

# Mental Maths

Developing fluency in mental maths at Cleves... and how you can help at home!

# Aims

- To highlight the importance of fluency in mental maths
- To show how we develop mental maths skills at Cleves
- To provide activities that can be played at home

# What is fluency?

*Fluency is at the centre of the updated National Curriculum for maths. In this context, “fluency” refers to knowing key mathematical facts and methods and recalling these efficiently.*

Fluency is not solely about memorising and recalling facts; it also means being able to work flexibly and choose the **most appropriate method** for the problem at hand.

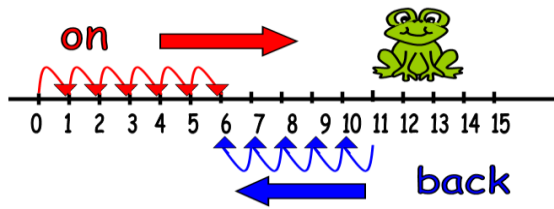
Children need the basics, but delivered in an open-ended, rich and engaging way.

# What is number sense?

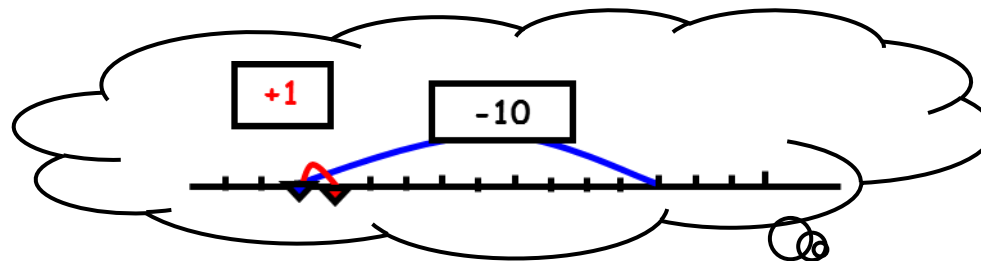
**'I would call number sense, ...[is]...  
when students [are] able to break  
numbers apart and decompose and  
add them and use them flexibly.'**  
*Jo Boaler 2013 Stamford University*



**'a well organised conceptual framework of  
number information that enables a person to  
understand numbers and number relationships  
and to solve mathematical problems that are not  
bound by traditional algorithms' (Bobis, 1996)**



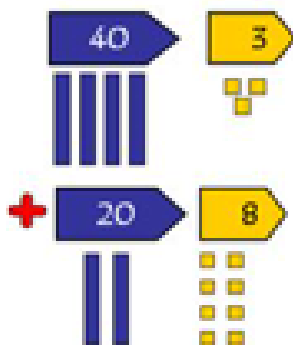
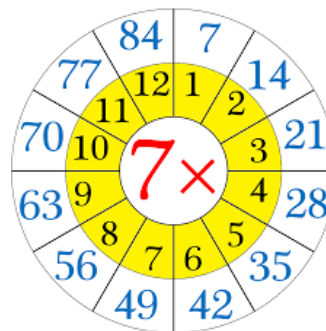
Counted on/back



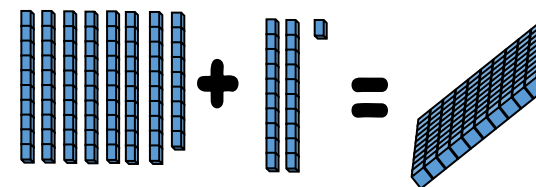
Picture in my head



Quick recall



Calculated  
(partitioned/  
recombined,  
nearest multiple of  
ten and adjust)



$$79 + 21 = 100$$

Exploited known  
number relations  
(e.g. number bonds, doubles)

What skills are integral to  
mental manipulation of number?



- Recognising numerals and their magnitude
- Counting on and back in 1s, 10s and 100s
- Number bonds
- Place value - partitioning and recombining to aid addition and subtraction
- Multiplying and dividing by 10, 100
- Multiplying by multiples of 10
- Multiplication and division including remainders
- Using the inverse (I'm thinking of a number, empty boxes)
- Crossing boundaries forwards and backwards
- Using known facts to carry out simple decimal multiplication, addition and subtraction.
- Knowing and using simple fractions and percentages
- Rapid recall of multiplication tables and corresponding division facts
- Knowing facts about shapes and measures including time (applying these to solve problems)
- Understand and use mathematical language (vocabulary for operations, multiples, factors, odd, even etc.)

