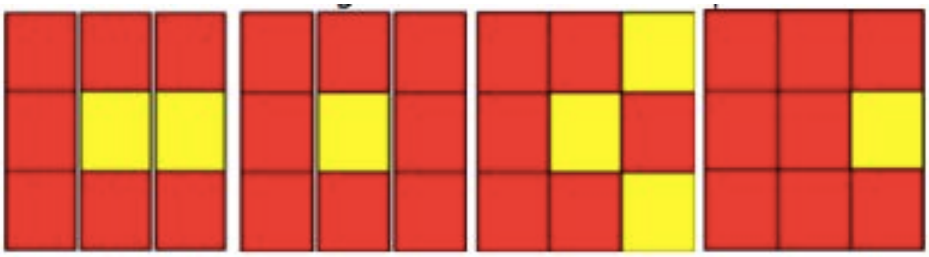
Cracking the Code, Part 1: Alphabet Blocks



Coding is an essential skill in today's world. From programming the latest app to keeping our online accounts secure, an informed digital citizen must be aware of coding skills. This series of lessons introduces students of all ages to some of the concepts associated with codes.

Alphabet blocks asks students to create as many of the letters of the alphabet as possible using one face of a Rubik's® cube. While some letters, C and O for example are easy, others, H and N, can easily be mistaken for one another. Still others, perhaps E, are impossible. The activity asks students to create as many of the letters of the English alphabet as possible and to articulate how the reader will know which letter is being formed. Perhaps context provides the key. Let your students determine the solution!

Standards Addressed in this Lesson:

Texas Essential Knowledge & Skills:

K-12 Process Standards

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas;

Algebraic Reasoning

Grade 4 Introduction: (4) The primary focal areas in Grade 4 are use of operations, fractions, and decimals and describing and analyzing geometry and measurement.... In algebraic reasoning, students will represent and solve multi-step problems involving the four operations with whole numbers with expressions and equations and generate and analyze patterns.

Materials:

A Rubik's® cube for each student
Handout for each student or group
9 block grid paper (attached)
red, green, blue, yellow, orange colored pencils, markers, or crayons
journal for each student (optional)

Background knowledge:

Students should be familiar with the skills needed to solve one face of the Rubik's® Cube. While it may be helpful to be able to solve one face, it is not an essential skill.

"If you are curious, you'll find the puzzles around you. If you are determined, you will solve them. "
Erno Rubik

Cracking the Code: Alphabet Letters

Which letters of the alphabet can you make on one face of a Rubik's® cube? Use the grid paper to record your solutions.

Which letters were the easiest to make?

Which were the most difficult to make?

If there were any letters that you couldn't make, record them here.

What made those letters impossible to make?

Share your letters with someone else. Did the other person recognize the letters that you made?

If there were any letters that the other person didn't recognize, write those letters here.

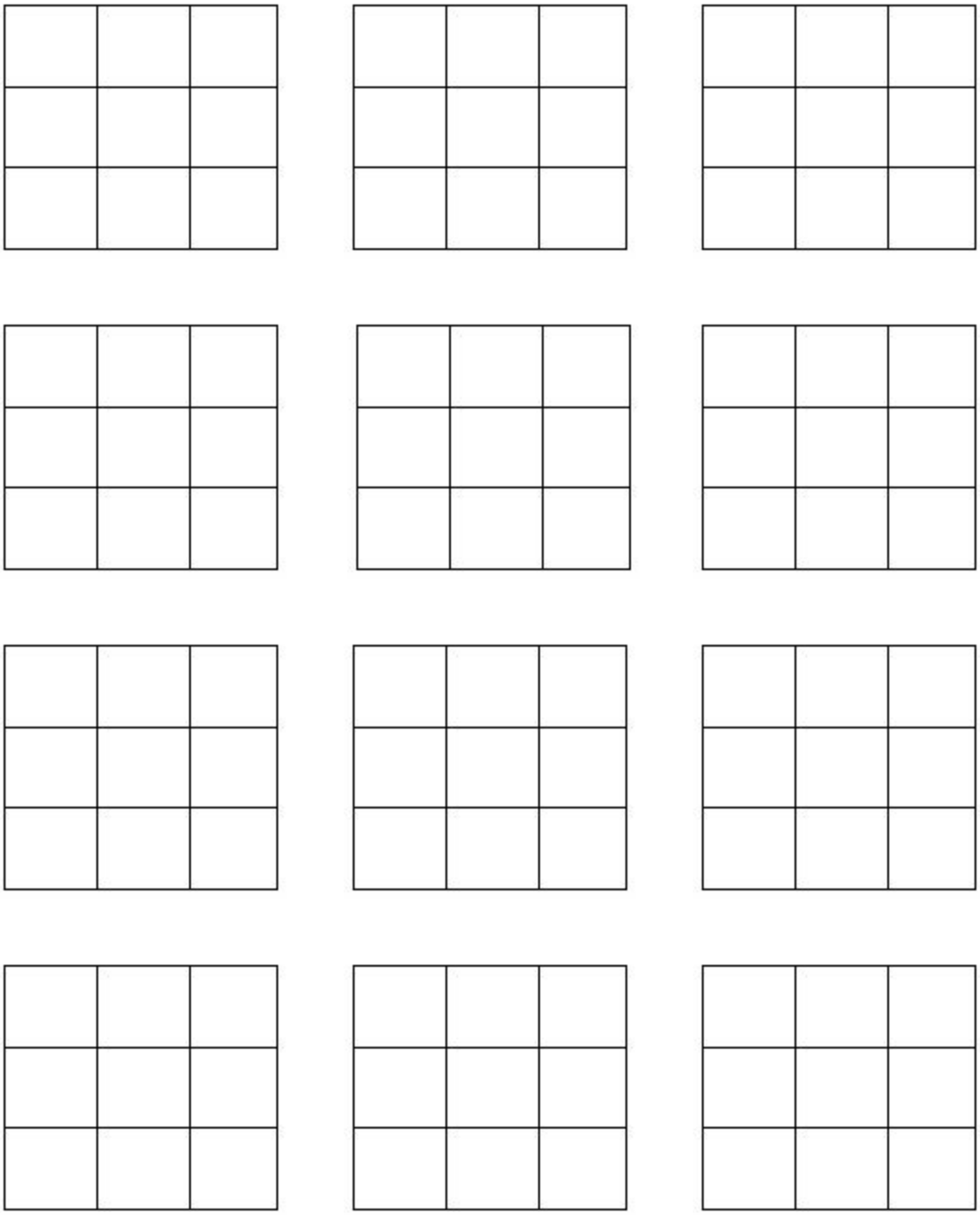
Did you and the other person make the letters the same way?

