TMSCA MIDDLE SCHOOL
MATHEMATICS
TEST #9 ©
JANUARY 27, 2018

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. 9.587 + 15.896 = _____ (nearest hundredth)
A. 25.483   B. 25.484   C. 24.48   D. 25.47   E. 25.48

2. 1,000,987 – 456,998 = _____ (nearest thousand)
A. 544,000   B. 543,000   C. 545,000   D. 543,900   E. 544,900

3. $-3\frac{1}{5} \times 16\frac{1}{4} =$ _____
A. $-52\frac{1}{20}$ B. $-52\frac{1}{9}$ C. -52 D. $-51\frac{3}{4}$ E. -51

4. $-16\frac{3}{8} \div (-0.25) =$ _____
A. $-65\frac{1}{4}$ B. $65\frac{1}{4}$ C. $65\frac{1}{2}$ D. $65\frac{3}{4}$ E. $65\frac{1}{8}$

5. If $1,960 = 2^a \cdot 5^b \cdot 7^c$, then what is the value of $ac \div b$?
A. 6   B. 2   C. 3   D. 4   E. ½

6. If a dozen pencils cost $4.50, how much will 50 pencils cost?
A. $17.25   B. $17.75   C. $18.75   D. $18.25   E. $18.50

7. Zhoya is baking lots of cookies for her sleep over with friends. Her recipe requires 22 ounces of butter. How many cups of butter does Zhoya need?
A. 2 ¼ cups   B. 3 ¼ cups   C. 2 ¾ cups   D. 3 ½ cups   E. 2 ½ cups

8. Using the magic square below, find the value of $a + b + c + d - e$.

13	a	b
c	10	d
9	e	7

A. 30   B. 51   C. 14   D. 23   E. 43

9. 45% of 600 = 30% of what number?
A. 810   B. 1,200   C. 900   D. 780   E. 720

10. A bag contains 3 red marbles, 5 blue marbles and 4 yellow marbles. If Mike chooses a marble without looking, what is the probability that Mike chooses a yellow or blue marble?
A. ½   B. ¼   C. ¾   D. ⅔   E. ⅝

11. What is the value of x?

$(8x + 17)°$ $(3x + 9)°$
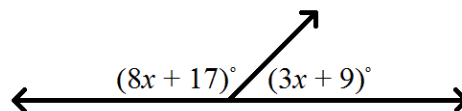
A. 17   B. 9   C. 11   D. 12   E. 14

12. 1,700 cm + 10,300 mm + 1 km = _____ meters
A. 1,027.3 m   B. 1,273 m   C. 12,730   D. 1,002.73   E. 1,000.273

13. Simplify: $5\left(\frac{3}{4} \div \frac{5}{4}\right) - 2^4 \div 4^0$
A. 8   B. -16 C. -13 D. -9 E. -8

14. A right triangle has legs measuring 10 inches and 24 inches. If a square has the same side length equal to that of the hypotenuse of the right triangle, what is the perimeter of the square?
A. 68 inches   B. 136 inches   C. 116 inches   D. 104 inches   E. 96 inches

15. Shayne is buying school supplies. He bought a pencil bag for $1.50, a box of pencils for $2.40, a pen for $3.00 and a flash drive for $9.60. If there was an 8% tax, how much did Shayne pay in total?
A. $16.52   B. $17.32   C. $16.72   D. $17.12   E. $17.82

16. If M < N, then what is the value of W in the subtraction problem below?

$$\begin{array}{r} N\,M \\ -\,M\,N \\ \hline W\,7 \end{array}$$

A. 4   B. 2   C. 5   D. 1   E. 3

17. Which sequence below is not an arithmetic sequence?
A. 17, 14, 11, 8, …   B. 120, 60, 0, -60, …   C. 2, 4, 8, 16, …   D. 1, 2, 3, 4, …   E. ½, 1, 1½, 2, …

18. Which formula below can be used to find the total surface area of a cube, where s = side length?
A. $SA = s^2$ B. $SA = 6s^2$ C. $SA = 4s^2$ D. $SA = \frac{s^2}{2}$ E. $SA = \frac{6s^2}{2}$

19. Clint has 1.38×10^8 snap cubes and Shane has 7×10^7 snap cubes. How many more snap cubes does Clint have than Shane?
A. 5.62×10^7 B. 8.38×10^8 C. 6.8×10^7 D. 6.8×10^8 E. 5.62×10^8

