

UW Math Circle

Week 16 – Linguistics

This week we are studying linguistics. In each of the following problems, you will study a language that you likely do not know, but you will use your mathematical problem solving skills to learn more about each language!

Some strategies:

- Keep track of all the information you know about the language, and add to your list as you learn more.
- When trying to translate words phonetically, can you figure out what characters or symbols make what sounds?
- When determining the number system of another languages, remember not all languages use our base 10 number system.

The following problems are taken from the International Linguistics Olympiad and aren't in any particular order, so feel free to jump around until you find a problem that is fun for you!

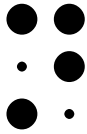
Georgian Countries

There are names of some countries in South America, written in the Georgian language, together with their translations to English:

ბრაზილია	Brazil
პერუ	Peru
ურუგვაი	Uruguay
არგენტინა	
კოლუმბია	

What are the names, in English, of the two untranslated countries?

Japanese Braille



Braille is a tactile writing system, based on a series of raised dots, that is widely used by the blind. It was invented in 1821 by Louis Braille to write French, but has since been adapted to many other languages. English, which uses the Roman alphabet just as French does, required very little adaptation, but languages that do not use the Roman alphabet, such as Japanese, Korean, or Chinese, are often organized in a very different manner!

To the right is a Japanese word written in the *tenji* (“dot characters”) writing system. The large dots represent the raised bumps; the tiny dots represent empty positions.

karaoke

1. The following *tenji* words represent *atari*, *haiku*, *katana*, *kimono*, *koi*, and *sake*. Which is which? You don’t need to know either Japanese or Braille to figure it out; you’ll find that the system is highly logical.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

2. What are the following words?

g. _____

h. _____

3. Write the following words in *tenji* characters:

i. samurai _____

j. miso _____

Molistic

Imagine that you have heard these sentences: Jane is molistic and slatty.

Jennifer is cluvious and brastic.

Molly and Kyle are slatty but danty.

The teacher is danty and cloovy.

Mary is blitty but cloovy.

Jeremiah is not only sloshful but also weasy.

Even though frumsy, Jim is sloshful.

Strungy and struffy, Diane was a pleasure to watch.

Easy though weasy, John is strungy.

Carla is blitty but struffy.

The salespeople were cluvious and not slatty.

1. Then which of the following would you be likely to hear?

_____ a. Meredith is blitty and brastic.

_____ b. The singer was not only molistic but also cluvious.

_____ c. May found a dog that was danty but sloshful.

2. What quality or qualities would you be looking for in a person?

_____ a. blitty

_____ b. weasy

_____ c. sloshful

_____ d. frumsy

Kazakh

Several phrases have been translated into Kazakh (written in Roman script here), but the translations are given in random order. Some of the words are missing.

- | | | |
|------------------------|----------|-----------------|
| a. one and five | ___i. | ___ ben elüw |
| b. one and eight | ___ii. | bir men bes |
| c. three and two | ___iii. | bir ___ segiz |
| d. four and seven | ___iv. | elüw eki men on |
| e. seven and fifty | ___v. | ___ men elüw |
| f. eight and fifty | ___vi. | otız ben ___ |
| g. thirteen and thirty | ___vii. | tört pen žeti |
| h. thirty and two | ___viii. | üş ___ eki |
| i. fifty-two and ten | ___ix. | on üš pen otız |

1. Match each phrase with its correct translation and supply the missing words.

2. Translate into Kazakh:

- | | |
|--------------------------|-------|
| a. five and thirty-eight | _____ |
| b. ten and four | _____ |
| c. seven and fifty-three | _____ |
| d. thirty-eight and five | _____ |

Note: **i, ö, ü, ı** are specific Kazakh vowels. The letter **ž** has the sound of *s* in the word *usual*.

! Kazakh language belongs to the Central Turkic groups of languages. It is the official language and principle native language of the Republic of Kazakhstan. It is spoken by about 6,5 million people in Kazakhstan and about 1,5 million people southern Siberia, northwestern China and northwestern Mongolia.

Inuktitut Numbers

Inuktitut is one of the main languages of the Inuit people, which lives in several areas in the northern Canada and Alaska. Few years ago, students from a school in the small town of Kaktovik invented a new way of writing numbers, more appropriate for the way numbers are expressed in the Inuktitut language.

Imagine that you are travelling through northern Canada and find some Inuit students that know nothing about English, Latin script or Indo-Arabic numerals. Then, in order to start communication, one of the students offer you a list of mathematical operations, shown below (in the left column). This version of the table uses the Indo-Arabic symbols for the operations.

$$\backslash + \backslash = \vee$$

$$\vee + \backslash = \text{—}$$

$$\overline{\vee} + \nabla = \overline{\text{—}}$$

$$\overline{\text{—}} - \backslash = \overline{\text{—}}$$

$$\backslash \times \text{—} = \overline{\text{—}}$$

$$\overline{\vee} \times \nabla = \backslash \backslash$$

$$w\delta + \overline{\text{—}} = w\overline{\text{—}}$$

$$\backslash + \backslash =$$

$$\delta \times \ggg =$$

$$\backslash \delta - \backslash =$$

$$\text{—} \times \text{—} =$$

$$\overline{\vee} - \backslash =$$

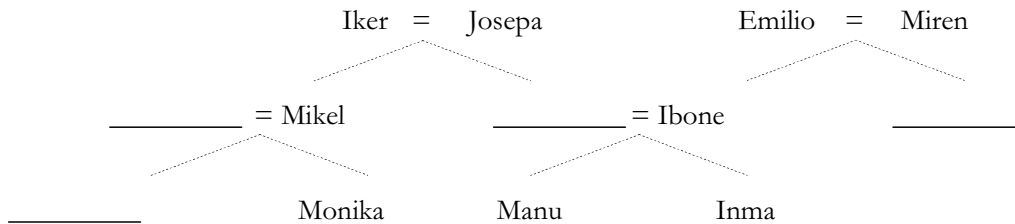
$$\backslash \nabla + \backslash \overline{\vee} =$$

