St Mary's C of E Junior School
Written Methods in Mathematics

Addition

Vocabulary

|		
add	addition	how much more is ......?
more	plus	equals
sum	total	hundreds boundary
altogether	score	increase
double	near double	is the same as
one more	two more	tens boundary
ten more	hundred more	sign
how many more to make ....?	how many more is ...than ?	make
exchanging	partition	hundreds/tens/units
tenths/hundredths		

Mental Skills

Recognise the position of number on a number line
Count on in ones and tens
Know number bonds to 10 and 20
Partition and recombine numbers
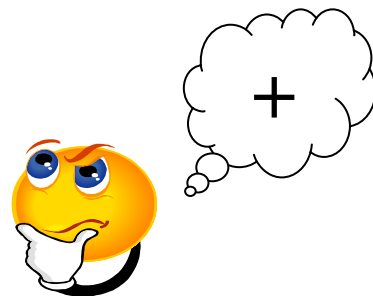
Models and Images

Counting apparatus (beads, counters, cubes)
Place value apparatus (cards, deines)
Number lines
Unstructured number lines
Hundred squares
Counting sticks
Bead strings
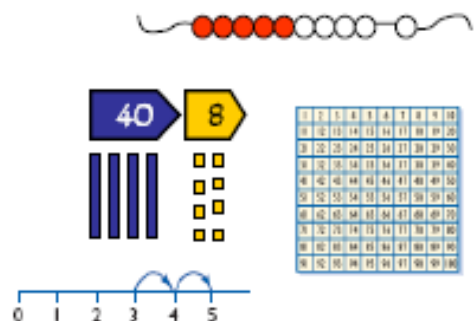
St Mary's C of E Junior School
Written Methods in Mathematics

## Progression in teaching written addition strategies

Although some methods are taught in specific year groups class teachers and teaching assistants will use their assessment of pupil's ability and understanding to introduce methods when appropriate. It is important that children have time to consolidate understanding of each phase.

Phase 1

Adding along a structured numbered number line

Children are taught to add using a number line. They will start on the biggest number and then jump along the number they were adding.

E.g. 6+5= 11

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
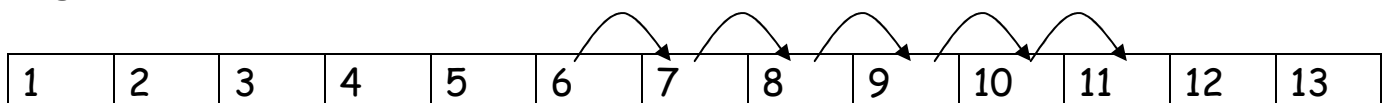
The children will then move on to using a 100 square, again starting with the largest number. They will also have been taught to count on in their head. They will be taught to put the biggest number in their head and count on the smaller number.
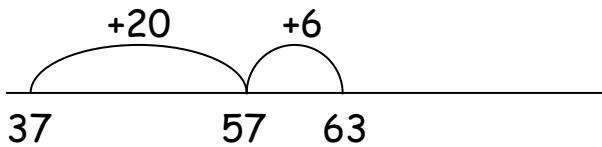
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Phase 2

Adding using an unstructured number line (not bridging through 10)

Put the largest number at the beginning of the number line. Partition the second number. Then add the tens and then the units.

37 + 26 =   (20+6)

```
       +20          +6
    ╭────────╮   ╭─────╮
 ───┘        └───┘     └────────
 37           57    63
```
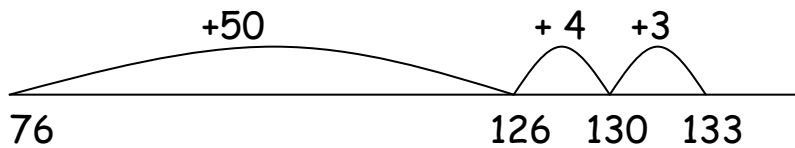
Phase 3

Unstructured number lines (bridging through 10 and 100)

Put the largest number at the beginning of the number line. Partition the second number. Then add the tens and then the units, bridging through 10.

