Red Hall Primary School Calculation Policy

Addition

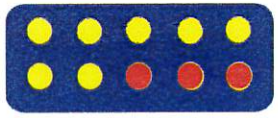
Year 1

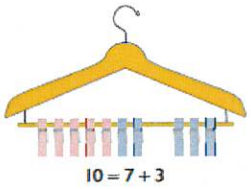
Mental Strategies (addition and subtraction)

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

Children should 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.



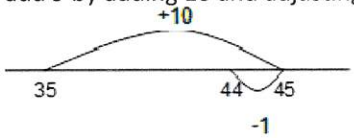


Year 2

Mental Strategies

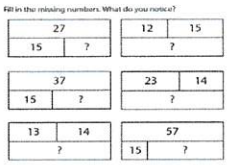
Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Counting forwards in tens from any number should lead to adding multiples of 10.

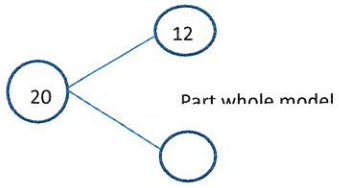
Number lines should continue to be an important image to support mathematical thinking, for example to model how to add 9 by adding 10 and adjusting.



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

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.

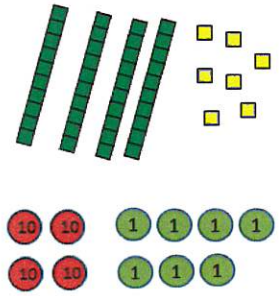
They should be encouraged to choose the mental strategies which are most efficient for the numbers involved, e.g.

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?



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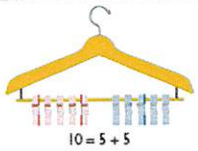
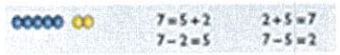


We have 10 pegs on the coathangers, how can we split them into 2 groups? Is there another way? How can you be sure you have got them all?

Use bundles of straws and Dienes 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 and counting on.

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.

Vocabulary

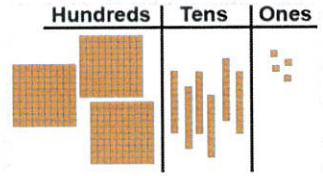
+, add, addition, more, plus, make, sum, total, part/whole, altogether, how many more to make…? how many more is… than…? how much more is…? =, equals, sign, is the same as, Tens, ones, partition
Near multiple of 10, tens boundary, More than, one more, two more… ten more… one hundred more

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

Vocabulary

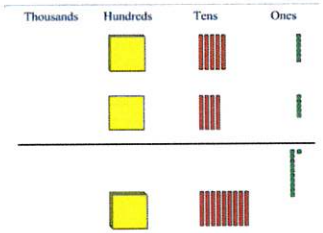
Hundreds, tens, ones, estimate, partition, recombine, difference, decrease, near multiple of 10 and 100, inverse, rounding, column subtraction, exchange
See also Y1 and Y2



Introduce column addition <u>without</u> crossing the boundary

24 (20+4)
<u>+53 (50+3)</u>
77 (70 + 7)

Introduce crossing boundary using denies apparatus or place value counters.



625
<u>+ 48</u>
13 (5+8)
60 (20 + 40)
<u>+ 600</u> (600 + 0)
673

Expanded notion to be used before compact to ensure understanding.
All language in the context of the place value and the mental addition of the totals to be done in any order.

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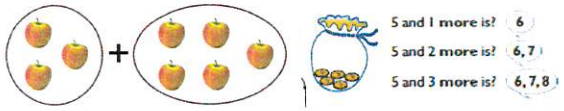


Vocabulary

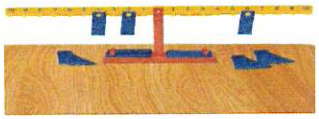
Sum, addition, add, forwards, put together, more than, total, altogether, distance between, difference between, equals = same as, most, pattern, odd, even, digit, counting on.

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.

Another example
here...promote balance in the equation.



10 = 7 + 3

- 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.

