

**Written Methods of Operations for Mathematics**

**Holy Trinity C of E Junior School**

**September 2016 - September 2017**

## **Introduction**

This booklet aims to show the different written methods that are used at Holy Trinity to add, subtract, multiply, divide, round and answer ratio questions.

We hope that you can work in conjunction with the school and your child on each of the methods of operation.

# ADDITION

## Column addition

Children write the calculation vertically. They start by adding the 'units' (where no carrying is required) and then adding the 'Tens' together.

After the children understand the concept of adding the units and then the tens, the children will then look at adding where they will be 'carrying' over tens or hundreds. In this example, they start by adding the units (4 + 8). Then they move onto adding the tens and then the hundreds. We carry over any 'ones' underneath the bottom line.

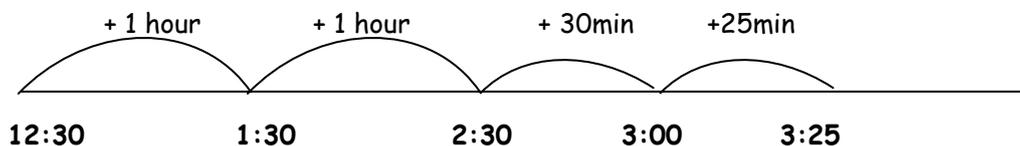
*Question: 34 + 68*

$$\begin{array}{r} \text{H T U} \\ 34 \\ + 68 \\ \hline 102 \\ \hline 1 \quad 1 \end{array}$$

# SUBTRACTION

## Number line (used for counting on for time and giving change)

*Question: The film starts at 12:30 and lasts for 2 hours 55 minutes. What time does the film end?*



In this example, we put the time the film starts at the beginning of the line. We add on the two hours so we land on 2:30. We then add on 30 minutes to land on 3:00 and then add on 25 minutes which means we land on 3:25. In total we have then added 2 hours and 55 minutes

## Column subtraction

Children write the calculation vertically. They start by subtracting the 'units' (where no exchanging is required) and then subtracting the 'Tens'.

After the children understand the concept of subtracting the units and then the tens, the children will then look at subtracting where they will be 'exchanging' tens or hundreds. In this example, the children write the calculation vertically. They start by subtracting the units and then move onto subtracting the tens, then the hundreds. We use the term 'exchange' when we take a ten or hundred from the next column.

$$\begin{array}{r} \text{H T U} \\ 163 \\ - 57 \\ \hline 106 \\ \hline \end{array}$$

*Question: 163 - 57*

# MULTIPLICATION

## Compact column method for multiplication

Example

$$\begin{array}{r}
 \text{H T U} \\
 38 \\
 \times 7 \\
 \hline
 266 \\
 \underset{5}{\phantom{0}}
 \end{array}$$

This stage of multiplication (column multiplication) is used in order to multiply large numbers. It is important that the children have a good understanding of place value in order to use this method.

In this example we first multiply 7 by 8 which is 56. The 6 stays in the units column while the 5 or '5 tens' is moved over into the tens column and placed under the line to be added later. We then multiply the 7 by the 3 (or 3 tens) which is 21. We add the 5 that we carried over to the 1 ten so we get 6 tens and write this in the Tens column. The 2 from 21 is carried over and placed in the Hundreds column

In year 5 and 6 the children need to multiply TU x TU and HTU x TU. In example 2 you can see that first 225 is multiplied by 5. Then a 'magic 0' is added into the next line. This is because we are now multiplying 225 by 2 (but the 2 is worth 20). We then add the two amounts together to get the answer.

Example 2:

$$\begin{array}{r}
 225 \\
 \times 25 \\
 \hline
 1125 \quad \rightarrow 225 \times 5 \\
 + 4500 \quad \rightarrow 225 \times 20 \\
 \hline
 5625 \quad \rightarrow 225 \times 25
 \end{array}$$

*Question: If a farmer plants 225 rows of cabbages with 25 in each row, how many cabbages is he growing altogether?*

Once the children have a good understanding of column multiplication they will then look at using column multiplication to multiply decimals (in year 6). We teach multiplying decimals by temporarily disregarding the decimal point and then multiplying the numbers together as shown below. Once the multiplication is completed the decimal point then needs to be reinserted. Because there are two numbers after the decimal point in the question there needs to be two numbers after the decimal point in the answer. (Originally we have multiplied 3.54 by 100 to make it 354 so now, at the end, we have to make the calculation 100 times smaller).

$$\begin{array}{r}
 354 \\
 \times 17 \\
 \hline
 2478 \quad \rightarrow 354 \times 7 \\
 \phantom{2}3\phantom{4}3\phantom{2} \\
 + 3540 \quad \rightarrow 354 \times 10 \\
 \hline
 6018 \quad \rightarrow 354 \times 17 \\
 \phantom{6}1\phantom{0}1
 \end{array}$$

*Question: It costs £3.54 per box of pencils. If I buy 17 boxes, how much does it cost in total?*

Answer: £60.18

# DIVISION

The children are taught how to do short division when dividing numbers by one digit (in years 3,4 and 5) and are taught long division (chunking) when dividing larger numbers (in year 6).

