



TMSCA MIDDLE SCHOOL MATHEMATICS

TEST #7 ©

JANUARY 16, 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]

1. $3.4 + 27\frac{9}{10} =$ _____

- A. 31.5 B. 31.3 C. 30.5 D. 30.3 E. 30.13

2. $\frac{9}{16} - \frac{3}{8} =$ _____

- A. $\frac{3}{8}$ B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. $\frac{3}{16}$ E. $\frac{2}{3}$

3. $0.114 \times 2.3 =$ _____ (nearest hundredth)

- A. 0.2 B. 0.3 C. 0.31 D. 0.25 E. 0.26

4. $38 \div \frac{2}{3} =$ _____

- A. $25\frac{1}{3}$ B. $\frac{77}{3}$ C. $15\frac{2}{3}$ D. $57\frac{1}{3}$ E. 57

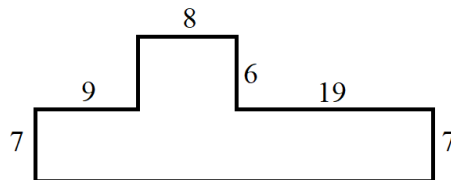
5. $142 - 77 =$ _____ (Roman numeral)

- A. XCV B. LXX C. DV D. LXV E. DXV

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 *FACE*?

- A. 12 B. 15 C. 16 D. 14 E. 13

7. What is the perimeter of the shape below?



- A. 62 units B. 56 units C. 92 units D. 98 units E. 81 units

8. Tamra has four dolls she wants to line up on a shelf. In how many ways can Tamra line up the dolls?

- A. 12 B. 18 C. 24 D. 16 E. 28

9. Simplify: $9 - (3 - x)$

- A. $x - 3$ B. $x - 12$ C. $x - 6$ D. $x + 6$ E. $-x + 6$

10. 56 is 25% of what number?

- A. 225 B. 256 C. 350 D. 328 E. 224

11. Evaluate $-m^3 - 7n + mn$ for $m = -4$ and $n = 12$.

- A. -28 B. -196 C. -68 D. -120 E. -144

12. What is the positive difference of the range and mean of the set of numbers 16, 27, 48, and 41?

- A. 14 B. 2 C. 1 D. 7 E. 5.5

13. $4\frac{1}{5}$ hours = _____ minutes

- A. 252 B. 264 C. 284 D. 188 E. 236

14. $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 =$ _____

- A. 100 B. 110 C. 90 D. 84 E. 120

15. How many elements are in set A , if $A = \{(4, 5, 6, 7, 8) \cap (2, 4, 6, 8, 10)\} \cup \{(1, 2, 3, 4, 5) \cap (1, 3, 6, 9, 12)\}$?
 A. 20 B. 5 C. 0 D. 4 E. 11

16. $2.5 \text{ hours} + \frac{4}{5} \text{ hour} = \underline{\hspace{2cm}}$ minutes
 A. 168 B. 138 C. 228 D. 178 E. 198

17. What is the positive difference of the LCM of the numbers 14 and 23 and the GCF of the numbers 56 and 105?
 A. 322 B. 315 C. 329 D. 308 E. 198

18. $\sqrt[3]{216} = \underline{\hspace{2cm}}$
 A. 72 B. 36 C. 16 D. 6 E. 8

19. What is the sum of the reciprocals of the positive factors of 10?
 A. $1\frac{1}{5}$ B. $1\frac{4}{5}$ C. $1\frac{3}{5}$ D. $1\frac{2}{5}$ E. 2

20. How many times larger is 0.0071 than 7.1×10^{-6} ?
 A. 0.001 B. 0.01 C. 10 D. 100 E. 1,000

21. In *Fort Sugar Land*, mayors can only serve 4-year terms. What is the maximum number of mayors *Fort Sugar Land* could have in a 26-year period?
 A. 6 B. 7 C. 8 D. 9 E. 10

