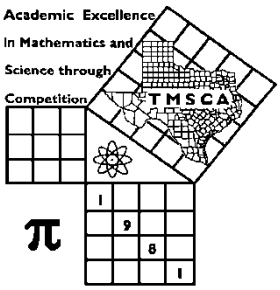

TMSCA MIDDLE SCHOOL MATHEMATICS

TEST #13 ©

FEBRUARY 25, 2023

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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2022 – 2023 TMSCA Middle School Mathematics Test #13

1. 1,487 + 1,385 + 1,726 = _____
A. 4,528 B. 4,628 C. 4,618 D. 4,588 E. 4,598

2. $376 - (88 + 123)$ = _____
A. 115 B. 175 C. 165 D. 125 E. 145

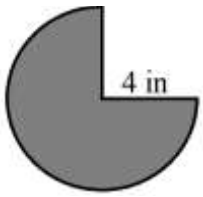
3. 4.5×1.12 = _____
A. 5.44 B. 5.34 C. 5.24 D. 5.14 E. 5.04

4. $988 \div 16$ = _____ (nearest tenth)
A. 60.9 B. 61.8 C. 61.4 D. 61.2 E. 60.7

5. What is the unit rate of purchasing 12 concert tickets for $1,350.00?
A. $116.25 B. $116.50 C. $112.50 D. $114.75 E. $114.50

6. 27 minutes is what percent of an hour?
A. 45% B. 35% C. 55% D. 40% E. 38%

7. 1/4 of a circle is cut away leaving the portion shown. What is the perimeter of the remaining portion? Let $\pi = 3$.



A. 18 inches B. 27 inches C. 26 inches D. 35 inches E. 36 inches

8. 983,466 ÷ 9 has a remainder of _____.
A. 4 B. 3 C. 2 D. 1 E. 0

9. 17,000,000 decigrams = _____ kilograms
A. 17,000 B. 170 C. 1,700 D. 17 E. 170,000

10. How many total diagonals can be drawn from one vertex of a regular 18-sided polygon?
A. 135 B. 128 C. 16 D. 15 E. 72

11. What is the next term of the sequence? 82, 41, 20.5, 10.25, …
A. 5.5 B. 5.125 C. 5.75 D. 5.375 E. 5.625

12. What is the largest palindrome less than the sum of 745 and 933?
A. 1,771 B. 1,678 C. 1,881 D. 1,661 E. 1,001

13. What value is 37 more than the GCF of the numbers 56 and 48?
A. 43 B. 47 C. 39 D. 41 E. 45

14. 10 yards = _____ inches
A. 360 B. 30 C. 720 D. 180 E. 900

15. $\frac{12}{13} - \frac{2}{3}$ = _____

A. 1 B. $\frac{10}{39}$ C. $\frac{8}{13}$ D. $\frac{9}{13}$ E. $\frac{4}{13}$

16. How many more sides does a nonagon have than a heptagon?

A. 0 B. 1 C. 2 D. 3 E. 4

17. What value of *n* can make the relation $\{(4,5),(n,-2),(-6,9),(-1,0),(7,10)\}$ a function?

A. -1 B. 4 C. 7 D. -6 E. 3

18. Solve: $-\frac{3}{2}w > -6$

A. $w < 9$ B. $w < -9$ C. $w > 4$ D. $w < 4$ E. $w < -4$

19. What is the positive difference of the mean and median of the set of numbers {29, 31, 45, 50, 20}?

A. 11 B. 7 C. 2 D. 4 E. 10

20. If the letters of the word *FUNCTION* are placed in a bag, what is the probability of drawing out an *N* on the first draw, and then with replacement, drawing out a vowel or *F*?

A. ⅔ B. ⅛ C. ¾ D. ⅜ E. ¼

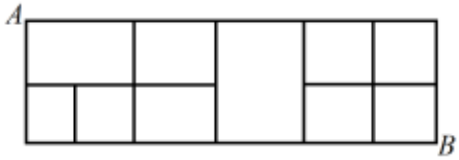
21. A perfect number is a composite number that is equal to the sum of all its divisors, excluding itself. 28 is a perfect number because its factors, other than itself, are 1, 2, 4, 7, and 14, and 1 + 2 + 4 + 7 + 14 = 28. What is the smallest perfect number less than 28?

A. 8 B. 4 C. 6 D. 10 E. 12

22. 7,854 = _____ (Roman numeral)

A. $PDCCCIV$ B. $PMMDCCCIV$ C. $\bar{V}MMDCCCLIV$ D. $\bar{P}MMDCCCIV$ E. $\bar{V}MMDCLIX$

23. Moving only to the right and/or down, how many paths exist from point *A* to point *B*?



A. 11 B. 12 C. 13 D. 14 E. 16

24. What is the product of the third and fifth triangular numbers?

A. 90 B. 150 C. 60 D. 18 E. 126

25. What is the surface area of a cube with an inner diagonal of 6 cm?

A. 72 cm^2 B. 36 cm^2 C. 108 cm^2 D. 144 cm^2 E. 216 cm^2

26. 218_9 = _____ (base 4)

A. 2311 B. 2303 C. 2233 D. 2223 E. 2323

27. If five lizards are equal to eight snakes, and twelve snakes are equal to seventeen turtles, how many lizards are equal to sixty-eight turtles?

