TMSCA MIDDLE SCHOOL
MATHEMATICS
REGIONAL TEST ©
MARCH 4, 2017

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. Which of the following expression has the least absolute value?
A. $524 - 2,067$
B. $12\,½ - 1\,½$
C. $133 - 2^2 \cdot 3 \cdot 11$
D. $640 \div 16$
E. $5^4 - 6^3$

2. $\frac{735}{12\frac{1}{4}} = 2^2 +$ _____
A. $2^3 \cdot 7$
B. $3^2 \cdot 5$
C. $2^2 + 11$
D. $2^2 \cdot 3^2$
E. $3^2 + 11$

3. Kareem has 4 gallons of chocolate milk. He gives Lorrie one-half gallon, Nelda three-fourths gallon, Nicole one-fourth gallon and Karen three-fourths gallon. How many ounces of chocolate milk does Kareem have left?
A. 320 ounces
B. 196 ounces
C. 224 ounces
D. 244 ounces
E. 276 ounces

4. Billy is at a store and wants to buy a shirt costing $15.50 and a pair of jeans that cost $32.50. Billy's mom gives him a $20 bill and he must pay the remaining total. If there is a 6% tax, how much money does Billy need to pay the bill?
A. $28.48
B. $32.88
C. $30.88
D. $28.88
E. $29.68

5. What is the positive difference of the total number of diagonals of a regular undecagon and the total number of diagonals of a regular hexagon?
A. 27
B. 35
C. 18
D. 5
E. 45

6. Point A has coordinates (-15, 28). Point A is reflected across the x-axis to point B. Point B is then rotated $90°$ about the origin clockwise to point C. Point C is then translated 2 units to the right and 3 units up to point D. What is the product of the coordinates of point D?
A. -504
B. $- 420$
C. $- 468$
D. -728
E. -390

7. Simplify: $-5(3x + 6y) - (7x - 8y) - (2x + 9y) + 15x - 7y$
A. $-18x + 19y$
B. $-18x - 19y$
C. $9x - 28y$
D. $-9x - 38y$
E. $-12x + 31y$

8. What is the positive difference between the sum of the first ten positive even integers and the first five positive odd integers?
A. 70
B. 75
C. 80
D. 85
E. 90

9. If $a\blacksquare b = 2^a + b^2$, then find the value of $\big((1\blacksquare(-1))\blacksquare(0\blacksquare 2)\big)$.
A. 37
B. 33
C. 27
D. 29
E. 41

10. Find the measure of $\angle A$, if the complement of $\angle A$ is one-third its supplement.
A. $45°$
B. $30°$
C. $35°$
D. $60°$
E. $15°$

11. If ☺ + ☺ = ▲, ☺ + ▲ + ▲ = ☼ and ♥ = ☼ + ☼ + ▲ + ☺, then how many ☺'s are equal to one ♥?
A. 12
B. 13
C. 14
D. 11
E. 10

12. $-17 + -5 + 7 + \ldots + 79 + 91 =$ _____
A. 280
B. 350
C. 290
D. 410
E. 370

13. Let $A = $ MMCDLXII and $B = $ MCMI. Which of the following is the value of $A - B$, in Roman numerals?
A. DLI
B. DLXI
C. DXLI
D. DCXLI
E. DCLI

14. $0.0000094 \cdot 0.000065 =$ _____ (scientific notation)
A. 61.1×10^9
B. 6.11×10^{11}
C. 6.11×10^{-10}
D. 6.11×10^{-9}
E. 6.11×10^{-11}

15. Simplify: $(3a^3)(2a^4 b)^3 (a^3 b^4)^3$
A. $18a^{16}b^{10}$
B. $18a^{15}b^{15}$
C. $24a^{10}b^{10}$
D. $24a^{21}b^{15}$
E. $24a^{24}b^{15}$

16. What is the sum of the LCM of the numbers 120 and 42 and the GCF of the numbers 2,420 and 560?
A. 920   B. 860   C. 840   D. 680   E. 740

17. Which set(s) of numbers below have a mean of 62?
    I. {58, 70, 74, 46}   II. {120, 160, 2, 4, 74}   III. {60, 124, 86, 16, 24}   IV. {84, 10, 89}
A. I only   B. IV only   C. I and II   D. I and IV   E. I and III

