

2019 Grade 7 Mathematics Contest

- Kathryn's restaurant bill is \$14.50 with 8.75% tax included. She gives the waiter a \$20 bill and tells him to add a 18% tip on the amount before tax was added. How much change should she receive back?
 - \$2.89
 - \$3.10
 - \$3.89
 - \$4.27
 - \$4.98

- Quadrilateral ABCD has sides 1 in., 2 in., 3 in., and 4 in. Quadrilateral EFGH has sides 2 in., 3 in., 4 in., and 5 in. Quadrilateral IJLK has sides 1 in., 1.5 in., 2 in., and 2.5 in. Which quadrilaterals are similar figures?
 - All three are similar.
 - None are similar.
 - Only ABCD and EFGH are similar.
 - Only ABCD and IJLK are similar.
 - Only EFGH and IJLK are similar.

- Mrs. Brown teaches 7th grade math at Rudolph Middle School. She writes five numbers on the board and asks students to decide which of the numbers are rational numbers. Here are the five numbers: $1.\overline{23}$, $1.0\overline{23}$, 3.14, $\frac{5}{7}$, $-\frac{5}{7}$

Audrey says that all five numbers are rational.
Holly says that all but 3.14 are rational.
Jeremy says that only 3.14, $\frac{5}{7}$, and $-\frac{5}{7}$ are rational.
Steven says that all but $-\frac{5}{7}$ are rational.
Jonathan says that only 3.14 and $\frac{5}{7}$ are rational.

Who is correct?

 - Audrey
 - Holly
 - Jeremy
 - Steven
 - Jonathan

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4. At Housetop Middle School, Mr. Claus wrote the following four data sets on the board and posed the question "In which data set(s) is B directly proportional to A?" to his 7th grade students.

Set 1	
A	B
0	0
1	1
2	4
3	9
4	16

Set 2	
A	B
0	1
1	2
2	5
3	10
4	17

Set 3	
A	B
0	0
1	1.5
2	3
3	4.5
4	6

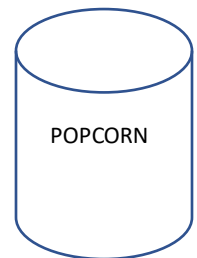
Set 4	
A	B
0	2
1	4
2	6
3	8
4	12

Jackie said Set 1 and Set 3 only.
 Darlene said Set 3 and Set 4 only.
 Jennifer said Set 1 only.
 Stephanie said Set 2 only.
 Angela said Set 3 only.

Who is correct?

- a. Jackie
- b. Darlene
- c. Jennifer
- d. Stephanie
- e. Angela

5. Angelo is wrapping a present for his little brother Steven. He is putting a tin of popcorn (pictured to the right) in a box to make it easier to wrap. Both the box and the tin of popcorn are 1 foot high. The diameter of the circular base of the tin is 9 inches and the base of the box is a square with 9 inch sides. After putting the tin in the box, Angelo wants to fill all the remaining space in the box with sand to make the present seem heavier than popcorn. How much sand (to the nearest cubic inch) will he need?



- a. 209 cubic inches
- b. 188 cubic inches
- c. 149 cubic inches
- d. 99 cubic inches
- e. 17 cubic inches

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6. Angelo is making a puzzle for his young cousin. He has made a rectangular puzzle, but has decided that his cousin would enjoy it more if it was much larger. Angelo decides to make the puzzle exactly the same shape but enlarge it so that the area is 16 times the area of the original puzzle. To achieve this result, how will Angelo need to change the sides of his original rectangular puzzle?

- a. Add 16 to each side.
- b. Add 4 to each side.
- c. Double each side.
- d. Multiply each side by 4.
- e. Multiply each side by 8.

7. Angelo has run out of cardboard, and he needs a rectangular piece. He finds a cardboard tube which is 3 feet high and designed for holding a map. The volume of the tube is 1018 cubic inches. He throws away the top lid and bottom lid of the tube and cuts the tube along the dotted line as pictured. He flattens out the cardboard to make a rectangle. What is the area of the resulting rectangular piece of cardboard to the nearest square inch?



