T M S C A   M I D D L E   S C H O O L
M A T H E M A T I C S
T E S T   # 5   ©
N O V E M B E R   1 8 ,   2 0 1 7

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. $21\frac{4}{7} + 9\frac{5}{7} = $ _____

A. $30\frac{2}{7}$ 　　　　　B. $31\frac{2}{7}$ 　　　　　C. $32\frac{1}{7}$ 　　　　　D. $32\frac{2}{7}$ 　　　　　E. $31\frac{1}{7}$

2. $22\frac{5}{8} - 4\frac{1}{4} = $ _____

A. $18\frac{3}{8}$ 　　　　　B. $19\frac{1}{2}$ 　　　　　C. $18\frac{7}{8}$ 　　　　　D. $19\frac{3}{8}$ 　　　　　E. $18\frac{1}{8}$

3. $33 \times \frac{2}{9} = $ _____

A. $7\frac{2}{3}$ 　　　　　B. $7\frac{1}{3}$ 　　　　　C. $7\frac{7}{9}$ 　　　　　D. $8\frac{1}{3}$ 　　　　　E. $7\frac{4}{9}$

4. $56 \div \frac{2}{5} = $ _____

A. $10\frac{1}{5}$ 　　　　　B. $22\frac{2}{5}$ 　　　　　C. 165 　　　　　D. 140 　　　　　E. 22

5. Chelsea's recipe calls for 3.5 cups of flour. How many ounces of flour does Chelsea's recipe call for?
A. 26.5 ounces 　　　　B. 28 ounces 　　　　C. 32 ounces 　　　　D. 30 ounces 　　　　E. 26 ounces

6. In Fort Walton Beach, Florida, it was reported that 0.64 inches of rain fell on August 1, 2016. Which fraction below is equivalent to the amount of rain that fell in Fort Walton Beach, Florida, on August 1, 2016?
A. $\frac{32}{25}$ 　　　　B. $\frac{3}{5}$ 　　　　C. $\frac{33}{50}$ 　　　　D. $\frac{7}{10}$ 　　　　E. $\frac{16}{25}$

7. Sammy bought five shirts for $89.15. Three of the shirts cost $16.95, $19.00 and $14.50. What is the mean of the cost of the remaining two shirts?
A. $18.25 　　　　B. $20.25 　　　　C. $18.45 　　　　D. $19.35 　　　　E. $19.55

8. Find n, if $540 = 2^2 \cdot 3^n \cdot 5$.
A. 3 　　　　B. 2 　　　　C. 1 　　　　D. 4 　　　　E. 0

9. 36 is what percentage of 120?
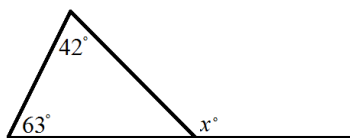A. 33 ⅓% 　　　　B. 33 ⅔% 　　　　C. 30% 　　　　D. 33% 　　　　E. 32%

10. Which sum below produces the largest negative number?
A. $-45 + 76$ 　　　B. $-23 + (-19)$ 　　　C. $1 + (-39)$ 　　　D. $23 + (-74)$ 　　　E. $19 + 21$

11. Simplify: 　　　　　$(2x^4y^5)^0$
A. -1 　　　　B. 0 　　　　C. 1 　　　　D. $2x^4y^5$ 　　　　E. 2

12. One terabyte is equivalent to 1,000,000 megabytes. In scientific notation, how many megabytes are in 6 terabytes?
A. 6×10^6 　　　B. 6×10^9 　　　C. 6×10^{36} 　　　D. 6×10^8 　　　E. 6×10^{10}

13. Simplify: 　　　　　$|16 - 23| + (4.5 - 11.5)^2$
A. 56 　　　　B. 42 　　　　C. -25.5 　　　　D. 196 　　　　E. 49
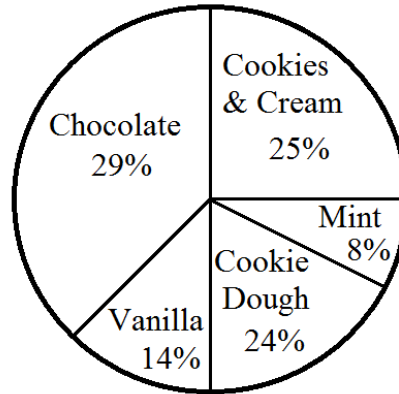
14. What is the value of x?

