Progression in Mental Calculation at Beaufort Primary

FOUNDATION STAGE NUMBER OBJECTIVES

BY THE END OF RECEPTION (FS2), CHILDREN SHOULD BE CONFIDENT IN THE FOLLOWING AREAS OF NUMBER STRATEGIES:

Says some number names in familiar contexts, such as number rhymes.

For example:

Number rhymes – one potato, two potatoes…

Using number names in role-play – setting the table with two cups, three plates, etc.

Counts reliably up to 20 everyday objects.

For example:

To count up to six objects and count out a specified number of things from a larger collection of objects, e.g. beads, counters, bricks, pencils.

Says number names in order.

For example:

Reciting the number names in sequence, counting to, or backwards up to 20.

Recognises numerals 1 to 20.

For example:

To consistently recognise numerals on number tracks, birthday cards, books, clock faces etc.

Spot numbers in different environments; at the park, shops, school etc.

Order numbers, up to 20.

For example:

To arrange, in order, a complete set of numbers from 1 -20.

Uses developing mathematical ideas and methods to solve practical problems.

For example:

Attempts to solve problems in everyday play situations, e.g missing numbers, grouping, sharing and estimation, questioning.

An example; the child estimates how many coins are in the purse, is there sufficient pieces of fruit for each child, questions like, How shall we do it? What could we try next?

Recognises, counts, orders, writes and uses numbers up to 20.(Begin to understand place value through practical experience)

For example:

To have a secure understanding of numbers to 20, counting objects and recognising and writing numbers accurately.

Responds to vocabulary involved in addition and subtraction in rhymes and games.

For example:

Joining in with rhymes such as 'Five Currant buns' etc.

In practical play contexts, to begin to use some of the vocabulary involved in addition and subtraction, for example, 'one's gone', 'one's left'.

Recognises differences in quantity when comparing sets of objects.

For example:

To compare two groups of objects and recognise differences between unequal groups.

Find one more or one less from a group of up to 20 objects. For example in practical
contexts with everyday objects, (using fingers to model the numbers) the child is able to find one more or less e.g 'There are three children on the bus. One more gets on. How many children are there now?

Relates addition to combining two groups.

For example:

Using everyday objects, find how many there are in two groups by combining and counting them.

Relates subtraction to taking away.

For example:

Using everyday objects, the child says how many are left when some are eaten, taken away or hidden, by counting them, taking some away and then counting those that are left.

In practical activites and discussion, begins to use the vocabulary involved in adding and subtracting.

For example:

Using objects in practical contexts, the child understands and begins to use vocabulary involved in addition and subtraction, such as 'add', 'take-away', 'makes', 'altogether', 'how many

Finds one more or one less than a number from 1-20.

For example:

Through play, responds to instructions involving one more or one less, for example working out how many cakes are left after selling one.

Uses developing mathematical ideas and methods to solve practical problems.

For example:

Exploring practical problems in a range of real or role-play contexts such as doubling, halving, grouping and sharing, using their own methods. For example, the child finds different ways of separating 10 objects into two groups, pairs knives and folks, share out food, etc.

The next steps for children achieving this would be:

Uses a range of strategies for addition and subtraction, including some mental recall of number bonds(be able to explore number bonds through patterns- begin to see that 8+2 =2+8)

For example:

To use a range of strategies for addition and subtraction such as counting on, counting back and counting up as appropriate. They begin to display mental recall of some addition and subtraction facts, including some addition doubles and pairs of numbers that total 10.

YEAR 1 MENTAL CALCULATION OBJECTIVES

Count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number

**BY THE END OF YEAR 1, CHILDREN SHOULD BE CONFIDENT IN THE FOLLOWING
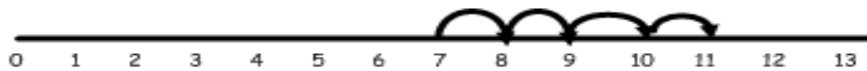AREAS OF MENTAL CALCULATION STRATEGIES:**

- IDENTIFY ONE MORE OR LESS THAN A GIVEN NUMBER-USING A NUMBER LINE

USE KNOWLEDGE THAT ADDITION CAN BE DONE IN ANY ORDER

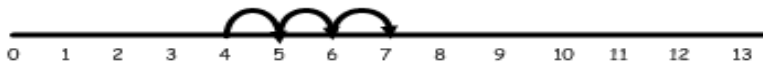For example:
put the larger number first
arrange 4 + 7 as 7 + 4, and count on 4 from 7

FIND A SMALL DIFFERENCE BY COUNTING UP

For example:
- work out mentally that 7-4 = 3 by counting up from 4 (children often include the number 4 by mistake and counting on from the next number should be emphasised)

- this can also be achieved by counting back from 7. Use a number line to support early understanding.

