Bentley Heath Calculation Sequencing Guidance

The following document sets out the sequence and links that need to be drawn when teaching the four operations at Bentley Heath.

The document sets out the sequence for teaching addition and subtraction then the sequence for teaching multiplication and division.

Definitions:

CONCRETE – This resource can be moved, manipulated, rearranged and remade by pupils. Concrete resources can often be shown as pictures but may not easily be drawn/created by pupils e.g. Numicon, multilink

PICTORIAL – This representation is a picture that can be touched and may be drawn/created easily by the pupil. It represents the relative scale of and relationship between the numbers.

ABSTRACT – Using the abstract method requires a secure mental model of the relative scale of and relationship between the numbers to be successful. The pupils understand the real and relative values of the symbols within this method.

Addition and subtraction glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

Multiplication and division glossary

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

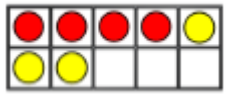
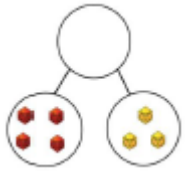
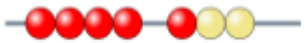
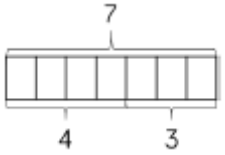
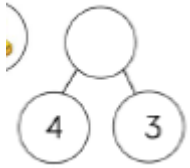
Product – The result of multiplying one number by another.

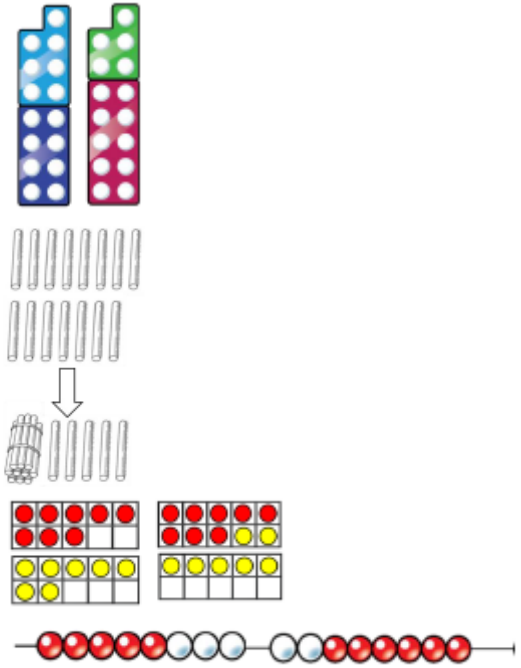
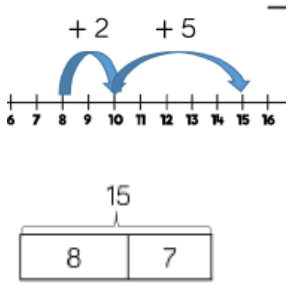
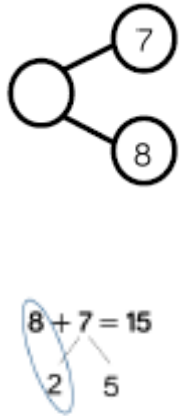
Quotient – The result of a division

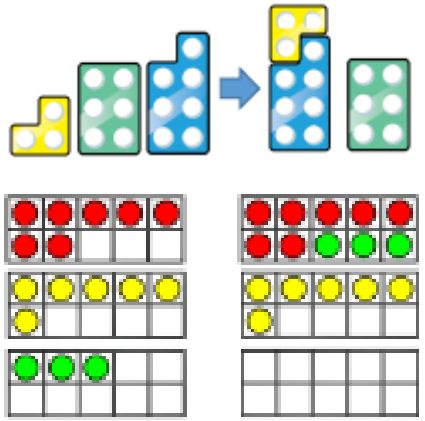
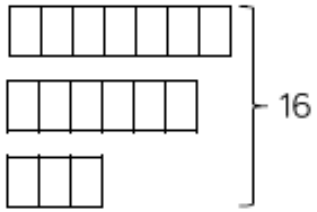
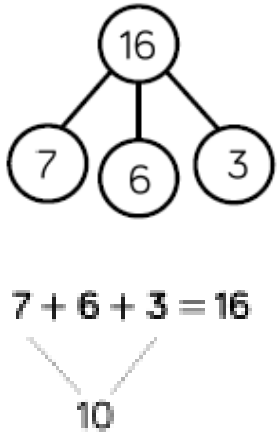
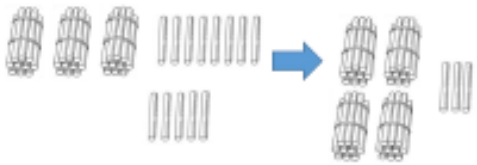
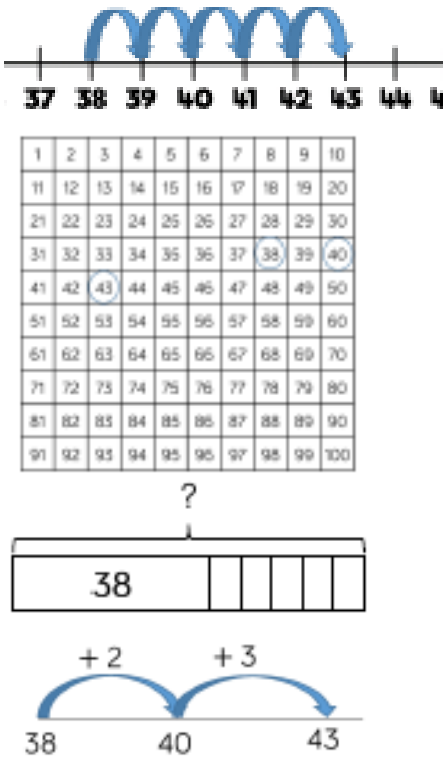
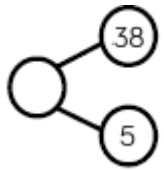
Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor

Addition

Skill / Year Group		Concrete Resources	Pictorial Representation	Abstract Method
Add two 1-digit numbers to 10 $4 + 3 = 7$	1	     	  	

