



OKLAHOMA SCHOOL of SCIENCE and MATHEMATICS

17th Annual OSSM Middle School Math: An Awesome Contest—Round Two

6th Grade Test

Spring 2019

Before you begin:

1. Please write your name on your answer sheet.
2. On your name tag you have been given a three-digit OSSM student id number. On the answer sheet, in the lower right-hand corner, there is a place to fill in the three-digit student id number (use the first three boxes). Fill in the appropriate bubbles for your OSSM student id.

Directions: Use the scratch paper provided to do your work. Calculators are needed. Choose the appropriate answer, and then fill in the corresponding bubble ON THE ANSWER SHEET. DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET; it may cause the machine to misread your answer sheet and may disqualify your score.

This is a 40-question, 1-hour contest. All questions are multiple-choice. Figures are not to scale. Each question is worth one point. Your score will be the number of correct answers. There is no partial credit or penalty for wrong answers. Please continue working or reworking problems until time is called.

There is a Prize Question on the back page.
Write your answer ON THE BACK OF THE ANSWER SHEET.
All students should answer the Prize Question.

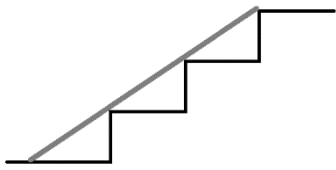
Do Not Open or Turn Over Until Instructed To Do So


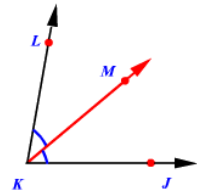
Fill in your answers ON THE ANSWER SHEET by filling in the corresponding bubble.

DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET!

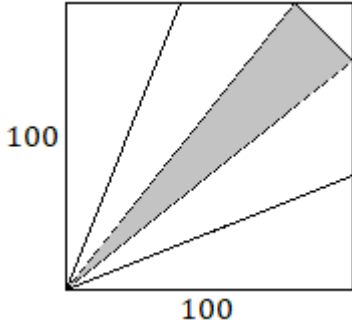
You may use this space for scratch paper

WRITE YOUR ANSWERS ON THE ANSWER SHEET. DO NOT MAKE ANY STRAY MARKS ON YOUR ANSWER SHEET!

