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 # 8 ©
J A N U A R Y   2 1 , 2 0 2 3

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 **<u>MAY NOT</u>** 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.

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA TMSCA

1. $541 + 763 + 118 =$ _____
A. 1,651   B. 1,652   C. 1,422   D. 1,584   E. 1,476

2. $(811 - 768) - 29 =$ _____
A. 36   B. 14   C. 18   D. 24   E. 26
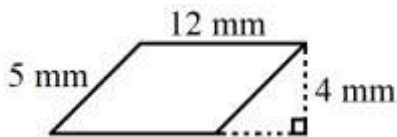
3. $12\frac{1}{2} \times 6\frac{1}{2} =$ _____
A. 74   B. $80\frac{1}{2}$ C. $80\frac{3}{4}$ D. $81\frac{3}{4}$ E. $81\frac{1}{4}$

4. $931 \div 9.8 =$ _____ (nearest ten)
A. 100   B. 80   C. 90   D. 110   E. 70

5. 380 decimeters = _____ decameters
A. 38,000   B. 3,800   C. 38   D. 3.8   E. 0.38

6. What is the remainder when the number 458 is divided by 23?
A. 17   B. 19   C. 21   D. 18   E. 20

7. What is the area of the parallelogram below?

A. 30 mm^2 B. 20 mm^2 C. 60 mm^2 D. 48 mm^2 E. 34 mm^2

8. Find the sum of the largest palindrome less than 600 and the fifth smallest prime number.
A. 606   B. 617   C. 602   D. 623   E. 611

9. $\frac{7}{90} =$ _____ (decimal)
A. 0.8   B. $0.0\overline{8}$ C. 0.078   D. $0.07\overline{8}$ E. $0.0\overline{7}$

10. If $A = 1$, $B = 2$, $C = 3$, …, $Y = 25$ and $Z = 26$, what is the sum of the letters of the expression *I CAN DIVIDE*?
A. 60   B. 80   C. 76   D. 84   E. 72

11. $\sqrt{600}$ lies between which two integers?
A. 22 and 23   B. 23 and 24   C. 24 and 25   D. 25 and 26   E. 26 and 27

12. What is the sum of the distinct prime factors of the number 560?
A. 20   B. 14   C. 18   D. 16   E. 1,488

13. If $a \nabla b = a^2 + ab + b^2$, then what is the value of $-3 \nabla 5$?
A. 4   B. -14 C. -7 D. 1   E. 19

14. If L is seven less than the LCM of 18 and 76, what is the value of L?
A. 677   B. 691   C. 684   D. 1,361   E. 1,368

15. If 8 movie tickets cost $108.00, how much do 5 movie tickets cost?
A. $67.50   B. $81.00   C. $54.00   D. $84.50   E. $72.50

16. Henry has 30% of the amount of pennies as Miriam has. If Miriam has ten more pennies as Khalid has, and Khalid has 300 pennies, how many pennies does Henry have?
A. 90   B. 93   C. 96   D. 87   E. 84

17. If a rooster will cock-a-doodle-do four times in fifteen minutes, how many times will a rooster cock-a-doodle-do in two hours?
A. 16   B. 20   C. 40   D. 28   E. 32

18. What is the arithmetic mean of the data in the line plot below?

```
         •
         •   •    •   •
         •   •    •   •
      +--+--+--+--+--+--
         8  9 10 11 13
```
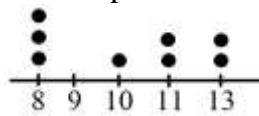
A. 10.75   B. 9.75   C. 10.25   D. 10.5   E. 11.25

19. What is the next term of the sequence 3120, 1560, 780, 390, 195, …?
A. 96   B. 94   C. 97.5   D. 92   E. 98

20. MMCCLV – MDCCI – DXXXIII - _____ (Arabic number)
A. 27   B. 21   C. 14   D. 30   E. 17

21. If you flip a coin and roll a die, what is the probability of getting a head on the coin and a prime number on the die?
A. $\frac{1}{3}$ B. $\frac{1}{4}$ C. $\frac{2}{3}$ D. $\frac{1}{2}$ E. $\frac{3}{4}$

