

Timed question:

**EACH PROBLEM THAT I SOLVED BECAME A RULE WHICH SERVED
AFTERWARDS TO SOLVE OTHER PROBLEMS.**

1)

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P
D	E	C	R	Y	P	T	T	H	E	A	F	F	I	N	E	C	I	P	H	E	R

Here's how we get the answer. Since we are given that

$$D(3) \rightarrow X(23)$$

$$E(4) \rightarrow C(2)$$

From this we know:

$$(a \times 3 + b) \bmod 26 = 23$$

$$(a \times 4 + b) \bmod 26 = 2$$

Looking at the formulas we see that it is easiest to subtract the first from the last.

$$(a \times 4 + b) \bmod 26 = 2$$

$$-(a \times 3 + b) \bmod 26 = 23$$

$$a \bmod 26 = -21$$

$$a \bmod 26 = 5$$

Now that we know that $a = 5$

Popping that back into any of the formulas (we pick the first one because it is the lowest multiplier)

$$(5 \times 3 + b) \bmod 26 = 23$$

$$(15 + b) \bmod 26 = 23$$

We can then subtract 15 from both sides

$$(15 + b) \bmod 26 - 15 = (23 - 15) \bmod 26$$

$$b \bmod 26 = 8 \bmod 26$$

And we see that $b = 8$. However, we only know a few of the letters in the cipher:

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P
D	E								E						E					E	

Our first step is to encode the common letters ETAOIN to see what they would map to. Note that we already know the mapping for E so we don't have to do that one.

E

$$E(4) \rightarrow 4 \times 5 + 8 = 28 \rightarrow C(2)$$

$$T(19) \rightarrow 19 \times 5 + 8 = 103 \rightarrow Z(25)$$

$$A(0) \rightarrow 0 \times 5 + 8 = 8 \rightarrow I(8)$$

$$O(14) \rightarrow 14 \times 5 + 8 = 78 \rightarrow A(0)$$

$$I(8) \rightarrow 8 \times 5 + 8 = 48 \rightarrow W(22)$$

$$N(13) \rightarrow 13 \times 5 + 8 = 73 \rightarrow V(21)$$

Filling in the letters we found (ZIAWV) we get a bit more of the answer.

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P
D	E					T	T		E	A			I	N	E		I			E	

This doesn't give us enough to solve it quickly so we just take the next 5 letters SRHLD.

$$S(18) \rightarrow 18 \times 5 + 8 = 98 \rightarrow U(20)$$

$$R(17) \rightarrow 17 \times 5 + 8 = 93 \rightarrow P(15)$$

H(7) → 7 × 5 + 8 = 43 → R(17)
 L(11) → 11 × 5 + 8 = 63 → L(11)
 D(3) → 3 × 5 + 8 = 23 → X(23)

We know the reverse mapping of 5 more letters (UPRLX) which we can fill in.

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P
D	E		R			T	T	H	E	A			I	N	E		I		H	E	R

While we could take some guesses (THE clearly shows up in the text) we can attack 5 more letters CUMFP from the frequency table that we were given with the test.

C(2) → 2 × 5 + 8 = 18 → S(18)
 U(20) → 20 × 5 + 8 = 108 → E(4)
 M(12) → 12 × 5 + 8 = 68 → Q(16)
 F(5) → 5 × 5 + 8 = 33 → H(7)
 P(15) → 15 × 5 + 8 = 83 → F(5)

This gives us the reverse mapping of 5 more letters (SEQHF) which we can fill in.

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P
D	E	C	R		P	T	T	H	E	A	F	F	I	N	E	C	I	P	H	E	R

This leaves us with only one letter that we don't know (although it is obvious). At this point you have three options

- Leave it blank since you can have two wrong and still get the full points for the question
- Guess that it is the letter Y and fill it in
- Confirm that it is the letter by doing the math ($24 \times 5 + 8 = 128 \pmod{26} \equiv 24$)

2)

Y'N UBB YS WUGMP MW AQQOYSX TUSXQPMFD HQUOMSD MFE
 I'M ALL IN FAVOR OF KEEPING DANGEROUS WEAPONS OUT

MW ERQ RUSTD MW WMMBD. BQE'D DEUPE HYER EJOQHYPYEQPD
 OF THE HANDS OF FOOLS. LET'S START WITH TYPEWRITERS.

