MEREWORTH COMMUNITY PRIMARY SCHOOL

Calculation & Maths Policy

Date of Publication	January 2017
Person with responsibility	Amanda Lavelle Head Teacher
Review Date	January 2019
Governing Body	FGB
Chair of Governors *Signature and Date*	
Head Teacher *Signature and Date*	

This policy is based on statutory expectations from the New Curriculum 2014. Year groups have not been included, to allow the School flexibility in deciding appropriate methods for different groups of children.

Mereworth Community Primary School

Progression towards a standard method of Calculation January 2017

Introduction:
The National Curriculum 2014 provides a structured and systematic approach to the teaching of calculation. At Mereworth Community Primary School, we have developed a consistent approach to the teaching of written calculation methods in order to establish consistency, continuity and progression throughout the school.

Aims:
Children should be able to choose an efficient method, mental, written or ICT (calculator) appropriate to the given task. By the end of Year 6, children working at Age Expected or Exceeding will have been taught, and be secure with, a compact standard method for each operation.

General Progression:

- Establish mental methods, based on a good understanding of place value
- Use of informal jottings to aid mental calculations
- Develop use of empty number line to help mental imagery and aid recording
- Use partitioning and recombining to aid informal methods
- Introduce expanded written methods
- Develop expanded methods into compact standard written form

Before carrying out a calculation, children will be encouraged to consider :

- Can I do it in my head? (using rounding, adjustment)
- The size of an approximate answer (estimation)
- Could I use jottings to keep track of the calculation?
- Do I need to use an expanded or compact written method?

When are children ready for written calculations?

Addition and subtraction:

- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

Multiplication and Division:

- Do they know the 2,3,4,5,6,7,8,9,10,11 and 12 times tables and corresponding division facts?
- Do they know the result of multiplying by 1 and 0?
- Do they understand 0 as a place holder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Can they use multiplication and division facts they know to derive mentally other multiplication and division facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

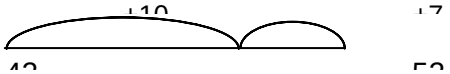
These lists are not exhaustive but are a guide for the teacher to judge when a child is ready to move from informal to formal methods of calculation. It is also important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for each operation.

Point to note:
The correct terminology should be used when referring to the value of digits to support the children's understanding of place value.
E.g. Tens and Ones and 68 + 47 should be read 'sixty add forty' not 'six add four'
Teachers should refer to the key vocab document for key vocabulary for each year group.

Progression of Written Calculations

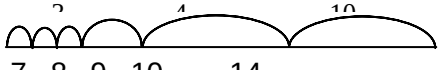
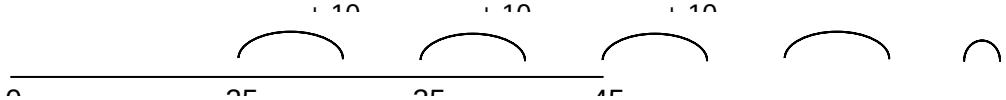
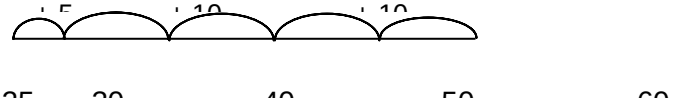
Key Stage	Progression of Written Calculations
Foundation	Children begin to record in the context of play or practical activities and problems.
Stage 1	Children will: • Develop the use of pictures and mixture of words and symbols to represent numerical activities • Use of standard symbols and conventions (0 – 9, + , - , x , ÷ , =) • Use of jottings to aid mental calculations, number tracks, empty number lines, partitioning **(Initially all calculations at KS1 will be presented horizontally and by the end of Year 2 calculations will be presented vertically for addition and subtraction).**
Stage 2 **Stage 3**	Children will: • Continue use of jottings to aid mental calculations • Use of compact, and as appropriate expanded, methods for addition and subtraction • Develop use of compact method for addition and subtraction • Use of expanded methods for multiplication and division (by the end of year 4) Begin to use ICT including a calculator as a tool to check calculations. **(Calculations are presented horizontally and vertically)** • Continue use of jottings to aid mental calculations • Secure understanding of compact methods for addition and subtraction (develop use with decimals) • Develop use of compact methods for multiplication and division, expanded methods still acceptable • Effective use of ICT including a calculator as a tool to check calculations. **(Calculations presented horizontally and vertically)**

