

**TMSCA MIDDLE SCHOOL  
MATHEMATICS  
TEST #12 ©  
FEBRUARY 16, 2019**

**GENERAL DIRECTIONS**

- About this test:
  - You will be given 40 minutes to take this test.
  - There are 50 problems on this test.
- 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.
- If you are using a Chatsworth or Scantron card, please follow the specific instructions given at your particular meet.
- You may write anywhere on the test itself. You must write only answers on the answer sheet.
- You may use additional scratch paper provided by the contest director.
- All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
- Calculators **MAY NOT** be used on this test.
- 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.
- In case of ties, percent accuracy will be used as a tie breaker.



2018 – 2019 TMSCA Middle School Mathematics Test #12

1.  $500 - 0.18 - 152.77 =$  \_\_\_\_\_ (nearest tenth)

- A. 347.1                      B. 347.2                      C. 347.0                      D. 347.3                      E. 347.4

2.  $4\frac{3}{8} + 115\frac{7}{8} =$  \_\_\_\_\_

- A.  $\frac{481}{4}$                       B.  $\frac{361}{8}$                       C.  $\frac{121}{8}$                       D.  $\frac{121}{4}$                       E.  $\frac{481}{8}$

3.  $7.48 \div 0.44 =$  \_\_\_\_\_

- A. 16.84                      B. 17.24                      C. 17.12                      D. 17.00                      E. 17.84

4.  $4.5 \times 0.028 \times 100 =$  \_\_\_\_\_

- A. 14.16                      B. 13.8                      C. 12.6                      D. 12.16                      E. 11.4

5. A school bus can hold a maximum of 42 students. What is the minimum number of school buses needed to carry 542 students to their home?

- A. 12                      B. 13                      C. 14                      D. 15                      E. 16

6.  $\frac{15}{16} =$  \_\_\_\_\_ %

- A. 92.75                      B. 93.25                      C. 92.25                      D. 93.5                      E. 93.75

7. Simplify:  $\frac{1}{8}(4^3) + \frac{2}{3}(3^3) + \frac{3}{4}(12 - 8)$

- A. 21                      B. 8.5                      C. 14.5                      D. 32                      E. 29

8. The legs of a right triangle measure 6 cm and 8 cm. If each side of the triangle were doubled, what is the perimeter of the new triangle?

- A. 96 cm                      B. 64 cm                      C. 48 cm                      D. 192 cm                      E. 36 cm

9. If  $A = 1$ ,  $B = 2$ ,  $C = 3$ , ...,  $Y = 25$  and  $Z = 26$ , what is the sum of the values of the letters of the word *TURQUOISE*?

- A. 148                      B. 151                      C. 145                      D. 163                      E. 149

10. What is the product of the GCF and LCM of the numbers 56 and 72?

- A. 4,032                      B. 512                      C. 2,048                      D. 4,544                      E. 4,028

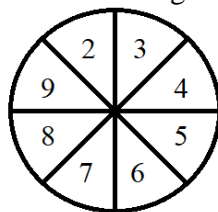
11. What is the sum of the mean and mode of the set of numbers {96, 89, 70, 70, 105}?

- A. 159                      B. 175                      C. 156                      D. 79                      E. 166

12. 3 square yards = \_\_\_\_\_ square feet

- A. 12                      B. 9                      C. 36                      D. 27                      E. 18

13. What are the odds of spinning the spinner below and landing on a composite number?



- A. 1:4                      B. 1:1                      C. 4:1                      D. 1:2                      E. 2:1

14. Which formula gives the  $n^{\text{th}}$  term of the sequence? 2, 11, 26, 47, ...  
 A.  $5n - 3$       B.  $2n^2 + 1$       C.  $n^3 + 1$       D.  $8n^2 - 7$       E.  $3n^2 - 1$

