TMSCA MIDDLE SCHOOL MATHEMATICS

TEST #9 ©

FEBRUARY 1, 2020

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. $36 + (-75) + (-119) = $ _____
A. -194 B. -176 C. -230 D. -158 E. -64

2. $73\frac{3}{10} - 58\frac{2}{3} = $ _____
A. $14\frac{19}{30}$ B. $14\frac{17}{30}$ C. $14\frac{11}{30}$ D. $14\frac{23}{30}$ E. $14\frac{7}{30}$

3. $367 \times 123 = $ _____
A. 62,091   B. 53,941   C. 51,051   D. 50,141   E. 45,141

4. $5,941 \div 13 = $ _____
A. 457   B. 563   C. 453   D. 417   E. 433

5. What is the sum of the interior angles of an octagon and a decagon?
A. $1,440°$ B. $2,880°$ C. $2,520°$ D. $1,980°$ E. $2,340°$

6. What is the remainder when the number 162 is divided by 24?
A. 6   B. 12   C. 16   D. 14   E. 18

7. Which of the following are not prime numbers?
     I. 23   II. 51   III. 79   IV. 63
A. IV only   B. I and IV only   C. II and IV only   D. I and III only   E. II, III and IV only

8. What is the volume of the cone, in terms of π?

34 units, 16, 30 units
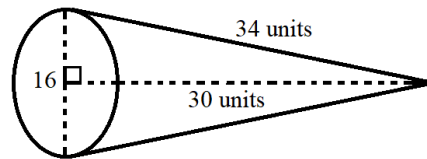
A. 832π units^3 B. 640π units^3 C. $725.\overline{3}\pi$ units^3 D. $2,560\pi$ units^3 E. 854π units^3

9. Simplify: $5\left(12 \div \frac{5}{3}\right) - 3\left(4 \div \frac{1}{2}\right)^1$
A. 9   B. 12   C. 15   D. 6   E. 3

10. If the number 120 is increased by 25% and then that result is decreased by 40%, what is the final value?
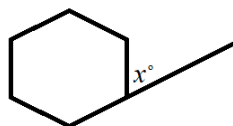A. 80   B. 84   C. 90   D. 96   E. 60

11. Sheehan has $12.56 worth of change in his pocket. If he gives a friend 18 quarters, 23 dimes and 78 nickels, how much money will Sheehan have left?
A. $1.86   B. $2.28   C. $2.26   D. $1.92   E. $1.94

12. 288 inches = _____ yards
A. 7   B. 7.5   C. 8   D. 8.5   E. 9

13. A regular hexagon is pictured below. What is the value of x?

$x°$

A. 45   B. 30   C. 90   D. 35   E. 60

14. One leg of a right triangle measures 15 cm and the hypotenuse measures 25 cm. What is the perimeter of the triangle?
A. 90 cm   B. 40 cm   C. 45 cm   D. 60 cm   E. 80 cm

15. If set A = {12, 14, 16, 18, 20, 22} and set B = {14, 18, 22, 26}, then what is the sum of the elements of $A \cup B$?
A. 54   B. 128   C. 74   D. 182   E. 142

16. Solve for x: $\frac{2x}{5} = -18 + (-32)$
A. -75 B. -150 C. -250 D. -20 E. -125

17. Hira bought 9 blouses for $149.31, without tax. How much will one dozen blouses cost?
A. $201.28   B. $196.18   C. $199.08   D. $199.78   E. $197.58

18. What is the 20th term of the sequence 14, 17, 20, 23, …?
A. 68   B. 59   C. 74   D. 65   E. 71

19. What is the unit's digit of 8^4?
A. 8   B. 4   C. 2   D. 6   E. 0

20. $0.\overline{24}$ = _____ (fraction)
A. $\frac{3}{11}$ B. $\frac{5}{32}$ C. $\frac{9}{26}$ D. $\frac{6}{23}$ E. $\frac{8}{33}$

21. What is the mean of the set of numbers 78, 54, 53, 67, and 83?
A. 67   B. 30   C. 60   D. 63   E. 65

22. On a map, ¾ of an inch is equal to 15 miles. If the distance between two cities on the map is 12 inches, how many miles are actually between the two cities?
A. 320   B. 360   C. 260   D. 240   E. 180