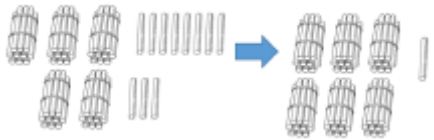
Add 1 and 2-digit numbers to 20 $8 + 7 = 15$	1			

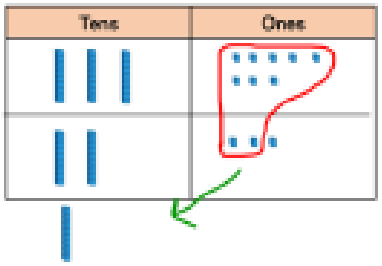
Add three 1-digit numbers $7 + 6 + 3 = 16$	2			
Add 1 and 2-digit numbers to 100 $38 + 5 = 43$	2			

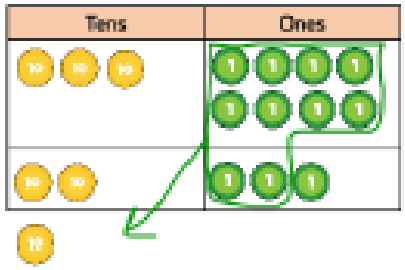
Add two 2-digit numbers

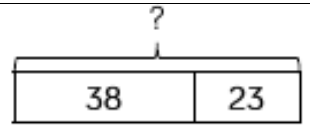
2

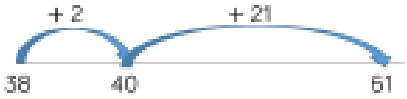
38 + 23 = 61

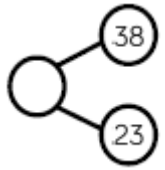








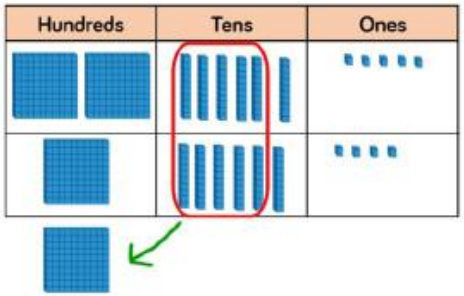


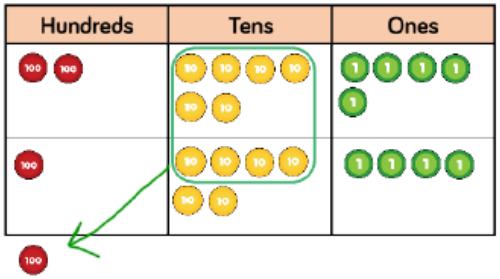


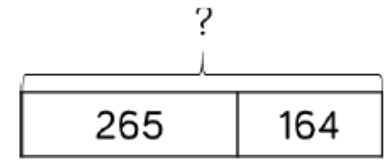
$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline {\scriptstyle 1} \end{array}$$

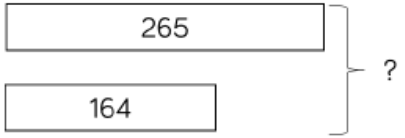
Add with up to 3-digits | 3

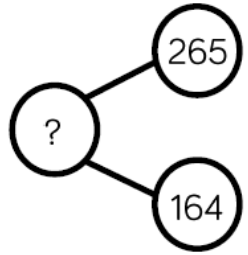
$265 + 164 = 429$







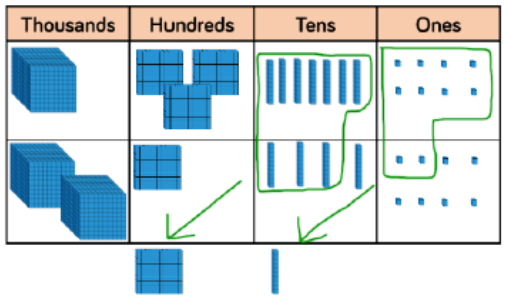


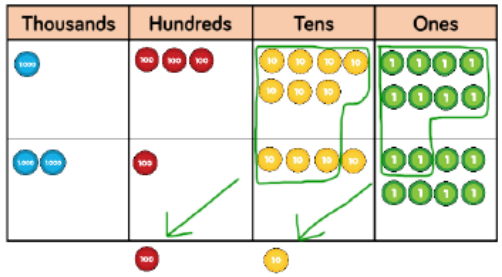


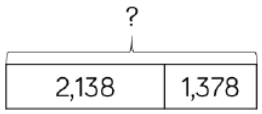
$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

