



## Knowles Primary School Written Methods October 2013

This is Knowles Primary School's agreed progression for teaching formal written calculations. It is important to us that children have secure processes for mathematical calculations. Teachers need to be aware of the statutory guidance in the New Curriculum for their year group, when teaching written methods, however it is essential that all pupils are taught according to their need.

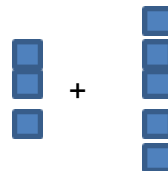
- October 2013** – Children in Years 3, 2 and 1 will start the progression to learn the agreed formal written methods for addition, subtraction, multiplication and division.
- Children in Year 4 will learn the agreed formal written methods for addition, subtraction and multiplication.
  - Children in Year 5 and 6 will continue using the efficient written methods which have been learnt to date.

### Addition

Pupils should be taught to add numbers using concrete objects, pictorial representations, and mentally. Children in Key stage 1 will be taught using both horizontal and vertical setting out. They will also be taught to partition and recombine using tens and units.

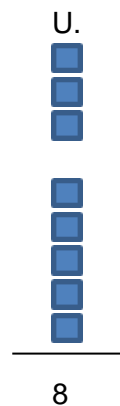
Each stage below should be modelled using Dienes apparatus, then if needed, and appropriate, draw the Dienes blocks alongside using the blocks. Then move on to showing the written calculation.

1)  $3 + 5 = 8$



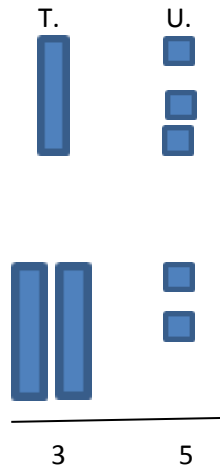
2)  $3 + 5 =$

$$\begin{array}{r} \text{U} \\ 3 \\ + 5 \\ \hline 8 \end{array}$$



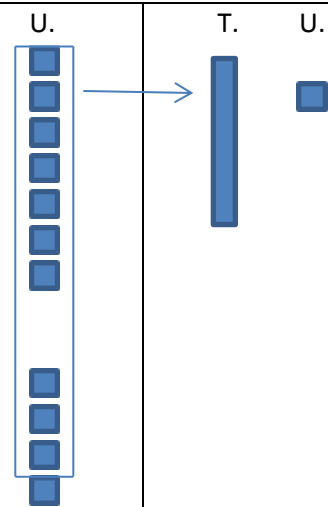
3)  $13 + 22 = 35$

T.	U
1	3
+ 2	2
3	5



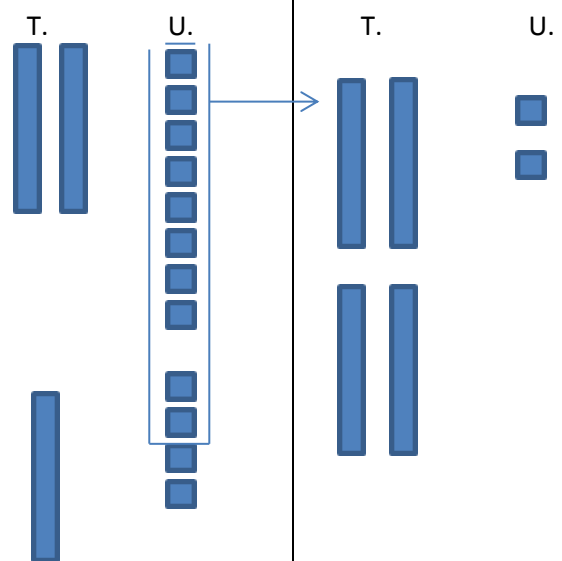
4)  $7 + 4 = 11$

T.	U
	7
+	4
1	1



5)  $28 + 14 =$

T.	U
2	8
+	1
1	4
4	2
1	



6)  $145 + 272 =$

	H.	T.	U.
	1	4	5
+	2	7	2
<hr/>			
	4	1	7
	1		

With apparatus to start with, as above.

## Subtraction

Pupils should be taught to subtract numbers using concrete objects, pictorial representations, and mentally.

