Lingfield Education Trust

# Mental Maths Guidance

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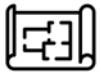
 Year Group Plans p12

# Rationale

## Logistics & Timetabling

Best practice is for these strategies to be taught away from the main maths lesson as part of your fact fluency program for ten to fifteen minutes daily. This division from the main maths lesson is especially important for lower attainers as the strategies might not directly align with the main maths lessons, which will lead to cognitive overload.

| Fact Fluency Program | | | | | |
|---|---|---|---|---|---|
| EYFS | KS1 | | LKS2 | | UKS2 |
| Subitising & Number Composition | Addition & Subtraction Facts | | Multiplication Table Facts & Mental Maths | | Arithmetic Paper Skills |
| Number Sense starters<br>Main EYFS Scheme | Year 1<br>Not bridging 10 up to twenty | Year 2<br>Bridging 10 up to twenty | Year 3<br>x2, x10, x5, x3, x4, x8 | Year 4<br>X6, x9, x7, x11, x12 | All four operations including fractions<br>Mental & written strategies |

We are aware of the timetable pressure for all subjects and so we feel a sensible approach to covering the skills taught in this document is as follows:

- EYFS and KS1 this is covered by your daily fact fluency program (Number Sense, Mastering Number or Fluency Bee)
- LKS2 these skills should be combined with your multiplication tables program daily practice (fact fluency)
- UPKS2 these skills should be combined with your arithmetic program (fact fluency)

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| Multiplication tables daily practice | Multiplication tables daily practice | Mental Calculation strategies | Mental Calculation strategies | Mental Calculation strategies |

* You could have 3 days multiplication tables instead.

## Pedagogical Approach

Too often flexible mental calculation strategies are left to chance – the chance that they will just emerge in lessons through discussion; the chance that teachers will teach them from their own knowledge bank; and the chance that someone will have taught them somewhere. Rarely, do most pupils stumble across effective mental strategies and this chance approach can mean pupils do not get taught flexible mental strategies and are often left to rely solely on longer, more formal written approaches that do not suit all calculations. Quite often they are kept solely for higher attainers, when in fact they empower all pupils.

This document aims to provide a structured, whole-school approach to directly teaching flexible mental calculation strategies to all pupils.

We have found that the most effective way to teach the strategies contained in this booklet is through these steps:

- Direct teacher modelling of worked examples
- Pupil practice on whiteboards of modelled strategy, including jottings. We feel that whiteboards allow pupils the freedom to concentrate on their jottings without worrying as much about presentation in books and for short fact fluency lessons books are time consuming.
- Well-placed reasoning lessons where pupils make decisions about the most effective strategy for given calculations. This stage is crucial as it is this reasoning that secures the learning.
- Regular chances to apply to varied fluency questions.

## Assessment

Formative assessment should take place while pupils are working on their whiteboards and through discussion of the answers afterwards. There is no need for formal, summative assessment of these sessions, rather their effectiveness will be seen in improved fact fluency check scores, improved MTC scores, improved arithmetic scores and improved progress in pupil work books in main maths lessons.

## Small Steps

The aim of directly teaching these strategies to all pupils is that every child learns effective approaches to a range of calculations, however often lower attainers struggle due to cognitive overload. This happens when too much variation is introduced too quickly.

The strategies in this document have been broken up into small steps so that pupils start from what they already know and move systematically through to the year group expectation with only one difference each step. This is how you capture all pupils – especially lower attainers. It may seem **slow** and **repetitive** but **it is meant to be**.

## Revisiting Key Skills

Once pupils have learned basic number facts, including addition and subtraction facts to twenty and multiplication tables, it is tempting to see the work as complete. However, pupils will lose their automaticity if these facts are not constantly revisited. Should older pupils be practising basic number bonds still? No. However, they can practice them using place value with 7 + 3 becoming 700 + 300 or 0.7 + 0.3

In addition to the automaticity gained in KS1, the strategies (e.g. hidden doubles, near doubles) need revisiting and it is for that reason that this document has the following strategies running through it from EYFS to KS1 to KS2 to ensure basic facts/strategies are always revisited for automaticity:

- Bonds to ten
- Near doubles (adjusting) and hidden doubles (adjusting)
- Near tens (adjusting)
- Partitioning
- Number lines
- Using place value and known facts for multiplication and division
- Doubling and halving for multiplication and division
- Flexible partitioning for division

## Reasoning / Choice Lessons

Teaching strategies is not enough alone; pupils need to be given the chance to reason and decide about which strategies go best with which calculation. This is also a very simple yet effective way to build discussion, oracy and debate into your maths lessons to further deepen understanding.

