

Mathletes Problem of the Week #12

Break the Code!

PRE KWCB! PHFFTYRKW BSIFFY LRBNHR SN BQDB QK WXNHQ-
SVHHR SVYQH "ZFAPRW BVHMRMQY SYQBB" QN JRWHSW BSIFFY RB
KF AFHW. RN IQB PWWK HWJYQSWL PD Q "SQYARKE AWLRNQNRFK
SYQBB." JHRKS RJQY YWBYWD HDQK-ARYYWH BQDB BIW CQB
VKQCQHW FO NIW ZFAPRW SYQBB VKNRY BIW HWQL QK QHNR SYW
QPFVN RNB JFJVYQHRND RK NIW JWKEVRK JFBN. ARYYWH BQDB
BIW "SFVYLK'N PWYRMMW NIQN CFVYL QSNVQYYD PW Q SYQBB."
BFAW JQHWKNB IQL GVWBNR FKWL NIW WLVSQNR FKQY MQYVW FO
NIW SYQBB. FNIWHB CQKNWL NF NQTW RN NIWABWYMWB.

A **substitution cipher** is a form of cryptography, which is a way of keeping information secret. Substitution ciphers have been used since ancient times to secure messages. In a substitution cipher, a key is used to change each letter of the original message (called the "plain text") into a new letter (creating the "cipher text"). The key says which letter should be substituted for every letter. Here is an example:

Plain	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Cipher	J	I	B	R	K	T	C	N	O	F	Q	Y	G	A	U	Z	H	S	V	W	M	X	L	D	E	P

plain text : c r y p t o g r a p h y
cipher text : B S E Z W U C S J Z N E

This key is NOT the key that was used for the cipher text at the top of the page. Your job is to find the right key and decode the secret message!

Solutions & Explanations: (Write out the proper substitution key below and the final decoded message on the back or use a separate sheet of paper. Another copy of the cipher text is attached to help you with your decoding.)

Name _____ Class _____

(First and last name, please!)

Solutions due: March 29th

PRE KWCB! PHFFTYRKW BSIFFY LRBNHR SN BQDB QK

WXNHQ-SVHHRSVYQH “ZFAPRW BVHMRMQY SYQBB” QN

JRWHSW BSIFFY RB KF AFHW. RN IQB PWWK HWJYQSWL

PD Q “SQYARKE AWLRNQNRFK SYQBB.” JHRKSRJQY

YWBYWD HDQK-ARYYWH BQDB BIW CQB VKQCQHW FO NIW

ZFAPRW SYQBB VKNRY BIW HWQL QK QHNRSYW QPFVN

RNB JFJVYQHRND RK NIW JWKEVRK JFBN. ARYYWH BQDB

BIW “SFVYLK’N PWYRMMW NIQN CFVYL QSNVQYYD PW Q

SYQBB.” BFAW JQHWKNB IQL GVWBNRFBWL NIW

WLVSQNRFBKQY MQYVW FO NIW SYQBB. FNIWHB CQKNWL

NF NQTW RN NIWABWYMWB.

Tips for Codebreaking!

- **Scan through the cipher, looking for single-letter words.** They're almost definitely *A* or *I*.
- **Count how many times each symbol appears in the puzzle.** The most frequent symbol is probably *E*. It could also be *T*, *A*, or *O*, especially if the cryptogram is fairly short.
- **Pencil in your guesses over the ciphertext.** Do typical word fragments start to reveal themselves? Be prepared to erase and change your guesses!
- **Look for apostrophes.** They're generally followed by *S*, *T*, *D*, *M*, *LL*, or *RE*.
- **Look for repeating letter patterns.** They may be common letter groups, such as *TH*, *SH*, *RE*, *CH*, *TR*, *ING*, *ION*, and *ENT*.
- **Try to decipher two-, three-, and four-letter words.**
 - Two-letter words almost always have one vowel and one consonant. The five most common two-letter words, in order of frequency, are *OF*, *TO*, *IN*, *IS*, and *IT*.
 - The most common three-letter words, in order of frequency, are *THE*, *AND*, *FOR*, *WAS*, and *HIS*.
 - The most common four-letter word is *THAT*. An encrypted word with the pattern 1 – – 1 is likely to be *THAT*. However, the pattern 1 – – 1 also represents 30 other words, so keep this in mind!
- **Scan for double letters.** They're most likely to be *LL*, followed in frequency by *EE*, *SS*, *OO*, and *TT* (and on to less commonly seen doubles).