22. $54^2 =$ _____
A. 2,916   B. 4,096   C. 3,364   D. 3,136   E. 2,116

23. If $P = 14 \times 36$, what is the prime factorization of P?
A. $2^3 \times 3 \times 7^2$ B. $2^4 \times 3 \times 7$ C. $2^3 \times 3^2 \times 7$ D. $2 \times 3^3 \times 7$ E. $2 \times 3 \times 7^2$

24. The odds of it not raining tomorrow are 4:9. What is the probability of it raining tomorrow?
A. $\frac{9}{13}$ B. $\frac{4}{13}$ C. $\frac{4}{9}$ D. $\frac{5}{9}$ E. $\frac{5}{4}$

25. Which prism below has 10 faces, sixteen vertices and twenty-four edges?
A. triangular prism   B. octagonal prism   C. rectangular prism   D. decagonal prism   E. hexagonal prism

26. Sammy is 4.5 feet tall and casts a 6 feet long shadow. At the same time, how long is the shadow of a tree that is 18 feet tall?
A. 22.5 feet   B. 24 feet   C. 26.5 feet   D. 20.5 feet   E. 28 feet

27. $1001_2 =$ _____ (base 6)
A. 13   B. 14   C. 15   D. 21   E. 23

28. Three positive integers are in a ratio of 3:4:7 and have a sum of 196. What is the smallest of the three integers?
A. 36   B. 56   C. 98   D. 42   E. 39

29. $0.078 \times 10^{-19} =$ _____ (scientific notation)
A. 7.8×10^{-2} B. 7.8×10^{-17} C. 7.8×10^{2} D. 78×10^{-16} E. 7.8×10^{-21}

30. Farmer Frieda wants to buy enough grain to feed her goats for one month. If the grain costs $12.96 per pound, how much will Frieda pay for $33\frac{1}{3}$ pounds?
A. $444.96   B. $457.92   C. $426.00   D. $466.00   E. $432.00

31. $\frac{1}{56} + \frac{1}{72} + \frac{1}{90} =$ _____
A. $\frac{6}{65}$ B. $\frac{1}{8}$ C. $\frac{3}{70}$ D. $\frac{1}{12}$ E. $\frac{1}{28}$

32. $104°F =$ _____ $°C$
A. 45   B. 35   C. 30   D. 40   E. 55

33. The sum of three consecutive odd integers is 129. What is the value of the product of the least and greatest of these integers?
A. 1,845   B. 1,937   C. 1,892   D. 1,806   E. 2,024

34. What is the direct variation equation that passes through the point $(-7, 21)$?
A. $y = -\frac{1}{3}x$ B. $y = \frac{1}{3}x$ C. $y = -3x$ D. $y = 3x$ E. $y = x + 3$

35. Square *ABCD* and square *WXYZ* are shown below. Square *WXZY* has an area equal to one-fourth the area of square *ABCD*. What is the perimeter of square *WXYZ*?
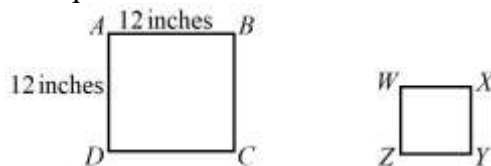
A. 36 inches   B. 24 inches   C. 72 inches   D. 48 inches   E. 42 inches

36. What is the percent of increase if a $72.00 shirt is marked up to $90.00?
A. 20%   B. 30%   C. 15%   D. 35%   E. 25%

37. What is the slope of the line that passes through the points $(-14, 8)$ and $(11, 8)$?
A. ⅓   B. −⅓   C. 0-slope   D. undefined slope   E. −3

38. $\frac{7\pi}{18}$ radians = _____ (degrees)
A. 70   B. 110   C 15   D. 80   E. 105

39. Points *A*, *B*, *C* and *D* are collinear, with *B* between *A* and *C*, and *C* between *B* and *D*. What is the measure of *CD*, if $AB = 4x - 1$, $BC = 6x - 2$, $BD = 11x + 5$, and $AD = 64$?
A. 15 units   B. 22 units   C. 25 units   D. 27 units   E. 33 units

