

(D) Real Numbers (1/2) [Solution]

D1.

(a)

(b)

(c)

D2. (a) piŋasut

(b) qulit atausiq

(c) iñuiññaq malguk

D3. (a) 1

(b) 5

(c) 19

D4. a. 2022-1-27

b. 4000

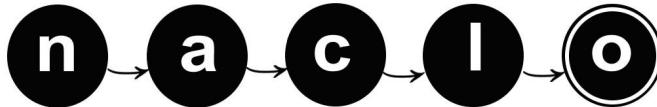
The writing is the date – in this version January 27, 2022 (date of the Open Round). The Kaktovik Inupiaq numerals read 2022-1-27, with $2022 = (5*400 + 1*20 + 2)$; the Inupiaq says “January twenty-seven, two thousand twenty-two”.

The suffix -agliaq (meaning *400), shown in the date, is applied to base qulit to form quliagliaq, 4000.

The word for “January” has nothing numeric in it; it refers to the appearance of the brightness of the new/returning sun. (This is not intended/possible to be deduced.)

The Kaktovik Inupiaq numerals are formed with (relatively) vertical lines indicating ones, and (relatively) horizontal lines indicating fives, up to nineteen. After that, a base-20 positional notation begins (using zero as needed):

| | | | | |
|----|----|----|----|----|
| 0 | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 |



(D) Real Numbers (2/2) [Solution]

The Iñupiaq is similarly base-20 with a sub-base of 5:

| | | | |
|-------------|---------------------|--------------------|---------------------|
| 1: atausiq | 6: itchaksrat | 11: qulit atausiq | 16: akimiaq atausiq |
| 2: malġuk | 7: tallimat malġuk | 12: qulit malġuk | 17: akimiaq malġuk |
| 3: piŋasut | 8: tallimat piŋasut | 13: qulit piŋasut | 18: akimiaq piŋasut |
| 4: sisamat | 9: quliŋŋuġutaiļaq | 14: akimiaġutaiļaq | 19: iñuiññaġutaiļaq |
| 5: tallimat | 10: qulit | 15: akimiaq | 20: iñuiññaq |

The sub-base and base words are formed from body part/position words: tallimat means hand/arm, qulit means top (upper body digits), akimiaq means (roughly) “it goes across”, and iñuiññaq means “complete/entire person”, with the iñu- root (person) shared with Iñupiaq (mentioned in the footnote). (This root is cognate with those in “Inuit”, in which the -it is cognate with the -t in Iñupiat (i.e., a plural marker), inukshuk/inuksuk, and many others.)

Numbers words 20-38 are formed with the iñuiññaq base, followed by the remainder; 40 is malġukipiaq and 39 is malġukipiaġutaiļaq; higher multiples of 20 are formed like malġukipiaq with -ipiaq. Multiples of 400 use the suffix -agliaq, as in tallimaagliaq (2000). Very large numbers can be formed by appending multiple suffixes.

In Arabic numerals, the equations on the blackboard are:

$$4 - 3 = 1$$

$$2 \times (a) = 8$$

$$4 + 8 = 12$$

$$(b) - 1 = 14$$

$$20 - 4 = 16$$

$$56 \div 7 = 8$$

$$5 \times (c) = 30$$

Sources:

Consultation from Edna Ahgeak MacLean, Kirk Miller, and Myles Creed.

https://en.wikipedia.org/wiki/I%C3%81upiaq_language#Numerals

https://en.wikipedia.org/wiki/Kaktovik_numerals

<http://www.ankn.uaf.edu/sop/SOPv2i1.pdf>

https://library.alaska.gov/hist/hist_docs/docs/anlm/200078.pdf

<https://www.uaf.edu/anlc/languages/inupiaq.php>