18. What is the maximum number of intersection points that can be created using only five lines?
A. 8   B. 10   C. 12   D. 9   E. 11

19. An isosceles triangle has a base of 18 cm and an area of 108 cm². What is the triangle's perimeter?
A. 48 cm   B. 36 cm   C. 54 cm   D. 60 cm   E. 44 cm

20. A triangle has two of its sides measuring 32 inches and 39 inches. What is the product of the smallest possible integral measure and largest possible integral measure of the third side?
A. 480   B. 560   C. 520   D. 640   E. 1,248

21. Regular pentagon *ABCDE* and square *BMNC* share a common side, as below. $\overline{AB}$ and $\overline{BM}$ are consecutive sides of a regular polygon called *Q*. How many sides does *Q* have?

A
E
B
M
D
C
N
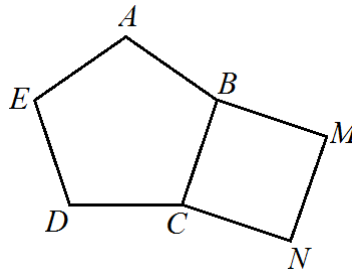
A. 24   B. 22   C. 20   D. 18   E. 16

22. *Scream for Your Life* theme park has twelve roller coasters. In how many ways can you choose eight of the roller coasters to ride in one day?
A. 415   B. 690   C. 845   D. 575   E. 495

23. Using the integers from 1 – 30, inclusive, which of the following has the largest arithmetic mean?
A. multiples of 2   B. multiples of 3   C. multiples of 4   D. multiples of 5   E. multiples of 6

24. If set *C* = {25, 29, 47, 44, 35} and set *D* = {32, 21, 31, 49, 43, 34}, what is the positive difference of the lower-quartile of *C* and the upper-quartile of *D*?
A. 17   B. 16   C. 21   D. 23   E. 20

25. A jar contains 11 white marbles and 9 red marbles. If one marble is drawn at a time, what is the probability of drawing two white marbles on the first two draws, without replacement (in ratio form)?
A. 11:27   B. 27:38   C. 11:38   D. 11:20   E. 121:400

26. The number 159 is divided into three parts. If the smallest number is 35 less than the largest number and the largest number is 28 more than the middle number, what is the value of the largest number?
A. 74   B. 68   C. 67   D. 71   E. 86

27. Sabrina can bake 20 cookies in her oven each hour and Danette can bake 45 cookies in her oven each hour. If the ladies work together, how long will it take them to bake 312 cookies?
A. 4 hours 36 minutes   B. 4 hours 48 minutes   C. 3 hours 52 minutes   D. 5 hours 12 minutes   E. 5 hours 24 minutes

28. Two squares have dimensions as in the picture below. What is the area of the shaded region?
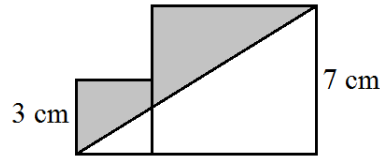
A. 40 cm^2 	B. 15 cm^2 	C. 37 cm^2 	D. 23 cm^2 	E. 27 cm^2

29. Fred is outlining a quadrilateral that has its vertices located at (–3, – 4), (9, 1), (13, 4) and (-3, 4). If Fred starts at one point and draws counterclockwise without picking his pencil up, how long of a line will Fred draw?
A. 34 units 	B. 36 units 	C. 42 units 	D. 45 units 	E. 48 units

30. Line l has the equation $y = ax + 5$ and passes through the point (24, -3). What is the slope of any line perpendicular to line l?
A. −⅓ 	B. ⅔ 	C. ½ 	D. 3 	E. -6

31. The length of a rectangle is 10 cm and the width of the rectangle is 20 cm. If each dimension were increased by 10%, then the area of the rectangle has a percent increase of which of the following?
A. 12% 	B. 24% 	C. 21% 	D. 27% 	E. 23%

32. Jacob can mow his yard in 2.6 hours. Rose can mow the same yard in 1.4 hours. If they work together, how long would it take them to mow the yard?
A. 52.2 min 	B. 91 min 	C. 81.6 min 	D. 54.6 min 	E. 48.2 min