Some 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?

```
 625
+ 48
 673
 1
```

Carrying digits to be noted under the line.

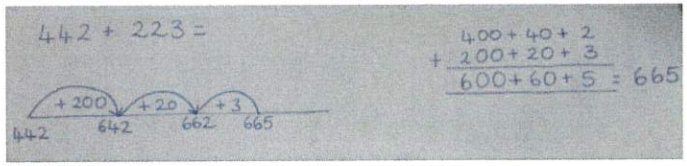
Generalisations

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?



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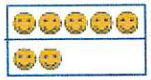

$7 + ? = 10$

Some 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?

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Addition

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.

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

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.

Some Key Questions

What do you notice?

What's the same? What's different?

Can you convince me?

How do you know?

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Continue with HTO + HTO, then extend to ThHTO + ThHTO.

Approximate using the most significant digit, rounding skills.

Check using the inverse.

Refer to the carried digit as a ten or a hundred.

```
  587
+ 475
 1062
 1 1
```

"7 add 5 equals 12. That's 2 units and 1 ten to carry over. 80 add 70 equals 150 and the one ten to carry makes 160. That's 6 tens and 100 to carry over. 500 add 400 equals 900 and the one hundred to carry makes 1000"

```
  7648
+ 1486
    14
   120
  1000
 +8000
  9134
```

```
  7648
+ 1486
  9134
  1 1 1
```

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 boundary, hundredths boundary, inverse, how many more/fewer? Equals sign, is the same as.

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?

Some Key Questions

What do you notice?

What's the same? What's different?

Can you convince me?

How do you know?

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Also see previous years. **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. **Some Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?		

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Subtraction

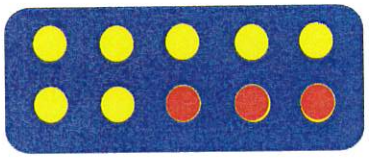
Year 1

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.

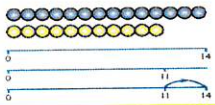
They should see addition and subtraction as related operations. E.g. 7 + 3 = 10 is related to 10 – 3 = 7, understanding of which could be supported by an image like this.



Use bundles of straws and Dienes to model partitioning teen numbers into tens and ones.

Children should begin to understand subtraction as both taking away and finding the difference between, and should find small differences by counting on.

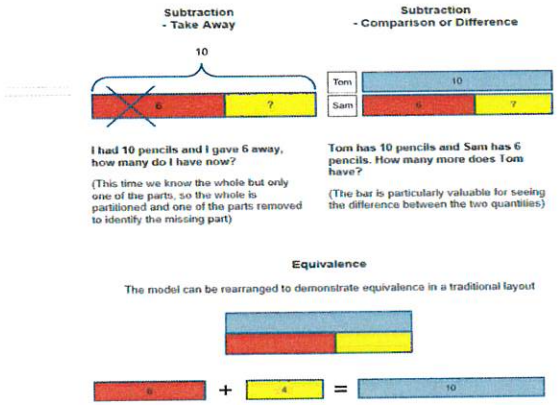
Subtraction as "taking away"



Subtraction as "the difference between"

Year 2

Mental Strategies



Continue to use the bar model to encourage the recall of subtraction facts.

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.

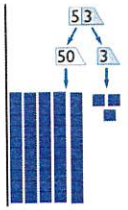
Year 3

Mental Strategies

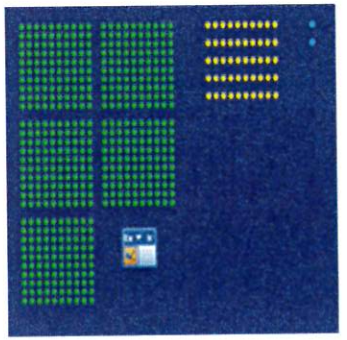
Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.

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 different ways.



53 is 5 tens and 3 units, but it is also 40 and 13 (drop the language of tens and units). Also using HTU.
E.g 552 is 500 and 50 and 3, and 500 and 40 and 12.



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Use unifix to model difference.

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.