Counting

For example (you may use a 100 square)

- Count in 1's , 2's, 5's and 10's
- Count in 10s from a single digit
- Count on and back in 10's from a multiple of 10
- Count on and back from any given number up to 100

Number Bonds

For example:

- learn number bonds thoroughly first to 10 and then 20(more able**)** and recall the corresponding halves
- *Memorise number bonds to 20 in three forms eg 9+7=16, 16-7=9 , 16-9 =7*
- 7 + ? =
- use this knowledge to aid subtraction e.g. 13 + 7 = 20   20 – 7 = 13

Doubles and Near Doubles

For example:

- learn doubles thoroughly first to 10 and then 20

6 + 6 = 12 and 13 + 13 = 26

- play as oral games(near doubles)
- 6 + 7 = 6 + 6 + 1

Add or subtract 9, extend and adjusting by 1

For example:

- Add 9 to a single-digit number by adding 10 and subtracting 1. For example: 6+9 = 6 + 10 – 1

Use patterns of similar calculations

For example

- Develop and recognise a pattern such as 7 + 0 = 7   6 + 1 = 7   5 + 2 = 7   etc

and so deduce that 3 + 4 = 7

Similarly 10 – 0 = 10   10 – 1 = 9   10 -2 = 8 etc and so deduce that 10 -6 = 4

Use the relationship between addition and subtraction For example: 3 + 4 = 7   7 – 4 = 3

Use known number facts and place value to add a pair of numbers mentally

For example:

- Respond to oral questions like 2 + 4, 6 + 4, 8 – 5
- Work mentally to complete written question like:

2 + 3 = _____   _____ + 3= 5

Add or subtract a single digit to or from a 'teens' number, without crossing 20 or 10

- Respond to oral questions like:

15 + 3   18 – 6   and explain method

- Work mentally to complete written questions like:

15 + 4 =___   15 +_____ = 19   _____ + 4 = 19

- Begin to add a 'teens' number to a 'teens' number, without crossing the tens boundary (in the units column)

14 + 11   12 + 13

THROUGH GROUPING AND SHARING SMALL QUANTITIES, PUPILS BEGIN TO UNDERSTAND; MULTIPLICATION AND DIVISION, DOUBLING NUMBERS AND QUANTITIES- LINK DOUBLING WITH HALVING

Keeping Skills Sharp

With Year 1 children it is very important that regular practise takes place throughout the mathematical areas in the form of simple oral games.

Consolidate 'left/right' (and other positional language) through 'Simon Says' e.g. Simon says put your right hand on your left shoulder etc.

2D and 3D Shapes

- 'What shape has 3 sides?' Square/circle/triangle?
- 'Shape Detective' - Have a shape in your mind, children to ask you questions in order to guess the shape eg 'Does it have 4 sides?' etc Take this opportunity to reinforce the connected language eg sides, face, corners(refer to cubes/cuboids/pyramids/spheres)

Days, months, seasons

- This needs regular practise e.g What day is it today? Say the days of the week but leave one out – What day is missing?
- Do an action song for the months of the year – make it up!
- Make a story for the seasons so that the children attach memory ideas to each season. Practise the months in each season.

Time

Start with o'clock, then half past. Practise the associated language of past, to, minutes and hours.

Measurement-Use simple questions in order to relate to the units of measurements used for mass/weight, length, capacity.

- Let the children use the weighing scale and read the scale.
- For length let the children experience toe-heel counting from one side of the room to another, then walking and finally striding. Compare results. It is helpful for them to understand how small a centimetre is compared to one metre .It is a good idea to practise the names of the units frequently.

YEAR 2 MENTAL CALCULATION OBJECTIVES

MULTIPLICATION FACTS – <u>2, 5, 10</u> – including counting forwards and backwards in these multiples. Able to count in multiples of 3 to support later understanding of a third.

<u>By the end of Year 2, children should be confident in the following areas of mental calculation strategies:</u>

<u>NUMBER BONDS AND PLACE VALUE</u>
- Recognise the place value of each digit in a two- digit number(tens, ones)

- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100. 3+7+10; 10-7+3 and 7+ 10-3 to calculate 30+ 70 =100; 100-70 =30 and 70= 100-30
- <u>Use known number facts and place value to add a pair ofnumbers mentally</u>
  For example:
- Using knowledge of number bonds to 10 to help with 3 digit number work, and knowledge of number bonds to 100 to help with even greater numbers eg 1+9=10 10+90 =100   100+900= 1000

<u>ADDITION AND SUBTRACTION</u>
Add and subtract numbers using concrete objects, pictorial representations and mentally including:
- Add or subtract a pair of multiples of 10   40+50   80-30   ___ - 30 = 40 20+ ___ =70 (arrange 30+60 as 60+30 and count in tens from 60)
- A two – digit number and ones
- A two- digit number and tens 52+30
- Two two digit numbers 22+ 28(use also numbers with units that form number bonds) Explore questions like:12+23 = 12+20+3 =32 +3 =35
- Adding three one digit numbers)

<u>USE KNOWLEDGE THAT ADDITION CAN BE DONE IN ANY ORDER</u>
- Check calculations by adding and subtracting numbers in a different order e.g 5+ 2+1 = 1+5+2$= 1 + 5 + 2 = 1 + 2 + 5$
- put the larger number first
- look for pairs that make 10 and add these first
- partition and recombine
- Begin to add 3 digit numbers mentally(identifying number bonds) eg <u>5+</u> 3+ <u>5</u>
- Partition the 2nd number to help mental thinking eg 43+13 = (43 + 10) +3

  53+3 = 56

- **<u>IDENTIFY NEAR DOUBLES</u>** For example:
- Work out mentally that 6 + 7 = 13 explaining that it is double 6   plus 1

DOUBLES
- Know pairs of multiples of 10 that total up to 100 eg 20+ 80 30+ 70…
- Doubles of multiples of 5 eg 10+10 15+15= 20+20= 25+25 = 30+30 = 35+35…(more able26+26=25+25(+2)………
- Know doubles for numbers up to at least 15 and corresponding halves

USING THE INVERSE

- Recognise and use the inverse relationship between addition subtraction/ multiplication/ division and use this to check calculations and solve missing number problems

