Osborne
Co-operative Academy Trust

Calculation Policy

Thameside Primary School

Last reviewed: September 2022
Next review date: September 2024

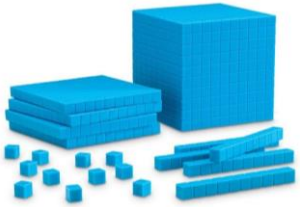
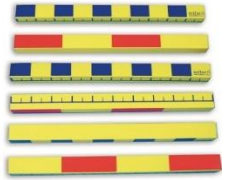
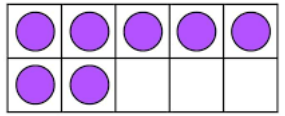
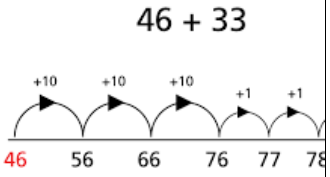
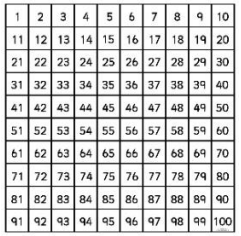
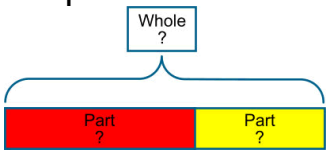
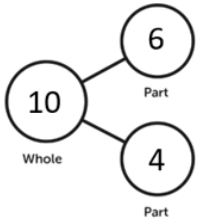
Osborne Co-operative Academy Trust is a multi-academy trust (MAT) incorporated around the principles and values of the international co-operative movement. These are Equality, Equity, Democracy, Self-help, Self-Responsibility and Solidarity, along with the ethical values of openness, honesty, social responsibility and caring for others. These values and principles underpin all our actions.

Thameside Primary's Written Maths Calculation Policy 2022-2024

This policy is intended to demonstrate how we teach different forms of calculation at Thameside Primary School. It is organised by year groups and designed to ensure progression for each operation in order to ensure smooth transition from one year group to the next. Mathematical understanding is developed through use of representations that are first of all concrete (e.g. base ten, apparatus), then pictorial (e.g. array, place value counters) to then facilitate abstract working (e.g. columnar addition, long multiplication). It is important that conceptual understanding, supported by the use of representation, is secure for procedures and if at any point a pupil is struggling with a procedure, they should revert to concrete and/or pictorial resources and representations to solidify understanding. Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

Visual and practical representations

Representations are vitally important throughout a child's maths education. Representations provide a 'hook' for children to 'hang' mathematical concepts and allow children to manipulate and later visualise the structure of mathematics. Representations are therefore a significant aid in developing conceptual understanding. Different concepts can be represented using the same resource/representation depending on the child's age and stage of mathematical development. Below are the key representations, presented in alphabetical order, that will be in use throughout a child's maths education at Thameside Primary School.

Base 10/Dienes 	Bead Strings	Numicon	Counting sticks 	Ten frames 
Multilink Cubes	Number lines and blank number lines 	Hundred squares 	Bar Model representations 	Number tracks
Clocks	Money	Dice	Part Whole Model 	Subitising objects

EYFS

Addition

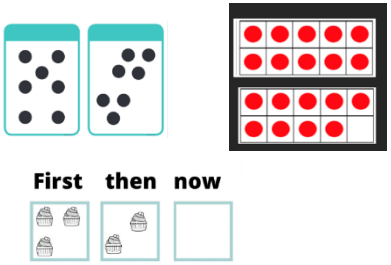
Mental strategies

Children to use Perceptual subitising to recognise an amount without counting each one.

Children to use Conceptual subitising (the ability to identify a whole quantity as a result of composing smaller quantities).

Use ten frames and subitising objects to model partitioning teen numbers into tens and ones and develop understanding of place value.

Children should understand the composition of numbers to 10 and this will allow them to reason, experiencing the = sign in different positions.



Vocabulary

Subitising, add, equal to, first, then, now, five frame, number track, ten frame, more than, odd, even

Key questions

What do you see?
How do you see it?

Subtraction

Mental strategies

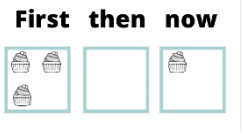
Children to use Perceptual subitising to recognise an amount without counting each one.

Children to use Conceptual subitising (the ability to identify a whole quantity as a result of composing smaller quantities).

Use ten frames and subitising objects to model partitioning teen numbers into tens and ones and develop understanding of place value.

Children should understand the composition of numbers to 10 and this will allow them to reason, experiencing the = sign in different positions.