## Short division

$$\begin{array}{r} 12 \\ 8 \overline{) 96} \end{array}$$

This method is a useful and quick method especially when dividing by one digit.

8 fits into 9 once (there is one lot of 8 in 9) so we write a one above the line and carry over the one that is left over and place it by the 6 to make 16. 8 fits into 16 twice so we write the 2 above the line. The answer is 12.

## Short division- Example 2

$$\begin{array}{r} 168.25 \\ 4 \overline{) 673.00} \end{array}$$

In this example, 4 fits into 6 once (there is one lot of 4 in 6) so we write a one above the line and carry over the two that is left over and place it by the 7 to make 27. Four fits into 27 six times so we write the 6 above the line and carry over the 3 that is left over and place it next to the other three to make 33. Four fits into 33 eight times so we write the 8 above the line and carry over the 1 that is left over. We now have to add in a decimal point and some '0' as we haven't finished dividing. We place the 1 that is left over next to the 0 to make 10. Four fits into 10 two times so we write the 2 above the line and carry over the 2 that is left over. Four fits into 20 five times so we write the 5 above the line and we have nothing to carry over. The answer is 168.25

## Long division- Chunking (part 1- dividing a three digit number by a two digit number) As we are following the 'New Curriculum', children are not expected to divide by a two-digit number until they reach Year 6

The expanded method for division is often called 'chunking' and really just involves partitioning the number into helpful 'chunks' related to the number you are dividing by (divisor) or taking away chunks of the same size until you run out.

It uses the fact that division is repeated subtraction of the same size group. So  $20 \div 4 = 5$  involves subtracting 4s from 20 until it's been used up. You can do this 5 times.

Here is an example:

**Question:** 304 pears are packed in boxes of 16. How many boxes of pears would there be?

$$\begin{array}{r} \overset{2}{\cancel{3}} \overset{1}{0} 4 \\ - \underline{160} \text{ that's } 10 \times 16 \\ \overset{0}{1} \overset{1}{4} 4 \text{ left} \\ - \underline{80} \text{ that's } 5 \times 16 \\ \quad 64 \text{ left} \\ - \underline{32} \text{ that's } 2 \times 16 \\ \quad \quad 32 \text{ left} \\ - \underline{32} \text{ that's } 2 \times 16 \\ \quad \quad \quad 0 \text{ left} \end{array}$$

Check box:

$$16 \times 2 = 32$$

$$16 \times 5 = 80$$

$$16 \times 10 = 160$$

First, we make a check box which contains all the 'easy' times table facts for the 16 times table (the number we're dividing by). We know that  $10 \times 16$  is 160 so we can deduct that amount from our initial number and then see what's left. There is now 144 left. We know that  $5 \times 16 = 80$  and we deduct this from what was left. There is now 64 left. We know that  $2 \times 16 = 32$  and we deduct this from what was left. There is now 32 left. We know that  $2 \times 16 = 32$  and we deduct this from what was left. There is now 0 left. So now we can see how many 'chunks' we took out  $10 + 5 + 2 + 2 = 19$ . So, 19 boxes of pears could be packed.

NOTE: With division, as with all calculation, it's important to think about what the actual problem is asking when you come to give an answer

Long division- Chunking (part 2- dividing a three digit numbers by two digit numbers and dividing involving decimals)

Question:  $810 \div 36$

Check box: $36 \times 2 = 72$ $36 \times 5 = 180$ $36 \times 10 = 360$
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$$\begin{array}{r}
 810 \\
 - 360 \text{ that's } 10 \times 36 \\
 \hline
 450 \text{ left} \\
 - 360 \text{ that's } 10 \times 36 \\
 \hline
 90 \text{ left} \\
 - 72 \text{ that's } 2 \times 36 \\
 \hline
 18 \text{ left} \\
 - 18 \text{ that's } 0.5 \times 36 \\
 \hline
 0 \text{ left}
 \end{array}$$

Answer: 22.5

This stage is the same as chunking part 1 but is more difficult because you work with decimal numbers.

