TMSCA MIDDLE SCHOOL MATHEMATICS

TEST#9 ©

JANUARY 30, 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. $\frac{3}{4}+\frac{7}{2}+\frac{3}{5}$ = _____

A. $4\frac{17}{20}$ B. $4\frac{3}{4}$ C. $4\frac{11}{20}$ D. $4\frac{7}{20}$ E. $4\frac{7}{10}$

2. 9,442 – 1,718 = _____ (nearest hundred)

A. 7,600 B. 7,800 C. 8,000 D. 7,900 E. 7,700

3. 992×999 = _____

A. 991,108 B. 991,080 C. 991,008 D. 991,118 E. 991,800

4. $428 \div \frac{2}{3}$ = _____

A. 652 B. 676 C. 628 D. 662 E. 642

5. If A = 237, B = 112, and C = 42, then $A + B - C$ = _____ (Roman numeral)

A. CCCXII B. CCCIX C. CCCVII D. CCXCVII E. CDVII

6. 3.7 hours = _____ minutes

A. 262 B. 222 C. 234 D. 212 E. 266

7. 112 is 16% of what number?

A. 710 B. 720 C. 700 D. 680 E. 780

8. Simplify: $(8 - w) - (4 - w)$

A. $4 - w$ B. $4 + w$ C. $12 + w$ D. $4 + 2w$ E. 4

9. Evaluate $\frac{3}{4}a + \frac{1}{2}b - \frac{5}{6}c$ for $a = 36, b = -28$ and c = 48.

A. -27 B. -18 C. 12 D. -9 E. -45

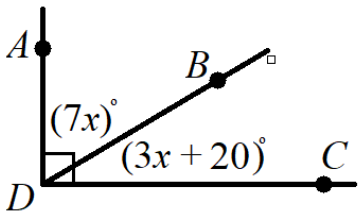
10. $\sqrt{3750}$ lies between which two integers?

A. 58 and 59 B. 59 and 60 C. 60 and 61 D. 61 and 62 E. 62 and 63

11. How many numbers are there between 11 and 103, inclusive?

A. 92 B. 91 C. 90 D. 93 E. 94

12. What is the measure of $\angle BDC$ in the picture below?



A. 16° B. 32° C. 49° D. 68° E. 41°

13. $5^2 - 4^2 + 3^2 - 2^2 + 1^2$ = _____

A. 17 B. 15 C. 13 D. 11 E. 19

14. 3.5 quarts = _____ pints

A. 14 B. 7 C. 28 D. 1.75 E. 17.5

15. What is the sum of all the reciprocals of the factors of 14?

A. $\frac{5}{7}$ B. $1\frac{2}{7}$ C. $1\frac{5}{7}$ D. $1\frac{2}{5}$ E. $1\frac{5}{24}$

16. Express the ratio $\frac{1}{5}$ to 2 as a common fraction.

A. $\frac{1}{2}$ B. $\frac{1}{4}$ C. $\frac{2}{5}$ D. $\frac{1}{25}$ E. $\frac{1}{10}$

17. It is exactly 10:55 am on a 12-hour clock. What time will it be in exactly 3 hours 22 minutes?

A. 2:23 pm B. 2:13 pm C. 2:17 pm D. 2:27 pm E. 1:57 pm

18. What is the sum of the digits of the sum of 1,782 + 836 + 3,929?

A. 22 B. 21 C. 25 D. 23 E. 24

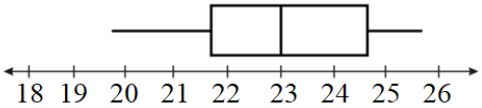
19. What is the probability of rolling a pair of dice and getting a sum of 10 facing up?

A. $\frac{1}{6}$ B. $\frac{1}{18}$ C. $\frac{1}{9}$ D. $\frac{1}{12}$ E. $\frac{1}{4}$

20. The angles in a triangle are in a ratio of 2:4:9. What is the measure of the largest angle?

A. 126° B. 128° C. 118° D. 106° E. 108°

21. What is twice the value of the median in the box and whisker plot?



A. 49.5 B. 46 C. 43.6 D. 50 E. 44

22. Simplify: $19 + (-89) - 55 - (-36)$

A. -89 B. -87 C. 17 D. -161 E. 51

23. What is the 16th term of the arithmetic sequence $-17, -9, -1, ...$?

A. 91 B. 97 C. 103 D. 105 E. 107

24. A human heart can beat $1\frac{1}{3}$ beats per second. How many beats can a human heart beat in one hour? Answer in scientific notation.

A. 8×10^1 B. 8×10^3 C. 4.8×10^6 D. 4.8×10^3 E. 1.92×10^3

25. An employee's salary increased by $7,560, which represents an 18% raise. What is the employee's new salary?

A. $49,280 B. $49,140 C. $49,320 D. $49,560 E. $49,720

26. Merina walked by 12 equally spaced fence posts at her ranch. It took her 3 seconds to walk from the first post to the second, 4 seconds to walk form the second post to the third, and so on, with each time increasing by 1 second as she slowed down. How long did it take Merina to walk from the first post to the last?

