TMSCA MIDDLE SCHOOL MATHEMATICS

TEST#3 ©

NOVEMBER 6, 2021

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. $26 + 18 + 54 =$ _____

A. 104 B. 106 C. 108 D. 96 E. 98

2. $321 - 17 - 38 =$ _____

A. 266 B. 247 C. 273 D. 276 E. 256

3. $4 \times 13 \times 11 =$ _____

A. 576 B. 572 C. 544 D. 546 E. 542

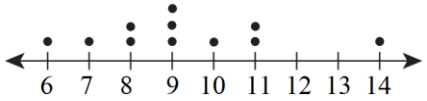
4. $256 \div 4 \div 8 =$ _____

A. 16 B. 4 C. 8 D. 12 E. 2

5. If $f(x) = -6x$, then what is the value of $f(-14)$?

A. -84 B. 84 C. -20 D. 20 E. -8

6. What is the sum of all the data points in the dot plot below?



A. 102 B. 93 C. 92 D. 98 E. 104

7. Which of the following is a solution to the inequality $n + 3 < 28$?

A. 51 B. 28 C. 27 D. 24.5 E. 25.5

8. Which expression is equivalent to $(8 \cdot y) - 5$?

A. $-5 + 8y$ B. $8y + 5$ C. $8 - 5 \cdot y$ D. $-40y$ E. $8(y - 5)$

9. CLXVIII = _____ (Arabic number)

A. 1,688 B. 173 C. 1,173 D. 168 E. 167

10. What is the multiplicative inverse of $\frac{6}{11}$?

A. $\frac{5}{11}$ B. $\frac{11}{6}$ C. $-\frac{6}{11}$ D. $-\frac{11}{6}$ E. $-\frac{11}{5}$

11. What is the probability of rolling a pair of dice and getting two prime numbers facing up?

A. $\frac{1}{2}$ B. $\frac{3}{8}$ C. $\frac{3}{4}$ D. $\frac{1}{4}$ E. $\frac{5}{9}$

12. What is the least common multiple, or LCM, of the numbers 24 and 18?

A. 6 B. 216 C. 42 D. 432 E. 72

13. Which set of numbers is correctly listed from least to greatest?

A. $3\frac{9}{25}, 3.08, 3.5, 3\frac{3}{5}$ B. $3\frac{3}{5}, 3.08, 3.5, 3\frac{9}{25}$ C. $3.08, 3.5, 3\frac{3}{5}, 3\frac{9}{25}$ D. $3.08, 3.5, 3\frac{9}{25}, 3\frac{3}{5}$ E. $3.08, 3\frac{9}{25}, 3.5, 3\frac{3}{5}$

14. Jessica's dog weighs 3.5 pounds less than Makhil's dog. If Makhil's dog weighs 5 pounds, how many ounces does Jessica's dog weigh?

A. 1.5 ounces B. 15 ounces C. 36 ounces D. 18 ounces E. 24 ounces

15. If 5 out of every 12 people have blue eyes, how many people out of 108 do not have blue eyes?
A. 27 B. 63 C. 45 D. 36 E. 72

16. Which of the following is equivalent to 8.5×10^{-5}?
A. 0.0000085 B. 0.00085 C. 0.000085 D. 8,500,000 E. 850,000

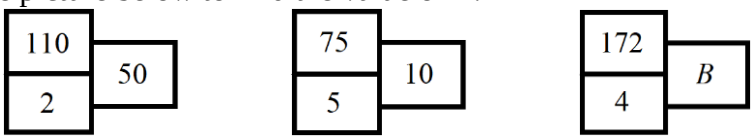
17. If you write down the numbers one to twelve on a sheet of paper, how many digits do you write?
A. 15 B. 12 C. 10 D. 18 E. 24

18. 17 Pennies + 17 nickels + 17 dimes + 17 quarters = _____
A. \$7.37 B. \$6.77 C. \$6.87 D. \$7.17 E. \$6.97

19. What is the sum of all the interior angles of a regular pentagon?
A. 500° B. 180° C. 360° D. 540° E. 480°

20. To make a batch of 18 cookies, Shayna needs four eggs. How many eggs will Shayna need to make 72 cookies?
A. 8 eggs B. 12 eggs C. 16 eggs D. 20 eggs E. 24 eggs

21. Use the examples in the picture below to find the value of *B*.



A. 40 B. 30 C. 38 D. 42 E. 46

22. If $a \blacklozenge b = \frac{ab}{2} + b$, then what is the value of $-6 \blacklozenge 4$?
A. -8 B. -12 C. 16 D. -3 E. -16

