Calculations policy

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At Jerry Clay Academy, we aim, through creative and inclusive lessons, to create a sense of excitement and curiosity around mathematics. Children are encouraged to make links between what they are learning and the world around them. A high quality maths education provides a foundation for understanding of the world. Maths is essential to everyday life and necessary in almost all forms of employment. As children at our schools learn mathematics, they are acquiring fluency in mental methods (maths they do in their heads) as well as written methods.

The National Curriculum for mathematics aims to ensure all pupils:

- Become **fluent** in the fundamentals of mathematics so that they are efficient in using and selecting the appropriate written algorithms and
mental methods, underpinned by mathematical concepts
- Can **solve problems** by applying their mathematics to a variety of problems with increasing sophistication, including in unfamiliar contexts
and to model real-life scenarios
- Can **reason mathematically** by following a line of enquiry and develop and present a justification, including in unfamiliar mathematical language.

In order that fluency in mathematics in attained, children know that quick and accurate mental recall of facts is essential.

Pupils are expected to practise and then apply their mathematics to a range of problems. Through a curriculum based on conceptual understanding, children are able to select and apply different mathematical methods in different contexts. Solving contextualised problems is integral to maths learning at Jerry Clay Academy and analysing, identifying patterns, proving, recognising, remembering, identifying, conjecturing, finding relationships and generalisations are fundamental to embedding mathematical skills that can be built on throughout our children's school life. Our children are empowered with accurate mathematical language with which they are able to communicate their ideas effectively. Perseverance and determination are skills developed across the curriculum but particularly through problem solving in mathematics.

Although the way we teach calculation is organised in a sequence, teaching staff work with the ethos that individual children's needs denote the part of the curriculum that should be accessed. Progression in mathematics for all children is essential and so, no matter what their starting point, through accurate assessment, high expectations and quality teaching, pupils at Jerry Clay are able to realise their mathematical potential. All teachers ensure children with special educational needs are as carefully planned for and inclusivity is at the heart of what we do. The Early Years Curriculum ensures mathematics is interactive, real life and encompasses adult led and child led activities. Cross-curricular links are made where possible, particularly in science, through the use of technology and during whole school topics.

Rationale

The policy contains the written and mental maths methods that will be taught at our school. It has been written to ensure consistent progression throughout the school.

The progression is set out in year groups. However, children should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded. Nor should children be stopped from going on to the next stage but, in this case, it is essential for their teacher to see that they are ready for this. The aim is for children to be able to independently select an efficient method of their choice that is appropriate for the given task.

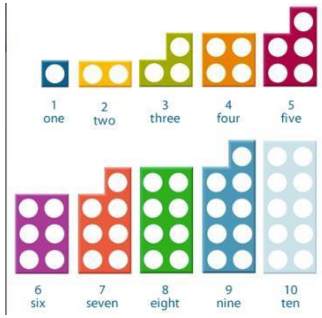
Further explanation of the stages

For each of the four operations (addition, subtraction, multiplication and division), a progression of stages is demonstrated to show how a child will develop in their written and mental calculation methods. The written calculation methods have drawn examples and the mental calculation strategies are shown to demonstrate what would support this method. In addition to this, the visual equipment that will be used to support your child are shown.

Models and Images

At Jerry Clay Academy, children are first given the opportunity to explore mathematical concepts using the following practical resources;

Numicon - aids children in recognising how much a number is worth, ordering and comparing numbers. Numicon is used to help children explain their mathematical thinking when problem solving.



Counters - used to aid children with counting. We also use the different colours to represent different amounts, introducing algebraic thinking.

Bead strings - used for all four operations (addition, subtraction, multiplication and division). They are also used to count up in different amounts.

Dienes/base 10 – used to demonstrate a visual representation when understanding the value of numbers. They are also used for all four operations. Dienes/base 10 are related to each other in terms of size helping children to compare numbers.

