Understanding Subtraction a complete process

WorkNotes

Teaching Subtraction

OBJECT

To teach successful methods for the vertical subtraction algorithm.

LANGUAGE

While I firmly believe that if you want "to do the maths you must be able to talk the maths" there are times when young learners do not need to know all the language. By all means use the words, however, a young learner should not be expected to know the words and the definitions are not required for learning subtraction. That said to explain the process I will list the formal terms for subtraction.

<u>Minuend</u> – the number you start with

<u>Subtrahend</u> – the number you are subtracting

<u>Difference</u> – the answer (difference is self-evident from the language. Eg. 68 - 25 = 43

 $68 - \leftarrow \text{Minuend}$ $25 \leftarrow \text{Subtrahend}$

 $\overline{43}$ \leftarrow Difference

PROCESS

While people often incorrectly propagate the concept 'New mathematics', subtraction, in fact, is one of the rare areas where there is an alternative method being taught for processing specific questions. I will fully demonstrate both methods.

It is important for me to add that I consider it inappropriate to challenge which method is being used if the young learner is competent and successful.

Simple subtraction. This is where all place value numbers of the minuend are larger than corresponding place value numbers of the subtrahend.

Eg. 68 - 25 = 43

Other subtraction. This is where some place value numbers of the minuend are smaller than corresponding place value numbers of the subtrahend.

Eg. 63 - 25 = 38

Borrow and pay back. This is the traditional method used for subtraction

Decomposition method. Also referred to as trading. This modern process is now generally accepted as a better method.

METHOD Simple subtraction

Eg. 76 - 34 =

Rewrite as an vertical algorithm. The location of the subtraction sign varies depending on the curriculum, however, it doe not change the method. It is of utmost importance that the numbers are written neatly in place value columns.

NO	NO
266-	266-
123	123
	NO 266- 123

Т	he incorrect structure can and will lead to errors.
	76- <u>34</u>
Start with the units column.	76- 34
	$\frac{1}{12}$ k 6 - 4 = 2
Now the tens column.	76- 34
	$\overline{42}$
Hence 76 – 34 = 42	
Eg. 838 – 417 = Rewrite as an vertical algorithm.	
	838 - <u>417</u>
Start with the units column.	838-
	$\frac{417}{1}$ N 8 - 7 = 1
Next is the tens column.	0 2 0
	$\frac{417}{21}$
	$\uparrow \\ 3-1=2$
Now the hundreds column.	838 - <u>417</u>
	421 8 - 4 = 4 7

Hence 838 – 417 = 421

62 -17

Borrow and pay back

Eg. 62 - 27 =

-27-

Start with the units column.

Since 7 is larger than 2 borrow one lot of 10s and pay back by increasing the 10s subtrahend (bottom) by 1. The number in the minuend (top) of the units column is now 10 + 2 = 12



Now the tens column.

Remembering that you have paid back one lot of 10s the bottom 10s number is 1 + 1 = 2

6

$$6^{-1}2 - \frac{1}{1} \frac{7}{4} \frac{7}{5} - 2 = 4 7$$

Hence 62 - 27 = 45

Eg. 548 - 263 =Rewrite as an vertical algorithm.

Start with the units column.

$$5 48 - \frac{2 63}{5}$$

\$\overline\$ 8 - 3 =

5

548-263

Next is the tens column.

Since 6 is larger than 4 borrow one lot of 100s and pay back by increasing the 100s subtrahend (bottom) by 1. The number in the minuend (top) of the tens column is now 10 + 4 = 14. Here we deal with the numbers in the column and not their real value (which is 100 + 40 = 140)

$$5^{-1}4 8 - \frac{2_1 6 3}{8 1}$$

$$\uparrow$$

$$14 - 6 = 8$$

Now the hundreds column.

Remembering that you have paid back one lot of 100s the bottom 100s number is 2 + 1 = 3. Here we deal with the numbers in the column and not their real value (which is 500 - 200 = 300)

$$5^{-1}48 - \frac{2_1 63}{2 8 1}$$

5 - 3 = 2 7

Hence 838 – 417 = 421

4209-1736

Eg. 4209 - 1736 =Rewrite as an vertical algorithm.

Start with the units column.

 $\frac{42\ 0\ 9}{17\ 3\ 6} - \frac{17\ 3\ 6}{3}$ $\boxed{8}\ 9 - 6 = 3$

Next is the tens column.

Since 3 is larger than 0 borrow one lot of 100s and pay back by increasing the 100s subtrahend (bottom) by 1. The number in the minuend (top) of the tens column is now 10 + 0 = 10. Here we deal with the numbers in the column and not their real value (which is 100 + 0 = 100)

$$\begin{array}{r} 42 \ ^{1}09 - \\ \hline 17_{1} \ 36 \\ \hline 7 \ 3 \\ \hline \\ 10 - 3 = 7 \end{array}$$

Next is the hundreds column.

Remembering that you have paid back one lot of 100s the bottom 100s number is 7 + 1 = 8.

