Application Tools for *Feeling Mathematics* using Excel VBA

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Related to: TSG15 The role of technology in the teaching and learning of mathematics

Spreadsheet software, MS-Excel is a typical one, is popular for both teachers and students. It is a convenient and powerful tool for mathematics and it's education. Moreover, Excel VBA (Visual Basic for Applications) is a powerful programming language. Two examples of application tools for upper secondary level, using Excel VBA made by the author, will be presented. Both of them are aimed to *FEEL MATHEMATICS*.

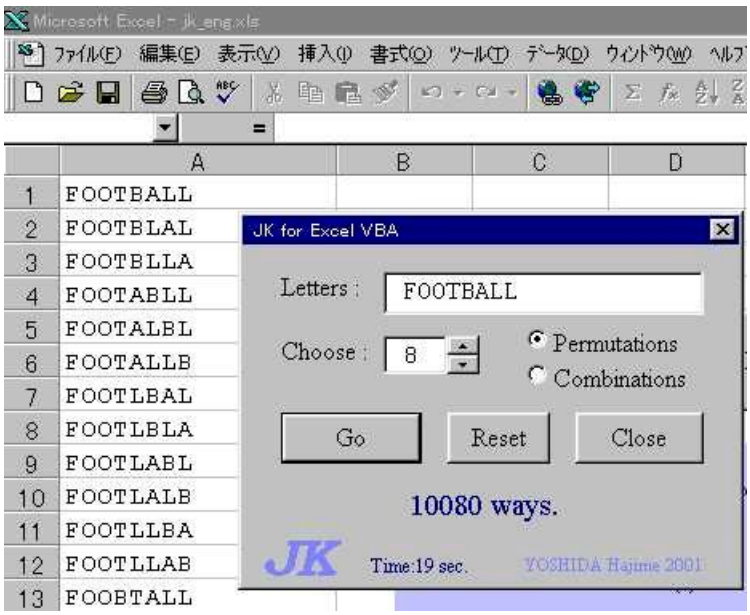
These tools can be downloaded from the next Web site:

http://www.ne.jp/asahi/math.edu/ami/myprog/icme10ps.html

Microsoft Excel97 or later on Windows (Not confirm on Mac) is required. Free for Educational use.

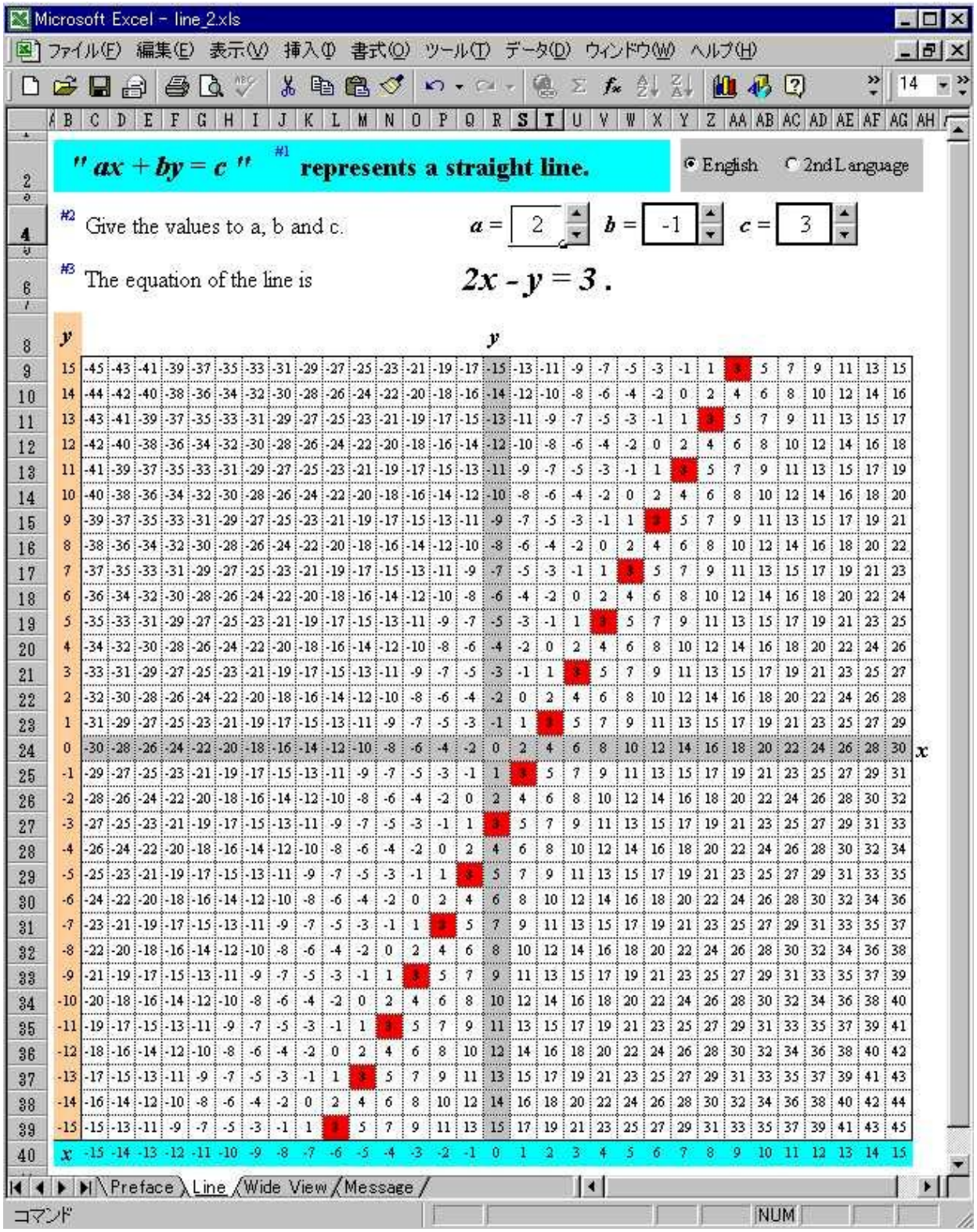
Example 1: **jk_eng.xls** (approximate 230KB)