The most effective way to allow pupils to reason about the most effective strategy for a given calculation is to present them with a grid like the below that should be populated with questions the pupils have strategies for and especially the strategy just taught.

There are then several options of how to use these grids:

- Ask pupils to select the questions that a given strategy suits and explain why
- Ask pupils to select the questions that a given strategy suits, explain why and complete the calculation
- Ask the pupils to identify what strategy should be used for each calculation and explain why
- Ask the pupils to identify what strategy should be used for each calculation, explain why and complete the calculation

As above, sometimes the activity does not need to be about the answer but the strategy.

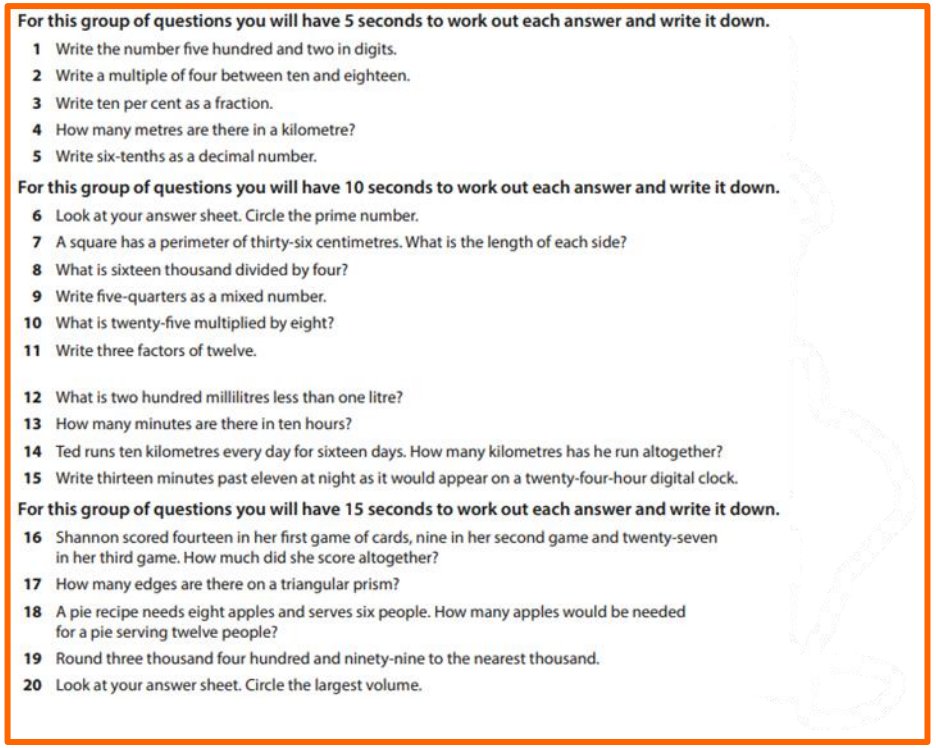
| | | | |
|---|---|---|---|
| **2 + 3** | **6 + 2** | **10 + 4** | **7 + 3** |
| **8 + 4** | **12 + 5** | **15 + 8** | **20 + 6** |
| **32 + 14** | **45 + 32** | **37 + 18** | **48 + 37** |
| **4567 + 687** | **32 + 33** | **406 + 10** | **4.56 + 23.76** |

## Application

In addition to regular reasoning/choice sessions another excellent way to reinforce the learning of these strategies is allowing pupils to apply them a wider, more varied range of questions.

Prior to the introduction of the KS2 Arithmetic Test in 2016, pupils completed a mental maths test and these questions still provide an excellent way to let children apply their mental calculation strategies.