20. Mindy shared her bag of candies with her friends. She gave one-half of her candies to her friend Sheila, one-third of the candies that were left to her friend Amanda, and the remaining twelve pieces of candy to her friend Sam. How many pieces of candy did Mindy have in her bag before she shared her candy with her friends?
A. 24   B. 48   C. 36   D. 60   E. 72

21. If $A = 4n + 7$ and $B = -3n + 5$, find $A - B$.
A. $n - 2$ B. $n + 12$ C. $-7n + 12$ D. $7n + 12$ E. $7n + 2$

22. If $M = \{3, 6, 9, 12, 15\}$, $N = \{2, 4, 6, 8, 10, 12\}$ and $P = \{4, 8, 12, 16\}$, then $M \cup (N \cap P)$ has _____ elements.
A. 7   B. 6   C. 5   D. 13   E. 1

23. $24^3 =$ _____ (nearest thousand).
A. 14,000   B. 13,000   C. 15,000   D. 12,000   E. 10,000

24. If $a \,\text{☼}\, b = ab \div 4 + b$, then find the value of $(36 \,\text{☼}\, 2) \,\text{☼}\, 2$.
A. 16   B. 12   C. 4   D. $6.\overline{6}$ E. 6

25. How many positive integers less than 50 are relatively prime to 50?
A. 25   B. 18   C. 15   D. 5   E. 20

26. What is the probability of rolling a pair of dice and getting a 5 on either die and the sum of the dice is 7?
A. $\frac{1}{18}$ B. $\frac{1}{9}$ C. $\frac{1}{4}$ D. $\frac{1}{3}$ E. $\frac{2}{9}$

27. The largest unattainable sum of the numbers 13 and 9 is which of the following?
A. 95   B. 98   C. 106   D. 101   E. 91

28. The complement of $\angle A$ is nine less than one-half the measure of $\angle A$. What is measure of the supplement of $\angle A$?
A. $112°$ B. $114°$ C. $108°$ D. $124°$ E. $118°$

29. If today is Tuesday, what day of the week will it be in four days after the day before yesterday?
A. Monday   B. Friday   C. Saturday   D. Wednesday   E. Thursday

30. Let f be a function such that $f(x) = 3x - 5$ is defined on the domain $-1 \le x \le 6$. What is the range of the function?
A. $-3 \le y \le -1$ B. $-30 \le y \le -3$ C. $-6 \le y \le 13$ D. $-8 \le y \le 13$ E. $-30 \le y \le -6$

31. $34_6 + 332_5 = $ _____ (base 7)
A. 212   B. 232   C. 252   D. 242   E. 222

32. A rabbit population of twelve rabbits triples every three months. Which function represents how many rabbits there will be after two years?
A. $y = 12(2)^6$ B. $y = 12(6)^2$ C. $y = 12(3)^8$ D. $y = 12(3)^2$ E. $y = 12(3)^6$

33. Using the picture below, we are given rectangle $ABCD$ and point E on $\overline{AB}$, such that $\overline{DE} \perp \overline{EC}$. If $DE = 6$ inches and $EC = 4$ inches, what is the area of rectangle $ABCD$?
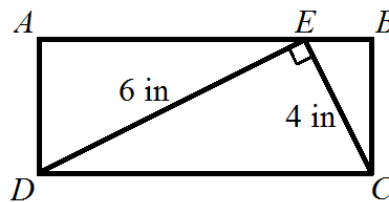

A. 48 in^2 B. 24 in^2 C. 36 in^2 D. 20 in^2 E. $12\sqrt{6}$ in^2

34. Which of the following points is not on the graph of $y = 3x^2 - x - 1$?
A. $(-4, 51)$ B. $(-1, 3)$ C. $(0, -1)$ D. $(4, 42)$ E. $(2, 9)$

35. What is the value of the x-intercept of the linear equation $4y + 2x = -18$?
A. -4.5 B. 4.5 C. $-\dfrac{2}{9}$ D. $\dfrac{-1}{9}$ E. -9

36. If the side lengths of a triangle are 14, 16 and 17 units long, then the triangle is which of the following?
A. acute   B. right   C. obtuse   D. equilateral   E. isosceles