A. 155 　　　　B. 75 　　　　C. 117 　　　　D. 105 　　　　E. 84

15. If $c \heartsuit d = 4^c - d^3$, then find the value of $2 \heartsuit (-7)$.
A. −327   B. −29   C. 29   D. 375   E. 359

16. $DCX + CCIX + VIII =$ _____ (Arabic number)
A. 1,327   B. 827   C. 627   D. 327   E. 777

17. 4.5 gallons = _____ cups
A. 80   B. 72   C. 96   D. 576   E. 64

18. 350 students were asked what was their favorite flavor of ice-cream. Based on the circle graph, how many students said vanilla was their favorite flavor?

A. 101   B. 84   C. 28   D. 42   E. 49

19. $-3 + (-2) + (-1) + \ldots + 11 + 12 + 13 =$ _____
A. 85   B. 84   C. 91   D. 97   E. 89

20. This year, there are 280 boys out of 400 students in the 6th grade class. Next year, the 6th grade class will have 520 students. If the ratio is the same for girls to boys both years, how many boys will be in the 6th grade class next year?
A. 324   B. 344   C. 364   D. 384   E. 414

21. The sum of three different prime numbers, a, b and c, is 26. Find the product of the largest two of the three prime numbers if $a = 2$, $b > 5$ and $c > 13$.
A. 77   B. 119   C. 187   D. 65   E. 91

22. $\frac{14}{11} =$ _____ (decimal)
A. 1.27   B. $1.2\overline{7}$ C. $\overline{1.27}$ D. 1.28   E. $1.\overline{27}$

23. Simplify: $4(5n - 3) - 2(6n - 3) - 2n + 6$
A. $6n$ B. $6n + 12$ C. $6n - 12$ D. $8n$ E. $8n + 12$

24. The length of a rectangle is 20 cm and the width is 12 cm. If the dimensions of the rectangle are dilated by a scale factor of 1.5, what is the new perimeter of the rectangle after the dilation?
A. 64 cm   B. 128 cm   C. 96 cm   D. 124 cm   E. 112 cm

25. What is the sum of the next three terms in the sequence?   0.5, 2, 8, 32, …
A. 2,048   B. 8,192   C. 2,688   D. 3,200   E. 3,248

26. If 3 wums equal 4 bims and 6 bims equal 11 cams, how many cams are there in 9 wums?
A. 66   B. 22   C. 33   D. 44   E. 55

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27. What is the volume of the triangular prism below?

8 cm

6 cm

13 cm

10 cm
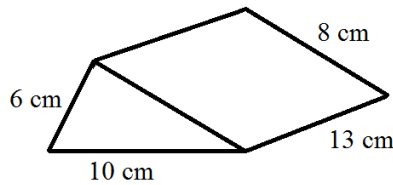
A. 312 cm^3 B. 390 cm^3 C. 624 cm^3 D. 1,040 cm^3 E. 324 cm^3

28. There are six students that will be asked to stand in a line. Two of the students are wearing glasses. One of the students wearing glasses will be the first in line and the other will be the last in line. How many different ways can the six students stand in line?
A. 24   B. 720   C. 120   D. 48   E. 42

29. What is the interquartile range of the set of data?   {34, 54, 12, 86, 16, 16, 92, 6}
A. 70   B. 64   C. 56   D. 48   E. 60

30. Using the magic square below, what is the value of ab?

17		71
a	59	
	b	101

A. 142   B. 994   C. 2,283   D. 2,301   E. 3,277

31. $1112_4 = $ _____ (base 10)
A. 126   B. 116   C. 106   D. 96   E. 86

32. From a standard deck of cards, you randomly choose a card. What is the probability the card you chose is not a black ten?
A. $\frac{1}{13}$ B. $\frac{1}{26}$ C. $\frac{12}{13}$ D. $\frac{15}{26}$ E. $\frac{25}{26}$
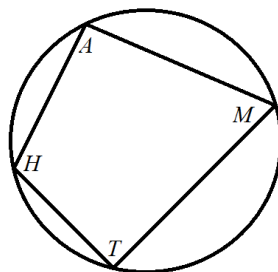
33. A spinner is divided equally into eight sections. Each section is labeled, alphabetically, A – H. What are the odds of spinning the spinner and it landing on a vowel?
A. 1:3   B. 1:4   C. 2:5   D. 3:8   E. 2:3