10+6 =16   6+10=16   16-6 =10   16 -10 = 6

So __+ 6 =16   10 +___ =16   ___- 6 =16   16-__ =10 and 16 =10+__ Or 16= __ -2

- Able to use commutativity and inverse relations to develop multiplicative reasoning e.g 4 x 5 =20   and 20÷ 5= 4

USE PATTERNS OF SIMILAR CALCULATIONS

For example:
- Develop and recognise a pattern such as 3 + 5 = 8

13 + 5 = 18

23 + 5 = 28

and so deduce that 63 + 5 = 68

- Recognise and use the pattern in, for example:

4 + 3 = 7

40 + 30 = 70

400 + 300 = 700

ADD OR SUBTRACT A PAIR OF NUMBERS MENTALLY BY BRIDGING THROUGH 10 OR 100, AND ADJUSTING

For example:
- Use 2 steps and cross 10 as a middle stage 15 – 8 = 7

Explain that 15 – 8 is the same as 15 – 5 (answer 10) and then
– 3 (answer 7)

FINDING FRACTIONS

Pupils count in fractions up to 10, starting from any number

Be able to find simple fractions of objects. Numbers and quantities

Find $\frac{1}{2}$ $\frac{1}{4}$ of a quantity

FIND A SMALL DIFFERENCE BY COUNTING UP

For example:
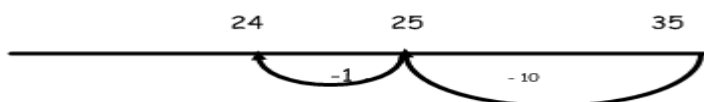- Work out mentally that 82 - 79 = 3 by counting up from 79(using a number line)

Add or subtract 9, 19, 29… or 11, 21, 31… by adding or
subtracting 10, 20 30… and adjusting by 1

For example:

Work out mentally that 24 -9 =15 because it is the same as 24 -10 and then +1
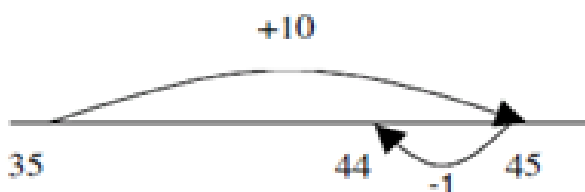

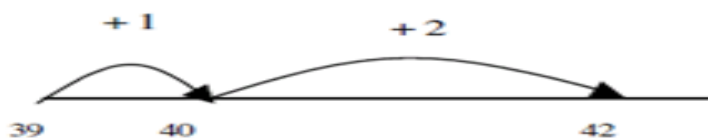- Work out mentally that 35- 11 = 24 because it is the same as 35- 10 and then -1

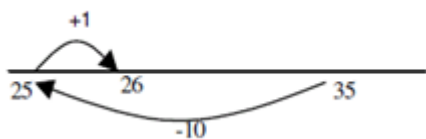Embed the mental strategy to add 9 or 11 just add 10 and adjust by 1:
e.g. 35 + 9

Use a number line to find a small difference by counting up.
E.g. 42 – 39 = 3

Subtract 9 or 11 by taking away 10 and adjusting by 1 (using a hundred square)
E.g. 35 – 9 = 26

YEAR 3 MENTAL CALCULATION OBJECTIVES

MULIPLICATION FACTS- _3 4 8_ 10 50 and 100
Be able to use multiples of 2,3,4,5, 8, 10, 50 and 100 by the end of year 3 (through doubling, they connect the 2, 4 and 8 multiplication tables)

RECALL MULTIPLICATION AND DIVISION FACTS FOR THE 3,4 AND 8 MULTIPLICATION TABLES
- Count from 0 in multiples of 4,8,50 and 100; find 10 or 100 more or less than a given number
- Count in steps of 2,3 5 and 10- count in 10s from any number and give 10 more or less than a given number to 100
- Pupils continue to count to count in ones, tens, hundreds, so that they become fluent in the order and place value of numbers to 1000
- _Count up and down in tenths; recognise that tenths arise form dividing an object into 10 equal parts and in dividing one- digit numbers or quantities by 10- 0.1, 0.2, 0.3, 0.4...._

Add and Subtract numbers mentally, including;
Add subtract a single digit to/ from a 2 digit number crossing the tens barrier

e.g 68+7 = 68 +2+5 =70+5 =75 and 62-7 = 62 -2 -5=60-5 =55

Adding/ subtracting multiples of 10 e.g 90+40 =_____(start with the largest number) 110-30

Find what must be added to a three digit multiple of 10 to make the next higher multiple of 100

e.g 540+_____ = 600   260+_____ = 300

A three- digit number and ones- 125 +7 (125+5) +2

A three- digit number and tens- 125+ 20- extend to 125+22- (125+20) +2

A three- digit number and hundreds- 125+300 -extend to 125+310- (125+300) +10

USE KNOWLEDGE THAT ADDITION CAN BE DONE IN ANY ORDER
For example:
- put the larger number first
- look for pairs that make 10 and add these first
- partition and recombine

Move onto 43+13 = (40+10)+3 = 53+3 = 56 FOLLOW UP WITH 67+85(60+80) + (7+5)

140   + 12 = 152

GET PUPILS USED TO PUTTING THE LARGEST NUMBER 1ST

- Add a two digit number to a multiple of 100 e.g 600+27 or 400+ 18
- Add a multiple of 10 to and from a 2/3 digit number eg 124+ 50
- Add a 2 digit number to a 2/ 3 digit number eg 24 + 37=(20+ 30)+ (4+7) or

