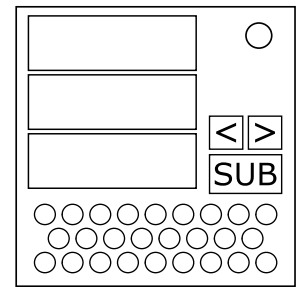# On the Subject of The Shape Ciphers

When the geometry teacher gives you homework.

On the module, you will see 3 screens, a keyboard, 2 arrows, and a submit button that displays the current page you're on.

Pressing the right arrow takes you to the next page. Pressing the left arrow takes you to the previous page. There is a total of 7 pages.

On page 1, the top screen shows a 6 letter encrypted word, the middle screen shows a keyword. This keyword is referred to as KW1.

On pages 2 and 3, all 3 screens show a number. Each digit is used for the Circle Cipher.

On page 4, the top screen shows a keyword. This is referred to as KW2.

On pages 4 and 5, digits from 0-11 are shown, and the screen below them show their rotations.

On page 5, the bottom screen shows a digit. This digit is used for making the 12 triangular keys for Triangle Cipher.

On pages 6 and 7, the displays shows six letters that are encrypted in Morse code. This is referred to as KW3. This is used for Square Cipher.

Take the encrypted word and follow the mechanics down below:

Step 1: Circle Cipher

For this step use KW1 to create the string.

To create it, put the alphabet behind the keyword, remove any duplicates so each letter occurs once.

The string and pi are zero-indexed.

Take the number on the top screen in page 2 to get a position in pi. Take the number in that position, and shift to the left that many times from the first letter, wrapping around if necessary. Continue this process for all 6 letters and numbers.

Here is the first 120 digits of pi:

314159265358979323846

264338327950288419716

939937510582097494

45923078164062862089

98628034825342117067

98214808651328230664

The resulting letters forms your new encrypted word.

<u>Example</u>

Encrypted Word: LSXTFC
Key 1: CARNIVLBDEFGHJKMOPQSTUWXYZ
Numbers: 2, 12, 33, 44, 45, 62

Position 2: 4, L->R
Position 12: 9, S->F
Position 33: 2, X->U
Position 44: 9, T->G
Position 45: 9, F->A
Position 62: 9, C->P
New Encrypted Word: RFUGAP

Step 2: Triangle Cipher

For this step use KW2 to create the string.

To create it, put the alphabet behind the keyword, remove any duplicates so each letter occurs once. Then take the first ten letters, and add those to the end. You should have a string of 36 letters.

Take the first letter. Then, advance a number of times equal to the digit on page 5 to the right and take the letter obtained. Repeat the previous step once again to get another letter. This three-letter string is your first triangle. Repeat this process, starting with the earliest unused position, until you have 12 triangles in total.

The clockwise and counter-clockwise symbols on pages 4 and 5 tells you the rotations you need to take to decrypt the encrypted word. Each of the rotations corresponds with its respected triangles on the screens above.

Use the first rotation on the first listed triangle on the module to get a letter.
Repeat this until all letters have been decrypted.

<u>Example</u>

Encrypted Word: RFUGAP
Key 2: FANREBCDGHIJKLMOPQSTUVWXYZFANREBCDGH
Digit: 9, 0, 8, 6, 9, 4
Triangles: 2
Rotations: ↺↺↺↺↺↺

Triangle Strings:

FNE

ARB

CGI

DHJ

KMP

LOQ

SUW

TVX

YFN

ZAR

ECG

BDH

Decryption:

R->Z

F->N

U->W

G->E

A->R

P->M

New Encrypted Word: ZNWERM

Step 3: Square Cipher

For this step refer to page 5 to decrypt KW3, then take the decrypted KW3 to
create the a matrix.

To create it, replace any J's with I's, take KW3 and remove any duplicates so each letter occurs once. Then take the alphabet and remove any occurrences of all the letters in your current key, then put the alphabet at the end of the key.

Once you have the 25 length string, create a 5x5 matrix of letters.

Split the encrypted word into character pairs. For each pair:

- If the 2 letters are exactly the same, keep them as is.
- Otherwise, if the letters appear on the same row of your matrix, reflect their positions across the middle row.
- Otherwise, if the letters are on the same column of your matrix, reflect their positions across the middle column.
- Otherwise, replace each of them with the letter on the same cloumn but in the row of the other letter in the original pair.

Example

Encrypted Word: ZNWERM

Key 3: VOLUMEABCDFGHIKNPQRSTWXYZ

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

ZN -> ST

WE -> AT

RM -> US

Decrypted Word: STATUS

Once you finally have your decrypted word, you can submit it. Once you start typing, all the screens will go black and the bottom screen will show what you are typing.

To clear it, just click one of the arrows. This goes to one of the pages and clears any input you put in. It will not let you go over 6 letters on input.

Once you are satisfied with your input, press the button labeled "SUB" to submit your answer. On a strike, the module will go back to the first page of the module, but it does not regenerate.

A ● ▬	U ● ● ▬
B ▬ ● ● ●	V ● ● ● ▬
C ▬ ● ▬ ●	W ● ▬ ▬
D ▬ ● ●	X ▬ ● ● ▬
E ●	Y ▬ ● ▬ ▬
F ● ● ▬ ●	Z ▬ ▬ ● ●
G ▬ ▬ ●	
H ● ● ● ●	
I ● ●	
J ● ▬ ▬ ▬	
K ▬ ● ▬	O ▬ ▬ ▬ ▬ ▬
L ● ▬ ● ●	1 ● ▬ ▬ ▬ ▬
M ▬ ▬	2 ● ● ▬ ▬ ▬
N ▬ ●	3 ● ● ● ▬ ▬
O ▬ ▬ ▬	4 ● ● ● ● ▬
P ● ▬ ▬ ●	5 ● ● ● ● ●
Q ▬ ▬ ● ▬	6 ▬ ● ● ● ●
R ● ▬ ●	7 ▬ ▬ ● ● ●
S ● ● ●	8 ▬ ▬ ▬ ● ●
T ▬	9 ▬ ▬ ▬ ▬ ●