23. 4,838 = _____ (Arabic number)
A. $MMMMDCCCXXXVIII$ B. $\overline{IV}DCCCXXXVIII$ C. $\overline{IVDCCCXXXVIII}$ D. $\overline{VI}XXXIV$ E. $\overline{IV}XXXVIII$

24. $100^{\frac{1}{2}}$ = _____
A. 10   B. 25   C. 50   D. 200   E. $\frac{1}{100}$

25. The length of a rectangle is five more than twice the width. If the perimeter of the rectangle is 82 units, what is the measure of the length of the rectangle?
A. 18 units   B. 31 units   C. 33 units   D. 29 units   E. 27 units

26. Line A passes through the points $(11, 23)$ and $(-9, -13)$. Line B is perpendicular to line A, what is the slope of B?
A. $\frac{9}{5}$ B. $-\frac{9}{5}$ C. $\frac{5}{9}$ D. $-\frac{5}{9}$ E. $-\frac{1}{5}$

27. How many ways can you make $1.00 using only dimes and/or nickels?
A. 13   B. 10   C. 12   D. 11   E. 14

28. Mia has a standard deck of cards. What is the probability she will draw a 4, a black jack or a red ace?
A. $\frac{7}{26}$ B. $\frac{3}{13}$ C. $\frac{2}{13}$ D. $\frac{4}{13}$ E. $\frac{3}{26}$

29. $65_8 - 36_8 =$ _____$_{10}$
A. 29   B. 23   C. 27   D. 25   E. 31

30. Your car has a 24-gallon gas tank, but is only ⅜ full. If gas costs $2.85, how much will it cost to fill your gas tank?
A. $40.25   B. $41.50   C. $44.25   D. $42.75   E. $25.65

31. Canon won the election for student body president over Nikhil by a margin of 67 votes. If there were a total of 279 votes, how many votes did Canon receive?
A. 104   B. 106   C. 108   D. 110   E. 102

32. Henry threw a dart on a coordinate grid and it landed at the point (4, 1). He threw a second dart with it landing at the point $(-8, -4)$. If Henry draws a line segment from one point to the other, how long will the line segment be?
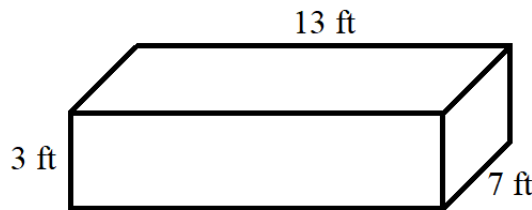A. $10\sqrt{2}$ units   B. $11\sqrt{2}$ units   C. 11 units   D. 12 units   E. 13 units

33. Moving only up or to the right, how many paths exist from point A to point B?
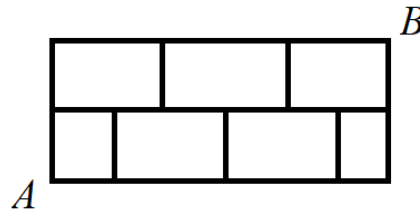
A. 11   B. 8   C. 10   D. 12   E. 9

34. Marissa is building a rectangular pen for her pet turtles. She wants to fill it half full with dirt before she plants grass inside. How much dirt will Marissa need for her turtle pen?

A. 136.5 ft³   B. 120.75 ft³   C. 124.5 ft³   D. 302.25 ft³   E. 148.5 ft²

35. If $g(x) = 5x^2$ and $h(x) = x - 4$, then what is $g(h(x))$?
A. $5x^2 - 80$ B. $5x^2 + 80$ C. $5x^2 - 40x + 80$ D. $5x^2 + 40x + 80$ E. $5x^2 - 40x - 80$

36. What is the value of C that will make the polynomial $4x^2 + 20x + C$ a perfect square trinomial?
A. 16   B. 36   C. 9   D. 40   E. 25

37. The fish population for a small neighborhood pond is 5,000. If the fish population is increasing at a rate of 2% each year, how many fish will be in the pond after two years?
A. 5,112   B. 5,212   C. 5,192   D. 5,224   E. 5,202

38. How many different permutations are there of the letters in the word *CALCULATE*?
A. 10,080   B. 30,240   C. 45,360   D. 90,720   E. 60,480

39. What is the domain of the function $y = \frac{2}{5}x - 18$, when the range is $\{-22, -20, -14\}$?

A. $\{-26.8, -26, -23.6\}$ 　　B. $\left\{-\frac{136}{5}, -26, -\frac{119}{5}\right\}$ 　　C. $\{-5, -2.5, 5\}$ 　　D. $\{-15, -10, 15\}$ 　　E. $\{-10, -5, 10\}$

40. The solution to the system $\begin{cases} 6x = -12y + 7 \\ 15y = 8x + 1 \end{cases}$ is (x, y). What is the value of $\frac{x}{y}$?

