**Ysgol Trelawnyd V.A. School**

**Written calculations policy for Key Stage 2**

****

Outlined are the methods we use for the four operations, they are used alongside the mental calculation strategies which are mentioned as appropriate throughout the document. The policy is designed to ensure that there is progression as a child moves through the school and also to provide the flexibility that allows children to develop at their own pace.

Review: March 2023

Signed by governors:

Date:

**Progression through calculations for Addition**

**Addition within 1000**

Sums are written vertically and each column must line up correctly. Children add the ones first, then the tens, then the hundreds. Methods are taught starting with simple addition and no regrouping, then regrouping of the ones, then regrouping of the tens, then with regrouping of tens and ones and then regrouping of hundreds, tens and ones and so on until all possibilities have been practiced. Children are also given word problems and encouraged to set out sums vertically as they’ve been taught.

Place value charts and Deines equipment is used to support these calculations.

778 + 119 = 2 2 8

 + 1 2 4

 3 5 2 12 ones is regrouped to 1

 1 ten and 2 ones on the

 chart

|  |  |  |
| --- | --- | --- |
| Hundreds | Tens | Ones |
| 200 |  20 | 8 |
| 100 | 20  | 4 |

**Bar model**

Consolidation of understanding place value, comparing and ordering numbers is done before introducing the bar model. Simple addition sums are written as a vertical sum where no regrouping is required. The least significant digit is added first.

 7 1

 + 1 8

The bar model shows how the sum can represented

 pictorially. 71 18

**Addition within 10,000**

Addition then progresses to regrouping of hundreds, then regrouping of ones, tens, hundreds and thousands. Each step is broken down to show how the regrouping is calculated.

 5 5 3 2 Add the ones and regroup the ones to 1 ten

 + 2 9 8 9 and 1 one etc.

 8 5 2 1

 1 1 1

methods are then applied to word problems and supported by bar models.

**Mental calculations**

Sums are written horizontally and part – whole diagrams are used to support mental partitioning of numbers.

50

52

37 + 52 =

first add 50 then add 2

2

The compensation method is also used.

98

100

19 + 98 =

first add 100 then subtract 2

2

**Money**

Sums with simple amounts are written horizontally, pounds and pence added separately then recombined to make the answer.

Working box

£26 + £72 = £98

40p + 50p = 90p

£98 + 90p =£98.90

£26.40 + £72.50 = £

£26 40p £72 50p

Regrouping of pounds and pence

The pence amounts are regrouped to make an amount up to whole pounds before adding the money together. This is supported by part – whole diagrams.

£3

£2.80

£3.40 + £2.80 = £3.20 + £3

 = £6.20

20p

£3.20 20p

Further examples are written vertically and treated in the same way as adding whole numbers.

 £2.30 >>> 230

+ £6.20 + 620

 £8.50 850

**Time**

Part – whole diagrams are used to convert minutes to hours and minutes.

1

h

80 mins

20

mins

In the same way as money, hours and minutes are added separately then recombined.

Working box

2h + 2h = 4h

15 mins + 20 mins = 35 mins

4 h + 35 mins = 4h 35 mins

2h 15 mins + 2h 20 mins =

2h 15mins 2h 20mins

= 4h 35mins

Where the minutes go over 60, they are regrouped supported by a part – whole diagram.

20 mins + 55 mins = 75 mins

75 mins = 1 h 15mins

15

mins

mins

60

Duration of time is calculated using a timeline, similar to a number line.

2:30 p.m. to 3:15 p.m. = 45mins

15mins

30mins

2:30p.m. 3:00 p.m. 3:15p.m.

**Decimals**

Addition of decimals follows work on understanding tenths, hundredths and thousandths in terms of place value. Sums are written horizontally and using words to show that tenths are being added.

 0.3 + 0.5 = 3 tenths + 5 tenths

 = 8 tenths

 = 0.8

part – whole diagrams are also used to support understanding that tenths are parts of a whole number. Sums are then written vertically and treated in the same way as addition sums without a decimal part. They are regrouped in the same way as previous methods, keeping the decimal place aligned in the correct position.

 2 . 3 4 add hundredths, regroup into tenths and hundredths

 + 0 . 8 7 add the tenths, regroup into ones and tenths

 add the ones

Number lines are also be used to represent the decimal amounts between the whole numbers.