40. What is the solution to the inequality $3n - 12 > 4n - 16$, using interval notation?

A. $[-\infty, 4)$ B. $(-\infty, 4)$ C. $[-\infty, 4]$ D. $(4, \infty)$ E. $(4, \infty]$

41. What is the measure of an interior angle of a regular octagon?

A. $150°$ B. $120°$ C. $135°$ D. $67.5°$ E. $175°$

42. $\left(\dfrac{(a^3 b)^5}{a^{-2}b^4}\right)^3 = $ _____

A. $a^{4913}b^9$ B. $a^{20}b^3$ C. $\dfrac{a^{75}}{b^{45}}$ D. $a^{75}b^{45}$ E. $a^{51}b^3$

43. What is the value of the geometric mean of the numbers 3, 4, and 18?

A. $8\frac{1}{3}$ B. $8\frac{2}{3}$ C. 8   D. 6   E. 5.5

44. What is the measure of the diameter of the circle with the equation $x^2 + y^2 - 6y - 8x = -16$?

A. 3 units   B. 6 units   C. 9 units   D. 12 units   E. 18 units

45. What is the perimeter of a regular dodecagon with a side length of $5\sqrt{6}$ inches?

A. $50\sqrt{6}$ inches   B. $60\sqrt{6}$ inches   C. $60\sqrt{30}$ inches   D. $360\sqrt{2}$ inches   E. $55\sqrt{6}$ inches

46. If the solution to the system of equations $\begin{cases} 6x - 5y = 8 \\ -12x + 2y = 0 \end{cases}$ is (a, b), then what is the value of $9a + 2b$?

A. -5 B. -7 C. -12 D. 4   E. 23

47. Using the picture below, which trig function can be used to find the length of x?
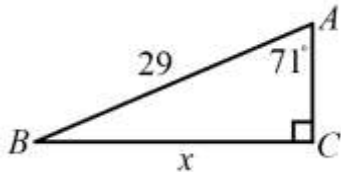
A. $\tan(71) = \frac{x}{29}$ B. $\tan(71) = \frac{29}{x}$ C. $\sin(71) = \frac{29}{x}$ D. $\cos(71) = \frac{x}{29}$ E. $\sin(71) = \frac{x}{29}$
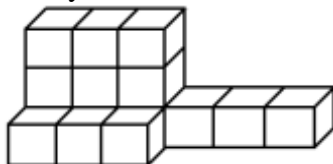
48. Johnny bought an old used car worth $12,000 and is decreasing in value by 70% each year. What will be the car's value after two years?

A. $1,080.00   B. $5,880.00   C. $2,940.00   D. $1,470.00   E. $2,112.00

49. If $g(x) = x^2 + x$, then what is $g(x - 7)$?

A. $x^2 + x - 56$ B. $x^2 + x + 42$ C. $x^2 - 13x + 42$ D. $x^2 - 6x - 56$ E. $x^2 - 6x + 42$

50. The figure below was formed using 2-inch by 2-inch cubes. What is the total surface area of the figure?

A. 156 in^2 B. 200 in^2 C. 196 in^2 D. 120 in^2 E. 100 in^2

2022 – 2023 TMSCA Middle School Mathematics Test #8 Answer Key

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

16. If Miriam has ten more pennies as Khalid has, and Khalid has 300 pennies, then Miriam has $300 + 10 = 310$ pennies. Henry has 30% of the amount of pennies as Miriam has, so Henry has $0.3(310) = 93$ pennies.

19. Given the sequence the sequence 3120, 1560, 780, 390, 195, …, to get the next term, divide the previous term by 2. Therefore, the next term of the sequence is equal $\frac{195}{2} = 97.5$.