Children in Key stage 1 will start subtracting by taking away, using concrete apparatus.

They will then move on to writing subtraction number sentences horizontally

$$14 - 6 = 8$$

Then they will turn the calculation vertically in order that they are familiar with both forms.

Each stage below should be modelled using Dienes apparatus, then if needed, and appropriate, draw the Dienes blocks alongside using the blocks. Then move on to showing the written calculation.

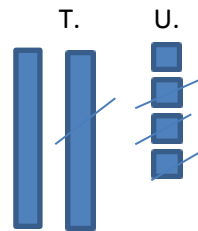
1)  $8 - 6 = 2$

$$\begin{array}{r} \text{U.} \\ 8 \\ - 6 \\ \hline 2 \end{array}$$



2)  $24 - 13 =$

$$\begin{array}{r} \text{T. U.} \\ 2 \ 4 \\ - 1 \ 3 \\ \hline 1 \ 1 \end{array}$$

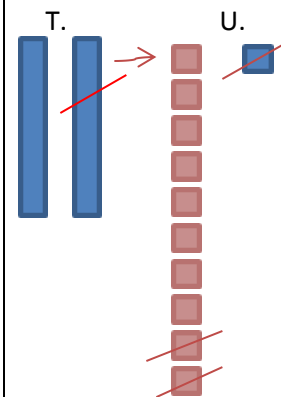
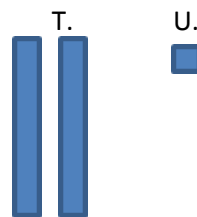


Start with Dienes blocks.

4 units subtract 3 units leaves 1 unit,  
2 tens subtract 1 ten leaves 1 ten, or 20  
subtract 10 leaves 10.

3)  $21 - 13 =$

$$\begin{array}{r} \text{T. U.} \\ 1 \cancel{2} \ 1 \\ - 1 \ 3 \\ \hline 8 \end{array}$$



Start with Dienes blocks.

1 unit subtract 3 units (not enough units), so  
change 1 ten into 10 units.  
Now there are 11 units, subtract 3 units which  
leaves 8 units.  
Now there is 1 ten, subtract 1 ten, which  
leaves 0 tens .