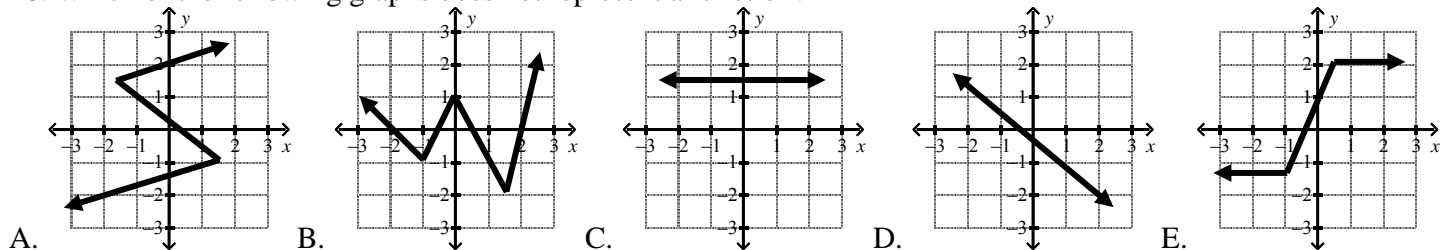
22. Two sides of a triangle measure 7 and 9 units. What is the greatest possible integral length of the third side?
 A. 2 B. 3 C. 16 D. 15 E. 17

23. $222_3 = \underline{\hspace{2cm}}$ (base 9)
 A. 28 B. 27 C. 26 D. 31 E. 32

24. The perimeter of a rectangle is 42 units. If the length is five more than the width, what is the measure of the length?
 A. 12 units B. 13 units C. 18 units D. 14 units E. 16 units

25. What is the measure of an interior angle of a regular nonagon?
 A. 120° B. 150° C. 140° D. 60° E. 40°

26. Which of the following graphs does not represent a function?



27. Juan received his check for the week from his job. He gave 30% of his earnings to his sister, Clarissa, for cleaning his room all week. Clarissa gave 20% of her money she received from Juan to her friend for helping her with her homework. If Clarissa gave her friend \$9.00, how much money did Juan originally have?
 A. \$180.00 B. \$150.00 C. \$120.00 D. \$75.00 E. \$90.00

28. If $a \nabla b = \frac{a^2}{b} + \frac{b^2}{a}$, then what is the value of $4 \nabla (-2)$?

- A. -1 B. -14 C. -7 D. -21 E. -28

29. If all the letters of the word MULTIPLICATION were placed in a bag and someone were to pull out two letters, one at a time, what is the probability that the first letter is a vowel and with out replacement, the second letter is another vowel?

- A. $\frac{24}{91}$ B. $\frac{15}{91}$ C. $\frac{9}{49}$ D. $\frac{15}{28}$ E. $\frac{15}{52}$

30. $(7n - 3)(5n + 11) =$ _____

- A. $35n^2 + 62n + 8$ B. $35n^2 - 33$ C. $35n^2 + 92n + 33$ D. $35n^2 - 62n - 33$ E. $35n^2 + 62n - 33$

31. The mean of the set $\{3, 6, x, 8, 17\}$ is 9. What is the median?

- A. 8 B. 7 C. 11 D. 9 E. 6.5

32. Tim's Hardware store is having a one-day 30% off sale. What will the sale price be for a new hammer that regularly sells for \$24.50?

