



**TMSCA MIDDLE SCHOOL
MATHEMATICS
STATE MEET ©
APRIL 16, 2016**

GENERAL DIRECTIONS

- About this test:
 - You will be given 40 minutes to take this test.
 - There are 50 problems on this test.
- 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.
- If you are using a Chatsworth or Scantron card, please follow the specific instructions given at your particular meet.
- You may write anywhere on the test itself. You must write only answers on the answer sheet.
- You may use additional scratch paper provided by the contest director.
- All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
- Calculators **MAY NOT** be used on this test.
- 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.
- In case of ties, percent accuracy will be used as a tie breaker.

2015 – 2016 TMSCA Middle School Mathematics State Championship Test

1. $599 + 29 + 19 + 6,783 =$ _____ (nearest hundred)
 A. 6,400 B. 6,800 C. 7,200 D. 7,400 E. 7,000

2. $54 - 700 - 69 - 8 =$ _____ (nearest ten)
 A. -710 B. -720 C. -700 D. 740 E. 690

3. What is the product of 6 and $4.\bar{6}$?
 A. 14 B. 30 C. 28 D. 26 E. 34

4. $960 \div \left(5 \cdot \frac{2}{5} \cdot 0.2\right) =$ _____
 A. 240 B. 2,400 C. 24 D. 2.4 E. 24,000

5. Find the GCF of $75mn^4$ and $50m^2n^3p$
 A. $150mn^3p$ B. $25mn^3p$ C. $25mn^3$ D. $150mn^3$ E. $25m^2n^4p$

6. Clay swam ten laps on Monday, seven laps on Tuesday, five on Wednesday, six on Thursday and twelve laps on Friday. What was his average number of laps swam for the five days?
 A. 7 laps B. 8 laps C. 9 laps D. 7.5 laps E. 8.5 laps

7. 114 is 30% of what number?
 A. 380 B. 43.2 C. 342 D. 360 E. 370

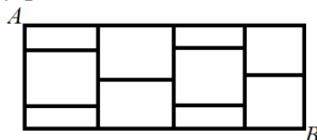
8. 3.4×10^{-5} is equivalent to which of the following?
 A. 340,000 B. 3,400,000 C. 0.0000034 D. 0.000034 E. 0.340000

9. $1^2 + 2^2 + 3^2 + \dots + 7^2 + 8^2 =$ _____ (Roman numeral)
 A. CCVI B. MDCIX C. MDVII D. DDII E. CCIV

10. What number is seven-eighths less than the additive inverse of positive five-sixths?
 A. $-\frac{1}{24}$ B. $1\frac{17}{24}$ C. $-1\frac{17}{24}$ D. $-1\frac{3}{4}$ E. $1\frac{1}{4}$

11. Find the value of $\frac{n}{26}$, if $\frac{1}{60} = \frac{1}{156} + \frac{1}{n} + \frac{1}{210}$.
 A. 14 B. 12 C. 8 D. 7 E. 6

12. Moving only to the right or down, how many paths are there from A to B?



A. 15 B. 18 C. 21 D. 24 E. 20

13. A rectangle has a perimeter of $24n + 16$ and a width of $3n - 1$. What is the measure of the length of the rectangle?
 A. $8n + 7$ B. $9n + 7$ C. $8n + 8$ D. $9n + 6$ E. $9n + 9$

14. What is the probability of rolling a pair of dice and getting a multiple of 4 facing up?
 A. $\frac{1}{3}$ B. $\frac{3}{8}$ C. $\frac{1}{4}$ D. $\frac{3}{4}$ E. $\frac{2}{3}$

15. If the sum of the complement and supplement of an acute angle is equal to sixteen times the angle, what is the degree measure of the acute angle?
 A. 15° B. 20° C. 25° D. 22° E. 18°

16. Point A is located at $(11, -3)$. If point A is translated to the left fourteen units and then down six units, and then reflected across the x -axis, what is the product of the new coordinates of point A ?

- A. 9 B. -27 C. -18 D. -33 E. 21

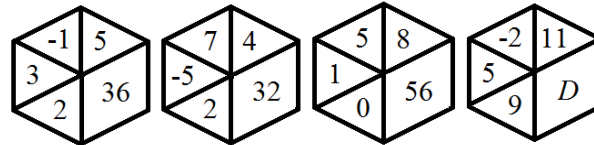
17. How many vertices does an octagonal prism have?

