

3.A Secret Codes

First we will use functions to create codes. Later we will use functions to break codes. Assign a number to each letter of the alphabet. A is 1, B is 2, and so on.

A	1	H	8	O	15	V	22
B	2	I	9	P	16	W	23
C	3	J	10	Q	17	X	24
D	4	K	11	R	18	Y	25
E	5	L	12	S	19	Z	26
F	6	M	13	T	20		
G	7	N	14	U	21		

Definition: The text of a message, before it is encoded, is called the *plaintext*.

The easiest code works by replacing each letter by one that follows it at a certain distance in the alphabet. For example, A (letter 1) is replaced with H (letter 8), B (2) is replaced with I (9), and so on. The function used in this example is $y = 7 + x$, where x is the number of the plaintext letter, and y is the number of the coded letter.

If the number of the coded letter is greater than 26, subtract 26 from it. For example, V's number is 22, $22 + 7 = 29$, $29 - 26 = 3$, so the code letter for V is C.

- Copy and complete this table to show the $y = 7 + x$ code.

Plaintext	Code
A	H
B	I
C	...

- Use $y = 7 + x$ to encode the words *smile*, *juggle*, *dance*, *puzzl*.
- Choose a number, b , and use $y = b + x$ to encode a message for a classmate. (Let classmate know the value of b so he or she will be able to decode the message quickly.)
- Decode the following message, which has been encoded with $y = 10 + x$.
DRSC COXDOXMO ECOC RKVP DRO VODDOBC SX DRO KVZRKL0D.
- Find the function that would decode the message in problem 4. Check your answer by actually using it on DRSC, and make sure it gives the expected plaintext.
- Use the function $y = 27 - x$ to encode these names:
Bernard, Carol, Ellen, Peter
 - Describe in words the code obtained from this function.
- Encode your name with $y = 30 - x$.
 - Now take the answer to (a) and encode it with $y = 30 - x$ again.
 - Comment on the result in (b).
- Encode the word *bilingual* with $y = 8 - x$ and then with $y = x - 8$. Do you get the same answer? Explain.
 - Find a decoding function for each function in part (a).
- Report** In this lesson you learned about three kinds of coding functions. Some look like $y = 7 + x$, and others look like $y = 8 - x$. Write a report on how to decode messages coded by each kind of function and also by functions like $y = x - 8$. Give examples using other numbers for each of the three kinds of functions. Mention any special numbers. (For example, what happens when $y = x + 26$?)