Calculation policy.

Renewed: October 2015.

Review date: ongoing

Our Vision.

St Patrick's Catholic Primary School will be a model of educational excellence, consistently within the top 5% of schools in England. The School will have achieved this through the delivery of a creative and rigorous curriculum which inspires and motivates all our children to realise their God-given potential. Children will leave St Patrick's happy with who they are, confident in their abilities, polite and articulate, and ambitious for their future growth at secondary school and beyond.

How does our calculation policy support our vision?

Our policy is built on the expertise and experience of our teachers and through discussion with our children about what methods they find most useful in becoming efficient mathematicians. At the centre of this policy are the three core principles of the Mathematics curriculum: Fluency, Reasoning and Problem Solving. We aim for our children to become fluent, capable and enthusiastic mathematicians with an appreciation for the significance and relevance of Maths in their everyday lives. We encourage our children to speak mathematically and explain their reasons and methods. We encourage a deep, reasoned understanding rather than a broad, shallow recall of facts.

EYFS	Aim by end of EYFS: – ADDITION AND SUBTRACTION: All can move (count on or back) up to 10 spaces on a number line. –Some can add two 1 digit numbers showing method used. –All can subtract small numbers by taking away using apparatus. DIVISION AND MULTIPLICATION: –All can count in 2s, 5s and 10s (exceeding) and solve practical problems in a real or role play context. –All understand sharing as giving everyone the same amount and solve problems by sharing objects into equal groups.

ADDITION

Sing nursery rhymes and simple songs.

Use objects to count (fingers, cars, teddies, pasta, cubes etc)

Reception: From Spring term use a number line to find one more than a number.

Say the number one more than when playing a board game.

Experience addition as counting on, e.g. rolling a dice and moving along a number track when playing snakes and ladders.
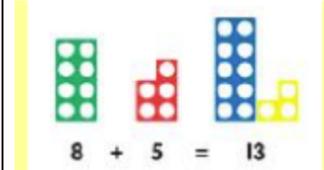
Practically count sets of objects.

Begin to relate addition to combining two groups of objects and counting o in context.

Begin to record numbers and number sentences, when ready. 3 + 2 = 5

Select two groups of objects to make a given total e.g. Find dominoes with 6 dots on.
Adults scribe number sentences.

2 + 4 = 6   1 + 5 = 6

Use Numicon to combine two sets.

8 + 5 = 13

Use number tracks to count on

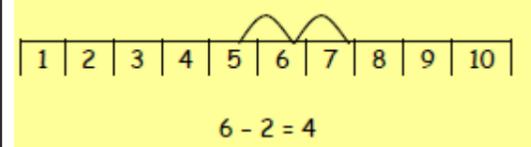Work practically with bead strings

SUBTRACTION

Sing nursery rhymes, involving something being taken away in each verse e.g. 5 little men in a flying saucer.

Begin to relate subtraction to taking objects away from a group and counting what is left. Find own way of recording for subtraction e.g. cross-outs.

◯ ◯ ◯ ◯ ◯ ⊗ ⊗ ⊗

Children record number sentences related to practical work, when ready.

Use number tracks to count backwards

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

6 – 2 = 4

Work practically with bead strings

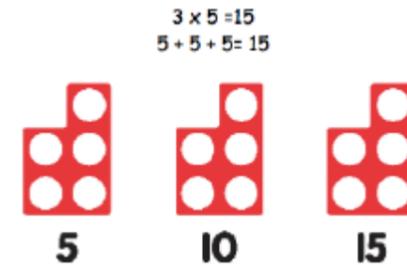Reception: Begin to use a number line from Spring term.

MULTIPLICATION

Solve practical problems in a real or role play context e.g. ● How many shoe lace holes are there on this shoe? ● Put 5 cherries on each cake. How many cherries do you need?

