

The Strange Case of

The Calculating



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Music by Gideon Escott

Teachers' Notes

Maths content

Work sheet

The Strange case of the Calculating Mr One has been developed to support the maths curriculum and the teaching of numeracy in schools at Key Stage 2 and to reinforce much of the mental calculations tested in the SATS for year 6.

The main focus of the play is on the variety of methods available for problem solving and how to identify which is the most appropriate for the problem presented. Along the way we encounter number patterns, times tables and a selection of different techniques we can usefully employ to achieve this.

Each mathematical idea is built upon throughout the play involving the audience directly in both the calculations and the methodology employed in problem solving and encouraging them to use a variety of approaches to achieve a single answer. Throughout the play the work is put into a number of everyday contexts through which the problems are explored.

The following pages provide a summary of the work covered and examples of how it is put into practice in the play. At the back of this booklet you will find a pupils' worksheet designed to tie in with the topics covered in the play which can be photocopied for use in the classroom.



ORDERING NUMBERS

The position of a digit in a number gives its value and the order a digit occurs in a number determines the number's value. We start with a basic HTU grid and demonstrate that a number, such as 538 is not the same if the order of the numbers is reversed: 538 does not equal 835.

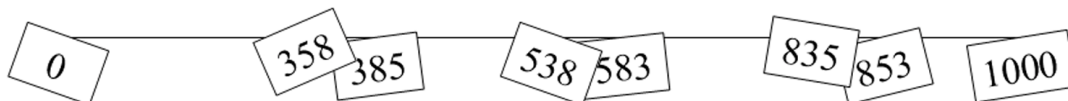
With help from the audience numbers are created from these three separate digits (8, 5 and 3) and are arranged in descending order according to their value in a HTU chart.

H	T	U
8	5	3
8	3	5
5	8	3
5	3	8
3	8	5
3	5	8

USING A NUMBER LINE

3 digit numbers are ordered according to their value using a number line between 0 and 1000 and the numbers we have created are then positioned on the number line with the help of the audience.

Our heroine, Kitty Beagle, makes a number line from a piece of wool, with 0 at one end and 1000 at the other.



Then with the help of the audience Mr Bloodhound places the numbers in their positions. We see that 538 is nearest the centre as it is the number nearest to 500. From this position we order the numbers created from the 3 digits.

IT'S ALL IN THE METHOD..... KITTY'S TOP TIPS

Our bright young spark, Kitty Beagle has been brought up to appreciate the finer points of mathematics and throughout the play she shares with the audience her knowledge of the best methods to employ for mental calculation. Each one of these becomes one of her 'Top Tips' and we explore each method in turn.

ESTIMATION— A CALCULATED GUESS?

Estimation is introduced as a useful tool in several ways: an approximate amount can be used when an exact answer is not needed ie. how many were present at a football match, it can be used to give a guide to the final answer of a calculation or to check it after a calculation has been made.

ROUNDING.....

Rounding is introduced to show how it is often used when exact answers are not needed and with the help of the audience the attendance figures for two football matches are rounded to the nearest 10, 100 and 1000.

Kitty has a pithy saying to remember how to round: ' For 5 and above, round it up! Anything below, down you go!'. Thus our figures become:

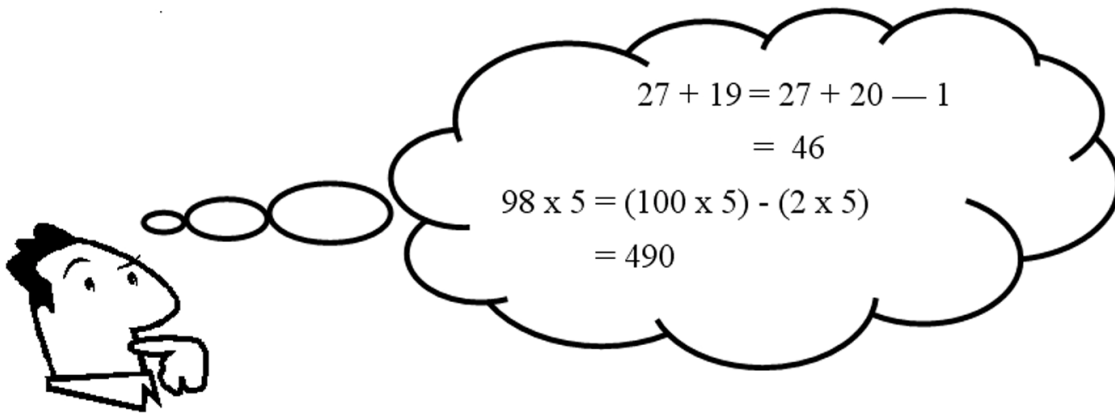
<u>Attendances</u>	<u>nearest 10</u>	<u>nearest 100</u>	<u>nearest 1000</u>
29,436	29, 440	29, 400	29,000
2,525	2, 530	2, 500	3,000

We then show how *Rounding* is used to *Estimate* an answer to a problem: *There are 8 Wine Gums in a packet. If I have one a day for every day of January how many are eaten in the month? To find an approximate answer we round the 8 gums up to 10 and the 31 days in January down to 30 and multiply the numbers together. Thus we estimate that around 300 wine gums are eaten in a month.*

.....AND ADJUSTING

If a number is near 10 or 20 or 100 etc. then rounding it up or down and adjusting at the end can make it much simpler to do the calculation in your head. *Rounding and Adjusting* is the next of Kitty's 'Top Tips'.

We use three examples to illustrate; an addition calculation, a subtraction and a multiplication. you need to add 9 or 19 etc. round it up to 10 or 20 to make the sum easier and then take away the 1.



COUNTING ON.....

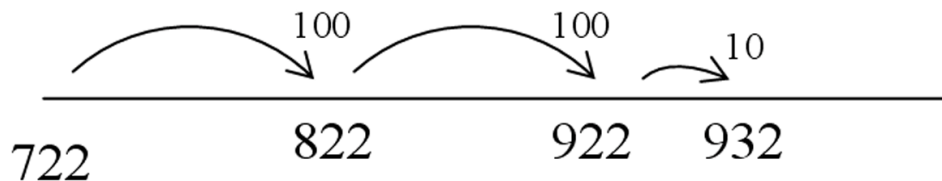
To solve certain calculations the most effective method to use is to *Count On*, (another of Kitty's Top Tips!) Situations such as finding out how much change you will get from £5.00 after spending £3.79 and with many subtraction calculations counting on is the best method to choose.

The calculation $210 + 722$ is set up.

Firstly we rearrange the sum to put the biggest number first: $722 + 210 = ?$

Next, we picture a number line in our heads and count on, firstly in 100s, and then 10

Thus we arrive at:



A subtraction calculation is then set up: $702 - 637 = ?$

This calculation cannot be rearranged as with addition but instead we *find the difference* by counting on from the smaller number to the larger one again by picturing a number line in our heads.

Count on 3 to 640, count on in 10s to 700, which gives us 63, and add the final 2. So we have the answer 65. You can always count on 'Counting On'!

.....PARTITION

With partition you must always deal with the units, tens and hundreds separately and it is a useful tool for both mental addition and subtraction.

Mr Bloodhound, the detective, is trying to take away 538 from 659. This is an ideal calculation to employ partition. Dealing with the units first we have:

<i>Units</i>	$9 - 8 = 1$
<i>Tens:</i>	$50 - 30 = 20$
<i>Hundreds</i>	$600 - 500 = 100$
<i>And the answer is:</i>	$659 - 538 = 121$

To check the answer is correct we then add the answer to the number we were taking away ie. $121 + 538 = ?$ Using partition once more we arrive at 659.

Partition is also a useful tool for multiplying:

$$12 \times 121 = (10 \times 121) + (2 \times 121)$$

By partitioning the 12 into 10 and 2 the multiplication is simple to do in your head and add the two answers together, again using partition: $1210 + 242 = 1452$

LEARN YOUR TABLES....