34. Which of the following inequalities does not have the solution of $x \leq 2$?
A. $4x + 8 \leq 16$ B. $-3x + 1 \geq -5$ C. $\frac{1}{2}x + 4 \leq 5$ D. $5x - 4 \leq 6$ E. $\frac{1}{2}x - 4 \leq -2$

35. Which of the following is true?

A. $m\angle H + m\angle M = 180°$ B. $m\angle A + m\angle M = 180°$ C. $m\angle T = 90°$ D. $m\angle H + m\angle T = 180°$ E. $m\angle M = 180°$

36. What is the rate of decay of the exponential decay function $y = 1.47\left(\frac{3}{5}\right)^x$?
A. 47%   B. 147%   C. 60%   D. 160%   E. 40%

37. Factor completely: $64x^2 + 48x + 9$
A. $(8x + 3)(8x - 3)$ B. $(32x + 3)(32x - 3)$ C. $(8x + 3)^2$ D. $(8x - 3)^2$ E. $(32x + 3)^2$

38. If $f(x) = \frac{x^2}{3}$, then what is the value of $f(-6) - f(9)$?
A. -15 B. 12   C. -24 D. -9 E. 12

39. $98^2 =$ _____
A. 9,604   B. 9,404   C. 9,804   D. 9,504   E. 9,764

40. What are the coordinates of the vertex of the quadratic equation $y = 3(x - 2)^2 + 9$?
A. $(-6, 9)$ B. $(2, 9)$ C. $(-2, 9)$ D. $(3, 9)$ E. $(6, 9)$

41. What is the simple interest when depositing $800 at 3.5% for 24 months?
A. $336.00   B. $672.00   C. $28.00   D. $56.00   E. $84.00

42. What is the GCF of $26a^3b^2$ and $32a^4b$?
A. $2a^3b$ B. $416a^3b$ C. $2a^4b^2$ D. $416a^4b^2$ E. $2ab$

43. How many positive integers less than 20 are relatively prime to 20?
A. 12   B. 10   C. 8   D. 6   E. 14

44. What is the equation for the axis of symmetry for the quadratic equation $y = 4x^2 + 8x - 9$?
A. $x = -\frac{9}{4}$ B. $x = -1$ C. $x = -2$ D. $x = -\frac{4}{9}$ E. $x = -\frac{1}{2}$

45. Find the value of B, if $\left(\sqrt{3} + \sqrt{6}\right)^2 = A + B\sqrt{2}$.
A. 9   B. 6   C. 3   D. 12   E. 2

46. What is the product of the coordinates of the solution of the system $\begin{cases} 3x = 3 + 2y \\ -4x + 3y = 1 \end{cases}$?
A. 145   B. 175   C. 185   D. 155   E. 165

47. Find $m + n$, if $\sqrt{\frac{5}{4} \cdot \frac{6}{5} \cdot \frac{7}{6} \cdot \frac{8}{7} \cdot \ldots \frac{m}{n}} = 2$.
A. 31   B. 32   C. 41   D. 45   E. 35

48. What is the slope of any line perpendicular to the line $y = -\frac{7}{6}x - 8$?
A. $-\frac{7}{6}$ B. $\frac{7}{6}$ C. $\frac{6}{7}$ D. $-\frac{6}{7}$ E. $\frac{8}{7}$

49. What is the product of the roots of the quadratic equation $32 = -4x^2 - 7x$?
A. -8 B. $\frac{32}{7}$ C. $-\frac{32}{7}$ D. 8   E. $\frac{1}{8}$

50. Simplify: $\left(\frac{3a^3b}{ab^{-2}}\right)^2\left(\frac{6ab}{a^2b^2}\right)^{-1}$
A. $1.5a^5b^7$ B. $1.5a^4b^6$ C. $0.\overline{6}a^5b^7$ D. $0.\overline{6}a^4b^6$ E. $1.5a^8b^{10}$

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2017 – 2018 TMSCA Middle School Mathematics Test #5 Answer Key

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

8. $540 = 2 \cdot 270 = 2 \cdot 2 \cdot 135 = 2 \cdot 2 \cdot 3 \cdot 45 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 15 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 = 2^2 \cdot 3^3 \cdot 5$. Thus, $n = 3$.