Other effective resources include Rising Star Mental Maths Tests and Schofield & Sims Mental Maths Tests. These, along with the old mental maths SATs, can both be found in the trust's shared maths resources folder under maths materials.



**For this group of questions you will have 5 seconds to work out each answer and write it down.**

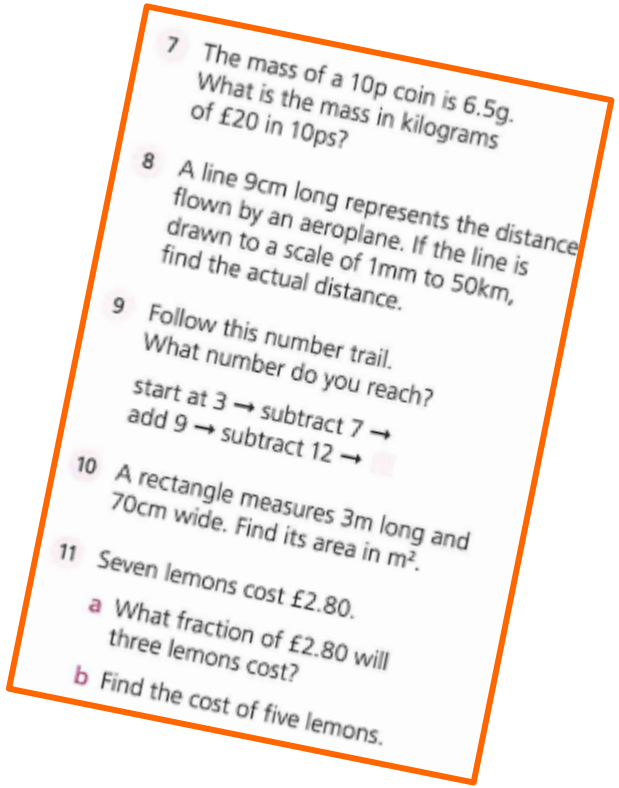
1 Write the number five hundred and two in digits.
2 Write a multiple of four between ten and eighteen.
3 Write ten per cent as a fraction.
4 How many metres are there in a kilometre?
5 Write six-tenths as a decimal number.

**For this group of questions you will have 10 seconds to work out each answer and write it down.**

6 Look at your answer sheet. Circle the prime number.
7 A square has a perimeter of thirty-six centimetres. What is the length of each side?
8 What is sixteen thousand divided by four?
9 Write five-quarters as a mixed number.
10 What is twenty-five multiplied by eight?
11 Write three factors of twelve.
12 What is two hundred millilitres less than one litre?
13 How many minutes are there in ten hours?
14 Ted runs ten kilometres every day for sixteen days. How many kilometres has he run altogether?
15 Write thirteen minutes past eleven at night as it would appear on a twenty-four-hour digital clock.

**For this group of questions you will have 15 seconds to work out each answer and write it down.**

16 Shannon scored fourteen in her first game of cards, nine in her second game and twenty-seven in her third game. How much did she score altogether?
17 How many edges are there on a triangular prism?
18 A pie recipe needs eight apples and serves six people. How many apples would be needed for a pie serving twelve people?
19 Round three thousand four hundred and ninety-nine to the nearest thousand.
20 Look at your answer sheet. Circle the largest volume.



7 The mass of a 10p coin is 6.5g. What is the mass in kilograms of £20 in 10ps?

8 A line 9cm long represents the distance flown by an aeroplane. If the line is drawn to a scale of 1mm to 50km, find the actual distance.

9 Follow this number trail. What number do you reach?

start at 3 → subtract 7 → add 9 → subtract 12 →

10 A rectangle measures 3m long and 70cm wide. Find its area in $m^2$.

11 Seven lemons cost £2.80.

a What fraction of £2.80 will three lemons cost?

b Find the cost of five lemons.

