

Math Circle - Homework 9

1. (10 points) *Swahili* belongs to a large language family, called *Bantu*. Bantu languages are spoken by probably more than 100 million people in the countries that cover most of the southern half of Africa. Swahili is the mother tongue of about 5 million people, and is the common language of trade and political communication along much of the east coast of Africa. The following are certain dates in Swahili. Their English translations are given in random order. Your task is to match the Swahili dates to the correct English translations:

Swahili Dates:

1. tarehe tatu Disemba jumamosi
2. tarehe tano Oktoba jumapili
3. tarehe pili Aprili jumanne
4. tarehe tano Oktoba jumatatu
5. tarehe nne Aprili jumanne
6. tarehe tano Oktoba jumatano

English Translations in **Random Order**:

- A. Monday, October 5th
- B. Tuesday, April 2nd
- C. Wednesday, October 5th
- D. Tuesday, April 4th
- E. Sunday, October 5th
- F. Saturday, December 3rd

Now, translate the following into Swahili:

Wednesday, April 3rd:

Sunday, December 2nd:

Credit: A. Zhurinsky, V. Vydrine



2. (10 points) Deep in the middle of the Pacific Ocean lives a tribe of people called the *Pacifists*. The Pacifist alphabet consists of the same 26 letters as English. However, any arrangement of letters is a word to the Pacifists. Two words in the Pacifists' language are considered **equal** if and only if they have the exact same letters (in any order). How many different 3-letter words do the Pacifists have?



3. (10 points) The famous explorer Dora has just returned from a trip to the Pacifist tribe, and she is surprisingly reporting *another* tribal group in the Pacific — the Oceanics. She announces: “I am starting to gather a wide variety of funds so that I can make another trip to the sunny Pacific to work on my tan — I mean, to study the Oceanic tribe!”

“The Oceanics,” she claims, “also use 26 letters in their alphabet. And just like the Pacifists, any arrangement of letters is a word to the Oceanics. But the Oceanics have a different way of deciding whether or not two words are considered **equal**. To them, two words are equal if and only if they have all the letters in the exact same place, except possibly switching around one pair of letters. For example, the words *abcde* and *aecdb* are equal, but *abcde* and *edcba* are not.”

Dora is lying. How can you unquestionably convince the explorer community of her lies, based solely on the language claims she made above?