A. 1 min 18 sec B. 1 min 28 sec C. 1 min 32 sec D. 1 min 42 sec E. 1 min 39 sec

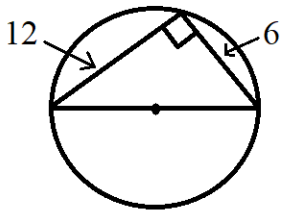
27. What value makes the equation $\frac{3}{4}(8x-1)=\frac{3}{2}(4-2x)$ true?
A. 0.75 B. 0.25 C. 0.5 D. 0.125 E. 0.375

28. 176 ft/sec = _____ mi/hr
A. 150 B. 120 C. 90 D. 140 E. 135

29. Point *C* is the midpoint of $\overline{AB}$, with *A* having coordinates (18, 34) and *B* having coordinates $(-14, 24)$. If $\overline{AB}$ is extended to point *D* with coordinates (50, 44), what are the coordinates of the midpoint of $\overline{CD}$?
A. (24, 33.5) B. (34, 39) C. (28, 34.5) D. (34, 33.5) E. (26, 36.5)

30. 134_{14} = _____ (base 10)
A. 236 B. 234 C. 232 D. 240 E. 242

31. What is the radius of the circle below?



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

32. If $f(x)=4x^2-7x$, then what is the value of $f(-3)$?
A. 45 B. 15 C. 57 D. 148 E. -15

33. $9^{\frac{3}{2}}$ = _____
A. 13.5 B. 81 C. 18 D. 27 E. $3\sqrt[3]{3}$

34. What is the axis of symmetry for the graph of the quadratic equation $y=-2x^2+4-8x$?
A. $x=-2$ B. $x=-1$ C. $x=1$ D. $x=½$ E. $x=-½$

35. Line *A* passes through the points (14, 16) and (2, 8). Line *B* passes through the points (5, 11) and (*x*, 3). If lines *A* and *B* are parallel, what is the value of *x*?
A. 9 B. -3 C. 13 D. -9 E. -7

36. Find the value of $8 \otimes -5$, if $x \otimes y=\frac{1}{x}-\frac{2}{y}$.
A. 0.475 B. 0.525 C. 0.575 D. 0.450 E. 0.625

37. A regular polygon has an exterior angle measure of 72°. How many sides does the polygon have?
A. 6 B. 8 C. 7 D. 12 E. 5

38. How many permutations can be made from seven objects taken four at a time?
A. 840 B. 35 C. 70 D. 910 E. 210

39. If 3 widgets are equal to 7 betas and 1 beta is equal to 8 cons, how many widgets are equal to 112 cons?
A. 14 B. 12 C. 4 D. 6 E. 8

40. On a number line, the distance from point *A* to point *B* is 37 units. Point *A* has the coordinate of -14. What is the sum of all possible value of *B*?

A. 51 B. 23 C. -28 D. -23 E. -16

41. The geometric mean of *a* and *b* is $8\sqrt{3}$. If *a* = 8, what is the value of *b*?

A. $\sqrt{3}$ B. 24 C. $16\sqrt{3} - 8$ D. 32 E. 48

42. If $\begin{bmatrix} -9 & 7 \\ -1 & 4 \end{bmatrix} \cdot \begin{bmatrix} 6 & -3 \\ 10 & 2 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then what is the value of $(c + d) - (a + b)$?

A. 34 B. -12 C. -2 D. 73 E. -52

43. What is the area of a triangle with vertices located at $(-5, 5), (5, -4)$, and $(-8, -2)$?

A. 51.5 units^2 B. 49.5 units^2 C. 50.5 units^2 D. 47.5 units^2 E. 48.5 units^2

44. $131_4 \times 20_4$ = _____ (base 10)

A. 151 B. 143 C. 142 D. 164 E. 232

45. The two points $(12, -4)$ and $(6, -10)$ lie on the same line. Which of the following points also lies on the same line?

A. $(-7, -23)$ B. $(-6, -24)$ C. (20, 6) D. (22, 8) E. (31, 17)

46. What is the decay rate of the exponential decay function $y = 1.6\left(\frac{4}{5}\right)^x$?

A. 60% B. 80% C. 20% D. 40% E. 10%

47. A square and a regular heptagon each have the same side length. If the perimeter of the heptagon is 84 units, what is the measure of the diagonal of the square?

A. 14 units B. $14\sqrt{2}$ units C. $16\sqrt{2}$ units D. 12 units E. $12\sqrt{2}$ units

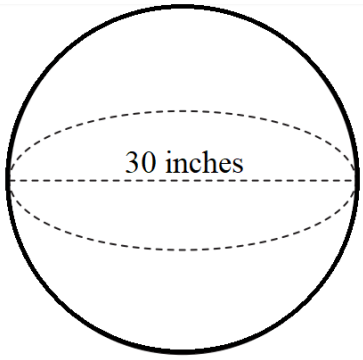
48. Rewrite $\log_4 256 = 4$ in exponential form.