- a. 205 square inches
- b. 358 square inches
- c. 472 square inches
- d. 547 square inches
- e. 679 square inches

8. When x increases by 5%, it is 7 more than y . Which mathematical sentence represents this situation?

- a. $x + .05 = 7 + y$
- b. $x + .05 + 7 = y$
- c. $x + .05x = 7 + y$
- d. $1.05x + 7 = y$
- e. $x + 5x = 7 + y$

9. Leping is a student in Mr. Saylor's 2:00 p.m. 8th grade math class. Her scores for the first 9 weeks grading period are 75, 88, 97, and 91. She is trying to figure out what she needs to make on the 5th test to have a B average. Mr. Saylor uses 80 up to 90 for a B. (90 is an A.) Leping correctly writes the following inequality to model this situation, using x for the 5th test score.

$$80 \leq \frac{75 + 88 + 97 + 91 + x}{5} < 90$$

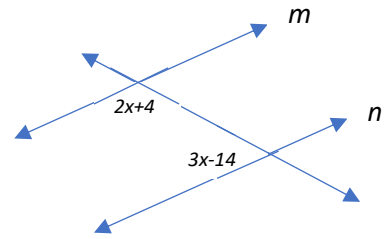
Solve the inequality to find the scores on the fifth test which will result in Leping having a B average.

- a. $59 \leq x < 99$
- b. $49 \leq x < 92$
- c. $59 \leq x < 92$
- d. $69 \leq x < 99$
- e. $49 \leq x < 99$

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10. In the figure, lines m and n are parallel. Find the value of x . (All angles measurements in this problem are expressed in degrees.)

- a. 18
- b. 19
- c. 38
- d. 52
- e. 74



11. The King found a full bowl of mangos and took $\frac{1}{6}$ of them to eat. Later on that night, the Queen ate $\frac{1}{5}$ of the remaining mangos. Later on, the Prince ate $\frac{1}{4}$ of the remaining mangos. The second Prince then ate $\frac{1}{3}$ of the remaining mangos. The last Prince ate $\frac{1}{2}$ of the remaining mangos, leaving exactly 3 mangos for the servants. How many mangos were there to begin with?

- a. 18
- b. 30
- c. 36
- d. 54
- e. 60

12. There are 40 game pieces in a paper sack. The game pieces are: 10 red triangles, 5 green triangles, 7 blue triangles, 6 red squares, 8 green squares, and 4 blue circles. One game piece is selected at random. What is the probability that it is neither red nor a square?

- a. $\frac{3}{4}$
- b. $\frac{29}{40}$
- c. $\frac{3}{5}$
- d. $\frac{2}{5}$
- e. $\frac{1}{4}$

13. There are 40 game pieces in a paper sack. The game pieces are: 10 red triangles, 5 green triangles, 7 blue triangles, 6 red squares, 8 green squares, and 4 blue circles. Two game pieces are selected randomly (after the first is selected, it is not returned to the sack). What is the probability they will be the same color (rounded to the nearest hundredth)?

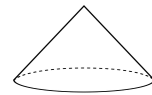
- a. .24
- b. .29
- c. .32
- d. .38
- e. .50

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14. Each of the triangular faces of a square pyramid has an area which is two-thirds the area of the base of the pyramid. What is the surface area of the pyramid? In the choices below, B is the area of the base of the pyramid.

- a. $\frac{7}{3}B$
- b. $\frac{8}{3}B$
- c. $3B$
- d. $\frac{11}{3}B$
- e. $4B$

15. Abby, Bella, Carla, Donita, and Ellen are trying to picture the 2-dimensional shapes that could be formed by slicing the hollow cone pictured below with a plane. (The cone has a base, but is hollow inside). Abby says all of these shapes will be circles. Bella says that none of the shapes will be circles. Carla says that while some of the shapes are circles, you can get a shape that is not a circle, but that the shape will always be a closed curve. Donita agrees with Carla except she says that the shape does not have to be a closed curve; it could be a spiral. Ellen says that some of the shapes are circles, some are not circles, some are closed curves and some are not closed curves, but you can never get a spiral. Who is correct?



- a. Abby
- b. Bella
- c. Carla
- d. Donita
- e. Ellen

16. A fair coin is tossed many times in succession. Consider the following scenarios.

Scenario 1: 7 of the first 10 rolls were heads.

Scenario 2: 70 of the first 100 rolls were heads.

Mary says that both scenario 1 and 2 are equally likely to happen.

Dennis says that Scenario 1 is more likely to happen than scenario 2.

Ginger says that Scenario 2 is more likely to happen than scenario 1.