Children should understand the mathematical difference between less than and fewer.



Vocabulary

Less than, fewer than, subtract, take away, minus, equal to

Key Questions

What do you see?
How do you see it?
First we had three, now we have 1, how many did I take away?

Multiplication

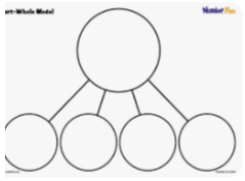
Mental strategies

They should see ways to represent odd and even numbers. This will help them to understand the pattern in numbers.

Children should begin to understand multiplication as equal groups.

Children should begin to use objects to group amounts to develop understanding of multiplication in a practical sense, e.g., two groups of 2

Children should begin to understand the term 'double'.



Vocabulary

Odd, even, groups, double, lots of

Key Questions

How many groups can we make?

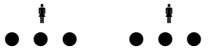
Division

Mental strategies

Children should begin to recognise the number of groups to support understanding of the relationship between multiplication and division.

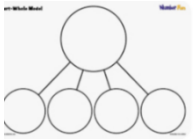
Children should begin to understand division as both sharing and grouping.

Sharing:
6 sweets are shared between 2 people.
How many do they have each?



Grouping:
How many 2's are in 6?

Children should use objects to group and share amounts to develop understanding of division in a practical sense.



Vocabulary

Sharing, halving, groups of

Key Questions

How many groups can we make?
How many can each group definitely get?

Addition

Year 1

Mental Strategies (addition and subtraction)

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

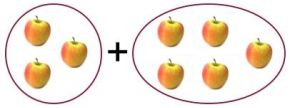
Children should understand the composition of numbers to 20 and this will allow them to reason, experiencing the = sign in different positions.

They should see addition and subtraction as related operations. E.g. 7 + 3 = 10 is related to 10 – 3 = 7, understanding of which could be supported by an image like this.

Use ten frames and subitising objects to model partitioning teen numbers into tens and ones and develop understanding of place value.

Children have opportunities to explore partitioning numbers in different ways.
e.g. 7 = 6 + 1, 7 = 5 + 2, 7 = 4 + 3 =

Children should begin to understand addition as combining groups.

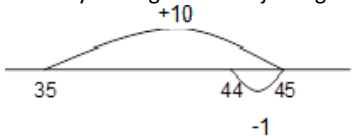


Year 2

Mental Strategies

Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Counting forwards in tens from any number should lead to adding multiples of 10.

Number lines should continue to be an important image to support mathematical thinking, for example to model how to add 9 by adding 10 and adjusting.



Children should practise addition to 20 to become increasingly fluent. They should use the facts they know to derive others, e.g using 7 + 3 = 10 to find 17 + 3= 20, 70 + 30 = 100

They should use concrete objects such as bead strings and number lines to explore missing numbers – 45 + ___ = 50.

As well as number lines, 100 squares could be used to explore patterns in calculations such as 74 +11, 77 + 9 encouraging children to think about 'What do you notice?' where partitioning or adjusting is used.

Children should learn to check their calculations, by using the inverse.

They should continue to see addition as both combining groups and counting on.

They should use Dienes to model partitioning into tens and ones and learn to partition numbers in different ways e.g. 23 = 20 + 3 = 10 + 13.

Year 3

Mental Strategies

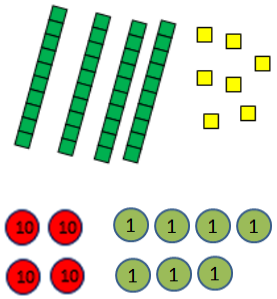
Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged. This will help to develop children's understanding of working mentally.

Children should continue to partition numbers in different ways.

They should be encouraged to choose the mental strategies which are most efficient for the numbers involved, e.g.
Add the nearest multiple of 10, then adjust such as 63 + 29 is the same as 63 + 30 – 1;
counting on by partitioning the second number only such as 72 + 31 = 72 + 30 + 1 = 102 + 1 = 103

Manipulatives can be used to support mental imagery and conceptual understanding. Children need to be shown how these images are related eg.
What's the same? What's different?



Vocabulary
Addition, add, forwards, put together, more than, total, altogether, distance between, difference between, equals = same as, most, pattern, odd, even, digit, counting on.

Generalisations
- True or false? Addition makes numbers bigger.
- True or false? You can add numbers in any order and still get the same answer.

(Links between addition and subtraction)
When introduced to the equals sign, children should see it as signifying equality. They should become used to seeing it in different positions.

