



CODES

Context

Maths: An understanding of codes and the process of encryption and decryption;
History: The importance of codes in WW2.

Objectives

- To understand and familiarise yourself with working in a range of codes;
- To learn to encrypt and decrypt;
- To learn to use simple formulae as an introduction to Algebra;
- To be introduced to the concept and uses of code in WW2;
- To use code to write a message of thanks.

Introduction

Throughout history, codes have been used to allow people to communicate in secret, without fear of their messages being intercepted. Julius Caesar used code now known as the 'Caesar cipher' to encrypt messages to his Generals. In World War 2 more advanced cipher algorithms were needed to keep messages secret as the other side tried to break the codes.

There are lots of types of codes. Try some of the following:

I. NUMBER CODES

We can create a simple code using numbers:

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

1. Write your name in code. Can you write the phrase **REMEMBER US** in code?
2. Is this a good code? Discuss that this would be very easy to crack.
3. Introduce a new formula e.g. $n+2$ so $A=3$ because $1+2=3$, $B=4$ because $2+2=4$.
4. What will the formula be to decode or decipher the message. e.g. $n-3$





2. THE CAESAR CODE

The Caesar Cipher is a form of **Substitution Cipher** which uses a simple letter-shifting technique to encrypt a message. For example, we can shift the letters in a message by 1 to create the following code:

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

- Now we can encrypt a message using this code e.g. **HELLO** becomes **IFMMP**
- Can you decipher the following words:
 - TBDSJGJDF
 - DPNNFNPSBUJPO
 - DPMBCPSBUJPO
- We can make this more complicated by making a different code. The code or Key above is 1. But if we shift our letters to a key of 7 – each letter moves to a letter + 7 so A = H and B = I.
- Create your own key. Working in pairs, send each other some secret messages.

3. MORSE CODE

The Morse Code was named after Samuel Morse an inventor of the telegraph. It is transmitted in telecommunications such as through sound waves or light and is internationally recognised so can be used for instance at sea. It encodes the Latin alphabet.

- Using the following alphabet code (attached), translate the phrase below. Does it sound familiar?





.. .-- .-.-.- - - - - -.. --- --.-.- -... .. -

.--- - -.-.-.-. .. --. ---

ACTIVITY

Using any of the above codes, or others you have created, write a message expressing your gratitude to someone who was involved in Operation Overlord and the preparations for D-Day. It could be to an individual, or a group of people working in a particular area, or to everyone who contributed.

Plenary

The codes we have used are all very easy to break but the really effective ones are the ones which are extremely difficult to decrypt if you don't know the key. The key or pattern of a code is called an **algorithm**. Analysing the effectiveness an encryption algorithm is called **Cryptanalysis**.

The codebreakers at Bletchley Park were trying to break an immensely complex one called the Enigma code which they did by looking for patterns in the messages and through creating special machines called Bombes.

See Bletchley Park Information and Activities

EXTENSION ACTIVITY FOR ADVANCED STUDENTS/KS3

We can use poems, or sentences to make codes. To do this, we take a sentence and write down the first time each letter of the alphabet appears, followed by any missing letters.

Example:

Sentence: TODAY IS A DAY FOR REMEMBRANCE

First Letters: TODAYISFREMBNC

Missing Letters: GHJKLPQUVWXZ

Key: TODAYISFREMBNCGHJKLPQUVWXZ





We can then use this to encode messages.

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

Message: I WANT TO DO ME BIT
 Encrypted: R VTCP PG AG NY ORP

1. Write a short poem (or use a verse from *Two Minutes* or *D Day 2*) and create your code using this poem.
2. Discuss your poems. What makes a poem a good/bad way to share a key?

ANSWERS

- I. Caesar Code:
 - a. Sacrifice
 - b. Commemoration
 - c. Collaboration
- I. Morse Code: I want to do my bit. What can I do?



An Enigma Machine © IWM MH 271718





Morse code key

Letters

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	— — • •

Numbers

1	• — — — —
2	• • — — —
3	• • • — —
4	• • • • —
5	• • • • •
6	— • • • •
7	— — • • •
8	— — — • •
9	— — — — •
0	— — — — —

