T I C S

T E S T # 4 ©

N O V E M B E R 7 , 2 0 2 0

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.

2020 – 2021 TMSCA Middle School Mathematics Test #4

1. 1,111 – 888 = _____
A. 233 B. 213 C. 223 D. 243 E. 203

2. 176 + 19.4 + 911 = _____ (nearest ten)
A. 1,110 B. 1,100 C. 1,108.1 D. 1,111 E. 1,120

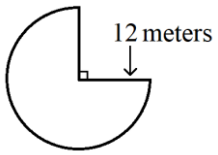
3. $34 \times 1.5 \times 2$ = _____
A. 1,020 B. 51 C. 102.2 D. 1,200 E. 102

4. $4{,}872 \div 0.06$ = _____ (nearest thousand)
A. 80,000 B. 82,000 C. 81,000 D. 81,200 E. 81,210

5. What is 70% of 440?
A. 312 B. 306 C. 318 D. 328 E. 308

6. If $A = 2^3 \cdot 3^2 \cdot 13$, how many positive integral divisors does *A* have?
A. 36 B. 8 C. 18 D. 24 E. 16

7. What is the perimeter of the shape below? Let $\pi = 3$.



A. 72 meters B. 54 meters C. 66 meters D. 78 meters E. 90 meters

8. Evaluate $a^2 - b^2$ for $a = 19$ and $b = -12$.
A. 217 B. 62 C. 505 D. 385 E. -106

9. 196 minutes = _____
A. 2 hours 18 minutes B. 3 hours 18 minutes C. 3 hours 16 minutes D. 2 hours 56 minutes E. 3 hours 56 minutes

10. $\frac{1}{2}(6m - 8n) + 11m - 4n$ is equivalent to which of the following?
A. $\frac{17}{2}m - 6n$ B. $14m - 8n$ C. $14m - 4n$ D. $14m - 12n$ E. $\frac{17}{2}m - 4n$

11. CCLXVIII = _____ (Arabic number)
A. 2,628 B. 2,618 C. 268 D. 248 E. 258

12. What is the LCM of the numbers 42 and 30?
A. 1,260 B. 630 C. 210 D. 320 E. 420

13. Which of the following is not an irrational number?
A. $\sqrt{31}$ B. $\sqrt{841}$ C. π D. $-\sqrt{2}$ E. $\sqrt[3]{9}$

14. What is the sum of the edges and vertices of a pentagonal prism?
A. 25 B. 32 C. 17 D. 22 E. 20

15. What is the complement of an angle measuring 83.6°?
A. 96.4° B. 176.4° C. 106.4° D. 7.4° E. 6.4°

16. When a number, *w*, is subtracted from 18 and the difference is divided by *w*, the final result is 2. What is the value of $-2w^2$?
A. -32 B. -100 C. -128 D. -72 E. -50

17. The additive inverse of -24 is equal to one-third of a number, *n*. What is the value of *n*?
A. -8 B. -72 C. 8 D. 12 E. 72

18. How may diagonals can be drawn from one vertex of a regular dodecagon?
A. 24 B. 54 C. 6 D. 12 E. 9

19. How may terms are in the sequence 18, 31, 44, 57, …, 161, 174, and 187?
A. 12 B. 14 C. 16 D. 18 E. 15

20. How may subsets can be found using the set of numbers {13, 22, 14, 21}?
A. 12 B. 10 C. 16 D. 8 E. 4

21. If $x \boxminus y = 2x^2 - y$, then what is the value of $-1 \boxminus (3 \boxminus 4)$?
A. -8 B. 6 C. 14 D. -6 E. -12

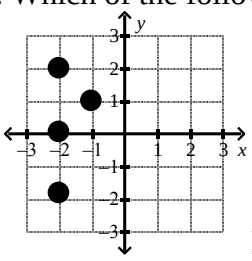
22. Last year, the local fish population was 160. This year, after a severe drought, the fish population dropped to 112. What was the percent decrease in the fish population?
A. 24% B. 42% C. 36% D. 28% E. 30%

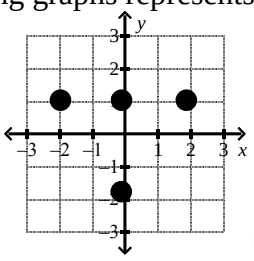
23. Which inequality is true?
A. $\frac{3}{8} < \frac{1}{4}$ B. $\frac{2}{5} > \frac{3}{7}$ C. $\frac{5}{8} > \frac{3}{4}$ D. $\frac{3}{5} > \frac{4}{7}$ E. $\frac{5}{9} < \frac{3}{8}$

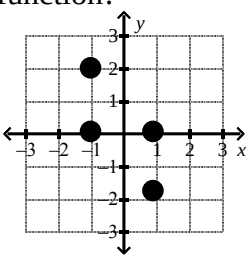
24. Simplify: $|6 - 10| - 2^3$
A. -4 B. -8 C. -12 D. 8 E. 16

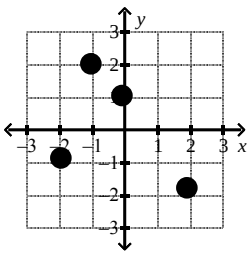
25. What is the remainder when 76,288 is divided by 9?
A. 6 B. 5 C. 4 D. 3 E. 2

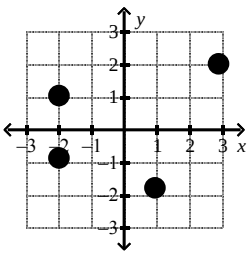
26. Which of the following graphs represents a function?

