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

G E A R U P ©

D E C E M B E R 5, 2 0 2 1

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.

2021 – 2022 TMSCA Middle School Mathematics Gear-Up Test

1. $\frac{5}{3} + \frac{8}{3}$ = _____

A. $4\frac{2}{3}$ B. $4\frac{1}{3}$ C. $5\frac{1}{3}$ D. $5\frac{2}{3}$ E. $3\frac{2}{3}$

2. 63.007 – 7.84 = _____ (nearest tenth)

A. 55.2 B. 55.1 C. 55.17 D. 55.16 E. 60

3. $22 \times 9 \times 31$ = _____

A. 6,258 B. 6,158 C. 6,188 D. 6,278 E. 6,138

4. $14\frac{5}{8} \div 3$ = _____

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

5. 137 + 95 = _____ (Roman numeral)

A. CCXII B. CCXXXII C. CXXXVII D. XCV E. CXXLVII

6. Which of the following is not a quadrilateral?

A. kite B. rhombus C. square D. septagon E. trapezoid

7. Collin pays $135 a month for his select baseball team dues. At this rate, how much will Collin pay for four years of select baseball dues?

A. $540 B. $3,240 C. $6,480 D. $1,620 E. $4,860

8. What is the prime factorization of the number 440?

A. $2^3 \cdot 5 \cdot 11$ B. $2^2 \cdot 5^2 \cdot 11$ C. $2^2 \cdot 5 \cdot 11^2$ D. $2 \cdot 3 \cdot 5 \cdot 11$ E. $2 \cdot 3^2 \cdot 5 \cdot 11$

9. Point *A* has coordinates $(-7, -3)$ and is translated down 11 units and to the left 9 units. What are the new coordinates of *A*?

A. $(-18, -12)$ B. $(4, 6)$ C. $(-16, -14)$ D. $(4, -14)$ E. $(2, 8)$

10. 2 gallons = _____ ounces

A. 96 B. 256 C. 96 D. 192 E. 426

11. Which inequality matches the graph?

A. $x > 1$ B. $x \geq 1$ C. $x < 1$ D. $x \leq 1$ E. $-\infty < x < \infty$

12. If *A* = 0.0000076 and *B* = 0.0000014, then *A* – *B* = _____ (scientific notation).

A. 6.2×10^{-6} B. 6.2×10^{6} C. 6.2×10^{-5} D. 9×10^{-6} E. 9×10^{-5}

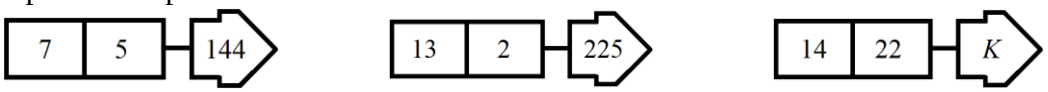
13. What is the probability of drawing a red 7 from a standard deck of cards?

A. $\frac{1}{13}$ B. $\frac{2}{13}$ C. $\frac{4}{13}$ D. $\frac{1}{26}$ E. $\frac{1}{4}$

14. The angles measures of a triangle are $18^\circ, 46^\circ$, and $(2x)^\circ$. What is the value of *x*?
A. 116 B. 26 C. 52 D. 58 E. 104

15. Simplify: $14 + 2(6-4)^3 - 3^2$
A. 18 B. 21 C. -47 D. 69 E. 24

16. Use the examples in the picture below to find the value of *K*.



A. 72 B. 964 C. 1,296 D. 792 E. 1,584

17. \$14.66 = 34 quarters + _____ dimes + 1 nickel + 1 penny
A. 57 B. 59 C. 61 D. 63 E. 65

18. What is the positive difference of the range and mode of the set of numbers 34, 5, 31, 34, 19, 77, 11, and 8?
A. 82 B. 33 C. 43 D. 50.5 E. 38

19. If $a \otimes b = 12a - 8b$, then what is the value of $5 \otimes (-2 \otimes (-3))$?
A. 60 B. 44 C. 72 D. 36 E. 48

20. What is the GCF of $44a^4$ and $121a$?
A. 11 B. $11a^2$ C. $11a$ D. $11a^3$ E. $11a^4$

21. Lila earned \$40 babysitting on Friday night. On Saturday, she babysat for 5 hours at a rate of \$9.50 per hour. On Sunday she went to the store and spent \$14.75 on a new t-shirt. How much money does Lila have remaining after buying the new t-shirt?
A. \$34.75 B. \$34.25 C. \$72.75 D. \$72.25 E. \$74.75

22. If $A = 5x^2 - 12$ and $B = 6 - 4x^2$, find *A* – *B*.
A. $9x^2 - 6$ B. $9x^2 - 18$ C. $x^2 - 6$ D. $x^2 - 18$ E. $-x^2 - 16$

23. 34^2 = _____
A. 1,156 B. 1,448 C. 1,196 D. 1,236 E. 1,272

24. 212_3 = _____ (base 10)
A. 31 B. 29 C. 27 D. 25 E. 23

25. How many different combinations can be made using three letters from the group of letters A, B, C, and D?
A. 16 B. 4 C. 12 D. 24 E. 8

