

Secret Codes With the Polybius' Checkerboard

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This activity connects counting and number-recognition skills to letter matching and basic logic.

Materials Needed

Student pages, slips of paper

The Cipher Method

The Polybius' Checkerboard cipher is a form of a *substitution encryption* where number pairs are directly substituted for letters.

The Polybius' Checkerboard

	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	IJ	K
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

For example, 25 stands for the letter K and 52 stands for the letter W.

The IJ Pair: The checkerboard uses a 5 x 5 table which only creates 25 letter-number pair matches. Since J is only used about 3 times per 1000 characters and I is used about 63 times per 1000 characters, it is easy to determine if 24 is an I or a J by looking at the whole message in context.

Encryption Tips for Kids

It is easier to write and to cipher if there is space between the number pairs: "23 15 31 31 35" is easier to see and read than "2315313135."

Kids can draw lines between the number pairs on the secret codes to make their matching job easier.

History

Polybius (204 – 122 B. C.) was a Greek philosopher, historian and writer. He is famous for writing about the Roman Empire in several books, including: *The Histories of Polybius*.

Read about Polybius

<http://www.encyclopedia.com/html/p/polybius.asp>

<http://home.cogeco.ca/~ve3ll/cypeople.htm>

In the 19th century, Russian Nihilist political prisoners used the tapping method (see the student pages), in the Cyrillic alphabet, to transmit messages in their prison.

Reference

Invitation to Cryptology, Thomas H. Barr, Prentice Hall, 2002

STUDENT PAGE

Who's That Tapping? Secret Codes With the Polybius' Checkerboard

Ralph hears some tapping:



Tap-Tap — Tap-Tap-Tap
Tap — Tap-Tap-Tap-Tap-Tap
Tap-Tap-Tap — Tap
Tap-Tap-Tap — Tap
Tap-Tap-Tap — Tap-Tap-Tap-Tap

It must be a secret message! Ralph needs your help!

Ralph thinks and thinks and thinks.... Finally he remembers a table his friend Griselda shared with him. Griselda called the table The Polybius' Checkerboard Table.

The Polybius' Checkerboard looks like this:

	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	IJ	K
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

Griselda gave Ralph a clue... Griselda said that you could use the table to represent the letter X as the number pair 5-3!



1. Ralph thinks and thinks... He thinks the numbers might relate to the tapping. Can you help Ralph? What does the message mean?

Tap-Tap — Tap-Tap-Tap
Tap — Tap-Tap-Tap-Tap-Tap
Tap-Tap-Tap — Tap
Tap-Tap-Tap — Tap
Tap-Tap-Tap — Tap-Tap-Tap-Tap5

Numbers					
Letters					

The secret tapping message is: _____

STUDENT PAGE

2. Ralph loves this new game! He decides to write out numbers instead of tapping. Ralph has coded a secret message for you. What is Ralph's secret message?

24 52 11 33 44 44 34 12 15 54 34 45 42 21 42 24 15 33 14

Numbers										
Letters										
Numbers										
Letters										

Ralph's secret message is: _____

3. Oh, that was tricky, since 24 works for I and for J! I guess you have to be careful and see which letter makes sense in the message! Why do you think Polybius used the same number pair for I and for J?

Polybius thought this would be OK. Do you know that J is one of the least used letters in English? Compared to I, J is hardly ever used! Justine Just Juices Jewels!

4. Now it is your turn! Make up a secret message for your friend (careful, don't let anyone see it!). Now match your letters with Polybius' Checkerboard and write out your secret code on a slip of paper to transmit your secret message to your friend.

Trade messages with your friend—what is his or her secret message?

5. Polybius was a Greek philosopher, historian and writer. He wrote a famous book *The Histories of Polybius* about the Roman Empire. Polybius was born in 204 B. C. and he died in 122 B. C. How old was Polybius when he died?