76 + 57 = 133

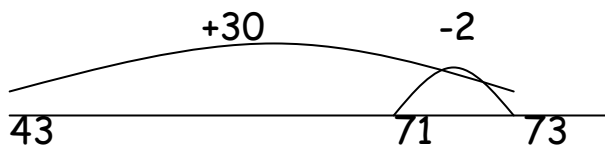```
           +50   + 4   +3
     ╭──────────────╮   ╭───╮ ╭───╮
 ────┘   └─────┘   └─┘   └──
 76   126 130 133
```

# St Mary's C of E Junior School
# Written Methods in Mathematics

**Phase 4**

**Unstructured number lines Adding and adjusting**

Put the largest number at the beginning of the number line. Add the nearest multiple of 10 and then adjust. (This is often the same as adding the tens then the units)

43 + 28



**Phase 5**
**Adding by Partitioning and Recombining**

Initially children are taught to partition both numbers
53 + 24 = 77

| | | |
|---|---|---|
| 50 + 3 | 20 + 4 | (Partition the numbers into tens and units) |

50 + 20 = 70          (Add the tens numbers together)
 3 +  4 =  7          (Add the units numbers together)
70 +  7=  77          (Add the tens and units answers together)

Children are then encouraged to partition the second (smallest number) only prior to adding
e.g.
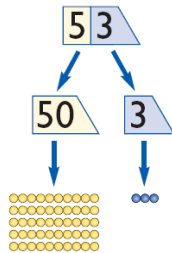36+53       = 53 +  30 =83

# Written Methods in Mathematics

= 83 + 6 = 89

345+214    = 345 + 200=545
           = 545 + 10 = 555
           = 555 + 4 = 559

*(Partition means to split a number into tens and units*
*E.g. 53 = 50 + 3))*

Children in lower KS2 (year 3 and 4) will not usually move onto more formal written methods, they will continue to use partitioning and blank number lines using larger numbers. Some children will progress to more formal written methods of addition if they are assessed to be ready and have a sound understanding of place value.
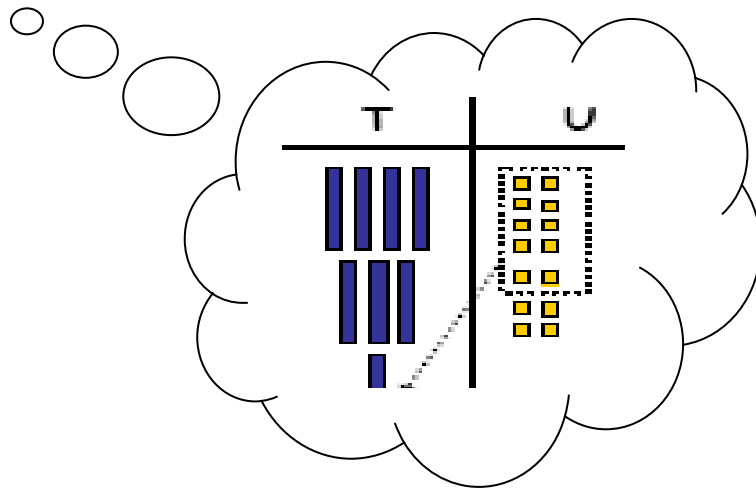
# St Mary's C of E Junior School
# Written Methods in Mathematics

## Phase 6

## Expanded written method

It is important that the children have a good understanding of place value and partitioning using concrete resources and visual images to support calculations. The expanded method enables children to see what happens to numbers in the standard written method.

65 + 23

```
e.g.      6 5
      +   2 8
      ─────────
         1 3   (8 + 5)  }  add mentally from the top    -Add the units
         8 0   (60 + 20))                               -Add the ten
      ─────────                                         -Finally add the,
           93                                            tens and units together
```

423+48=

```
e.g.    4 2 3
      +   4 8
      ─────────
         1 1   (8 + 3)  }  add mentally from the top    -Add the units
         6 0   (40 + 20)                                -Add the tens
       4 0 0  (400 +  0)                                -Add the hundreds
      ─────────                                         -Finally add the hundreds,
         4 7 1                                           tens and units together
```

St Mary's C of E Junior School
Written Methods in Mathematics

Phase 7

Standard / Formal column method for addition with exchanging

e.g.