(24+ 40)- 3

- Add a multiple of 10 or 100 to a 3 digit number eg 3<u>4</u>7 +<u>4</u>0 (identify the tens column)
- Add a three digit number and hundreds 347+200- extend to 347+210(347 +200) +10

USE PATTERNS OF SIMILAR CALCULATIONS

- Develop and recognise a pattern such as 14 + 3 = 17

14 + 13 = 27

14 + 23 = 37

and so deduce that 14 + 83 = 97

- Recognise and use the pattern in, for example:

4 + 8 = 12

40 + 80 = 120

400 + 800 = 1200

- Use known number facts and place value to add a pair of numbers mentally

For example: Using knowledge of number bonds to 10 to help with 3 digit number work, and knowledge of number bonds to 100 to help with even greater numbers **eg 3+7 = 10 so 30+70=10**

DOUBLES

Know doubles and corresponding halves for numbers up to 20 eg

16+ 16= (10+10)+ (6+6)   or (15+15) +2   (halving odd numbers eg 13 take 1 off=12 – half 12 and add 0.5

IDENTIFY NEAR DOUBLES

For example:

Work out mentally that 36 + 35 = 71 explaining that it is double 35 plus 1 (know doubles of 15, 25, 35 and 45) Work out mentally 60+70+ it is two 60s plus 10 or two 70s minus 10

• ADD OR SUBTRACT A PAIR OF NUMBERS MENTALLY BY BRIDGING THROUGH 10 OR 100, AND ADJUSTING

For example:

- Use 2 steps and cross 10 as a middle stage 15 – 8 = 7

Explain that 15 – 8 is the same as 15 – 5 (answer 10) and then

– 3 (answer 7)

SOLVE PROBLEMS INVOLVING MEASURES

Solve mental problems involving measures, weight and time

Eg How many seconds are there in 3 minutes? How many hours are there in 420 minutes?

FIND A SMALL DIFFERENCE BY COUNTING UP

FOR EXAMPLE:
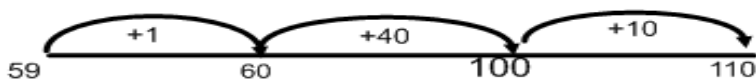
Subtract a 2 digit multiple of 10 from a 3 digit multiple of 10 eg 140 – 60(use known number facts eg 14-6 = 8 so 140-60 = 80) OR COUNT BACK 6 TENS OR COUNT UP FROM 60 TO 140 eg
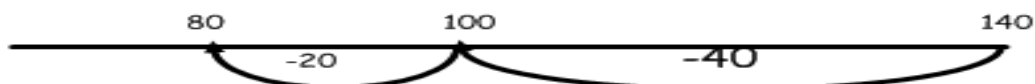
- **Work out mentally that 504 - 498 = 6 by counting up from 498- use a number line to demonstrate**
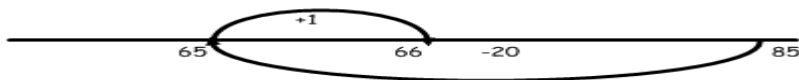

SUBTRACT A MULTIPLE OF 10 FROM A 2/3 DIGIT NUMBER EG 76- 30   135- 70
SUBTRACT A 2 DIGIT NUMBER FROM A 2/3 DIGIT NUMBER- USE A NUMBER LINE AND COUNT ON
FROM THE SMALLER NUMBER – REACH A MULTIPLE OF 10 AND THEN ADD ON EG 110- 59

- <u>Subtract a multiple of 10 or 100 from a 3 or 4 digit number eg 156- 70</u>

Add or subtract 9, 19, 29… or 11, 21, 31… by adding or subtracting 10, 20 30… and adjusting by 1 eg
85-19

For example:
- Work out mentally that 284 – 9 = 275 because it is the same as 284 – 10 and then + 1
- Work out mentally that 49+25 = (50+25)-1

MULTIPLICATION
Pupils develop efficient mental methods eg using commutativity and associativity e.g
(4 x 12 x 5 = 4 x 5 x 12 =20x12 =240) and multiplication and division facts(3 x2 =6, 6÷3 =2 and
2= 6÷3) to derive related facts (30 x2 =60, 60÷3 =20 and 20= 60÷3)

SHIFT THE DIGITS OF A NUMBER ONE PLACE TO THE LEFT/RIGHT TO MULTIPLY/DIVIDE BY 10
For example:
- Develop patterns as on this grid:

1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900

- Say or write a division statement corresponding to a given multiplication statement

For example:
- **7 x 5 = 35 implies that 35 ÷ 5 = 7**
- Use multiplication facts to support questions such as 3x 4= 12   so 3x 4<u>0</u> = 12<u>0</u>
- *Use Multiplication and division facts eg 3 x 2= 6, 6 ÷ 2 = 3   and 2= 6÷ 3*
  to calculate 30 x2 =60, 60 ÷ 3 = 20   and 20 = 60 ÷   3

YEAR 4 MENTAL CALCULATION OBJECTIVES

Multiplication facts- 1) *Count in multiples of 6,7, 9,* 25 and 1000- by the end of Year 4 be able to recall multiplication and division facts for multiplication tables up to 12 x 12