- A. 8 B. 16 C. 24 D. 10 E. 14

18. One-fifth of a fourth of m equals a third of a half of w . If $m = 80$, what is the value of w ?

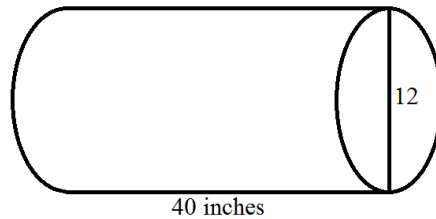
- A. 15 B. 60 C. 24 D. 16 E. 32

19. Use the examples below to find the value of D .



- A. 84 B. 108 C. 92 D. 112 E. 102

20. What is the lateral surface area of the cylinder below, in terms of π , and all measures are inches?



- A. $360\pi \text{ in}^2$ B. $2,880\pi \text{ in}^2$ C. $520\pi \text{ in}^2$ D. $440\pi \text{ in}^2$ E. $480\pi \text{ in}^2$

21. Samuel asked thirty-three students if they preferred orchestra or band. His results showed that twenty-three students liked orchestra, eighteen liked band, and eight preferred both band and orchestra. How many students that Samuel questioned like orchestra, but not band?

- A. eight B. twenty-five C. ten D. twelve E. fifteen

22. Find the sum of the x -intercept and y -intercept of the linear equation $3x + 15y = 90$.

- A. 18 B. 27 C. 28 D. 36 E. 45

23. The long leg of a 30-60-90 right triangle measures 6 cm. What is the length of the hypotenuse of the triangle?

- A. $6\sqrt{2}$ cm B. $6\sqrt{3}$ cm C. $2\sqrt{3}$ cm D. $3\sqrt{3}$ cm E. $4\sqrt{3}$ cm

24. The sum of three consecutive integers is 18. What is the product of the three integers?

- A. 90 B. 217 C. 120 D. 140 E. 210

25. The domain of the function $f(x) = 7x + 2$ is $\{-1, 0, 3\}$. What is the sum of the range values produced when using the given domain values?

- A. 25 B. 23 C. 20 D. 21 E. 18

26. What is the 21st term in the sequence? 17, 13, 9, 5, ...

- A. -67 B. -63 C. -69 D. -77 E. -75

27. Forty-eight 6th graders voted for their favorite ice cream flavor. This represents $\frac{3}{8}$ of the students in sixth grade. How many sixth graders did not vote for their favorite ice-cream flavor?

- A. 128 B. 124 C. 60 D. 80 E. 76

28. How many combinations can be made from 7 items taken 4 at a time?

- A. 28 B. 56 C. 840 D. 110 E. 35

29. In the following equation, solve for a .

- A. $a = \frac{ce}{d+e}$ B. $a = c\left(\frac{d}{e} + 1\right)$ C. $a = \frac{ce+1}{d+e}$ D. $a = \frac{cd}{e} + c$ E. $a = \frac{d+e}{ce}$

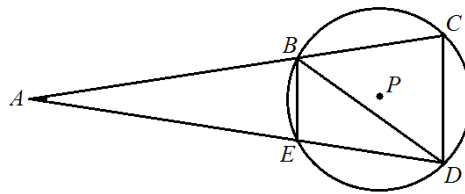
30. $45^2 =$ _____

- A. 2,125 B. 2,025 C. 1,625 D. 2,225 E. 1,825

31. In a pentagon with angles a , b , c , d , and e degrees, the mean of c , d , and e is a . If $b = a$, what is the value of a ?

- A. 112 B. 108 C. 120 D. 90 E. 72

32. In the picture below, $m\angle CBD = 45^\circ$ and the measure of minor arc $BE = 20^\circ$. What is the measure of $\angle A$?



- A. 65° B. 45° C. 12.5° D. 25° E. 35°

33. The measure of the supplement of a 148° angle is equal to _____ (radians).

- A. $\frac{14\pi}{45}$ B. $\frac{8\pi}{45}$ C. $\frac{37\pi}{180}$ D. $\frac{22\pi}{45}$ E. $\frac{37\pi}{45}$

34. What is the units digit of 12^5 ?

- A. 0 B. 2 C. 4 D. 6 E. 8

35. The point $(12, 2)$ lies on the circle with the equation $(x - 7)^2 + (y - 2)^2 = 25$. What is the equation of the line tangent to the circle at that point?