# Mental Maths in... Year 2

- count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:  $\square$  a two-digit number and ones  $\square$  a two-digit number and tens  $\square$  two two-digit numbers  $\square$  adding three one-digit numbers
- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers



# Mental Maths in... Year 3

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- add and subtract numbers mentally, including:  $\square$  a three-digit number and ones  $\square$  a three-digit number and tens  $\square$  a three-digit number and hundreds
- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables

# Mental Maths in... Year 4

- count in multiples of 6, 7, 9, 25 and 1000
- find 1000 more or less than a given number
- count backwards through zero to include negative numbers
- recall multiplication and division facts for multiplication tables up to  $12 \times 12$
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

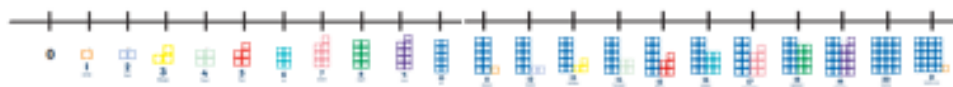
# Mental Maths in... Year 5 **and 6**

- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- add and subtract numbers mentally with increasingly large numbers
- multiply and divide numbers mentally drawing upon known facts
- **perform mental calculations, including with mixed operations and large numbers**

# Representation and imagery

## Numicon

Number value, ordering and comparing, number bonds



## Number Track/Number Line

Modelling, visualisation, jottings



## Count Stick

Teacher modelling/scaffolding. Smaller versions can be used to support individual children

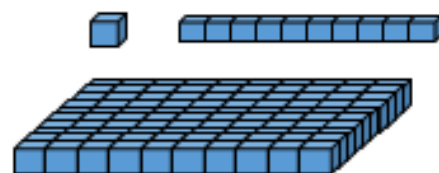
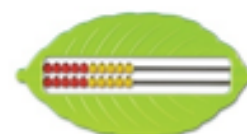


## Bead Strings

Multiples and factors, counting, 'five and a bit'

## Tens Frames/Abacus

Number bonds, 'five and a bit', addition and subtraction



## Dienes/place value apparatus

Modelling, visualisation, jottings

## ITPs (Interactive Teaching Programs)

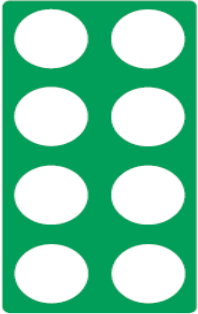
Archived National Strategies

interactive programs including ruler, measuring scales and measuring cylinder



How many facts can you generate about these numbers?

*double four*



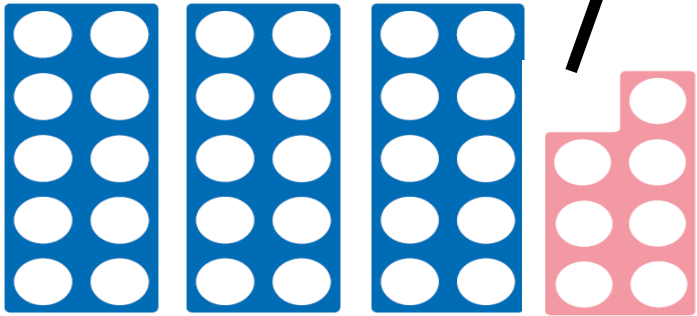
*one more than seven*

*even*

*multiple of two*

*one less than nine*

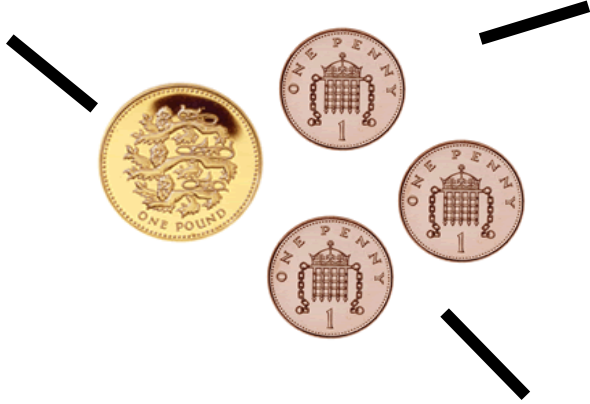
*odd*

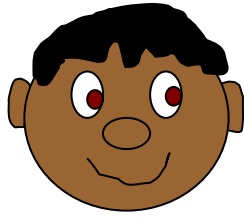


*rounds up to forty*

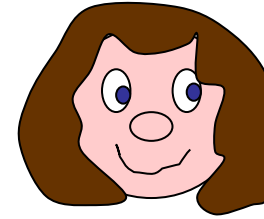
*three tens and seven units/ones*

ten, unit/one, tenths, hundredths, round, odd/even, multiple, prime, square, greater than/less than, before/after, digit, same as, integer, positive/negative