11. The zero-exponent rule states that any term raised to the zero power is equal to 1. Algebraically, $a^0 = 1$. We are given $(2x^4y^5)^0$, so by the zero-exponent rule, $(2x^4y^5)^0 = 1$.

14. An exterior angle of a triangle is equal to the sum of the opposite interior angles. Therefore, $x = 42 + 63 = 105$.

24. The length of a rectangle is 20 cm and the width is 12 cm. If all dimensions are dilated by a scale factor of 1.5, then the new width is $1.5(12) = 18$ and the new length is $1.5(20) = 30$. The new perimeter of the rectangle is $2(18) + 2(30) = 96$ cm.

29. First, arrange the data in order from least to greatest. $\{34, 54, 12, 86, 16, 16, 92, 6\} \rightarrow \{6, 12, 16, 16, 34, 54, 86, 92\}$. Next, identify the median, which is $\frac{16+34}{2} = \frac{50}{2} = 25$. The median divides the data into two sections, the lower half and the upper half. To find the lower quartile, find the median of the lower half of the data, $\frac{12+16}{2} = \frac{28}{2} = 14$. To find the upper quartile, find the median of the upper half of data, $\frac{54+86}{2} = \frac{140}{2} = 70$. To find the inter-quartile range, subtract the lower quartile from the upper quartile. The inter-quartile range is therefore, $70 - 14 = 56$.

32. We can use the complement of drawing a black ten to find our answer. The probability of drawing a black ten is $\frac{2}{52} = \frac{1}{26}$. The probability of not drawing a black ten is $1 - \frac{1}{26} = \frac{25}{26}$.

40. The quadratic equation given, $y = 3(x - 2)^2 + 9$, is in vertex form, which is $y = a(x - h)^2 + k$ with vertex (h, k). Therefore, in the equation $y = 3(x - 2)^2 + 9$, the vertex has coordinates (2, 9).

43. To find how many positive integers greater than 0 relatively prime to a number, first, find the prime factorization of the number, $20 = 2^2 \cdot 5$. Next, subtract one from each exponent and multiply the results out, $2^{2-1} \cdot 5^{1-1} = 2^1 \cdot 5^0 = 2$. Next, subtract one from each base integer, $2 - 1 = 1$ and $5 - 1 = 4$. Finally, multiply the bases minus one and the product of the one less from the exponents, $2 \cdot 1 \cdot 4 = 8$. There are 8 numbers greater than 0 but less than 20 that are relatively prime to 20.

44. The equation for the axis of symmetry of a quadratic equation is $x = \frac{-B}{2A}$ if the equation is in standard form, $Ax^2 + Bx + C = 0$. In the given equation, $y = 4x^2 + 8x - 9$, $A = 4$ and $B = 8$. Therefore, the axis of symmetry is $x = \frac{-8}{2(4)} = \frac{-8}{8} = -1$.

48. The equation of the line given is in slope-intercept form, $y = mx + b$, where m represents the slope of the line. So, the line $y = -\frac{7}{6}x - 8$ has a slope of $-\frac{7}{6}$. Perpendicular lines have negative reciprocal slopes. The reciprocal of $-\frac{7}{6}$ is $-\frac{6}{7}$. The negation of $-\frac{6}{7}$ is $\frac{6}{7}$. The slope of any line perpendicular to the line $y = -\frac{7}{6}x - 8$ is $\frac{6}{7}$.

49. First, get the quadratic equation into standard form, $Ax^2 + Bx + C = 0$. $32 = -4x^2 - 7x \rightarrow -4x^2 - 7x - 32 = 0$, so $A = -4$, $B = -7$ and $C = -32$. To find the product of the roots, use $\frac{C}{A}$. Therefore, the product of the roots of the quadratic equation $-4x^2 - 7x - 32$ is $\frac{-32}{-4} = 8$.

50. $\left(\frac{3a^3b}{ab^{-2}}\right)^2 \left(\frac{6ab}{a^2b^2}\right)^{-1} = (3a^2b^3)^2 \left(\frac{6}{ab}\right)^{-1} = 9a^4b^6 \cdot \frac{ab}{6} = \frac{9a^5b^7}{6} = \frac{3a^5b^7}{2} = 1.5a^5b^7$.