

**TMSCA MIDDLE SCHOOL  
MATHEMATICS  
TEST #12 ©  
FEBRUARY 22, 2020**

**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.



1.  $5\frac{1}{4} + 6\frac{1}{2} + \frac{7}{8} =$  \_\_\_\_\_

- A.  $11\frac{9}{8}$                       B.  $12\frac{5}{8}$                       C.  $12\frac{1}{2}$                       D.  $12\frac{3}{8}$                       E.  $12\frac{3}{4}$

2.  $15.11 - 47 =$  \_\_\_\_\_

- A.  $-31.79$                       B.  $-31.99$                       C.  $-31.69$                       D.  $-31.59$                       E.  $-31.89$

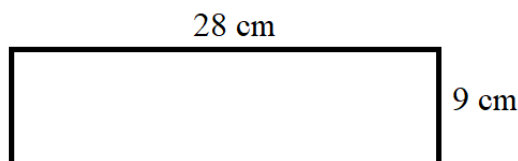
3.  $1.11 \times 8.01 =$  \_\_\_\_\_ (nearest hundredth)

- A. 8.88                      B. 8.91                      C. 8.89                      D. 8.90                      E. 8.80

4.  $196 \div 0.08 =$  \_\_\_\_\_

- A. 2,450                      B. 2,750                      C. 2,250                      D. 2,550                      E. 2,825

5. Kelsey wants to color one-fourth of the rectangle below the color purple. What is the number of square centimeters Kelsey will color?



- A.  $18.5 \text{ cm}^2$                       B.  $36 \text{ cm}^2$                       C.  $72 \text{ cm}^2$                       D.  $63 \text{ cm}^2$                       E.  $54 \text{ cm}^2$

6. What is the remainder when the number 541 is divided by 17?

- A. 14                      B. 9                      C. 8                      D. 16                      E. 11

7. What is the sum of the largest two prime numbers less than 100?

- A. 186                      B. 190                      C. 188                      D. 192                      E. 194

8. 1.72 kilometers = \_\_\_\_\_ centimeters (scientific notation)

- A.  $1.72 \times 10^6$                       B.  $17.2 \times 10^6$                       C.  $1.72 \times 10^4$                       D.  $1.72 \times 10^5$                       E.  $1.72 \times 10^{-6}$

9. What is the lower-quartile for the numbers 134, 183, 177, 156, 143, 171, and 135?

- A. 49                      B. 156                      C. 135                      D. 134.5                      E. 139

10. Point  $B$  has coordinates  $(-6, 17)$ . If  $B$  is reflected across the  $y$ -axis, then translated to the left 14 units and down 21 units, what are the new coordinates of  $B$ ?

- A.  $(20, 38)$                       B.  $(-8, -4)$                       C.  $(-8, 38)$                       D.  $(20, -4)$                       E.  $(-6, -6)$

11. If  $6,500 = 2^a \cdot 5^b \cdot 13^c$ , what is the value of  $(2^a)^b + (3^b)^c$ ?

- A. 43                      B. 86                      C. 59                      D. 91                      E. 89

12. 14 miles = \_\_\_\_\_ yards

- A. 24,420                      B. 24,640                      C. 26,180                      D. 23,960                      E. 73,920

13. James wants to leave an 18% tip of his total bill at lunch. If James's total bill is \$16.20, what is the amount of the tip?

- A. \$2.95                      B. \$2.92                      C. \$2.87                      D. \$2.97                      E. \$2.85

14. Simplify:  $\frac{5}{3}(-9 + 15)^2 - 7$

- A. 55                      B. 47                      C. 59                      D. 51                      E. 53

15. What is the next term of the sequence 1, 8, 27, 64, 125, ...?

- A. 216                      B. 189                      C. 256                      D. 225                      E. 343

16. What is the sum of the interior angles of a regular polygon with 13 sides?

- A.  $1,800^\circ$                       B.  $2,340^\circ$                       C.  $2,520^\circ$                       D.  $1,620^\circ$                       E.  $1,980^\circ$

17. What is the sum of the GCF of the numbers 120 and 45 and the LCM of the numbers 32 and 6?

- A. 111                      B. 96                      C. 288                      D. 126                      E. 133

18. Which of the following are prime numbers?

- I. 89                      II. 101                      III. 123                      IV. 117

- A. I only                      B. II and III only                      C. I and IV only                      D. I and II only                      E. III and IV only

19.  $MXXIV \div IV = \underline{\hspace{2cm}}$  (Arabic number)