Chris says that if scenario 2 happened, the coin could not be fair.

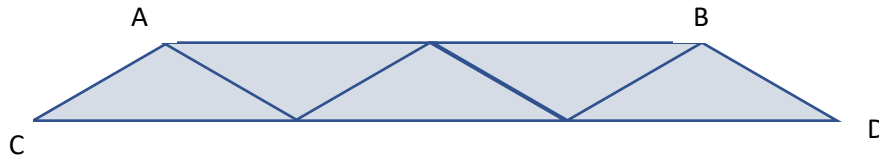
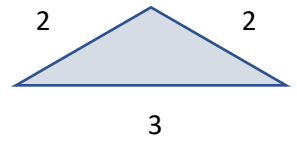
Who made a true statement?

- a. Mary only
- b. Dennis only
- c. Ginger only
- d. Mary and Chris only
- e. Dennis and Chris only

2.

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17. Simon formed trapezoid ABCD by arranging five copies of this isosceles triangle as pictured below.



What is the area of trapezoid ABCD?

- a. $\frac{15\sqrt{7}}{4}$ square units
 b. 35 square units
 c. $\frac{135}{4}$ square units
 d. 19 square units
 e. $4\sqrt{7}$ square units
18. Reo has been experimenting with mixing paint colors to get the color he likes best. He has decided that his favorite color is a mixture of red, blue, and green which consists of 3 parts red, 2 parts blue, and 4 parts green. If he needs 3 gallons of paint to paint two rooms and paint can only be purchased in the quantity of a gallon, what is the minimum number of gallon buckets of each color Reo will need to purchase to paint these two rooms?
- a. 1 red, 1 blue, 1 green
 b. 1 red, 1 blue, 2 green
 c. 2 red, 1 blue, 2 green
 d. 2 red, 2 blue, 4 green
 e. 3 red, 2 blue, 4 green
19. Consider whether each of the following two statements are always true, sometimes true, or never true.
- (1) Given two different rational numbers, there are infinitely many rational numbers between them.
 (2) Given two different integers, there are infinitely many integers between them.
- a. Both are always true.
 b. Both are never true.
 c. Both are sometimes true.
 d. 1) is sometimes true and 2) is never true.
 e. 1) is always true, and 2) is never true.

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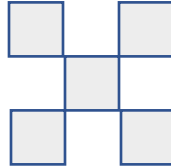
20. The area of this square  is 1 square unit.

A sequence of pictures is formed using copies of this square as pictured below. If the sequence of pictures is continued, what would be the area of the shaded region in the 14th picture of the sequence?

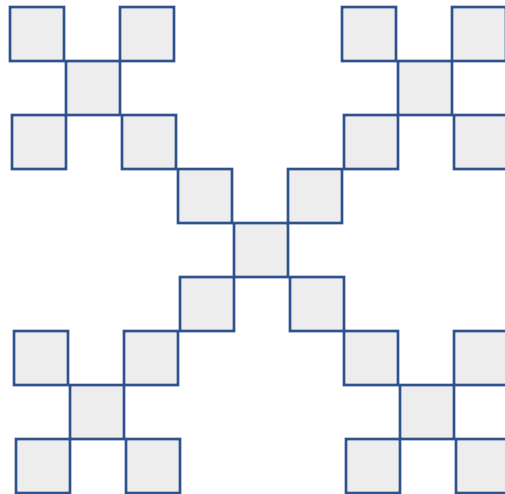
Picture 1:



Picture 2:



Picture 3:



- a. 6,103,515,625 square units
- b. 1,220,703,125 square units
- c. 244,140,625 square units
- d. 9,765,625 square units
- e. 48,828,125 square units

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21. Mr. Saylor teaches 7th grade math classes at 8:00 a.m., 9:00 a.m., and 10:00 a.m. Each class has 10 students. The following are the scores for the first test in the school year for each class.

8:00 Class Scores	9:00 Class Scores	10:00 Class Scores
66	66	66
67	66	70
68	68	70
69	68	70
70	70	70
71	71	71
72	73	71
73	73	71
74	75	71
75	75	75

Mr. Saylor wanted to compare the performance of the three classes. So he computed measures of center and measures of variability. For the measures of center, he computed the mean and median. Amazingly, both the mean and median for each class were 70.5. For the measures of variability, he decided to compute the range and the average absolute deviation from the mean (average of the absolute values of the difference of each score from the mean). Amazingly, the classes had the same range, namely 9. However, before doing any more computations, Mr. Saylor noticed from just looking at the scores that the classes had different amounts of variability when variability was measured by the average absolute deviation from the mean. Which class had the largest average absolute deviation from the mean and which class had the smallest?