<p>1. Which of the following is not a point on the graph of the equation $y^2 = x^2 + 1$?</p> <p>a. $(-\sqrt{3}, 2)$ b. $(-1, 0)$ c. $(0, -1)$ d. $(0, 1)$ e. $(\sqrt{2}, \sqrt{3})$</p>	<p>1. a. <input checked="" type="radio"/> b. c. d. e.</p>																																																
<p>2. If $x + 8 = 0$, and $\sqrt{y} = 4$, then what is the value of $\frac{2x+y}{y}$?</p> <p>a. -16 b. -7 c. 0 d. 2 e. 16</p>	<p>2. a. b. <input checked="" type="radio"/> c. d. e.</p>																																																
<p>3. A triangle has an area of 25 and a height of 10. What is the width of the base?</p> <p>a. Insufficient information b. 0.8 c. 1.25 d. 5 e. None of the above.</p>	<p>3. a. b. c. <input checked="" type="radio"/> d. e.</p>																																																
<p>4. If Charles Darwin brings a dozen cookies to a party, Michael Faraday brings half a dozen cookies, and Louis Pasteur brings three cookies, but they all share equally, how many cookies do they each eat?</p> <p>a. 3 b. 6 c. 7 d. 9 e. 21</p>	<p>4. a. b. <input checked="" type="radio"/> c. d. e.</p>																																																
<p>5. There are three 7-inch tall steps leading to the porch of a house as pictured. Each step is 11 inches deep. If a board is laid against the steps, what would be the slope of the board?</p> <p>a. $\frac{11}{21}$ b. $\frac{7}{11}$ c. $\frac{2}{3}$ d. $\frac{11}{7}$ e. $\frac{33}{7}$</p>	<p>5. a. <input checked="" type="radio"/> b. c. d. e.</p> 																																																
<p>6. Which lines are parallel?</p> <p>I. $3x - 6y = 7$ II. $y = 2x - 7$ III. $2x - y = 5$</p> <p>a. I & II only b. I & III only c. II & III only d. All of them. e. None of them.</p>	<p>6. a. b. <input checked="" type="radio"/> c. d. e.</p>																																																
<p>7. Triangles that are <i>similar</i> have corresponding angles are equal, but the corresponding sides are proportional. Consider the triangles with side lengths given. Which triangles are similar?</p> <p>I. 3-4-5 IV. 12-16-25 II. 5-12-13 V. 10-20-26 III. 9-12-15</p> <p>a. I & III b. II & V c. I, III, & IV d. I & IV e. I & III are similar, as are II & V</p>	<p>7. <input checked="" type="radio"/> a. b. c. d. e.</p>																																																
<p>8. Which of the following is equivalent to $\frac{15x^{-4}y^{11}z^3}{5x^{-3}y^7z}$?</p> <p>a. $\frac{3y^4z^2}{x}$ b. $\frac{10y^4z^2}{x}$ c. $\frac{3x^{-1}y^4}{z^{-3}}$ d. $\frac{10y^4z}{x^{-7}}$ e. $3x^{-1}y^4z$</p>	<p>8. <input checked="" type="radio"/> a. b. c. d. e.</p>																																																
<p>9. Which table of data would match $y = 7 - \frac{2}{5}x$?</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>a.</th> <th>b.</th> <th>c.</th> <th>d.</th> </tr> </thead> <tbody> <tr> <td> <table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-5</td><td>9.0</td></tr> <tr><td>-3.5</td><td>8.4</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>3</td><td>5.8</td></tr> </table> </td> <td> <table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-10</td><td>3.0</td></tr> <tr><td>-6.5</td><td>4.4</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>5</td><td>9.0</td></tr> </table> </td> <td> <table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-5</td><td>9.0</td></tr> <tr><td>-2</td><td>8.0</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>5</td><td>5.0</td></tr> </table> </td> <td> <table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-1</td><td>6.2</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>1</td><td>7.8</td></tr> <tr><td>17.5</td><td>0.0</td></tr> </table> </td> </tr> </tbody> </table>	a.	b.	c.	d.	