

**TMSCA MIDDLE SCHOOL
MATHEMATICS
BANA INVITATIONAL ©
2017**

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. $2,007 + 378 + 619 =$ _____ (nearest ten)
 A. 3,010 B. 3,020 C. 3,000 D. 2,990 E. 3,030
2. $17\frac{1}{3} - 5\frac{5}{9} =$ _____
 A. $11\frac{5}{9}$ B. $12\frac{2}{3}$ C. $12\frac{7}{9}$ D. $11\frac{2}{9}$ E. $11\frac{7}{9}$
3. $4.7 \times 32.6 =$ _____
 A. 135.22 B. 153.42 C. 135.32 D. 153.22 E. 153.12
4. $120 \div \frac{2}{3} =$ _____
 A. 20 B. 80 C. 180 D. 150 E. 210
5. Which of the following is the correct prime factorization of the number 136?
 A. $2^2 \cdot 3 \cdot 17$ B. $2^3 \cdot 17$ C. $2^3 \cdot 3^2 \cdot 11$ D. $2^2 \cdot 3^2 \cdot 11$ E. $2 \cdot 3^2 \cdot 13$
6. Which number below is not a rational number?
 A. 7.112 B. 1.1010010001 C. $3.\bar{8}$ D. $\sqrt{64}$ E. $\sqrt{5}$
7. 2.4 miles = _____ feet
 A. 12,672 B. 13,728 C. 11,616 D. 4,224 E. 42,224
8. Which of the following shapes is not a polygon?
 A. kite B. undecagon C. septagon D. cube E. parallelogram
9. Two angles are supplementary. If one angle measure is triple the other, what is the measure of the larger angle?
 A. 45° B. 120° C. 135° D. 150° E. 124°
10. What is the name of the shape?



- A. hexagon B. nonagon C. heptagon D. decagon E. undecagon
11. $19\frac{3}{11} =$ _____ (decimal)
 A. $19.2\bar{7}$ B. $19.\bar{27}$ C. $19.27\bar{2}$ D. 19.28 E. 19.27
12. What is the perimeter of a square with an area of 576 in^2 ?
 A. 96 inches B. 288 inches C. 144 inches D. 72 inches E. 112 inches
13. If it takes Lucinda 12 minutes to sew 15 buttons, how many buttons can she sew in 28 minutes?
 A. 31 B. 35 C. 38 D. 41 E. 39
14. Shelby had a new personal-sized strawberry cheesecake. She ate one-fifth of the cake after lunch and then 50% of what was remaining after dinner. How much of the strawberry cheesecake does Shelby have remaining?
 A. $\frac{3}{4}$ B. $\frac{3}{5}$ C. $\frac{2}{5}$ D. $\frac{1}{4}$ E. $\frac{1}{2}$
15. How many diagonals can be drawn from one vertex of a regular 14-sided polygon?
 A. 9 B. 154 C. 11 D. 18 E. 22

16. 48 is what percent of 160?
 A. 25% B. 30% C. 35% D. 32.5% E. 37.5%

17. Billy and Lucy start reading the same book at the same time, from the beginning, at 6:30 am. Lucy finished the book in five hours and fifteen minutes. Billy finished the book two hours and ten minutes after Lucy finished the book. At what time did Billy finish reading the book?
 A. 1:55 pm B. 11:55 am C. 11:55 pm D. 2:05 pm E. 1:45 pm

18. What is the length of the diameter of a circle that has an area of $324\pi \text{ cm}^2$?
 A. 18 cm B. 32 cm C. 36 cm D. 9 cm E. 81 cm

19. If $2n - 17 = 35$, then $5n - 45$ is equal to which of the following?
 A. 175 B. 130 C. 85 D. 69 E. 90

20. Which of the following is in correct scientific notation?
 A. 45×10^2 B. 0.23×10^8 C. 310×10^{-2} D. 11.4×10^3 E. 8.5×10^{-7}