This tool shows all of the permutations / combinations of input letters, not only to calculate the value of them. It gives reality to the students such as large number of permutations / combinations. "FOOTBALL" has 8 letters. 2"O"s and 2"L"s are identical. Number of permutations of "FOOTBALL" is $\frac{8!}{2!\times 2!} = 10080$. This tool shows all of them.



Example 2: **line2.xls** (approximate 320KB)

In this application tool, worksheet cells are regarded as x-y grids. The cells, which value is "ax+by=c" according to input value a, b, and c, will form a line.



Messages on the Line worksheet can be changed to the second language. Moreover, it is easy to change to another language on user's PC. English, Japanese, French and Korean were checked. Other languages may be usable. Please test and report.

The Law of 3964:

The mysterious number predicted Brazil win the World Cup in 2002 !?

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Some numerical formulas were written on a white-board, in a meeting room for the Brazil team, Yokohama stadium, Japan, just several minutes before the final game of the World Cup in 2002, Brazil-Germany.　(Original text is written in Portuguese.)

> Brazil: 1994 + 1970 = 3964,
> Germany: 1990 + 1974 = 3964,
> Argentina: 1986 + 1978 = 3964.

These numbers indicate the year each team won. Every two numbers makes up 3964. And also one more formula was written:

> 3964－1962 = 2002 …… *Brazil !*

Perhaps a coach of the Brazil team inspired,

> According to "the law of 3964", which team will win today,
> Brazil or Germany?
> We also won in 1962. So, 3964－1962 = 2002.
> Therefore we will win!

Brazil won just like that.

The above was shown in the Japan Soccer Museum, but without a reason.

Mathematics shows the reason of "the law of 3964".

Arithmetic progression:

$$a,\quad a+d,\quad a+2d,\quad \cdots, a+(n-2)d,\quad a+(n-1)d,\quad a+nd,\quad \cdots$$

■ ▲ ● ● ▲ ■

- ■ + ■ : $(a)+(a+nd)=2a+nd$
- ▲ + ▲ : $(a+d)+\{a+(n-1)d\}=2a+nd$
- ● + ● : $(a+2d)+(a+(n-2)d)=2a+nd$

Generally in an arithmetic progression,

$$a_n + a_m = a_{n+i} + a_{m-i}$$

The World Cup is held in every 4 years, so the years line up an arithmetic progression.
Actually, the winners of the World Cup are as follows.

4	1950	Uruguay	
5	1954	(W) Germany	
6	1958	Brazil	
7	1962	Brazil	○
8	1966	England	
9	1970	Brazil	■
10	1974	(W) Germany	▲
11	1978	Argentina	●
12	1982	Italy	
13	1986	Argentina	●
14	1990	(W) Germany	▲
15	1994	Brazil	■
16	1998	France	
17	2002	Brazil	○
18	2006	?	

"The law of 3964" is just a sequence of winners like this.