Place value/gattengno table – aids children in understanding how much a number is worth. This is also used when multiplying and dividing by 10, 100 and 1000…showing how the digits move to the left or right.

Hundred number square – used to aid early counting. Excellent for adding and subtracting 10. Children can use this to find patterns in multiplication tables.

Place value arrow cards – used to demonstrate and know how much a number is worth. Also used to partition numbers (break up into, for example, hundreds, tens and units and add or subtract).

Cuisinaire/number rods – used to demonstrate proportional relationships between numbers and fractions. They can be used to model the Singapore Bar Method for problem solving.

Money – used when problem solving with money and to understand decimals.

Progression in number lines

Number lines should be introduced in the following order:

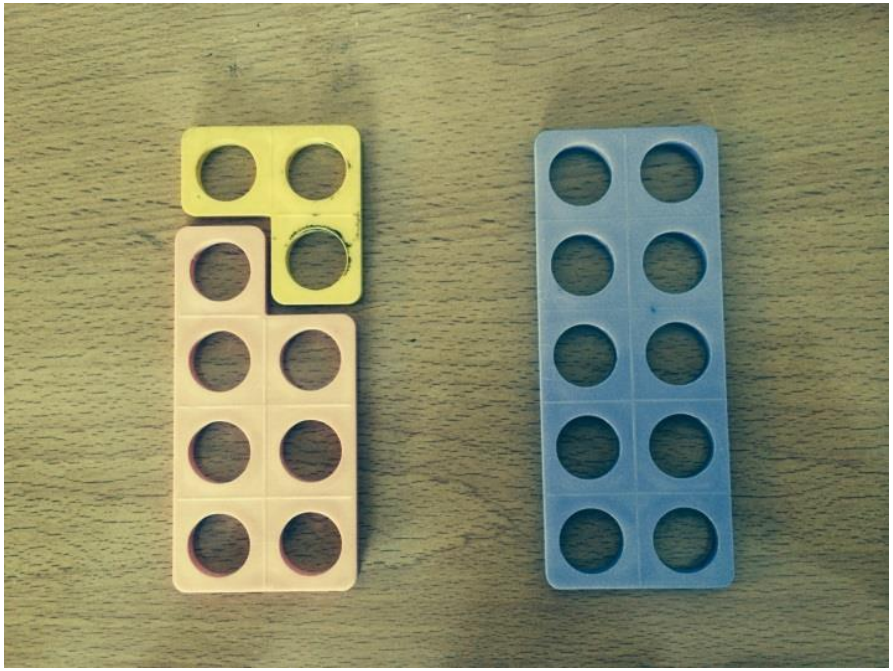
- Number tracks
- Number line with all numbers labelled
- Number line with 5's and 10's labelled
- Number line with 10's labelled
- Numberline, marked but unlabelled
- Empty number line

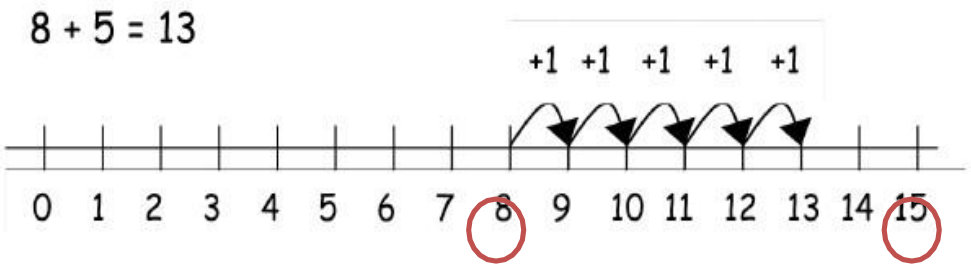
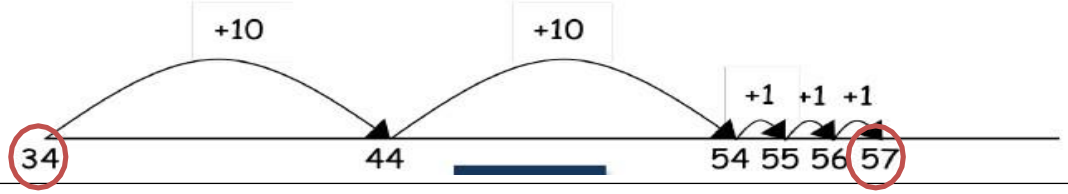
Efficient Calculation:

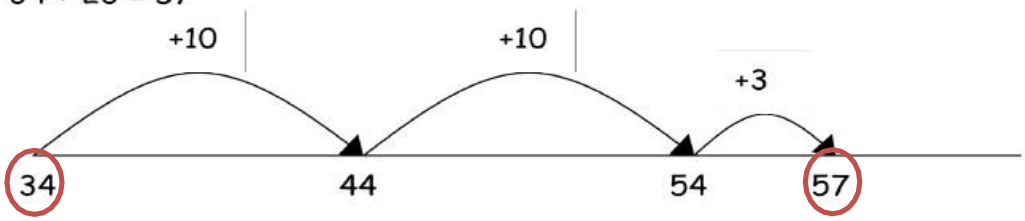
At Jerry Clay Academy, we appreciate the importance of fluency in mental calculation. When faced with a mathematics problem, we encourage children to follow these steps to success:

When faced with a calculation, no matter how large or tricky the numbers appear to be, all children should ask themselves…

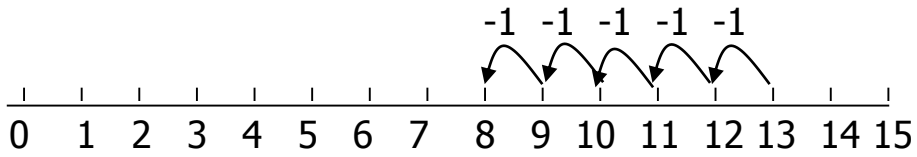
"Can I do this in my head?"
"Do I know the approximate size of the answer?"
"What strategy do I need to choose to solve this problem?"
"If I can't do it wholly in my head, what jottings do I need to write down in order to calculate the answer mentally?"

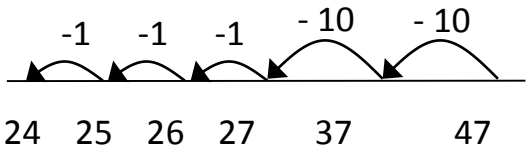
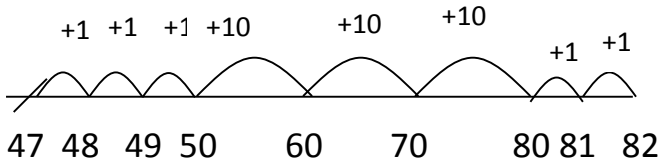
Addition	Steps to success
Stage 1 	**I can…** - Select 2 numicon shapes - Place them together and see what shape they have made - Check by placing the shape on top

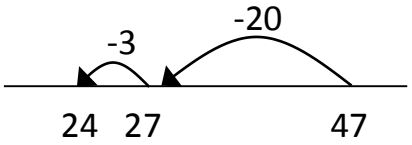
Stage 2 Children use a numbered number line to support calculations. They count on in ones. 8 + 5 = 13  Extend into higher numbers (TU + u) and model starting with the biggest number	**I can…** - Circle the bigger number on my number line - Count on in ones - Circle the number I land on
Stage 3 Children still use a published number line to add TU + TU. They break down the smallest number. Use a 100 square to support adding tens. ✓ First count on in tens and ones 34 + 23 = 57  	**I can…** - Circle the bigger number on my number line - Partition the smaller number into tens and ones - Count on in tens - Count on in ones - Circle the number I land on

