

CODE BREAKING AND ENCODING

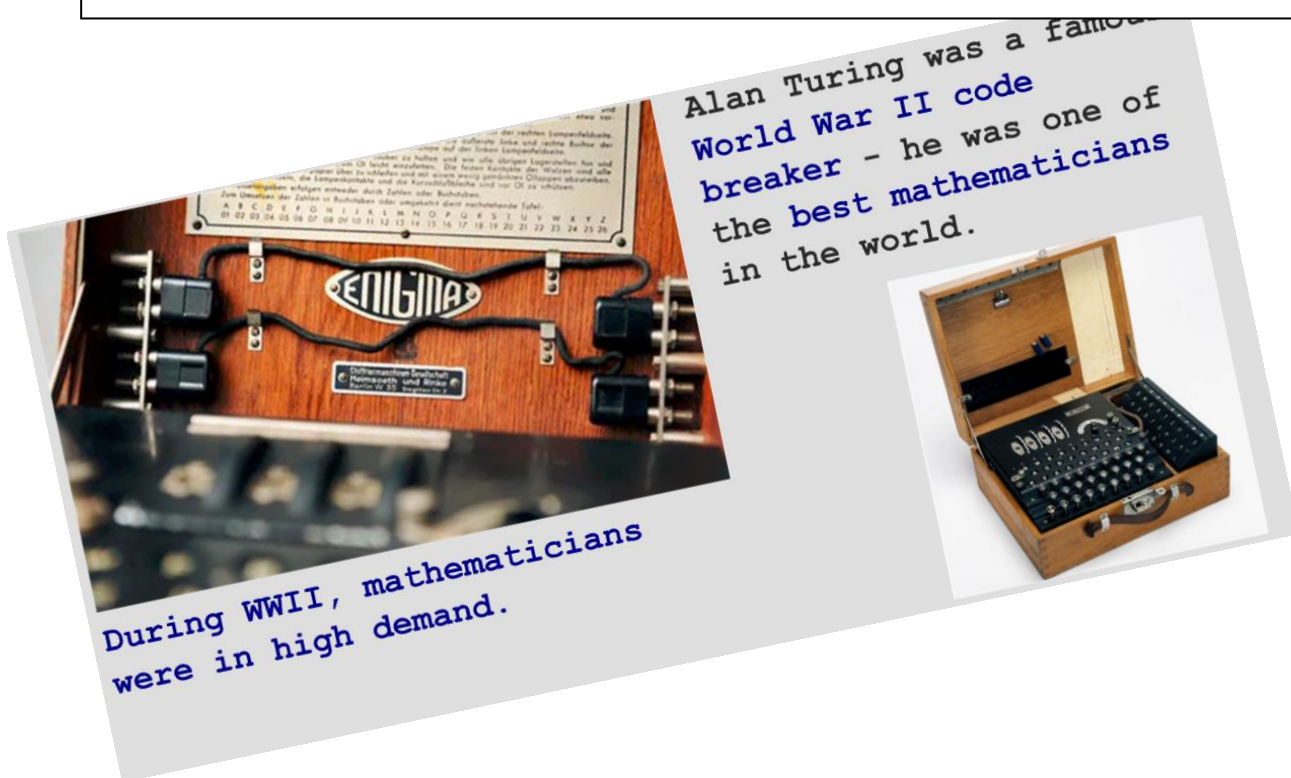
WALT: use knowledge of **order of operations** to complete calculations using **factors, primes** and **square numbers**.



Year six children have been learning about World War Two in history.

In maths, they decided to find out about how mathematicians saved lives by breaking codes and creating secret coded messages!

It is said that mathematicians at Bletchley Park help to shorten the war by up to two years.



Alan Turing was a famous
World War II code
breaker - he was one of
the best mathematicians
in the world.

During WWII, mathematicians
were in high demand.

Now follow given steps to **encode** your secret World War Two message!