Mr Bloodhound visits the great inventor Ebenezer Brainteezer who has invented the calculating machine. With the help of the audience Mr Brainteezer and Mr Bloodhound chant the multiples of 6, 7 and 8:

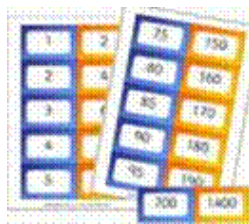
6,12,18, 24, 30, 36, 42, 48, 54, 60

7,14, 21, 28, 35, 42, 49, 56, 63, 70

8, 16,24,32, 40, 48, 56, 64, 72, 80

Knowledge of your tables is vital for multiplication and division calculations and an understanding of multiples as factors helps solve problems quickly.

....DOUBLING AND HALVING



Doubling and Halving is an extremely useful mental warm up and as well as promoting an aptitude to manipulate numbers and understand their relationships can also be a vital tool for what first appear as rather tricky multiplication calculations.

We set up the calculation 28×50 . By doubling the 50 to 100 we can easily multiply:

$$28 \times 100 = 2800$$

Then to find the answer to the original calculation we simply halve the answer:

$$2800 \div 2 = 1400$$

Another calculation is set up: 25×188 . This time we double the 25 to 50 and again double the 50 to 100. Thus we have:

$$188 \times 100 = 18800$$

We then halve and halve again:

$$18800 \div 2 = 9400$$

$$9400 \div 2 = 4700$$

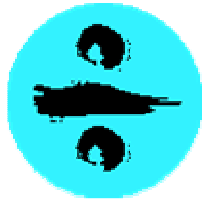
So we arrive at the answer through four simple steps of *Doubling and Halving*, and it can be applied to many calculations to make simplify a task.

DIVIDING.....

Division is introduced and understood as sharing:

There are 18 wine gums and if they were to be split equally between 2 people how many gums would each person have? If there were 3 people how many would they have each? What about 4 people? How many are left over? We introduce the 'remainder' being the 2 gums left over after diving 18 by 4.

.....RULES OF DIVISION



There are some interesting rules to help decide whether a number is divisible by another. We give the audience these rules to use:

- To divide by 2: It needs to be an even number
- To divide by 3: The sum of the digits must divide by three
- To divide by 5: The number must end in a 0 or 5
- To divide by 6: The number must be an even number that divides by 3
- To divide by 9: The sum of the digits must divide by 9
- To divide by 10: The number must end in a 0.

As most of the children will know that to be divisible by 2 a number must be even and to be divisible by 10 a number must end in a 0 we give the audience some three digit numbers and use the rules to see if they are divisible by 3, 5 and 9. The numbers we explore are: 835, 138, 432 and 315.

We find that there are several factors to some of the numbers and that the final number, 315, is divisible by 3, 5 and 9.

Here are some more rules of division for 4, 6 and 8:

- To divide by 4: The last two digits must divide by 4
- To divide by 6: The number must be even and the sum of the digits divides by 3
- To divide by 8: Half of the number is divisible by 4

The rules of division are a great shortcut to knowing if a number has factors, or will divide exactly with no remainder.

CLUES

There are two mysterious clues that need deciphering and with them come some mathematical calculations.

Clue 1:

$$(210 + 722) - 930 = \textit{top}$$

$$(702 - 637) - 63 = \textit{big}$$

*Put 2 and 2
together*

Clue 2:

Circus

$$48 \div 24 = ? \textit{ night}$$

$$\textit{at } 7 \times ? = 56$$

2,3,5,7,11,13,17

~~*rim*~~

IT'S ALL IN THE METHOD.....

And finally, here are the words to Kitty's song which is sung many times throughout the play:

It's all in the method
The method's all in all!
To calculate there isn't just one way!
Why not try some 'counting on'
But you must adjust your sum
And from the biggest number count away.
With subtraction and addition
It's good to try 'partition'
Split your numbers into tens and ones.
And another way to trust
Is to round and then adjust
Or doubling or halving can be done.
And don't forget to brush up on your number bonds and tables
And the world of calculation will be effortless and fun!

See how much you can remember in class.....