26. $0.\overline{18}$ = _____ (fraction)
A. $\frac{3}{7}$ B. $\frac{1}{55}$ C. $\frac{2}{11}$ D. $\frac{1}{5}$ E. $\frac{6}{13}$

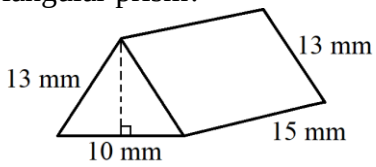
27. $\sqrt{850}$ lies between which pair of integers?
A. 28 and 29 B. 29 and 30 C. 30 and 31 D. 31 and 32 E. 32 and 33

28. What is the 11th term of the sequence 3, 4, 7, 11, 18, …?
A. 306 B. 336 C. 328 D. 322 E. 314

29. Let *U* be a universal set and *A* and *B* be subsets of *U* defined as shown. How many elements are in $A \cup B'$?
$U = \{all\ positive\ integers\ less\ than\ 20\}$ $A = \{multiples\ of\ 5\}$ $B = \{multiples\ of\ 3\}$
A. 14 B. 15 C. 16 D. 17 E. 18

30. What is the value of $g(-3)$, if $g(x) = -2x^3 + 5$?
A. -49 B. -13 C. 23 D. 221 E. 59

31. What is the total surface area of the triangular prism?

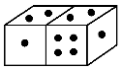


A. 540 mm^2 B. 1,080 mm^2 C. 510 mm^2 D. 900 mm^2 E. 660 mm^2

32. What is the equation of the vertical line passing through the point $(17, 32)$?
A. $x = 17$ B. $x = -17$ C. $y = 32$ D. $y = -32$ E. $y = 17x$

33. If the sum of 14 consecutive integers is 49, what is the value of the largest of these integers?
A. 14 B. 13 C. 10 D. 8 E. 6

34. A pair of dice is rolled and land side by side as shown below. What is the product of the faces not shown?



A. 32,400 B. 36,200 C. 34,200 D. 30,800 E. 34,600

35. Simplify: $\frac{2(xy^3)^2}{2x^5y^5}$
A. $\frac{2y}{x^3}$ B. $\frac{2}{x^3}$ C. x^4y^8 D. $\frac{y}{x^3}$ E. $\frac{1}{x^3}$

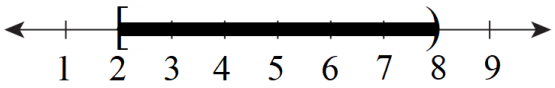
36. What is the slope of the line that passes through the points $(5a, 9b)$ and $(2a, -6b)$?
A. $\frac{5b}{a}$ B. $\frac{7a}{16b}$ C. $\frac{16b}{7a}$ D. $-\frac{7b}{16a}$ E. $-\frac{b}{a}$

37. 15 yards = _____ inches
A. 1,800 B. 180 C. 1,080 D. 360 E. 540

38. What is the value of *x*, if $\frac{x}{2x+7} = \frac{6}{7}$?
A. -8.4 B. -7.6 C. -6.8 D. -7.2 E. -8.0

39. $\frac{1}{\frac{2}{3}+2-\frac{1}{6}}$ = _____ (decimal)
A. 0.6 B. 0.24 C. 0.4 D. 0.25 E. 0.8

40. The graph below represents which of the following inequalities?



A. $2 < x < 8$ B. $2 < x \leq 8$ C. $2 \leq x \leq 8$ D. $2 \leq x < 8$ E. $2 \geq x > 8$

41. What is the balance of a savings account if you deposit \$10,000 at 4% compounded annually for 2 years?
A. \$10,724 B. \$10,816 C. \$10,834 D. \$10,786 E. \$10,774

42. What is the product of the roots of the quadratic equation $10x^2 - 25x = 40$?
A. -2.5 B. 2.5 C. -4 D. 4 E. ¼

43. What is the geometric mean of the numbers 1, 8, and 27?
A. 12 B. $6\sqrt{6}$ C. $12\sqrt{6}$ D. 6 E. 17.5

44. What is the product of the coordinates of the solution to the system of linear equations $\begin{cases} y = \frac{1}{2}x + 17 \\ \frac{1}{4}x + 2y = 24 \end{cases}$?
A. -128 B. 120 C. -96 D. -104 E. 5

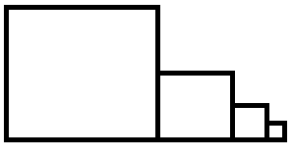
45. Lindsey draws a quadrilateral *ABCD* with vertices $A(-6, 1)$, $B(2, 4)$, $C(4, 1)$, and $D(-4, -2)$. What is the area of quadrilateral *ABCD*?
A. 39 units^2 B. 36 units^2 C. 32 units^2 D. 27 units^2 E. 30 units^2

46. Factor completely over the set of real numbers: $m^4 - 1$
A. $(m^2 - 1)^2$ B. $(m^2 + 1)^2$ C. $(m^4 - 1)(m^4 + 1)$ D. $m^2(m^2 - 1)$ E. $(m^2 + 1)(m + 1)(m - 1)$

47. The diameter of a circle is 12 cm. What is the area of a sector of the circle with a central angle of 50°?
A. 36π cm^2 B. $1.\bar{6}\pi$ cm^2 C. 5π cm^2 D. 6π cm^2 E. 20π cm^2

48. $\frac{8!-7!}{5!}$ = _____
A. 294 B. 48 C. 67.2 D. 336 E. 1,152

49. Four adjacent squares are lined up horizontally, as shown below. The length of a side of the smallest square is 1 unit. Each square before the smallest square has a side length twice as long as a side of the following square. What is the perimeter of the shape?