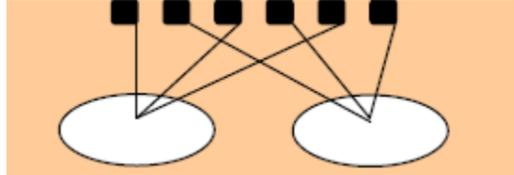Oral counting in twos, fives and tens.

Count practically in repeated groups of the same size.

Use Numicon.

3 x 5 =15
5 + 5 + 5= 15

5   10   15

DIVISION

Understand sharing as giving everyone the same amount e.g. 6 grapes are shared equally between 2 people. How many grapes does each one get?

Solve practical problems in a real or role play context e.g. ● How many pairs of socks are there in the drawer? Can you cut the cake in half? How many pieces are there?

Fractions.
Use the words 'Half' and 'Equal' in real life contexts.
Find halves of shapes in practical situations.
Children share objects in to 2 equal groups.

Y1	Aim by end of YEAR 1: - ADDITION AND SUBTRACTION: All can add two 1 digit numbers and 2 digit numbers. Showing method used. -All can count Relate addition to combining two groups and counting on and record in a number sentence using + and = signs. Relate subtraction to taking away by counting back and as counting on and record in a number sentence using the – and = signs. Record addition by: - showing jumps on prepared number lines - drawing own number line e.g. 6 + 5 = 11 6 7 8 9 10 11 Record simple subtraction in a number sentence using the – and = signs e.g. There were 8 cakes on a plate. Mary ate 3 of them. How many were left? 8 – 3 = 5back on a number line to subtract 1 digit numbers from a 1 or 2 digit number. Represent and use number bonds and related subtraction facts within 20 DIVISION AND MULTIPLICATION: -All can count in twos, fives and tens and can derive multiples of 2,5 and 10. -All can solve real problems involving combining groups. -All understand sharing as giving everyone the same amount and solve problems by sharing objects into equal groups.

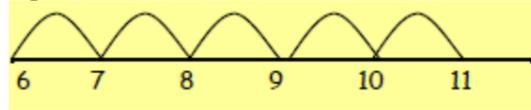| ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Use practical objects to support addition and subtraction.

Relate addition to combining two groups and counting on and record in a number sentence using + and = signs.

Use a 100 square to support counting on and back.

Record addition by: - showing jumps on prepared number lines and drawing own number line e.g. 6 + 5 = 11

Using the empty number line to add 10 to a single digit number. e.g. 8 + 10 = 18

Use a number line to add a pair of single digit numbers to bridge through 10 e.g. 8 + 5 = 13

Say the number that is one more and ten more than any given number. Use a bead string to support this.

Add 9 by adding 10 and subtracting 1.
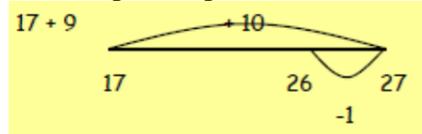
Children are extended by writing word problems based on the number calculations they have solved. | Use practical objects to support addition and subtraction.

Relate subtraction to taking away by counting back and as counting on and record in a number sentence using the – and = signs.

Record simple subtraction in a number sentence using the – and = signs e.g. There were 8 cakes on a plate. Mary ate 3 of them. How many were left?

Use a 100 square to support counting on and back.

Use a marked or empty number line to count back (take away) or to count on (find the difference)
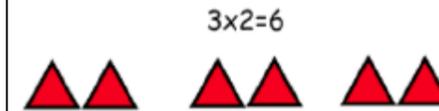
9 – 4 = 5 (counting back) - marked line
1 2 3 4 5 6 7 8 9
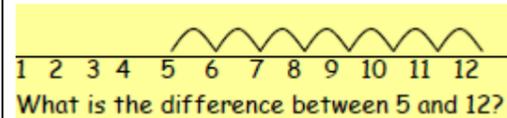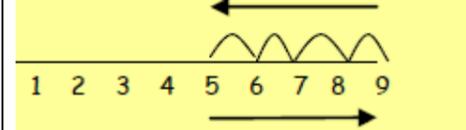
1 2 3 4 5 6 7 8 9 10 11 12
What is the difference between 5 and 12?

