Name: _____ Date: _____

NUMB3RS Activity: Code Crackers

Agent Don Eppes intercepted two messages that Charlie decided used the substitution codes with keys 6 and 25. Use the charts and the keys to help you decode the messages below.

1. *Message*: GYYN GY NIHCABN UN MYPYH JFUWY NI VY HUGYX *Key:* 6

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

_____

2. *Message*: HFUUZ DFOUFS FBTU FOUSBODF *Key:* 25

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

_____

Answer the following questions about the type of substitution code used above.

3. How many unique keys are there? Explain why there aren't more.

_____

_____

4. If someone intercepted a coded message and wanted to read it without the key, what could they do to break it? _____

_____

5. Shifting the alphabet 1 space is the same as shifting the alphabet 27 spaces.

   a. If Charlie found someone using a key of 47, what might that mean?

   _____

   b. Find three other keys that are equivalent to a key of 15.

   _____

6. a. How could you make a substitution code that is harder to break?

   _____

   b. What key would the receiver need in order to read the message?

   _____

Extensions

Activity: Two More Hand Codes

Pig Pen Cipher: In the pig pen cipher, pens are formed for letters by the spaces in a tic-tac-toe grid as shown.

A	B	C	J	K	L	S	T	U
D	E	F	M	N	O	V	W	X
G	H	I	P	Q	R	Y	Z	

Letters are coded by their placement in the "pens" in which they are found. Letters A-I are coded by sides of the their pens and with no dots, letters in the second grid shown with pens having one dot and letters in the third grid shown in pens with as two dots. Some examples are shown below:

A = F = L = N = V = Y =

Example:

Rail Fence Cipher: To encode a message, write it in a table with columns of a given length. Consider the message "Come alone we have your brother" written in the table below. Note that the trailing letters G and A are used to complete the grid – without them, you would not be able to decipher the code.

1	C	A	E	A	O	R	E
2	O	L	W	V	U	O	R
3	M	O	E	E	R	T	G
4	E	N	H	Y	B	H	A

Then write the text out reading from left to right:

CAEAOREOLWVUORMOEERTGENHYBHA

This string of jumbled letters is your coded message. The length of the column (a number) is the key. The key for this code is **4**.

To decode it this message, use the key, **4**, and separate the text into **4** groups of equal length:

CAEAORE|OLWVU OR|MOEERTG|ENHYBHA

Now reading the 1st letter of each group, then the 2nd letter of each group, and so on, will reveal the coded message.

Example: T G N M G H L D I H E E S D T E L A N R A A T I E *Key*: 5