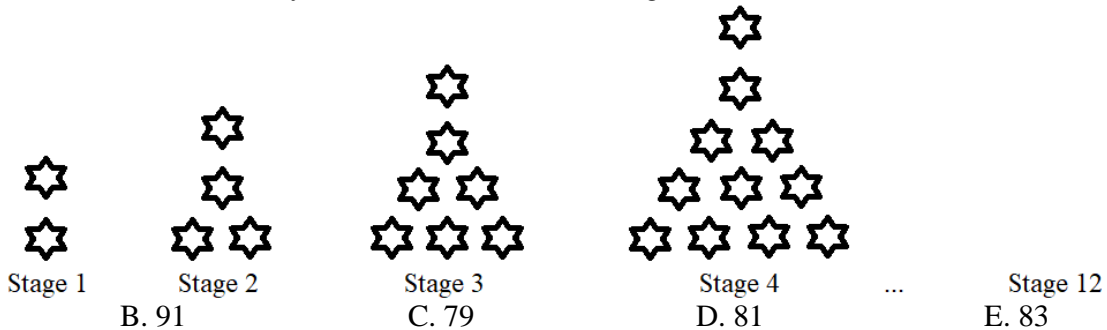
15. Solve:  $\frac{a}{4} - 11 \leq -47$   
 A.  $a \leq -144$       B.  $a \leq -177$       C.  $a \geq -144$       D.  $a \geq 144$       E.  $a \leq 177$

16. What is the perimeter of a square that has an area of 676 units<sup>2</sup>?  
 A. 104 units      B. 52 units      C. 156 units      D. 338 units      E. 169 units

17. If  $a \heartsuit b = \frac{1}{2}a + \frac{3}{4}b + \frac{1}{3}ab$ , find the value of  $12 \heartsuit 16$ .  
 A. 76      B. 96      C. 64      D. 82      E. 104

18.  $1,965 - 1,618 = \underline{\hspace{2cm}}$  (Roman numeral)  
 A. CCCLXVI      B. CCCXDVII      C. MCCCLXII      D. MCCCLVII      E. CCCXLVII

19. If the pattern continues, how many stars will be needed for Stage 12?



20. What is the 10<sup>th</sup> term of the sequence 2, 3, 4, 9, 16, 29, ...?  
 A. 335      B. 417      C. 318      D. 354      E. 343

21. A fair coin is tossed three times. What is the probability of at least two consecutive tails?  
 A.  $\frac{1}{8}$       B.  $\frac{5}{8}$       C.  $\frac{3}{8}$       D.  $\frac{1}{2}$       E.  $\frac{3}{4}$

22. If  $A = \{5, 10, 15, 20\}$ ,  $B = \{9, 8, 7, 6, 5\}$ ,  $C = \{2, 4, 6, 8, 10\}$  and  $D = \{6, 5, 4, 3, 2\}$ ,  $(A \cup B) \cap (C \cup D)$  has how many elements?  
 A. 4      B. 19      C. 9      D. 6      E. 5

23. The product of two consecutive positive even integers is 2,024. What is the sum of the two integers?  
 A. 86      B. 88      C. 92      D. 94      E. 90

24.  $\$33.80 - \text{five quarters} - 345 \text{ pennies} - 290 \text{ dimes} = \underline{\hspace{2cm}}$  nickels  
 A. 6      B. 2      C. 42      D. 12      E. 24

25.  $114_5 - 33_5 = \underline{\hspace{2cm}}_5$   
 A. 81      B. 101      C. 43      D. 31      E. 34

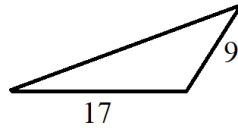
26. Points  $A$ ,  $B$  and  $C$  are collinear. Point  $B$  lies between  $A$  and  $C$ . What is the value of  $x$ , if  $AC = 48$ ,  $AB = 6x + 2$  and  $BC = 4x - 4$ ?  
 A. 32      B. 16      C. 8      D. 5      E. 6

27.  $26^{\circ} C + 44^{\circ} C = \underline{\hspace{2cm}}^{\circ} F$   
 A.  $158^{\circ} F$                       B.  $126^{\circ} F$                       C.  $190^{\circ} F$                       D.  $215^{\circ} F$                       E.  $183.6^{\circ} F$