A. 5.5 　　　　B. 3.5 　　　　C. -2.5 　　　　D. -0.5 　　　　E. 1.5

41. Tony gave 2 baseball cards to each of his classmates. He would have needed 96 more cards to give them 6 cards each. How many classmates did Tony give baseball cards to?
A. 18 　　　　B. 16 　　　　C. 28 　　　　D. 24 　　　　E. 32

42. What is the measure of the diameter of a circle with the equation $x^2 + y^2 + 4y - 32 = 0$?
A. 16 units 　　　　B. 12 units 　　　　C. 36 units 　　　　D. 24 units 　　　　E. 18 units

43. The height of a cylinder is 6 inches and the circumference of its base is 14π inches. What is the volume of the cylinder?
A. 294π in^3 　　　B. 84π in^3 　　　C. 168π in^3 　　　D. $1{,}176\pi$ in^3 　　　E. 588π in^3

44. Rationalize the denominator: $\sqrt{\dfrac{5}{6}}$

A. $\dfrac{\sqrt{5}}{\sqrt{6}}$ 　　　B. $\sqrt{\dfrac{6}{5}}$ 　　　C. $\dfrac{\sqrt{30}}{6}$ 　　　D. $\dfrac{\sqrt{5}}{12}$ 　　　E. $\dfrac{\sqrt{30}}{12}$

45. If $2(x - 4)(3x + 2) = Ax^2 + Bx + C$, what is the value of $B - 2AC$?
A. 96 　　　　B. 120 　　　　C. 196 　　　　D. -314 　　　　E. 172

46. If the hypotenuse of a 30-60-90 right triangle measures $14\sqrt{3}$ units, what is the measure of the shortest leg?
A. $7\sqrt{6}$ units 　　　B. $7\sqrt{3}$ units 　　　C. 14 units 　　　D. $7\sqrt{2}$ units 　　　E. $3\sqrt{14}$ units

47. $\left(\dfrac{a^5 b^{-3} c^2}{a^{-2} bc^{-1}}\right)^{-2} \cdot \left(\dfrac{a^3 a^2 b^{-2} bc}{abc}\right)^{-1} = $ _____

A. $\dfrac{b^{10}}{a^{18} c^6}$ 　　B. $\dfrac{b^8}{a^{14} c^6}$ 　　C. $\dfrac{a^{14} c^6}{b^8}$ 　　D. $\dfrac{a^{18} c^6}{b^{10}}$ 　　E. $\dfrac{a^{14} b^8}{c^6}$

48. Solve for x. 　　　$|12 - 2x| + 18 = 4$
A. $\{\pm 1\}$ 　　B. $\{-1, 11\}$ 　　C. $\{-11, 1\}$ 　　D. no solution 　　E. all real numbers

49. Using the triangle below, what is the trig ratio, $\tan\angle A$?
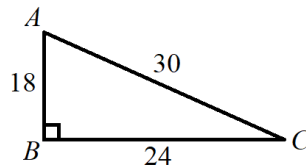
A. $\dfrac{5}{4}$ 　　　B. $\dfrac{4}{5}$ 　　　C. $\dfrac{3}{4}$ 　　　D. $\dfrac{4}{3}$ 　　　E. $\dfrac{3}{5}$

50. The roots of $x^2 - 4x + C = 0$ are m and n. If $6m + 7n = 17$, what is the value of C?
A. -117 　　　B. -51 　　　C. -77 　　　D. -12 　　　E. -45

2019 – 2020 TMSCA Middle School Mathematics Test #9 Answer Key

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

5. An octagon has 8 sides and a decagon has 10 sides. The formula to find total degrees of a regular polygon is $180(n-2)$, where n is the number of sides of the polygon. An octagon then has $180(8-2) = 1,080°$ and a decagon has $180(10-2) = 1,440°$. So, the total degrees of an octagon and decagon is $1,080 + 1,440 = 2,520°$.

