Oaklands Junior School

Mathematics

Calculation Methods

This guide sets out the way in which the school teaches maths calculations across the whole school. It is useful both for teachers and parents/carers who are then able to support their child's learning at home, using the same methods that are being taught at school. If you require more information, please contact the school's Mathematics Subject Leader (Mr. Holland).

Calculation Information for Parents

Year 3

Addition and subtraction
Pupils must be taught to:

- add and subtract numbers with up to 3 digits, including using column addition and subtraction
- accurately add and subtract numbers mentally, including pairs of one- and 2-digit numbers; 3-digit numbers and ones; 3-digit numbers and tens; 3-digit numbers and hundreds
- solve word problems including missing number problems, using number facts, place value, and more complex addition and subtraction

Multiplication and division
Pupils must be taught to:

- recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables
- write and calculate mathematical statements for multiplication and division within the multiplication tables; and for 2-digit numbers x 1-digit numbers, using mental and written methods
- solve word problems involving the four operations, including missing number problems

Year 4

Addition and subtraction
Pupils must be taught to:

- add and subtract numbers using formal written methods with up to 4 digits
- accurately add and subtract numbers mentally including two 2-digit numbers
- estimate, within a range, the answer to a calculation and use inverse operations to check answers

Multiplication and division
Pupils must be taught to:

- recall multiplication and division facts for multiplication tables up to 12 x 12
- mentally perform multiplication and division calculations quickly and accurately, including multiplying by 0 and dividing by 1
- multiply or divide 2-digit and 3-digit numbers by a 1-digit number using formal written methods; interpret remainders appropriately as integers
- recognise and use factor pairs within 144
- solve word problems involving the four operations
- find the effect of dividing a 2-digit number by 10 and 100, identifying the value of the digits in the answer as units, tenths and hundredths

Year 5

Addition and subtraction

Pupils must be taught to:

- add and subtract whole numbers with up to 5 digits, including using formal written methods
- add and subtract numbers mentally with increasingly large numbers
- add and subtract numbers with up to three decimal places

Multiplication and division

Pupils must be taught to:

- identify multiples including common multiples, and factors including common factors
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall the prime numbers up to 19
- multiply numbers up to 4-digits by a 1 or 2-digit number using a formal written method, including long multiplication
- accurately multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a 1-digit number and 10 and interpret remainders appropriately
- multiply and divide numbers by 10, 100 and 1000
- recognise and use square numbers and square roots and the notation for square (^{2}) and square root ($\sqrt{}$)
- solve word problems involving addition and subtraction, multiplication and division

Year 6

Addition, subtraction, multiplication and division

Pupils must be taught to:

- add and subtract negative integers
- multiply numbers with at least 4-digits by 2-digit whole number using long multiplication
- divide numbers up to 4-digits by a 2-digit whole number using long division, and interpret remainders as whole number remainders, fractions, decimals or by rounding
- perform mental calculations, including with mixed operations and large numbers
- use estimation to check answers to calculations and determine in the context of a problem whether an answer should be rounded, or written as a fraction or a decimal
- carry out combined operations involving the four operations accurately and state the order of operations
- solve word problems involving addition, subtraction, multiplication and division
- identify the value of each digit to three decimal places and multiply or divide numbers up to three decimal places by 10, 100 and 1000
- multiply and divide numbers with up to two decimal places by 1-digit and 2-digit whole numbers
- recognise and use division in the context of fractions, percentages and ratio
- solve linear missing number problems, including those involving decimals and fractions, and find pairs of number that satisfy number sentences involving two unknowns.

The following pages show our school's written calculation methods for maths.

They are organised by number operations:

Addition (+), Subtraction (-), Division (÷) and Multiplication (x).

Each section shows the written calculation methods for each operation

starting from simple methods progressing to more advanced ones.

ADDITION

Children are taught to understand addition as combining two sets and counting on.