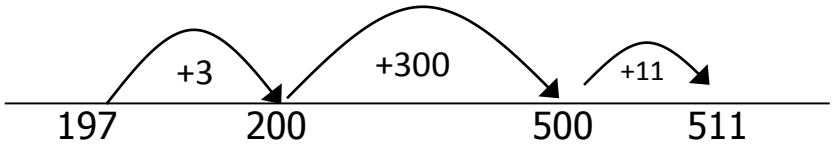
Stage 4 Children progress from a published number line to drawing their own to show their understanding. Use a hundred square to support counting in tens. ✓ Teach the children to become more efficient by adding the units in 1 jump (encourage them to use known number facts) 34 + 23 = 57  	**I can…** - Draw a blank number line - Mark the bigger number on the line - Break the smaller number into 10's and ones - Count on in tens (and mark this on number line) - Count on in ones	
Stage 5 Children partition both numbers and recombine. Encourage children to us know facts to add tens. Progress onto HTU + HTU 84 + 23 = 80 4 20 3 100 + 7 = 107 362 + 234 = 300 60 2 200 30 4 500 + 90 + 6	**I can…** - Partition the numbers into hundreds, tens and ones - Add the hundreds - Add the tens - Add the ones - recombine to find the sum	

Stage 6 Children are prepared for the formal method by aligning vertically and adding the units first. 318+ 175 318 + 175 13 80 400 493	**I can…** -Line the numbers up in their correct columns -Add the ones. -Add the tens. -Add the hundreds. -Recombine by adding all the totals together.	
Stage 7 Children use the formal method, showing numbers 3587 + 675 4262 111 Extend to decimals (same number of decimals places) and adding several numbers (with different numbers of digits). Extend to numbers with any number of digits and decimals with 1 and 2 decimal places.	**I can…** -Line the numbers using their place value Th, H, T, O. -Add the ones -Add the tens -Add the hundred. -Add the thousands * If a column sum is greater than 10, record the ones and exchange to the next column on the left.	

Subtraction		Try it!
Stage 1 	I can - select two numicon shapes below ten - place the smaller plate on the bigger plate - count the difference between the two shapes.	
Stage 2 *Children use a pre-drawn number line to count back in ones.* 13 – 5 = 8  *Then extend this to larger TU - U*	**I can** - find the bigger number on my number line. - jump back on top one number at a time. - Circle the number I land on.	

Stage 3 *Children still use a pre-drawn number line to subtract TU – TU. They break down the smallest number into tens and ones and subtract from the large number.* 47 – 23 = 24  	**I can** -find the bigger number on my number line. -partition the smaller number into tens and ones. -count back on top in tens. -count back on top in ones. -circle the number I land on.	
Stage 3 If the numbers involved in the calculation are close together or near to a multiple of 10,100 etc., it can be more efficient to count on to find the difference. Then use a pre-drawn number line. Then mark the larger number in the right hand side of the number line and the smaller on the left.	**I can** -mark the bigger number on the right of my number line. -mark the smaller number the left. Of number line. -count on in ones to the next multiple of ten.	
They jump on in ones to the next multiple of ten. Then they jump on in tens and ones to reach the larger number. 82 - 47  	-count on in tens and ones to reach the larger number. -add all the jumps of ten and one to find the answer.	-

Stage 4 *Children progress from using a published number line to drawing their own to show their understanding.* *As with addition, teach the children to become more efficient by subtracting the units in one jump (encourage them to use known number facts).* 47 – 23 = 24  *Children should be able to use the number line for increasingly large numbers.*	**I can** -draw a blank number line -mark the bigger number at the end of the line -partition the smaller number into 10's and ones -count back in tens on top (and mark this on my number line) -count back underneath in ones (and mark this on my number line)	

Stage 4 When counting on to find the difference, teach the children to be more efficient by adding the ones in one jump. They may jump on in multiples of ten and a hundred. Children should be able to use the number line for increasingly large numbers. 511 – 197 = 314  	**I can** -draw a blank number line -mark the bigger number on the right of my number line. -mark the smaller number on the left of my number line. -count on in an efficient jump to the next multiple of ten. -Count on in efficient jumps of tens and ones to reach the larger number. -add the jumps to find the difference between the numbers.	