A. $4^4 = 256$ B. 4(4) = 256 C. $2^2 = 256$ D. $4(4)^4 = 256$ E. $2(4)^2 = 256$

49. You would multiply $\frac{3}{4+\sqrt{3}}$ by which of the following to rationalize the denominator?

A. $\frac{3\sqrt{3}}{3\sqrt{3}}$ B. $\frac{\sqrt{3}}{\sqrt{3}}$ C. $\frac{4+\sqrt{3}}{4+\sqrt{3}}$ D. $\frac{4-\sqrt{3}}{4-\sqrt{3}}$ E. $\frac{4+\sqrt{3}}{4-\sqrt{3}}$

50. If $\pi = 3$, what is the volume of the sphere below?



A. 13,500 in^3 B. 2,700 in^3 C. 1,200 in^3 D. 36,000 in^3 E. 900 in^3

2020 – 2021 TMSCA Middle School Mathematics Test #9 Answer Key

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

2020 – 2021 TMSCA Middle School Mathematics Test #9 Selected Answers

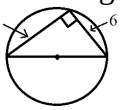
13. The alternating sum of n^2 numbers is equal to $n^2 - (n-1)^2 + \cdots + 3^2 - 2^2 + 1^2 = 1 + 2 + 3 + \cdots + n$. Therefore, $5^2 - 4^2 + 3^2 - 2^2 + 1^2 = 1 + 2 + 3 + 4 + 5 = 15$.

22. $19 + (-89) - 55 - (-36) = 19 - 89 - 55 + 36 = -70 - 55 + 36 = -125 + 36 = -89$.

23. The formula to find the n^{th} term of an arithmetic sequence is $a_n = a_1 + (n-1)(d)$, with a_1 = 1st term, *n* is the term we are trying to find and *d* is the common difference. We are given the arithmetic sequence $-17, -9, -1, \ldots$, so the 16th term is equal to $a_{16} = (-17) + (16-1)(8) = 103$.

26. From the 1st fence post to the 12th, there are 11 gaps, so the time is 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 = 88 seconds. Since 60 seconds = 1 minute, 88 seconds = 1 minute 28 seconds.

31. If a right triangle is drawn inside a circle, its hypotenuse is equal to the diameter of the circle.



In the picture given, using the Pythagorean Theorem, the hypotenuse is equal to $\sqrt{12^2 + 6^2} = \sqrt{180} = 6\sqrt{5}$. The radius is half the diameter, so the radius is equal to $(½)\left(6\sqrt{5}\right) = 3\sqrt{5}$.

33. Because $a^{\frac{m}{n}} = \sqrt[n]{a^m}$ or $(\sqrt[n]{a})^m$, then $9^{\frac{3}{2}} = \left(\sqrt[2]{9}\right)^3 = 3^3 = 27$.

40. If point *A* has the coordinate of -14, the point *B* could be located in the positive direction or negative direction of point *A*. If *B* is in the positive direction, then *B* = $-14 + 37 = 23$. If *B* is in the negative direction, then *B* = $-14 - 37 = -51$. Therefore, the sum of all possible values of *B* is $-51 + 23 = -28$.

41. The geometric mean of *a* and *b* is equal to $\sqrt{ab}$. Since *a* = 8, and the geometric mean of *a* and *b* is equal to $8\sqrt{3} = \sqrt{64 \cdot 3} = \sqrt{192}$, then *b* is equal to $192 \div 8 = 24$.

47. A heptagon has 7 sides, so if the perimeter is 84 units, then the side length is $84 \div 7 = 12$ units. The side length of the heptagon and square are each 12 units. The diagonal of a square is equal to $s\sqrt{2}$ units, with *s* equal to the side length of the square. If the side length of the square is 12 units, then its diagonal is $12\sqrt{2}$ units.

48. Since $\log_x Z = y$ can be rewritten as $x^y = Z$, then $\log_4 256 = 4$ can be rewritten as $4^4 = 256$.

49. To rationalize the denominator of $\frac{3}{4+\sqrt{3}}$, you would multiply the fraction by 1, but that contains the conjugate of the denominator. The denominator is $4 + \sqrt{3}$, so the conjugate is $4 - \sqrt{3}$. Therefore, the fraction needed to multiply $\frac{3}{4+\sqrt{3}}$ with to rationalize the denominator is $\frac{4-\sqrt{3}}{4-\sqrt{3}}$.

50. The diameter of the sphere is 30 inches, so the radius is one-half of the diameter, or ½(30) = 15 inches. The formula for volume of a sphere is $V = \frac{4}{3}\pi r^3$. Since *r* = 15 and π = 3, the volume of the sphere is $V = \frac{4}{3} \cdot 3 \cdot 15^3 = 4 \cdot 3{,}375 = 13{,}500$ in^3.