Children are extended by writing word problems based on the number calculations they have solved. | Group in sets.

3x2=6

Recognise what happens when you multiply a number by 0 or 1.

When learning times tables begin with 5 X upwards.

Use of Numicon to begin to show multiplication as repeated addition.

Use of coins to show counting in 2s, 5s and 10s. | Understand sharing as giving everyone the same amount e.g. You have 12 wheels, how many cars can you make?

Model using arrays

Number sentences used in context. |

Fractions.
Recall halves of numbers to 10.
Recognise halves of shapes and group objects in to two equal groups.
Recognise quarters of shapes and group objects in to four equal groups.

Y2	Aim by end of YEAR 2: ADDITION AND SUBTRACTION: –All can add 1 digit number to a 2 digit number. –Some can add two 2 digit numbers showing method used. –All can use a number line to subtract 2 digit numbers –Some can subtract numbers that cross 100. DIVISION AND MULTIPLICATION: –All know 2x,5x and 10x tables and be able to derive division facts. –Most understand multiplication as repeated addition and describing an array. – Most understand the different interpretations of division.

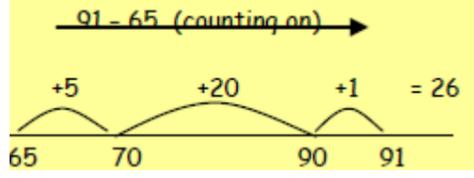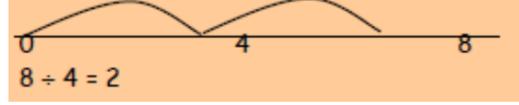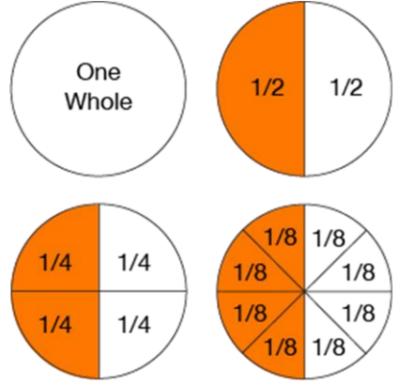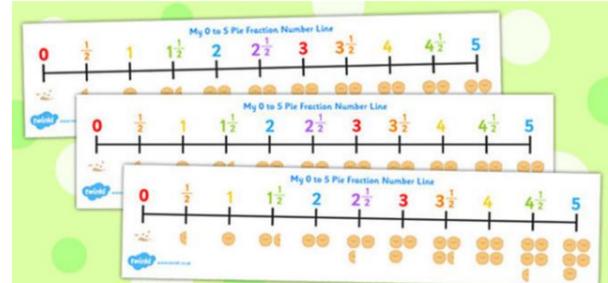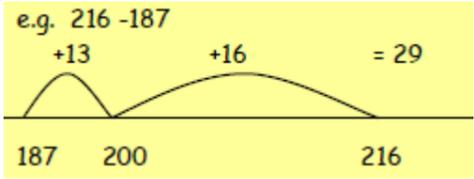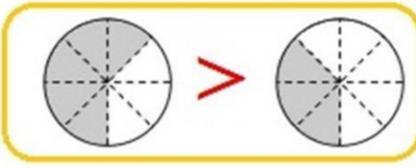| ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Use prepared number lines then progress on to drawing own empty number lines to: Count in tens Count in multiples of ten To add tens and units by partitioning using different methods of recording. Add tens first vertically to support column method. 25 + 37= 20 + 5 30 + 7 50 + 12 = 62 Add 1 or 10 to any given number. Add 19 or 21 by adding 10 and adjusting. Children are extended by writing word problems based on the number calculations they have solved.	Use marked, partly marked or empty number lines to count back (take away) or to count on (find the difference) – as Y1. Understand when it is sensible to count back and when to count on e.g 93-5 (count back) 93 – 88 (count on) Use jottings and number lines to count backwards, then record number sentence. Develop to counting back in three steps on number line. e.g 91- 65 = 5 + 20 + 1 When subtracting a number where the difference is greater than 10 will be counted forwards. Use partitioning to subtract. e.g 48 – 23 40 + 8 20 + 3 20 + 5 = 25	Recognise what happens when you multiply a number by 0 or 1. When learning times tables begin with 5 X upwards. Show multiplication as repeated addition This can also be shown as repeated jumps on a number line (modelling on bead bar is useful image). Understand multiplication as describing an array. ● 5 x 4 = 20 (explained a 5 four times) 4 x 5 = 20 (explained as 4 five times) Relate to real life contexts. Make links between arrays and number lines.	Understand division as Sharing equally and as Grouping (this is repeated subtraction) e.g 12 grouped in to 2 is 6 groups of 2, 12 shared in to 2 is 2 groups of 6. Use a number line to demonstrate division as repeated subtraction. Count forwards and backwards. Record simple mental divisions in a number sentence using the ÷ and = signs Know that division is the inverse of multiplication.