Key Questions
How many altogether? How many more to make…? I add …more. What is the total? How many more is… than…? How much more is…? One more, two more, ten more…
What can you see here?
Is this true or false?
What is the same? What is different?

Vocabulary
+, add, addition, more, plus, make, sum, total, altogether, how many more to make…? how many more is… than…? how much more is…? =, equals, sign, is the same as, Tens, ones, partition
Near multiple of 10, tens boundary, More than, one more, two more… ten more… one hundred more

Generalisation
- Noticing what happens when you count in tens (the digits in the ones column stay the same)
- Odd + odd = even; odd + even = odd; etc
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and missing number problems. This understanding could be supported by images such as this.

$7 + ? = 10$

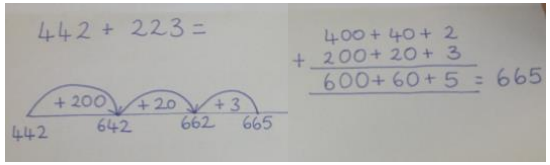
Key Questions
How many altogether? How many more to make…? How many more is… than…? How much more is…?
Is this true or false?
If I know that 17 + 2 = 19, what else do I know? (e.g. 2 + 17 = 19; 19 – 17 = 2; 19 – 2 = 17; 190 – 20 = 170 etc).
What do you notice? What patterns can you see?

Vocabulary
Hundreds, tens, ones, estimate, partition, recombine, difference, decrease, near multiple of 10 and 100, inverse, rounding, column subtraction, exchange
See also Y1 and Y2

Generalisations
- Noticing what happens to the digits when you count in tens and hundreds.
- Odd + odd = even etc (see Year 2)
- Inverses and related facts – develop fluency in finding related addition and subtraction facts.
- Develop the knowledge that the inverse relationship can be used as a checking method.

Key Questions
What do you notice? What patterns can you see?

When comparing two methods alongside each other: What's the same? What's different? Look at this number in the formal method; can you see where it is in the expanded method / on the number line?



Addition

Year 4

Mental Strategies

Children should continue to count, on and back, now including multiples of 6, 7, 9, 25 and 1000, and steps of 1/100.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate.

Children should continue to partition numbers in different ways.

They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards: 124 – 47, count back 40 from 124, then 4 to 80, then 3 to 77
- Reordering: 28 + 75, 75 + 28 (thinking of 28 as 25 + 3)
- Partitioning: counting on or back: 5.6 + 3.7, 5.6 + 3 + 0.7 = 8.6 + 0.7
- Partitioning: bridging through multiples of 10: 6070 – 4987, 4987 + 13 + 1000 + 70
- Partitioning: compensating – 138 + 69, 138 + 70 - 1
- Partitioning: using 'near' doubles - 160 + 170 is double 150, then add 10, then add 20, or double 160 and add 10, or double 170 and subtract 10
- Partitioning: bridging through 60 to calculate a time interval – What was the time 33 minutes before 2.15pm?
- Using known facts and place value to find related facts.

Vocabulary

Add, addition, sum, more, plus, increase, sum, total, altogether, double, near double, how many more to make..? how much more? ones boundary, tens boundary, hundreds boundary, thousands boundary, tenths

Year 5

Mental Strategies

Children should continue to count on and back, now including steps of powers of 10.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate.

Children should continue to partition numbers in different ways.

They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards in tenths and hundredths: 1.7 + 0.55
- Reordering: 4.7 + 5.6 – 0.7, 4.7 – 0.7 + 5.6 = 4 + 5.6
- Partitioning: counting on or back - 540 + 280, 540 + 200 + 80
- Partitioning: bridging through multiples of 10:
- Partitioning: compensating: 5.7 + 3.9, 5.7 + 4.0 – 0.1
- Partitioning: using 'near' double: 2.5 + 2.6 is double 2.5 and add 0.1 or double 2.6 and subtract 0.1
- Partitioning: bridging through 60 to calculate a time interval: It is 11.45. How many hours and minutes is it to 15.20?
- Using known facts and place value to find related facts.

Vocabulary

tens of thousands boundary,
Also see previous years

Generalisation

- Sometimes, always or never true? The difference between a number and its reverse will be a multiple of 9.
- What do you notice about the differences between consecutive square numbers?

Year 6

Mental Strategies

Consolidate previous years.

Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45

Vocabulary

See previous years

Generalisations

- Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to design their own ways of remembering.
- Sometimes, always or never true? Subtracting numbers makes them smaller.