1.3

1.8

0 1 2 3

**Progression through calculations for Subtraction**

**Subtraction within 1000**

Sums are written horizontally and vertically. In a vertical sum, each column must line up carefully. Children subtract the ones first, then the tens, then the hundreds. Methods are taught starting with simple subtraction and no regrouping, then regrouping of the tens and ones, then with regrouping of the hundreds and tens, then regrouping of hundreds, tens and ones and so on until all possibilities have been practiced. Children are also given word problems and encouraged to set out sums vertically as they’ve been taught.

 1 13 1

241 – 173 = 2 4 1

 - 1 7 3

 6 8

**Bar model**

Bar models are introduced with simple subtraction sums to develop and support understanding of difference. Sums are written vertically and horizontally.

 6 4 78 – 42 =

 - 1 2

find the difference between 40 and 17

40

40 – 17 = 23

23

17

The difference is calculated mentally, supported by the bar model, to count on from 17 to twenty and then count on in tens from 20 to 40 to get 23.

**Subtraction within 10,000**

Place value charts and Deines equipment are used to do simple subtraction within 10,000. It then progresses to regrouping in hundreds and thousands, using the regrouping calculations previously shown.

 5 1

 6 0 0 0

- 8 0 0

 5 2 0 0

Calculations progress further to regrouping of ones, tens, hundreds and thousands. Each step is broken down to show how the regrouping is calculated.

 7 1 16 1

 8 2 7 0 Subtract the ones by regrouping the tens and

 - 1 3 7 9 ones. Subtract the tens by regrouping the

 hundreds and tens. Subtract the hundreds by

 6 8 9 1 regrouping the thousands and hundreds.

 Subtract the thousands.

methods are then applied to word problems and supported by bar models.

**Mental subtraction**

Sums are written horizontally and part – whole diagrams are used to partition numbers in order to subtract mentally.

50

53

78 - 53 = 25

first subtract 50 then subtract 3

3

The compensation methods are also used.

47

50

83 - 47 = 36

first subtract 50 then add 3

3

**Money**

Sums with simple amounts are written horizontally, pounds and pence subtracted separately then recombined to make the answer.

Working box

£3 - £1 = £2

20p - 15p = 5p

£2 + 5p =£2.05

£3.20 - £1.15 = £

£3 20p £1 15p

Regrouping of pounds and pence

The pence amounts can be regrouped to make an amount up to whole pounds before subtracting, this extra will then be added back to compensate. This is supported by part – whole diagrams.

£1

90p

£5.60 - £0.90 = £?

10p

£5.60 - £1 = £4.60

 £4.60 + 10p = £4.70 first subtract £1

£5.60 - £0.90 = £4.70 then add back 10p

Further examples are written vertically and treated in the same way as subtracting whole numbers.

 £12.35 >>> 1235

- £ 4.25 - 425

 £ 8.10 810

**Time**

In the same way as with addition, hours and minutes are subtracted separately then recombined.

Working box

7h - 3h = 4h

20 mins - 10 mins = 10 mins

4 h + 10 mins = 4h 10 mins

7h 20 mins - 3h 10 mins =

7h 20mins 3h 10mins

= 4h 10mins

Where the minutes are more in the time being taken away, the first time is regrouped so that it has a larger amount of minutes to subtract from, this is supported by a part – whole diagram.

2h 20 mins – 1h 50 mins = 1 h 80 mins – 1 h 50 mins

 = 1h – 1h = 0h and 80mins – 50 mins = 30 mins

 = 0h 30 mins = 30 mins

80

mins

h

1

Duration of time is calculated using a timeline, similar to a number line.

2:30 p.m. to 3:15 p.m. = 45mins

15mins

30mins

2:30p.m. 3:00 p.m. 3:15p.m.

**Decimals**

Subtraction of decimals follows work on understanding tenths, hundredths and thousandths in terms of place value. Sums are written horizontally and using words to show that tenths are being subtracted.

 0.9 - 0.4 = 9 tenths + 4 tenths

 = 5 tenths

 = 0.5

Sums are written vertically and treated in the same way as subtraction sums without a decimal part. They are regrouped in the same way as previous methods, keeping the decimal place aligned in the correct position.

 4 . 2 3 cannot subtract 4 hundredths from 3 hundredths

 - 1 . 5 4 regroup 2 tenths and 3 hundredths into 1 tenths

 and 13 hundredths. Subtract 4 from 13 to get the

 hundredths. Further regrouping is done in the same

 way as previously taught.