- A. $y = x + 2$ B. $y = 2$ C. $x = 12$ D. $y = 2x + 12$ E. $y = \frac{1}{2}x + 2$

36. Find the length of a line segment with its endpoints located at $(-8, -6)$ and $(4, 3)$.

- A. 18 units B. 16 units C. 15 units D. 12 units E. 9 units

37. Square A has an area of 100 in^2 , square B has an area of 196 in^2 and square C has an area of 6.25 ft^2 . If the three squares are placed side by side in the order of A , B , C , to create an octagon, what is the perimeter of the octagon?

- A. 106 inches B. 216 inches C. 170 inches D. 172 inches E. 168 inches

38. Find the rate of decay of the exponential decay function $y = 46\left(\frac{3}{8}\right)^x$.

- A. 87.5% B. 62.5% C. 37.5% D. 46.5% E. 24.5%

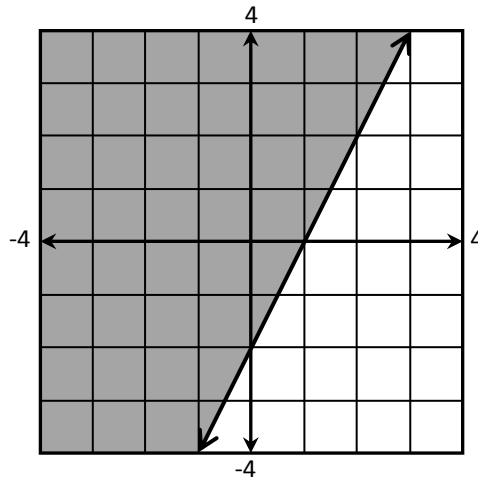
39. If $8\begin{bmatrix} 2 & -1 \\ -4 & 3 \end{bmatrix} - \frac{4}{5}\begin{bmatrix} 25 & -15 \\ -30 & 45 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then find the value of $ad \div bc$.

- A. -48 B. -96 C. -24 D. 1.5 E. -1.5

40. Consider the line that passes through the three points $(-21, -21)$, $(-18, -19)$ and $(9, -1)$. Which of the following points does not lie on the same line as the three given points?

- A. $(12, 1)$ B. $(-6, -11)$ C. $(0, -7)$ D. $(15, 2)$ E. $(21, 7)$

41. Which of the following would be the linear inequality of the graph below after it is translated two units to the right?



- A. $y \leq -\frac{1}{2}x - 4$ B. $y \geq \frac{1}{2}x - 4$ C. $y \geq 2x - 2$ D. $y \geq 2x - 6$ E. $y \geq 2x + 5$

42. A circle has an area of 36π units². An inscribed square is drawn in the circle. What is the perimeter of the square?

- A. $12\sqrt{2}$ units B. $18\sqrt{2}$ units C. $24\sqrt{2}$ units D. $36\sqrt{2}$ units E. $30\sqrt{2}$ units

43. Find the value of $\log_9(342 + 387) + \log_6(111 + 105) - \log_5(40 + 85)$.

- A. 3 B. 6 C. 9 D. 12 E. 15

44. Which system(s) below do not have their solution located in the first quadrant?

I. $\begin{cases} 2x + y = 7 \\ y - x = 1 \end{cases}$ II. $\begin{cases} 3x + 4y = 19 \\ x - 2y = -7 \end{cases}$ III. $\begin{cases} 4x - y = 10 \\ 7x + 2y = 10 \end{cases}$ IV. $\begin{cases} 6x + 5y = 31 \\ y - 2x = 3 \end{cases}$

- A. I and II B. I, II and IV C. II and IV D. III only E. III and IV

45. Khalil and Roopa ate a meal at a restaurant and their subtotal was \$36.50. A 6% tax and an 18% tip were added to the bill with both being applied to the subtotal. What was the total cost with tax and tip of Khalil and Roopa's meal?