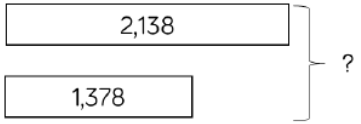
Add with up to 4-digits | 4

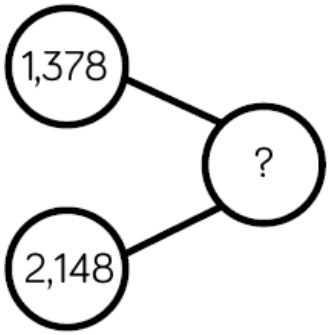
$1{,}378 + 2{,}148 = 3{,}526$









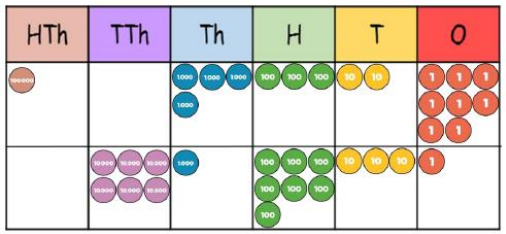


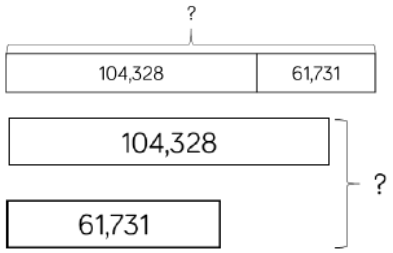
	1	3	7	8
+	2	1	4	8
	3	5	2	6
		1	1	

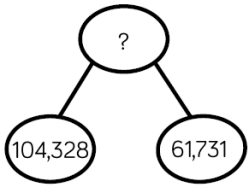
Add with more than 4 digits

5

104,328 + 61,731 = 166,059







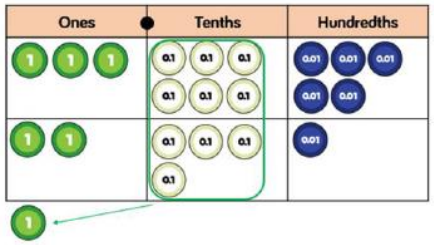
1	0	4	3	2	8
+	6	1	7	3	1
1	6	6	0	5	9

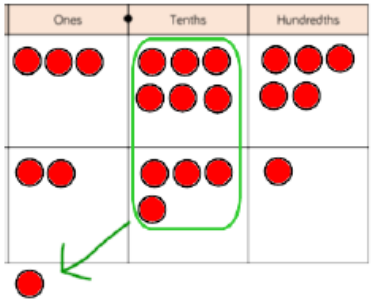
1

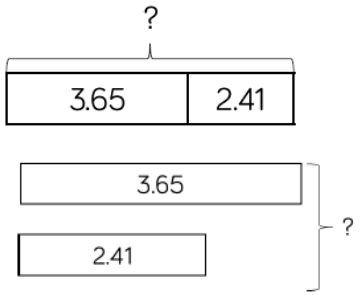
Add with up to 3 decimal places

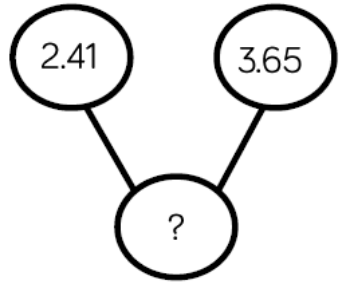
5

3.65 + 2.41 = 6.06



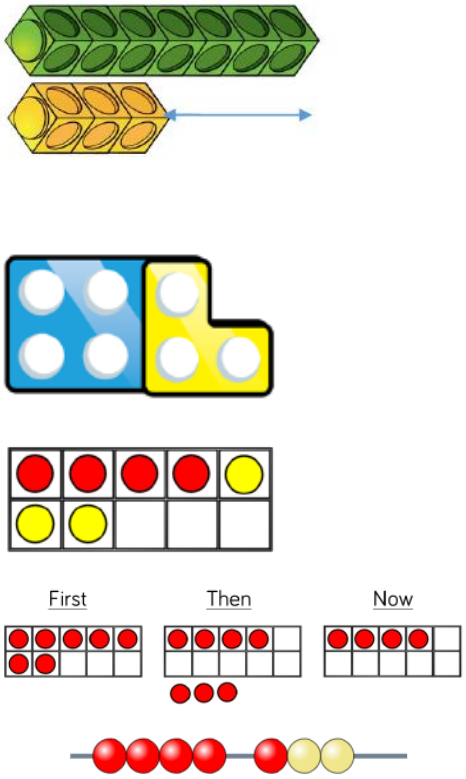
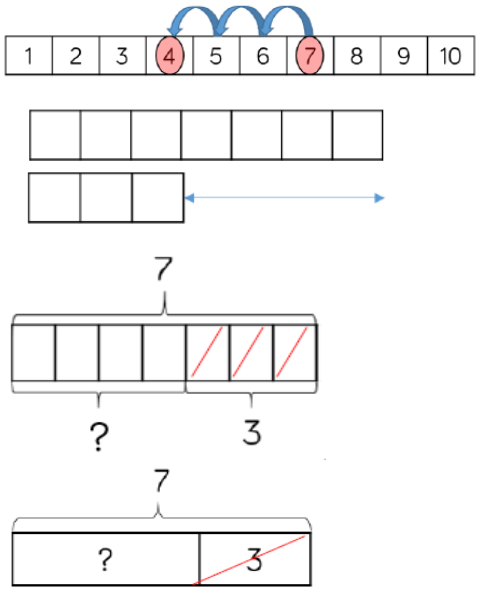
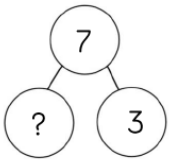


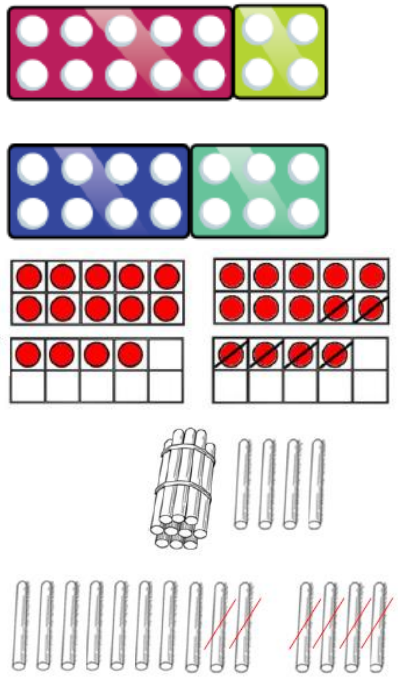
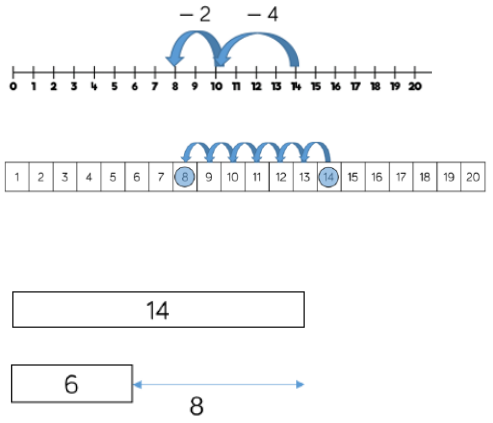
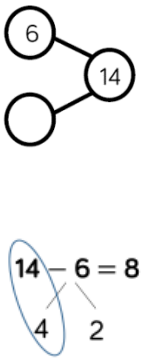




$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

Subtraction

Skill / Year Group		Concrete Resources	Pictorial Representation	Abstract Method
Subtract two 1-digit numbers to 10 $7 - 3 = 4$	1			