37. Simplify: $\dfrac{2y^3}{3x^2y^{-4}} \cdot \dfrac{3xy^5}{2x^6y}$

A. $\dfrac{6y^7}{x^5}$ B. $\dfrac{x^5}{y^7}$ C. $\dfrac{y^{11}}{x^7}$ D. $\dfrac{x^7}{y^{11}}$ E. $\dfrac{2y^{11}}{3x^7}$

38. A square has side length equal to the radius of a circle. In terms of π, what is the area of $\odot O$ if $AO = 13\sqrt{2}$ cm?
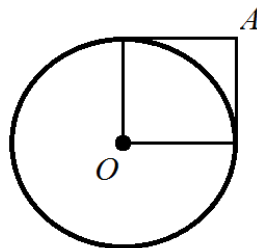
A. $52\sqrt{2}\pi$ cm^2 B. $104\sqrt{2}\pi$ cm^2 C. 104π cm^2 D. 169π cm^2 E. $169\sqrt{2}\pi$ cm^2

39. The equation of which line passes through the points $(-8, -9)$ and $(20, 12)$?
A. $2x = 6y - 12$ B. $y = \frac{3}{4}x + 3$ C. $y = \frac{3}{4}x - 6$ D. $4y = -3x + 12$ E. $y - 6 = \frac{3}{4}(x - 12)$

40. Tillman was given a picture from a friend and asked to find the missing length of one of the legs of a right triangle given the hypotenuse measures 6 cm and the second leg measures 2 cm. What is Tillman's correct answer?
A. $2\sqrt{2}$ cm   B. $6\sqrt{2}$ cm   C. $4\sqrt{2}$ cm   D. $2\sqrt{10}$ cm   E. $4\sqrt{10}$ cm

41. What are the roots of the quadratic equation $x^2 - 2x = 14$?
A. $-1 \pm \sqrt{15}$ B. $1 + \sqrt{15}$ C. $-1 - \sqrt{15}$ D. $\sqrt{15} \pm 1$ E. $1 \pm \sqrt{15}$

42. Factor completely over the set of rational numbers: $16x^8 - 1$
A. $(8x^4 + 1)(8x^4 - 1)$ B. $(4x^4 + 1)(2x^2 + 1)(2x^2 - 1)$ C. $(4x^4 - 1)(2x^2 + 1)(2x^2 - 1)$ D. unfactorable   E. $(8x^4 - 1)^2$

43. What is the measure of $\angle n$ in the picture?
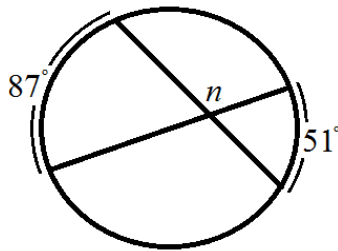
A. $36°$ B. $54°$ C. $69°$ D. $111°$ E. $136°$

44. The area of a rectangle is 48 cm². The ratio of the length to width of the rectangle is 4:3. What is the perimeter of the rectangle?
A. 28 cm   B. 24 cm   C. 30 cm   D. 38 cm   E. 32 cm

45. From Nautical Fun Marina, it takes a small boat 1.5 hours to travel 12 miles downstream and then 6 hours to return back to the marina. How fast is the speed of the boat in still water?
A. 4 mph   B. 6 mph   C. 3 mph   D. 9 mph   E. 5 mph

46. If $a^2 + b^2 = c^2$, then b is equal to which of the following?
A. $c^2 - a^2$ B. $\sqrt{c - a}$ C. $c - a$ D. $\sqrt{c^2 - a^2}$ E. $\sqrt{a^2 - c^2}$

47. The vertex of the quadratic equation $y = 5x^2 + 1 - 10x$ is located within which quadrant?
A. I   B. II   C. III   D. IV   E. V

48. Solve for n: $3(4 - n) \geq 2(n - 8)$
A. $n \geq -4$ B. $n \leq 4$ C. $n \leq 5\frac{3}{5}$ D. $n \geq -5\frac{3}{5}$ E. $n \geq 5.6$

49. What is the name of the regular polygon that has an interior angle measure of $144°$?
A. octagon   B. decagon   C. dodecagon   D. hexagon   E. septagon

50. If $a + b = 11$ and $ab = 10$, what is the value of $a^2 + b^2$?
A. 101   B. 131   C. 121   D. 111   E. 122

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

11. The two angles pictured are supplementary angles, which sum to $180°$. Make an equation, $8x + 17 + 3x + 9 = 180$. Combine like terms to get $11x + 26 = 180$. Subtract 26 from both sides and we get $11x = 154$. Divide both sides by 11 and $x = 14$.