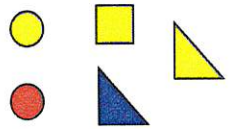
Children could see the image below and consider, "What can you see here?" e.g.

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



Some 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...?

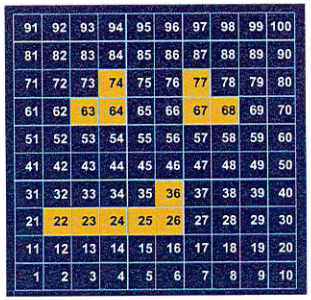
What can you see here?

Is this true or false?

55 – 27 = 28

Find the difference (counting on to the right) Model with numbers that are close together.

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.

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.

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.

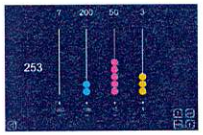
89	=	80	9
- 24	=	20	4
		60	5 = 65

"9 subtract 4 equals 5 and 80 subtract 20 equals 60. 60 and 5 make 65"

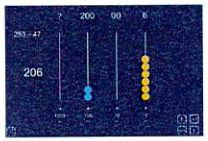
No crossing of boundaries to begin with.

Teach exchange using place value counters and beadsticks ITP.

Exchange - Beadsticks



253 – 47 = 206



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Teach partitioning the second number, e.g
85 – 34 (underline the second number)
85 – 30 = 55
55 – 4 = 51

85- 37 (underline the second number)
85 – 30 = 55
55- 7 = (55-5 then -2 this shows thinking) 48

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 (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.

Decomposition
(Continue with Dienes and/or money as appropriate)

754	700	50	4	
- 86		80	6	
600	60	8	=668	

754	600	140	14	
- 86		80	6	
600	60	8	=668	

*"It's tricky to subtract 6 from 4 and 80 from 50. I need to rearrange the number. I will exchange one ten from 50 which leaves 40 and makes 14 in the units. 40 to subtract 80 is tricky. I will **exchange** one hundred from 700 and make 140. 14 subtract 6 equals 8. 140 subtract 80 equals 60 and 600 subtract 0 equals 600."*

Emphasis on language of place value, i.e. 14 units subtract 6 units, 14 tens subtract 8 tens, and 6 hundreds subtract 2 hundreds.

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.

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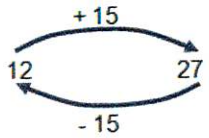
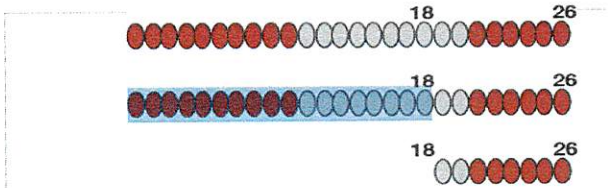
Inversion loops



The bar model

Relative position



Relative position promotes decision making, e.g 'are the numbers close together? If so, then finding the difference is the better subtraction strategy'.

Some 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?

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

Red Hall Primary School Calculation Policy

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.

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

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.

Some Key Questions

What do you notice?

What's the same? What's different?

Can you convince me?

How do you know?

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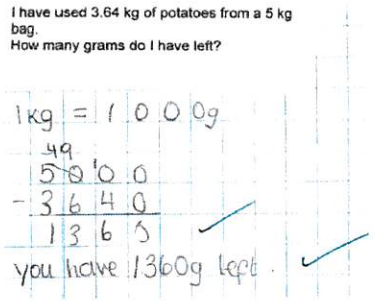


Vocabulary

subtract, difference, exchange, inverse, sum, fewer, plus, decrease, total, altogether, double, half, near double, how many more to make..? how much more? ones boundary, tens boundary, hundreds boundary, thousands boundary, tenths boundary, hundredths boundary 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.

Some Key Questions

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

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?

Some Key Questions

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

Red Hall Primary School Calculation Policy

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.

Pictorial repeated addition.
Grouping is a random arrangement of a quantity into equal groups.

Arrays are a rectangular arrangement to show the equal groups.