Key Questions

What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

boundary, hundredths boundary, inverse, how many more/fewer? Equals sign, is the same as. **Generalisations** • Investigate when re-ordering works as a strategy for subtraction. Eg. 20 – 3 – 10 = 20 – 10 – 3, but 3 – 20 – 10 would give a different answer. **Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	Investigate a – b = (a-1) – (b-1) represented visually. **Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	

Subtraction

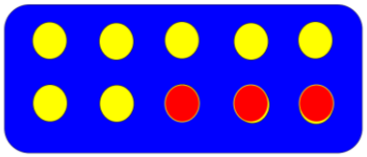
Year 1

Mental Strategies

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

Children should memorise and reason with number bonds for numbers to 20, experiencing the = sign in different positions.

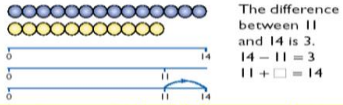
They should see addition and subtraction as related operations. E.g. 7 + 3 = 10 is related to 10 – 3 = 7, understanding of which could be supported by an image like this.



Use ten frames and subitising objects to model partitioning teen numbers into tens and ones.

Children should begin to understand subtraction as both taking away and finding the difference between.

Subtraction as "taking away"



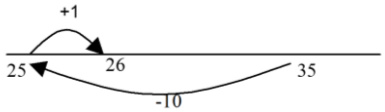
Subtraction as "the difference between"

Year 2

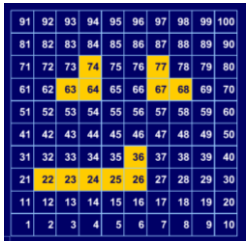
Mental Strategies

Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Counting back in tens from any number should lead to subtracting multiples of 10.

Number lines should continue to be an important image to support thinking, for example to model how to subtract 9 by adjusting.



Children should practise subtraction to 20 to become increasingly fluent. They should use the facts they know to derive others, e.g using 10 - 7 = 3 and 7 = 10 - 3 to calculate 100 - 70 = 30 and 70 = 100 - 30.



91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	39	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

As well as number lines, 100 squares could be used to model calculations such as 74 – 11, 77 – 9 or 36 – 14, where partitioning or adjusting are used. On the example above, 1 is in the bottom left corner so that 'up' equates to 'add'.

Children should learn to check their calculations, including by adding to check.
They should continue to see subtraction as both take away and finding the difference, and should find a small difference by counting up.

Year 3

Mental Strategies

Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged.

Children should continue to partition numbers in difference ways.

They should be encouraged to choose the mental strategies which are most efficient for the numbers involved, e.g. counting up (difference, or complementary addition) for 201 – 198; counting back (taking away / partition into tens and ones) for 201 – 12.

Calculators can usefully be introduced to encourage fluency by using them for games such as 'Zap' [e.g. Enter the number 567. Can you 'zap' the 6 digit and make the display say 507 by subtracting 1 number?]

The strategy of adjusting can be taken further, e.g. subtract 100 and add one back on to subtract 99. Subtract other near multiples of 10 using this strategy.

Vocabulary

Hundreds, tens, ones, estimate, partition, recombine, difference, decrease, near multiple of 10 and 100, inverse, rounding, column subtraction, exchange
See also Y1 and Y2

Generalisations

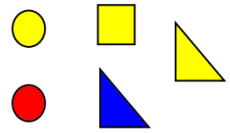
- Noticing what happens to the digits when you count in tens and hundreds.
- Odd – odd = even etc (see Year 2)

Vocabulary
Subtraction, subtract, take away, distance between, difference between, more than, minus, less than, equals = same as, most, least, pattern, odd, even, digit,

Generalisations

- True or false? Subtraction makes numbers smaller
- When introduced to the equals sign, children should see it as signifying equality. They should become used to seeing it in different positions.
- Children could see the image below and consider, "What can you see here?" e.g.

3 yellow, 1 red, 1 blue. 3 + 1 + 1 = 5
2 circles, 2 triangles, 1 square. 2 + 2 + 1 = 5
I see 2 shapes with curved lines and 3 with straight lines. 5 = 2 + 3
5 = 3 + 1 + 1 = 2 + 2 + 1 = 2 + 3



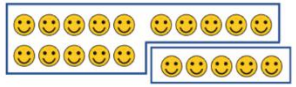
Key Questions
How many more to make…? How many more is… than…? How much more is…? How many are left/left over? How many have gone? One less, two less, ten less… How many fewer is… than…? How much less is…?
What can you see here?
Is this true or false?

They should use Dienes to model partitioning into tens and ones and learn to partition numbers in different ways e.g. 23 = 20 + 3 = 10 + 13.