# Guess My Number



0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99
100	101	102	103	104	105	106	107	108	109
110	111	112	113	114	115	116	117	118	119
120	121	122	123	124	125	126	127	128	129
130	131	132	133	134	135	136	137	138	139
140	141	142	143	144	145	146	147	148	149
150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169
170	171	172	173	174	175	176	177	178	179
180	181	182	183	184	185	186	187	188	189
190	191	192	193	194	195	196	197	198	199

[www.sweetcounter.co.uk](http://www.sweetcounter.co.uk)

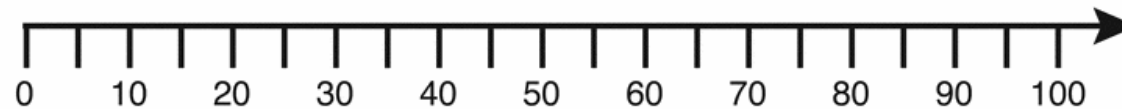
*Write a two-digit number on a post-it note.*

*Be careful not to show anyone.*

*Now place the post-it note (carefully) on your partner's forehead. How many questions will it take for your partner to guess the number they have on their forehead? Keep a tally.*

*Can the number of questions be reduced each time?*

*How might a number square or number line help?*

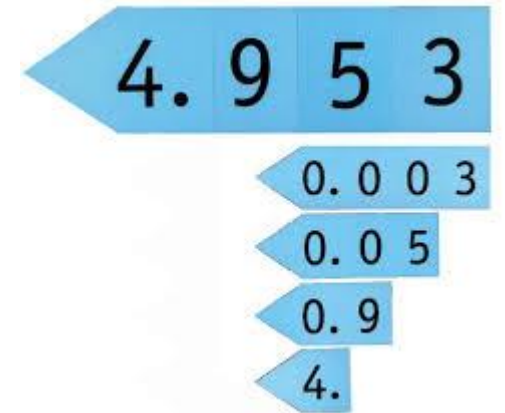


*Alternatives: Write the number in words, vary the size of the number (include decimals/fractions)*

# Guess My Number: decimal

Work in pairs

- One person writes down a number with three decimal places
- Their partner uses the arrow cards to narrow down the possibilities and arrive at the number that has been written
- Questions can only be answered with 'yes' or no'
- Tally the number of questions asked and total
- Swap
- Who guessed in the fewest number of questions?
- What makes a 'good' question?



**Millions**

**Thousands**

**H T U**

**6 2 5**

**, 7 8 4**

**, 3 1 9**



# Chris Moyles' Quiz Night

- <https://www.youtube.com/watch?v=s7YXw1rmlzg> - Hoosiers
- <https://www.youtube.com/watch?v=meIO97tXv2o> - JLS
- <https://www.youtube.com/watch?v=VzXEJh9wzx4> - Keane
- <http://www.sheffieldmaths.co.uk/Chris%20Moyles%20Starters.html> –  
All (to download)

$$4 \times 5 \times 2$$

$$+ 26$$

$$- 2$$

$$\div 4$$

$$\times \frac{1}{4}$$

$$+ 8$$

$$\times 12$$

$$+ 10$$

What strategies did you use to calculate at each stage?