$4 \times 2 = 8$

$2 \times 4 = 8$

$2 \times 4 = 8$

$4 \times 2 = 8$

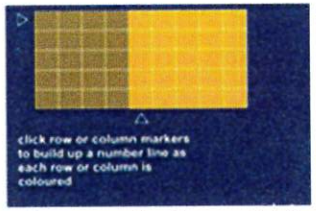
Counting in 2s, 5s and 10s and begin counting in 3s.

Introduce the x symbol once repeated addition is understood.

Year 2

Mental Strategies

Children should count regularly, on and back, in steps of 2, **3**, 5 and 10, including recognising odd and even numbers within the table facts, e.g 3 x 7 = 21, odd x odd = odd



In the example above with 5 rows and 9 columns, when you select to count along the columns the given calculation is:
5 x 9 = 45 [the 5 is multiplied by 9].
Selecting to count along rows gives:
9 x 5 = 45 [the 9 is multiplied by 5].

Children should practise times table facts using the commutative law
2 x 1 =
2 x 2 =
2 x 3 =

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

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 tenths.
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 using teaching strategies such as: singing tables, table ITP, promote patterns including doubling for 2's, 4's and 8'sidentifying table facts for instant recall.

Multiplication Board ITP

Multiplication tables ITP

Doubles are same as x2.

Vocabulary of double, multiply, groups of, sets of, lots of etc.

Partitioning strategy for doubling.

Double 35

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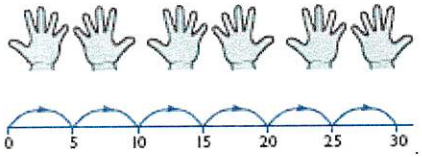
2 × 5 = 10

5 × 2 = 10



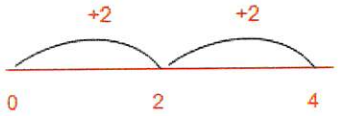
5 + 5 + 5 + 5 + 5 + 5 = 30
5 × 6 = 30
5 multiplied by 6
6 groups of 5
6 hops of 5

1 group of 3 = 3

2 groups of 3 = 6

Doubles and grouping recorded on number lines

2 + 2 =



Children to show notation

To understand that any number multiplied by zero will always be zero.

Use a clock face to support understanding of counting in 5s.
Use money to support counting in 2s, 5s, 10s, 20s, 50s

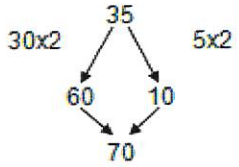
Vocabulary
multiple, multiplication array, multiplication tables / facts
groups of, lots of, times, columns, rows

Generalisation
Commutative law shown on array (video)

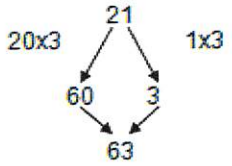
Repeated addition can be shown mentally on a number line

Inverse relationship between multiplication and division. Use an array to explore how numbers can be organised into groups.

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



A lolly costs 21p. How much do 3 cost?



Informal recording of partitioned numbers
15 x 5 = 75

10 x 5 = 50
5 x 5 = 25

27 x 3 = 81

20x3 = 60
7x3 = 21

"20 **multiplied by** 3 equals 60 and 7 **multiplied by** 3 equals 21. 60 add 21 equals 81."

23 x 8 =
20 x 8 =160
3 x 8 = 24

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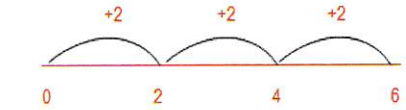
2 + 2 + 2 =



Children to show notation

3 x 2 =6

3 multiplied by 2 equals 6.

3 times 2 equals 6

Finding simple fractions of quantities.
Finding half of 10 apples.

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)

x	20	3
8		

Progressing to formal written methods

23
x 8
24 (8 x3)
160 (8 x20)
184

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?)

Some Key Questions

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

Red Hall Primary School Calculation Policy

Generalisations Understand 6 counters can be arranged as 3+3 or 2+2+2 Understand that when counting in twos, the numbers are always even. **Some 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?		

