

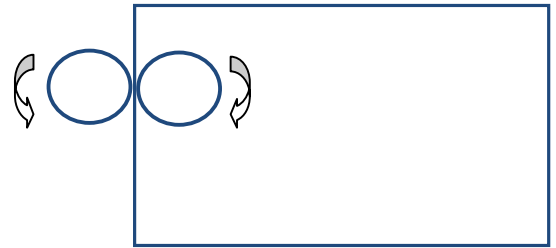
2014 Sigma Tournament

Day 4: Math-Linguistics Round 1 (Math)



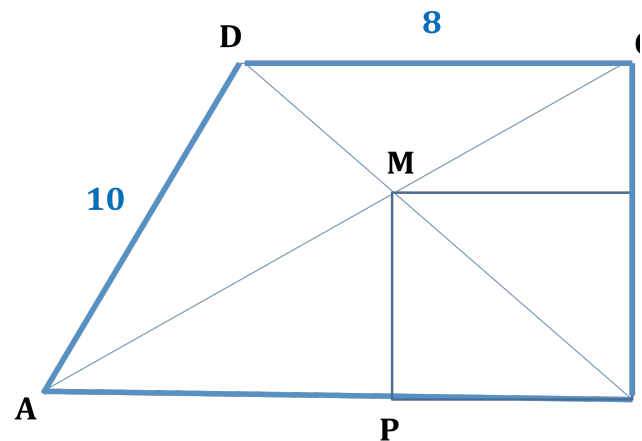
1) Find **all** prime numbers N such that $N+44$ and $N+136$ are also prime numbers. Prove that your list is complete.

2) Two identical coins touch the side of a rectangle at the same point—one from the inside, the other from the outside. The coins are rolled in the plane along the perimeter of the rectangle until they come back to their initial positions. The height of the rectangle is twice the circumference of the coins and its width is twice its height. How many revolutions will each coin make?



3) In a trapezoid $ABCD$, side BC is perpendicular to the base AB . $|AB| > |CD|$. Point M is the intersection the diagonals. There are two points, N and P that belong to BC and AB , respectively, such that $BPMN$ is a square. The length of CD is 8 cm, and the length of AD is 10 cm. Find the area of the trapezoid.

Note: picture is not to scale



4) Find **all** four-digit perfect square whose first digit is the same as the second, and third digit is the same as the fourth.

5) On his way from Sigma City to the beach, a bicyclist makes part of the trip uphill, another part downhill, and the rest of the journey on a flat road. It takes him 2 hours get to the beach and 3 hours to make a return trip. What is the distance between the Sigma City and the beach if he maintained speed 12 km/hr uphill, 20 km/hr downhill, and 15 km/hr on a flat road?

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Day 4: Math-Linguistics Round 2 (Linguistics)



Experimental problem! (4 points for a complete solution)

Luvian

*Original puzzle by A. Zhurinsky. English adaptation by Valentin Vydrin.
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In the early 20th century, archeologists had collected a large quantity of inscriptions presumed to be in the ancient Hittite language. Unfortunately, these writings were totally incomprehensible until one scholar discovered the key. Many of the words in the inscriptions were names of regions, cities or kings. This key allowed the scholars to unlock the secrets of this ancient writing system. However, it was also discovered that the language was not Hittite! Rather it is an Anatolian language called Luvian (or Luwian). Some of the important names were the following:

Regions: Khamatu, Palaa.
Cities: Kurkuma, Tuvarnava.
Kings: Varpalava, Tarkumuva.

1. The following are the inscriptions that correspond to these names. Your job is to match each inscription with the name that it represents. The process you use to solve this puzzle is very similar to what archeological linguists actually do when they discover writings and inscriptions in unknown languages.

1.

4.

2.

5.

3.

6.

2. Now, the next step is to use what you have just learned to determine what the Luvian inscription would probably be for each of the following names:

Kings: Parta Armura

Regions: Tarmu Tuva Narva