Stage 5	**I can** -partition the numbers into hundreds, tens and ones -subtract the ones -subtract the tens -recombine the differences to find the answer.	

Children use partitioning as the initial process for decomposition.

- ✓ Initially use examples which do not need regrouping.

89 - 57

80	9
50	7
30	2 = 32

Stage 6

Children then begin to learn how to *regroup*.

71 – 46 = 25

60 ¹1
70 .
- 40 - 6
20 . 5 = 25

- ✓ Children should be taught to line up the digits
- ✓ Progress with larger numbers which require exchanging hundreds and tens

754 – 86 = 668

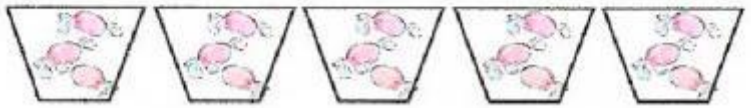
600 140
700 + 50 . ¹4
- 80 + 6
600 + 60 . 8 = 668

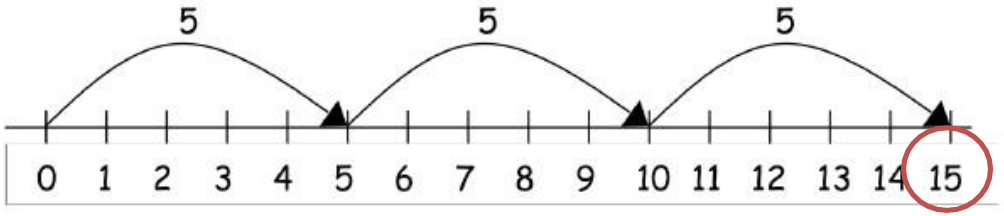
I can

-partition the numbers into hundreds, tens and ones
-subtract the ones, bottom from top
-subtract the tens, bottom from top
-subtract the ones, bottom from top

* if the bottom number is bigger than the top number regroup from the column on the left.

Stage 7	Children move onto regrouping. 754 – 86 = 668 614 1 7 5 4 - 8 6 6 6 8 Extend by subtracting numbers with different numbers of digits and by using decimal places.	**I can…** -Line the numbers up in their columns using place value. -subtract the ones -subtract the tens -subtract the hundreds * if the bottom number is bigger than the top number regroup from the column on the left.	

Multiplication		Try it…
Stage 1 Children use Pictures and symbols. There are 3 sweets in one bag. How many sweets are there in 5 bags? 	**I can…** -say how many groups I need. -count how many need to go in each group. -Count the total number of objects I have.	
Stage 2  6 x3 =18 Or 3 rows of 6. 6, three times Children create arrays to demonstrate multiplication as repeated addition.	**I can…** -Make groups of the number I am multiplying with counter. -Lay them in straight rows one beneath the other. -Read the array in rows.	

Stage 3 Children use repeated addition on a published number line. 5 x 3 = 15  Children to use written calculations to solve sums they can do mentally e.g. if a child knows their 5 times tables they should not be given this type of multiplication to solve. Arrays can be used here as well.	**I can…** -Start at 0 -Count in jumps of the number you are multiplying. (5) -The number of jumps should be the same as the multiplier.(3) **Teaching note:** It is important that the children are aware that multiplication is commutative like addition.	

Stage 4 Children use partitioning. 15 x 7 = 10 x 7 = 70 5 x 7 = 35 70 + 35 = 105 Extend into higher two digit numbers and encourage children to use known number facts.	**I can…** -Partition the two-digit number. -Lay the partitioned number out beneath in columns. -Multiply the tens by the multiplier. -Multiply the ones. -Add together the answers to find the product.	