Red Hall Primary School Calculation Policy

Year 4	Year 5	Year 6
Mental Strategies Children should continue to count regularly, on and back, now including multiples of 6, 7, 9, 25 and 1000, and steps of hundredths. 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?) 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. Approximate first. Partitioning / distributive law, e.g. 28x4 can be split up into 25x4 add 3x4 or 30x4 subtract 2x4.	**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) ThHTOx TO and HTO x TO and including decimals. TO x TO 78 x 42 16 (2 x 8) 140 (2 x 70) 320 (40 x 8) +2800 (40 x 70) 3276	**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 BIDMAS, or could be encouraged to design their own ways of remembering. Understanding the use of multiplication to support conversions between units of measurement.

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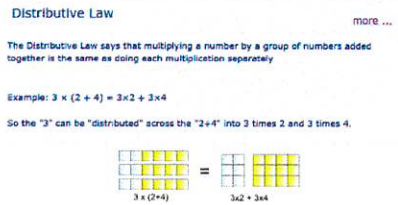

Pupils to explain the effect of multiplying by 10 and 100.

Addition to be done mentally.

HTU and TU x U.
Record using expanded notation of the gird and expanded short multiplication.

346 x 9

x	300	40	6
9			

Compact (long)

```
  78
 x42
 156
1
+3120
 3276
```

Vocabulary

product
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)

Some 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?

Some Key Questions

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

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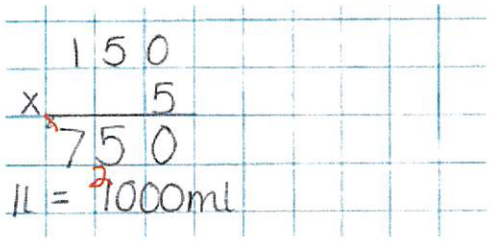
346 x 9 54 (9 x 6) 360 (9 x 40) 2700 (9 x 300) 3114 1 1 Short multiplication with compact notation to be introduced once the expanded method is secure. A bottle holds 1 litre of lemonade. Rachel fills 5 glasses with lemonade. She puts 150 millilitres in each glass. How much lemonade is left in the bottle?  **Vocabulary** Factor		

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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?) **Some Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?		

Red Hall Primary School Calculation Policy

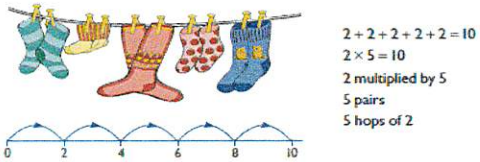
Division

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?

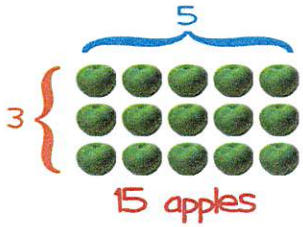
They should use objects to group and share amounts to develop understanding of division in a practical sense.
E.g. using counters to find out how many 5's are in 30?
How many pairs of gloves if you have 12 gloves?

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.

5 x 3 = 15
3 x 5 = 15



To recognise the dividend of 15 and the associated division facts such as: 15 ÷3 = 5

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

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?

Rearranging the dividend.
Use denies to build dividends that can be rearranged into multiplies of the divisor.

48 ÷ 3 =
'What do I know about 3 x tables?'
"I know 3 x 10 = 30."

30 18
↓ ↓
10 6

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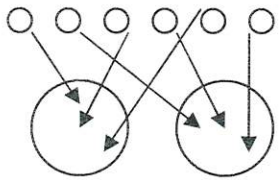
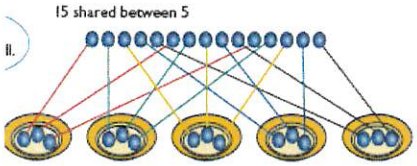
Record sharing by using pictorial notation

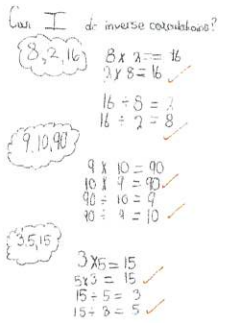
There are 6 cakes and 2 children. How many cakes will they each get?
One for you and one for you.