13. $5\left(\frac{3}{4} \div \frac{5}{4}\right) - 2^4 \div 4^0 = 5\left(\frac{3}{4} \div \frac{5}{4}\right) - 16 \div 1 = 5\left(\frac{3}{4} \cdot \frac{4}{5}\right) - 16 = 5\left(\frac{3}{5}\right) - 16 = 3 - 16 = -13$.

17. 2, 4, 8, 16, …is not an arithmetic sequence because it does not have a common difference, it has a common ratio of 2, making it a geometric sequence.

21. If $A = 4n + 7$ and $B = -3n + 5$, then $A - B = (4n + 7) - (-3n + 5) = 4n + 7 + 3n - 5 = 7n + 2$.

23. $24^3 = 24 \cdot 24 \cdot 24 = 13{,}824 = 14{,}000$ (nearest thousand).

35. A linear equation in standard form is $Ax + By = C$. We are given the equation $4y + 2x = -18$, so first rewrite the equation in standard form to $2x + 4y = -18$, and $A = 2$, $B = 4$ and $C = -18$. To find the x-intercept of a linear equation in standard form, use $\frac{C}{A}$. Thus, the x-intercept of the linear equation is $\frac{-18}{2} = -9$.

36. We use the Pythagorean Theorem to classify triangles. a and b will always be the shortest sides. If $a^2 + b^2 = c^2$, then the triangle is right, if $a^2 + b^2 < c^2$, then the triangle is obtuse, if $a^2 + b^2 > c^2$, then the triangle is acute. $14^2 + 16^2 = 196 + 256 = 452$ and $17^2 = 289$. Since $452 > 289$, the triangle is acute.

41. To find the roots, or solutions, of a quadratic equation $Ax^2 + Bx + C = 0$, use the quadratic formula $x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$. First, subtract 14 from both sides to get the equation in standard form, $x^2 - 2x - 14 = 0$. Now, $A = 1$, $B = -2$ and $C = -14$. Substitute into the formula, $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-14)}}{2(1)} = \frac{2 \pm \sqrt{60}}{2}$. Now, simplify the radical and we get $\frac{2 \pm \sqrt{4 \cdot 15}}{2} = \frac{2 \pm 2\sqrt{15}}{2} = 1 - \sqrt{15}$ or $1 + \sqrt{15}$, which is the same as $1 \pm \sqrt{15}$.

42. $16x^8 - 1$ is a difference of squares, so $16x^8 - 1 = (4x^2 + 1)(4x^2 - 1)$. $4x^2 - 1$ is a difference of squares, so $4x^2 - 1 = (2x^2 + 1)(2x^2 - 1)$. Therefore, when factored completely, $16x^8 - 1 = (4x^2 + 1)(2x^2 + 1)(2x^2 - 1)$.

43. To find the measure of $\angle n$, first you must find the measure of $\angle x$.
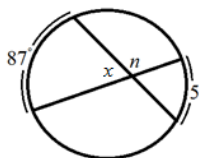
The measure of $\angle x = \frac{1}{2}(87 + 51) = \frac{1}{2}(138) = 69°$. $\angle n$ is supplementary to $\angle x$, so therefore, $m\angle n = 180 - 69 = 111°$.

44. Let x be the constant multiplier. If the area of the rectangle is 48 cm², then $4x(3x) = 48$, and $12x^2 = 48$. Divide both sides by 12 and $x^2 = 4$ and so $x = 2$. Since $x = 2$, the length of the rectangle is $4(2) = 8$ and the width of the rectangle is $3(2) = 6$. The perimeter of the rectangle is then $2(8) + 2(6) = 16 + 12 = 28$ cm².

46. We are given $a^2 + b^2 = c^2$, so first subtract a^2 from both sides. We now have $b^2 = c^2 - a^2$. Now, take the square root of both sides and we get $\sqrt{b^2} = \sqrt{c^2 - a^2}$ and then finally, $b = \sqrt{c^2 - a^2}$.