28.  $(2.5 \times 10^4)^2 = \underline{\hspace{2cm}}$  (scientific notation)  
 A.  $62.5 \times 10^6$                       B.  $6.25 \times 10^6$                       C.  $6.25 \times 10^8$                       D.  $6.25 \times 10^{16}$                       E.  $6.25 \times 10^2$

29. Max bought a jacket for \$124.00. Nick bought the same jacket a week later for \$93.00. What was the percent of decrease in the amounts of the jacket?  
 A. 35%                      B. 25%                      C. 40%                      D. 15%                      E. 20%

30. What is the largest possible integral measure of the missing side of the triangle?



- A. 26                      B. 27                      C. 12                      D. 25                      E. 13

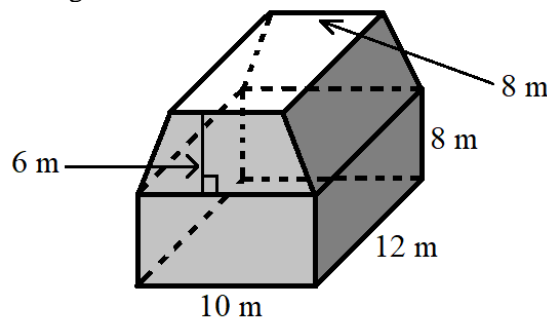
31. The angles in a quadrilateral are in a ratio of 1:3:4:7. What is the measure of the largest angle?  
 A.  $112^{\circ}$                       B.  $152^{\circ}$                       C.  $168^{\circ}$                       D.  $172^{\circ}$                       E.  $156^{\circ}$

32. How many permutations can be made of 17 items taken 2 at a time?  
 A. 136                      B. 162                      C. 289                      D. 256                      E. 272

33. How is the linear equation  $\frac{5}{8}x - \frac{3}{4}y = \frac{2}{3}$  written in standard form?  
 A.  $18x - 15y = 16$                       B.  $15x - 18y = 16$                       C.  $\frac{15}{24}x - \frac{18}{24}y = \frac{16}{24}$                       D.  $y = -\frac{11}{8}x - \frac{1}{12}$                       E.  $y = \frac{5}{6}x - \frac{8}{9}$

34. Two buildings stand 48 meters apart. One building is 36 meters tall and the other is 50 meters tall. A wire is strung from the tip of the 50-meter tall building to the tip of the 36-meter tall building. What is the length of the wire?  
 A. 50 meters                      B. 54 meters                      C. 14 meters                      D. 24 meters                      E. 32 meters

35. Frankford Farm is building a new storage shed. What is the maximum volume of the new storage shed below?



- A.  $1,608 \text{ m}^3$                       B.  $920 \text{ m}^3$                       C.  $1,840 \text{ m}^3$                       D.  $1,028 \text{ m}^3$                       E.  $1,460 \text{ m}^3$

36. How many positive three-digit integers can be written in such a way that the first digit is greater than both the second digit and third digit?  
 A. 289                      B. 276                      C. 450                      D. 285                      E. 345

37. If  $f$  is a linear function and  $f(0) = 4$  and  $f(2) = -1$ , what is the value of  $f(1)$ .  
 A. 3                      B.  $-2$                       C.  $-2.5$                       D. 1.5                      E. 2.5

38.  $\odot O$  circumscribes regular hexagon  $ABCDEF$ . Hexagon  $ABCDEF$  has an area of  $864\sqrt{3}$   $\text{cm}^2$ . If the angle bisectors of  $\angle B$  and  $\angle C$  intersect at  $O$ , what is the measure of the diameter of  $\odot O$ ?