21. Which expression correctly represents “five less than twice a number”?
 A. $5 - 2n$ B. $2(5 - n)$ C. $5(2n)$ D. $5(2 - n)$ E. $2n - 5$

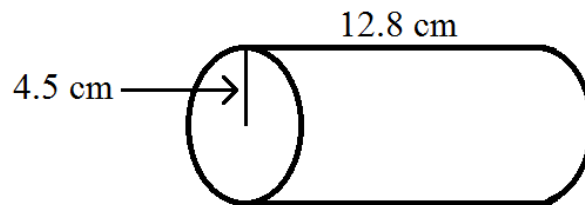
22. If $a \heartsuit b = 11a - 7b$, then what is the value of $18.6 \heartsuit 0.6$?
 A. 22 B. 200.4 C. 204.6 D. 208.8 E. 202.2

23. $\$4.45 + 325\text{¢} =$ _____ nickels
 A. 77 B. 170 C. 47 D. 154 E. 770

24. $13 + 14 + 15 + \dots + 26 + 27 + 28 =$ _____
 A. 328 B. 315 C. 344 D. 357 E. 331

25. How many positive integral divisors does the number 3,960 have?
 A. 50 B. 36 C. 48 D. 24 E. 84

26. What is the volume of the cylinder? Let $\pi = 3$.



A. 778.4 cm^3 B. 772.8 cm^3 C. 777.6 cm^3 D. 775.4 cm^3 E. 778.6 cm^3

27. Simplify: $(x^2 \cdot x^3)^4$
 A. x^9 B. $2x^9$ C. x^{24} D. $2x^{20}$ E. x^{20}

28. What is the simple interest if investing \$350 at 4% for 6 years?
 A. \$84.00 B. \$434.00 C. \$266.00 D. \$36.00 E. \$64.00

29. What is the distance between the points $(-2, 2)$ and $(3, 14)$?
 A. 10 units B. 11 units C. 12 units D. 13 units E. 14 units

30. The side length of an equilateral triangle is 8 units. What is the area of this equilateral triangle?
 A. $32\sqrt{3} \text{ units}^2$ B. $16\sqrt{3} \text{ units}^2$ C. $64\sqrt{3} \text{ units}^2$ D. $8\sqrt{3} \text{ units}^2$ E. $8\sqrt{2} \text{ units}^2$

31. $34_5 + 11_6 + 25_7 =$ _____ (base 8)

- A. 46 B. 45 C. 105 D. 55 E. 63

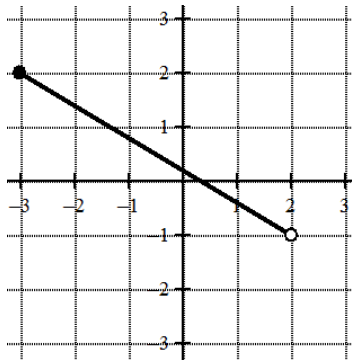
32. Identify the rate of decay for the exponential decay function $y = 1.28(0.714)^x$.

- A. 128% B. 28% C. 71.4% D. 28.6% E. 7.14%

33. The area of a rectangle is $8x^2 + 10x - 7$. If the length of the rectangle is $(2x - 1)$, what is the width of the rectangle?

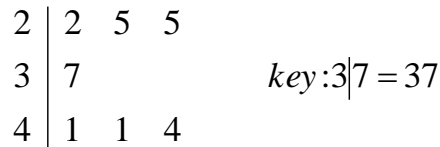
- A. $6x + 6$ B. $6x - 8$ C. $4x - 7$ D. $4x + 6$ E. $4x + 7$

34. What is the domain of the graph?



- A. $-1 < x < 2$ B. $-1 < x \leq 2$ C. $-3 < x \leq 2$ D. $-3 \leq x \leq 2$ E. $-3 \leq x < 2$

