2018 INTERNATIONAL MATH CONTEST

FINAL ROUND

Grades 7-8

RSM FOUNDATION

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11	
12	

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1 Find the fifth-smallest seven-digit multiple of 2018.

2 A bag contains 18 small red, 19 small black, 13 large black, and 15 large red T-shirts, and nothing else. What is the least number of T-shirts Alpa must take out of the bag (without looking at them) to be absolutely sure of having at least two T-shirts among them that differ only by size or only by color?

3 Several RSM students solved a total of 101 different problems. Each of these problems was solved by exactly one student, and each student solved a different number of problems. The number of problems each student solved was a prime. What is the greatest possible number of these students?

4 A rectangle is rotated 90° around its center. Both rectangular shapes (the original and the new ones) define a square as their intersection and a 12-gon as their union. The perimeter of the 12-gon is 100 times the perimeter of the square. The area of the 12-gon is X times the area of the square. Compute the value of X.

5 Three apples weigh as much as five kiwis. Five apples weigh as much as eight mandarins. What is the least possible odd total number of kiwis and mandarins that could be split into two groups of the same weight, without cutting any of the kiwis and/or mandarins? Assume that all apples weigh the same, all kiwis weigh the same, and all mandarins weigh the same.

6 The average degree measure of an interior angle of an N-gon is 140°. Compute the average degree measure of an exterior angle of an $(N + 1)$-gon. (An exterior angle of a polygon is an angle formed outside the polygon by one of its sides and an extension of an adjacent side.)

7 The product of a three-digit number and all of its non-zero digits equals X^Y, where X and Y are positive integers. Compute the greatest possible value of Y.

Please fold over on line. Write answers on back.

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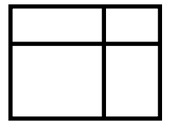
A rectangular shape is divided into four non-overlapping rectangular shapes as shown in the diagram. The areas of these four regions (in some order) are 27 square feet, 20 square feet, 18 square feet, and N square feet, where N is an integer. Compute the area (in square feet) of the original rectangle.



9

The numerator and the denominator of a fraction are positive integers. If both of them are increased by 1, the value of the new fraction would be 0.1 greater than the value of the original fraction. Compute the number of different original fractions satisfying the above conditions.

10

In Numberland there is a cube, and all of the numbers live on its edges (some live on the corners). For each of the 12 edges, Olga calculated the sum of all of the numbers living on that edge (including the corners), and she got (in some order) all different positive integers from 1 through 12. The sum of all of the numbers in Numberland equals 50. Find the sum of all of the numbers living on the corners of the cube.

11

Say that a number is "striped" if all its digits are different, and digits of the same parity (even or odd) do not appear next to each other. For example, the numbers 1 and 218 are striped, but the numbers 900 and 2018 are not. How many different striped ten-digit numbers are there?

12

Say that a positive integer K is "boring" if none of the factorials ends in exactly K zeroes. For example, the number 1 is not boring since $6! = 1\times2\times3\times4\times5\times6 = 720$ ends in exactly one zero. Say that a positive integer K is "not-so-boring" if all three numbers $K - 1$, K, and $K + 1$ are boring. Find the smallest not-so-boring number. (Note that N factorial, written as "N!", is the product of all integers from 1 through N, where N is a positive integer.)

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