# Whole School Overview

# Mental Calculation Expectations

| | Addition | Subtraction | Multiplication | Division |
|---|---|---|---|---|
| YR | • Perceptually subitise to 10<br>• Conceptually subitise to 5<br>• Find the total number of items in two groups, up to a total of 10 *(combine and subitise, count all (aggregation), use known facts)*<br>• 1 more to 10<br>• Add zero, within numbers to 10 | • 1 less to 10<br>• Remove from a small group and find how many are left, up to a total of 10 *(take away and subitise, take away and count how many are left, use known facts)*<br>• Subtract zero to 10 | • Doubles to 5 | |
| Year 1 | • Subitising 1-5<br>• Recognizing numbers on tens frames<br>• Add 1-digit to tens<br>• Add 1-digit to teens<br>• Number Bonds to 10<br>• Bridging 10 single digits<br>• Near doubles to 5, e.g. 3+2 | • Subtract pairs of 1-digit numbers<br>• Subtraction facts to 10<br>• Bridging 10 by single digit subtraction<br>• Subtract1-digit from teens<br>• Subtract1-digit from ten<br>• | • Double numbers to 5<br>• Count forwards and backwards in 2s, 5s and 10s | • Halve even numbers to 10 |
| Year 2 | • Bridging 10 (TU + U)<br>• 1-digit to a multiple of ten (e.g. 60 + 5)<br>• Add multiples of 10 to a 2-digit number (e.g. 27 + 60)<br>• Add three 1-digit numbers<br>• Number Bonds to 20<br>• Number Bonds to 100 in 10s<br>• Add 10 to 2-digit numbers using place value<br>• Add 11 by adding 10 add 1<br>• Add 9 by add 10 take 1<br>• Near doubles to 10, e.g 6+5 | • Subtract 10 from a 2-digit number using place value<br>• Bridging any 2-digit10 by single digit subtraction<br>• Subtract 1-digit from multiple of 10<br>• Subtraction facts to 20<br>• Subtraction facts to 100 in 10s<br>• Subtract 11 by subtracting 10 then 1<br>• Subtract 9 by subtracting 10 and adding 1 | • Double numbers to 10<br>• Double any multiple of 10 up to 50<br>• Recognize odd and even<br>• Rapid recall of x2,10,5 as a minimum | • Halve even numbers to 20<br>• Halve any multiple of 10 with an even tens digit up to 100<br>• Rapid recall of division facts for x2,10,5 as a minimum |
| Year 3 | • Add 100 to any 3-digit number using place value<br>• Bridging to 3-digit<br>• Add pairs of multiples of 10 up to 2-digit using bonds<br>• 2-digit Near Doubles (teens and tens, e.g. 14 + 13, 30 + 20)<br>• 2-digit near 10s round up (e.g. 27 + 19/21)<br>• Add any 2-digit numbers using partitioning<br>• Add any 2-digit numbers using counting on | • Subtract 100 from any 3-digit number using place value<br>• Bridging HTU by U subtraction<br>• Subtract a 2-digit number from a multiple of 10<br>• Subtract pairs of multiples of 10 up to 2-digit using bonds<br>• Subtract near multiples of 10 rounding up<br>• Subtract pairs of 2-digit using partitioning<br>• Subtract pairs of 2-digit using counting on | • Double any multiple of 10 up to 100<br>• Find 4 of a number by doubling and doubling again<br>• Rapid recall of x3, 4,8 as a minimum<br>• Multiply any 2-digit number by 10<br>• Multiply TU x U using partitioning<br>• Use place value and known facts to TU x U, e.g. 80 x 3 | • Halve any multiple of 10 up to 100<br>• Find a quarter by halving and halving again<br>• Rapid recall of division facts for x3,4,8 as a minimum<br>• Identify the remainder when dividing TU by 2,10,5<br>• Divide any 3-digit multiple of 10 by 10<br>• Use place value and known facts to HTU ÷ U, e.g. 400 ÷ 8 |

This is an over view of the minimum requirements for mental maths strategies to be taught in each year group for each operation.

They were created by combing **teaching expertise**, **DfE *Teaching Children to Calculate Mentally*** and the **SPCFC materials from Together for Sunderland**.

The strategies outlined for Year R, Year 1 and Year 2 correspond to those covered by most EYFS schemes and the main KS1 fact fluency schemes (Number Sense, NCETM Mastering Number and W Fluency Bee).