5 hops in 15. How big is each hop?



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?*



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

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

Pat has no more than 20 sweets in a bag.

She counts her sweets in groups of two. She has one left over.

Then she counts her sweets in groups of five. She has 2 left over.

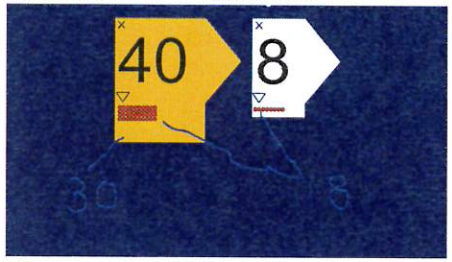
How many sweets could Pat have? Is there another answer?

Pupils to recognise when a dividend will leave a remainder, for example, 21 ÷ 5 .

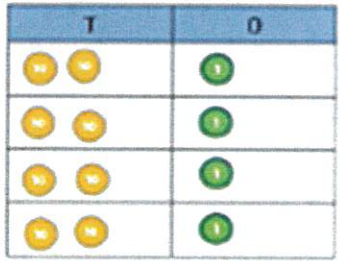
Children should be given opportunities to find a half, a quarter and a third of shapes, objects, numbers and quantities. Finding a fraction of a number of objects to be related to sharing.

48 ÷ 3 = 16

10 x 3 = 30 6 x 3 = 18



84 ÷ 4



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.

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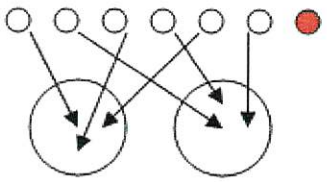
There are 7 cakes and 2 children. How many cakes will they each get?
'Leftovers' introduced.



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.

Some 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.

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.

Some 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.

Some 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? $17 = 5 \times 3 + \_\_$
$\_\_ = 2 \times 8 + 1$

Red Hall Primary School Calculation Policy

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

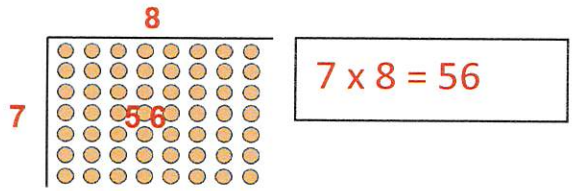
times as (big, long, wide ...etc)

equals, remainder, quotient, divisor, dividend

inverse

Towards a formal written method

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



7 x 8 = 56

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.

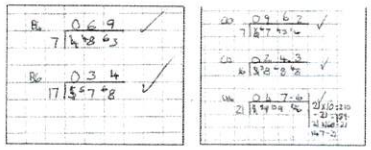
Year 5

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.

Short division with formal notation ThHTO divided by O



"483 divided by 7. 4 hundreds cannot be shared equally between 7, so exchange the 100s for 40 tens. I now have 48 tens which shared equally between 7 is 6 with a remainder of 6 tens. Exchange the 6 tens for 60 units, we now have 63 units.
63 divided equally between 7 equals 9. The answer is 69.
Use Diennes or place value equipment to model.

Children can divide ThHTO by TO for known tables (11, 12) using short division method.

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.

Explain the effect of dividing by1000.

Extend methods to include Th HTO by TO.

Continue to use the short division method when the two digit divisor is up to 12 or is a easily recognisable multiple eg 20, 25 or 50.

Move to long division method for TO that are not known tables or easily recognisable multiples.

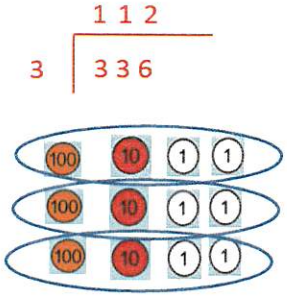
Use a calculator appropriately, approximating first.
Use of calculator for interpreting the quotient by entering a fraction to find the decimal equivalent.

Continued next page.

