

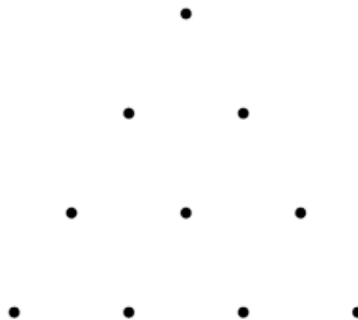
# 7<sup>th</sup> Grade Individual Contest

IMSA *Mu Alpha Theta*

March 10, 2021

1. Compute  $6 \times 4 \div 12 + 72 \div 8 - 9$ .
2. Rainville Elementary School bought some new books for the school library. There was a sale and the books only cost 60% of their normal price. If the school saved \$430, compute the normal price of the books.
3. Jilly is 24 years older than Millie, and 16 years older than Lily. If all three ages add up to 155, how old is Millie?
4. The teacher writes 5 numbers on the board, and their average is 50. The teacher writes a sixth number on the board, and the average of all six numbers is 45. What was the sixth number?
5. The hour hand of a regular circular clock is pointing to the 12. To what hour does it point 2021 hours later?
6. If a necklace and a set of earrings costs \$210 together, and the necklace costs \$100 more than the earrings, how much does the necklace cost by itself?
7. There are a number ways to rearrange the string of letters A A B B C C D D so that the A's are next to each other, there is exactly one letter between the two B's, exactly two letters between the C's, and exactly three letters between the D's. For your answer, write the arrangement that comes first alphabetically.
8. A small farm has some sheep and some goats (and no other animals). Originally 40% of the animals on the farm are sheep, but then the farmer buys four more sheep and now 50% of the animals on the farm are sheep. How many animals in total are there now on this farm?
9. How many integers satisfy the inequalities  $3x - 7 < 32$  and  $5 - 9x < 17$ ?
10. Express  $0.\overline{857142}$  as a fraction in lowest terms. The line over the digits means that the digits repeat forever (for example  $0.\overline{63} = 0.63636363\dots$ ).
11. Two positive integers have a sum of 45 and a product of 486. Determine the larger of the two numbers.

12. Which of the following operations are guaranteed *not* to change the median of a collection of numbers? List the letter(s) corresponding to the correct choice(s).
- Add 10 to the smallest number in the collection.
  - Add 10 to the largest number in the collection.
  - Multiply the smallest number in the collection by 10.
  - Multiply the largest number in the collection by 10.
13. When  $n$  is a positive integer, the notation  $n!$  means  $1 \cdot 2 \cdot 3 \cdots n$ . So, for instance,  $4! = 1 \cdot 2 \cdot 3 \cdot 4 = 24$ . Simplify  $\frac{\sqrt{100! \cdot 99!}}{99!}$ .
14. A piece of land is shaped like a rectangle. One side is bordered by a straight river. The other three sides have a fence along them, and the total length of the fence is 80 meters. What is the largest possible area of the piece of land?
15.  $T_1$  is an equilateral triangle. The midpoints of the three sides of  $T_1$  are connected to each other to form a smaller equilateral triangle  $T_2$ . The midpoints of the sides of  $T_2$  are then connected to form yet another smaller equilateral triangle  $T_3$ . Find  $\frac{\text{Area of } T_1}{\text{Area of } T_3}$ .
16. The SooperScoop ice cream store sells 6 different flavors of ice cream, including vanilla. To celebrate the success of the online JHMC, IMSA students are ordering an ice cream cake with four layers. They want all four layers to be different flavors. One of the flavors should be vanilla, but it should not be the top or bottom layer. How many different possible ways are there for the students to order the cake?
17. Two different numbers are selected from the set  $\{1, 2, 3, 4, 5, 6\}$ . Determine the probability that the product of the two numbers is even.
18. In one hour, Anna can shovel  $\frac{1}{6}$  of the driveway. Her sister Elsa can shovel  $\frac{1}{4}$  of the driveway in one hour. Working together, how many minutes will it take them to shovel the whole driveway?
19. In the grid of dots below, which are as evenly spaced as they appear to be, what is the maximum number of dots that may be colored red so that no three red dots are the vertices of an equilateral triangle?



20. A regular polygon has interior angles of  $140^\circ$ . How many diagonals does it have?