Vocabulary
Subtraction, subtract, take away, difference, difference between, minus
Tens, ones, partition
Near multiple of 10, tens boundary
Less than, one less, two less… ten less… one hundred less
More, one more, two more... ten more... one hundred more

Generalisation

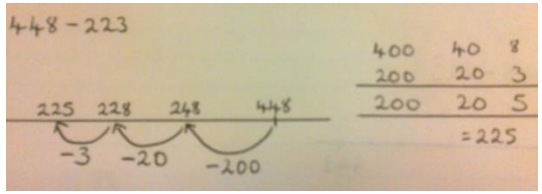
- Noticing what happens when you count in tens
- Odd – odd = even; odd – even = odd; etc
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and missing number problems. This understanding could be supported by images such as this.



Key Questions
How many more to make…? How many more is… than…? How much more is…? How many are left/left over? How many fewer is… than…? How much less is…?
Is this true or false?
If I know that 7 + 2 = 9, what else do I know? (e.g. 2 + 7 = 9; 9 – 7 = 2; 9 – 2 = 7; 90 – 20 = 70 etc).
What do you notice? What patterns can you see?

- Inverses and related facts – develop fluency in finding related addition and subtraction facts.
- Develop the knowledge that the inverse relationship can be used as a checking method.

Key Questions
What do you notice? What patterns can you see?
When comparing two methods alongside each other: What's the same? What's different? Look at this number in the formal method; can you see where it is in the expanded method / on the number line



Subtraction

Year 4

Mental Strategies

Children should continue to count regularly, on and back, now including multiples of 6, 7, 9, 25 and 1000, and steps of 1/100.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate.

Children should continue to partition numbers in different ways.

They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards: 124 – 47, count back 40 from 124, then 4 to 80, then 3 to 77
- Reordering: 28 + 75, 75 + 28 (thinking of 28 as 25 + 3)
- Partitioning: counting on or back: 5.6 + 3.7, 5.6 + 3 + 0.7 = 8.6 + 0.7
- Partitioning: bridging through multiples of 10: 6070 – 4987, 4987 + 13 + 1000 + 70
- Partitioning: compensating – 138 + 69, 138 + 70 - 1
- Partitioning: using 'near' doubles - 160 + 170 is double 150, then add 10, then add 20, or double 160 and add 10, or double 170 and subtract 10
- Partitioning: bridging through 60 to calculate a time interval – What was the time 33 minutes before 2.15pm?
- Using known facts and place value to find related facts.

Vocabulary

add, addition, sum, more, plus, increase, sum, total, altogether, double, near double, how many more to

Year 5

Mental Strategies

Children should continue to count regularly, on and back, now including steps of powers of 10.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate.

Children should continue to partition numbers in different ways.

They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards in tenths and hundredths: 1.7 + 0.55
- Reordering: 4.7 + 5.6 – 0.7, 4.7 – 0.7 + 5.6 = 4 + 5.6
- Partitioning: counting on or back - 540 + 280, 540 + 200 + 80
- Partitioning: bridging through multiples of 10:
- Partitioning: compensating: 5.7 + 3.9, 5.7 + 4.0 – 0.1
- Partitioning: using 'near' double: 2.5 + 2.6 is double 2.5 and add 0.1 or double 2.6 and subtract 0.1
- Partitioning: bridging through 60 to calculate a time interval: It is 11.45. How many hours and minutes is it to 15.20?
- Using known facts and place value to find related facts.

Vocabulary

tens of thousands boundary,
Also see previous years

Generalisation

- Sometimes, always or never true? The difference between a number and its reverse will be a multiple of 9.
- What do you notice about the differences between consecutive square numbers?
  Investigate a – b = (a-1) – (b-1) represented visually.

Year 6

Mental Strategies

Consolidate previous years.

Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45

Vocabulary

See previous years

Generalisations

- Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to design their own ways of remembering.
- Sometimes, always or never true? Subtracting numbers makes them smaller.

Key Questions

What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

make..? how much more? ones boundary, tens boundary, hundreds boundary, thousands boundary, tenths boundary, hundredths boundary, inverse, how many more/fewer? Equals sign, is the same as. **Generalisations** • Investigate when re-ordering works as a strategy for subtraction. Eg. 20 – 3 – 10 = 20 – 10 – 3, but 3 – 20 – 10 would give a different answer. **Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	**Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	

Multiplication

Year 1

Mental Strategies

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

Children should memorise and reason with numbers in 2, 5 and 10 times tables

They should see ways to represent odd and even numbers. This will help them to understand the pattern in numbers.