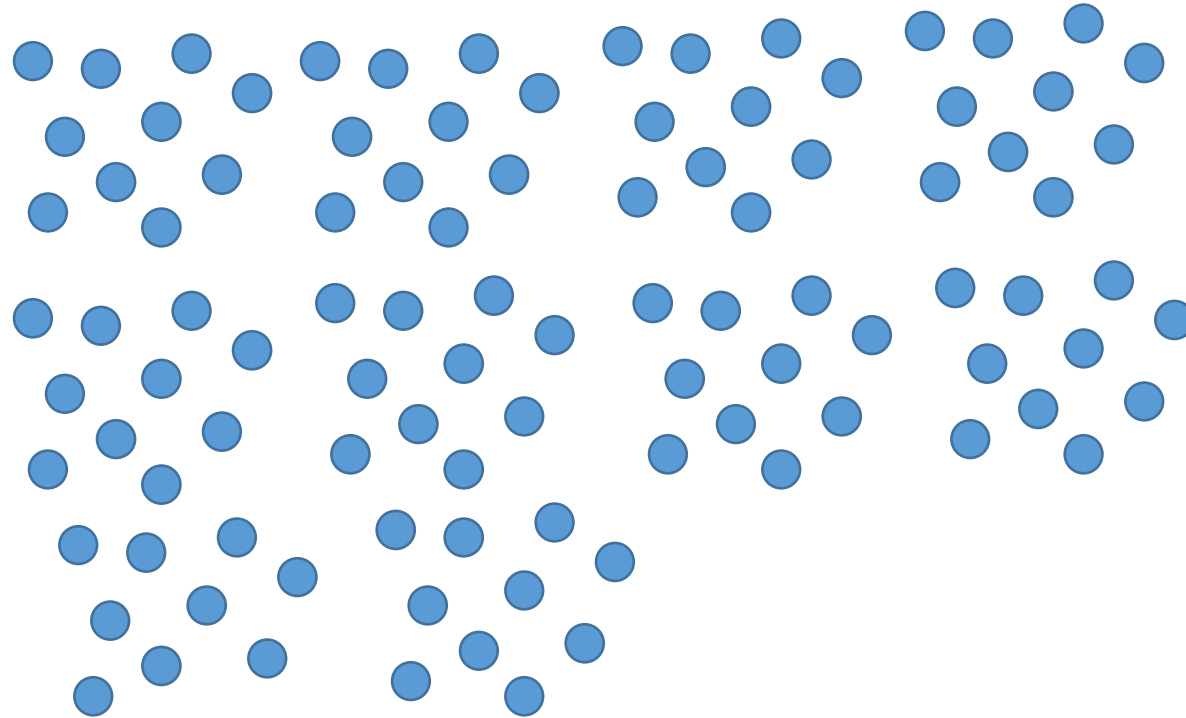


Where are potential teaching points?

# Efficient or not efficient?

3

$89 + 10 =$



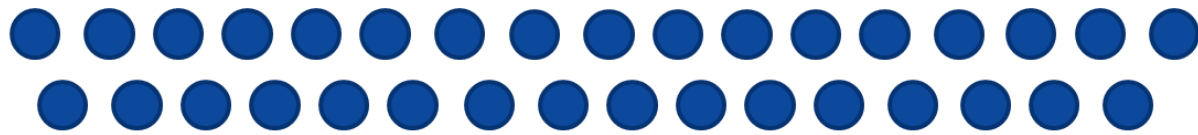
# Developing/refining mental strategies

$$17 + 16$$

Strategic flexibility in mental calculation refers to the extent to which the way the problem is solved is affected by circumstances (Star and Seifert, 2006).

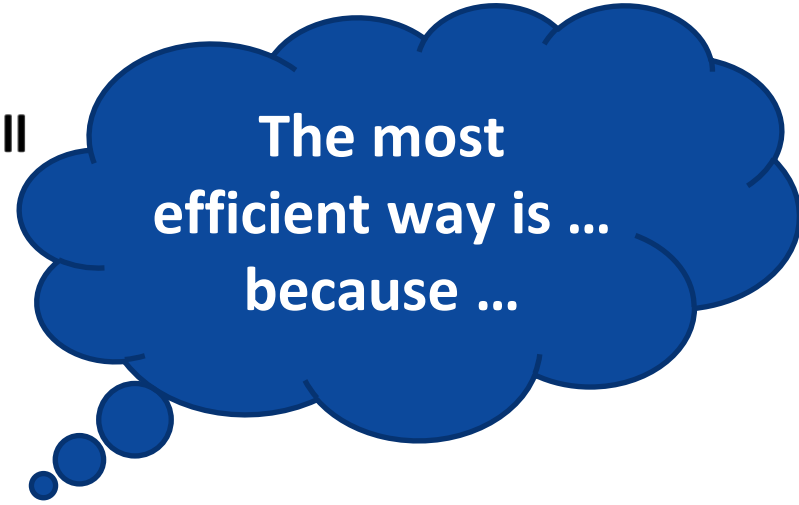
How many different ways can you work this out?

Which strategies are more efficient?  
Why?