<p>4) <math>214 - 162 =</math></p> <table style="margin-left: 100px;"> <thead> <tr> <th></th> <th>H.</th> <th>T.</th> <th>U.</th> </tr> </thead> <tbody> <tr> <td></td> <td><del><sup>1</sup>2</del></td> <td><del><sup>1</sup>1</del></td> <td>4</td> </tr> <tr> <td>-</td> <td>1</td> <td>6</td> <td>2</td> </tr> <tr> <td colspan="4" style="border-top: 1px solid black;"></td> </tr> <tr> <td></td> <td></td> <td>5</td> <td>2</td> </tr> </tbody> </table>		H.	T.	U.		<del><sup>1</sup>2</del>	<del><sup>1</sup>1</del>	4	-	1	6	2							5	2	<p>Start with Dienes blocks.  4 units subtract 2 units, leaves 2 units.  1 ten subtract 6 tens (or 10 subtract 60).  (Not enough tens), so change a hundred into 10 tens.  Now there are 11 tens so subtract 6 tens, which leaves 5 tens or <math>110 - 60 = 50</math>.  1 hundred subtract 1 hundred leaves 0.</p>
	H.	T.	U.																		
	<del><sup>1</sup>2</del>	<del><sup>1</sup>1</del>	4																		
-	1	6	2																		
		5	2																		
<p>5) <math>423 - 164 =</math></p> <table style="margin-left: 100px;"> <thead> <tr> <th></th> <th>H.</th> <th>T.</th> <th>U.</th> </tr> </thead> <tbody> <tr> <td></td> <td><del><sup>3</sup>4</del></td> <td><del><sup>11</sup>2</del></td> <td><del><sup>1</sup>3</del></td> </tr> <tr> <td>-</td> <td>1</td> <td>6</td> <td>4</td> </tr> <tr> <td colspan="4" style="border-top: 1px solid black;"></td> </tr> <tr> <td></td> <td>2</td> <td>5</td> <td>9</td> </tr> </tbody> </table>		H.	T.	U.		<del><sup>3</sup>4</del>	<del><sup>11</sup>2</del>	<del><sup>1</sup>3</del>	-	1	6	4						2	5	9	<p>Start with Dienes blocks.  3 units subtract 4 units, (not enough units) so change a ten into 10 units.  Now there are 13 units, subtract 4 units which leaves 9 units.  There is only 1 ten and 6 tens need to be taken away (not enough tens). So change 1 hundred into 10 tens.  Now there are 11 tens, subtract 6 tens, which leaves 5 tens.  Finally there are 3 hundreds, so subtract 1 hundred which leaves 2 hundreds.</p>
	H.	T.	U.																		
	<del><sup>3</sup>4</del>	<del><sup>11</sup>2</del>	<del><sup>1</sup>3</del>																		
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	2	5	9																		
<p>6) <math>600 - 134 =</math></p> <table style="margin-left: 100px;"> <thead> <tr> <th></th> <th>H.</th> <th>T.</th> <th>U.</th> </tr> </thead> <tbody> <tr> <td></td> <td><del><sup>5</sup>6</del></td> <td><del><sup>9</sup>10</del></td> <td><del><sup>1</sup>0</del></td> </tr> <tr> <td>-</td> <td>1</td> <td>3</td> <td>4</td> </tr> <tr> <td colspan="4" style="border-top: 1px solid black;"></td> </tr> <tr> <td></td> <td>4</td> <td>6</td> <td>6</td> </tr> </tbody> </table>		H.	T.	U.		<del><sup>5</sup>6</del>	<del><sup>9</sup>10</del>	<del><sup>1</sup>0</del>	-	1	3	4						4	6	6	<p>Start with Dienes blocks.  0 units subtract 4 units, (there are not enough units), so go to the tens column, but there are no tens.  So go to the hundreds and change a hundred into 10 tens.  Now there are 10 tens so 1 ten can be changed into units.  So there are now 10 units and 9 tens.  Now 4 units can be subtracted from the 10 units which leaves 6 units.  Next subtract 3 tens from the 9 tens, which leaves 6 tens.  Finally subtract 1 hundred from the 5 hundreds which leaves 4 hundreds.</p>
	H.	T.	U.																		
	<del><sup>5</sup>6</del>	<del><sup>9</sup>10</del>	<del><sup>1</sup>0</del>																		
-	1	3	4																		
	4	6	6																		

## Multiplication

Children in KS1 will start multiplication by using concrete apparatus, arrays, repeated addition, mental methods and multiplication facts.

They will write multiplication number sentences horizontally  $4 \times 2 = 8$

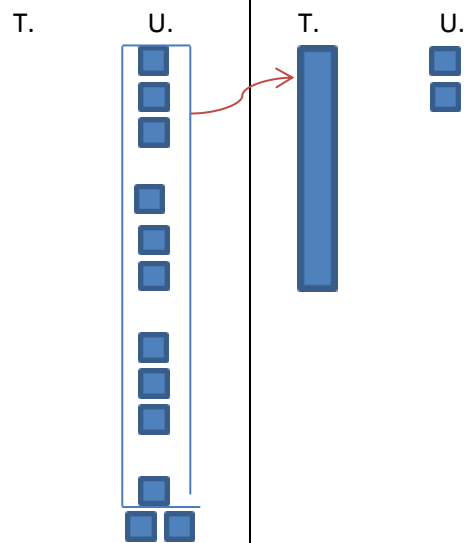
In Key stage 2 they will turn the calculation vertically in order that they are familiar with both forms.

Each stage below should be modelled using Dienes apparatus, then if needed, and appropriate, draw the Dienes blocks alongside using the blocks. Then move on to showing the written calculation.