A. 18 B. 30 C. 48 D. 42 E. 36

28. Which is closest to $\sqrt{20}$?
A. 4.4 B. 4.6 C. 4.2 D. 4.3 E. 4.5

29. What is the remainder when 673,122,003 is divided by 7?
A. 4 B. 3 C. 2 D. 1 E. 0

30. 116 is what term of the arithmetic sequence 18, 25, 32, 39, …?
A. 13^{th} B. 14^{th} C. 15^{th} D. 16^{th} E. 17^{th}

31. $15℃ =$ _____°F
A. 50 B. 59 C. 68 D. 41 E. 77

32. If the number 140 is increased by 50%, and if that result is then decreased by 50%, what is the final result?
A. 110 B. 115 C. 95 D. 105 E. 125

33. $\frac{126\times10^8}{4.2\times10^3}$ = _____ (scientific notation)
A. 3×10^5 B. 3×10^6 C. 3×10^{-5} D. 3×10^{-6} E. 3×10^4

34. A line passes through the points $(-4, 6)$ and $(8, y)$ and has a slope of $\frac{1}{6}$. What is the value of y?
A. 10 B. 4 C. -4 D. 8 E. 6

35. How many permutations can be made of 15 items taken 2 at a time?
A. 30 B. 105 C. 125 D. 420 E. 210

36. If $f(x) = x^3$, $g(x) = 10 - 3x$, and $h(x) = \sqrt{x}$, then what is the value of $g\left(f\left(h(9)\right)\right)$?
A. -17 B. 7 C. -71 D. 1 E. $-2{,}177$

37. A bag contains a combination of 150 red and blue gummy bears. What is the number of blue gummy bears in the bag if 28% of the gummy bears are not red?
A. 112 B. 102 C. 36 D. 72 E. 42

38. If $x^3 < 125$, what is the sum of all positive integers, x, that satisfy the inequality?
A. 10 B. 24 C. 15 D. 36 E. 20

39. A triangle has vertices located at coordinates $(-5, -2)$, $(-1, -1)$, and (2, 6). What is the length of the longest side of the triangle?
A. $2\sqrt{37}$ units B. $\sqrt{113}$ units C. $\sqrt{134}$ units D. $2\sqrt{34}$ units E. $4\sqrt{85}$

40. A sculpture is increasing in value at a rate of 20% each year. If the sculpture is worth \$200 now, how much will the sculpture be worth after two years?
A. \$264 B. \$272 C. \$224 D. \$288 E. \$240

41. What is the area of a regular pentagon with a side length of 8 cm and an apothem of 6 cm?
A. 48 cm^2 B. 96 cm^2 C. 192 cm^2 D. 144 cm^2 E. 120 cm^2

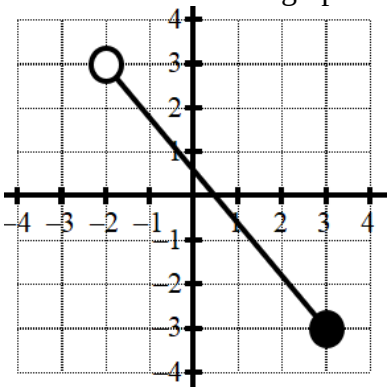
42. $\left(\frac{a^5b^7}{ab^{-3}}\right)\left(\frac{a^{-3}b^4}{a^3b^{-1}}\right)\left(\frac{a^2b^{-2}}{ab^8}\right)$ = _____

A. ab^5 B. $\frac{1}{a^3b^5}$ C. $\frac{a}{b^5}$ D. $\frac{b^5}{a}$ E. a^2b^5

43. What is the equation $y = -\frac{2}{3}x + \frac{5}{6}$ expressed in standard form?

A. $4x + 6y = 5$ B. $4x - 6y = 5$ C. $4x + 6y = -5$ D. $4x - 6y = -5$ E. $6x - 4y = 5$

44. Using interval notation, what is the domain of the function graphed below?

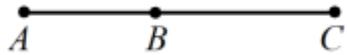


A. $(-2, 3]$ B. $[-2, 3)$ C. $(-2, 3)$ D. $[-3, 3]$ E. $[-3, 3)$

45. What is the surface area of the sphere with the equation $(x + 6)^2 + (y - 8)^2 + (z + 11)^2 - 61 = 263$, with $\pi = 3$?

A. 972 units^2 B. 1,944 units^2 C. 3,888 units^2 D. 23,328 units^2 E. 5,832 units^2

46. In $\overline{AC}$ below, $AB = x^2 - 2$, $BC = 5x - 2$, and $AC = 2x^2 + 6x - 60$. What is the measure of $\overline{AB}$?