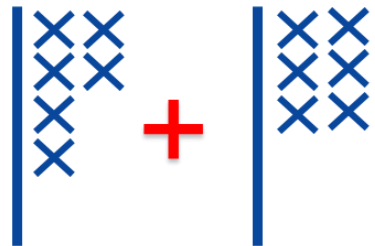


counting all

counting on in ones



$(17 + 17) - 1$  near doubles



$10 + 10 + 7 + 6$

partitioning TU

# The Magic Pot

*If I know  $2 \times 3 = 6$  what else do I know/can I work out?*

$$3 \times 2 = 6$$

$$30 \times 2 = 60$$

$$20 \times 3 = 60$$

$$6 \div 2 = 3$$

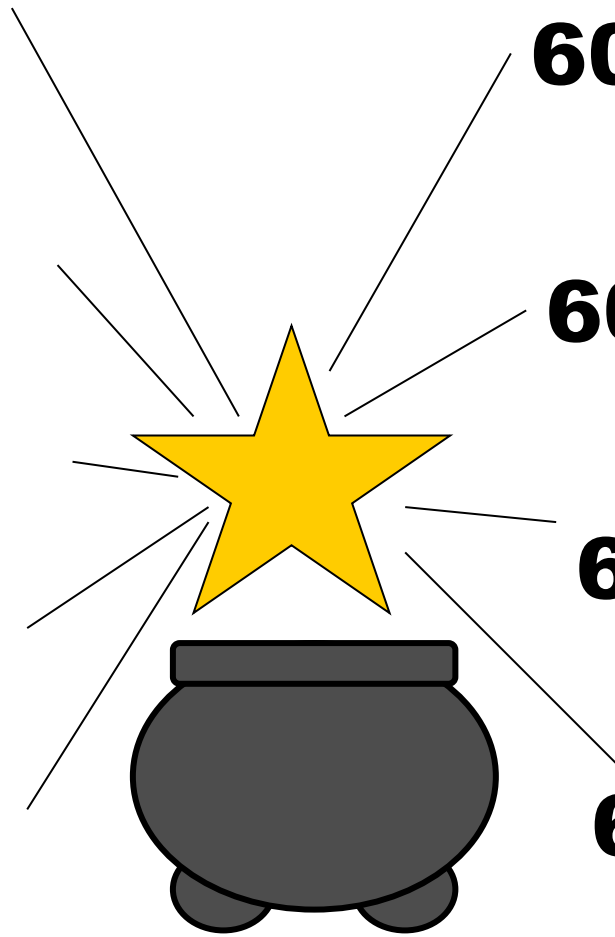
$$6 \div 3 = 2$$

$$60 \div 2 = 30$$

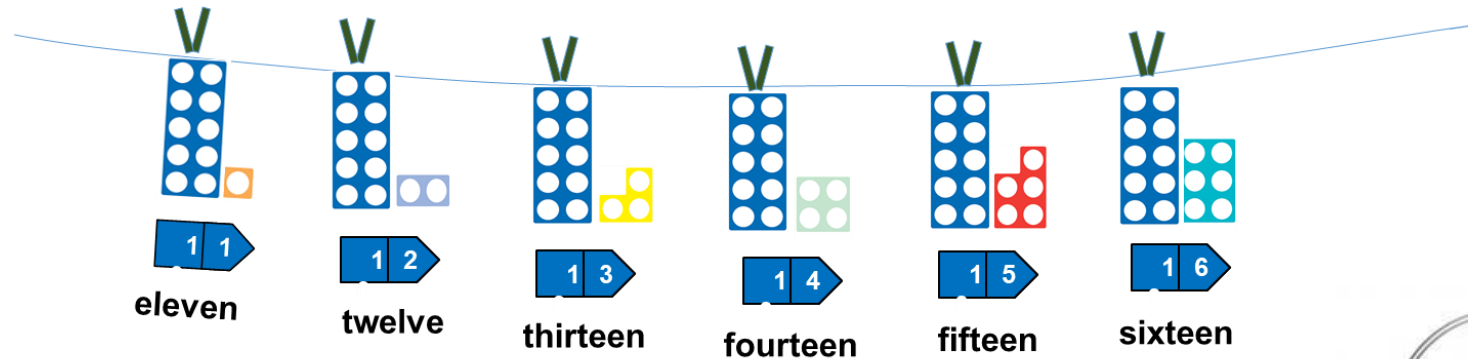
$$60 \div 3 = 20$$

$$60 \div 20 = 3$$

$$60 \div 30 = 2$$



Many pupils even in upper KS2 demonstrated a lack of basic counting skills; struggling to count forwards and backwards in 1s and 10s, particularly when bridging 100s and 1000s. This in turn is impacting on calculation especially subtraction.