- **COUNTING**
- Count backwards through zero to include negative numbers- use a horizontal and vertical number line- (count down or up to zero when appropriate)
- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten e.g 0.01, 0.02..extend to adding hundredths and tenths e.g 0.6+0.04 =0.64- use money to support place value
- Count on or back in repeated steps of 1, 10, 100, 1000
- Continue to add/ subtract two digit multiples of 10 e.g 40+70   130- 50

For example:
- 143 +50 = 193 by counting on in steps of 10
- 163 – 50 = 113 by counting back in steps of 10

And so on…

NUMBER BONDS TO 100

Find what to add to a two or three digit number to make 100 or the next higher multiple of 100
- What must be added to 37 to make 100?(use a number line)
- Use this knowledge to solve problems such as 486 + ___ = 500   731+ ____ =800
- Work mentally to complete written questions like 4.8+____= 5   7.3+___8
- Find what to add to a four digit multiple of 100 to make the next higher multiple of 1000

e.g 3200+_____ = 4000   8400+____ = 9000

UNDERSTAND THAT ADDITION CAN BE DONE IN ANY ORDER

For example:
- Look for pairs that make 10 and add these first

Partition e.g. Step 1: 24 + 58 = 82;

Step 2: 20 + 50 = 70;

Step 3: 4 + 8 = 12;

Step 4: 70 + 12 = 82   use brackets 24+58 (20+50) + (4+8) = 72 or **ADJUST** (24+60)-2
- Move onto 3 digit plus a 2 digit number eg 143+ 45
- Add several multiples of 10 or 100 eg 60 + 70+ 40 or 600+ 700+ 400 (look for number bonds)

USE THE RELATIONSHIP BETWEEN ADDITION AND SUBTRACTION

For example:
- 36 + 19 = 55 so 55 – 19 = 36 so 55 – 36 = 19

Use number bonds to add a pair of numbers and groups of numbers

mentally

For example:
- 8 + 1 + 12 + 9 so (9 + 1 = 10) and (8 + 12 = 20) therefore (20 + 10 = 30)

Use patterns of similar calculations
For example:
Adding /Multiplication

- 4 + 8 = 12   2 x 3 =6
- 40 + 80 = 120   2 x 30 = 60
- 400 + 800 = 1200   2 x 300 = 600
- Add or subtract a pair of numbers mentally by using knowledge of number

bonds to 10 or 100, and adjusting
For example:

- 15 – 8 = 7

Explain that 15 – 8 is the same as 15 – 5 (answer 10) and then – 3 (answer 7)

FIND 1000 MORE OR LESS THAN A GIVEN NUMBER
e.g 4562+1000 or 4562 -1000   extend to larger numbers 32462+2000 or 32462-2000

USE DISTRIBUTIVE LAW

      39 X7 = 30 X 7 =210
       9 X7 =63
      210 + 63 = 273

USE ASSOCIATIVE LAW

 (2X3) X 4 = 2 X (3X4)

- Combine knowledge of number facts and rules to solve mental calculations e.g
  2 x 6 x 5 = 10 x 6 =60
- Multiply three numbers together
- Use knowledge of multiplication tables and related division facts e.g
  600÷ 3=200 can be derived from 2 x 3 =6

SAY OR WRITE A DIVISION SUM CORRESPONDING TO A GIVEN MULTIPLICATION SUM

- For example   7 x 5 = 35 so 35 ÷ 5 = 7
- MOVE ONTO MULTIPLYING A 2 DIGIT NUMBER BY A SINGLE DIGIT eg 7 x20 =140
  Move onto   7x 23 = (7x20) + (7x3)
              140   +   21 = 161
  Extend to 3 digit to derive facts eg 300 x 2 = 600 into   600 ÷ 3 = 200

MULTIPLY/ DIVIDE A NUMBER BY 10
Shift the digits of a number one place to the left/right to multiply/divide by10
For example:
TH H T U. tenths
1 0
1 0 0
1 0 0 0

SOLVE PROBLEMS INVOLVING MEASURES
- Convert between different units of measures(e.g km to m; hour to minute)
- Calculate the perimeter of a square by multiplying by four(double then double again)Find also the perimeter of a rectangle by adding the length and width then doubling the answer- 2(a + b)

DOUBLES
- Derive and identify doubles of multiples of 5 up to 50 e, 15,25,35,45/ (double by partitioning)
  38+38= (30+30) + (8+8) or use knowledge of known double e.g double 36 = 35+35 =70

  $$1+ \quad 1 \underline{= 2}$$
  $$\underline{\quad 72}$$

  Derive doubles/ halves of multiples of 10-500/ 100- 5000
  Begin with half of 30/ 50/70/ 90- use that knowledge to move onto half of 300/500/700/900
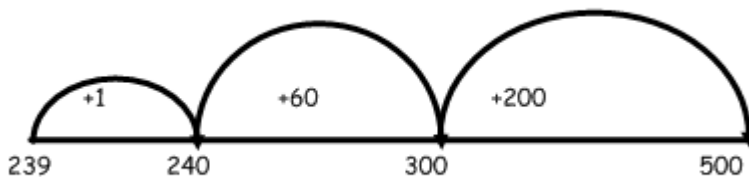 Double/ Half of 380   Double/ half 3800
  Double 380=(300+300)+ (80+80) = 760 or (400+400)- 40 =760 or (350+350)+60= 760
  Half 380 = 150+ 40= 190 (look also for known halves eg ½ of 38= 19 so ½ of 380 = 190)