A. 38 units B. 47 units C. 45 units D. 33 units E. 12 units

47. The solution to the system of equation $\begin{cases} x - y = -13 \\ 2x + y = -2 \end{cases}$ is (a, b), and the solution to the system of equation $\begin{cases} 5x - 4y = 2 \\ 3x + 2y = 32 \end{cases}$ is (c, d), then what is the value of $ac + bd$?

A. 14 B. 26 C. 34 D. 22 E. 18

48. Frozen Freddy's Ice Cream Stand offers two different-sized ice-cream cones. The smaller cones are 4 inches tall with a diameter of 3 inches, and the larger cone is 6 inches tall with a diameter of 4 inches. If $\pi = 3$, how much larger is the volume of the larger cone than the smaller cone?

A. 18 in^3 B. 21 in^3 C. 15 in^3 D. 9 in^3 E. 12 in^3

49. What is the value of the *y*-intercept of the graph of the quadratic equation $y = -7(x + 2)^2 - 8$?

A. -7 B. -8 C. -32 D. -36 E. -20

50. If $m + \frac{1}{m} = 18$, then what is the value of $2m^2 + \frac{2}{m^2}$?

A. 324 B. 652 C. 644 D. 642 E. 648

2022 – 2023 TMSCA Middle School Mathematics Test #13 Answer Key

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

2022 – 2023 TMSCA Middle School Mathematics Test #13 Selected Answers

6. 27 minutes of an hour is equal to $\frac{27}{60} = \frac{9}{20}$. Because $\frac{9}{20} = 0.45$, 27 minutes is equal to 45% of an hour.

11. The pattern of the sequence 82, 41, 20.5, 10.25, … is dividing the previous term by 2. Therefore, the next term of the sequence is equal to $10.25 \div 2 = 5.125$.

17. A relation is a set of ordered pairs. A function is a relation in which no *x*-value repeats. So, of the answer choices given, the value of *n* to make the relation $\{(4, 5), (n, -2), (-6, 9), (-1, 0), (7, 10)\}$ a function is 3.

21. The smallest perfect number less than 28 is 6, because 6 = 1 + 2 + 3.

27. One way to find the number of lizards equal to 68 turtles is to find a common multiple of 8 and 12, as shown. A common multiple is 48. So, if there are 5 lizards for every 8 snakes, then there are 30 lizards for every 48 snakes. Also, if there are 12 snakes for every 17 turtles, then there are 48 snakes for every 68 turtles. Therefore, there are 30 lizards for every 68 snakes.

30L = 48S
5L = 8S
12S = 17T
48S = 68T

28. An irrational number is a non-repeating, non-terminating number, $\sqrt{20} = 4.472135955$ .... Of the answer choices, $4.6^2 = 21.16$, $4.4^2 = 19.36$, and $4.5^2 = 20.25$. Therefore, $\sqrt{20}$ is closest to 4.5 because 20.25 is closer to 20 than 19.36.

36. $h(9) = \sqrt{9} = 3$. $f(3) = 3^3 = 27$. $g(27) = 10 - 3(27) = -71$. Therefore, $g\left(f\left(h(9)\right)\right) = -71$.

41. The formula for area of a regular polygon is $A = \frac{aP}{2}$, where *a* is the apothem and *P* is the perimeter of the polygon. The apothem is the distance from the center of the polygon perpendicular to a side of the polygon. A pentagon has 5 sides, so its perimeter is 5(8) = 40 cm. Substituting into the formula, the area of the regular pentagon is equal to $A = \frac{6(40)}{2} = \frac{240}{2} = 120$ cm^2.

45. The standard form equation of a sphere is $(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2$. To get the given equation $(x + 6)^2 + (y - 8)^2 + (z + 11)^2 - 61 = 263$ into standard form, add 61 to both sides of the equation to get $(x + 6)^2 + (y - 8)^2 + (z + 11)^2 = 324$. Since $r^2 = 324$, *r* = 18. The formula for finding the surface area of a sphere is $SA = 4\pi r^2$. Substituting into the formula, the surface area of the given sphere is then $SA = 4\pi r^2 = 4(3)(18)^2 = 4(3)(324) = 3{,}888$ units^2.

49. One way to find the *y*-intercept of a quadratic function is to substitute 0 in for *x* and solve for *y*. The given equation $y = -7(x + 2)^2 - 8$ would then change to $y = -7(0 + 2)^2 - 8$. Using order of operations, $y = -7(0 + 2)^2 - 8 = -7(2)^2 - 8 = -7(4) - 8 = -28 - 8 = -36$. Therefore, the *y*-intercept of the graph of the quadratic equation $y = -7(0 + 2)^2 - 8$ is -36.

50. Square both sides of the equation $m + \frac{1}{m} = 18$ to get $\left(m + \frac{1}{m}\right)^2 = 18^2 \rightarrow m^2 + 2 + \frac{1}{m^2} = 324$. Subtract 2 from both sides of the equation to get $m^2 + \frac{1}{m^2} = 322$. Multiplying both sides of the equation by 2 produces $2\left(m^2 + \frac{1}{m^2}\right) = 2(322) \rightarrow 2m^2 + \frac{2}{m^2} = 644$.