```
    6 6 4 8
  + 1 4 8 6
  ───────
    8 1 3 4
    1 1 1
```

```
    1 2 . 3 4
  + 1 0 . 8 6
  ─────────
    2 3 . 2 0
       1   1
```

(The exchanged figures should be put under the answer line and crossed out as they are added and children should be encouraged to use correct terminology when explaining their methods)

Some helpful skills to practice:
- Counting forwards and backwards in tens
- Adding units across the tens boundary
- Learn by heart number bonds to 10 then 20 and pairs of numbers that make all totals below 10 then 20 e.g. 12+3=15
- Knowing how to add 9 and 11 by adding 10 and adjusting
  e.g. 34+9 (34+10-1=33)

When adding decimals (generally upper school):
- Counting forwards and backwards in tenths and hundredths
- Adding tenths or hundredths across whole number boundary
- Learning by heart number bonds to 1 for tenths and hundredths
  e.g. 0.8+0.2=1   3.6 + 0.4 = 4

St Mary's C of E Junior School
Written Methods in Mathematics
Subtraction

Vocabulary

minus	how many are left/left over?
leave	one less
two less	ten less
hundred less	how much less is ....than ...?
... fewer than...?	difference between
half	halve
take away	subtraction
decrease	leave
exchanging	partition
hundreds/tens/units	tenths/hundredths

Mental Skills

Recognise the size and position of numbers on a number line
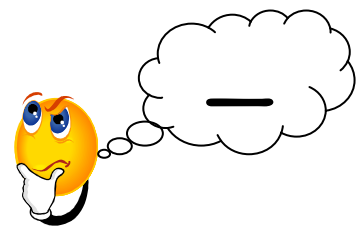(e.g. 20 is less than 43 and 12.3 is less that n 12.6)
Count back in ones and tens
Know number facts for all numbers to 20 (e.g. 19-6=13)
Subtract multiples of 10 from any number
Partition and recombine numbers (only partition the number to be subtracted
e.g. 48-24 = 48-20-4))
Bridge through 10 (26-9=17, bridging through 20)

Models and Images

Counting apparatus (beads, counters, cubes)
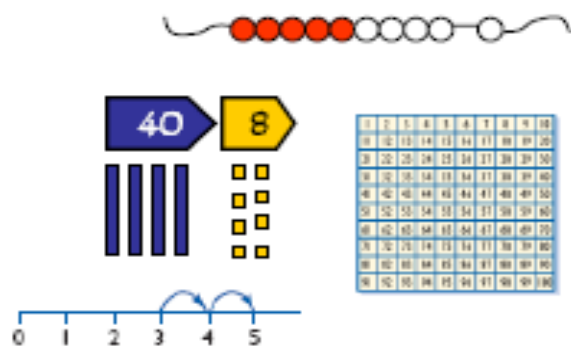Place value apparatus (cards, deines)
Number lines
Unstructured number lines
Hundred squares
Counting sticks
Bead strings

St Mary's C of E Junior School
Written Methods in Mathematics
## Progression in teaching written subtraction strategies

Although some methods are taught in specific year groups, class teachers and teaching assistants will use their assessment of pupil's ability and understanding to introduce methods when appropriate. It is important that children have time to consolidate understanding of each phase.

Phase 1
Subtraction using a structured number line

Start on the largest number and jump back.
e.g. 12-6=6

1	2	3	4	5	6	7	8	9	10	11	12	13
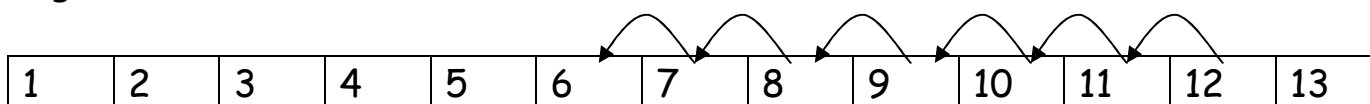
Then moving on to counting back using a 100 square.
Children then continue to use a 100 square but the emphasis is on counting on from the lower number rather than counting back.
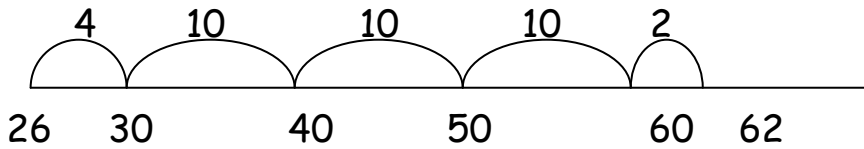
Phase 2

Subtraction using an unstructured number line – counting on/up (finding the difference

62 – 26 = 36

- Write the number you are subtracting at the start of the number line.
- Write the number you wish to subtract from at the end of the number line.
- On the number line mark all the multiples of ten between the 2 numbers.
- Mark on the jumps from each number as shown below. Then add up your jumps
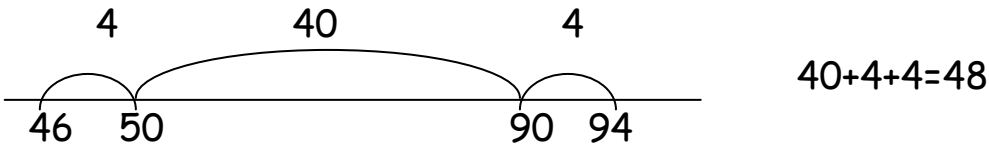
Written Methods in Mathematics

4   10   10   10   2

26   30   40   50   60   62

10+10+10+4+2=36

Children will then be taught to count on from the smallest number (the number you are subtracting) in the most efficient way.

e.g. 94 - 46 = 48

4   40   4
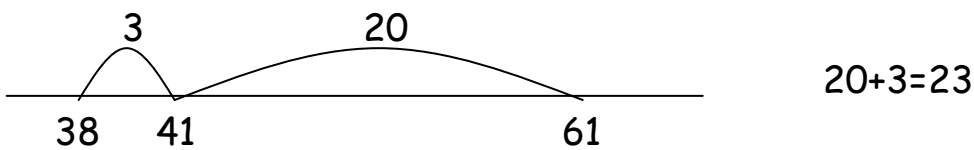
46   50   90   94

40+4+4=48

Phase 3
Subtraction using an unstructured number line - counting back

Children are also taught to count back from the larger to the smaller number.

e.g.
61 – 23 = 38

3   20

38   41   61

20+3=23

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Written Methods in Mathematics

Phase 4
Subtraction by partitioning

Children are taught to only partition the number they are subtracting
E.g.

98 – 43
98 – 40 = 58
58 – 3 = 55

456 – 143
456 – 100 = 356
356 – 40 = 316
316 – 3 = 313

Phase 5
Subtraction by Decomposition

This method helps children to understand the concept of exchanging which is required when using formal subtraction later.
E.g.

754 – 86

 754
- 86

$= 700 + 50 + 4$

$- \quad\quad 80 + 6$

$= 700 + 40 + 14$ (exchanging 1 ten for 10 units to allow the subtraction of 6)

$- \quad\quad 80 + 6$

$= 600 + 140 + 14$ (exchanging 1 hundred for 10 tens to allow the subtraction of 80)

$- \quad\quad 80 + 6$

$= 600 + 60 + 8 = 668$

St Mary's C of E Junior School
Written Methods in Mathematics

Phase 6

Counting up

Children may be introduced to the following method which can be used alongside the 'counting up' number line.

e.g.   654 – 96 =