Progression in Addition

Stage	Progression of Written Calculations
Foundation	**Begin to relate addition to combining two groups of objects** • Make a record in pictures, words or symbols of addition activities already carried out • Construct number sentences to go with practical activities • Relate addition to counting on • Use of games and songs to develop vocabulary
Stage 1	**Understand the operation of addition and use the related vocabulary** • Record simple mental additions in a number sentence using + and = • Know that addition can be done in any order • Introduction of empty number lines • Count on from the most significant number • Continue to develop the use of vocabulary • Continue to use practical apparatus and visual aids to support the recording of calculations • Begin to partition and recombine (seeing 12 + 15 as 10 + 10 and 2 + 5, then 20 + 7 as 27) • Using informal jottings with larger numbers (the empty numberline) **42 + 17 =59** 
Stage 2	**Develop pencil and paper methods for additions that cannot be done mentally** **35 + 52** 5 + 2 = 7 30 + 50 = 80 80 + 7 =87 (no formal layout, informal jottings) • Continue informal partitioning, reinforce use of empty number line. • Expanded written method, horizontal layout. (NO 'carrying'). **35 + 52** **67 + 24** 50 + 2 60 + 7 30 + 5 20 + 4 80+ 7 = 87 80 + 11 = 91

Stage 3	Add least significant digits first: 264 + 48 12 100 200 312
Stage 4	Children will progress to using the compact written method, involving carrying, with least significant digit first 783 + 135 918 1 **Extend written methods to column addition of two integers less than 10 000 as appropriate** *(could explore larger numbers with expanded methods, then apply compact method with least significant digits first)* • Add several numbers with different numbers of digits 47 + 76 = 123 (1 1) 258 + 87 = 345 (1 1) 366 + 458 = 824 (1 1) • Extend column addition to the use of decimals, including amounts of money, lengths, weights

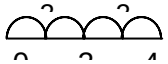
Progression in Subtraction

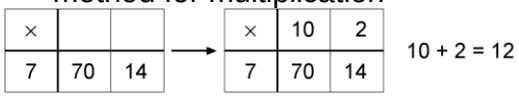
Stage	Progression of Written Calculations
Foundation	**Begin to relate subtraction to 'taking away'** • Make a record in pictures, words or symbols of subtraction activities already carried out • Use of games and songs to develop vocabulary • Construct number sentences to go with practical activities • Relate subtraction to taking away and counting how many objects are left.
Stage 1	**Understand the operation of subtraction and use the related vocabulary** • Use of pictures and visual aids to record calculations • Record simple mental subtractions in a number sentence using – and = • Develop use of vocabulary • Use jottings to support mental subtractions (empty numberline) Children to decide how to set out numberlines i.e. the number of steps to use **34 - 27** 
Stage 2	**Develop pencil and paper methods for subtractions that cannot, at this stage, be done mentally (two-digit numbers)** **67 – 25** With jottings and partitioning 67 – 20 = 47 47 – 5 = 42 Counting on to find a difference  Using multiples of 10  • Subtraction can also be recorded using partitioning to answer equivalent calculations that could then be carried out mentally 74 – 27 = 74 – 20 – 7 = 54 – 7 = 47 74 – 27 = 70 + 4 – 20 + 7 = 60 + 14 – 20 + 7 = 40 + 7 = 47 Children need to be introduced to the concept of the unknown number: 62 - □ = 27

Stage 3	**Expanded written methods showing vertical layout but with no decomposition** 60 7 - 20 5 40 2 → 42 • **Expanded decomposition** 80 1 → 70 11 - 50 7 - 50 7 20 4 → 24 • **Extend to 3-digit number and hundreds to tens decomposition** 700 50 4 → 700 40 14 → 600 140 14 - 80 6 - 80 6 - 80 6 600 60 8 → 686 Once children are aware that tens or hundreds are brought across, they can cross numbers out and write the adjusted amount in each column, to make this method less time consuming 600 140 14 700 50 4 - 80 6 600 60 8 → 668
Stage 4	**Compact written methods involving decomposition** 5 13 363 - 127 236 • Provide examples where children deal with 0 as a place holder **503 – 278** 500 + 0 + 3 − 200 + 70 + 8 400 + 90 + 13 − 200 + 70 + 8 = 200 + 20 + 5 400 90 13 ~~500~~ + ~~0~~ + ~~3~~ − 200 + 70 + 8 = 200 + 20 + 5 4 9 13 ~~5~~ ~~0~~ ~~3~~ − 2 7 8 = 2 2 5 Here 0 acts as a place holder for the tens. The adjustment has to be done in two stages. First the 500 + 0 is partitioned into 400 + 100 and then the 100 + 3 is partitioned into 90 + 13.
Stage 5	• Extend written methods for subtraction, to include decimal numbers with up to 2 decimal places and larger numbers up to 10 000 • Choose the most efficient and appropriate method for each calculation