- a. Largest 8:00; Smallest 10:00
 - b. Largest 9:00; Smallest 8:00
 - c. Largest 9:00; Smallest 10:00
 - d. Largest 8:00, Smallest 9:00
 - e. Largest 10:00; Smallest 8:00
22. Ying challenged her friends to find all numbers x whose distance from 2 is less than 5. Specifically, she asked them to write an inequality whose solution will produce the answer. Her friends wrote the following.

Cheng wrote: $x - 5 < 2$

Fala wrote: $-5 < x - 2 < 5$

Aashi wrote: $|x - 2| < 5$

Rebecca wrote: $|x - 5| < 2$

Who was correct?

- a. Cheng only
- b. Fala Only
- c. Aashi only
- d. Rebecca only
- e. Fala and Aashi only

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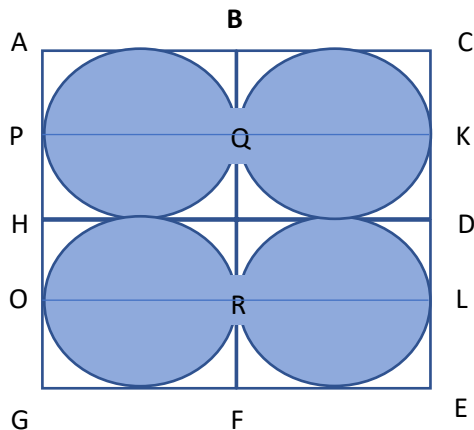
23. Jaci and her friends are collecting pull-tabs to benefit a charity. Jaci collected twice as many pull-tabs as Betty. Cindy collected three times as many as Betty. If they collected 3,000 pull-tabs all together, how many did Cindy collect?

- a. 1000
- b. 1200
- c. 1500
- d. 1800
- e. 2000

24. Unknown to the other one, Jamil and his friend Abdul each visited an observation tower on the same afternoon, with Jamil arriving before Abdul. However, the elevator is not working at all that day, so they must take the stairs. There are 480 steps to the top. It turns out that Jamil starts coming down the stairs at exactly the same time that Abdul starts going up. Jamil walks a constant rate of 3 steps a second all the way down. Abdul starts out at 4 steps a second but slows down to 2 steps a second after 1 minute. On which step do they meet?

- a. Step 240 from the bottom
- b. Step 248 from the bottom
- c. Step 256 from the bottom
- d. Step 264 from the bottom
- e. Step 272 from the bottom

25. Quadrilateral ACEG is a square. The length of segment AC is 8 units. B is the midpoint of AC. D is the midpoint of CE. F is the midpoint of GE. H is the midpoint of AG. The shaded region consists of four circles of which segments PQ, QK, OR, RL are diameters. What percentage of the area of square ACEG is shaded? Round to nearest half of a percent.



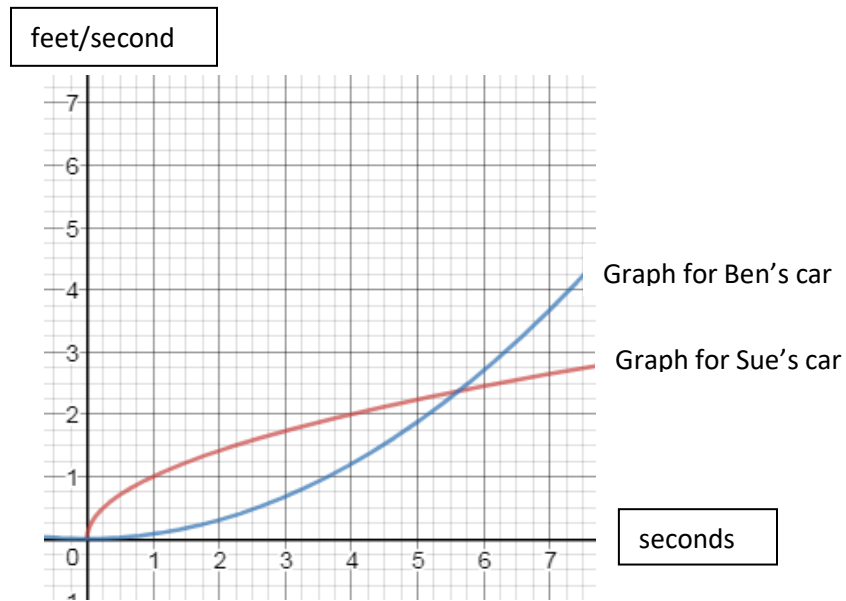
- a. 75.0%
- b. 76.0%
- c. 78.5%
- d. 79.0%
- e. 80.5%