Calculation Method	Explanation
Year 3	
1 2 7 + 7 4 100 + 20 +7 + 70 +4 100 + 90+11 =201	Children will be taught **written method**s for those calculations they cannot do 'in their heads'. **Expanded methods** build on mental methods and make the value of the digits clear to children. The language used is very important **(7+4, 20+70, 100+0, then 100+90+11) - *add this mentally*** **In this expanded method, when children add their partitioned digits together they may be required to 'carry' numbers (see below).** The value of the numbers should not exceed 3 digits.
2 9 8 3 5 8 6 5 6 1 1	When children are confident using the expanded method, this can be 'squashed' into the traditional compact method. (Carrying!)
Year 4	
2786 + 2568 = 2 786 people visited the museum last month. Numbers increased by 2 568. How many people altogether visited this month? 2 7 8 6 + 2 5 6 8 5 3 5 4 1 1 1	When children are confident using the expanded method, this can be 'squashed' into the traditional compact method. (Carrying!) The value of the numbers should not exceed 4 digits.
Year 5	
2 0 + 4 + 0 . 5 3 0 + 9 + 0 . 8 5 0 + 1 3 + 1 . 3 = 6 4 . 3 2 4 . 5 3 9 . 8 6 4 . 3 1 1	Add whole numbers up to 5 digits. Decimals numbers will be introduced this year. Children will start with the expanded method to ensure their understanding of place value is secure before moving onto the compact method.
Year 6	
2 4 . 5 6 6 3 9 . 7 0 0 0 . 5 6 0 6 4 . 8 2 6 1 1 1	Year 6 will use the compact method and add larger numbers and decimals up to 3 places.In order to keep the place value the children may add 0s in the empty decimal columns.

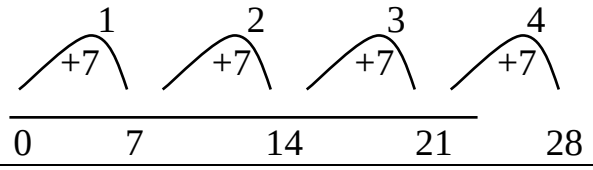
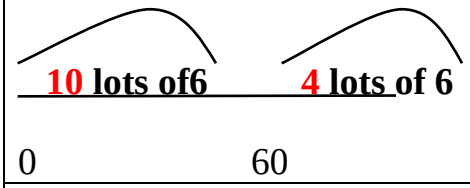
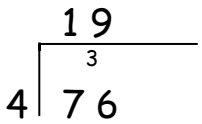
SUBTRACTION

Children are taught subtraction as taking away and finding the difference (counting up).

Calculation Method	Explanation
Year 3	
Expanded decomposition 600 140 ~~700~~ + ~~40~~ + 9 **749** → 200 + 70 + 3 400 + 70 + 6 = 476	When children are secure using the column method, expanded decomposition is introduced. Partition the numbers and set out in **columns**. Always start subtracting the **units** first. If the top number is smaller than the bottom number, then you will need to take from the column on the left. Remember to adjust the columns to show the new amounts. Finally, recombine the answers to give your final answer. The value of the numbers should not exceed 3 digits.
Decomposition 6 1 5 ~~7~~ 2 - 2 4 5 3 2 7	Once the children are secure with expanded, they can move onto to the shortened/compact method. This is just the same as above but the numbers are not partitioned out to see the different columns as clearly.
Year 4	
2 1 3 1 ~~3~~ 5 ~~4~~ 7 - 2 6 2 8 0 9 1 9	The children will use the same methods as year 3; column and decomposition but the value of the digits should not exceed 4 digits.
Year 5	
2 1 3 1 1 7 1 ~~3~~ 5 ~~4~~ 7 . ~~8~~ 8 ~~5~~ - 2 6 2 8 . 2 7 8 0 9 1 0 . 5 0 7	The children will use the same methods as in years 3 and 4; column and decomposition but the value of the digits should not exceed 5 digits. Decimals will be introduced up to 3 decimal places – in this instance, expanded decomposition should be taught first to ensure all children understand the place value.
Year 6	
2 1 3 1 7 1 ~~3~~ 5 ~~4~~ 7 . 8 ~~8~~ 5 - 2 6 2 8 . 2 7 8 0 9 1 9 . 6 0 7	The children will use the same methods as in years 3, 4 and 5; column and decomposition with a range of larger numbers. They will also add and subtract negative integers – this will be done using a number line.