33. $243_6 + 254_9 = 61_5 \times$ _____$_3$
A. 21 	B. 110 	C.111 	D. 101 	E. 210

34. The angle ratio in a triangle is 4:12:29. What is the supplement to the largest of these angles?
A. 64° 	B. 42° 	C. 56° 	D. 72° 	E. 36°

35. Find the area of a sector of a circle with an arc length of 80 inches and a diameter of 48 inches.
A. 840 in^2 	B. 1,920 in^2 	C. 1,240 in^2 	D. 1,680 in^2 	E. 960 in^2

36. A rectangle has side lengths of $(4n + 3)$ units and $(n + 40)$ units. For what integer values of n would the rectangle have a perimeter of at least 300 units?
A. $n \geq 22$ 	B. $n \geq 70$ 	C. $n > 257$ 	D. $n > 51$ 	E. $n > 64$

37. Using the picture below, how much larger is the perimeter of ΔA than ΔB?
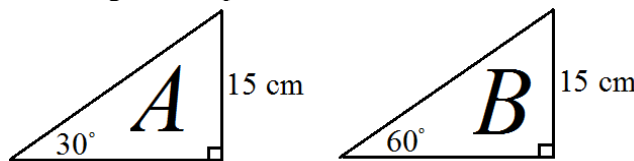
A. 0 cm 	B. 15 cm 	C. 30 cm 	D. $15\sqrt{3}$ cm 	E. $30\sqrt{3}$ cm

38. What is the units digit of 12^7?
A. 8 	B. 4 	C. 2 	D. 6 	E. 0

39. $\sqrt{10\sqrt{10}}$ is equivalent to which of the following?
A. $10^{\frac{1}{2}}$ 	B. $10^{\frac{1}{4}}$ 	C. $10^{\frac{3}{2}}$ 	D. $10^{\frac{3}{4}}$ 	E. $10^{\frac{1}{8}}$

40. If $f(x) = 3x - 5b$, find $f(a + b)$.

A. $3a + 3b$ B. $3a - 5b$ C. $3x - 8b$ D. $3a - 2b$ E. $3a + 8b$

41. 77 people took part in a survey asking them if they like football, basketball and/or soccer. 31 people said they like soccer, 43 said they like football and 39 said they like basketball. 13 said they like both soccer and basketball, and of these, 8 said they like football as well. 15 like only soccer and 14 only basketball. How many people like football only?

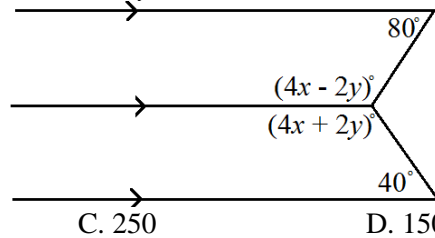A. 18   B. 16   C. 21   D. 22   E. 20

42. There are a total of three three-digit perfect squares that are palindromes. What is the sum of the three perfect squares?

A. 1,373   B. 1,281   C. 1,594   D. 1,510   E. 1,181

43. Find the value of xy, if $3^x = 7$ and $7^y = 243$.

A. 24   B. 15   C. 9   D. 5   E. 3

44. Using the picture below, find the product of x and y.


A. 300   B. 200   C. 250   D. 150   E. 450

45. In a classroom game, a teacher asks her students to stand in a circle evenly spaced apart. The teacher starts with the first child and walks around the circle giving each student a letter, starting with A and working alphabetically. The student holding the letter H stands opposite the student holding the letter R. How many students are in the class?

A. 24   B. 38   C. 18   D. 20   E. 22

46. Using the picture below, find the value of $378^{\frac{1}{2}} - n$.
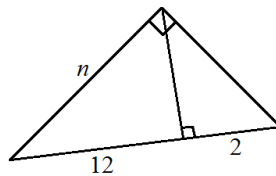
A. $4\sqrt{42}$ B. $3\sqrt{42}$ C. $2\sqrt{42}$ D. $\sqrt{42}$ E. $6\sqrt{42}$

47. Let A equal the mean absolute deviation of the set of numbers $\{12, 18, 14, 20\}$ and let B equal the mean absolute deviation of the set of numbers $\{23, 11, 7, 3\}$. What is the arithmetic mean of A and B?