A. 92 units B. 60 units C. 30 units D. 46 units E. 54 units

50. What is the largest value of *x* which satisfies $2^{-2} + 3^{-2} = x^{-2}$?
A. $\frac{6\sqrt{13}}{13}$ B. $\frac{5\sqrt{13}}{13}$ C. $\frac{12\sqrt{13}}{13}$ D. $\frac{8\sqrt{13}}{13}$ E. $\frac{10\sqrt{13}}{13}$

2021 – 2022 TMSCA Middle School Mathematics Gear-Up Test Answer Key

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

2021 – 2022 TMSCA Middle School Mathematics Gear-Up Test Selected Answers

10. If 1 gallon = 128 ounces, 2 gallons = 128(2) = 256 ounces.

25. Choosing 3 letters at a time from the group of letters A, B, C, and D, there are 4 combinations. They are ABC, ABD, ACD, and CBD.

26. If we let $x = 0.\overline{18}$, then $100x = 18.\overline{18}$. $100x - x = 99x$, which is equal to $18.\overline{18} - 0.\overline{18} = 18$. Now we have $99x = 18$. Dividing by 99 to both sides of the equation gives us $x = \frac{18}{99} = \frac{2}{11}$.

32. The equation of any vertical line is $x = \#$. Therefore, the equation of the vertical line passing through the point $(17, 32)$ is $x = 17$.

35. $\frac{2(xy^3)^2}{2x^5y^5} = \frac{2x^2y^{3(2)}}{2x^5y^5} = \frac{2x^2y^6}{2x^5y^5} = \frac{2}{2} \cdot \frac{x^2}{x^5} \cdot \frac{y^6}{y^5} = 1 \cdot x^{2-5} \cdot y^{6-5} = x^{-3}y = \frac{y}{x^3}$.

37. 15 yards = 15(3) = 45 feet = 45(12) = 540 inches.

39. $\frac{1}{\frac{2}{3}+2-\frac{1}{6}} = \frac{1}{\frac{4}{6}+\frac{12}{6}-\frac{1}{6}} = \frac{1}{\frac{15}{6}} = \frac{1}{\frac{5}{2}} = 1 \div \frac{5}{2} = 1 \cdot \frac{2}{5} = \frac{2}{5} = 0.4$.

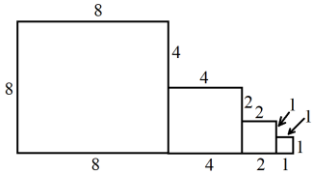
42. A quadratic equation in standard form is in the form $Ax^2 + Bx + C = 0$. To find the product of the roots, use $\frac{C}{A}$. We are given the equation $10x^2 - 25x = 40$. First, subtract 40 from both sides of the equation to get the equation equal to 0, $10x^2 - 25x - 40 = 0$. Now, $A = 10$ and $C = -40$. Therefore, the product of the roots of the equation is $\frac{-40}{10} = -4$.

43. The geometric mean of three numbers *a*, *b*, and *c* is equal to $\sqrt[3]{abc}$. Therefore, the geometric mean of 1, 8, and 27 is equal to $\sqrt[3]{1 \cdot 8 \cdot 27} = \sqrt[3]{1} \cdot \sqrt[3]{8} \cdot \sqrt[3]{27} = 1 \cdot 2 \cdot 3 = 6$.

46. $m^4 - 1$ is a difference of squares. A difference of squares can be factored as $a^2 - b^2 = (a + b)(a - b)$. So, $m^4 - 1$ can be factored as $m^4 - 1 = (m^2 + 1)(m^2 - 1)$. $m^2 - 1$ is a difference of square, which can be factored as $m^2 - 1 = (m + 1)(m - 1)$. Because neither of these factors can be factored further, $m^4 - 1 = (m^2 + 1)(m + 1)(m - 1)$.

47. The area of a sector of the circle with a central angle of x° is equal to $\frac{x}{360} \cdot \pi r^2$. We are given a diameter of 12 cm, so the radius is $12 \div 2 = 6$ cm, and a central angle of 50°. Substituting into the formula, and the area of the sector is $\frac{50}{360} \cdot \pi(6)^2 = \frac{5}{36} \cdot 36\pi = \frac{5(36)\pi}{36} = 5\pi$ cm^2.

49. With the information given, we can draw the following:



From the picture, we can find the perimeter to be
8 + 8 + 8 + 4 + 4 + 4 + 2 + 2 + 2 + 1 + 1 + 1 + 1 = 46.