DIVISION

Children are taught to understand division as sharing and grouping

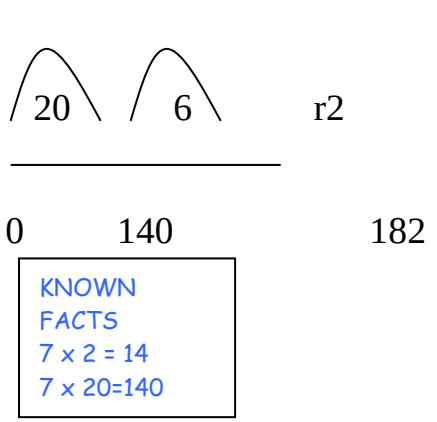
Calculation Method	Explanation
Year 3	
Mental Strategy **28 ÷ 7 = 4** A chew bar costs 7p. How many can I buy with 28p?  	To work out how many lots of 7 there are in 28, draw **jumps** of 7 along a **number line. This shows you need 4 jumps of 7 to reach 28.**
Mental Strategy **84 ÷ 6 =**  	It would take a long time for the children to jump in sixes to 84 so children can jump on in bigger '**jumps**'. A jump of 10 groups of 6 takes you to 60. Then you need another 4 lots of 6 which is 24 will take you to 84. Altogether this is **14 sixes.** Calculations should be 2 digit by 1 digit.
Short Division  	The teacher would explain to the children that we ignore place value when teaching short division as a strategy. Firstly, work out how many fours fit into 7. Write the **answer above** 7 and the **reminder** in front of the next digit of the number to be divided. Then count up in fours to see how many now fit into 36 and write the answer above the digit 6. If the divisor does not fit exactly into the final number, you will be left with a remainder to be recorded next to your answer. Remainders can be interpreted as fractions, decimals or rounding. E.g. 36 ÷ 5 = 7 r1 = 7 1/5 = 7.2 = 7 (rounded to the nearest whole number)

Year 4/5

Mental Strategy

184 ÷ 7 =

I need 184 chairs for a concert. I arrange them in rows of 7. How many rows do I need?



This method is known as **counting up on a number line.**

In this example, you are counting up in jumps of 7.

Using their **KNOWN FACTS** children will know 7 x 2=14 so 7 x 20=140

So first add on a jump of 20 lots of 7 and land on 140.

You are left with 44. Cont...

Then add on a jump of 6 lots of 7 which is 42 and land on 182, to leave 2.

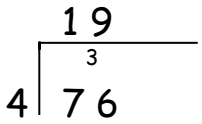
Altogether, that is 26x7 with a remainder of 2.

Calculations should be 2 or 3 digit by 1 digit and children should be taught to interpret the remainder appropriately.

In year 5 children will divide up to 4 digits by a 1 digit number and 10 and interpret remainders appropriately.

Year 5/6

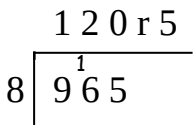
Short Division



Firstly, work out how many fours fit into 7. Write the **answer above** 7 and the **reminder** in front of the next digit of the number to be divided. The teacher would explain to the children that we ignore place value when teaching short division as a strategy.

Then count up in fours to see how many now fit into 36 and write the answer above the digit 6.

If the divisor does not fit exactly into the final number, you will be left with a remainder to be recorded next to your answer.



Remainders can be interpreted as fractions, decimals or rounding.

e.g. 965 ÷ 8 = 120 r5
= 120 5/8
= 120.625
= 121 (rounded to the nearest whole number)

Examples will be taught and practised that include 0 and when divisors divide exactly.

Year 5/6	
Long Division	
0 3 3 r 3 15|4 6 8 4 5 ↓ 0 1 8 1 5 0 3	Teacher would explain to the children that we ignore place value when teaching long division as a strategy. Long division requires the children to be competent and confident with their tables, and subtraction before they can use it as a division strategy. 468 ÷ 15 How many 15s in 4? The answer is 0 so this is placed above the 4, above the division gate. The next question is how many 15s are in 46? (We have put the 4 and 6 together to make 46). The answer is 3, so this is placed above the 6, above the division gate. 3 x 15 is 45, this is written under the 46 and a subtraction calculation is done to work out the remainder which is 1. The remaining digit (8) is then brought down to join the 1 to form 18. So the next question we ask is; how many 15s are there in 18? The answer is 1, so this is written above the 8, above the division gate. 1 x 15 is 15, this is written under the 18 and a subtraction calculation is done to work out the final remainder, which in this example is 3.

MULTIPLICATION

Children are taught to understand multiplication as repeated addition. It can also describe an array (see below).