A. 1.5   B. 2.5   C. 4.5   D. 3.5   E. 5.5

48. If a is a root of $x^2 + 3x - 10 = 0$, then what is the greatest possible value of $\frac{a^2-1}{2a+1}$?

A. -1   B. $\frac{2}{5}$ C. $\frac{4}{5}$ D. $\frac{24}{11}$ E. $\frac{3}{5}$

49. Circle M has a diameter of 24 cm and circle N has a diameter of 16 cm. What is the ratio of the area of circle M to the area of circle N?

A. 9:4   B. 4:1   C. 16:3   D. 36:1   E. 9:1

50. What is the sum of the integral solutions of the inequality $\left|\frac{3}{4}x + 3\right| \leq 12$?

A. -132   B. -210   C. 78   D. 156   E. -156

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2016 – 2017 TMSCA Middle School Mathematics Regional Test Answer Key

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

4. The combined cost of Billy's clothes is $15.50 + $32.50 = $48.00. The total cost of the clothes is 48(1.06) = $50.88. Subtracting the $20 Billy's mom gives him leaves a balance of 50.88 – 20 = $30.88.

22. We want o know how many combinations are there of 12 rides taken 8 at a time. Combinations can be found by $_rC_n = \frac{r!}{n!(r-n)!}$, so $_{12}C_8 = \frac{12!}{8!(12-8)!} = \frac{12!}{8!4!} = 495$.

26. Let x equal the smallest integer. Our equation is $x + x + 7 + x + 35 = 159$. After combining like terms, $3x + 42 = 159$. Subtract 42 and we have $3x = 117$. Dividing by 3 and $x = 39$. $39 + 35 = 74$.

27. If Sabrina can bake 20 cookies in an hour and Danette can bake 45 cookies in an hour, then together they can bake 65 cookies in an hour. $312 \div 65 = 4.8$. $0.8(60) = 48$ minutes. Together the ladies can bake 312 cookies in 4 hours 48 minutes.
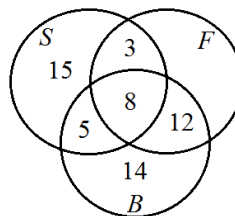
39. $\sqrt{10\sqrt{10}} = \sqrt{10} \cdot \sqrt{\sqrt{10}}$. $\sqrt{10} = 10^{\frac{1}{2}}$. $\sqrt{\sqrt{10}} = \sqrt{10^{\frac{1}{2}}} = \left(10^{\frac{1}{2}}\right)^{\frac{1}{2}} = 10^{\frac{1}{4}}$. $10^{\frac{1}{2}} \cdot 10^{\frac{1}{4}} = 10^{\frac{1}{2}+\frac{1}{4}} = 10^{\frac{3}{4}}$.

40. If $f(x) = 3x - 5b$, then $f(a + b) = 3(a + b) - 5b = 3a + 3b - 5b = 3a - 2b$.

41. Using the information given, create a venn diagram, as such,
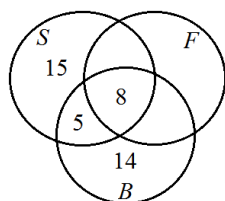
There are a total of 31 people that like soccer, so the missing number is $31 - 15 - 5 - 8 = 3$. There are a total of 39 people that like basketball, so the missing number there is $39 - 5 - 8 - 14 = 12$. Now we have the picture,

There are a total of 43 people that like football, so $43 - 3 - 8 - 12 = 20$ people who only like football.

42. The three three-digit perfect squares that are palindromes are $11^2 = 121$, $22^2 = 484$ and $26^2 = 676$. The sum is then $121 + 484 + 676 = 1,281$.

43. If $3^x = 7$ and $7^y = 243$, then $(3^x)^y = 243$. Using exponent rules, $(3^x)^y = 3^{xy}$. $243 = 3^5$, so $3^{xy} = 3^5$ and $xy = 5$.

45. If each student is holding a letter and the letters are in alphabetical order, then think of the letters as numbers. The person holding the H is holding an 8 and the person holding the R is holding an 18. So we know that the half the students will be between 8 and 18. So, using S for students, we have the equation $8 + \frac{S}{2} = 18$. We subtract 8 from both sides and get $\frac{S}{2} = 10$ and multiplying by 2 gives us $S = 20$. There are 20 students in the class.