A. 

B. 

C. 

D. 

E. 

27. 301_{10} = _____ (base 9)
A. 382 B. 392 C. 354 D. 364 E. 376

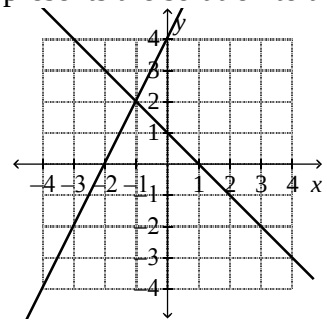
28. Mitchel ordered a pizza for he and his friends. He cut the pizza using a pizza cutter making 5 cuts. What is the maximum number of pieces into which the pizza can be cut?
A. 10 B. 12 C. 14 D. 16 E. 20

29. If $\Delta ABC \sim \Delta XYZ$, which of the following proportions is true?
A. $\frac{AB}{BC} = \frac{XY}{XZ}$ B. $\frac{AB}{XY} = \frac{AC}{XZ}$ C. $\frac{AC}{XY} = \frac{BC}{YZ}$ D. $\frac{BC}{AC} = \frac{XZ}{YZ}$ E. $\frac{CA}{YZ} = \frac{CB}{ZX}$

30. A basic calculator can perform an arithmetic operation in 4×10^{-4} seconds. How many of the same operations can the basic calculator perform in one hour? Answer in scientific notation.
A. 4×10^{36} B. 2.4×10^{-2} C. 9×10^{6} D. 2.4×10^{-1} E. 1.5×10^{6}

31. What is the slope of a line passing through the points (12, 18) and $(-4, 6)$?
A. ¾ B. ½ C. 1½ D. 3 E. 1¾

32. Which of the following ordered pairs represents the solution to the system of linear equations graphed below?



A. (0, 4) B. (1, 0) C. $(-2, 0)$ D. (0, 1) E. $(-1, 2)$

33. $15^{\circ}\ C =$ _____ $^{\circ}\ F$
A. 47 B. 57 C. 59 D. 63 E. 55

34. ½ of ⅓ of ¼ of 600 = _____
A. 12.5 B. 25 C. 50 D. 75 E. 30

35. If the point $(-2, 7)$ is translated nine units left and ten units up, what are its new coordinates?
A. $(7, -3)$ B. $(8, 16)$ C. $(-11, 17)$ D. $(-12, -2)$ E. $(-18, 70)$

36. If the interior angle of a regular polygon measures 120°, how many sides does the polygon have?
A. 10 B. 7 C. 9 D. 6 E. 8

37. $\sqrt{120}$ = _____
A. $2\sqrt{60}$ B. $4\sqrt{60}$ C. $2\sqrt{20}$ D. $2\sqrt{30}$ E. $4\sqrt{30}$

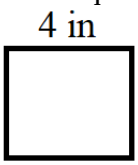
38. Vanessa can paint a mural on the side of a wall measuring 8 ft by 10 ft in 40 minutes. How long will it take Vanessa to paint a mural that measures 10 ft by 12 ft?
A. 55 minutes B. 60 minutes C. 65 minutes D. 48 minutes E. 52 minutes

39. Find the midpoint of $\overline{BC}$, if *B* has coordinates (7, 33) and *C* has coordinates $(-29, 45)$.
A. $(-11, 39)$ B. $(-11, 6)$ C. $(-22, 39)$ D. $(-22, 78)$ E. $(-11, -6)$

40. What is the positive geometric mean of the numbers 36 and 4?
A. 24 B. 20 C. 12 D. 16 E. 8

41. $36_7 + 34_7 =$ _____ (base 7)
A. 101 B. 70 C. 65 D. 103 D. 114

42. The radius of a circle is equal to the perimeter of the square below. If $\pi = 3$, what is the area of the circle?



A. 864 in^2 B. 144 in^2 C. 384 in^2 D. 1,728 in^2 E. 768 in^2

43. Simplify: $3n^3(4n^7)^2$
A. $24n^{12}$ B. $48n^{17}$ C. $24n^{17}$ D. $48n^{12}$ E. $48n^{20}$

44. Which of the following functions represents a direct variation.
A. $y = x^2$ B. $y = |2x| - 1$ C. $y = 6x - 1$ D. $y = 3^x$ E. $y = -\frac{3}{8}x$

45. What is the y-intercept of the graph of the quadratic function $y = 5x^2 - 10x + 15$?
A. 15 B. 3 C. -2 D. $-\frac{1}{2}$ E. $\frac{1}{3}$