K1	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
Frequency	1	4		7	8	2	1	3		1			9	1	3	5	8	3	5	2	6		5	2	5	
Replacement	K	L	Q	S	T	U	V	W	X	Y	Z	C	O	M	P	R	E	H	N	D	A	B	F	G	I	J

3) SVRD UCL NK HFNWM TKJ WZNCMO WZC IKII DKAFBNCNC

W	O	R	K
W	H	A	T
S	V	R	D

W	O	R
Y	O	U
U	C	L

K	W
D	O
N	K

O	R	K	W	O
T	O	D	A	Y
H	F	N	W	M

R	K	W
C	A	N
T	K	J

O	R	K	W	O	R	K
I	M	P	R	O	V	E
W	D	Z	N	C	M	O

W	O	R
A	L	L
W	Z	C

K	W	O	R
Y	O	U	R
I	K	I	I

K	W	O	R	K	W	O	R	K
T	O	M	O	R	R	O	W	S
D	K	A	F	B	N	C	N	C

4) ONCE YOU ELIMINATE THE IMPOSSIBLE, WHATEVER REMAINS, NO MATTER HOW IMPROBABLE, MUST BE THE TRUTH.

B	A	K	E	R
P	N	M	I	P
O	N	C	E	Y

B	A	K	E	R
P	U	O	P	Z
O	U	E	L	I

B	A	K	E	R
N	I	X	E	K
M	I	N	A	T

B	A	K	E	R
F	T	R	I	Z
E	T	H	E	I

B	A	K	E	R
N	P	Y	W	J
M	P	O	S	S

B	A	K	E	R
J	B	V	I	N
I	B	L	E	W

B	A	K	E	R
I	A	D	I	M
H	A	T	E	V

B	A	K	E	R
F	R	B	I	D
E	R	R	E	M

B	A	K	E	R
B	I	X	W	E
A	I	N	S	N

B	A	K	E	R
P	M	K	X	K
O	M	A	T	T

B	A	K	E	R
F	R	R	S	N
E	R	H	O	W

B	A	K	E	R
J	M	Z	V	F
I	M	P	R	O

B	A	K	E	R
C	A	L	P	V
B	A	B	L	E

B	A	K	E	R
N	U	C	X	S
M	U	S	T	B

B	A	K	E	R
F	T	R	I	K
E	T	H	E	T

B	A	K	E
S	U	D	L
R	U	T	H

5)

F	O	U
Y	O	U
D	C	O

R	S	C	O	R	E
C	A	N	N	O	T
T	S	P	B	F	X

A	N	D	S	E	V
E	S	C	A	P	E
E	F	F	S	T	Z

E	N	Y
T	H	E
X	U	C

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

E	R
O	F
S	W

S	B	R	O	U	G	H	T
T	O	M	O	R	R	O	W
L	P	D	C	L	X	V	P

F	O
B	Y
G	M

R	T	H	O	N	T	H
E	V	A	D	I	N	G
V	O	H	R	V	G	N

I	S
I	T
Q	L

C	O	N	T	I
T	O	D	A	Y
V	C	Q	T	G

It is important to remember to ignore spaces and punctuation on both the text to be encoded and the encoding key.

6) IN ANY CONTEST BETWEEN POWER AND PATIENCE, BET ON PATIENCE.

LDXDV ZFDMT KMYTM PTTDH FPTJX DSHXM

QUKUB MVUEJ DELJE ZJJUW VZJFK UNWKE

LTDZT YTMFD HXMLT DZT.

QJUMJ LJEVU WKEQJ UMJ.

<u>K1</u>	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
Frequency		1		1	6	1				10	4	2	3	1			3				8	3	3			2
Replacement	X	Y	Z	S	T	R	U	G	L	E	A	B	C	D	F	H	I	J	K	M	N	O	P	Q	V	W