Subtract 1 and 2-digit numbers to 20 $14 - 6 = 8$	1			

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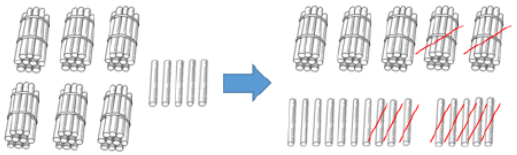
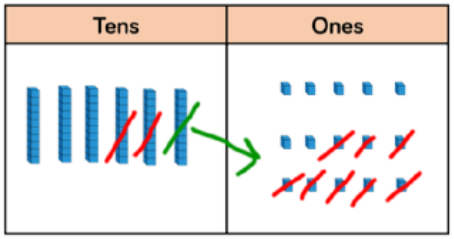
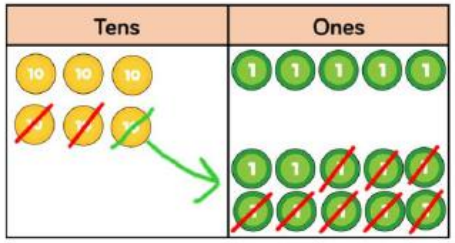
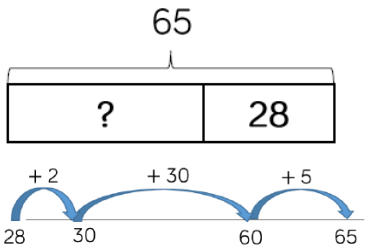
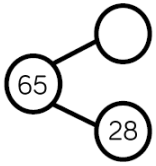
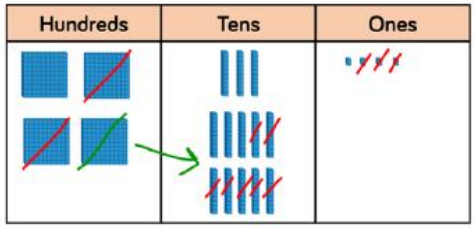
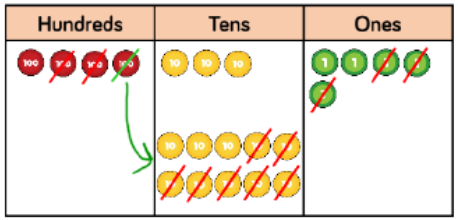
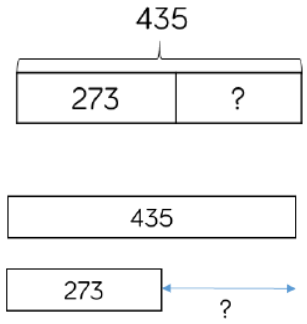
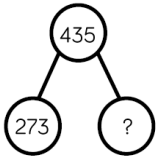
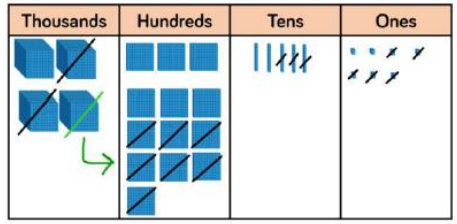
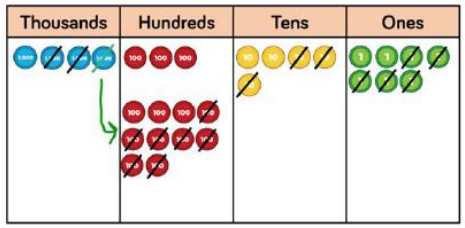
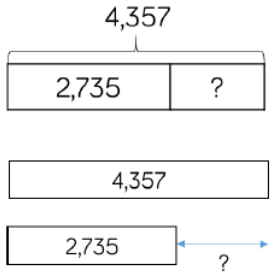
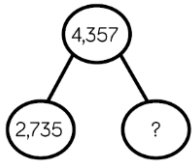
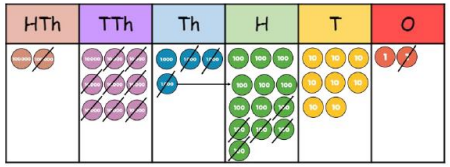
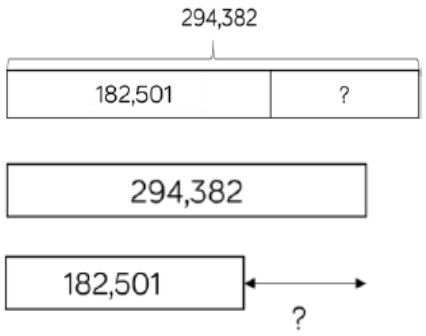
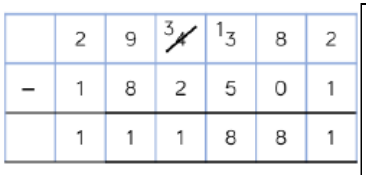
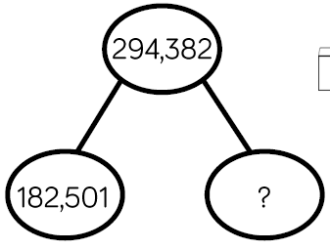
Subtract two 2-digit numbers

$65 - 28 = 37$</td>
<td>2

2</td>
<td> 
 
  </td>
<td>  </td>
<td> 
5 1
65
− 28
37</td>
</tr>
<tr>
<td>Subtract with up to 3-digits

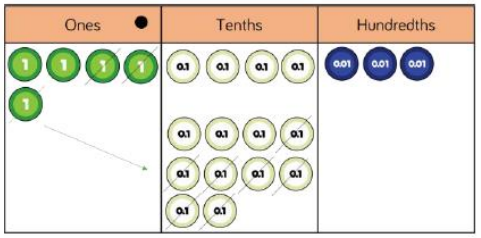
$435 - 273 = 262$</td>
<td>3</td>
<td> 
  </td>
<td>  </td>
<td> 
3 1
435
− 273
262</td>
</tr>
</table>