Progression in Multiplication and Division

Concepts in multiplication and division are very closely linked, and should be developed together

Stage	Progression in multiplication	Progression in division
Foundation	**Real life contexts and use of practical equipment to count in repeated groups of the same size:** • Count in twos**,** fives, tens	**Share objects into equal groups** Use related vocabulary
Stage 1	**Draw pictures to show equal sets:** 3 sets of 3 make 9 ○○○ ○○○ ○○○ 2 sets of 4 make 8 ○○○○ ○○○○ **Count in twos, fives and tens** • Identify patterns of 2s, 5s, 10s on a hundred square • Solve practical problems that combine groups of 2s, 5s and 10s.	**Draw pictures to show sharing and grouping:** 9 shared between 3 ○○○ ○○○ ○○○ How many groups of 4 in 8? ○○○○ ○○○○ **Count in twos, fives and tens** • Solve practical problems sharing groups of 2, 5 and 10.
Stage 2	**Develop use of vocabulary for multiplication.** • Use **x** symbol. **Count confidently in steps of 2, 5 and 10.** • Recall multiplication facts for 2, 5 and 10. **Begin to count in steps of 3 , 4 and 8.** • Use of empty numberlines and 100 squares as visual reminders when learning to count in steps of 3, 4 and 5. **Understand the operation of multiplication as repeated addition or as describing an array** • Make arrays practically • Use x and = to record mental calculations • Use a range of vocabulary: 3 lots of 2 2 lots of 3 'groups of' 3 x 2 = 6 multiplied by times	**Develop use of vocabulary for division.** • Use **÷** symbol. **Count confidently in steps of 2, 5 and 10.** • Recall division facts for 2, 5 and 10. **Practical tasks:** • Sharing equally: 15 ÷3 = 15 shared between 3 • Grouping: 15 ÷ 3 how many 3s in 15? **Relate grouping to arrays** • Use ÷ and = to record number calculations 6 ÷ 2 = 3 6 ÷ 3 = 2 • Use a number line to illustrate grouping e.g. **8 ÷ 2 = 4**  Begin to solve practical problems involving remainders

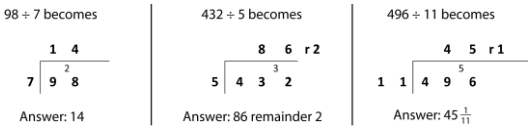
Stage 3	**Learn additional multiplication facts and work on different ways to derive new facts from those that they already know** • Know by heart multiplication facts for x2, x3, x4, x5, x6, x7, x8, x9, x10, x11 and x12. • Recognise multiples of 2, 5 and 10 up to 1000. • Understand effect of multiplying by 10 • Multiply a single digit by 1, 10, 100 7 x 10 =70 4 x 100 = 400 • Double any multiple of 5 up to 50 35 x 2 = 70 ☐ x 2 = 50 • Derive related facts 7 x 5 = 35 5 x 7 = 35 35 ÷ 5 = 7 35 ÷7 = 5 **Develop and refine written methods for multiplication, based on mental strategies:** • Multiply a 2-digit number by a single digit number, multiplying the tens first • Using multiples of 10 (mentally) 4 x 30 = (4 x 3) x 10 = 120 • Use jottings to show stages of calculation e.g. (Tens Ones x Ones) **32 x 3** 32 x 3 = (30 x 3) + (2 x 3) = 90 + 6 = 96 **or:** 30 2 ↓ ↓ x 3 90 6 → 96 **NB: It is important that children continue to use jottings to support mental calculations for <u>multiplication and division,</u> throughout KS2**	**Derive quickly division facts corresponding to 2, 5, and 10 times table** • Continue to use empty number lines for division and introduce remainders. • Understand effect of dividing by 10 • Divide a 3-digit multiple of 100 by 10 or 100 800 ÷ 100 = 8 300 ÷ 10 = 30 • Halve any multiple of 10 up to 100 50 ÷ 2 = 25 ☐ ÷ 2 = 35 • Given three numbers such as 4, 5, 20; say or write four different multiplication and division statements. • Solve division calculations by using multiplication strategies • Round remainders up or down depending on the context. **Develop and refine written methods for division, building upon mental strategies.** • Divide a 2-digit number by a single-digit, by using multiples of the divisor **Either:** • Use informal jottings E.g.: 84 ÷ 7= 70 + 14 ↓ ↓ ÷ 7 10 + 2 =12 **Or:** use a method linked to the grid method for multiplication  As the mental method is recorded, ask: 'How many sevens in seventy?' and: 'How many sevens in fourteen?' **Or:** Record mental division using partitioning: 64 ÷ 4 = (40 + 24) ÷ 4 = (40 ÷ 4) + (24 ÷ 4) = 10 + 6 = 16