Fractions.
Find fractions of shapes, lengths, sets of objects and quantities.
Recognise, find and write fractions of: third and quarters (including 1/4, 2/4
Recognise the equivalence of 2/4 and 3/4 of a shape.
Count in halves using visuals.

Y3	Aim by end of YEAR 3: ADDITION AND SUBTRACTION: -All children can add and subtract numbers up to 3 digits using formal column method. -All should mentally add and subtract 3 digit numbers and ones, tens, and hundreds. -All should be able to subtract using decomposition. DIVISION AND MULTIPLICATION: -All know 2, 3,4,5, 8 and 10 multiplication and division facts. -All recognise all multiples of 2, 5 and 10 up to 1000. -All understand division as grouping or sharing -All can round up or down after division depending on the context. -All can multiply a two digit number by a one digit number.

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Use of following equipment to support: base 10, number lines, Numicon, counting stick, place value holders. Develop methods for adding two digit and three digit numbers by partitioning second number only. e.g 246 + 87 246 + 80 + 7 Use knowledge of place value and partitioning of three digit numbers to develop written methods for addition of two and three digit numbers using expanded methods of recording. e.g 246 + 381 200 + 40 + 6 300 + 80 + 1 500 + 120 + 7 600 + 20 + 7 = 627	Use of following equipment to support: base 10, number lines, Numicon, counting stick, place value holders. Count up when the difference is small (complementary addition) using number lines e.g. 216 -187 e.g. 216 -187 +13 +16 = 29 187 200 216	Recognise what happens when you multiply a number by 0 or 1. When learning times tables begin with 5 X upwards. Understand multiplication as: • repeated addition • describing an array e.g 13 x3 (10 x 3 plus 3 x 3) ●●●●●●●●●●●●● ●●●●●●●●●●●●● ●●●●●●●●●●●●● Begin to develop informal ways of calculating and recording. Partition numbers in order to multiply them using the grid method (see glossary)	Understand the operation of division as • Sharing equally • Grouping Ensure that grouping continues to be modelled by adults and children on prepared and blank number lines. E.g. How many 5s make 35? Use practical and informal methods to support division of larger numbers to encourage chunking.
Children are extended by writing word problems based on the number calculations they have solved.			

Fractions.
Divide objects and quantities in to tenths (ten equal groups)
Recognise and show equivalent fractions of shapes and quantities.
Order fractions with the same denominator – focus on the numerator. Show visually using images.
Count up and down in 1/100ths

$$\frac{5}{8} \quad > \quad \frac{3}{8}$$

Y4	Aim by end of YEAR 4: – ADDITION AND SUBTRACTION: –All children to be able to add and subtract numbers up to 4 digits using column method where appropriate. DIVISION AND MULTIPLICATION: –All are confident with the grid method way of recording multiplication and are able to explain reasoning –All can derive and recall multiplication and division facts up to 12 x 12 (including multiplication by 0 and 1) –Multiply two digit and three digit numbers by 1 digit using a formal layout.