- A. \$36.69 B. \$43.07 C. \$45.76 D. \$45.26 E. \$44.96

46. Find the area of a pentagon with its vertices located at (-9, 1), (-1, -5), (3, -4), (-4, 4) and (7, 1).

- A. 90 units² B. 75 units² C. 90.5 units² D. 80 units² E. 76 units²

47. If $x^2 + \frac{1}{x^2} = 7$, what is the value of $x^4 + \frac{1}{x^4}$?

- A. 47 B. 27 C. 51 D. 49 E. 2,401

48. Find the value of the discriminant for the quadratic equation $0 = \frac{1}{4}x^2 - \frac{1}{2}x + \frac{3}{4}$.

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

49. Find the value of x , if $8^{3x+2} = 256$.

- A. $\frac{2}{3}$ B. $\frac{1}{3}$ C. $\frac{5}{6}$ D. $\frac{2}{9}$ E. $\frac{5}{9}$

50. Simplify $(x^2 + 7x + 10) \left(\frac{x^2 - 6x + 5}{x^2 - 25} \right)$ for all values of x for which the expression is defined.

- A. $x^2 + 2$ B. $x^2 + 5$ C. $x^2 + x - 2$ D. $x^2 - x - 2$ E. $x^2 + x - 5$

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

2015 – 2016 TMSCA Middle School Mathematics State Championship Test Selected Answers

3. $4\bar{6} = 4\frac{2}{3} = \frac{14}{3}$. The product of 6 and $\frac{14}{3}$ is equal to $\frac{6}{1} \cdot \frac{14}{3} = \frac{84}{3} = 28$.

14. There are 36 outcomes of rolling a pair of dice. The multiples of 4 are (3, 1), (1, 3), (2, 2), (2, 6), (6, 2), (3, 5), (5, 3), (4, 4), (6, 6) = 9 outcomes. Our probability is then $\frac{9}{36} = \frac{1}{4}$.

18. "One-fifth of a fourth of m equals a third of a half of w " is equal to $\frac{1}{5}\left(\frac{1}{4}m\right) = \frac{1}{3}\left(\frac{1}{2}w\right)$.
 $\frac{1}{5}\left(\frac{1}{4}m\right) = \frac{1}{3}\left(\frac{1}{2}w\right) \rightarrow \frac{1}{20}m = \frac{1}{6}w$. If we know that $m = 80$, then $\frac{1}{20}(80) = \frac{1}{6}w \rightarrow 4 = \frac{1}{6}w$. If we multiply both sides by 6, we see that $w = 24$.

23. The side ratios in a 30-60-90 triangle are $x : x\sqrt{3} : 2x$, respectively. If we know the long leg measures 6 cm, then we know $6 = x\sqrt{3}$. We divide both sides by $\sqrt{3}$ and we get $\frac{6}{\sqrt{3}} = x$. We must rationalize the denominator and we get $\frac{6}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{6\sqrt{3}}{3} = 2\sqrt{3} = x$. Since our hypotenuse is twice the measure of x , our hypotenuse is $2 \cdot 2\sqrt{3} = 4\sqrt{3}$ cm.

24. You can create an equation to solve this problem. Let x equal our first integer. We can see that the next two consecutive integers are $x + 1$ and $x + 2$. We have our equation to be $x + x + 1 + x + 2 = 18$ which gives us $3x + 3 = 18$. We subtract 3 from both sides and then divide by 3 to both sides and we get $x = 5$. If $5 = x$, our two consecutive integers are 6 and 7. The product of 5, 6 and 7 is equal to $5 \cdot 6 \cdot 7 = 210$.

50. To simplify $(x^2 + 7x + 10) \left(\frac{x^2 - 6x + 5}{x^2 - 25}\right)$, you must factor. $x^2 + 7x + 10 = (x + 2)(x + 5)$, and $\frac{x^2 - 6x + 5}{x^2 - 25} = \frac{(x - 5)(x - 1)}{(x + 5)(x - 5)}$. Now we have, $\frac{(x + 2)(x + 5)}{1} \cdot \frac{(x - 5)(x - 1)}{(x - 5)(x + 5)} = \frac{(x + 2)\cancel{(x - 5)}(x - 1)}{\cancel{(x - 5)}(x + 5)} = (x + 2)(x - 1)$. We must now multiply our binomials to get $(x + 2)(x - 1) = x^2 + x - 2$.