<table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-5</td><td>9.0</td></tr> <tr><td>-3.5</td><td>8.4</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>3</td><td>5.8</td></tr> </table>	x	y	-5	9.0	-3.5	8.4	0	7.0	3	5.8	<table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-10</td><td>3.0</td></tr> <tr><td>-6.5</td><td>4.4</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>5</td><td>9.0</td></tr> </table>	x	y	-10	3.0	-6.5	4.4	0	7.0	5	9.0	<table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-5</td><td>9.0</td></tr> <tr><td>-2</td><td>8.0</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>5</td><td>5.0</td></tr> </table>	x	y	-5	9.0	-2	8.0	0	7.0	5	5.0	<table border="1" style="width: 100%; text-align: center;"> <tr><th>x</th><th>y</th></tr> <tr><td>-1</td><td>6.2</td></tr> <tr><td>0</td><td>7.0</td></tr> <tr><td>1</td><td>7.8</td></tr> <tr><td>17.5</td><td>0.0</td></tr> </table>	x	y	-1	6.2	0	7.0	1	7.8	17.5	0.0	<p>9. <input checked="" type="radio"/> a. b. c. d.</p>
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<p>10. If $\sqrt{x} = y$ and $\sqrt{y} = z$ and $\sqrt{z} = 16$, then $x =$</p> <p>a. 16^3 b. 16^4 c. 16^6 d. 16^8 e. 16^{16}</p>	<p>10. a. b. c. (d) e.</p>
<p>11. If $2A - B = -1$ and $-3A + 2B = 2$, then $B - A =$</p> <p>a. -2 b. -1 c. 1 d. 2 e. 3</p>	<p>11. a. b. (c) d. e.</p>
<p>12. If $y = 1 - \frac{1}{\frac{n}{m+1}}$, which of the following is equal to $\frac{1}{y}$?</p> <p>a. $\frac{m+n}{n-2m}$ b. $\frac{m+n}{n}$ c. $\frac{n}{m}$ d. $\frac{nm+m}{1-m}$ e. $\frac{1-m}{n+m}$</p>	<p>12. a. (b) c. d. e.</p>
<p>13. Which two are lines that are perpendicular to one another?</p> <p>I. $y = 5x + 2$ IV. $y = -5x - 2$ II. $y = \frac{1}{5}x - 7$ V. $y = -\frac{1}{5}x^2$ III. $y = 10x + 2$</p> <p>a. I & II b. I & III c. I & V d. II & IV e. III & IV</p>	<p>13. a. b. c. (d) e</p>
<p>14. A farmer is using 200 feet of fence to enclose a rectangular pen along her barn wall. She will not need a fence on the barn side of the enclosure. Which of these is closest to the area of the largest total enclosure she can create?</p> <p>a. 2500 ft^2 b. 2800 ft^2 c. 3200 ft^2 d. 5000 ft^2 e. 10000 ft^2</p> 	<p>14. a. b. c. (d) e</p>
<p>15. \overline{KM} bisects angle LKJ. Angle $LKM = 35^\circ$. What is the measure of angle LKJ?</p> <p>a. 17.5° b. 35° c. 55° d. 65° e. 70°</p> 	<p>15. a. b. c. d. (e)</p>
<p>16. Consider the number pattern shown here. What is the solution (x, y) for the last equation?</p> <p style="text-align: center;"> $0 \cdot 9 + 1 = 1$ $1 \cdot 9 + 2 = 11$ $12 \cdot 9 + 3 = 111$ $123 \cdot 9 + 4 = 1111$... $x \cdot 9 + y = 111111111$ </p> <p>a. (12345678, 9) b. (123456789, 9) c. (123456789, 10) d. (1234567890, 9) e. (1234567890, 10)</p>	<p>16. (a) b. c. d. e.</p>
<p>17. On Round 2 of An Awesome Contest last year there were 180 participants. $\frac{1}{5}$ of the participants got between 0 and 9 questions correct, $\frac{2}{3}$ of them got 10 to 19 questions correct, $\frac{1}{10}$ got 20 to 29 questions correct. The rest got 30 to 40 of the questions correct. No participants are in more than one group. How many participants got 30 to 40 questions correct?</p> <p>a. 0 b. 3 c. 6 d. 8 e. 9</p>	<p>17. a. b. (c) d. e.</p>
<p>18. You have n identical wooden cubes. If you set them up side by side into a long chain, glue adjacent cubes together, and then paint the outside of this new solid red, how many square faces of the original cubes did you paint in total?</p> <p>a. $4n + 2$ b. $4n + 6$ c. $5n$ d. $5n + 1$ e. $5n + 2$</p>	<p>18. (a) b. c. d. e.</p>