<table>
<tr>
<td>Stage 4</td>
<td>Develop the extended written method of the grid method Tens Ones x Ones

e.g. 37 x 4

<table>
<tr><td>x</td><td>30</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

120 + 28 = 148</td>
<td>Develop use of short division method

Short division
 
</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Extend written methods, encouraging estimation first.

Grid method (HTOnes x Ones)
e.g. 246 x 7

<table>
<tr><td>x</td><td>200</td><td>40</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

1400 + 280 + 42 = 1722

Grid method (TOnes x TOnes)
e.g. 62 x 36

<table>
<tr><td>x</td><td>60</td></tr>
<tr><td>30</td><td>1800</td></tr>
<tr><td></td><td></td></tr>
</table>

2160 + 72 = 2232

This will then lead to a compact written method for multiplication;

Either:
246
x 7
42 (6 X 7)
280(40 X 7)
1400(200 X 7)
1722

or:
246
x 7
42
280
1400
1722</td>
<td>• short division giving quotient as fraction e.g. 90 ÷ 7 = 12 6/7

1 2 6/7
7) 9 20

• giving quotient as decimal

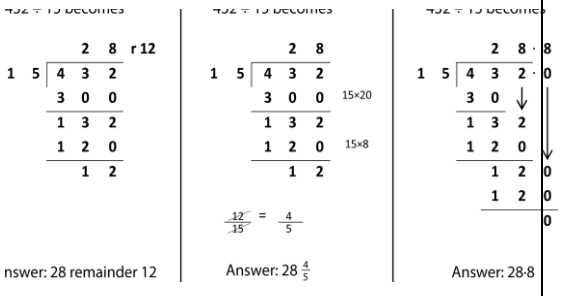
676 ÷ 8 =
84.5
8) 676
- 400 (50x8)
276
- 240 (30x8)
36
- 32 (4x8)
4
- 4 (0.5x8)
0

• short division of numbers involving decimals (87.5 ÷ 7)

Short division method can be used when children are confident to divide two and three digit numbers by a single digit.

So 1 2.5
7) 87.5

1 2.5
7) 8 1 7. 3 5</td>
</tr>
</table>

	Double digit multiplication 24 x17 24 17x ----- 28 (4x7) 140(20x7) 40(10x4) 200(10x20) + 408	
Stage 6	**Extend written methods for multiplication, encouraging estimation first.** • continue to use grid method as an expanded written method • develop short multiplication 625 x 6 3750 13 • leading to multiplication of numbers involving decimals 4·62 x 3 13·86 1 *Pupils will be taught the more compact method of multiplication if and when the teacher feels they are ready for it.* *27* *35 x* *So 5 x 7 (ones)* *5 x 2 (tens)* *3 x 7 (ones)* *3 x 2 (tens)* *Then progress to:* *27* *35 x* *135* *3* *810* *2* *945*	**Long Division:** **Extend written methods, encouraging estimation first** **So 2 8 12/15 or 28.8** **15) 43 13 2** 1x15=15 to 15 1 2x15=30 30 2 3x15=45 45 3 4x15=60 60 4 5x15=75 75 5 6x15=90 90 6 7x15=105 105 7 8x15=120 

For fractions guidance please visit:

http://nrich.maths.org/2550/index?nomenu=1

Please contact the Maths Subject Leader for any clarification on any further methods to be used.