ADDITION

Use a number line to Add 10 or 100 to any given number, and to add a near multiple of 10 to a two digit e.g. 45 + 28

45 + 28
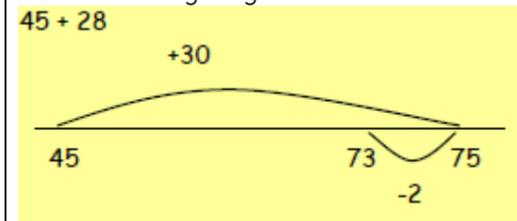
Begin expanded method, adding most significant digit first
e.g
625 + 48

Is 600 + 0 = 600
    20 + 40 = 60
     5 + 8 = 13
          673

Leads to carrying below the line and a more compact recording.

Extend to decimals as appropriate.

Children are extended by writing word problems based on the number calculations they have solved.

SUBTRACTION

Use a number line to subtract 10 or 100 from any given number, and to subtract a near multiple of 10 from a two digit e.g. 45 – 28

Teach expanded decomposition leading to expanded decomposition.

```
   754    = 700 and 50 and 4
-   86    -        80 and 6

          = 700 and 40  and 14
          -         80 and  6

          = 600 and 140 and 14
          -          80 and 6   = 668
```

If using this method use Deines apparatus to support understanding.

Leading to…

```
        600  1
 754  = 700  50  4
- 86  -      80  6
        600  60  8   = 668
```

Leading to…

```
  7'5 8
- 8 6
  6 6 8
```

Extend to decimals as appropriate.

MULTIPLICATION

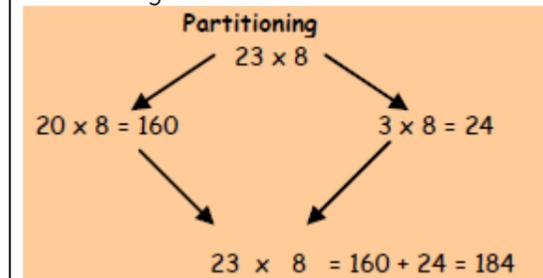Recognise what happens when you multiply a number by 0 or 1.

When learning times tables begin with 5 X upwards.

Show multiplication as an array.

Begin to develop informal ways of calculating and recording by partitioning and recombining.
e.g. 17x5
10 x 5 = 50
7 x 5 = 35
50 + 35 = 85

Partitioning

Partitioning
23 x 8
20 x 8 = 160   3 x 8 = 24
23 x 8 = 160 + 24 = 184

Grid method

x	20	3	
8	160	24	=184

Compact method

```
  23
x  8
 184
  2
```
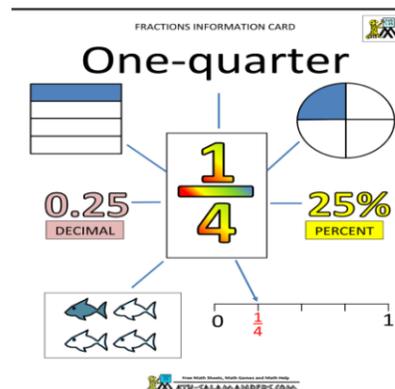
DIVISION

Understand the concept of a remainder. E.g. How many lengths of 10 cms can you cut from 51 cm of tape? How many will be left?