```
      6 5 4
    -   9 6
    ─────────
          4      (to make 100)      Add on to 96 the number that makes 100
      5 0 0      (to make 600)      Add on to 100 the number that makes 600
    ────5 4      (to make 654)      Add on to 600 what makes 654
      5 5 8
```
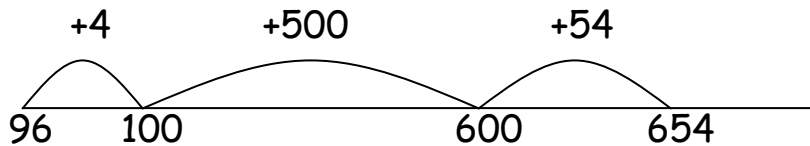
This relates to the number line method as follows

654-96= 558

```
      +4          +500              +54
    ‿      ╱‾‾‾‾‾‾‾‾‾╲      ‿
  96    100              600      654
```

500+54+4=558

Counting down

654 – 96 =

```
      6 5 4
    -   9 6
    ─────────
        5 4      (to make 600)      take away from 654 the number to make 600
      5 0 0      (to make 100)      take away from 600 the number to make 100
    ──────4      (to make 96)       take away from 100 the number to make 96
      5 5 8
```

Children will continue to use the number line and informal written method of counting up, including problems involving decimals, until they are assessed to be ready to learn alternative methods for subtraction

St Mary's C of E Junior School
Written Methods in Mathematics

Phase 7
Formal /standardised column subtraction

Children should not be introduced to this formal method of subtraction until they have a sound understanding of place value. Practical equipment should be used to support this and develop understanding of exchanging.