Stage 5

Children use the grid method.

123 x 3 = 369

x	100	20	3	
3	300	60	9	= 369

Extend to HTU x U and TU x TU.

I can…

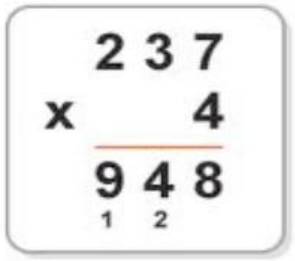
-Write the calculation.
-Partition the numbers into hundreds tens and ones.
-Multiply along the grid, from left to right.
-Write the answer in the corresponding box.
-Add the products together to find the answer.

Try it…….

Stage 6

Children use short multiplication (multiplication by a single digit) and long multiplication (multiplication by more than a single digit)

237 x 4 = 948



"Exchanged" – correct mathematical vocabulary for "carrying". For example, 28 ones can be exchanged for two tens and 8 ones. The tens are laid beneath the tens column.

Extend using larger digits and decimal points. 'Carried' numbers to sit just under the answer.

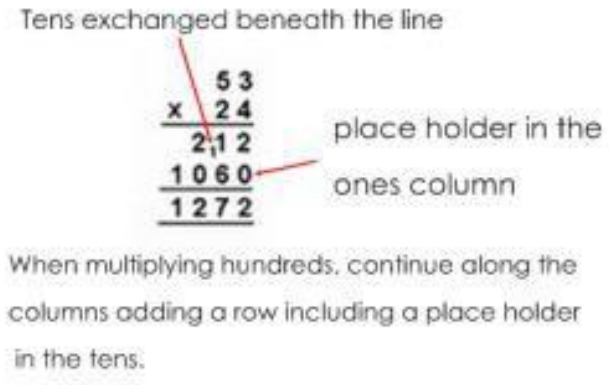
I can…

-Multiply the ones (exchanging the tens to the next column on the left.)

-Multiply the ten (remembering to add any tens exchanged and exchange the hundreds to the next column on the left)

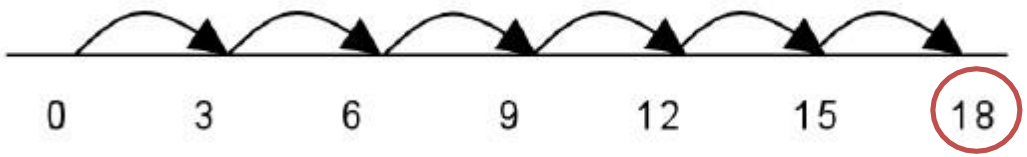
-Multiply the hundreds (remembering to add any tens exchanged and exchange the hundreds to the next column on the left)

Try it…….

Stage 7	I can:	Try it.....
	-Set up the calculation so that the bigger is number is on the top. -Start by multiplying the top number by the ones. -Move down to the next row and add a place holder in the ones. -Multiply the top number by the tens. -Keep adding a row and a place holder if there are hundreds and thousands. -Exchange beneath the row. -Add together the products to find the answer.	

Division		Try it……
Stage 1 Children use pictures to share objects out. 12 children get into teams of 4 to play a game. How many teams are there? 	**I can…** -Count out the biggest number identified in the problem. -Group into the lowest number you can. -Count how many groups you have.	

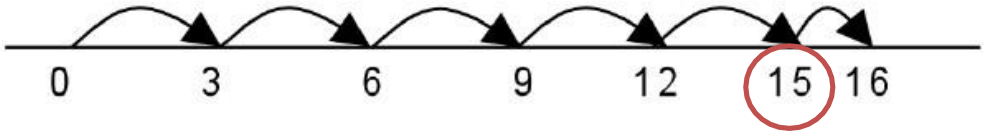
Stage 2 Children use a published number line to understand grouping. I Numicon to support. 6 ÷ 2 = 3  	**I can…** -I can start at 0 -Count in jumps of the number you are dividing by (the divisor) -The last jump lands on the dividend (the number you are dividing) -Count the number of jumps you have made.	