**Progression through calculations for multiplication**

**Oral and mental methods**

Counting in steps or skip counting is practiced and used to multiply by 6, 7, 8 and 9. Numbers may be written out as a sequence, as a short multiplication sum e.g. 5 x 6 = as a repeated addition sum or a word problem with pictures. This enables pupils to become familiar with a variety of representations. Pupils need to practice and learn to skip count fluently.

**Written methods**

**Without regrouping**

Sums are written vertically with working notes at the side

 1 3 3 ones x 2 = 6 ones

 x 2 1 ten x 2 = 2 tens

 2 6

this is then extended to a single digit multiplying a 3 digit number.

**Multiplication with regrouping**

Sums are written vertically and working notes to accompany each step.

18 x 7 = T O

 1 8

 x 7

 1 2 6

 5

The ones are multiplied by 7 first, they are then regrouped into tens and ones and the tens are written under the line. Then tens are multiplied by 7. The tens are added and regrouped into hundreds and tens.

This method is extended to regrouping in ones, tens, hundreds and thousands using the same way. In word problems pupils set out their multiplication sums in this way.

**Bar models**

Models are used to support calculations with word problems.

Café A sells 480 cups of tea, café B sell twice as many. How many cups of tea does café B sell?

480 cups

 Café A

 Café B

? cups

480 x 2 =

Pupils would then write the sum vertically as taught previously to calculate the answer.

**Multiplying by a 1-digit number**

Higher order multiplication facts are derived by looking for patterns when multiplying. This helps pupils to make links when calculating.

7 x 8 =

70 x 8 =

700 x 8 =

7000 x 8 =

**multiplying by a 2 digit number**

When multiplying a multiple of 10 by a 2digit number, the calculation is broken down into factors that can be calculated mentally.

41 x 60 = 41 x 6 x 10

 = 246 x 10

 = 2460

 Pupils are taught to think about and check whether answers are reasonable and to make estimates first.

A harder multiplication sum uses a formal algorithm to calculate the answer.

 2 7 Step 1: the multiplicand (27) is multiplied

 x 3 2 by the ones (2) and regrouped. 2 tens 7 ones

 x 2 = 4 tens 14 ones = 5 tens 4 ones = 54

 5 4

 2

 1

 2 7 Step 2: the multiplicand (27) is multiplied

 x 3 2 by the tens (30) and regrouped. 2 tens 7 ones

 x 30 = 60 tens 210 ones = 6 hundreds +

 2 hundreds + 1 ten = 8 hundreds and 1 ten.

 5 4

 8 1 0

 2

 1

 2 7 Step 3: add the values from step 1 and 2.

 x 3 2 8 hundreds + 1 ten + 5 tens + 4 ones

 = 8 hundreds 6 tens 4 ones = 864

 5 4

 8 1 0

 8 6 4

**Decimals**

Sums are written horizontally and begin with a single digit multiplying a tenths number.

0.3 x 2 = 3 tenths x 2

 = 6 tenths

 = 0.6

This method is then extended to hundredths numbers.

0.03 x 3 = 3 hundredths x 3

 = 9 hundredths

 = 0.09

Sums then progress to vertical layout and regrouping is treated in the same way as previously taught, multiplying by the least significant digit first.

Number lines may also be used to show repeated jumps of a decimal number landing between whole numbers on a number line.

**Progression through calculations for division**

**Oral and mental methods**

Multiplication sentences are used to derive division sentences. Sums are written horizontally, showing the link between division and multiplication.

9 x 5 = 45 leads to 45 ÷ 9 = 5 and 45 ÷ 5 = 9

If pupils are fluent at skip counting, they will understand that division is about reducing a number into equal groups and that it can be written in this way. Pupils are also taught to think about whether a number is divisible by 2 or not by identifying it as odd or even.

**Quotient and remainder**

The **quotient** is the number obtained by dividing one quantity by another. The **remainder** is the number left over after dividing one number by another if it cannot be divided into equal groups. These are the terms used when pupils are taught division. Sums are written horizontally and vertically and they begin with numbers that can easily be mentally calculated if pupils know their times tables.