```
      5 13  1
    6̶ 4̶ 6 7
  -  2 6 8 4
     3 7 8 3
```

The term exchanging, not borrowing should be used when describing this method.

Some helpful skills to practice:
- Counting forwards and backwards in tens
- Subtracting units across the tens boundary
- Learn by heart number bonds to 10 then 20 and pairs of numbers that make all totals below 10 then 20 e.g. 19-3=16
- Knowing how to subtract 9 and 11 by subtracting10 and adjusting
  e.g. 56-9=   56-10+1=47

When subtracting decimals (generally middle and upper school):
- Counting forwards and backwards in tenths and hundredths
- subtracting tenths or hundredths across whole number boundary
- Learning by heart number bonds to 1 for tenths and hundredths
e.g. 0.8+0.2=1   3.6 + 0.4 = 4

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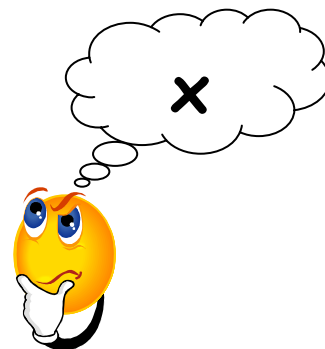# Written Methods in Mathematics
<u>Multiplication</u>

<u>Vocabulary</u>

|	
lots of	groups of
times	product
multiplication	multiply
multiplied by	multiple of
once	twice
three times	four times
five times	ten times as big
ten times as long	ten times as wide
repeated addition	array
column	row
double	

<u>Mental Skills</u>

Recognise the size and position of numbers on number lines
Count on in steps of 2, 5, 10, and 3 from any number
Double numbers up to 100
Quick recall of multiplication facts
Multiply by 10, 100, 1000
Multiply by multiples of 10 e.g. 20, 30, 50

<u>Models and Images</u>

Counting apparatus
Place value apparatus
Arrays
100 squares
Multiplication squares
Number lines
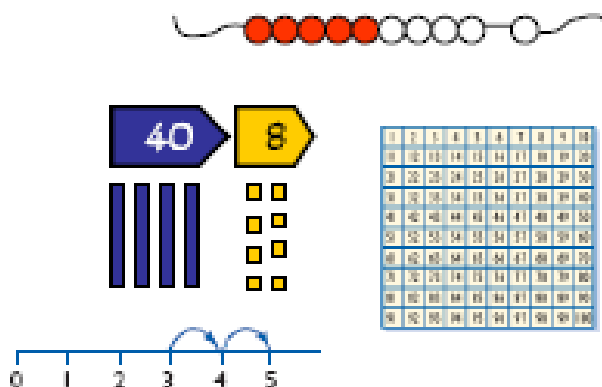
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Written Methods in Mathematics

Progression in teaching written multiplication strategies

Although some methods are taught in specific year groups, class teacher and teaching assistants will use their assessment of pupil's ability and understanding to introduce methods when appropriate. It is important that children have time to consolidate understanding of each phase.

Phase 1
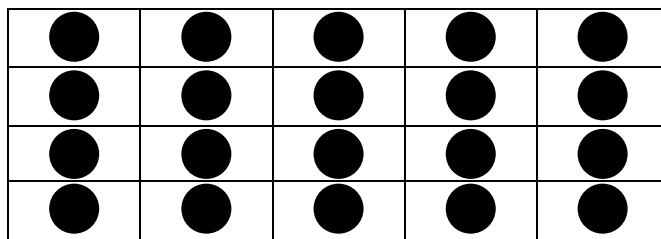## Multiplication using an array

This method can be done using a diagram supported by the use of practical equipment such as cubes or counters.

E.g.
What is 4x5?

          4 rows of 5
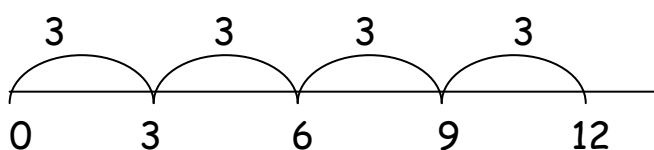   4 lots of 5

Phase 2
Multiplication through repeated addition on a number line (lower school)

4x3=   (4 groups of 3 or 4 jumps of 3)

Draw 4 groups onto the number line
Put 3 in each group

Phase 3

St Mary's C of E Junior School
Written Methods in Mathematics

Multiplication by partitioning

e.g.   32 x 3   is 30 x 3 plus 2 x 3

32 X 3 = (30 X 3) + (2 X 3)
       = 90 + 6
       = 96

Phase 4

Grid method

32x7 =

32 is partitioned into tens and units as shown below

Children then multiply 7x30 and 7x2 and add the answers together

X	30	2
7	210	14

210+14=224

34x25=

x	30	4
20	600	80
5	150	20

600 + 80= **680**

150 + 20= **170**

680+170=850

Children continue to use the above method, dealing with larger numbers and decimals (depending on their ability).

When, or if, your child's teacher feels they are ready they will move on to use the more formal written methods.

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Written Methods in Mathematics

Phase 5
Multiplication using an expanded written method

The order they multiply is important, encourage them to start with the units first

87 x 6

```
     87
   X  6
     42  (6x7)
    480  (6x80)
    522
```

Phase 6
Formal column multiplication / Long Multiplication

The order they multiply is important, always start with the units first.