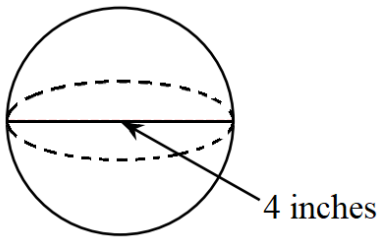
46. i^{111} is equivalent to which of the following?
A. $-i$ B. i C. 0 D. 1 E. -1

47. $6\begin{bmatrix} -12 & -9 \\ 7 & -13 \end{bmatrix} =$ _____

A. $\begin{bmatrix} -6 & -3 \\ 13 & -7 \end{bmatrix}$ B. $\begin{bmatrix} -18 & -54 \\ 42 & -78 \end{bmatrix}$ C. $\begin{bmatrix} -18 & -15 \\ 13 & -19 \end{bmatrix}$ D. $\begin{bmatrix} -72 & -54 \\ 42 & -78 \end{bmatrix}$ E. $\begin{bmatrix} -72 & -54 \\ -42 & -78 \end{bmatrix}$

48. What is the value of 3^x, if $3^{x-1} = 8$?
A. -3 B. 24 C. 6 D. $\frac{2}{3}$ E. $\frac{3}{8}$

49. What is the volume of the sphere? Let $\pi = 3$.



A. 256 in^3 B. 64 in^3 C. 128 in^3 D. 16 in^3 E. 32 in^3

50. Using the set of numbers $7, -1, 8, 16, -5, -1$, which inequality is true?
A. median > mean B. mean < mode C. mode > median D. median < mean E. mean = mode

2020 – 2021 TMSCA Middle School Mathematics Test #4 Answer Key

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

2020 – 2021 TMSCA Middle School Mathematics Test #4 Selected Answers

6. To find the number of positive integral divisors of a number, first find the prime factorization of that number. Once you have the prime factorization, add 1 to each exponent and then find the product of those numbers. We are given that $A = 2^3 \cdot 3^2 \cdot 13$, so the number of positive integral divisors of *A* is $(3 + 1)(2 + 1)(1 + 1) = (4)(3)(2) = 24$.

20. We are given the set {13, 22, 14, 21}, which has 4 elements within the set. The formula to find the number of subsets of a set is 2^n, where *n* is equal to the number of elements in the set. Therefore, with the given set having 4 elements, the number of subsets is equal to $2^4 = 16$.

30. Because there are 60 seconds in 1 minute and 60 minutes in 1 hour, there are $60 \times 60 = 3600$ seconds in 1 hour. Therefore, $3600 = 3.6 \times 10^3$, and so $\frac{3.6\times10^3}{4\times10^{-4}} = 9{,}000{,}000 = 9 \times 10^6$ operations that can be performed in one hour.

31. Given two points, (x_1, y_1) and (x_2, y_2), the slope formula is $\frac{y_2-y_1}{x_2-x_1}$. We are given the points (12, 18) and $(-4, 6)$, so the slope of the line passing though the points is equal to $\frac{6-18}{-4-12} = \frac{-12}{-16} = \frac{3}{4}$.

32. The solution to a graph of a system of linear functions is the point of intersection of the graphed lines. Therefore, the solution to the given system of linear functions is $(-1, 2)$.

33. To change ℃ to ℉, use the formula $F = \frac{9}{5}C + 32$. We are given $15^\circ C$, so substituting into our formula and we get $\frac{9}{5}(15) + 32 = 27 + 32 = 59^\circ F$.

36. The formula to find the interior angle of a regular polygon is equal to $\frac{180(n-2)}{n}$, where *n* is equal to the number of sides of the polygon. We are given an interior angle of 120°, so we can make the equation $\frac{180(n-2)}{n} = 120$. We can multiply both sides of the equation by *n* to get $180(n - 2) = 120n$. We can distribute next to get $180n - 360 = 120n$. Add 360 to both sides of the equation to get $180n = 120n + 360$. Subtract 120*n* from both sides to get $60n = 360$. Dividing by 60 to both sides and we get *n* = 6.

43. Using the exponent rules $a^m \cdot a^n = a^{m+n}$ and $(a^m)^n = a^{mn}$,
$3n^3(4n^7)^2 = 3n^3\left(16n^{7(2)}\right) = 3n^3(16n^{14}) = 48n^{3+14} = 48n^{17}$.

46. Imaginary numbers follow the pattern $i^0 = 1, i^1 = i, i^2 = -1$, and $i^3 = -i$. So, dividing 111 by 4, we get a remainder of 3. Since $i^3 = -i$, $i^{111} = -i$.

48. Using the exponent rule, $\frac{a^m}{a^n} = a^{m-n}$, $3^{x-1} = \frac{3^x}{3^1}$. So, we now have the equation $\frac{3^x}{3^1} = 8$. To solve this, multiply both sides of the equation by 3. Therefore, $3\left(\frac{3^x}{3^1} = 8\right) = \frac{3(3^x)}{3^1} = 8(3)$, which gives us $3^x = 24$.