$$\nabla \div \backslash =$$

1. Seeing that you understood the table, the student challenges you to write down the answers of another series of operations, shown in the right column. Give the answers in Inuktitut numerals.
2. To assure the student that you understood the system, you decided to write down the date of today (day, month and year) in Inuktitut numerals, assuming they used Gregorian calendar. What did you write down?

Basque Kinship

This is the genealogical tree of a Basque family. The blank spaces in the diagram stand for the names Ines, Kontxi, Felix, and Andres (listed here in no particular order).



Some of the relationships between the members of this family are described below in Basque:

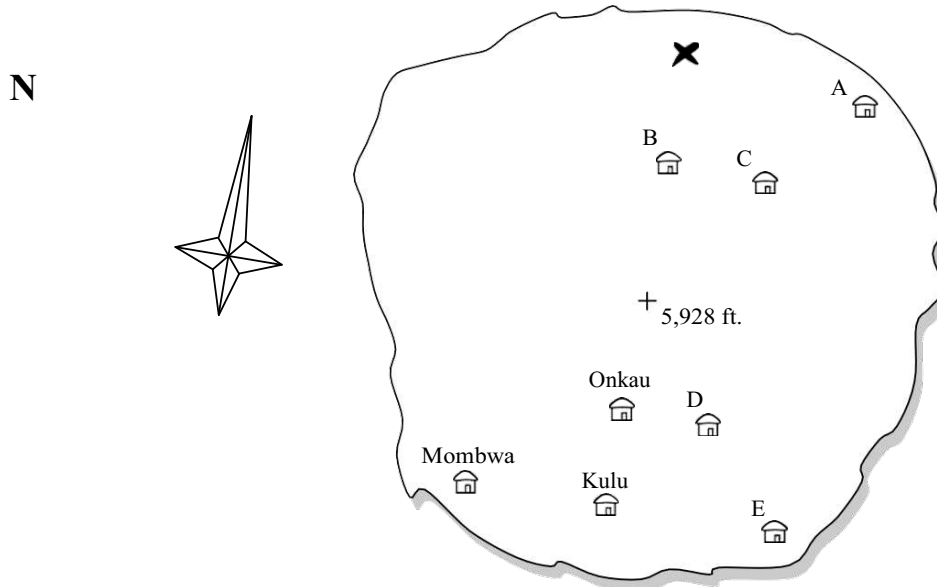
- | | |
|-----------------------------|--|
| Ines Mikelen emaztea da. | Andres Iboneren neba da. |
| Monika Kontxiren ahizpa da. | Ibone eta Felix senar-emazteak dira. |
| Inma Manuren arreba da. | Andres eta Ibone Emilioren seme-alabak dira. |
| Iker Joseparen senarra da. | Manu Iboneren semea da. |
| Mikel Felixen anaia da. | |

- Identify the names that belong in the blank spaces in the diagram.
- Is Kontxi male or female? Explain, using the data from the problem.
- Fill in the gaps in the following Basque sentences (referring to the same family):
 - Kontxi _____ ahizpa da.
 - Inma eta Manu Iboneren _____.
 - Ibone Andresen _____.
 - Manu Inmaren _____.
 - Kontxi Mikelen _____.
 - Emilio _____ senarra da.

Note: *Ibone*, *Ines*, *Inma*, *Josepa*, *Miren*, and *Monika* are women's names; *Andres*, *Emilio*, *Felix*, *Iker*, *Manu*, *Mikel* are men's names. The letters **s** and **x** stand for sounds similar to English *sh*; **z** has the sound of English *s*, **tx** of English *ch*, **j** is a sound intermediate between *g* and *y*; **h** is mute.

Manam

Manam Pile (“Manam Talk”) is a Malayo-Polynesian language spoken on Manam Island off the coast of Papua New Guinea. Manam is one of the most active volcanoes in the world, and during violent eruptions the population must be evacuated to the mainland.



Below, a Manam islander describes the relative locations of the houses above.

1. Onkau pera kana auta ieno, Kulu pera kana ilau ieno.
2. Mombwa pera kana ata ieno, Kulu pera kana awa ieno.
3. Tola pera kana auta ieno, Sala pera kana ilau ieno.
4. Sulung pera kana awa ieno, Tola pera kana ata ieno.
5. Sala pera kana awa ieno, Mombwa pera kana ata ieno.
6. Pita pera kana ilau ieno, Sulung pera kana auta ieno.
7. Sala pera kana awa ilau ieno, Onkau pera kana ata auta ieno.
8. Butokang pera kana awa auta ieno, Pita pera kana ata ilau ieno.

1. Onkau’s, Mombwa’s, and Kulu’s houses have already been located on the map above. Who lives in the other five houses?

A: _____ B: _____ C: _____ D: _____ E: _____

2. Arongo is building his new house in the location marked with an X. In three Manam Pile sentences like the ones above, describe the location of Arongo’s house in relation to the three closest houses.