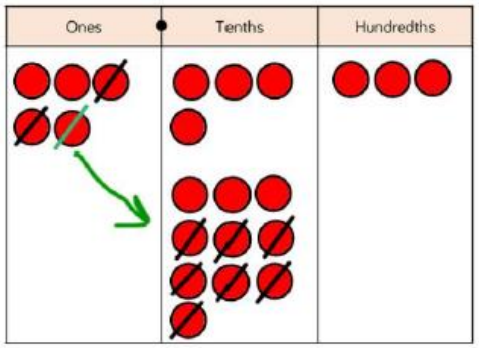
Subtract with up to 4-digits **4,357 − 2,735 = 1,622**	4		  	 3 1 4357 − 2735 1622
Subtract with more than 4 digits **294,382 − 182,501 = 111,881**	5		 	 

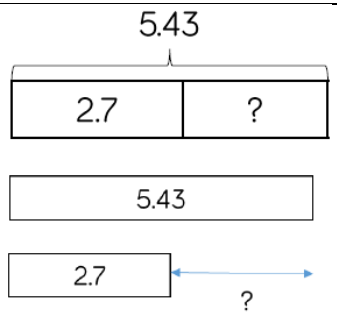
Subtract with up to 3 decimal places

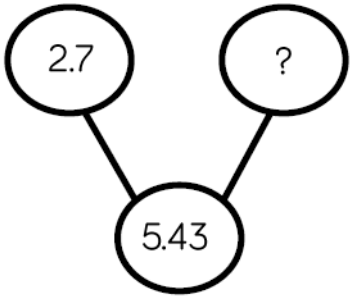
5

$$5.43 - 2.7 = 2.73$$



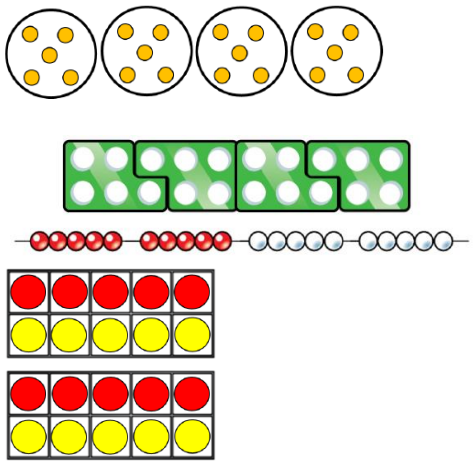
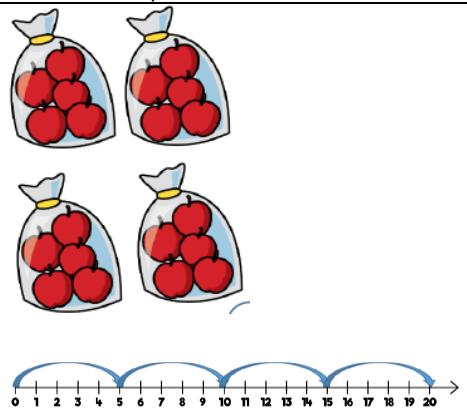






$$\begin{array}{r} {}^{4}\cancel{5}.{}^{1}43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$$

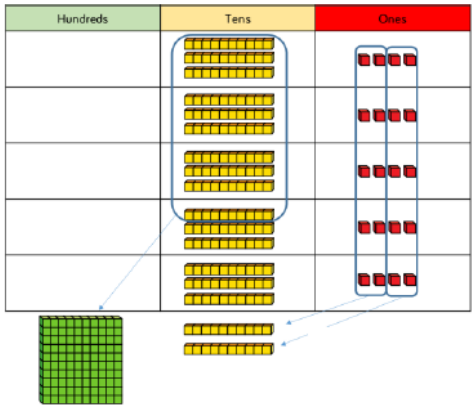
Multiplication

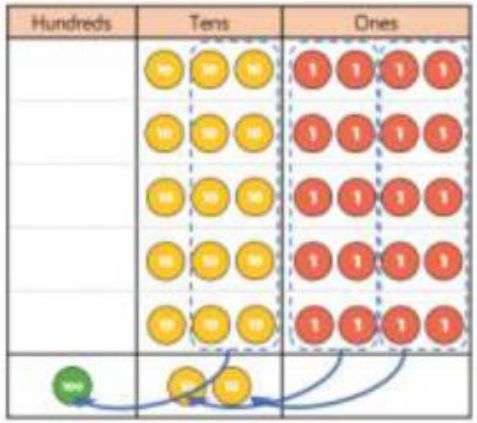
Skill / Year Group	Concrete Resources	Pictorial Representation	Abstract Method
Solve one-step problems with multiplication 1/2 One bag holds 5 apples. How many apples do 4 bags hold?		 5 (apples) x 4 (bags) = 20	$5 + 5 + 5 + 5 = 20$ $4 \times 5 = 20$ $5 \times 4 = 20$

Multiply 2-digit by 1-digit numbers

3/4

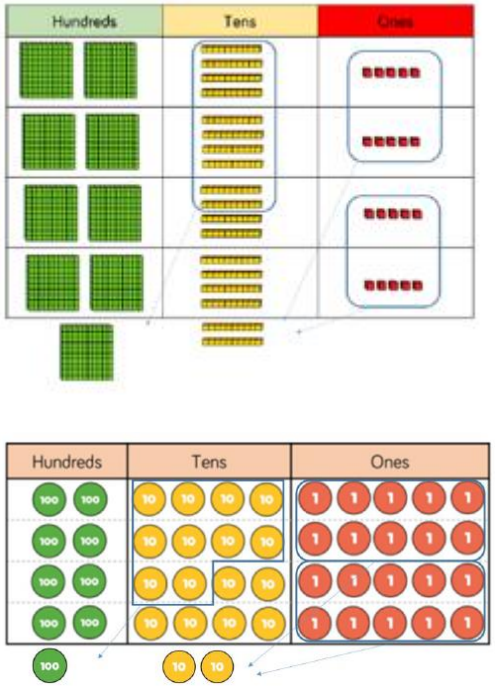
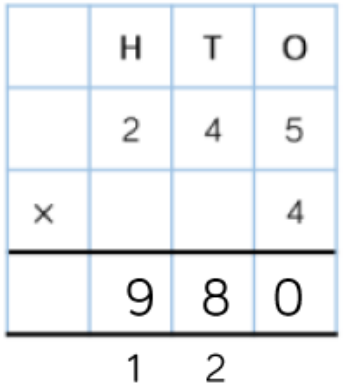
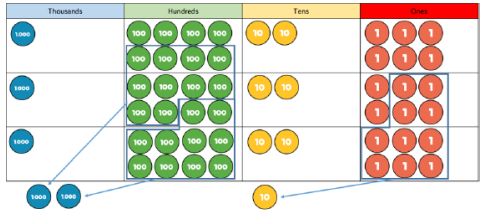
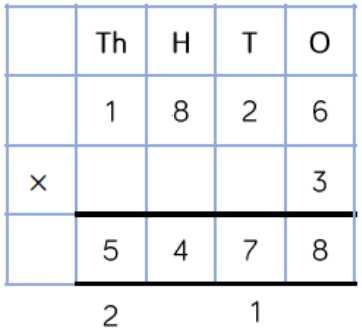
$$34 \times 5 = 170$$