23. Simplify: $3(2a + 7b) + 9a - 6b$
A. $15a + 4b$ B. $14a + 15b$ C. $15a + 16b$ D. $15a + 15b$ E. $14a + 4b$

24. $45_{10} =$ _____ (base 4)
A. 213 B. 233 C. 221 D. 211 E. 231

25. Which function below produces the table?

x	0	4	7	13
y	-7	-15	-21	-33

A. $y = -2x - 7$ B. $y = -0.5x - 5$ C. $y = 0.5x + 7$ D. $y = 2x + 5$ E. $y = -0.5x - 2$

26. What is the value of the mean absolute deviation of the set of numbers 111, 134, and 136?
A. $10\frac{1}{3}$ B. $9\frac{1}{3}$ C. $9\frac{2}{3}$ D. 10 E. $10\frac{2}{3}$

27. 5,000 decigrams = _____ dekagrams
A. 500,000 B. 50 C. 500 D. 50,000 E. 5

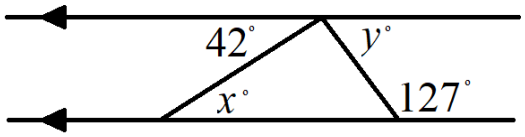
28. Simplify: $(8n^7)^2$

A. $8n^{14}$ B. $8n^9$ C. $64n^{49}$ D. $64n^{14}$ E. $64n^9$

29. If A is the set of all positive multiples of 4 less than 42 and B is the set of all prime numbers less than 20, how many elements are in $A \cup B$?

A. 18 B. 20 C. 21 D. 19 E. 1

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



A. 89 B. 137 C. 95 D. 97 E. 138

31. What is the slope of the line passing through the points $(-7, 13.5)$ and $(5, -28.5)$?

A. 3.5 B. -3.5 C. 5.5 D. -5.5 E. -1.25

32. The ratio of Patricia's blue marbles to red marbles is 3:13. If there are 52 red marbles, how many marbles does Patricia have?

A. 40 B. 68 C. 12 D. 62 E. 64

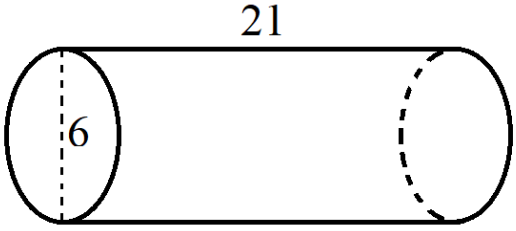
33. $\{1, 2, 3, 4, 5\} \cup \{2, 3, 4, 5, 6\} \cup \{3, 4, 5, 6, 7\}$ has how many elements?

A. 18 B. 3 C. 7 D. 10 E. 4

34. Augusto opens a book and the sum of the two page numbers he sees is 155. What is the product of the two page numbers?

A. 5,700 B. 6,162 C. 5,550 D. 6,006 E. 5,852

35. In terms of π, what is the lateral surface area of the cylinder?



A. 126π units^2 B. 378π units^2 C. 252π units^2 D. 144π units^2 E. 396π units^2

36. What is the x-intercept of the graph of the equation $2x + 7y = -12$?

A. -6 B. $-\frac{12}{7}$ C. $\frac{2}{7}$ D. $-\frac{2}{7}$ E. $-\frac{1}{6}$

37. What is the measure of an exterior angle of a regular pentagon?

A. 108° B. 60° C. 90° D. 54° E. 72°

38. A right triangle has legs of length 10 cm and 24 cm. If the triangle is dilated by a scale factor of 3, what is the new perimeter of the triangle?

A. 60 cm B. 180 cm C. 120 cm D. 102 cm E. 312 cm

39. What is the geometric mean of the numbers 36 and 4?
A. 40 B. 12 C. 20 D. 32 E. 16

40. Which of the following is a factor of the quadratic expression $3x^2 - 9x - 84$?
A. $3x + 21$ B. $3x + 4$ C. $x + 4$ D. $x - 4$ E. $x + 7$

41. What is the reciprocal of $\dfrac{6}{5-\frac{4}{3-\frac{2}{1}}}$?
A. $\frac{1}{6}$ B. 15 C. 12 D. $\frac{1}{12}$ E. $\frac{1}{18}$

42. A triangle has vertices (3, 4), $(5, -2)$, and (6, 4). What is the area of the triangle?
A. 9 units^2 B. 11 units^2 C. 14 units^2 D. 7 units^2 E. 10.5 units^2

43. $2i^2$ = _____
A. $2i$ B. $-2i$ C. 2 D. -2 E. $\sqrt{-2}$

44. What is the value of x in the equation $\frac{3}{x} + \frac{3}{2x} = \frac{3}{4}$?
A. 12 B. 18 C. ⅓ D. 8 E. 6

45. Dania has a pocket full of 18 coins consisting of quarters and dimes. If the value of Dania's coins is \$2.85, how many more dimes than quarters does Dania have?
A. 5 B. 4 C. 11 D. 7 E. 3

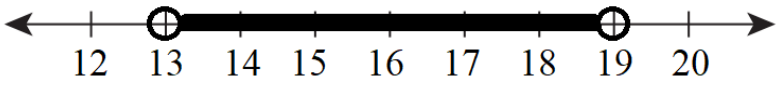
46. What are the coordinates of the vertex of the graph of the quadratic function $y = 2x^2 + 20x - 7$?
A. $(10, 393)$ B. $(-10, -7)$ C. $(-5, -57)$ D. $(0, -7)$ E. $(9, 317)$