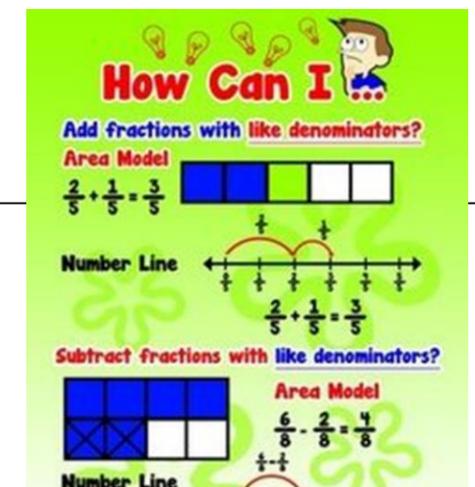Demonstrate this using number lines and arrays.

0 10 20 30 40 50 51
Answer: 5 lengths and 1 cm left over.
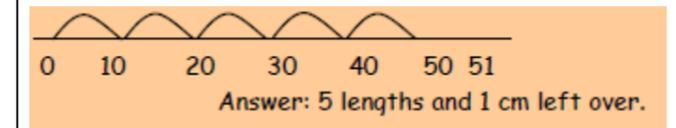
Moving towards short bus stop method.

```
    124
3 ) 37'2
    124
```

One-quarter

FRACTIONS INFORMATION CARD

0.25 DECIMAL   1/4   25% PERCENT

0 1/4 1

Fractions.

Continue to divide objects and quantities in to tenths (ten equal groups) and hundredths (100 equal groups)
Recognise and show equivalent fractions of shapes and quantities
Continue to order fractions with the same denominator – focus on the numerator. Show visually using images.
Begin to add and subtract fractions with the same denominator.
Continue to count up and down in 1/100ths
Recognise and write decimal equivalence of 1/4, 1/2, 3/4
Reduce fractions to their simplest forms.

How Can I…

Add fractions with like denominators?
Area Model
$\frac{2}{5} + \frac{1}{5} = \frac{3}{5}$
Number Line
$\frac{2}{5} + \frac{1}{5} = \frac{3}{5}$

Subtract fractions with like denominators?
Area Model
$\frac{6}{5} - \frac{2}{5} = \frac{4}{5}$
Number Line

Y5	Aim by end of YEAR 5: - ADDITION AND SUBTRACTION: All children are able to use compact method for addition and compact decomposition for subtraction, when appropriate, (numbers up to 10,000 and decimals) but should continue to use counting up method, where appropriate. DIVISION AND MULTIPLICATION: -All use an efficient and appropriate written method for multiplication numbers up to 4 digits 2 digits. Divide up to 4 digit numbers by 1 digit numbers. -All recall quickly multiplication facts up to 10 x 10 and use them to multiply pairs of multiples of 10 and 100. -All can explain methods and reasoning and whether to round up or down after division depending on context.

ADDITION

Informal recording of adding decimals using a numberline.
125.64 + 56.7
125.64 + 50 + 6 + 0.7
175.64 + 6 + 0.7
181.64 + 0.7
182.34
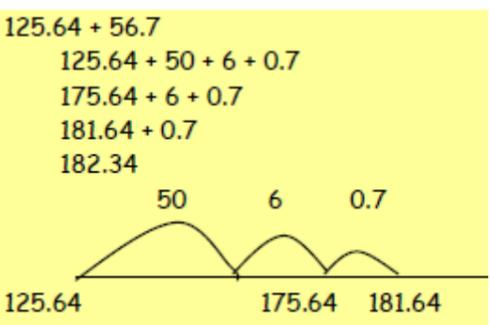
125.64 + 56.7
    125.64 + 50 + 6 + 0.7
    175.64 + 6 + 0.7
    181.64 + 0.7
    182.34
        50   6   0.7
125.64   175.64   181.64

Use compact carrying method:
HTU + HTU then ThHTU + ThHTU

Add fractions with the same denominator and denominators that are multiples of the same number.
3/15 + 5/15 = 8/15
2/5 +5/15 = 14/15

Use symbols and missing numbers:-
Continue to develop as in earlier years but with appropriate numbers (including decimals)

SUBTRACTION

Informal recording of subtracting decimals.
Using known number facts and place value to subtract
e.g. 4.1 – 1.8 = 2.3

