TMSCA MIDDLE SCHOOL MATHEMATICS
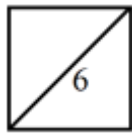
TEST #10 ©

FEBRUARY 4, 2023

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. $23\frac{3}{5} + 16\frac{9}{10} = $ _____

A. $39\frac{1}{4}$ B. $39\frac{1}{10}$ C. $40\frac{1}{2}$ D. $40\frac{1}{4}$ E. $40\frac{1}{10}$

2. $84.101 - 59.99 = $ _____ (nearest tenth)
A. 25.1   B. 25.2   C. 24.3   D. 24.2   E. 24.1

3. $35 \times 4 \times 12 = $ _____
A. 1,760   C. 1,520   C. 1,580   D. 1,680   E. 1,640

4. $238 \div (36 - 19) = $ _____
A. 12   B. 14   C. 16   D. 18   E. 20

5. A toy rocket traveled 504 feet in 6 seconds. Which rate is equivalent to the rate at which the toy rocket traveled?
A. 498 ft/sec   B. 96 ft/sec   C. 92 ft/sec   D. 88 ft/sec   E. 84 ft/sec

6. 18,000 centigrams = _____ hectograms
A. 1.8   B. 18   C. 180   D. 0.18   E. 18,000,000

7. Which of the following points is in the solutions set of the linear inequality $3x + 2y < 18$?
A. $(6, 3)$ B. $(0, 9)$ C. $(-1, 20)$ D. $(-20, 1)$ E. $(44, 2)$

8. What is the product of the GCF of the numbers 44 and 121 and the LCM of the numbers 30 and 40?
A. 1,320   B. 120   C. 1,200   D. 4,840   E. 680

9. What is the area of the square below?

A. 36 units^2 B. 24 units^2 C. 18 units^2 D. 12 units^2 E. 30 units^2

10. Simplify: $-5|11 - 28| - (-6) + (-9)$
A. 82   B. 70   C. -88 D. -69 E. -16

11. 2 square feet = _____ square inches
A. 144   B. 288   C. 24   D. 432   E. 216

12. The prime factorization of 4,410 is equal to $2^a \times 3^b \times 5^c \times 7^d$. What is the value of $ab + cd + ac + bd$?
A. 7   B. 12   C. 10   D. 13   E. 9

13. In how many ways can four books be arranged on a shelf?
A. 12   B. 6   C. 18   D. 24   E. 4

14. How many prime numbers are there between the numbers 20 and 70?
A. 9   B. 10   C. 11   D. 12   E. 13

15. Bubba can draw 7 flowers in 12 minutes. How may flowers can Bubba draw in 1.4 hours?
A. 0.8   B. 84   C. 63   D. 49   E. 56

16. If $m \# n = m^2 + mn$, then what is the value of $(2 \# 3) \# 4$?
A. 104   B. 56   C. 112   D. 140   E. 117

17. Simplify: $\frac{3}{2}(4a + 6b - 8) - \frac{2}{3}(9b + 12a - 15)$
A. $-2a - 6b + 3$ B. $-2a - 6b + 12$ C. $-2a - 3b + 10$ D. $-2a + 3b + 3$ E. $-2a + 3b - 2$

18. What is the surface area of a rectangular prism measuring $3\ in \times 4\ in \times 7\ in$?
A. 110 in^2 B. 84 in^2 C. 168 in^2 D. 112 in^2 E. 122 in^2

19. $9^3 =$ _____ (Roman numeral)
A. CMLXXIX   B. DCCXXIX   C. CMXIX   D. DCCXIX   E. DCXXIX

20. The ratio of red marbles to blue marbles in a bag is 2:3. If there are 48 red marbles in the bag, how many total marbles are there in the bag?
A. 120   B. 64   C. 72   D. 144   E. 84

21. Which inequality is represented by the graph?

13   14   15   16   17   18

A. $n = 15$ B. $n > 15$ C. $n \geq 15$ D. $n < 15$ E. $n \leq 15$

22. What is the sum of the digits of $5! + 2!$?
A. 3   B. 4   C. 5   D. 6   E. 9

23. Ian is pairing all the letters in the alphabet in a way, such that the 1st letter is paired with the 26th letter, AZ, the 2nd letter is paired with the 25th letter, BY, and so on. Which of the following is not one of Ian's pairs?
A. GT   B. IR   C. KP   D. LN   E. DW

24. $252_6 =$ _____ (base 7)
A. 202   B. 212   C. 204   D. 214   E. 206

25. Simplify: $3 - \left(\frac{1}{3}\right)^{-1} \div \left(\frac{1}{9}\right)^{-1}$
A. 0   B. 1   C. 2⅔   D. 9   E. -3

26. $1.5 \times 10^6 - 4.8 \times 10^5 =$ _____ (scientific notation)
A. 3.3×10^6 B. 1.02×10^6 C. 1.02×10^1 D. -3.3×10^1 E. 1.98×10^6