- A. 336                      B. 196                      C. 216                      D. 316                      E. 256

20. Solve for  $n, n > 0$ :  $\frac{48}{n} < 2$

- A.  $n < 24$                       B.  $n > 24$                       C.  $n < \frac{1}{24}$                       D.  $n > \frac{1}{24}$                       E.  $n > 96$

21.  $\frac{7}{16} = \underline{\hspace{2cm}}$  (decimal)

- A. 0.44                      B.  $0.4\overline{37}$                       C. 0.4375                      D. 0.4376                      E.  $0.437\overline{5}$

22. What is the sum of the digits of the sum of  $718 + 319$ ?

- A. 12                      B. 11                      C. 13                      D. 9                      E. 10

23. What is the measure of an exterior angle of a regular pentagon?

- A.  $60^\circ$                       B.  $30^\circ$                       C.  $72^\circ$                       D.  $45^\circ$                       E.  $36^\circ$

24. How many  $3 \text{ inch} \times 3 \text{ inch}$  square tiles can fit into a  $3 \text{ feet} \times 3 \text{ feet}$  floor space?

- A. 144                      B. 72                      C. 180                      D. 1,296                      E. 27

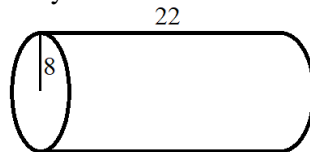
25. Every letter of the word *POLYNOMIAL* is placed inside a bag. What is the probability someone reaches inside the bag and draws out a vowel on the first draw and then, without replacement, draws a consonant on the second draw?

- A.  $\frac{3}{5}$                       B.  $\frac{3}{10}$                       C.  $\frac{4}{15}$                       D.  $\frac{2}{5}$                       E.  $\frac{16}{45}$

26.  $253_6 \div 50_7 = \underline{\hspace{2cm}}_{10}$

- A. 6                      B. 7                      C. 4                      D. 3                      E. 5

27. If  $\pi = 3$ , what is the lateral surface area of the cylinder?



- A. 1,248 units<sup>2</sup>                      B. 1,056 units<sup>2</sup>                      C. 1,440 units<sup>2</sup>                      D. 1,448 units<sup>2</sup>                      E. 4,224 units<sup>2</sup>

28. Line A has a slope of  $\frac{6}{19}$  and passes through the points  $(14, y)$  and  $(-24, 4)$ . What is the value of  $y$ ?

- A. 8                      B. 24                      C. 16                      D. -4                      E. -8

29. Let  $A$  equal the product of 5 and 7. How many numbers less than  $A$  are relatively prime to  $A$ ?

- A. 24                      B. 32                      C. 20                      D. 10                      E. 18

30. Let  $n$  represent the number of diagonals that can be drawn in a regular decagon. What is the value of  $\frac{2}{5}n$ ?

- A. 21                      B. 24                      C. 16                      D. 14                      E. 8

31. Simplify:  $4(3x - 2) + 2(x^2 - x + 5) + (-2x^2)$

- A.  $8x + 2$                       B.  $10x + 2$                       C.  $4x^2 + 8x + 2$                       D.  $4x^2 + 10x + 2$                       E.  $4x^2 + 12x + 2$

32. What is the equation  $xy = \sqrt{\frac{m}{np}}$  solved for  $p$ ?

- A.  $p = \frac{m}{(nxy)^2}$                       B.  $p = \left(\frac{nxy}{m}\right)^2$                       C.  $p = \frac{n\sqrt{xy}}{m}$                       D.  $p = \frac{m}{n(xy)^2}$                       E.  $p = \frac{m}{nxy^2}$

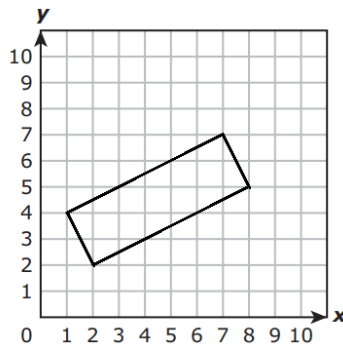
33. What is the value of the discriminant of the quadratic equation  $-5x + 10x^2 + 9 = 0$ ?

- A. 280                      B. -280                      C. 261                      D. 205                      E. -335

34. How many different permutations can be made using the letters of the word RACECAR?

- A. 90                      B. 5,040                      C. 420                      D. 630                      E. 260

35. What is the area of the rectangle below?



- A. 15 units<sup>2</sup>                      B. 12.5 units<sup>2</sup>                      C.  $12\sqrt{5}$  units<sup>2</sup>                      D.  $14\sqrt{5}$  units<sup>2</sup>                      E. 16 units<sup>2</sup>

36. What is the perimeter of the square which can be divided into two rectangles whose areas are 14 units<sup>2</sup> and 22 units<sup>2</sup>?