35. What is the inter-quartile range of the data from the stem-and-leaf plot?



- A. 37 B. 16 C. 22 D. 33 E. 33.6

36. $\{1, 2, 3, 4, 5, 6\} \cap \{2, 4, 6, 8, 10\} =$ _____

- A. $\{1, 2, 3, 4, 5, 6, 8, 10\}$ B. $\{2, 4, 6\}$ C. $\{1, 2, 2, 3, 4, 4, 5, 6, 6, 8, 10\}$ D. $\{\emptyset\}$ E. $\{1\}$

37. What is the x -intercept of the line with the equation $3x - \frac{1}{2}y = -12$?

- A. 24 B. -24 C. -4 D. -6 E. $-0.1\bar{7}$

38. Multiply: $(8x + 7)(11x - 9)$

- A. $88x^2 + 5x - 16$ B. $88x^2 - 5x - 16$ C. $88x^2 + 5x - 63$ D. $88x^2 - 5x - 63$ E. $19x^2 + 5x - 16$

39. How many combinations can be made of eight items taken five at a time?

- A. 112 B. 6,720 C. 36 D. 56 E. 336

40. $(XLVIII)^2 =$ _____ (Arabic number)

- A. 9,604 B. 4,356 C. 4,096 D. 1,444 E. 2,304

41. Mary plotted the points $(7, -3)$ and $(-1, 1)$ on a coordinate plane. If Mary draws a line through the two points, what will be the slope of that line?

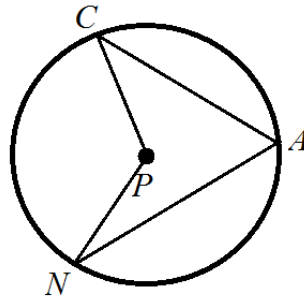
- A. -2 B. 2 C. $\frac{1}{2}$ D. $-\frac{1}{2}$ E. $\frac{1}{4}$

42. Solve the inequality: $\frac{4}{5}x - 8 \leq -\frac{3}{10}$

- A. $x \geq -10.375$ B. $x \leq -10.375$ C. $x \leq 9.625$ D. $x \geq 8.375$ E. $x \leq 7.625$

43. What is the measure of the diameter of a circle with an equation of $(x - 7)^2 + y^2 = 225$?
 A. 14 units B. 28 units C. 30 units D. 112.5 units E. 45 units

44. In the picture below, what is the measure of $\angle CPN$, if $m\angle CAN = 73.8^\circ$?



A. 147.6° B. 36.9° C. 136.6° D. 106.2° E. 147.2°

45. The product of the roots of the equation $8 = 15x + 2x^2$ is equal to which of the following?
 A. -4 B. 7.5 C. -7.5 D. -8 E. -16

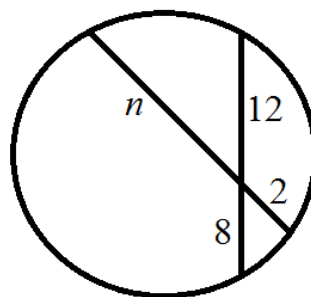
46. What is the sum of the coordinates of the solution to the system $\begin{cases} -3x = -y - 7 \\ y = -2 + 0.5x \end{cases}$?

A. -2 B. 2 C. 1 D. 11 E. -5

47. Simplify: $\sqrt{12}(\sqrt{6} + \sqrt{2})$
 A. $6\sqrt{2} + 2\sqrt{6}$ B. $12\sqrt{6} + 12\sqrt{2}$ C. $12\sqrt{6} + 2\sqrt{6}$ D. $12\sqrt{6} + 6\sqrt{2}$ E. $2\sqrt{6} + 3\sqrt{2}$

48. Blake went into a store and saw a new fishing pole that cost \$80.00. He decided to wait another week before he bought the pole. The next week Blake went into the store, the same fishing pole was on sale for \$56.00. What was the percent of change of the price of the new fishing pole?
 A. 25% decrease B. 30% decrease C. 45% decrease D. 24% decrease E. 28% decrease