Children should begin to understand multiplication as scaling in terms of double and half. (e.g. that tower of cubes is double the height of the other tower)

Vocabulary

Ones, groups, lots of, doubling
repeated addition
groups of, lots of, times, columns, rows
longer, bigger, higher etc
times as (big, long, wide …etc)

Generalisations

- Understand 6 counters can be arranged as 3+3 or 2+2+2
- Understand that when counting in twos, even numbers remain even and odd numbers remain odd.

Key Questions

Why is an even number an even number?
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Year 2

Mental Strategies

Children should count regularly, on and back, in steps of 2, 3, 5 and 10.

Number lines should continue to be an important image to support thinking, for example

Children should practise times table facts
2 x 1 =
2 x 2 =
2 x 3 =

Use a clock face to support understanding of counting in 5s.

Use money to support counting in 2s, 5s, 10s, 20s, 50s

Vocabulary

multiple, multiplication array, multiplication tables / facts
groups of, lots of, times, columns, rows

Generalisation

- Commutative law shown on array (video)
- Repeated addition can be shown mentally on a number line
- Inverse relationship between multiplication and division. Use an array to explore how numbers can be organised into groups.

Key Questions

What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Year 3

Mental Strategies

Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.

The number line should continue to be used as an important image to support thinking, and the use of informal jottings and drawings to solve problems should be encouraged.

Children should practise times table facts
3 x 1 =
3 x 2 =
3 x 3 =

Vocabulary

partition
grid method
inverse

Generalisations

- Connecting x2, x4 and x8 through multiplication facts
- Comparing times tables with the same times tables which is ten times bigger. If 4 x 3 = 12, then we know 4 x 30 = 120. Use place value counters to demonstrate this.
- When they know multiplication facts up to x12, do they know what x13 is? (i.e. can they use 4x12 to work out 4x13 and 4x14 and beyond?)

Key Questions

What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Multiplication

Year 4

Mental Strategies

Children should continue to count regularly, on and back, now including multiples of 6, 7, 9, 25 and 1000, and steps of 1/100.

Become fluent and confident to recall all tables to x 12

Use the context of a week and a calendar to support the 7 times table (e.g. how many days in 5 weeks?)

Use of finger strategy for 9 times table.

Multiply 3 numbers together

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged.

They should be encouraged to choose from a range of strategies:

- Partitioning using x10, x20 etc
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication

Vocabulary

Factor

Generalisations

- Children given the opportunity to investigate numbers multiplied by 1 and 0.
- When they know multiplication facts up to x12, do they know what x13 is? (i.e. can they use 4x12 to work out 4x13 and 4x14 and beyond?)

Key Questions

What do you notice?
What's the same? What's different?

Year 5

Mental Strategies

Children should continue to count regularly, on and back, now including steps of powers of 10.

Multiply by 10, 100, 1000, including decimals (Moving Digits ITP)

The number line should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged.

They should be encouraged to choose from a range of strategies to solve problems mentally:

- Partitioning using x10, x20 etc
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication
-

If children know the times table facts to 12 x 12. Can they use this to recite other times tables (e.g. the 13 times tables or the 24 times table)

Vocabulary

cube numbers
prime numbers
square numbers
common factors
prime number, prime factors
composite numbers

Generalisation

- Relating arrays to an understanding of square numbers and making cubes to show cube numbers.
- Understanding that the use of scaling by multiples of 10 can be used to convert between units of measure (e.g. metres to kilometres means to times by 1000)

Year 6

Mental Strategies

Consolidate previous years.

Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45

They should be encouraged to choose from a range of strategies to solve problems mentally:

- Partitioning using x10, x20 etc
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication

If children know the times table facts to 12 x 12. Can they use this to recite other times tables (e.g. the 13 times tables or the 24 times table)

Vocabulary

See previous years
common factor

Generalisations

- Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to design their own ways of remembering.
- Understanding the use of multiplication to support conversions between units of measurement.

Key Questions

What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Can you convince me? How do you know?	**Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know? How do you know this is a prime number?	

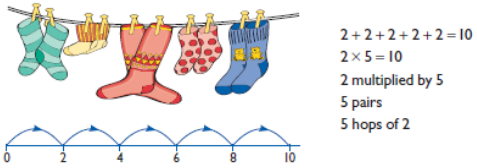
Division

Year 1

Mental Strategies

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

They should begin to recognise the number of groups counted to support understanding of relationship between multiplication and division.



Children should begin to understand division as both sharing and grouping.

Sharing
6 sweets are shared between 2 people. How many do they have each?

Grouping
How many 2's are in 6?