	H	T	O	
		3	4	
×			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	

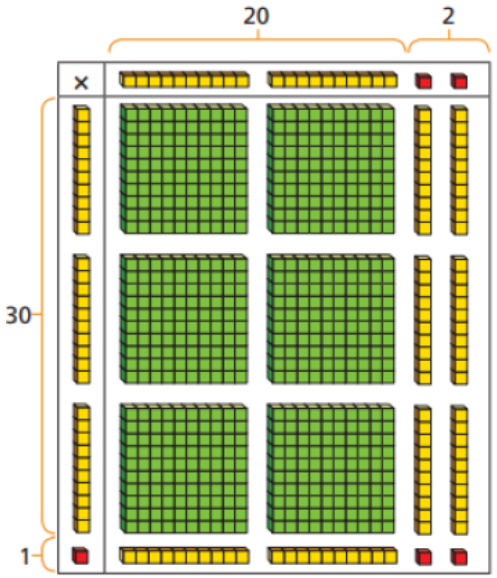
	H	T	O	
		3	4	
×			5	
	1	7	0	
	1	2		

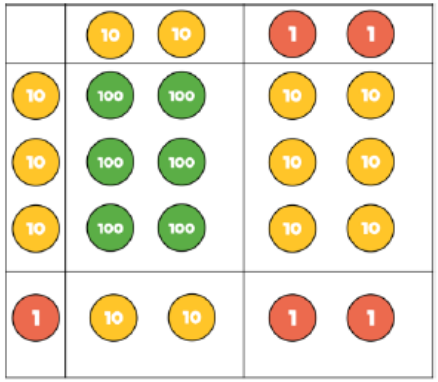
Multiply 3-digit by 1-digit numbers $245 \times 4 = 980$	4			
Multiply 4-digit by 1-digit numbers $1{,}826 \times 3 = 5{,}478$	5			

Multiply 2-digit by 2-digit numbers

5

$22 \times 31 = 682$





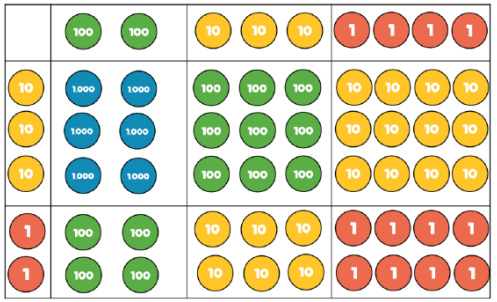
×	20	2
30	600	60
1	20	2

	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

Multiply 2-digit by 3-digit numbers

5

234 × 32 = 7,488



×	200	30	4
30	6,000	900	120
2	400	60	8

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

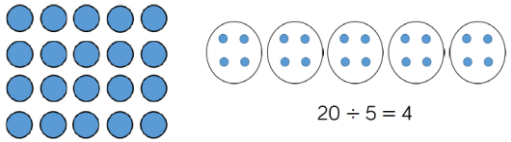
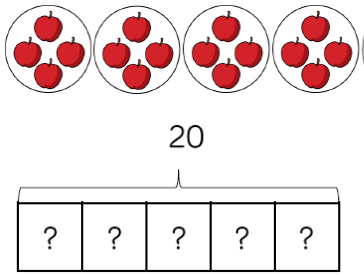
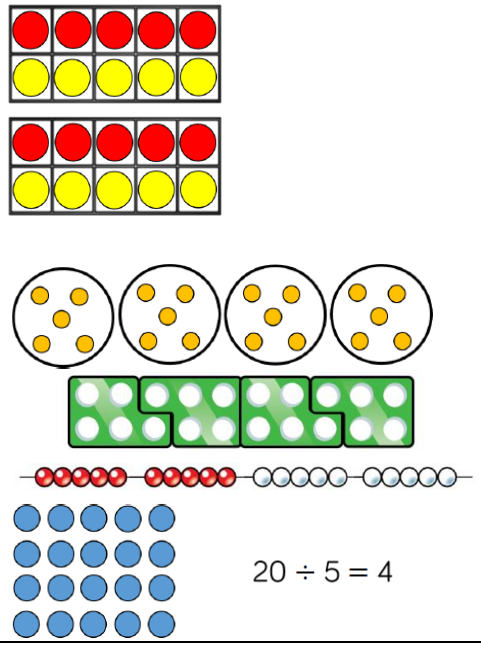
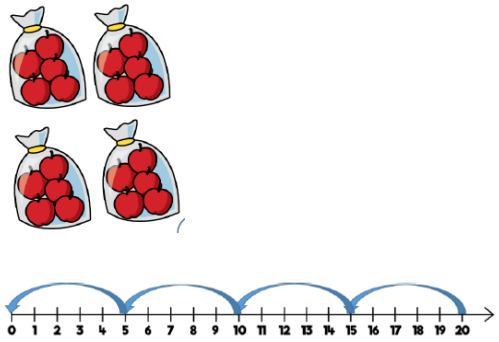
Multiply 2-digit by 4-digit numbers