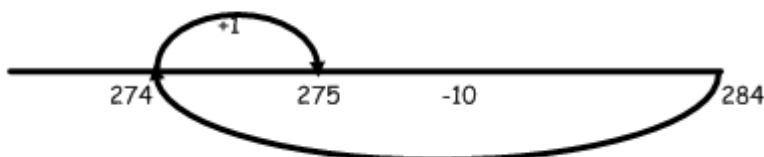## FIND A SMALL DIFFERENCE BY COUNTING UP
For example:
- Work out mentally that 2504 - 2498 = 6 by counting up from 498
- Subtract 2/3 digit numbers form3/ 4 digit numbers eg 500-239

Add or subtract 9, 19, 29... or 11, 21, 31... by adding or subtracting 10, 20 30... and adjusting by 1
For example:
- Work out mentally that 284 – 9 = 275 because it is the same as 284 – 10 and
then + 1- USE NUMBER LINE

YEAR 5 MENTAL CALCULATION OBJECTIVES

- **Multiplication facts- <u>11 and 12</u> (revision of all prior facts- the ability to commit them to memory and use them to make larger calculations) Know by heart all multiplication facts up to 12 x 12 and derive quickly the corresponding division facts**
- Incorporate algebra into tables eg if n= 9 what is 5n+1?
- Know squares of numbers to 12 x 12
- Recognise and use square numbers and cube numbers and the notation for both

COUNTING
- Count forwards or backwards in steps of 10, 100, 1000 or 10000 for any given number up to 1000000 and be able to determine the value of each digit
- Interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers including through zero

ADDITION/SUBTRACTION
Partitioning
324 + 58 = 324 + 50 + 8 = 374 + 8 = 382
Look for pairs that make 10
27 + 36 + 13 add the tens first to get 60, then 7 + 3 to get 70,
then add the 6
Add or subtract nearest multiple of 10, 100 or 1000 then adjust
458 + 71 = 458 + 70 + 1 = 528 + 1 = 529 or using brackets (458+70)+1
or **ADJUST- (460+71)-2**
583 - 71 = 583 - 70 - 1 = 513 - 1 = 512
274 + 99 = 274 + 100 - 1 = 374 - 1 = 373(refer to the use of the number line in Y4 if necessary)

DOUBLING AND HALVING
Derive quickly pairs of numbers that total 100
Derive doubles of numbers up to 100 and corresponding halves
Double 78 = double 70 + double 8- record (70+70)+(8+8)
Half 256 = half 200 + half 50 + half 6
Double 5.6 = double 5 + double 0.6 or double 56 and divide by 10
Identify near doubles
56 + 57 = double 56 + 1 = 112 + 1 = 113
1.5 + 1.6 = double 1.5 + 0.1 = 3.1
Find halves of decimals
What is half of 0.7- (put a zero on the end= 0.70 half is 0.35 extend to what is half of 0.15(put a zero on the end- 0.150= 0.075
Use relationship between addition and subtraction
36 + 19 = 55   19 + ? = 55
55 - 19 = ? 55 - ? = 19
Double any multiple of 5 to 100- e.d double 420 or 345= (600+ 90)
Halve any 3 digit number multiple of 10 e.g 150÷2 =75

Mentally add or subtract a pair of decimal numbers
4.6 + 7.5 = (4+7)+ (0.6+0.5)- USE MONEY eg £4.60+£7.50- ensure they know complements of 1 using addition and subtraction facts and place value eg 0.83 + 0.17 = 1
Or (46+75) divide by 10
- They mentally add and subtract tenths, and one-digit whole numbers and tenths e,g 6.1- 2.4
- **PRACTISE ADDING AND SUBTRACTING DECIMALS**, including a mix of whole numbers and decimals, decimals with different numbers of decimal places and complements of 1(e.g 0.83+ 0.17 =1)

- **USING NUMBER LINE TO SOLVE PROBLEMS INVOLVING MEASURES**
- A train left Derby station at 10: 35 and arrived at Edinburgh station at 13: 01- How long was the journey?


- Extend to problems involving **minutes and hours**-e.g how many minutes are there in 4.25 hours?
- **ANGLE**- find the missing interior angle of a triangle- pupils must know the sum of the interior angles of a triangle must equal 180 degrees
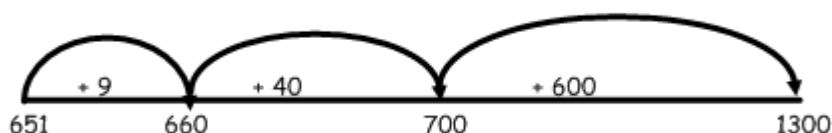

ADD OR SUBTRACT 9, 19, 29 99   129…OR 31, 51, 381… BY ADDING OR SUBTRACTING 10, 20 30… AND ADJUSTING BY 1

For example:
- Work out mentally that 284 – 9 = 275 because it is the same as 284 – 10 and then + 1- USE NUMBER LINE
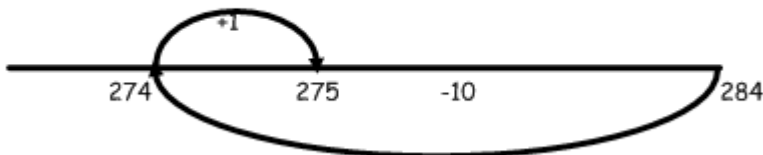
Counting on- using the number line e.g 651+____ =1300

Extend to addition of higher numbers of near multiples of 10 e.g   69+ 74 =70+74-1

COUNTING ON.