31 ones ÷ 4 = 7 r 3 (4 x 7 = 28)

quotient = 7 ones

remainder = 3 ones

 9 (3 x 9 = 27)

 3 2 7

 2 7

 0

**division without remainder and regrouping**

Place value charts and Deines equipment is used to support mental calculations where regrouping from tens to ones is required, sums are written informally for this.

12 ones ÷ 2 = ones

where sums are written vertically, the tens part of the dividend is divided first, followed by the ones part of the dividend. The divisor is a single digit.

 1 2 (3 ÷ 3 = 1)

 ( 6 ÷ 3 = 2)

 3 3 6

 3

 6

 6

 0

**Regrouping in tens and ones**

Sums are written vertically in columns, the divisor is still a single digit.

 1 6 (3tens ÷ 2 = 1ten r1ten)

 (1 ten and 2 ones = 12 ones)

 2 3 2 (12 ones ÷ 2 = 6 ones)

 2

 1 2

 1 2

 0 0

Division is then extended to regrouping of hundreds, tens and ones, with a single digit divisor.

 1

 (4 hundreds ÷ 3 = 1 hundred r1 hundred)

3 4 6 8

 3

 1

 (put the r1 hundred under the line)

3 4 6 8

 3

 1

 1 5

 (bring the 6 tens down next to the 1 hundred)

3 4 6 8 (1 hundred and 6 tens = 16 tens)

 (16 tens ÷ 3 = 5 tens r 1 ten)

 3

 1 6

 1 5 6

 (write the r 1 ten under the line)

3 4 6 8 (bring down the 8 ones next to the ten)

 (1 ten and 8 ones = 18 ones)

 3 (18 ones ÷ 3 = 6 ones)

 1 6

 1 5

 1 8

 1 8

 0

**Bar models**

Models are used to support calculations with word problems.

A florist has 728 flowers. She uses 4 to make a bunch. How many bunches of flowers can she make?

728 flowers

4

4

4

? bunches

728 ÷ 4 =

Pupils would then write the sum vertically as taught previously to calculate the answer.

**Decimals**

Sums are written horizontally and begin with a single digit dividing a tenths number.

0.6 ÷ 2 = 6 tenths ÷ 2

 = 3 tenths

 = 0.3

This method is then extended to hundredths numbers.

0.08 ÷ 2 = 8 hundredths ÷ 2

 = 4 hundredths

 = 0.04

Sums then progress to vertical layout and regrouping is treated in the same way as previously taught, dividing into the most significant digit first.

**Division of larger numbers**

Larger numbers are broken down into their value before dividing, having a good understanding of place value is required.

4900 ÷ 7 = 49 hundreds ÷ 7

 = 7 hundreds

 = 700

Harder division sums use a formal algorithm to calculate the answer. Numbers are always expressed in terms of thousands, hundreds, tens and ones.

Step 1 Th H T O

Divide 6 thousands by 3 2

6 thousands ÷ 3 = 2 thousands

= 2000 3 6 3 8 1

 6 << 2 x 3

Step 2 Th H T O

Divide 3 hundreds by 3 2 1

3 hundreds ÷ 3 = 1 hundred 3 6 3 8 1

= 100

 6

 3

 3 << 1 x 3

Step 3 Th H T O

Divide 8 tens by 3 2 1 8

8 tens ÷ 3 = 2 tens remainder 2 tens 3 6 3 8 1

= 20 remainder 20

 6

 3

 3 << 1 x 3

 8

 6 << 2 x 3

 2

Step 4 Th H T O

Divide 21 ones by 3 2 1 8 7

21 ones ÷ 3 = 7 ones 3 6 3 8 1

= 7

 6

 3

 3 << 1 x 3

 8

 6 << 2 x 3

 2 1

 2 1 << 7 x 3

 0

To divide by higher numbers pupils use their knowledge of times tables, place value and estimation skills to calculate in steps similar to those show above. They can also use repeated subtraction of multiples of the divisor with an approximation.

**Method 1**

977 ÷ 36 is approximately 1000 ÷ 40 = 25

977 ÷ 36 977

 -360 10 x 36

 617

 -360 10 x 36

 257

 -180 5 x 36

 77

1. 2 x 36

 5

 answer 27 r 5

**method 2**

972 ÷ 36 is approximately 1000 ÷ 40 = 25

36) 972

 - 720 20 x 36

 252

 - 252 7 x 36

 0

answer 27