# Mental Calculation Expectations

| | | | | |
|---|---|---|---|---|
| Year 4 | • Add 1000 to any 4-digit number using place value<br>• Bridging up to 4-digit<br>• Add pairs of multiples of 10 up to 3-digit using bonds<br>• 2-digit Near Doubles to 50, e.g. 36 + 37<br>• 2-digit near 10s round up & down (e.g. 27 + 19/21)<br>• Add any 3-digit numbers using partitioning<br>• Add any 3-digit numbers using counting on | • Subtract 1000 from any 4-digit number using place value<br>• Bridging THTU by U subtraction<br>• Subtract pairs of multiples of 10 up to 3-digit using bonds<br>• Subtract near multiples of 10 rounding up and down<br>• Subtract any 3-digit numbers using partitioning<br>• Subtract any 3-digit numbers using counting on<br>• | • Double any 2-digit number<br>• Double any multiple of 100<br>• Rapid recall of all tables to 12x12<br>• Multiply three 1-digit numbers<br>• Multiply any number to 100 by 10/100<br>• Multiply HTU x U using partitioning<br>• Use place value and known facts to HTU x U, e.g. 400 x 3 | • Halve any even number to 100<br>• Rapid recall of all division facts for tables to 12x12<br>• Identify the remainder when dividing HTU by 2,10,5<br>• Divide any number to 1000 by 10/100<br>• Use place value and known facts to THTU ÷ U, e.g. 1200 ÷ 3 |
| Year 5 | • Use place value to add powers of 10 to 1,000,000<br>• Bridging (U.t + .t)<br>• 2-digit Near Doubles to 100, e.g. 76 + 77<br>• Add near hundreds (e.g. 427 + 198)<br>• Add any U.t pairs (e.g 3.5 + 2.8) using partitioning<br>• Add any U.t pairs (e.g 3.5 + 2.8) using counting on<br>• Add pairs of multiples of U.t by making x10 larger | • Use place value to subtract powers of 10 up to 1,000,000<br>• Bridging U.t by U subtraction<br>• Subtract near hundreds (e.g. 427 - 198)<br>• subtract any U.t pairs (e.g 3.5 - 2.2) using partitioning<br>• subtract any U.t pairs (e.g 3.5 - 2.7) using counting on<br>• Subtract pairs of multiples of U.t by making x10 larger | • Double 3-digit multiples of 10<br>• Double U.t<br>• Multiply whole numbers by 10,100,1000<br>• Multiply U.t using partitioning<br>• Use place value and known facts to THTU x U, e.g. 8000 x 3<br>• Multiply pairs of multiples of 10 with same place value ,e.g. 400 x 300<br>• Multiply by 50 by multiplying by 100 and halving<br>• Multiply by 25 by multiplying by 100 and halving and halving again<br>• Multiply by 20 by multiplying by 10 and doubling<br>• Multiply by 5 by multiplying by 10 and halving | • Halve 3-digit multiples of 10<br>• Halve any whole number<br>• Find the remainder when dividing TU by any single digit<br>• Divide whole numbers by 10,100,1000<br>• Use place value and known facts to TTHTU ÷ U, e.g. 64000 ÷ 8<br>• Multiply pairs of multiples of 10 with same place value, e.g. 800 ÷ 200 |
| Year 6 | • Use place value to add powers of 10 to any number<br>• Bridging (U.th + .th)<br>• Near doubles to tenths (e.g. 1.7 + 1.6)<br>• Near tens to tenths (e.g. 4.2 + 1.9)<br>• Add any U.th pairs (e.g 3.52 + 2.87) using partitioning<br>• Add any U.th pairs (e.g 3.52 + 2.87) counting on | • Use place value to subtract powers of 10 from any number<br>• Subtract using near tens to tenths, e.g. 4.6 – 1.9<br>• Subtract any U.th pairs (e.g 3.52 - 2.31) using partitioning<br>• Subtract any U.th pairs (e.g 3.52 - 2.31) using counting on | • Double any number including to 2dp<br>• Multiply whole numbers and decimals by 10,100,1000<br>• Multiply U.th x U using partitioning<br>• Use place value and known facts for decimals, e.g. 0.3 x 4<br>• Multiply pairs of multiples of 10 with differing place value ,e.g. 4000 x 30 | • Halve any number including 2dp<br>• Divide whole numbers and decimals by 10,100,1000<br>• Use place value and known facts for decimals, e.g. 3.2 ÷ 8<br>• Divide pairs of multiples of 10 with differing place value, e.g. 8000 ÷ 200<br>• Divide by 50 by dividing by 100 and doubling<br>• Divide by 25 by dividing by 100 and doubling and doubling again<br>• Divide by 20 by dividing by 10 and halving<br>• Divide by 5 by diving by 10 and doubling |