- A. 36 units                      B. 32 units                      C. 72 units                      D. 18 units                      E. 24 units

37. If  $M = \frac{6\sqrt{6}}{-2\sqrt{30}}$ , what is the value of  $\frac{20}{4}M$ , in simplified radical form?

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

38. A store receives a shipment of 500 lawnmowers. If the store sells 30% of the lawnmowers each year, how many lawnmowers will the store have remaining after two years?

- A. 135                      B. 283                      C. 227                      D. 217                      E. 245

39. The solution to the system  $\begin{cases} 3x + 7y = -65 \\ x = 2y + 26 \end{cases}$  is  $(x, y)$  and the solution to the system  $\begin{cases} 14a - b = -23 \\ b = \frac{5}{2}a + \frac{23}{2} \end{cases}$  is  $(a, b)$ . What is the value of  $ab + xy$ ?

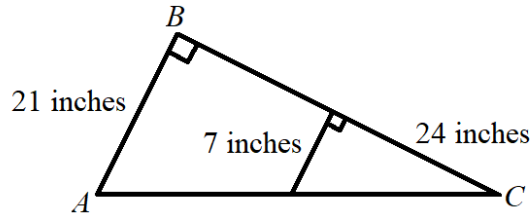
- A. -47                      B. -53                      C. -19                      D. -39                      E. -5

40. Solve for  $n$ , in interval notation:  $-9 \leq \frac{4n}{3} - 1 < 11$   
 A.  $[-6, 9)$       B.  $(-6, 9]$       C.  $[-\frac{15}{2}, \frac{15}{2}]$       D.  $(-\frac{15}{2}, \frac{15}{2})$       E.  $[-6, 9]$

41. Which linear equation below has a slope of  $\frac{3}{8}$  and a y-intercept of  $-3$ ?  
 A.  $3x + 8y = 24$       B.  $8x - 3y = 9$       C.  $16x - 6y = -18$       D.  $6x - 16y = 48$       E.  $3x + 8y = -24$

42. If  $5^x = 8$ , what is the value of  $5^{3x}$ ?  
 A. 24      B. 64      C. 512      D. 576      E. 128

43. What is the perimeter of  $\triangle ABC$ ?



- A. 189 inches      B. 378 inches      C. 182 inches      D. 168 inches      E. 175 inches

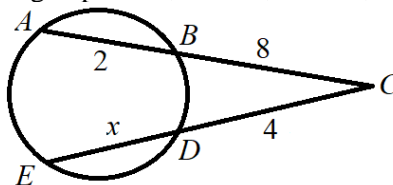
44.  $\left(\frac{2a^3c^{-1}}{3b^2c^3}\right)^2 \div \frac{4a^{-2}b^{-1}}{b^{-3}c^{-2}} =$  \_\_\_\_\_  
 A.  $\frac{4a^4}{b^2c^6}$       B.  $\frac{a^8}{9b^6c^{10}}$       C.  $\frac{4a^8}{b^6c^{10}}$       D.  $\frac{a^6}{18b^8c^{16}}$       E.  $\frac{a^6}{9b^8c^{16}}$

45. In right  $\triangle ABC$ ,  $m\angle B = 90^\circ$ ,  $AB = 16$ ,  $AC = 34$ , and  $BC = 30$ . What is the value of the trig ratio,  $\tan\angle C$ ?  
 A.  $\frac{8}{17}$       B.  $\frac{8}{15}$       C.  $\frac{15}{17}$       D.  $\frac{17}{15}$       E.  $\frac{15}{8}$

46. If  $f(x) = \frac{x}{4-x}$  and  $g(x) = 3^{-x}$ , what is the value of  $\frac{f(8)}{g(2)}$ ?  
 A.  $-24$       B.  $-\frac{2}{9}$       C.  $-\frac{1}{3}$       D.  $-12$       E.  $-18$

47. The Hendersons want to re-mulch their rectangular flower bed. The flower bed measure 6 feet by 15 feet. If the Hendersons buy two cubic yards of mulch, how many inches deep will the mulch be spread evenly over the flower bed?  
 A.  $7\frac{1}{2}$  inches      B.  $7\frac{1}{5}$  inches      C.  $8\frac{1}{4}$  inches      D.  $7\frac{3}{10}$  inches      E.  $7\frac{1}{8}$  inches

48. In the circle,  $\overline{AC}$  and  $\overline{EC}$  are secants meeting at point C,  $AB = 2$ ,  $BC = 8$ ,  $CD = 4$ , and  $ED = x$ . Find the value of  $x$ .