They should use objects to group and share amounts to develop understanding of division in a practical sense.
E.g. using objects, 5 frames or ten frames to find out how many 5's are in 30? How many pairs of gloves if you have 12 gloves?

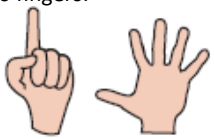
Year 2

Mental Strategies

Children should count regularly, on and back, in steps of 2, 3, 5 and 10.

Children who are able to count in twos, threes, fives and tens can use this knowledge to work out other facts such as 2 × 6, 5 × 4, 10 × 9.

Show the children how to hold out their fingers and count, touching each finger in turn. So for 2 × 6 (six twos), hold up 6 fingers:



Touching the fingers in turn is a means of keeping track of how far the children have gone in creating a sequence of numbers. The physical action can later be visualised without any actual movement.

This can then be used to support finding out 'How many 3's are in 18?' and children count along fingers in 3's therefore making link between multiplication and division.

Children should continue to develop understanding of division as sharing **and** grouping.

15 pencils shared between 3 pots, how many in each pot?

Children should be given opportunities to find a half, a quarter and a third of shapes, objects, numbers and quantities. Finding a fraction of a number of objects to be related to sharing.

Year 3

Mental Strategies

Children should count regularly, on and back, in steps of 3, 4 and 8.

Children are encouraged to use what they know about known times table facts to work out other times tables.

This then helps them to make new connections (e.g. through doubling they make connections between the 2, 4 and 8 times tables).

Children will make use multiplication and division facts they know to make links with other facts.
3 x 2 = 6, 6 ÷ 3 = 2, 2 = 6 ÷ 3
30 x 2 = 60, 60 ÷ 3 = 20, 2 = 60 ÷ 30

They should be given opportunities to solve grouping and sharing problems practically (including where there is a remainder but the answer needs to given as a whole number)
e.g. Pencils are sold in packs of 10. How many packs will I need to buy for 24 children?

Children should be given the opportunity to further develop understanding of division (sharing) to be used to find a fraction of a quantity or measure.

Use children's intuition to support understanding of fractions as an answer to a sharing problem.
3 apples shared between 4 people = $\frac{3}{4}$

Children should begin to explore finding simple fractions of objects, numbers and quantities.

E.g.*16 children went to the park at the weekend. Half that number went swimming. How many children went swimming?*

Vocabulary
share, share equally, one each, two each…, group, groups of, lots of, array

Generalisations
- True or false? I can only halve even numbers.
- Grouping and sharing are different types of problems. Some problems need solving by grouping and some by sharing. Encourage children to practically work out which they are doing.

Key Questions
How many groups of…?
How many in each group?
Share… equally into…
What can do you notice?

They will explore visually and understand how some fractions are equivalent – e.g. two quarters is the same as one half.

Use children's intuition to support understanding of fractions as an answer to a sharing problem.

3 apples shared between 4 people = $\frac{3}{4}$

Vocabulary
group in pairs, 3s … 10s etc
equal groups of
divide, ÷, divided by, divided into, remainder

Generalisations
- Noticing how counting in multiples if 2, 5 and 10 relates to the number of groups you have counted (introducing times tables)
- An understanding of the more you share between, the less each person will get (e.g. would you prefer to share these grapes between 2 people or 3 people? Why?)
- Secure understanding of grouping means you count the number of groups you have made. Whereas sharing means you count the number of objects in each group.

Key Questions
How many 10s can you subtract from 60?
I think of a number and double it. My answer is 8. What was my number?
If 12 x 2 = 24, what is 24 ÷ 2?
Questions in the context of money and measures (e.g. how many 10p coins do I need to have 60p? How many 100ml cups will I need to reach 600ml?)

Vocabulary
See Y1 and Y2
inverse

Generalisations
- Inverses and related facts – develop fluency in finding related multiplication and division facts.
- Develop the knowledge that the inverse relationship can be used as a checking method.

Key Questions
Questions in the context of money and measures that involve remainders (e.g. How many lengths of 10cm can I cut from 81cm of string? You have £54. How many £10 teddies can you buy?)
What is the missing number? 17 = 5 x 3 + __
__ = 2 x 8 + 1

Division

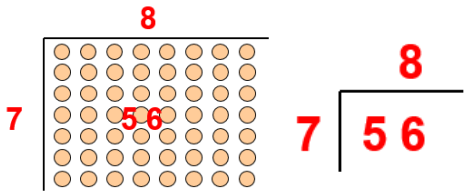
Year 4

Mental Strategies
Children should experience regular counting on and back from different numbers in multiples of 6, 7, 9, 25 and 1000.