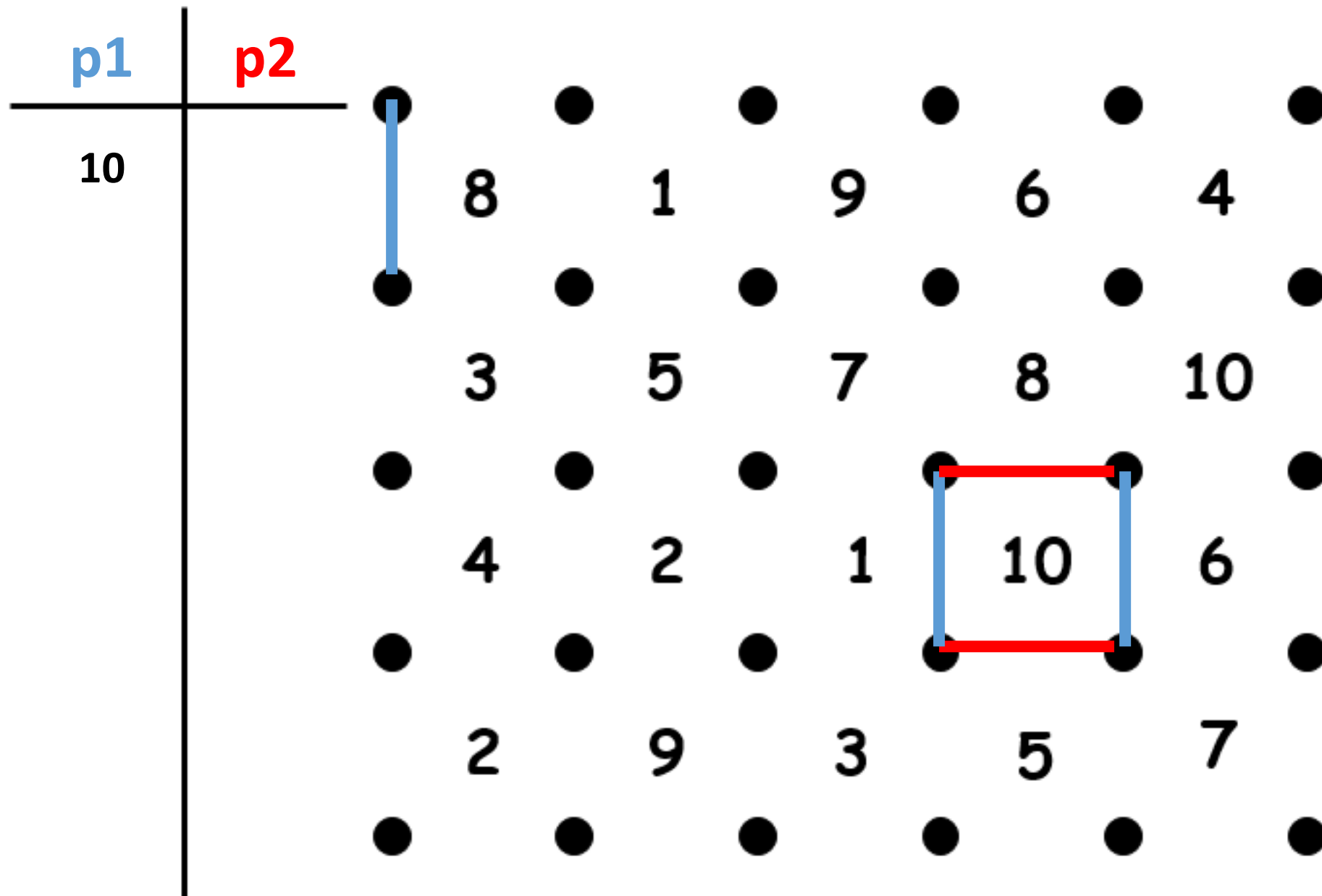


**Switch counting**

*5, 15, 25, 125, 225, 325, 315, 305*

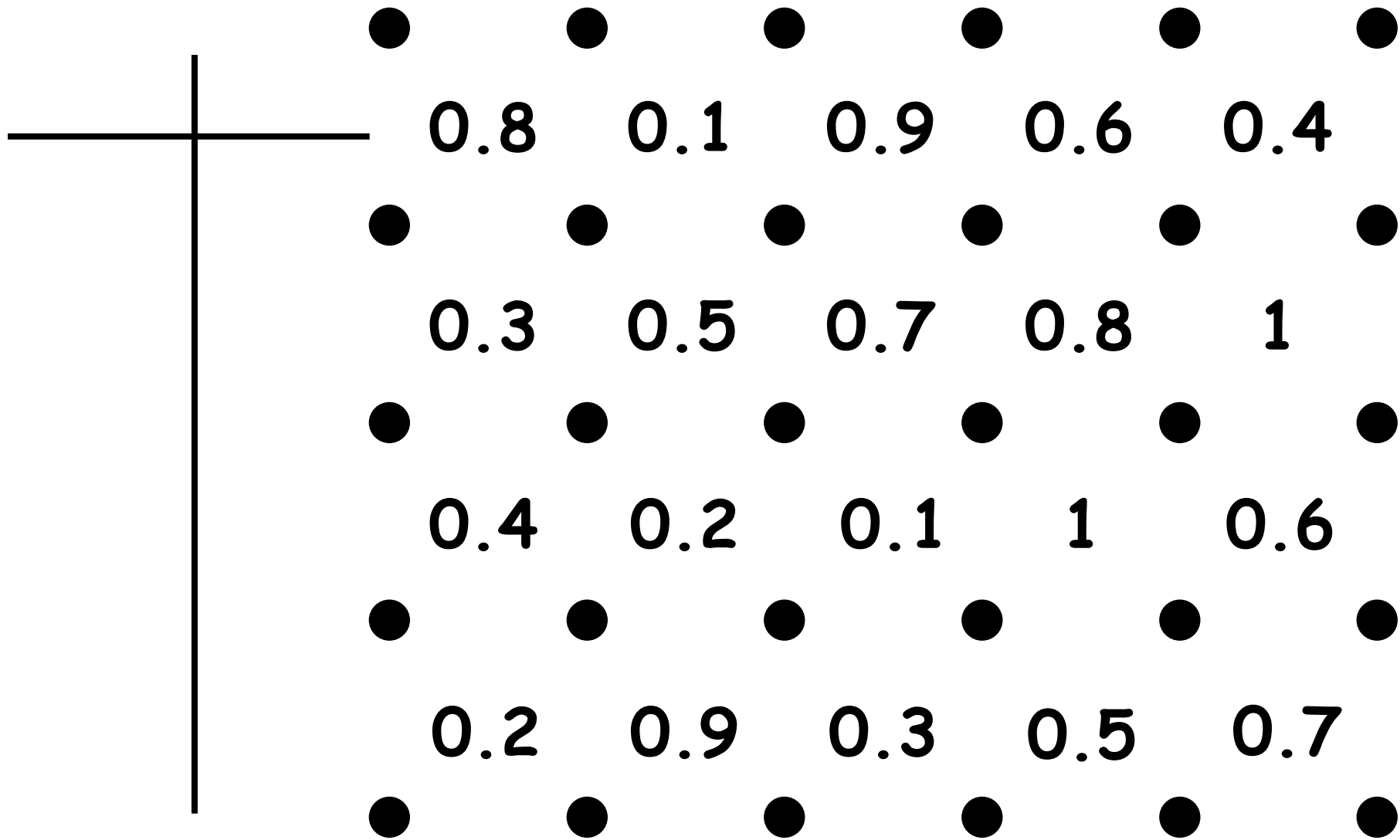
**Counting in context**





How might this activity be adapted?





## Beat the Calculator

$$100 \div 10$$

$$600 \div 10$$

$$400 \div 10$$

$$800 \div 10$$

$$300 \div 10$$

$$900 \div 10$$

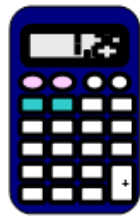
$$0 \div 10$$

$$500 \div 10$$

$$200 \div 10$$

$$700 \div 10$$

$$1000 \div 10$$



## Beat the Calculator

## Beat the Calculator

$$1.2 \times 10$$

$$6.3 \times 10$$

$$4.6 \times 10$$

$$8.1 \times 10$$

$$3.7 \times 10$$

$$9.4 \times 10$$

$$0.8 \times 10$$

$$5.5 \times 10$$

$$2.0 \times 10$$

$$7 \times 10$$

$$10.9 \times 10$$



Target Board 1

3	1	6	8	12
5	15	4	10	1
6	4	24	7	9
2	8	2	3	10

Target Board 12

$x+3$	$5x$	$2x+1$	$x+13$	$x^2$
$x^2+4$	$\frac{x}{2}$	$3x$	$\frac{3x}{2}$	$(2x)^2$
$2(x+3)$	$x^2-1$	$2(x-10)$	$2(x-5)+8$	$\frac{2(x+3)}{6}$
$x+1$	$4x^2$	$\frac{x}{2}-1$	$x-10$	$3x+2$