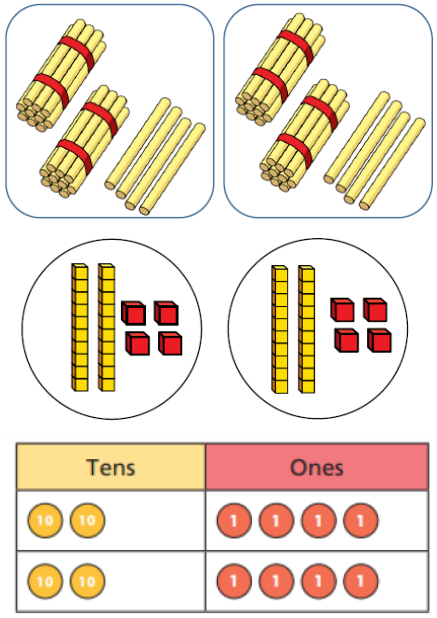
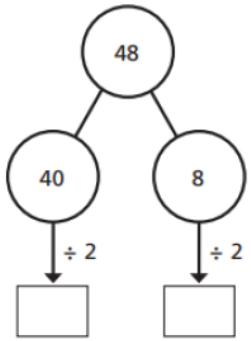
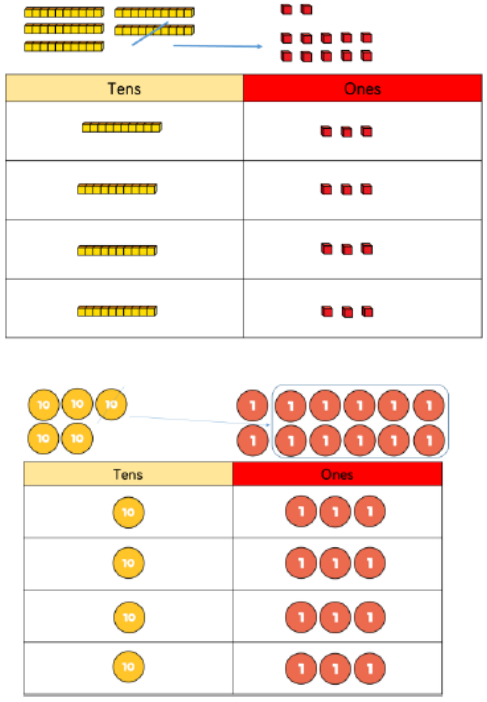
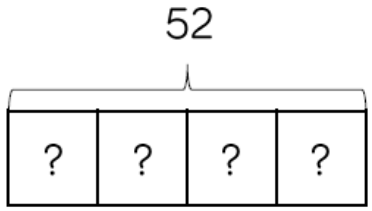
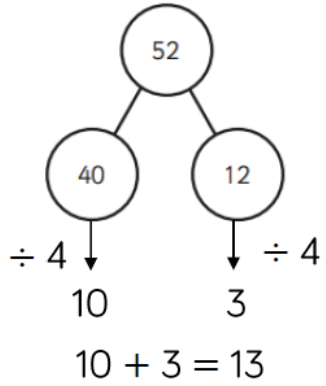
5/6

2,739 × 28 = 76,692

TTh	Th	H	T	O
	2	7	3	9
×			2	8
$^{2}2$	$^{5}1$	$^{3}9$	$^{7}1$	2
$^{1}5$	4	$^{1}7$	8	0
7	6	6	9	2
		1		

Division

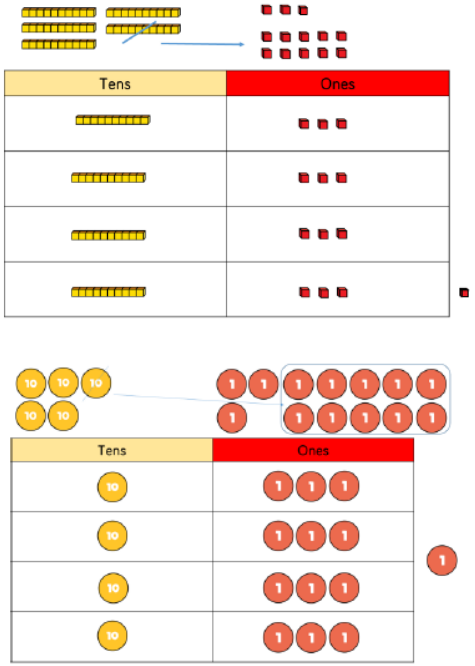
Skill / Year Group	Concrete Resources	Pictorial Representation	Abstract Method
Solve one-step problems with division (sharing) 1/2 There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?			
Solve one-step problems with division (grouping) 1/2 There are 20 apples altogether. They are put in bags of 5. How many bags are there?			

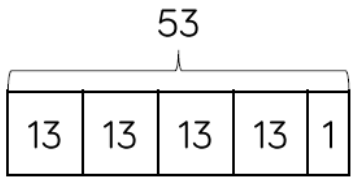
Divide 2-digits by 1-digit (no exchange sharing) **48 ÷ 2 = 24**	3			
Divide 2-digits by 1-digit (sharing with exchange) **52 ÷ 4 = 13**	3			

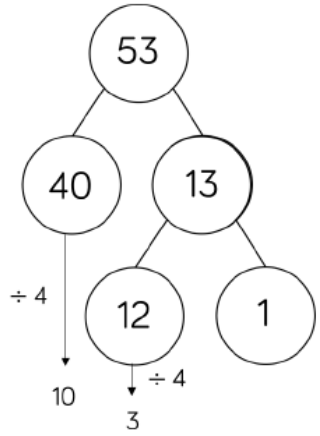
Divide 2-digits by 1-digit (sharing with remainders)