+0.2   +2.0   +0.1
1.8   2.0   4.0   4.1
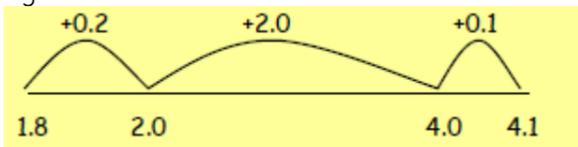
Continue to use compact decomposition
Continue to develop compact decomposition with different numbers of digits and decimals.
Note: Children should understand the importance of lining up units digits under units digits, tens under tens etc.

Subtract fractions with the same denominator and denominators that are multiples of the same number.
12/15 – 2/15 = 10/15
12/15 – 1/5 = 9/15

Children are extended by writing word problems based on the number calculations they have solved.

MULTIPLICATION

Recognise what happens when you multiply a number by 0 or 1.

When learning times tables begin with 5 X upwards.

Continue to use informal methods of recording to support and explain mental methods where the numbers are appropriate.

Make approximations E.g. 72 x 38 ans. approx. 70 x 40 = 2800

Then use the 'grid' method.

x	70	2
30	2100	60
8	560	16

2160
576 +
2736

Extend to simple decimals, with one decimal place, multiplied by a single digit. Approximate first.

4.9 x 3

x	4	0.9
3	12	2.7

12 + 2.7 =14.7

leading to   4.9
        x   3
        14.7
        2

DIVISION

Halve amounts of money to share.

£14.84

£7

42p

£8.42p

Short bus stop method

124
3)37 2 =
124

Fractions.

IMPROPER	MODEL	MIXED NUMBER
4/3		1⅓
5/2		2½
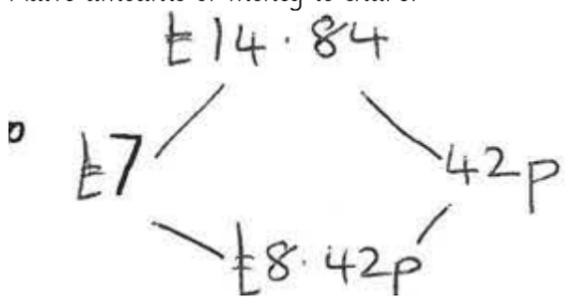
Understand how thousandths are related to hundredths and tenths.
Begin to add and subtract fractions with different denominators.
Reduce fractions to their simplest forms.
Convert mixed fractions and improper fractions.
Write decimals as fractions.
Multiply fractions by whole numbers.

One
Tenths
Hundredths
Thousandths

Y6	Aim by end of YEAR 6: -- ADDITION AND SUBTRACTION: All children should be able to use carrying method for addition and decomposition method for subtraction, accurately and reliably – when appropriate but should be able use counting up method, with jottings, where appropriate. Note: 'compact' method is not appropriate for adding and subtracting two 2-digit numbers – this is a mental method. DIVISION AND MULTIPLICATION: -All use an efficient and appropriate method for multiplication. - Divide 4 digit numbers by 2 digit numbers. -All can explain methods and reasoning and whether to round up or down after division. – All are comfortable using decimals in multiplication and division.

ADDITION

Develop use of empty number lines, partitioning and other informal recording methods developed in earlier years to support and explain calculations where appropriate (including decimals).

Use compact ('carrying') method. As Y5, extend method to any number of digits and decimal places

For those children who have not mastered compact method or are unable to use it reliably, use expanded method, but teach again when appropriate.

Add fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

4/5 +5/6 =
24/30 + 25/30 = 49/30
=1 19/30

Children are extended by writing word problems based on the number calculations they have solved.

SUBTRACTION

Develop use of empty number lines, partitioning and other informal recording methods developed in earlier years to support and explain calculations where appropriate (including decimals).