<p>19. Albert Einstein had 2^{17} hairs on his head. If he lost 100 hairs every day for 30 days after, but none grow back, which of these is closest to the number of hairs he had left?</p> <p>a. 3^{11} b. 5^7 c. 6^6 d. 2^{16} e. 7^6</p>	<p>19. a. b. c. d. <input checked="" type="radio"/> e.</p>
<p>20. To the nearest whole number, what percentage of the large triangle shown here is shaded?</p> <p>a. 33% b. 36% c. 40% d. 42% e. 45%</p>	<p>20. a. b. c. <input checked="" type="radio"/> d. e.</p>
<p>21. Which of the following equations is satisfied by all of the numbers $-2, -1, 1,$ and 2?</p> <p>a. $(x - 2)(x + 2) = 0$ b. $(x + 1)^2(x + 2)^2 = 0$ c. $(x - 1)^2(x - 2)^2 = 0$ d. $(x^2 - 1)(x^2 - 2) = 0$ e. $(x^2 - 1)(x^2 - 4) = 0$</p>	<p>21. a. b. c. d. <input checked="" type="radio"/> e.</p>
<p>22. There are 365 days in 2019, and 366 days in 2020 (since it's a leap year). If January 1, 2019, is a Tuesday, then what day of the week is December 31, 2020?</p> <p>a. Monday b. Wednesday c. Thursday d. Friday e. Sunday</p>	<p>22. a. b. <input checked="" type="radio"/> c. d. e.</p>
<p>23. If M is the largest number less than 1000 that is both a perfect square and a perfect cube, what is the sum of the digits of M?</p> <p>a. 12 b. 14 c. 16 d. 18 e. 20</p>	<p>23. a. b. c. <input checked="" type="radio"/> d. e.</p>
<p>24. 20% of 80% of 20 is equal to which of the following?</p> <p>a. 50% of 50% of 20 b. 80% of 20% of 80 c. 20% of 20% of 80 d. 20% of 20% of 20% of 20% of 20 e. 20% of 20% of 20% of 20% of 20% of 20</p>	<p>24. a. b. <input checked="" type="radio"/> c. d. e.</p>
<p>25. How many line segments appear in the following geometric design?</p> <p>a. 27 b. 30 c. 33 d. 36 e. 42</p>	<p>25. a. <input checked="" type="radio"/> b. c. d. e.</p>
<p>26. A <i>Sophie Germain prime</i> is a prime number p such that $2p + 1$ is also prime. For example, the prime number 3 is a Sophie Germain prime because $2 \cdot 3 + 1 = 7$ is also prime. Which one of the numbers below is a Sophie Germain prime?</p> <p>a. 37 b. 39 c. 41 d. 43 e. 47</p>	<p>26. a. b. <input checked="" type="radio"/> c. d. e.</p>
<p>27. If s is a rational number, and s divided by $\frac{3}{4}$ is $1\frac{1}{6}$, what is the value of s?</p> <p>a. $\frac{7}{9}$ b. $\frac{7}{8}$ c. $\frac{9}{8}$ d. $\frac{11}{9}$ e. $\frac{14}{9}$</p>	<p>27. a. <input checked="" type="radio"/> b. c. d. e.</p>
<p>28. $\left 0 - \left 1 - \left 2 - \left 3 - \left 4 - 5\right \right \right \right \right =$</p> <p>a. 1 b. 2 c. 3 d. 4 e. 5</p>	<p>28. <input checked="" type="radio"/> a. b. c. d. e.</p>
<p>29. Isaac Newton figured the sum of all of the integers from 1 to 12 and then divided by 2, naming that value a. He then divided 2019 by 4 twice and rounded that number to the nearest integer, naming that value b. What is the value of $5a + b$?</p> <p>a. 321 b. 322 c. 516 d. 699 e. 700</p>	<p>29. <input checked="" type="radio"/> a. b. c. d. e.</p>
<p>30. Suppose R and S are real numbers, and the average of R and $R \cdot S$ is zero. If $R \neq 0$, then which of the following statements <u>cannot be true</u>?</p> <p>a. $R < 0$ b. $R > 0$ c. $S < 0$ d. $S > 0$ e. $R = S$</p>	<p>30. a. b. c. <input checked="" type="radio"/> d. e.</p>