Stage 3	I can…	
Children draw an empty number line to understand grouping. 18 ÷ 3 = 6  	-Start at 0 -Count in jumps of the number you are dividing by (divisor). -The last jump lands on the dividend. (The number you are dividing) -Count the number of jumps you have made.	

Stage 4

Children are introduced to remainders and use an empty number line to solve calculations involving remainders. Extend by using larger numbers

16 ÷ 3 = 5r1



NB. Remember to teach real life problems where children have to round up because remainders are not appropriate. For example, ten children can sit at one table. There are 43 children. How many tables are needed so that each child can sit at a table?

I can…

-Start at 0

-Count in jumps of the divisor (the number you are dividing by)

-Keep going until you can't make another jump with the remaining amount.

-Count the number of jumps you have made.

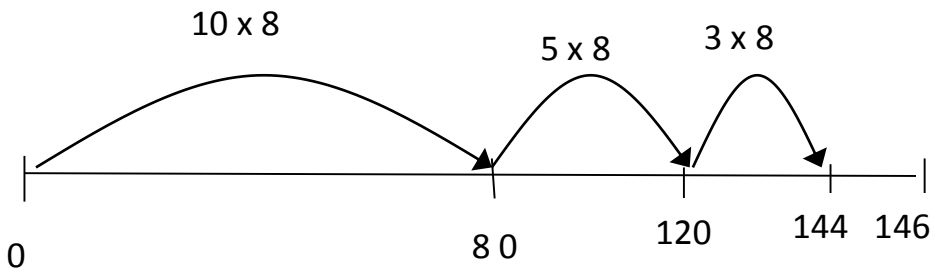
-Record the remainder.

Stage 5

Children use chunking on a number line for division

8 x table	
1 x	8
2 x	16
5 x	40
10 x	80
20 x	160
50 x	400

146 ÷ 8 = 18 r 2



Total all the chunks of 8 to find the answer

I can…

- complete a coin card to show multiples of the divisor. (1x, 2x, 5x, 10, 20, 50,)
- chunk off multiples of the divisor (8 x 10 in example)
- draw a jump on the number line and label each jump with the number of the divisor.
- continue to jump along the number line in multiples of the divisor until you reach the dividend (the number you are dividing)
- total all the chunks of 8 to find the answer.
- record the remainder.

Try it……

Stage 6

Short/Long Division

98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\ 9\ 8} \\ \quad 2 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 8\ 6\ \text{r}\,2 \\ 5\overline{)\ 4\ 3\ 2} \\ \quad 3 \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 4\ 5\ \text{r}\,1 \\ 1\ 1\overline{)\ 4\ 9\ 6} \\ \quad 5 \end{array}$$

Answer: $45\frac{1}{11}$

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\ \text{r}\,12 \\ 1\ 5\overline{)\ 4\ 3\ 2} \\ 3\ 0\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8 \\ 1\ 5\overline{)\ 4\ 3\ 2} \\ 3\ 0\ 0 \quad 15\times 20 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \quad 15\times 8 \\ \hline 1\ 2 \end{array}$$

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\cdot 8 \\ 1\ 5\overline{)\ 4\ 3\ 2\cdot 0} \\ 3\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2\ 0 \\ 1\ 2\ 0 \\ \hline 0 \end{array}$$

Answer: 28·8

I can…

-Divide into the dividend, one digit at a time, starting from the LEFT

-Put the result of each division directly above, on the top of the 'bus stop'

-If the small number won't go into a digit exactly, regroup the remainder across (to the next digit on the right). If it won't go at all put a 0 as a place holder and regroup the whole digit.