# Rounding

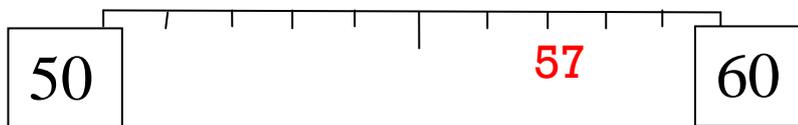
When first learning how to round numbers, the children are given a scaffold to help understand whether to round up/down

In order to be able to round numbers, children must have a good understanding of multiples of 10/100/1000. They must also be able to state the multiples of 10/100/1000 that are before or after the given number

## Example 1: Round 57 to the nearest 10.

If rounding to the nearest 10, the children first state the multiple of 10 less than the chosen number and the next multiple of 10 higher than the chosen number. Then put the chosen number on the number line. Finally see if the chosen number is closer to 50 or 60. This will be the answer. The answer is 60.

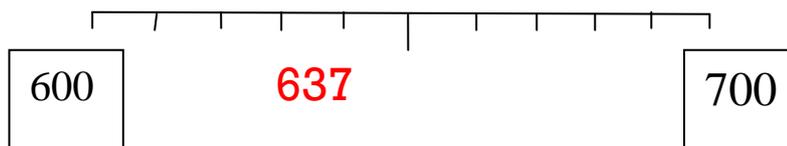
NB: If the chosen number ends in a five then the number is rounded up.



Once the children have developed an understanding of what rounding is they can round to different amounts

## Example 2: Round 637 to the nearest 100.

If rounding to the nearest 100, the children first state the multiple of 100 less than the chosen number and the next multiple of 100 higher than the chosen number. Then put the chosen number on the number line. Then see if the chosen number is closer to 600 or 700. This will be the answer. The answer is 600.



Once the children have a good understanding of what rounding means they can round without the visual scaffold.

## Ratio/ scaling questions

In order to understand ratio the children must always have a good understanding of multiplying and dividing

**Example 1:** *If 1 child gets 3 sweets how many would 2 children get?*

We lay out it like this where we name the columns 'C' for children and 'S' for sweets. We then add the information that we know. We put '1' under 'children' and '3' under 'sweets' and then, in a separate row, we put '2' under 'children'. The next step is to see what we need to multiply/divide '1' by to get to '2'. In this example we have to multiply 1 by 2 to get the answer 2. We then multiply the other side by 2 so  $3 \times 2 = 6$ . The final answer is 6 sweets

$$\begin{array}{cc}
 \mathbf{C} & \mathbf{S} \\
 \times 2 & \\
 \begin{array}{c} 1 \\ 2 \end{array} & : \begin{array}{c} 3 \\ 6 \end{array}
 \end{array}$$

**Example 2:** *In every packed lunch there are 4 sandwiches for every 2 biscuits. How many sandwiches are there if there are 16 biscuits?*

We lay out it like this where we name the columns 'S' for Sandwich and 'B' for Biscuits. We then add the information that we know. We put '4' under 'sandwiches' and '2' under 'biscuits' and then, in a separate row, we put '16' under 'biscuits'. The next step is to see what we need to multiply/divide '2' by to get to '16'. In this example we have to multiply 2 by 8 to get the answer 16. We then multiply the other side by 8 so  $4 \times 8 = 32$ . The final answer is 32 sandwiches

$$\begin{array}{cc}
 \mathbf{S} & \mathbf{B} \\
 \times 8 & \\
 \begin{array}{c} 4 \\ 32 \end{array} & : \begin{array}{c} 2 \\ 16 \end{array}
 \end{array}$$

**Example 3:** Alex and Ben share £160 in the ratio 1:3 How much money do they both receive?

In this example we are told the total amount (£160) and we are also told it is being shared in the ratio 1:3. In this question the amount of money is being shared into 4 equal parts (1 for Alex and 3 for Ben). We lay out the question like the previous ones but this time we add the total amount.

We lay out it like this where we name the columns 'A' for Alex and 'B' for Ben and this time another column for the total 'T'. We then add the information that we know. We put '1' under 'Alex' and '3' under 'Ben' and 4 under 'Total'. In a separate row, we put '160' under 'total'. The next step is to see what we need to multiply/divide '4' by to get to '160'. In this example we have to multiply 4 by 40 to get the answer 160. We then multiply the other numbers by 40 so  $1 \times 40 = 40$  and  $3 \times 40 = 120$ . The final answer is £40 for Alex and £120 for Bob.

$$\begin{array}{ccc}
 \mathbf{A} & \mathbf{B} & = \mathbf{T} \\
 \times 40 & & \\
 \begin{array}{c} 1 \\ 40 \end{array} & : \begin{array}{c} 3 \\ 120 \end{array} & = \begin{array}{c} 4 \\ 160 \end{array}
 \end{array}$$