27. What is the interquartile range of the set of numbers 34, 18, 26, 26, 52, and 60?
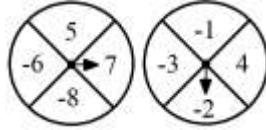A. 34   B. 42   C. 26   D. 21   E. 31

28. What is the 21st term of the sequence $-112, -108, -104, -100, ...$?
A. -24 B. -40 C. -36 D. -32 E. -28

29. $\frac{1}{72} + \frac{1}{90} + \frac{1}{110} =$ _____

A. $\frac{1}{29}$ B. $\frac{3}{92}$ C. $\frac{3}{84}$ D. $\frac{3}{91}$ E. $\frac{3}{88}$

30. Two spinners are equally divided into four sections as shown below. When both spinners are spun, what is the probability that the product of the two values is positive?

A. ¼   B. ⅜   C. ¾   D. ⅝   E. ½

31. The measures of an angle and its supplement are in a ratio of 4:5. What is the measure of the complement of the lesser angle?
A. $10°$ B. $20°$ C. $40°$ D. $15°$ E. $25°$

32. 55°C = _____°F
A. 140   B. 113   C. 167   D. 158   E. 131

33. What is the value of the 15th triangular number?
A. 105   B. 120   C. 136   D. 111   E. 118

34. Rapper Rico wants to buy enough candy to last him while he is traveling performing his shows. If the candy is $6.39 per pound, how much will Rico spend if he buys $66\frac{2}{3}$ pounds?
A. $438.00   B. $421.74   C. $432.00   D. $426.00   E. $428.00

35. The set of numbers {19, 21, 22, 27, 33} has how many proper subsets?
A. 10   B. 32   C. 1   D. 25   E. 31

36. In a 45-45-90 special right triangle, if the hypotenuse measures 24 cm, what is the measure of one of the legs of the triangle?
A. 12 cm   B. $12\sqrt{2}$ cm   C. $12\sqrt{6}$ cm   D. $24\sqrt{2}$ cm   E. $4\sqrt{6}$ cm

37. $135° =$ _____ (radians)
A. $\frac{2\pi}{3}$ B. $\frac{4\pi}{3}$ C. $\frac{3\pi}{4}$ D. $\frac{3\pi}{2}$ E. $\frac{5\pi}{6}$

38. Shayna made an extra $176.00 for selling magazine subscriptions. The extra $176.00 was 8% of the total value of the subscriptions sold. What was the total value of the magazine subscriptions Shayna sold?
A. $2,400.00   B. $2,600.00   C. $2,800.00   D. $3,000.00   E. $2,200.00

39. Six a's and nine b's equal -78. One a and one b equal -11. What value is equal to eight a's?
A. -56 B. -72 C. -80 D. -96 E. -48

40. $3(2a^3b^2)^2(2a^{-1}b^5)^3 =$ _____
A. $96a^9b^{60}$ B. $288a^3b^{12}$ C. $96a^3b^{12}$ D. $96a^3b^{19}$ E. $288a^3b^{19}$

41. If $f(x) = x^2$, then find $f(a + b) + f(a - b)$.
A. $2a^2 + 4ab + 2b^2$ B. $a^2 - b^2$ C. $2a^2 + 2b^2$ D. $2a + 2b$ E. $2a^2 - 4ab + 2b^2$

42. What is the slope of any line perpendicular to a line with an undefined slope?
A. ½ B. 0-slope C. undefined slope D. 1 E. -1

43. What is the value of 3^x, if $3^{x+3} = 108$?
A. 4 B. 1 C. 9 D. 27 E. 6

44. Shehan and Erneld are balanced at opposite ends of a seesaw. Shehan weighs 144 pounds and is 9 feet from the fulcrum. If Erneld is 8 feet from the fulcrum, how many pounds does Erneld weigh?
A. 154 B. 156 C. 164 D. 166 E. 162

45. Gemmi and three friends went to lunch, which had a subtotal of $94.00. An 8% tax and an 20% tip were added to the bill, both applied to the subtotal. What was the total cost of the lunch, including tax and tip?
A. $120.84 B. $119.76 C. $120.32 D. $119.98 E. $120.60

46. In three dimensions, what are the coordinates of the center of the sphere with the equation
$x^2 - 2x + y^2 - 4y + z^2 + 8z - 15 = 0$?
A. $(2, 4, 8)$ B. $(-2, -4, 8)$ C. $(1, 2, -4)$ D. $(-1, -2, 4)$ E. $(2, 4, -4)$

47. What is the area of the shaded region of $\odot P$, with a radius of 6 units and $m\angle APB = 42°$? Let $\pi = 3$.
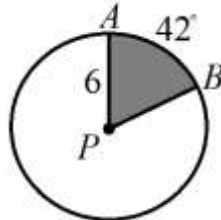
A. 13.2 units^2 B. 12.6 units^2 C. 14.4 units^2 D. 12.8 units^2 E. 13.6 units^2