How are the letters different?

Work with your partner and agree on a pattern for as many letters as you can. Are there letters that you can make now that you couldn't make before?

Cracking the Code: Alphabet Letters

Each set of 9 squares represents one face of a Rubik's® cube.



Teacher Notes: Cracking the Code: Alphabet Letters

Students may work alone or in groups. This may be done over several days in periods of 15 - 30 minutes. In one day, you may want to have students work for 15 - 20 minutes creating the letters, then spend time answering the next two sets of questions. Repeat this process for another 2 -3 days. Perhaps at the end of each session, you ask volunteers to share their findings.

Which letters of the alphabet can you make on one face of a Rubik's® cube?
Use the grid paper to record your solutions.

Which letters were the easiest to make?
Which were the most difficult to make?

If there were any letters that you couldn't make, record them here.
What made those letters impossible to make?

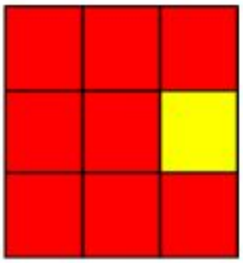
After ample time for the first 3 question sets above, have students work with a partner or another group to share their information and answer the questions below.

Share your letters with someone else. Did the other person recognize the letters that you made?
If there were any letters that the other person didn't recognize, write those letters here. Have students articulate what made it difficult to recognize the letter. Try to get them to suspend judgment about whether a pattern is or is not a particular letter. See if students can see more than one letter in a particular pattern. The question of how to know exactly which letter it is will be answered in the next activity.

Did you and the other person make the letters the same way?
How are the letters different? One way to make a letter may or may not be better than another. Perhaps there is a discussion about the use of color and how that helps or detracts from recognizing a letter.

Work with your partner and agree on a pattern for as many letters as you can.
Are there letters that you can make now that you couldn't make before?
Answers vary.

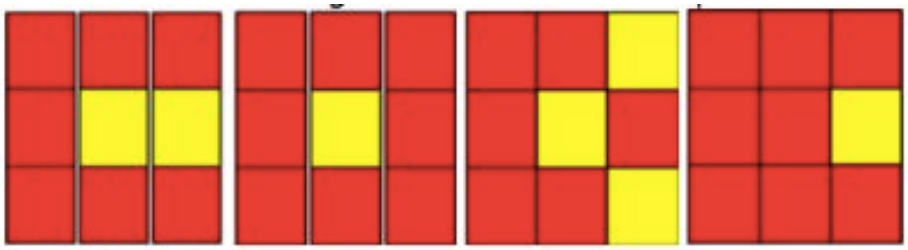
Teacher Notes: Cracking the Code: Alphabet Letters



Before beginning the next handout, show students the pattern on the left. You might ask:

Did anyone make this pattern? What letter were you trying to make?

Does anyone have any other suggestions?



Now show them this word:

Ask students what they think the word is. This might be an opportunity to talk about context clues and where students have used them.

Ask students what other alphabet patterns they've created that might have different meanings depending on the context. (You might also use this as an opportunity to talk about the mathematical order of operations in conjunction with context clues.)

In the next activity, students work alone or in pairs to create words or phrases that use some of the ambiguous letter patterns. They then share their words/phrases with another group to see if they can decode the words.

Extension Activity:

Chinese characters represent a concept or phrase. For example, the character on the right is the zodiac symbol for monkey. Strokes within Chinese characters may reappear in a phrase with a similar or related meaning. Notice the "wishbone" stroke that appears in the characters below that refer to people.

猴

人	rén	man; person; people
人们	rénmen	people
有人	yǒurén	someone; people; anyone; there is someone there; occupied (as in restroom)
人口	rénkǒu	population; people
普通人	pǔtōng rén	ordinary person; private citizen; people; the person in the street

http://www.yellowbridge.com/chinese/dictionary.php

Have students create their own symbols or emoji.

Cracking the Code: Alphabet Letters

In the first column, write a list of words or phrases you can make with your Rubik's letter patterns.

word or phrase	got it	didn't get it

Color blocks on your grid paper to make the words.

Share the words with someone else.
Check the column in the table above if the other person understood the word (got it) or didn't.

"If you are curious, you'll find the puzzles around you. If you are determined, you will solve them. "
Erno Rubik