49. Using the picture, find the value of $\frac{12^2}{n}$.



A. 16 B. 4 C. 12 D. 3 E. 6

50. Which of the following lines are perpendicular?

I. $y = 0.4x - 7$ II. $2.5y = -x$ III. $7.5x + 3y = 6$ IV. $9y - 6x = 1$
 A. I and IV B. II and III C. I and II D. II and IV E. I and III

2017 – 2018 TMSCA Middle School Invitational Mathematics Test ANSWER KEY

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

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4. $120 \div \frac{2}{3} = 120 \cdot \frac{3}{2} = \frac{120}{1} \cdot \frac{3}{2} = \frac{360}{2} = 180.$

6. A rational number is a number that, when written as a decimal, is a repeating or terminating decimal. Choices A and B are 7.112 and 1.1010010001, respectively, which are terminating decimals. Choice C is a repeating decimal. Choice D is 8 when simplified, which is also a terminating decimal. $\sqrt{5} = 2.2360679775\dots$, which is a non-repeating and non-terminating decimal, which is not a rational number. In fact, the square root of any prime number will produce a non-rational number, called an irrational number.

10. Even though the shape is irregular, it has 7 sides. A polygon with 7 sides is called a septagon, or a heptagon.

13. Use a proportional to solve for the missing value; $\frac{12}{15} = \frac{28}{x}$. Simplify to make the problem easier and $\frac{4}{5} = \frac{28}{x}$. Cross multiply and we get $4x = 140$. Dividing by 4 and we get $x = 35$. Lucinda can sew 35 buttons in 28 minutes.

23. $325\text{¢} = \$3.25$. $\$4.45 + \$3.25 = \$7.70$. To find the number of nickels that make up \$7.70, divide \$7.70 by 0.05. Thus, $7.70 \div 0.05 = 154$ nickels.

27. We are given $(x^2 \cdot x^3)^4$. First, simplify the inside of the parentheses by using the exponent rule, $a^m \cdot a^n = a^{m+n}$, so $(x^2 \cdot x^3)^4 = (x^{2+3})^4 = (x^5)^4$. Now, use the exponent rule, $(a^m)^n = a^{m \cdot n}$, and we get $(x^5)^4 = x^{5 \cdot 4} = x^{20}$.

30. The formula to find the area of an equilateral triangle when given the side length is $A = \frac{s^2\sqrt{3}}{4}$. We are given a side length of 8 units, so the area of the equilateral triangle is $A = \frac{8^2\sqrt{3}}{4} = \frac{64\sqrt{3}}{4} = 16\sqrt{3}$ units².

38. $(8x + 7)(11x - 9) = 8x(11x) + 8x(-9) + 7(11x) + 7(-9) = 88x^2 - 72x + 77x - 63 = 88x^2 + 5x - 63.$

39. To find the number of combinations of n objects taken r at a time, use the formula ${}_nC_r = \frac{n!}{r!(n-r)!}$. We are asked to find the number of combinations that can be made of eight items taken five at a time. So, substituting into our formula and we get ${}_8C_5 = \frac{8!}{5!(8-5)!} = \frac{8!}{5!3!} = 56.$

40. $(XLVIII)^2 = 48^2 = 2,304.$

47. $\sqrt{12}(\sqrt{6} + \sqrt{2}) = 2\sqrt{3}(\sqrt{6} + \sqrt{2}) = 2\sqrt{18} + 2\sqrt{6} = 2 \cdot 3\sqrt{2} + 2\sqrt{6} = 6\sqrt{2} + 2\sqrt{6}.$

48. To find percent of change, you divide the change in the amount by the original amount, or $\frac{\text{change in amount}}{\text{original amount}}$. The fishing pole was \$80 the first week and then \$56 the second week. So, $\frac{80-56}{80} = \frac{24}{80} = \frac{3}{10} = 0.3$. Now you must multiply by 100 and $0.3(100) = 30\%$. Since the price dropped, it was a 30% decrease.