48. What is the maximum point of the graph of the quadratic function $f(x) = -7(x - 2)^2 + 11$?
A. $(2, 11)$ B. $(14, 11)$ C. $(-2, 11)$ D. $(-14, 11)$ E. $(0, 11)$

49. $\dfrac{4x^2 - x - 3}{x - 1} = $ _____
A. $x + 1$ B. $4x - 1$ C. $4x + 1$ D. $4x + 3$ E. $4x - 3$

50. In the picture below, Figure A is made of seven 2-inch cubes and Figure B is made of five 3-inch cubes. How much larger is the volume of Figure B than Figure A?
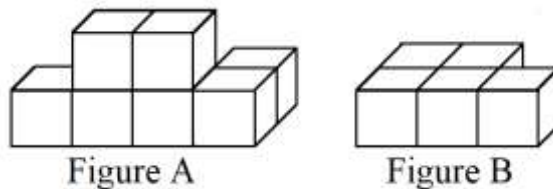
Figure A Figure B
A. 57 in^3 B. 17 in^3 C. 96 in^3 D. 108 in^3 E. 79 in^3

2022 – 2023 TMSCA Middle School Mathematics Test #10 Answer Key

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

9. The formula for area of a square when given the inner diagonal is $A = \frac{d^2}{2}$. In the given square, the inner diagonal is 6. Therefore, the area of the given square is equal to $A = \frac{6^2}{2} = \frac{36}{2} = 18$ units^2.

11. 1 square foot = 144 square inches, so 2 square feet = 2(144) = 288 square inches.

14. There are 11 prime numbers between 20 and 70, which are 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, and 67.

25. $3 - \left(\frac{1}{3}\right)^{-1} \div \left(\frac{1}{9}\right)^{-1} = 3 - \left(\frac{3}{1}\right)^1 \div \left(\frac{9}{1}\right)^1 = 3 - 3 \div 9 = 3 - \frac{1}{3} = 2\frac{2}{3}$.

26. $1.5 \times 10^6 - 4.8 \times 10^5 = 1500000 - 480000 = 1020000 = 1.02 \times 10^6$.

35. The number of proper subsets of a set is equal to $2^n - 1$, where n is equal to the number of elements within the set. We are given the set {19, 21, 22, 27, 33}, which has 5 elements. Therefore, the number of proper subsets of the set {19, 21, 22, 27, 33} is equal to $2^5 - 1 = 32 - 1 = 31$.

36. The ratio of legs to hypotenuse in a 45-45-90 special right triangle is shown below.
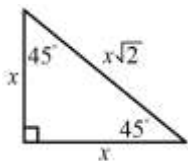
If the hypotenuse measures 24 cm, then form the equation $x\sqrt{2} = 24$. Divide each side of the equation by $\sqrt{2}$ and get $x = \frac{24}{\sqrt{2}}$. Multiply by $\frac{\sqrt{2}}{\sqrt{2}}$ in order to rationalize the denominator and get $x = \frac{24}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{24\sqrt{2}}{2} = 12\sqrt{2}$. Therefore, the side length is equal to $12\sqrt{2}$ cm.

40. Using the exponent rules $a^m \times a^n = a^{m+n}$, and $(a^m)^n = a^{mn}$,
$3(2a^3b^2)^2(2a^{-1}b^5)^3 = 3(4a^6b^4)(8a^{-3}b^{15}) = (12a^6b^4)(8a^{-3}b^{15}) = 96a^{6+(-3)}b^{4+15} = 96a^3b^{19}$.

41. If $f(x) = x^2$, then $f(a + b) = (a + b)^2 = a^2 + 2ab + b^2$, and $f(a - b) = (a - b)^2 = a^2 - 2ab + b^2$. Therefore, $f(a + b) + f(a - b) = a^2 + 2ab + b^2 + a^2 - 2ab + b^2 = 2a^2 + 2b^2$.

43. Using the exponent rule of $a^m \times a^n = a^{m+n}$, 3^{x+3} can be rewritten as $3^x \times 3^3$. So, $3^{x+3} = 108$ can be rewritten as $3^x \times 3^3 = 108$, which simplifies to $3^x \times 27 = 108$. Dividing both sides of the equation by 27 results in $3^x = 4$.

47. To find the area of a sector of a circle, use the formula $A = \frac{central\ angle}{360} \times \pi r^2$. In the problem, we are given $m\angle APB = 42°, \pi = 3$, and $\odot P$ having a radius of 6 units. Substituting into the formula gives an area of $A = \frac{42}{360} \times (3)(6)^2 = \frac{7}{60} \times 3 \times 36 = \frac{756}{60} = \frac{63}{5} = 12.6$ units^2.

49. In order to simplify $\frac{4x^2-x-3}{x-1}$, first factor the numerator to be $4x^2 - x - 3 = (4x + 3)(x - 1)$. This means, $\frac{4x^2-x-3}{x-1} = \frac{(4x+3)(x-1)}{x-1} = 4x + 3$.