```
     3 5 2              or     4 3 4 6
   X  2 7                    X       8
     2 4 6 4                  3 4 7 6 8
       ₃ ₁                      ₂ ₃ ₄
   7̷0 4 0
     ₁
    9 5 0 4
       ₁
```

Some helpful skills to practice:
- Multiplying numbers to 100 by 10,100 and 1000
- Learning multiplication facts up to 12x12

When multiplying decimals (upper school):
- Multiplying numbers with up to 2 decimals places by 10,100 and 1000 e.g. 3.45 x10

Division

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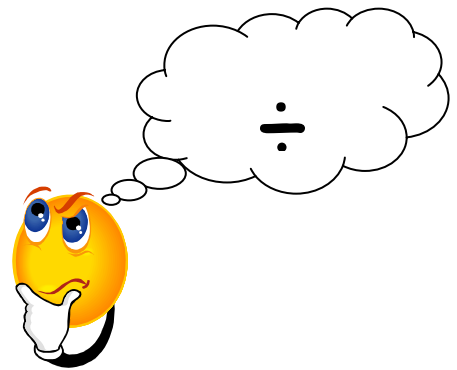# Written Methods in Mathematics

Vocabulary

halve	share
share equally	one each
two each	three each...
group in pairs	group in threes...
group in tens...	equal groups of
division	divide
divided by	divided into
left	left over
remainder	

Mental Skills

Recognise the size and position of numbers on number lines
Count back steps of 2, 5, 10, and 3 from any number
Halve numbers up to 100
Quick recall of division facts relating to tables
Divide by 10, 100, 1000
Divide by multiples of 10 e.g. 20, 30, 50

Models and Images

Counting apparatus
Place value apparatus
Arrays
100 squares
Multiplication squares
Number lines
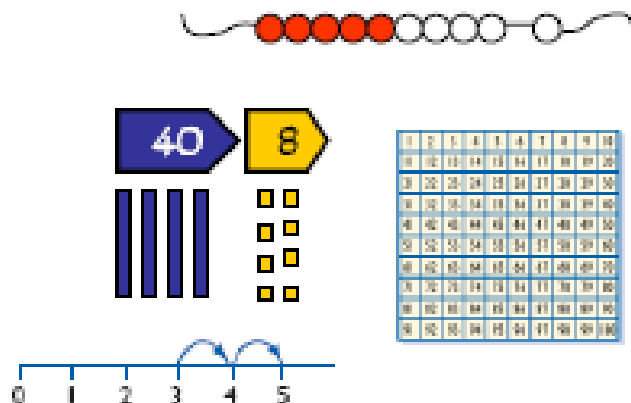
Progression in teaching written division strategies

St Mary's C of E Junior School
# Written Methods in Mathematics

Although some methods are taught in specific year groups, class teachers and teaching assistants will use their assessment of pupil's ability and understanding to introduce methods when appropriate. It is important that children have time to consolidate understanding of each phase.

Phase 1
Division by Grouping

E.g.

34 ÷ 8 =   (How many sets of 8 are there in 34?)

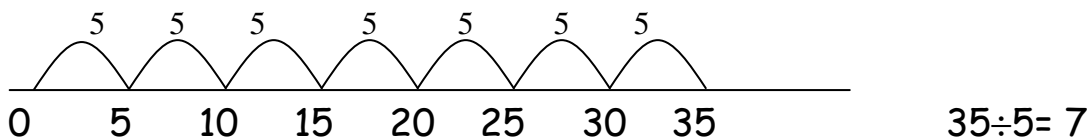| x x x x	x x x x	x x x x	x x x x
x x x x	x x x x	x x x x	x x x x

x   x
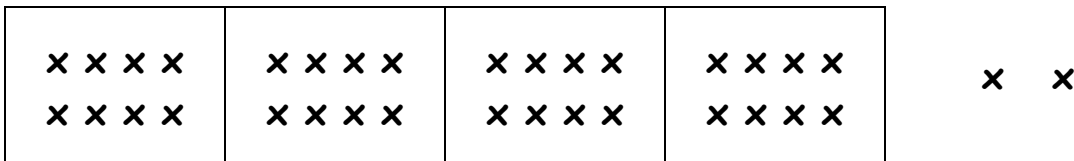
4 groups of 8 with 2 left over

34 ÷ 8 = 4 r 2

Phase 2

Division using a number line through counting up

E.g.

35÷5=   (How many 5's in 35?)

Children will mark 0 onto the beginning of a blank number line then will count in 5's until they reach 35. They will then count how many groups of 5 they have jumped.
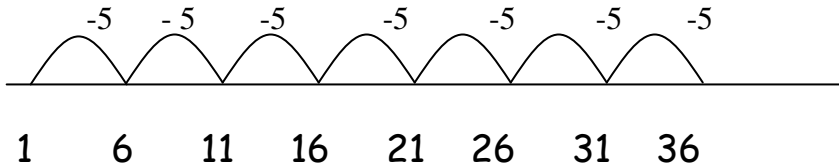

35÷5= 7

Phase 3

St Mary's C of E Junior School
Written Methods in Mathematics

Division using a number line through repeated subtraction

Children take away the divisor from the starting number until they can not take any more sets away. In this case 7 sets of 5 were subtracted from 36, leaving a remainder of 1

E.g.

36÷5=   (How many 5's in 36?)

1   6   11   16   21   26   31   36   36÷5= 7 r 1

Phase 4

Division using repeated subtraction

Children will be taught division as repeated subtraction of the divisor.

e.g. 20 ÷ 5 = _____

$5\overline{)20}$ Children keep subtracting 5 until they reach 0