7.3 + ? = 10 Count on to 8, then on to 10 to get 2.7 (USE NUMBER LINE)

705 - 287 = ? Count on from 287 to 300, then to 700, then on to 705 to get 418 (extend to 4 digits for the more able)

Practise mental calculations with increasingly large numbers to aid fluency e.g 23 000- 12462

USE FACTORS

Identify multiples and factors including finding all factor pairs of a number and common factors of two numbers.

Move onto;

15 x 6 = 15 x 3 x 2

90 ÷ 6 = 90 ÷ 3 ÷ 2

<u>Partitioning</u> 13 x 21 = (13 x 20) + (13 x 1)

13 x 19 =(13 x 20) -13

47 x 5 = (40 x 5) + (7 x 5)

<u>**Using relationship between multiply and divide**</u>

23 x 3 = 69   3 x ? = 69

69 ÷ ? = 23   69 ÷ 23 = ?

- Pupils use and explain the equals sign to indicate equivalence, including missing number problems e.g,13 +24=12 +25; 33= 5 x ___

USING PLACE VALUE TO MULTIPLY AND DIVIDE BY 10, 100 AND 1000

30 x 400

8200 ÷ 10, 100 and 1000

APPLY THIS KNOWLEDGE TO FIND PERCENTAGES e.g

Eg what is 10% of £34 what is 30/ 40%? etc (move onto 3 digit numbers)

USE MENTAL STRATEGIES TO SOLVE MULTIPLICATION PROBLEMS SUCH AS;Be able to multiply a number by 5 by multiplying by 10 and halving answer

Be able to multiply by 25 by multiplying by 100 and halving and halving again

Be able to multiply by 50 by multiplying by 100 and halving the answer

Double a number ending in 5 and halve the other number e.g 16 x 5 = 8 x10 =80

USE FACTORS TO SOLVE DIVISION FACTS e.g 90÷ 6= 90 or 90÷3=30 30÷2 =15

Be able to find a number that lies exactly half way between another eg' what number is half way between 120 and 48= (120+48) divided by 2 = 84

BE ABLE TO FIND FRACTIONS OF AMOUNTS (LINK WITH PERCENTAGES)

½ of number   (halving) ¼ of a number (half then half again)

One fifth- divide by 5 or divide by 10 and double answer

Move on to problems such as 2/3 of 36 by dividing by the denominator and multiplying the numerator

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SOLVE PROBLEMS INVOLVING MEASURES

- Solve mental problems involving different units of metric measure e.g Km to m and cm to m; cm to mm; g to kg; l to ml (conversion of units)
- Calculate the perimeter of a square by multiplying by four(double then double again)Find also the perimeter of a rectangle by adding the length and width then doubling the answer- 2(a + b) EXTEND FROM YEAR 5 BY USING LARGER NUMBERS
- Calculate MENTALLY the area of a rectangle using the formula LB- Can they also find the missing length of a rectangle if they're given the total area and the breadth?

<u>Mentally be able to accurately predict the nth term in a sequence using a function box</u>

number	1	2	3	4	10	100	formula
term	5	11	16	21	?	?	5n+1 =t

Pupils should see that the term is going up by 5 which gives a clue to what the number is being multiplied by. Can the pupils write a formula?

YEAR 6 MENTAL CALCULATION OBJECTIVES

 Revise all multiplication facts (12x12) + KNOW ALL SQUARE ROOTS UP TO
13X13 eg what is the square root of 169?
Incorporate algebra into tables eg if n= 9 what is 5n+3?

READ AND WRITE, ORDER AND COMPARE NUMBERS UP TO 1 000 000 AND DETERMINE THE VALUE
OF EACH DIGIT

ADD SEVERAL NUMBERS
For example:
Add mentally three or more multiples of 10; such as 80 + 70 + 40 + 90
Work mentally to complete question like:
31 +_____ +29 = 87
Use known number facts and place value to add or subtract a
pair of numbers mentally (include problems related to measures)
For example:
Respond to oral questions like 0.05 + 0.3 or 0.7 – 0.26 and explain method.
Respond to oral question like 5700 + 2500 or 6200 – 3800 and explain method

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IDENTIFY NEAR DOUBLES
For example:
Work out mentally that
352 + 353 = 350+ 350 = 700 +5 = 705
USE RELATED FACTS AND DOUBLING OR HALVING
For example:
Double 176 = 200 + 140 + 12 = 352- record using brackets
Half of 948 = half of 900 + half of 40 + half 0f 8 = 474
Work out 1 x 32 = 32 and so deduce
2 x 32 = 64
4 x 32 = 128
8 x 32 = 256
    16 x 32 = 512...
- Double a decimal fraction less than 1 with one or more decimal places e.g double 0.9
Double 0.65   or   ___   x 2 =1.6

- HALVE A DECIMAL FRACTION LESS THAN 1 with one or two decimal places
0.15÷2 =   (0.150 ÷2 = 0.75)   ___ ÷ 2 =0.85?