3/4

53 ÷ 4 = 13 r1



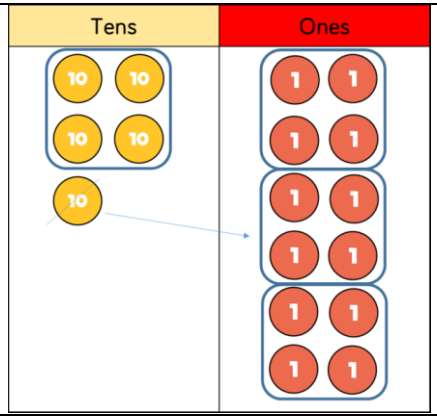


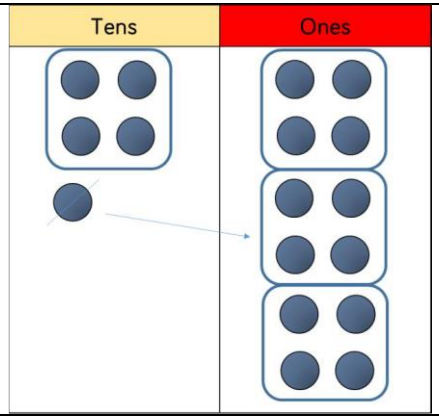


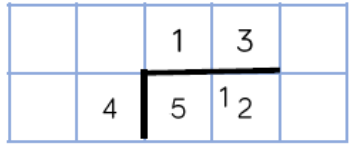
Divide 2-digits by 1-digit (grouping)

4/5

52 ÷ 4 = 13

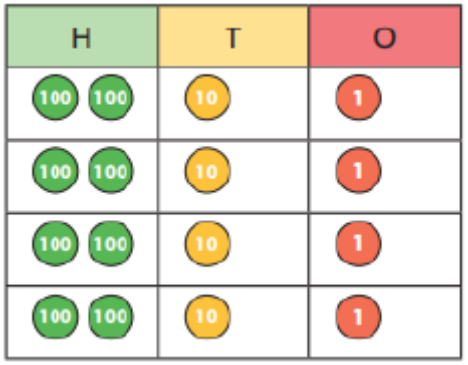


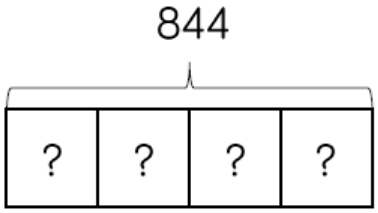


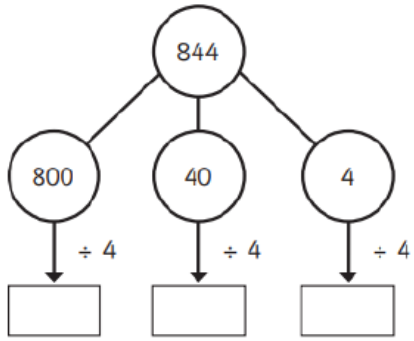


Divide 3 digits (sharing) - Y4

844 ÷ 4 = 211

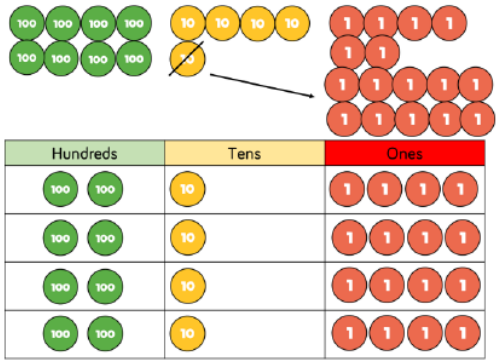


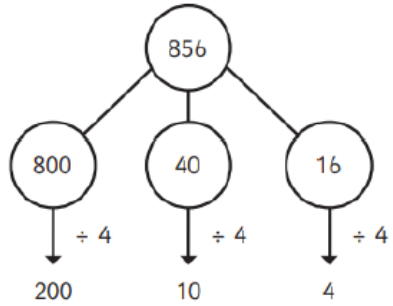




Divide 3 digits (sharing with exchange) - Y4

856 ÷ 4 = 214

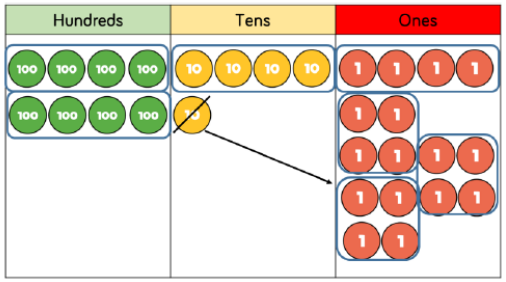


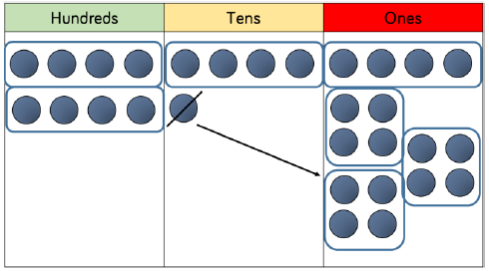


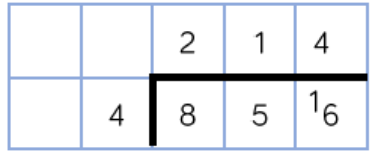
Divide 3-digits by 1-digit (grouping)

4/5

856 ÷ 4 = 214

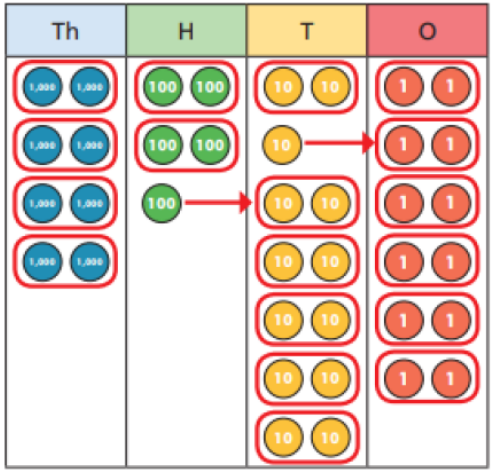






Divide 4-digits by 1-digit (grouping)	5			

$$8{,}532 \div 2 = 4{,}266$$



	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

$$5 \overline{)\,1\,2^{2}3^{3}4.^{4}0} \quad 2\,4\,6 \bullet 8$$

$$5 \overline{)\,7^{2}\,9.^{4}\,0} \quad 1\,5.\,8$$

Divide multi-digits by 2-digits (long division)	6