```
-    5
   _____
    15
-    5
   _____
    10
-    5
   _____
     5
-    5
   _____
     0          Answer is 4 as have taken away 5 four times.
```

Phase 5
Chunking

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Written Methods in Mathematics

Children then move on from repeated subtraction to 'chunking' which is a more efficient method of using repeated subtraction, however it relies on children having a good recall of times tables.

e.g. 96÷6=

```
    _____
 6/ 9 6
  -  6 0    (10 X 6)
     3 6
  -  3 6    ( 6 X 6)
       0
```

Children are taught to subtract multiples of the number they are dividing by (children do need to be confident with their times tables).

add how many groups you have subtracted (10+6)
Answer = 16

Children will continue to use chunking with larger numbers and decimals until they are confident with this method.

Phase 6
Formal written division / Short division

e.g. 265÷5= 53

```
      5 3
   _____
 5/ 2 6¹5
```

Children need to have a solid understanding of multiplication facts up to 12x12 in order to confidently use both chunking and the formal written method of division.

What can I do at home

to support my child?

Ways to help your child at home (Year 3)

St Mary's C of E Junior School
Written Methods in Mathematics

Games

Play games like snakes and ladders that involve counting, addition and subtraction. Play card games that require and practise mental agility like Pontoon – making numbers to 20.

Number

Practice:

- Counting in 2's, 3's, 4's, 5's, 6's, 10's and 100's (while out walking count on or back in steps of 10,100 etc).
- Number bonds to 20 (e.g. 18+2, 3+17 etc)
- Doubles and halves of numbers to 30 (Double 15 and Half of 30)
- Addition and subtraction facts to 20 (Also in worded questions such as: There were 19 sweets, I ate 15 how many are there left?)
- x2, x3, x4, x5, x6 and x10 times tables
- Make a card game (multiplication table on one card, answer on another. Match them up-like in snap or matching pairs).
- Writing and reading numbers to 1000 (Throw three dice or choose three playing cards write down in words and figures the three digit number)
- Draw and colour in a half, a quarter and three quarters of different shapes. Allow children to carry out practical activities such as cutting cakes, pizzas, pies etc into different fractions

Money

- Ask children to recognise the different coins/notes
- Ask which combinations of coins could be used to make different amounts of money
- Ask children to add sums of money and work out change
- Allow children to experience the use of real money

Measures and shape

- Point out the time at different times of the day e.g. lunch, bedtime. Ask questions such as: What time will it be in …. ? How long is it until ….

- Can children tell the time? Link to TV programmes and programming the video/DVD. Can they estimate a length of time?
- Use a mirror to see whether shapes are symmetrical
- Look for right angles (square corners) around the house. See if they can identify 10 right angles in each room.
- Play shape bingo. At home or on a journey, how many circles, squares etc. can they spot? Give them different point values.
- When cooking encourage to children estimate different measures? Do they know what 10 grams/10 ml/1 kilogram looks/feels like?

Ways to help your child at home (Year 4)

St Mary's C of E Junior School
Written Methods in Mathematics

Games

Play board games like Monopoly that involve counting, money, addition and subtraction. Play card games that require and practise mental agility like pontoon (21). Play darts it is a good way to help children get faster at mental maths.

Number

Practice:

- Counting in 2's, 3's, 4's, 5's, 6's, 7's, 8's, 9's 10's and 100's.
- All times tables up to 10x10
- Make a card game. Multiplication table on one card, answer on another. Match them up.
- Writing and reading numbers to 10,000
- Use the language of fractions when dividing pizzas, pies, cakes. Cut sandwiches into given fractions e.g. $\frac{1}{4}$, $\frac{1}{8}$. What do they notice if someone is given $\frac{1}{4}$ and another 2/8?
- When out shopping round prices to the nearest number.
- Roll 3 dice. Make all possible 3 digit numbers e.g. 2, 6, 4 could make 246, 264, 426, 462, 642, 624. Order them.
- Write some word problems for different sums and solve them. Link it to something they enjoy e.g. football, comic characters. Make sure that they include all the operations (+, -, x, ÷)

Money
- Ask children to recognise the different coins/notes
- Ask children to add sums of money and work out change