Children should learn the multiplication facts to 12 x 12.

Vocabulary
see years 1-3
divide, divided by, divisible by, divided into
share between, groups of
factor, factor pair, multiple
times as (big, long, wide …etc)
equals, remainder, quotient, divisor
inverse

Towards a formal written method
Alongside pictorial representations and the use of models and images, children should progress onto short division using a bus stop method.



Place value counters can be used to support children apply their knowledge of grouping. Reference should be made to the value of each digit in the dividend.

Each digit as a multiple of the divisor
'How many groups of 3 are there in the hundreds column?'
'How many groups of 3 are there in the tens column?'

Year 5

Mental Strategies
Children should count regularly using a range of multiples, and powers of 10, 100 and 1000, building fluency.
Children should practice and apply the multiplication facts to 12 x 12.

Vocabulary
see year 4
common factors
prime number, prime factors
composite numbers
short division
square number
cube number
inverse
power of

Generalisations
- The = sign means equality. Take it in turn to change one side of this equation , using multiplication and division, e.g.
  Start: **24 = 24**
  Player 1: **4 x 6 = 24**
  Player 2: **4 x 6 = 12 x 2**
  Player 1: **48 ÷ 2 = 12 x 2**
- Sometimes, always, never true questions about multiples and divisibility. E.g.:
  *If the last two digits of a number are divisible by 4, the number will be divisible by 4. If the digital root of a number is 9, the number will be divisible by 9.
  *When you square an even number the result will be divisible by 4 (one example of 'proof'

Year 6

Mental Strategies
Children should count regularly, building on previous work in previous years.
Children should practice and apply the multiplication facts to 12 x 12.

Vocabulary
see years 4 and 5

Generalisations
- Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to design their own ways of remembering.
- Sometimes, always, never true questions about multiples and divisibility. E.g.: If a number is divisible by 3 and 4, it will also be divisible by 12. (also see year 4 and 5, and the hyperlink from the Y5 column)
- Using what you know about rules of divisibility, do you think 7919 is a prime number? Explain your answer.

Some Key Questions for Year 4 to 6

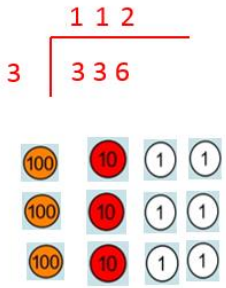
What do you notice?

What's the same? What's different?

Can you convince me?

How do you know?

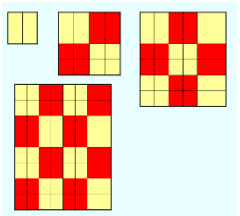
‘How many groups of 3 are there in the units/ones column?’



When children have conceptual understanding and fluency using the bus stop method without remainders, they can then progress onto ‘carrying’ their remainder across to the next digit.

Generalisations

- True or false? Dividing by 10 is the same as dividing by 2 and then dividing by 5. Can you find any more rules like this?
- Is it sometimes, always or never true that □ ÷ Δ = Δ ÷ □?
- Inverses and deriving facts. ‘Know one, get lots free!’ e.g.: 2 x 3 = 6, so 3 x 2 = 6, 6 ÷ 2 = 3, 60 ÷ 20 = 3, 600 ÷ 3 = 200 etc.
- Sometimes, always, never true questions about multiples and divisibility. (When looking at the examples on this page, remember that they **may not** be ‘always true’!) E.g.:
- Multiples of 5 end in 0 or 5.
- The digital root of a multiple of 3 will be 3, 6 or 9.
- The sum of 4 even numbers is divisible by 4.



Addition and Subtraction – Key vocabulary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

Multiplication and Division – Key vocabulary

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

Product – The result of multiplying one number by another.

Quotient – The result of a division

Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor

Recommended websites to support planning and teaching mathematics

- White Rose interactive tools - https://whiterosemaths.com/resources/digital-tools
- EY Maths - https://www.eymaths.co.uk/
- Polypad Visual resources - https://mathigon.org/polypad
- MathsBot Manipulatives - https://mathsbot.com/manipulativeMenu
- PiXL PrimayWise - https://auth.pixl.org.uk/primary#!/Home
- NRICH Thinking mathematically activities and games - https://nrich.maths.org/primary
- Reasoning strategies NCETM - https://www.ncetm.org.uk/classroom-resources/pm-reasoning-skills/
- TopMarks interactive games - https://www.topmarks.co.uk/
- 'Which One Doesn't Belong' logical reasoning images - https://wodb.ca/