MATHS BREAKS THE CODE

WORLD MATHEMATICAL YEAR 2008
 Celebrated in the United Kingdom

Many of today's secret codes rely on the difficulty of 'factorising' huge numbers. This means solving problems like those below:

$2 \times ? = 10$
 $11 \times ? = 33$
 $? \times ? = 91$

Every time you use a cash machine, your details must be checked with the bank's main computer. To protect your privacy, the data are scrambled mathematically. Number theory is important not only for keeping data secret, for example when shopping by credit card on a website, but also for cracking codes like that of the wartime Enigma machine.

$7 \times 7 = 8977912293265445403162361462162997220043102876199$



CREDIT CARD NUMBERS

Write out the card number

Double every other number, starting with the number first from the right.

$16\ 14\ 2\ 8\ 14\ 10\ 0\ 12$
 $32\ 28\ 4\ 16\ 28\ 20\ 0\ 24$
 $48\ 44\ 8\ 32\ 48\ 40\ 0\ 36$
 $7\ 5\ 12\ 8\ 16\ 10\ 0\ 18$

If a number has two digits, add them both together.

$4\ 8\ 12\ 16\ 20\ 24\ 28\ 32\ 36$
 $7\ 5\ 12\ 8\ 16\ 10\ 0\ 18$

Now add all the numbers.

$48\ 44\ 8\ 32\ 48\ 40\ 0\ 36$
 $7\ 5\ 12\ 8\ 16\ 10\ 0\ 18$
 $7\ 2\ 8\ 3\ 2\ 2\ 8\ 2\ 5\ 3\ 1\ 1\ 0\ 5\ 3\ 9$

If the last digit is 0, you have a real credit card number.

CHECK WHETHER THE FOLLOWING IS A CREDIT CARD NUMBER.

5184 8204 5526 6427



Apply the following rules so that each letter has a new numerical value:

- FOR PRIME NUMBERS $2^2 + (N - 1)$
- FOR NON-PRIMES $3^2 + (N - 6)$

Encode the following message:
 RAF planes refuel at noon

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
7	5	6	7	8	9	10	11	12	13	14	15	16
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26
7	18	19	20	21	22	23	24	25	26	27	28	29

21 4 3 6, 13 15 4 17 8 22 7, 21 8 9 24 8 13 4 23 ✓
 17 12 18 17 ✓

Apply the following rules so that each letter has a new numerical value:

- FOR PRIME NUMBERS $4^2 + (N - 11)$
- FOR NON-PRIMES $5^2 + (N - 20)$

Encode the message:
 Plan to evacuate children in process

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
6	7	8	9	10	11	12	13	14	15	16	17	18
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26
19	20	21	22	23	24	25	26	27	28	29	30	31

21 17 6 18, 25 20, 10 27 6 8 26 6 29 10 ✓
 8 12 14 17 9 23 10 19 14 19 21 23 20 8 10 ✓
 24 24 ✓

Use your knowledge of order of operations to solve calculations

ISBN codes

Look at the 10 digit ISBN number: **1-932698-18-3**

The first digit is 1 so do 1×1 . The second digit is 9 so do 2×9 . The third digit is 3 so do 3×3 . We do this all the way until 10×3 .

We then add all the totals together. If we have a proper ISBN number then we can divide this final number by 11.

If we do this for the barcode above we should get 286. $286/11 = 26$ so we have a genuine ISBN code.

Check whether the following is a real ISBN:

0-13165332-6

$1 \times 0 = 0$ $2 \times 1 = 2$ $3 \times 3 = 9$
 $4 \times 4 = 16$ $5 \times 6 = 30$ $7 \times 3 = 21$
 $8 \times 3 = 24$ $9 \times 2 = 18$ $10 \times 6 = 60$
 $78 + 105 + 15 = 198$

$\begin{array}{r} 0\ 1\ 8 \\ 1\ 1\ 1\ 9\ 80 \end{array}$

real ISBN code ✓

I have encoded a message by counting the letters and then writing it in rows and columns of its factor pairs.

I used more columns than rows.

I then re-wrote the encrypted message, by reading across the rows.

Can you decipher the hidden message?

YANCEEEOROOBARUEWDRKS

