



**1**

The sum of all three pairwise products of the numbers  $R$ ,  $S$ , and  $M$  is 99 less than the sum of all three pairwise products of the numbers  $R + 1$ ,  $S + 1$ , and  $M + 1$ . Compute  $R + S + M$ .

**2**

The sum of five natural numbers is 210. Not all of them have the same value. Find the least possible value of the largest of these numbers.

**3**

A teacher asked her students to find a 3-digit positive integer with the product of all its digits equal to 128. Jen realized that there was more than one such number, and listed each of them once. Find the sum of all of Jen's numbers.

**4**

In a triangle with perimeter 2017, all sides have integer lengths (in feet). One side is 10 feet shorter than another one. One side is 20 feet longer than another one. Compute the length (in feet) of the medium side of the triangle.

**5**

Anna and Oleg are collecting natural numbers. Anna is collecting only numbers with different digits (such as 2017), and so far she has collected all such numbers up to 1023. Oleg is collecting only prime numbers, and so far he has collected all such numbers up to 2017. What is the largest number which appears in both Anna's and Oleg's collections now?

**6**

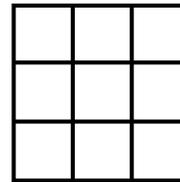
A metal letter R weighs 2 pounds, a metal letter S weighs 1 pound, and a metal letter M weighs 4 pounds. If you took a certain 10-letter "word" containing only the metal letters R, S, and M (at least one of each) and simultaneously replaced all letters R with S, all letters S with M, and all letters M with R, the total weight of all letters in this word would not change. Compute this total weight (in pounds).

*Please fold over on line. Write answers on back.*



**7** A horse ran at a constant speed and covered 20 km and 17 m in 20 min and 17 sec. The next day she ran at the same speed and covered 20 km and  $X$  m in 20 min and 30 sec. Compute the value of  $X$  rounded to the nearest integer.

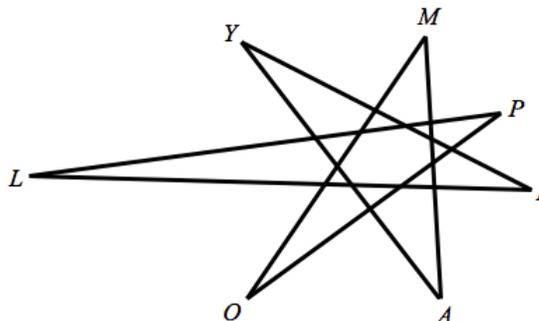
**8** How many different ways are there to place nine different digits from 1 to 9 inside the nine square cells of a 3-by-3 grid (one digit per cell) such that for every pair of consecutive digits their square cells share a side?



**9** All possible diagonals drawn from the two adjacent vertices  $A$  and  $B$  of a regular hectogon divide the hectogon's interior into a number of non-overlapping shapes - triangles and quadrilaterals (without any part of a line inside them). How many of these shapes are quadrilaterals? (A hectogon is a polygon with 100 sides.)

**10** Serena took two numbers which may or may not be integers, rounded each of them up to the nearest integer, multiplied the results, and got 100. When she took the original numbers, rounded each of them down to the nearest integer and multiplied the results, she got  $X$ . Find the largest possible value of  $X$ .

**11** Let  $D^\circ$  be the total degree measure of the seven internal angles of an irregular heptagonal star whose vertices are  $O, L, Y, M, P, I,$  and  $A$  (see the diagram). Compute the value of  $D$ .



**12** We define an RSM-word as a 6-letter word containing two letters R, two letters S, and two letters M, in which there is at least one way that Rosemary can circle three letters such that the circled letters read (from left to right) R-S-M. How many different RSM-words are there?

Please fold over on line. Write answers on back.