18. To find the nth term of an arithmetic sequence, use the formula $a_n = a_1 + (n-1) \cdot d$, where a_n is the desired term, a_1 is the first term, n is the term position and d is the common difference. In the given sequence, $n = 20$, $a_1 = 17$, and $d = 3$. Therefore, the 20th term of the sequence is $a_{20} = 14 + (20-1) \cdot 3 = 71$.

24. Since $n^{\frac{a}{b}} = \sqrt[b]{n^a}$, $100^{\frac{1}{2}} = \sqrt[2]{100^1} = \sqrt{100} = 10$.

27. There are 11 ways to make $1 using only dimes and nickels. If D = dimes and N = nickels, the 11 ways are $10D, 9D + 2N, 8D + 4N, 7D + 6N, 6D + 8N, 5D + 10N, 4D + 12N, 3D + 14N, 2D + 16N, 1D + 18N$, and $20N$.

35. If $g(x) = 5x^2$ and $h(x) = x - 4$, then $g(h(x)) = 5(x-4)^2 = 5(x^2 - 8x + 16) = 5x^2 - 40x + 80$.

37. The exponential growth function is in the form $y = a(1 + r)^x$, where a is the initial amount, r is the rate and x is the time in years. Our equation is then $y = 5000(1 + 0.02)^2$ and then the fish population will be $5000(1.02)^2 = 5000(1.0404)^2 = 5,202$.

39. Another name for domain is the input or x-values and another name for range is output or y-values. We are given the range of $\{-22, -20, -14\}$, so we must substitute each value in for y in the equation $y = \frac{2}{5}x - 18$ and solve for x. So, $-22 = \frac{2}{5}x - 18$ and $x = -10$, $-20 = \frac{2}{5}x - 18$ and $x = -5$, $-14 = \frac{2}{5}x - 18$ and $x = 10$. Therefore, the domain of the function $y = \frac{2}{5}x - 18$ with a range of $\{-22, -20, -14\}$ is $\{-10, -5, 10\}$.

42. We must change the equation $x^2 + y^2 + 4y - 32 = 0$ into the center-radius form of a circle, $(x-h)^2 + (y-k)^2 = r^2$. First, add 32 to both sides to get $x^2 + y^2 + 4y = 32$. With the y variable, use completing the square to add 4 to both sides, to get $x^2 + y^2 + 4y + 4 = 32 + 4$, which now becomes $x^2 + (y+2)^2 = 36$. The equation is now in center-radius form and we see the radius is $\sqrt{36} = 6$. The diameter of the circle is then $2(6) = 12$ units.

44. $\sqrt{\frac{5}{6}}$ can be rewritten as $\frac{\sqrt{5}}{\sqrt{6}}$. Multiply the fraction by $\frac{\sqrt{6}}{\sqrt{6}}$ to get $\frac{\sqrt{5}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{30}}{6}$.

47. $\left(\frac{a^5 b^{-3} c^2}{a^{-2} bc^{-1}}\right)^{-2} \cdot \left(\frac{a^3 a^2 b^{-2} bc}{abc}\right)^{-1} = \left(\frac{a^7 c^3}{b^4}\right)^{-2} \cdot \left(\frac{a^4}{b^2}\right)^{-1} = \left(\frac{b^4}{a^7 c^3}\right)^2 \cdot \left(\frac{b^2}{a^4}\right)^1 = \frac{b^8}{a^{14} c^6} \cdot \frac{b^2}{a^4} = \frac{b^{10}}{a^{18} c^6}$.

50. The sum of the roots of a quadratic equation $Ax^2 + Bx + C = 0$, can be found by $-\frac{B}{A}$. We are given the equation $x^2 - 4x + C = 0$. So, the sum of the roots is $\frac{-(-4)}{1} = 4$, so $m + n = 4$. We now have the system of equations $m + n = 4$ and $6m + 7n = 17$. Multiply the first equation by -6 and add it to the second equation to get $n = -7$, and then solve to get $m = 11$. The value of C is the product of the values of m and n, which will be $-7 \cdot 11 = -77$.