- A. \$18.25 B. \$17.15 C. \$17.85 D. \$18.05 E. \$16.95

33. Connie's air pump can fill 60 balloons in 9 minutes. How long would it take Connie to fill 140 balloons?

- A. 28 minutes B. 14 minutes C. 24 minutes D. 21 minutes E. 25 minutes

34. Kenslie has a limitless supply of 4¢ stamps and 15¢ stamps. What is the largest unattainable sum of the stamps?

- A. 9¢ B. 37¢ C. 53¢ D. 29¢ E. 41¢

35. Which of the following is the geometric mean of the numbers 24 and 18?

- A. $12\sqrt{3}$ B. $2\sqrt{6}$ C. $6\sqrt{2}$ D. $12\sqrt{6}$ E. $6\sqrt{3}$

36. Using the table below, if $f(a) = 18$, find $f(a - 3)$.

x	3	6	8	13	16
$f(x)$	5	9	11	15	18

- A. 8 B. 9 C. 15 D. 10 E. 5

37. What is the slope of any line parallel to the line with the equation $4x - 6y = 24$?

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

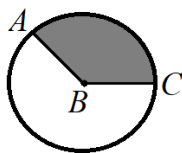
38. $\frac{i^{43}}{(i^7)^5} =$ _____

- A. 1 B. i C. -1 D. $-i$ E. 0

39. On a TMSCA Mathematics test, Kaye answered all but 6 problems and missed 8. What was Kaye's score?

- A. 229 B. 187 C. 180 D. 164 E. 171

40. In the picture below, if 40% of $\odot B$ is shaded, then $m\angle ABC = \underline{\hspace{1cm}}^\circ$.



- A. 124 B. 114 C. 154 D. 144 E. 164

41. If $\sqrt{242} + \sqrt{64} = x\sqrt{y}$, then what is the value of \sqrt{xy} ?

- A. $4\sqrt{2}$ B. $6\sqrt{6}$ C. $7\sqrt{3}$ D. $5\sqrt{2}$ E. $8\sqrt{6}$

42. $51_7 \times 6_7 = \underline{\hspace{1cm}}$ (base 10)

- A. 424 B. 426 C. 216 D. 224 E. 306

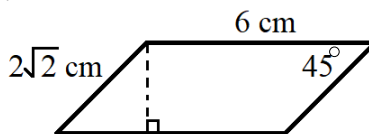
43. Simplify: $\frac{18a^4b^8c^{-12}}{4a^{-3}b^2c^{-3}}$

- A. $\frac{9a^7b^6}{2c^9}$ B. $\frac{9ab^6c^9}{2}$ C. $\frac{9ab^6}{2c^4}$ D. $\frac{2c^4}{9ab^6}$ E. $\frac{2a^7b^6}{2c^9}$

44. Solve for m : $3m - y = 9$

- A. $m = 9 - 3y$ B. $m = 9 + 3y$ C. $m = \frac{1}{3}(3 - y)$ D. $m = \frac{1}{3}(3 + y)$ E. $m = 3 + \frac{1}{3}y$

45. What is the area of the parallelogram?



- A. $8\sqrt{2} \text{ cm}^2$ B. 12 cm^2 C. 10 cm^2 D. $10\sqrt{2} \text{ cm}^2$ E. $12\sqrt{2} \text{ cm}^2$

46. What is the value of the discriminant of the given quadratic equation: $-2x^2 + 6x - 19 = 0$.

- A. -140 B. -116 C. -188 D. 188 E. 460

47. What is the distance between the points (8, 11) and (20, 6)?

- A. 15 units B. 18 units C. 13 units D. 16 units E. 12 units

48. The equation $-2|5x - 1| = -12$ has two solutions, a and b . What is the greatest difference of a and b ?

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

49. What is the value of x , if $(5^2 \cdot 5^3)^{x-2} = (5^x)^2$?

- A. 9 B. $\frac{10}{3}$ C. $\frac{1}{4}$ D. 12 E. $\frac{3}{4}$

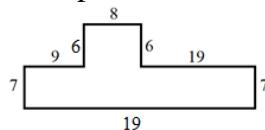
50. If $A = \begin{bmatrix} 5 & 6 \\ -7 & -11 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 4 \\ 2 & -2 \end{bmatrix}$, then what is the value of AB ?