Calculation Method	Explanation
Year 3	
Mental Strategy **26 x 7 =** Partitioning. 20 x 7= 140 6x 7= 42 140 + 42= 182 KNOWN FACTS 2 x 7 = 14 20 x 7=140	Children use the partitioning method to multiply mentally and when multiplying by a unit (single digit). Partition 26 (into 20 and 6) and use KNOWN FACTS to multiply by 7. 2x7=14 so 20 x 7=140 6x7= 42 Then add the answers together 140 + 42 = 182. This is a mental strategy
Mental Strategy Grid multiplication 54 x 7 = X | 50 | 4 7 | 350 | 28 = 378 KNOWN FACTS 5 x 7 = 35 5 x 70 = 350	Split up the numbers and multiply each part. Remember to write down KNOWN FACTS. **Add across the rows, then add those two answers together.**
Short Multiplication H T U 3 4 x 6 2 0 4 2	Children use short multiplication to multiply TU x U Starting with the units column U x U (6 x 4= 24). Place the 4 from 24 into the answer in the units column and carry the 2 tens below the answer in the tens column. Then multiply T x U (30 x 6 = 180). Add your 2 carried tens from below the answer column to equal 200. This is 20 Tens therefore you write 20 in the answer column under H and T.

Year 4

Short Multiplication H T U 3 4 x 6 2 0 4 2	Children use short multiplication to multiply TU x U To understand place value we would explain the following: Starting with the units column U x U (6 x 4= 24). Place the 4 from 24 into the answer in the units column and carry the 2 tens below the answer in the tens column. Then multiply T x U (30 x 6 = 180). Add your 2 carried tens from below the answer column to equal 200. This is 20 Tens therefore you write 20 in the answer column under H and T. Final answer =204 *When teaching children our dialogue would be:* *Step 1- U x U 4 x 6 = 24, put the 4 in the answer and carry the 2.* *Step 2 T X U 3 x 6= 18, add the 2 = 20. Put the 20 in the answer box. Final answer= 204.*
Short Multiplication Th H T U 3 2 5 X 7 2 2 7 5 1 3	Children use short multiplication to multiply HTU x U To understand place value we would explain the following: Starting with U x U (5 x 7= 35). Place the 5 from the 35 into the answer in the units column and carry the 3 tens below the answer in the tens column. Then multiply T x U (20 x 7= 140) Add your carried 3 tens (140 +30=170) Place the 7 Tens in the Tens column of your answer and carry the 1 hundred below the answer in the hundreds column. Next multiply H x U (300 x 7= 2100). This is 21 hundreds so now add the carried 1 hundred to make 22 Hundreds (2200). Finally place 22 under Th and H columns. Final answer = 2275 *When teaching children our dialogue would be:* *Step 1- U x U 5 x 7 = 35 put 5 in the answer carry the 3.* *Step 2 T x U 2 X 7 = 14 add the 3 = 17. Put the 7 in the answer carry the 1.* *Step 3- H x U 3 x 7=21 add the 1 = 22. Write 22 in the answer box.* *Final answer = 2275*

Year 5/6 (progressing to larger numbers and decimals for Year 6)	
Short Multiplication Th H T U 3 2 5 X 7 2 2 7 5 1 3	Children use short multiplication to multiply HTU x U To understand place value we would explain the following: Starting with U x U (5 x 7= 35). Place the 5 from the 35 into the answer in the units column and carry the 3 tens below the answer in the tens column. Then multiply T x U (20 x 7= 140) Add your carried 3 tens (140 +30=170) Place the 7 Tens in the Tens column of your answer and carry the 1 hundred below the answer in the hundreds column. Next multiply the H x U (300 x 7= 2100). This is 21 hundreds so now add the carried 1 hundred to make 22 Hundreds (2200). Finally place the 22 under the Th and H columns. Final answer = 2275 *When teaching the children our dialogue would be:* *Step 1- U x U 5 x 7 = 35 put 5 in the answer carry the 3.* *Step 2 T x U 2 X 7 = 14 add the 3 = 17. Put the 7 in the answer carry the 1.* *Step 3- H x U 3 x 7=21 add the 1 = 22. Write 22 in the answer box.* *Final answer = 2275*
Long Multiplication. 59 x 26 Th H T U 5 9 X 2 6 1 5 3 5 4 1 1 8 0 1 5 3 4 1	*When teaching the children our dialogue would be:* *Step 1- U x U 6 x 9= 54 put the 4 in the answer and carry the 5 above the line.* *Step 2- U x T 6 x 5= 30. Add the 5 to make 35. Put 35 in the answer, First line answer 354.* *Step 3- Put a 0 in the answer under the units column to hold the place value as you are about to multiply everything by 10.* *Step 4 T x U 2 x 9=18, put 8 in the answer, carry 1 above the line.* *Step 5 T X T 2 X 5= 10, add the 1 = 11put 11 in the answer. Second line answer 1180.* *Step 6 add first and second line answers together. Final answer= 1534.*