<p>31. On Day 1, Bernhard Riemann eats 1 pound of spaghetti. On Day 2, he eats 2 pounds of spaghetti. On Day 3, he eats 3 pounds of spaghetti, and so on. At the end of Day 3 he will have eaten 6 pounds of spaghetti, <u>total</u>. Assuming he keeps this up, on which day will he finally have eaten over 10,000 pounds of spaghetti, <u>total</u>?</p> <p>a. Day 141 b. Day 142 c. Day 143 d. Day 144 e. Day 145</p>	<p>31. <input checked="" type="radio"/> a. b. c. d. e</p>
<p>32. Grace Hopper reaches into a drawer that contains 2 black socks and 2 white socks. She pulls out two socks completely at random. What is the probability that the two socks match?</p> <p>a. $1/6$ b. $1/5$ c. $1/4$ d. $1/3$ e. $1/2$</p>	<p>32. a. b. c. <input checked="" type="radio"/> d. e.</p>
<p>33. The fraction $22/7$ is sometimes used as an approximation for π. What is the 2019th digit after the decimal point when $22/7$ is written out as a decimal?</p> <p>a. 2 b. 4 c. 5 d. 7 e. 8</p>	<p>33. <input checked="" type="radio"/> a. b. c. d. e.</p>
<p>34. Archimedes and Zeno each run at constant (but different) speeds. Archimedes gives Zeno a 10-mile head start in a long footrace. And they're off! After 1 hour, Archimedes reaches Zeno's starting point, but meanwhile Zeno has run forward 1 mile. How much <u>more</u> time will it take Archimedes to completely catch up with Zeno?</p> <p>a. $1/11$ of an hour b. $1/10$ of an hour c. $11/100$ of an hour d. $1/9$ of an hour e. Archimedes will never catch up with Zeno no matter how long they both run</p>	<p>34. a. b. c. <input checked="" type="radio"/> d. e.</p>
<p>35. The <i>factorial</i> of n, written $n!$, is the product of all the whole numbers from n down to 1. For example $3! = 3 \times 2 \times 1 = 6$, and $4! = 4 \times 3 \times 2 \times 1 = 24$. We can also repeat the factorial operation—for example, $3!! = (3 \times 2 \times 1)! = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$. Which of these numbers is the largest?</p> <p>a. $65536!!$ b. $256!!!$ c. $16!!!!$ d. $4!!!!$ e. $2!!!!!!$</p>	<p>35. a. b. c. <input checked="" type="radio"/> d. e.</p>
<p>36. Srinivasa Ramanujan wrote down a list of seven positive whole numbers, all different. The mean (average) of the numbers on his list is 22 and the median (middle number when arranged in numerical order) is 4. If N is the smallest possible value for the largest number on his list, what is the sum of the digits of N?</p> <p>a. 9 b. 10 c. 11 d. 12 e. 13</p>	<p>36. a. b. c. d. <input checked="" type="radio"/> e.</p>
<p>37. A rectangle has a side of length $2x$, and its area is $12x^2$. What is the rectangle's other side length?</p> <p>a. $6x$ b. $6x^2$ c. $10x$ d. $10x^2$ e. $24x$</p>	<p>37. <input checked="" type="radio"/> a. b. c. d. e.</p>
<p>38. How many ping-pong balls could you place in a single layer, without stacking, on the surface of a ping-pong table?</p> <p>a. about 300 b. about 3000 c. about 30,000 d. about 300,000 e. about 3,000,000</p>	<p>38. a. <input checked="" type="radio"/> b. c. d. e.</p>
<p>39. A certain triangle has its two smallest angles measuring about 37° and 53°. If its two largest sides have lengths about 20 cm and 25 cm, which of these is closest to its area?</p> <p>a. 150 cm^2 b. 175 cm^2 c. 200 cm^2 d. 225 cm^2 e. 250 cm^2</p>	<p>39. <input checked="" type="radio"/> a. b. c. d. e.</p>
<p>40. A square with side length 100 has four segments drawn from its lower left corner in such a way that they cut the square into five regions of equal area. What is the area of the triangle formed by connecting the ends of the two middle line segments, as shown?</p> <p>a. 1600 b. $1200\sqrt{2}$ c. 1750 d. 1800 e. $1350\sqrt{2}$</p>	<p>40. a. b. c. <input checked="" type="radio"/> d. e.</p> 

Prize Question

WRITE YOUR ANSWER ON THE BACK OF YOUR ANSWER SHEET

Every participant should write down any whole number of their choosing between 1 and 1000. The participant who writes down the number that is closest to $\frac{2}{3}$ of the average of all of the numbers written down by participants for this question will win a small prize.

You may use this space for scratch paper,



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