FINDING A DIFFERENCE
Find a difference by counting up through the next multiple of
10, 100 or 1000.
For example:
Work out mentally by counting up from the smaller to the larger number- start with 3digit numbers
and possibly move onto 4 digit numbers
8000 – 2785 is 5 + 10 + 200 + 5000 = 5215 (use number line to demonstrate)

Find a difference by counting up through the next multiple of 10, 100 or 1000.
For example:
Work out mentally by counting up from the smaller to the larger number- start with 3digit numbers and possibly move onto 4 digit numbers
8000 – 2785 is 5 + 10 + 200 + 5000 = 5215 (use number line to demonstrate)
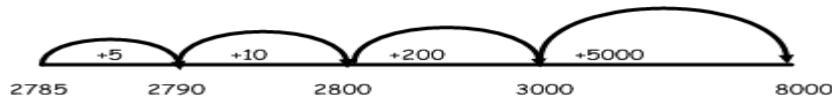

ADDING/ SUBTRACTING DECIMALS.
For example:
Add or subtract 0.9, 1.9, 2.9... or 1.1, 2.1, 3.1... by adding or subtracting 1,2,3... then adjusting eg 15-2.9 = (15-3)+0.1 or add up from the number line 17- 5.9

**USE NEGATIVE NUMBERS IN CONTEXT AND CALCULATE INTERVALS ACROSS ZERO**
What is the difference between -15 and 24(link with temperature/ worded problems)-USE NUMBER LINE to record mental strategies e.g
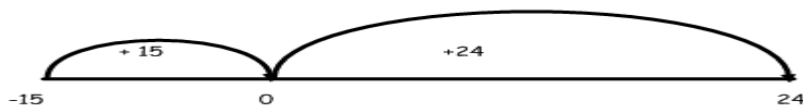
EXTEND by being able to find a number half way between a positive and negative number

Develop the use of the number line to include solving problems related to time including 24hr clock eg
A train left Derby station at 10: 35 and arrived at Edinburgh station at 13: 01- How long was the journey?
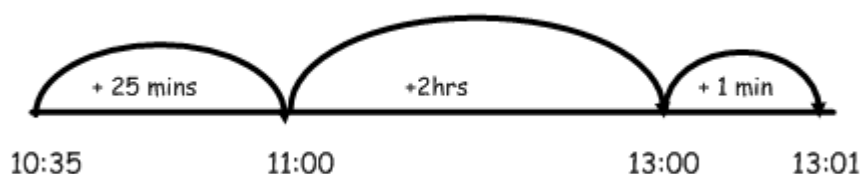
PROPERTIES OF NUMBERS

- Recognise and use square roots of numbers (up to 12x12)-' What is the square root of 144?'-'what is 5 squared?'
- Know and use the vocab of Prime numbers- establish whether a number up to 100 is Prime and recall the Prime numbers up to 19- use DIVISIBILITY rules especially for the number three to check if a number is prime eg is 57 prime? Add digits 5+7=12- if the answer (12) is divisible by 3 then so will 57 so therefore it cannot be Prime!
- Perform mental calculations including mixed operations and large numbers
- **Identify common factors, common multiples and prime numbers**
- As part of a mental warm-up explore the use of brackets e.g 2+1 x3 =5- where would you place the brackets to ensure the largest total ?

USE KNOWN NUMBER FACTS AND PLACE VALUE TO MULTIPLY OR DIVIDE MENTALLY

For example:

Multiply a decimal fraction with one or two decimal places by 10 or 100.

E.g. 3.27 x 10

9.6 x 100

0.82 x____ = 82

Divide a one or two digit whole number by 100 or 10

E.g. 84 ÷ 100

3 ÷ 10

EXTEND by multiplying decimals by whole numbers such as 0.4 x 2 = 0.8(in practical contexts such as measures and money- extend to 3.4 x 6   24.2 x 3

MULTIPLYING AND DIVIDING

- Multiply by 25- multiply by 100 then divide by 4
- Multiply by 15 – 14 x 15 = 14 x 10 =140 140÷2 =70 so 14 x 15 = 210
- Multiply a number by 49 or 51 13 x51 =(13 x 50) + 13

    650 + 13 = 663
- Multiply a number by 101 or 99 e.g 13 x101 = (13 x100) + 13
- Continue to multiply a 2 digit number by a single digit by multiplying the tens first e.g
    86 x 7 = (80 x 7) + (6 x7) = 560+42 = 602 Move onto 8.6 x7 = (8x7) +(0.6 x 7) = 56+42 =60.2
- Multiply a fraction such as 0.6 by a single digit number e.g 0.4 x 9- extend to
    3.7 x 5 (3 x 5) + (0.7 x5) 15+ 3.5 =18.5

APPLY THIS KNOWLEDGE TO FIND PERCENTAGE S OF NUMBERS eg

What is 10% of £340? What is 30/ 40% of £342?

What is 10% of £342?   What is 30% of £342?

What is 15% of £340?   What is 35% of £ 640?

Recall rapidly the key decimal equivalence of halves/ quarters / thirds/ tenths /fifths/eighths..

Be able to find fractions of amounts such as;

2/3 of 150   or   3/5 of 150- develop difficulty where appropriate

Solve more complex place value problems mentally e.g 0.6 + [   ] = 0.78

MENTALLY BE ABLE TO ACCURATELY PREDICT THE NTH TERM IN A SEQUENCE USING A FUNCTION BOX

Mentally be able to accurately predict the nth term in a sequence using a function box

number	1	2	3	4	10	100	formula
term	5	11	16	21	?	?	5n+1 =t

Pupils should see that the term is going up by 5 which gives a clue to what the number is being multiplied by. Can the pupils write a formula?

Extend to finding the value of each expression mentally

x	X + 1	X -1	2x-1	3(x+2)	3x+ 2	X - 1	10 - x
3							
7							

Fill in the value of each expression MENTALLY

a	b	a + b	a - b	2a + 3b	a - b	a + b	4(a +2b)
1							
2							