**All children need to learn their tables.**

1)  $3 \times 4 =$

$$\begin{array}{r}
 \text{T. U} \\
 3 \\
 \times 4 \\
 \hline
 12
 \end{array}$$



2)  $14 \times 3 =$

$$\begin{array}{r}
 \text{T. U.} \\
 14 \\
 \times 3 \\
 \hline
 42 \\
 1
 \end{array}$$

3)  $24 \times 26 =$

$$\begin{array}{r}
 \text{H. T. U.} \\
 24 \\
 \times 26 \\
 \hline
 144 \quad (6 \times 4) \\
 480 \quad (6 \times 20) \\
 480 \quad (20 \times 4) \\
 4800 \quad (20 \times 20) \\
 \hline
 624
 \end{array}$$

4)  $146 \times 14 =$

	H.	T.	U.	
	1	4	6	
X		1	4	
		2	4	(4 x 6)
	1	6	0	(4 x 40)
	4	0	0	(4 x 100)
		6	0	(10 x 6)
	4	0	0	(10 x 40)
1	0	0	0	(10 x 100)
	2	0	4	4
	1			

5)  $124 \times 6 =$

Most able children should be encouraged to complete the multiplication calculation using this method.

	1	2	4	
X		2	6	
	7	4	4	
	1	2	4	
	2	4	8	0
	3	2	2	4
	1	1		

## Division

Children in KS1 will start division by using concrete apparatus, arrays, mental methods and division facts.

They will write division number sentences horizontally  $8 \div 2 = 4$

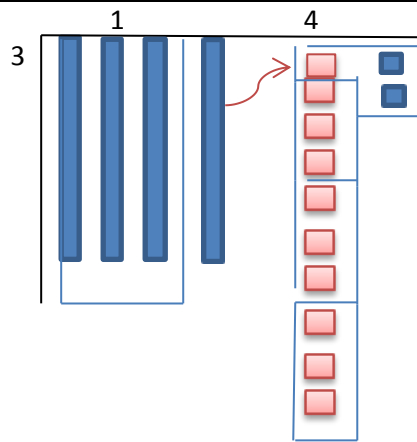
In Key stage 2 they will turn the calculation into short division calculations.

Each stage below should be modelled using Dienes apparatus, then if needed, and appropriate, draw the Dienes blocks alongside using the blocks. Then move on to showing the written calculation.

### Short Division

1)  $42 \div 3 = 14$

There are 4 tens to be put into groups of 3.  
So there is 1 group of 3 tens and 1 ten left.  
The ten that is left is changed into units, so there are now 12 units.  
The 12 units are to be put into groups of 3, which is 4 groups.  
So the answer is 14.



$$3 \overline{) 42} \begin{array}{r} 14 \\ 4 \phantom{2} \\ \underline{12} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

2)  $432 \div 5 = 86 \text{ remainder } 2$

$$5 \overline{) 432} \begin{array}{r} 86 \text{ r } 2 \\ 4 \phantom{3} \phantom{2} \\ \underline{40} \phantom{2} \\ 32 \\ \underline{30} \\ 2 \end{array}$$

3)  $496 \div 11 = 45 \frac{1}{11}$

$$11 \overline{) 496} \begin{array}{r} 45 \text{ r } 1 \\ 4 \phantom{9} \phantom{6} \\ \underline{44} \phantom{6} \\ 96 \\ \underline{95} \\ 1 \end{array}$$

4)  $432 \div 15 = 28.8$

$$15 \overline{) 432.0} \begin{array}{r} 28.8 \\ 4 \phantom{3} \phantom{2} \phantom{.} \phantom{0} \\ \underline{30} \phantom{2} \phantom{.} \phantom{0} \\ 32 \phantom{.} \phantom{0} \\ \underline{30} \phantom{.} \phantom{0} \\ 20 \\ \underline{15} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \end{array}$$



Long Division

5)  $432 \div 15 = 28.8$

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \phantom{0} \\ 132 \\ \underline{120} \phantom{0} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

The diagram shows the long division of 432 by 15. The quotient is 28.8. The dividend is 432.0. The divisor is 15. The first step is to divide 43 by 15, which gives 2 with a remainder of 13. The second step is to bring down the 2, making the number 132. Dividing 132 by 15 gives 8 with a remainder of 12. The third step is to bring down the 0, making the number 120. Dividing 120 by 15 gives 8 with a remainder of 0. Blue arrows indicate the downward movement of the decimal point and the bringing down of the next digit.