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26. Misha's Cupcake House sells to corporate events at the following cost: \$75 service fee plus \$7.50 per cupcake ordered. Risha's Bakery sells to corporate at the following cost: $\$50 + (\$2.5x + \$25) + \$5x$, where x is the number of cupcakes ordered. Which statement below is true?
- a. Misha's Cupcake House is a better deal than Risha's Bakery regardless of the number of cupcakes ordered.
 - b. Risha's Bakery is a better deal than Misha's Cupcake House regardless of the number of cupcakes ordered.
 - c. The two companies offer the same deal for corporate events.
 - d. Risha's Bakery is the better deal only if ordering over 1,000 cupcakes.
 - e. Misha's Cupcake House is the better deal only if ordering under 30 cupcakes.
27. Exactly one of the statements below is false. Which is false?
- a. $2^{1,000,000} \cdot 3^{1,000,002} = 6^{1,000,000} \cdot 3^2$
 - b. $16^{24,002} \cdot 18^{24,000} = 36^{24,000} \cdot 8^{24,000} \cdot 16^2$
 - c. $\frac{24^{5,000}}{18^{3,000}} = \frac{2^{12,000}}{3^{1,000}}$
 - d. $5^{3,000} \cdot 2^2 = 10^{3,002}$
 - e. $3^{1,500} \cdot 2^{3,000} = 12^{1,500}$
28. Cup A and Cup B are the same size cups, and they are both half full of cocoa. However, the cocoa in cup A is twice as strong as the cocoa in cup B. Suppose half of the contents of cup A is then poured into cup B. Which mixture will then have the strongest cocoa flavor?
- a. Cup A will still be the strongest, although it will not be as strong as previously.
 - b. Cup A will still be the strongest, and it will be the same strength as previously.
 - c. Cup B will now be the strongest.
 - d. They will both be the same strength.
 - e. There is not enough information given to determine.

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29. Sue and Ben race model cars on a straight flat track. Below is a graph showing the **speed** of each car for the first 7 seconds. Which car travels the greatest distance in the first 7 seconds, and how do you know from the graph?



- Ben's car travels a greater distance than Sue's car in the first 7 seconds because the graph above for Ben's car is higher than the graph for Sue's car when $t = 7$ seconds.
 - Sue's car travels a greater distance than Ben's car in the first 7 seconds because the graph above for Sue's car is higher than the graph for Ben's car when $t = 7$ seconds.
 - Ben's car travels a greater distance than Sue's car in the first 7 seconds because the area under the graph above for Ben's car from $t = 0$ seconds to $t = 7$ seconds is greater than the area under the graph for Sue's car from $t = 0$ seconds to $t = 7$ seconds.
 - Sue's car travels a greater distance than Ben's car in the first 7 seconds because the area under the graph above for Sue's car from $t = 0$ seconds to $t = 7$ seconds is greater than the area under the graph for Ben's car from $t = 0$ seconds to $t = 7$ seconds.
 - Ben's car and Sue's car travel the same distance because for some time the graph above for Ben's car is sometimes higher and the graph for Susan's car is sometimes higher during the time interval from $t = 0$ to $t = 7$ seconds.
30. The following is a modern translation of information which has been found about the mathematician of antiquity Diophantus who is sometimes called the father of algebra.

Diophantus's youth lasted $\frac{1}{6}$ of his life. He grew a beard after $\frac{1}{12}$ more of his life. After $\frac{1}{7}$ more of his life Diophantus married. Five years later he had a son. The son lived exactly one half as long as his father, and Diophantus died just four years after his son's death. How long did Diophantus live?

If this information is true, what is the digit in the ten's place of Diophantus's age when he died?

- 0
- 2
- 4
- 6
- 8