Lesson 2 September, 15, 2009 BMC Elementary

Overview.

1. Coded pictures. The attached handouts contain the coded pictures. On the square grid paper one can follow the directions of the code to produce some pictures. This activity is a preparation for the method of coordinates.

2. Coded texts. The second set of handouts considers coding messages by cyclic permutation of letters of the alphabet. The wheel facilitates decoding. We discussed, how different codes can be made by different cyclic permutations, how many of those we can make. The last example – with Mister Spy was inspired by "The Adventure of the Dancing Men" short story written by Arthur Conan Doyle. There Holmes easily cracks the code after he guessed some words in the coded letter (e.g. "Dear" in the beginning of the message).

3. Game with even/odd numbers. We greeted even/odd numbers, as well as numbers, divisible by 3, by wild sounds.

Observations.

1. After the class I was asked by one of the parents, what is relation between those coded texts and mathematics. Cryptography is a wide area in mathematics. For example, check

The Uneasy Relationship Between Mathematics and Cryptography:
http://www.ams.org/notices/200708/tx070800972p.pdf

3. Kids have very good knowledge of even/odd numbers and the game was a relaxing closure of the lesson.

HANDOUT CODED PICTURES – 2

On graph paper draw pictures, coded by the sequence of directions of movements. For example, ↓1 means that one has to go down one box of the grid, ↘2 means that one has to go twice along the diagonals of boxes: two times down and to the right, and so on.

E

→2 ↗2 ↓5 ↙1
←1 ↓2 →1 ↓1
→1 ↓2 →3 ↓1
←9 ↑3 →1 ↑1
→1 ↑2 ←1 ↖1
↑5 ↘2

F

↑1 ↖1 ↓1 ←1 ↑1
↙1 ↓4 ↘1 →1 ↗1
↑1 →1 ↓4 →1 ↑3
→1 ↓3 →1 ↑3 →2
↓3 →1 ↑3 →1 ↓3
→1 ↑8 ←1 ↓2 ←8

G

↓1 →4 ↑1 →2 ↓1
→17 ↙1 ←5 ↓3 ←1
↑1 ←8 ↓1 ←1 ↑1
←8 ↑1 →5 ↑1 ←5
↑2 →1

Answer: Cat, dog, crocodile

HANDOUT CODED PICTURES -1

On graph paper draw pictures, coded by the sequence of directions of movements. For example, ↓1 means that one has to go down one box of the grid, ↘2 means that one has to go twice along the diagonals of boxes: down and to the right etc.

Hint: grid should contain at least 9 by 9 squares. Start from the point that is 1 box down and 4 boxes to the right from the left upper corner.

A

→1 ↘ 1 ↓1 ↙1 →3 ↓1
←3 ↓1 ↘2 →1 ↓ 1 ←2
↑1 ↖1 ←1 ↙1 ↓1 ←2
↑1 →1 ↗2 ↑1 ←3 ↑1
→3 ↖1 ↑1 ↗1

B

→1 ↘ 1 ↓1 ↙1 →3 ↓1
←3 ↓1 ↘1 ←1 ↓ 2 ←1
↑2 ←1 ↗1 ↑1 ←3 ↑1
→3 ↖1 ↑1 ↗1

C

↗1 →1 ↓2 →3 ↙2
←1 ↓1 ↘1 ←3 ↗1
↑1 ←1 ↖2 →3 ↑1 ←1

D

→1 ↓2 ↘3 ←3 ↓1
→4 ↙1 ← 8 ↖1 →4
↑1 ←3 ↗3 ↑1 ←1 ↗1 →1

Answer: A- boy, B- girl, C- bird, D- ship.

SECRET CODES

Using the magic wheel, find the meaning of the following words and sentences.
Part 1. In the following coded words the letter B stands for the letter A

IPVTF CPPL

NBUI MJGF

Part 2. In the following coded sentences the letter B stands for the letter A

NZ EPH JT GVOOZ.

J MJLF DBUT.

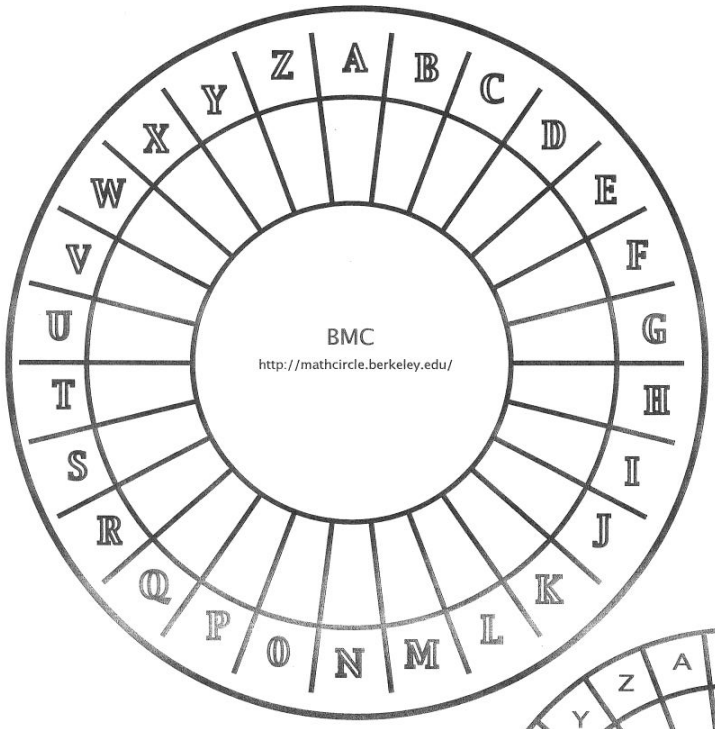
Part 3 A. Write your name in secret code.
B. Write a word in a secrete code and give it to your neighbor.

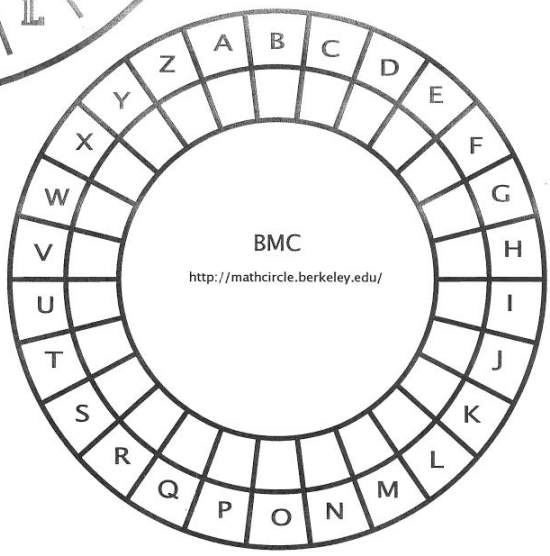
Part 4. Using the magic wheel, we can produce many other codes (How many?).
Code the word

AUTUMN

so that the letter A would be coded by a letter S. Code the same word so that the letter A would be coded by a some other letter (e.g. H).

Les 2





Secret code handout.(SC1) Prepared for BMC by NR, Fall 2009.

http://mathcircle.berkeley.edu/

урок 2

This is a secret letter from Mister SPY. He wrote it with the help of the magic wheel, and he did not tell us, what step he used. But we can try to break it anyway!

CDZQ JHCR,

XNT AQNJD LX RDBQDS BNCD!

LHRSDQ ROX

Answers: Part 1: house, book, math, life;
Part 2 : My dog is funny / I like cats
Mister SPY: Dear Kids, You broke my secret code! Mister SPY.