Since 8 is larger than 2 borrow one lot of 1000s and pay back by increasing the 1000s subtrahend (bottom) by 1. The number in the minuend (top) of the tens column is now 10 + 2 = 12. Here we deal with the numbers in the column and not their real value (which is 1000 + 200 = 1200)

$$\begin{array}{r}
4 & 12 & 10 & 9 \\
\hline
1 & 17 & 3 & 6 \\
\hline
4 & 7 & 3 \\
\hline
12 & -8 &= 4
\end{array}$$

Now the thousands column.

Remembering that you have paid back one lot of 1000s the bottom 1000s number is 1 + 1 = 2. Here we deal with the numbers in the column and not their real value (which is 4000 - 2000 = 2000)

$$4^{1}2^{1}09 - \frac{1_{1}7_{1} \ 36}{2 \ 4 \ 7 \ 3}$$
$$4 - 2 = 2 \ 7$$

Hence 4209 - 1736 = 2473

62 -17

Decomposition method

Eg. 62 - 27 =

Start with the units column.

Since 7 is larger than 2 trade one lot of 10s to the units column. The number in the minuend (top) of the units column is now 10 + 2 = 12. The number in the minuend (top) of the tens column is now 6 - 1 = 5

$$56^{1}2 - \frac{17}{5}$$

 $12 - 7 = 5$

Now the tens column.

Remembering that you have traded one lot of 10s the top 10s number is now 6 - 1 = 5

$$5 - 1 = 4 7$$

Hence 62 - 27 = 45

Eg. 548 - 263 =Rewrite as an vertical algorithm.

Start with the units column.

$$548 - \frac{263}{5}$$

5

Next is the tens column.

Since 6 is larger than 4 one lot of 100s is traded to the 10s column. The number in the minuend (top) of the tens column is now 10 + 4 = 14. The number in the minuend (top) of the hundreds column is now 5 - 1 = 4

548-263

$$\begin{array}{r} {}^{4}5 \, {}^{1}4 \, 8 \, - \\ \\ \underline{2 \, 6 \, 3} \\ \\ 8 \, 5 \\ \\ \hline \\ 14 - 6 = 8 \end{array}$$

Now the hundreds column.

Remembering that you have traded one lot of 100s the minuend (top) is now 4.

$$4 - 2 = 2 7$$

Hence 548 - 263 = 285

4209-1736

Eg. 4209 - 1736 =Rewrite as an vertical algorithm.

Start with the units column.

 $\frac{42\ 0\ 9}{17\ 3\ 6}$

Next is the tens column.

Since 3 is larger than 0 trade one lot of 100s to the top of the 10s column. The minuend (top) of the tens column is now 10

$$4^{1}2^{1}09 - \frac{1}{7} \frac{3}{3} \frac{6}{7} \frac{7}{3} \frac{1}{10} - 3 = 7$$

Next is the hundreds column.

Remembering that you have traded one lot of 1000s to the 100s the top number is 1.

Since 7 is larger than 1 you have to trade one lot of 1000s to the 100s. The number in the minuend (top) of the hundreds column is now 10 + 1 = 11. The minuend (top) of the thousands column is now 4 - 1 = 3

$$\begin{array}{c}
^{3}4^{11}2^{1}09 \\
\underline{1 \ 7 \ 3 6} \\
4 \ 7 \ 3 \\
\uparrow \\
11 - 7 = 4
\end{array}$$

Now the thousands column.

Remembering that you have traded one lot of 1000s to the 100s column the minuend (top) of the thousands column is now 4 - 1 = 3.

$$34^{11}2^{10}9 - \frac{1736}{2473}$$

$$3 - 1 = 2 7$$

Hence 4209 - 1736 = 2473

Eg. 7300 - 1825 =Rewrite as an vertical algorithm.

Start with the units column.

Since 5 is larger than 0 trade one lot of 10s to the top of the units column . Here you will see that the process is a little more complex because the minuend (top) of the tens column is also zero and a trade is not yet possible. Hence you have to do an extra trade. So trade one lot of 100s to the top of the 10s column. The minuend (top) of the tens column is now 10 and the minuend (top) of the 100s column is now 2.

$$7 \frac{^{2}3^{10}0}{1} \frac{0}{8} \frac{0}{2} \frac{-}{5}$$

Now trade one lot of 10s to the top of the units column . The minuend (top) of the units column is now 10 and the minuend (top) of the 10s column is now 9.

$$7 \frac{{}^{2}3^{9}}{{}^{10}0} \frac{{}^{1}0}{{}^{10}-10} - \frac{1}{8} \frac{2}{2} \frac{5}{5}}{7} \frac{5}{5} + \frac{5}{9} - 6 = 3$$

Next is the hundreds column.

Remembering that you have traded one lot of 100s to the 10s the top number is 2.

Since 8 is larger than 2 you have to trade one lot of 1000s to the 100s. The number in the minuend (top) of the hundreds column is now 10 + 2 = 2. The minuend (top) of the thousands column is now 7 - 1 = 6

$$67^{12}3^{40}\theta^{1}\theta^{-$$

Hence 7300 – 1825 = 5475