- A. 64 cm                      B. 36 cm                      C. 48 cm                      D. 32 cm                      E. 56 cm

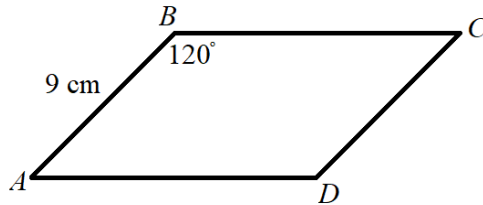
39. What is the volume of a sphere with a diameter of 12 cm? Let  $\pi = 3$ .

- A.  $864 \text{ cm}^3$                       B.  $576 \text{ cm}^3$                       C.  $432 \text{ cm}^3$                       D.  $6,912 \text{ cm}^3$                       E.  $1,728 \text{ cm}^3$

40. What are all the real values of  $x$  which satisfy  $\sqrt{1 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 1} = x^2$ ?

- A.  $\{\pm 2, \pm 3\}$                       B.  $\{2, 3\}$                       C.  $\{2, 3, 6\}$                       D.  $\{\pm 2, \pm 3, \pm 6\}$                       E.  $\{\pm 6\}$

41. Rhombus  $ABCD$  has  $m\angle ABC = 120^\circ$  and  $AB = 9$  cm. What is the measure of  $BD$ ?



- A. 9 cm                      B.  $9\sqrt{2}$  cm                      C.  $9\sqrt{3}$  cm                      D.  $4.5\sqrt{3}$  cm                      E.  $18\sqrt{2}$  cm

42. What is the measure of the diameter of the circle with equation  $x^2 + y^2 + 7 + 10x + 23 - 6y = 0$ ?

- A. 6 units                      B. 4 units                      C. 8 units                      D. 7 units                      E. 5 units

43. Shuman deposited \$40 into an account at 14% compounded quarterly. Which function can be used to find the amount of money Shuman has in his account after 6 years 3 months, if no further deposits are made?

- A.  $y = 40 \left(1 + \frac{0.14}{4}\right)^{25}$                       B.  $y = 40 \left(1 + \frac{0.14}{4}\right)^{6.25}$                       C.  $y = 40(1.14)^{25}$                       D.  $y = 40(1.14)^{6.25}$                       E.  $y = 40 \left(\frac{1+0.14}{4}\right)^{6.25}$

44. Which of the following is equivalent to  $4 \log_4 5 - 4 \log_4 3$ ?

- A.  $\log_4(8)$                       B.  $\log_4 \left(\frac{5}{3}\right)^4$                       C.  $\log_4 \left(\frac{5^4}{3}\right)$                       D.  $\log_4 \left(\frac{5}{3^4}\right)$                       E.  $\frac{\log_4 9}{\log_4 7}$

45. If  $3x = \sqrt{-4x + 32} + 2x$ , what is the value of  $5x + 2$ ?

- A. 17                      B. 12                      C. 27                      D. 37                      E. 22

46.  $7! \times 5! \times 3! =$  \_\_\_\_\_

- A.  $9! \times 2!$                       B.  $15!$                       C.  $12!$                       D.  $6! \times 6! \times 2!$                       E.  $10!$

47. What is the product of the coordinates of the vertex of the graph of the quadratic equation  $3x^2 = 18x - 34$ ?

- A. 24                      B. -24                      C. -21                      D. 21                      E. 9

48. If  $a + b = 14$  and  $2a + b = 76$ , what is the value of  $2b - a$ ?

- A. -158                      B. -146                      C. 34                      D. 172                      E. -34

49.  $\frac{8-\sqrt{6}}{2-\sqrt{6}} =$  \_\_\_\_\_

- A.  $-5 + 3\sqrt{6}$                       B.  $5 + 3\sqrt{6}$                       C.  $-5 - 3\sqrt{6}$                       D.  $5 - 3\sqrt{6}$                       E.  $5 - 6\sqrt{3}$

50. The diagonals of square  $ABCD$  intersect at point  $E$ , which has coordinates  $(-1, 2)$ . The coordinates of  $A$  are  $(-4, 5)$ . What is the area of square  $ABCD$ ?