47. What is the growth rate of the exponential growth function $y = 3(1.34)^x$?
A. 34% B. 134% C. 300% D. 66% E. 166%

48. $\left(\frac{10a^7}{3b^3}\right) \cdot \left(\frac{6b}{15a^5}\right) \cdot \left(\frac{5ab}{4a^2}\right)$ = _____
A. $\frac{2b}{3a}$ B. $\frac{5a}{3b}$ C. $\frac{2a^2}{3b^2}$ D. $\frac{5a^2}{3b^2}$ E. $\frac{2ab}{3}$

49. If $3^{x+3} = 1$ and $5^{y-2} = 1$, what is the value of $3^x 5^y$?
A. $\frac{3}{5}$ B. $\frac{5}{3}$ C. $\frac{9}{25}$ D. $\frac{25}{9}$ E. $\frac{25}{27}$

50. Which of the following is the correct interval notation that is represented by the graph?



A. [13, 19] B. [13, 19) C. (13, 19] D. (13, 19) E. $[-13, -19]$

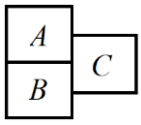
2021 – 2022 TMSCA Middle School Mathematics Test #3 Answer Key

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

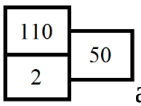
2021 – 2022 TMSCA Middle School Mathematics Test #3 Selected Answers

10. The multiplicative inverse, or reciprocal, of a fraction $\frac{a}{b}$ is $\frac{b}{a}$. The product of a fraction and its multiplicative inverse will always be equal to 1. Therefore, the multiplicative inverse of $\frac{6}{11}$ is $\frac{11}{6}$ because $\frac{6}{11} \cdot \frac{11}{6} = \frac{66}{66} = 1$.

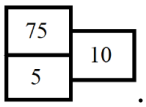
21. Draw a similar shape labeled as such:



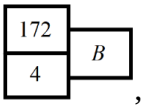
Now look at the examples given:



and



. We see from the first example, $\frac{110}{2} - 5 = 50$ and from the second example, $\frac{75}{5} - 5 = 10$. So, the rule is then $\frac{A}{B} - 5 = C$. In the picture,



, $B = \frac{172}{4} - 5 = 43 - 5 = 38$.

22. If $a \blacklozenge b = \frac{ab}{2} + b$, then $-6 \blacklozenge 4 = \frac{-6(4)}{2} + 4 = \frac{-24}{2} + 4 = -12 + 4 = -8$.

23. To simplify $3(2a + 7b) + 9a - 6b$, first distribute to get $6a + 21b + 9a - 6b$. Now, combine like terms to get the expression $15a + 15b$.

27. 100 decigrams = 1 dekagram, so 5,000 decigrams = $5{,}000 \div 100 = 50$ dekagrams.

28. The Power of a Power Property of Exponents state $(a^m)^n = a^{mn}$. We are given $(8n^7)^2$, using the power of a power property, $(8n^7)^2 = 8^2 \cdot n^{7 \cdot 2} = 64n^{14}$.

37. The exterior angle of a regular polygon is found using $\frac{360}{n}$, where n is the number of sides of the polygon. A pentagon has five sides, so the exterior angle of a regular pentagon is $\frac{360}{5} = 72^\circ$.

39. The geometric mean of two numbers a and b is $\sqrt{a \cdot b}$. We are given the numbers 36 and 4. Therefore, the geometric mean of 36 and 4 is $\sqrt{36 \cdot 4} = \sqrt{144} = 12$.

41. $\frac{6}{5-\frac{4}{3-\frac{2}{1}}} = \frac{6}{5-\frac{4}{3-2}} = \frac{6}{5-\frac{4}{1}} = \frac{6}{5-4} = \frac{6}{1} = 6.$

43. Since $i^2 = -1$, then $2i^2 = 2(-1) = -2$.

47. The exponential growth function is in the form $y = a \cdot b^x$, where $b = 1 + r$ and r is the rate. We are given the exponential growth function $y = 3(1.34)^x$, so $b = 1.34$. Since $b = 1 + r = 1.34$, $r = 0.34$. Therefore, the exponential growth rate is 34%.

48. $\left(\frac{10a^7}{3b^3}\right) \cdot \left(\frac{6b}{15a^5}\right) \cdot \left(\frac{5ab}{4a^2}\right) = \frac{10a^7}{3b^3} \cdot \frac{2b}{5a^5} \cdot \frac{5ab}{4a^2} = \frac{10 \cdot 2 \cdot 5 \cdot a^{7+1} \cdot b^{1+1}}{3 \cdot 5 \cdot 4 \cdot a^{5+2} \cdot b^3} = \frac{100a^8b^2}{60a^7b^3} = \frac{5a}{3b}$.