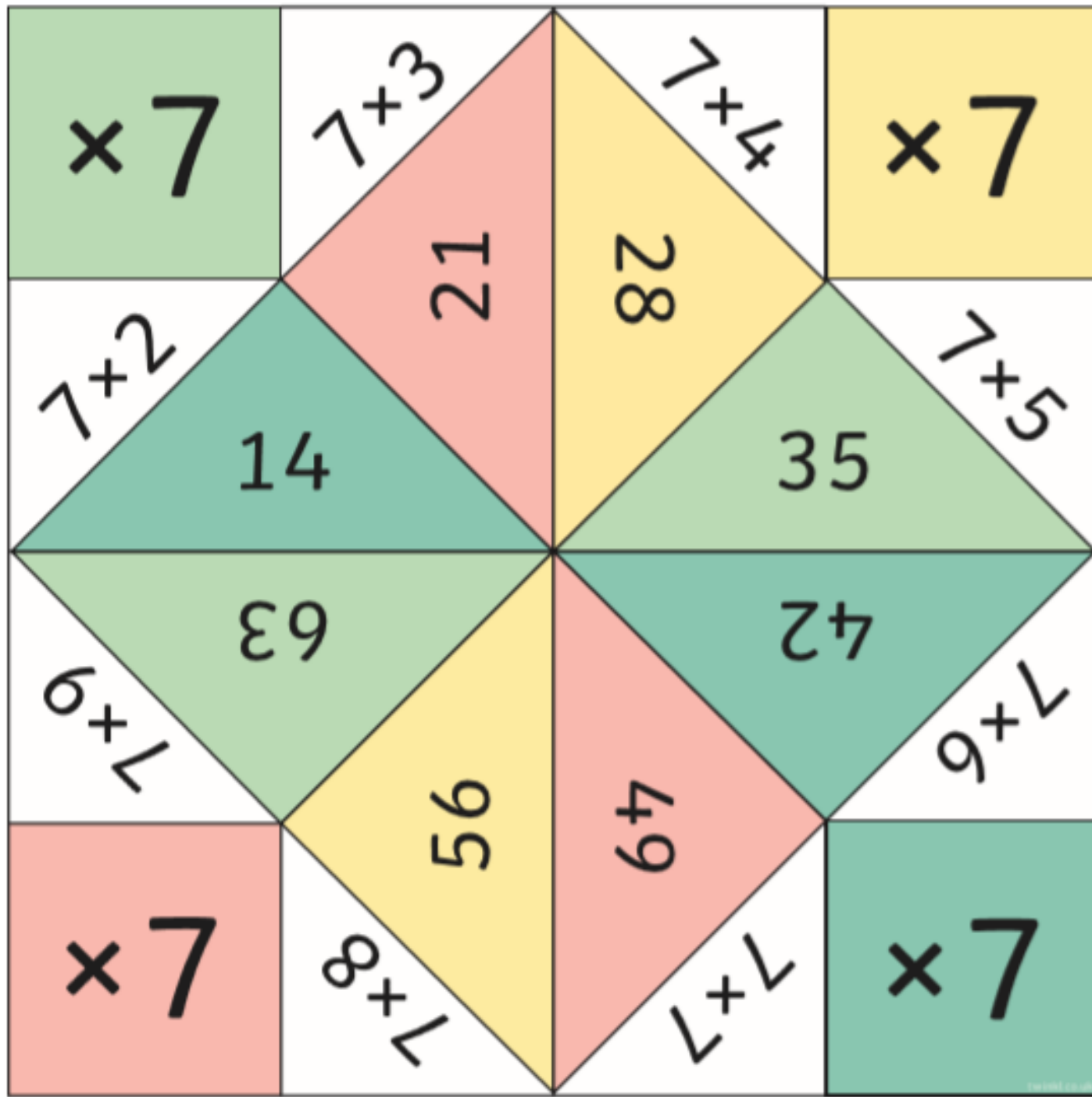
# Multiplying multiples of 10

240	360	60	120	150	20
160	200	180	90	40	300
30	10	240	50	100	40
300	80	180	250	120	60

Throw a dice, multiply the score by one of these numbers. Cover the number you make. "Four in a Line" to win.



10	20	30
40	50	60



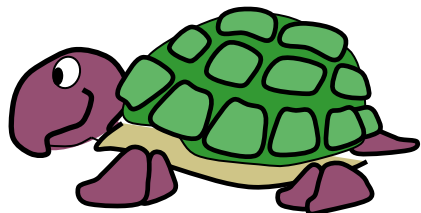


Are you a  
times table wizard?

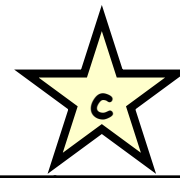
Under 30s  
speedy

Under 20s  
super speed

Under 10s  
supersonic speed



6x, 7x, 8x, 9x, 11x



x	8	11	7	6	9
11					
8					
6					
7					
9					



**5 x table**



Question	Answer
$4 \times 5$	20
$10 \times 5$	50
$7 \times 5$	35
$8 \times 5$	40
$2 \times 5$	10
$3 \times 5$	15
$5 \times 5$	25
$6 \times 5$	30
$9 \times 5$	45
$1 \times 5$	5



# Café Rose

10p

£1.49

55p

60p

£1.00

£4.99

90p

£1.50



Total  
£10.14



# Useful websites

- <https://trockstars.com/>
- <http://www.sumdog.com/>
- <https://mathsframe.co.uk/en/resources/category/22/most-popular>
- <https://www.khanacademy.org/math>