21. If you flip a coin, the probability of getting a head is equal to ½. If you roll a die, the probability of getting a prime number is ½. Therefore, the probability of getting a head on the coin and a prime number on the die is equal to $½ \times ½ = ¼$.
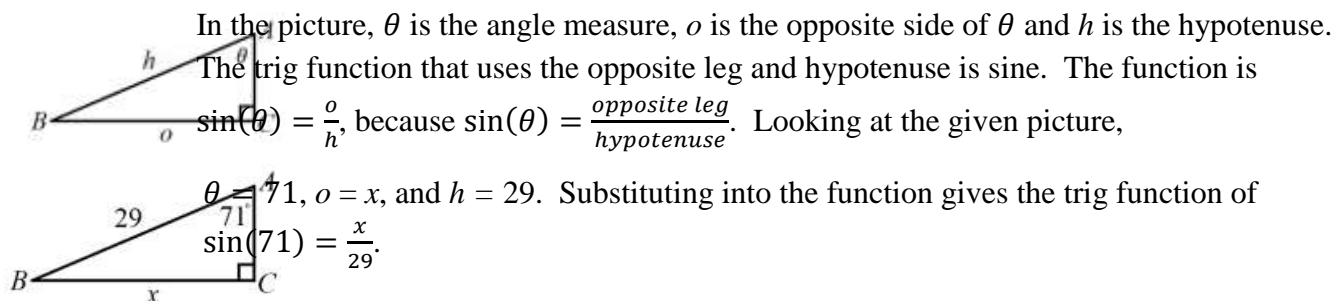
22. $54^2 = 54 \times 54 = 2{,}916$.

25. An octagonal prism has 10 faces, sixteen vertices and twenty-four edges.

37. The slope formula given two points (x_1, y_1) and (x_2, y_2) is $\frac{y_2 - y_1}{x_2 - x_1}$. The slope of the line that passes through the points $(-14, 8)$ and $(11, 8)$ is therefore, $\frac{8-8}{-14-11} = \frac{0}{-25} = 0\text{-slope}$.

41. To find the measure of an interior angle of a regular polygon, use the formula $\frac{(n-2)180}{n}$, where n is equal to the number of sides of the polygon. An octagon has 8 sides, so $n = 8$. Substitute into the formula to get the measure of an interior angle of a regular octagon to be $\frac{(8-2)180}{8} = \frac{6(180)}{8} = \frac{1080}{8} = 135°$.

42. Using the exponent rules $a^m \cdot a^n = a^{m+n}, \frac{a^m}{a^n} = a^{m-n}, a^{-m} = \frac{1}{a^m}$, and $(a^m)^n = a^{mn}$, $\left(\frac{(a^3 b)^5}{a^{-2}b^4}\right)^3 = \left(\frac{a^{15}b^5}{a^{-2}b^4}\right)^3 = \left(\frac{a^{15}a^2 b^5}{b^4}\right)^3 = \left(\frac{a^{15}a^2 b^5}{b^4}\right)^3 = (a^{15+2}b^{5-4})^3 = (a^{17}b^1)^3 = a^{17(3)}b^{1(3)} = a^{51}b^3$.

47. Label the right triangle as shown.

In the picture, θ is the angle measure, o is the opposite side of θ and h is the hypotenuse. The trig function that uses the opposite leg and hypotenuse is sine. The function is $\sin(\theta) = \frac{o}{h}$, because $\sin(\theta) = \frac{opposite\ leg}{hypotenuse}$. Looking at the given picture, $\theta = 71$, $o = x$, and $h = 29$. Substituting into the function gives the trig function of $\sin(71) = \frac{x}{29}$.

48. An exponential decay function is in the form $y = a(1 - r)^t$, where a is equal to the principal amount, r is equal to the rate and t is equal to time in years. In the given problem, $r = 70\% = 0.7$ and $t = 2$. Set up the equation $y = (12{,}000)(1 - 0.7)^2$. Therefore, the value of the used car, after two years, will be equal to $(12000)(0.3)^2 = (12000)(0.09) = \$1{,}080.00$.

49. If $g(x) = x^2 + x$, then $g(x - 7) = (x - 7)^2 + (x - 7) = x^2 - 14x + 49 + x - 7 = x^2 - 13x + 42$.