- A. $\begin{bmatrix} 2 & 10 \\ -5 & -13 \end{bmatrix}$ B. $\begin{bmatrix} 8 & 2 \\ -9 & -9 \end{bmatrix}$ C. $\begin{bmatrix} -15 & 24 \\ -14 & 22 \end{bmatrix}$ D. $\begin{bmatrix} -3 & 8 \\ -1 & -6 \end{bmatrix}$ E. $\begin{bmatrix} -15 & 24 \\ -14 & -22 \end{bmatrix}$

2020 – 2021 TMSCA Middle School Mathematics Test #7 Answer Key

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

7. The picture is missing two side lengths. So, first label the side lengths as shown:



Now, we can find the perimeter by adding all sides lengths to get $19 + 7 + 9 + 6 + 8 + 6 + 19 + 7 = 81$ units.

14. Use the rule $1 + 2 + \cdots + (n - 1) + n + (n - 1) + \cdots + 2 + 1 = n^2$. Therefore, $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 10^2 = 100$.

19. The factors of 10 are 1, 2, 5, and 10. Therefore, the sum of their reciprocals is $\frac{1}{1} + \frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \frac{9}{5} = 1\frac{4}{5}$.

33. To solve this problem, create a proportion, such as $\frac{60 \text{ balloons}}{9 \text{ minutes}} = \frac{140 \text{ balloons}}{x \text{ minutes}}$. $\frac{60}{9}$ simplifies to $\frac{20}{3}$, so we have the proportion $\frac{20}{3} = \frac{140}{x}$. If we cross multiply, we get $3(140) = 20x$, which equals $420 = 20x$. Dividing both sides of the equation by 20 and we get $x = 21$. It will take 21 minutes to fill 140 balloons.

34. The formula to calculate the largest unattainable sum of two number a and b is $ab - a - b$. Therefore, the largest unattainable sum of 4¢ and 15¢ is $4(15) - 4 - 15 = 41\text{¢}$.

36. Using the table below, if $f(a) = 18$, then $a = x = 16$. Therefore, $f(a - 3) = f(16 - 3) = f(13) = 15$.

x	3	6	8	13	16
$f(x)$	5	9	11	15	18

44. We are given the literal equation $3m - y = 9$. To solve for m , first add y to both sides of the equation to get $3m - y + y = 9 + y \rightarrow 3m = 9 + y$. Now, divide both sides of the equation by 3 to get $\frac{3m}{3} = \frac{9}{3} + \frac{y}{3} \rightarrow m = 3 + \frac{1}{3}y$.

46. The formula to find the discriminant of a quadratic equation in the form $Ax^2 + Bx + C = 0$ is $B^2 - 4AC$. We are given the equation $-2x^2 + 6x - 19 = 0$, so $A = -2$, $B = 6$ and $C = -19$. Substituting our values and we get $6^2 - 4(-2)(-19) = 36 - 4(-2)(-19) = 36 - 152 = -116$.

47. The distance formula between two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$. Therefore, after substituting, the distance between the points $(8, 11)$ and $(20, 6)$ is $\sqrt{(8 - 20)^2 + (11 - 6)^2} = \sqrt{(-12)^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$ units.

50. When multiplying a 2×2 matrix by a 2×2 matrix, use the following:

$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \end{bmatrix}$. Therefore, $A = \begin{bmatrix} 5 & 6 \\ -7 & -11 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 4 \\ 2 & -2 \end{bmatrix}$, then the value of AB is equal to $\begin{bmatrix} 5 & 6 \\ -7 & -11 \end{bmatrix} \cdot \begin{bmatrix} -3 & 4 \\ 2 & -2 \end{bmatrix} = \begin{bmatrix} 5(-3) + 6(2) & 5(4) + 6(-2) \\ -7(-3) + (-11)(2) & -7(4) + (-11)(-2) \end{bmatrix} = \begin{bmatrix} -3 & 8 \\ -1 & -6 \end{bmatrix}$.