- A.  $36\sqrt{2}$  units<sup>2</sup>                      B.  $18\sqrt{2}$  units<sup>2</sup>                      C.  $36\sqrt{3}$  units<sup>2</sup>                      D.  $36$  units<sup>2</sup>                      E.  $18$  units<sup>2</sup>

2018 – 2019 TMSCA Middle School Mathematics Test #12 Answer Key

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

18.  $1,965 - 1,618 = 347$  and  $347 = \text{CCCXLVII}$ .

19. The pattern is to find the sum of the integers of the stage number down to 1 and then add one more. For example, Stage 1 =  $1 + 1 = 2$ , Stage 2 =  $2 + 1 + 1 = 4$ , Stage 3 =  $3 + 2 + 1 + 1 = 7$  and Stage 4 =  $4 + 3 + 2 + 1 + 1 = 11$ . Therefore, at Stage 12, there will be  $12 + 11 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 + 1 = 79$  stars.

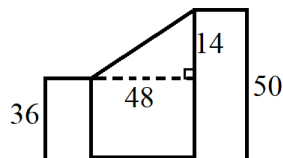
21. If a fair coin is tossed three times, there are 8 possible outcomes. They are: HHH, HHT, HTH, THH, TTH, THT, HTT and TTT. Of the 8 possible outcomes, only TTT, TTH and HTT have at least two consecutive tails. Therefore, the probability of getting at least two consecutive tails is  $\frac{3}{8}$ .

29. The percent of decrease is  $\frac{\text{change in amount}}{\text{original amount}} \times 100$ . Therefore, from the information given in the problem,  $\frac{124-93}{124} = 0.25 \times 100 = 25\%$  decrease.

31. There are  $360^\circ$  in a quadrilateral. If the ratio of the angles is 1:3:4:7, we can make the equation  $x + 3x + 4x + 7x = 360$ . Combine like terms to get the equation  $15x = 360$ . Divide both sides by 15 and we get  $x = 24$ . Therefore, the largest angle is then  $7(24) = 168^\circ$ .

32. The number of permutation of 17 items taken 2 at a time is  $17(16) = 272$ .

34. From the problem, draw the picture:



We can see the length of the wire is actually the length of the hypotenuse in the right triangle. Therefore,  $\sqrt{48^2 + 14^2} = \sqrt{2,304 + 196} = \sqrt{2,500} = 50$ . The length of the wire is 50 meters long.

36. We are asked to find the number of positive three-digit integers can be written in such a way that the first digit is greater than both the second digit and third digit. If we use 1 as the first digit, there is only one number that satisfies the condition, which is 100. If we use 2 as our first digit, there are 4 numbers that can be written to satisfy the condition, which are 200, 201, 210 and 211. If we use 3 as the first digit, there are 9 numbers that can be written, which are 300, 301, 302, 310, 311, 312, 320, 321 and 322. If the pattern continues, we see that there are  $1 + 4 + 9 + 25 + 36 + 49 + 64 + 81 = 285$  numbers that can be written where the first digit is greater than the seconds and third digits.

39. To find the volume of a sphere, use the formula  $V = \frac{4}{3}\pi r^3$ . We are given a sphere with a diameter of 12 cm, so the radius is 6 cm. We are also given  $\pi = 3$ . Substituting into the formula, the volume of the sphere is  $V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3)(6^3) = \frac{4}{3}(3)(216) = 864 \text{ cm}^3$ .

49. The conjugate of  $2 - \sqrt{6}$  is  $2 + \sqrt{6}$ . So, we must multiply  $\frac{8-\sqrt{6}}{2-\sqrt{6}}$  by  $\frac{2+\sqrt{6}}{2+\sqrt{6}}$ . Therefore,  $\frac{8-\sqrt{6}}{2-\sqrt{6}} \cdot \frac{2+\sqrt{6}}{2+\sqrt{6}} = \frac{16+8\sqrt{6}-2\sqrt{6}-6}{4+2\sqrt{6}-2\sqrt{6}-6} = \frac{10+6\sqrt{6}}{-2} = -5 - 3\sqrt{6}$ .