Red Hall Primary School Calculation Policy

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



When children have conceptual understanding and fluency using the formal 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 ÷ □?

Vocabulary

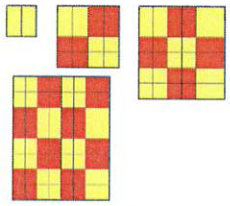
see year 4
common factors
prime number, prime factors
composite numbers
short division
square number
cube number
inverse
power of

Generalisations

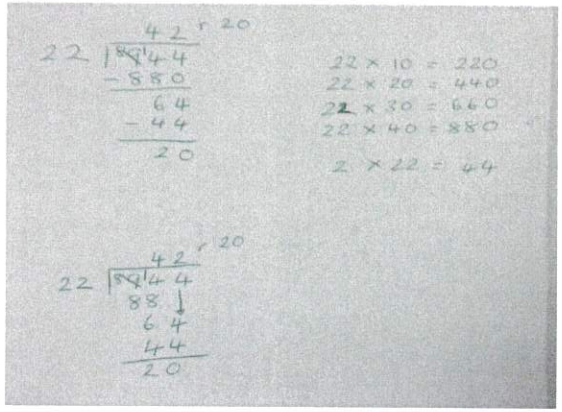
The = sign means equality. Take it in turn to change one side of this equation, using multiplication and division, e.g.
Start: **24 = 24**
Player 1: **4 x 6 = 24**
Player 2: **4 x 6 = 12 x 2**
Player 1: **48 ÷ 2 = 12 x 2**

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' shown left)



Use long division only with pupils who are secure with number sense and place value.



944 ÷ 22
"What do I know about the divisor?"
Record partial tables.

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).

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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.		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?**

Red Hall Primary School Calculation Policy

Reception

Addition

Key skills: count sets of objects splitting them into different sized groups using practical apparatus.

Begin to understand that they can split in any way and the total number remains the same.

Children use number rhymes and stories in a meaningful context.

Pictorial recording of practical experiences.

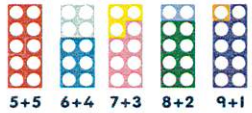
Understand that when we add, the number gets bigger.

Jane had three bears. She was given 2 more. How many does she have now?

= 5

Show calculation as pictures or a number sentence.

Count reliably to 20
Order the numbers 1 to 20
Children say what one more than a number is.



Add 2 single digit nos by counting on using numicon and tens frames.

Subtraction

Key skills: know that the number gets smaller because objects have been removed from the set.

Practical models of subtraction.

Counting back on fingers, orally, number lines.

Counting back from 20.

Children can say 1 less than a given number.

Find the difference counting on, orally, number lines.

Practical demonstration of take away.

Extended use of model and images – use apparatus to 'move' images (concrete to abstract).

There were 9 balloons.

9 – 2 = 7

Two popped. How many are left?

Find the difference where numbers are close together.

How many more do I add to 7 to get 9?

Red Hall Primary School Calculation Policy

Reception

Multiplication

Key skills: count sets of objects splitting them into different sized groups using practical apparatus.

Understand that multiplication is repeated addition, use practical equipment to understand.

Be able to double numbers to 10.

Know that multiplication is commutative so can be done in any order.

Use practical apparatus to show doubles of numbers.

Use a number line to show repeated addition as a way to multiply. Use concrete models to make the link.

Pictures to show 2 lots of 3 or 3 lots of 2.

Division

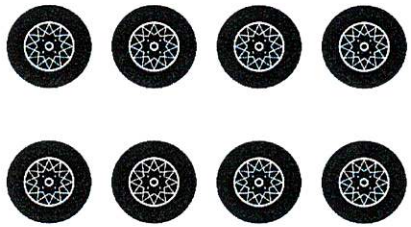
Sharing and group objects equally in practical contexts.

Solve problems including sharing.

Use pictures to record what they have done.

Introduce the idea of grouping –

A car has 4 wheels, how many cars can you make if you have 8 wheels? 2 cars.



and

6 sweets are put into groups of 3. How many groups will you make?