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- Allow children to experience the use of real money

Measures and shape

- Measure objects length, their width, their height. Ask questions such as: What's the tallest item in the house? Smallest? Widest?
- Involve your child with cooking; encourage them to weigh the different ingredients.
- Reinforce telling the time. What times of the day do they do different things? How long do they spend on each activity?
- Play shape bingo. Draw six shapes and ask someone to read out clues and see if you can cross them off.
- Play 'Shape Treasure Hunt'. How many objects can they find in a room of a particular shape?

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Ways to help your child at home (year 5)

Games

Play board games like Monopoly. Play card games that require and practise mental agility like cribbage. Play darts and snooker, they are good ways to help children get faster at mental maths.

Number

- Help your child to know all times tables to 10x10
- Make a tables game using blank playing cards – write the 'sum' in one colour on one card and the answer in a another colour on a different card. Turn them face down. Pick a pair. Keep them if you are right.
- Play tables 'Millionaire'. Devise questions for each stage including tables backwards e.g. how many 8s in 56?
- Write fractions and decimals on different blank playing cards and match them.
- Watch the weather forecast, write down the temperatures and order them.
- Whilst out shopping encourage children to round prices up/down and estimate totals.
- Make up word problems in different categories e.g. time, money, measurement.

Money
- Use a catalogue like Argos and ask children to choose 5 items under £20. Calculate how much they cost and the change from £100.
- Give them a budget for the week/month – encourage them to keep a record of their spending and what they have left
- Allow children to experience the use of real money

Written Methods in Mathematics

- Can your child help you research your holiday destination? What will it cost? What is the temperature likely to be? What is the exchange rate?

Measures and shape

- Measure some rectangles in the home e.g. coffee table, bedside cabinet, CD case, DVD case and work out their area. Wrap a 'box' shaped present. How much wrapping paper will be needed?
- How many different quadrilaterals can they draw with a specific area?
- Cut out different triangles and quadrilaterals. Name and sort them. Which have right angles? Which have acute angles? Which have parallel sides? Etc.

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Written Methods in Mathematics
Ways to help your child at home (Year 6)

Games

Play board games like Monopoly. Play darts and snooker, they are good ways to help children get faster at mental maths. Many card games and dice games encourage children to calculate mentally, such as: Yahtzee, Rummy, Whist, Pontoon, Newmarket, Cribbage

Number

- Practice all times tables to 12x12
- Choose 5 items from a catalogue and use a calculator to work out how much they would cost if they were reduced by 10%, 20% etc.
- Play tables 'Millionaire'. Devise questions for each stage including tables backwards e.g. how many 8s in 56?
- Write fractions and decimals on different blank playing cards and match them.
- Make up word problems in different categories e.g. time, money

Money

- Allow children to experience the use of real money
- Using different holiday brochures calculate how much it would cost for a holiday to different locations. Do different companies offer the same holiday? Which is cheaper? How much would it cost for families of different sizes?
- Use a catalogue like Argos and ask children to choose 5 items under £20. Calculate how much they cost and the change from £100.
- Give your child a budget for the week/month – encourage them to keep a record of spending
- Plan and cost a party within a given budget. Essentials? How many people can you cater for?

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Measures and shape

- Allow children to redesign their bedroom. Measure the room. Look at dimensions of furniture in a catalogue. What will fit? Calculate cost and draw a plan.
- Look at different recipes and calculate the quantities needed if you had twice as many people, half as many people, one more person, one less etc.
- Read maps. Work out distances using scale
- Involve children with everyday situations that involve time e.g. setting the video, looking at bus timetable, estimating journey times.