Encourage to subtract the nearest multiple of 10, 100, 1000

Subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

3/5 – 1/3 =
9/15 – 5/15 = 4/15
1 1/5 – 1/3 =
6/5 – 1/3 =
18/15 – 5/15 = 13/15

MULTIPLICATION

Recognise what happens when you multiply a number by 0 or 1.

When learning times tables begin with 5 X upwards.

Continue to use 'grid' method if it is more reliable and better understood.

Leading to columnar multiplication
e.g
```
 3 7 2
   2 4  X
1 4 8 8
      +
7 4 4 0
8 9 2 8
```

Extend to decimals with up to 2 decimal places multiplied by a single digit. Moving towards multiplying decimal numbers with 2 decimal places by other decimal numbers.
Show using grid method, expanded and finally columnar.

Multiply fractions by firstly multiplying numerators, then denominators.
$\frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$

Be able to simplify if needed
$\frac{12}{16} = \frac{3}{4}$

DIVISION

If children are unsure then try the 'chunking' method as a way of repeated subtraction.

Solve word problems involving remainders then round up or down.

Work using the bus stop method with remainders.
Expanded form:

```
       0 3 1 8  r 5
20 ) 6 3 6 5
     - 6 0
         3 6
         2 0
         1 6 5
         1 6 0
             5
```

Express remainder as a fraction
e.g. $\frac{5}{20}$ simplified: $\frac{1}{4}$

Divide fractions by flipping the second fraction and multiplying.
$\frac{1}{2} \div \frac{1}{6}$ becomes
$\frac{1}{2} \times \frac{6}{1} = \frac{6}{2}$ simplified= 3.

Solve problems with money so involving the decimal point.

Fractions.
Consolidate Year 5 fractions learning.
Multiply and divide decimals by 10, 100, 1000 and 10,000.
Divide proper fractions by whole numbers.

Glossary of terms for adults.

Sharing: e.g 6 divided in to 2 = (6 shared in to 2 groups) 3

Grouping: e.g 6 divided in to 2 = (6 grouped in to 2s) 3 (Includes: **Groups of...**)

Grid method:

X	20	3
10	200	30
2	40	6

Expanded decomposition: Partitioning a number in to its place value parts before completing a calculation. Each stage is recorded in full — the whole calculation is expanded. For multiplication this may be done alongside the calculation in brackets.

Compact decomposition: A more compact method of the above. Set out as a column with place value accounted for. (E.g tens are below tens, ones below ones.) May include carrying.

Bus stop: Used when dividing. The divisor is outside the bus stop, the number to be divided is underneath the bus stop. The answer is above the bus stop.

Partitioning: Splitting a number in to its place value parts (e.g. thousands, hundreds, tens and ones) NOTE: Referred to as ones AND units. Children must know both.

Complimentary addition: counting up when the difference is small e.g 24 -19, it make sense to count up from 19 to 24, rather than to subtract 19 from 24.

Chunking: Used when dividing. 'Chunk' multiples of the divisor. E.g 75 divided by 4 = We know 10 X 4 is 40 therefore we can initially say 40 divided by 4=10, now find 35 divided by 4.

Column method: Setting out a calculation vertically. Ensure children are aligning digits in correct places for place value.

Communicative: An operation which can be done in either order. E.g addition is communicative 3 + 7 or 7 + 3, subtraction is not.

The sum of: adding numbers together.

The product of: multiplying numbers together.

Array: Showing a multiplication/ division sentence as a visual depiction of dots/ crosses/ objects in groups.

BODMAS: Order of operations: Brackets, orders, division, multiplication, addition, subtraction.

Vocabulary to be used with the children.

The vocabulary covered in the adult glossary should also be taught to children (when appropriate)

Bigger/ Smaller.

More/ Less

Counting up/ Counting down.

Number bonds

Find the difference

Exchange

figure/ digit

Number sentence

Calculation

Equals means 'the same as', NOT 'here is the answer'

Array

Value

increase/ decrease.

fluency

reasoning

coins/ money (ensure children either use £ or p, never both)