- A. 20      B. 18      C. 16      D. 6      E. 1

49. In 1980, the minimum wage was \$3.70 per hour. In 2019, in Arkansas, the minimum wage is \$9.25. what is the percent of increase of the wages?  
 A. 150%      B. 60%      C. 160%      D. 170%      E. 185%

50. Find the value of  $n$ , if  $n! = (3!)(5!)(7!)$ .  
 A. 15      B. 12      C. 13      D. 10      E. 14

2019 – 2020 TMSCA Middle School Mathematics Test #12 Answer Key

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

12. Since 1 mile = 1,760 yards, 14 miles =  $14(1,760) = 24,640$  yards.

32. Given the equation  $xy = \sqrt{\frac{m}{np}}$ , to solve for  $p$ , first square both sides to get  $(xy)^2 = \frac{m}{np}$ . Now, multiply both sides by  $p$  to get  $p(xy)^2 = \frac{m}{n}$ . Divide both sides by  $(xy)^2$  to get  $p = \frac{m}{n(xy)^2}$ .

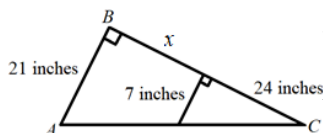
36. If a square can be divided into two rectangles having areas of 14 units<sup>2</sup> and 22 units<sup>2</sup>, then the total area of the square is  $14 + 22 = 36$  units<sup>2</sup>. This means the side length of the square is equal to  $\sqrt{36} = 6$  units. Therefore, the perimeter of the square is equal to  $4(6) = 24$  units.

38. This problem is an exponential decay problem. The exponential decay form is  $y = a \cdot b^x$ , where  $a$  is the initial amount and  $b$  is equal to  $1 - r$ , which is the rate. From our problem, we get  $y = 500(1 - 0.3)^2$ , which becomes  $500(0.7)^2 = 500(0.49) = 245$ . After 2 years, there will be 245 lawnmowers remaining.

40. To solve  $-9 \leq \frac{4n}{3} - 1 < 11$ , first add 1 to each part of the inequality to get  $-8 \leq \frac{4n}{3} < 12$ . Now multiply each part of the inequality by  $\frac{3}{4}$  to get  $-6 \leq n < 9$ . This is expressed using interval notation as  $[-6, 9)$ .

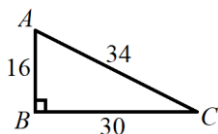
42.  $5^{3x}$  can be rewritten as  $(5^x)^3$ . Since  $5^x = 8$ , we can substitute to get  $(5^x)^3 = 8^3 = 512$ .

43. Using the picture below, since the triangles are similar, set up the proportion  $\frac{7}{24} = \frac{21}{x+24}$ . Cross multiply to get  $7(x + 24) = 21(24)$ , which simplifies to  $7x + 168 = 504$ . Subtract 168 from both sides and get  $7x = 336$ . Divide both sides by 7 and get  $x = 48$ . We now have a right triangle with legs of 21 inches and  $48 + 24 = 72$  inches. Using the Pythagorean



Theorem, the hypotenuse is equal to  $\sqrt{21^2 + 72^2} = \sqrt{5,625} = 75$ . The perimeter of the triangle will then be  $21 + 75 + 72 = 168$  inches.

45. Draw the triangle as shown. The trig function tangent is equal to  $\frac{\text{opposite side}}{\text{adjacent side}}$  from a reference angle.



So, the tangent of  $\angle C$  is equal to  $\frac{16}{30} = \frac{8}{15}$ .

47. 1 cubic yard = 27 cubic feet, so 2 cubic yards = 54 cubic feet. We can make the equation  $54 = (6)(15)(x)$ , which simplifies to  $54 = 90x$ . Divide both sides by 90 and  $x = \frac{54}{90} = \frac{3}{5}$  feet. Since we are asked to find the measure in inches, multiply  $\frac{3}{5}$  by 12 and get  $\frac{36}{5} = 7\frac{1}{5}$ . The mulch will be  $7\frac{1}{5}$  inches deep.

50. We know that  $3! = 3 \cdot 2 \cdot 1$ ,  $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ , and  $7! = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ . We can take the factors of 2 and 4 from  $5!$  to make 8. We can take the factors of 3 and 3 from  $3!$  and  $5!$  to make 9. We can take the factors of 5 and 2 from  $3!$  and  $5!$  to make 10. So, we are left with  $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 10!$ .