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# Year Group Plans

# Reception, Year 1 & 2

These skills are aligned with Number Sense and the supporting detail is to be found on *Number Sense*

# EYFS & KS1 Mental Calculation Strategies – Aligned with *Number Sense*

| | Reception | Year 1 | Year 2 |
|---|---|---|---|
| **Autumn 1** | Subitising 1<br>Subitising 2<br>Subitising 3 | Subitising 1 to 5<br>Subitising 6 – 10<br>Composition / make & break 5<br>Composition / make & break 4, 3, 2<br>Composition / make & break 10 | Subitising revisit<br>Using tens frame revisit<br>Cumulative fluency revisit |
| **Autumn 2** | Subitising 4<br>Subitising 5<br>Subitising 1 – 5 using tens frames | Composition / make & break 6<br>Composition / make & break 7<br>Composition / make & break 8<br>Composition / make & break | Adding 9<br>Adding 8<br>Adding 7<br>Subtracting back to 9<br>Subtracting back to 8<br>Subtracting back to 7 |
| **Spring 1** | Subitising 6<br>Subitising 7<br>Subitising 8<br>Subitising 9<br>Subitising 10<br>Counting up to 10 items | One more<br>One less<br>Two more<br>Two less<br>Fact families to 3<br>Fact families to 5<br>Fact families to 10 | Doubles and halves<br>Near doubles<br>Hidden doubles<br>Near tens addition (9)<br>Near tens addition (9)<br>Near tens subtraction (8)<br>Near ten subtraction (8)<br>Constant difference |
| **Spring 2** | Partitioning 2, 3 and 4<br>Partitioning 5 and 10 | Five and a bit; Zero<br>Doubles; Near doubles | Fact Fluency<br>Strategy Selection |
| **Summer 1** | Composition of 6<br>Composition of 7<br>Composition of 8<br>Composition of 9<br>Comparing numbers to 10 | Even number neighbours<br>Odd number neighbours<br>7 tree<br>9 square | Enumerating tens<br>Adding tens<br>Subtracting tens<br>Adding ones<br>Subtracting ones |
| **Summer 2** | Patterns in odd/even; Patterns in doubles<br>Equal Distribution | Ten and a bit<br>Consolidation & gaps | Fluency on number lines<br>Fluency with part-part-whole models |

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# Year 3

# Year 3 Mental Calculation Strategies

Autumn Term

**Bridging 10 Addition**
*Practice make ten and then*

- Bridging the first 10 (e.g. 7 + 6)
- Bridging 100 in multiples of 10 (e.g. 70 + 60)
- Bridging other 10s (e.g. 17 + 6)

**Bridging 10 Subtraction**
*Practice get back to ten and then*

- Bridging the first 10 (e.g. 7 + 6)
- Bridging 100 in multiples of 10 (e.g. 70 + 60)
- Bridging other 10s (e.g. 17 + 6)

**Place Value Addition**
*Add 100 to any 3-digit number using place value*

- +10 to 2-digit using PV
- +10 to 3-digit using PV
- +100 to 3-digit using PV

**Place Value Subtraction**
*Subtract 100 from any 3-digit number using PV*

- -10 from a 2-digit using PV
- -10 from a 3-digit using PV
- -100 from a 3-digit using PV

**Partition Addition**
*Add any 2-digit numbers using partitioning*

- Add pairs of multiples of 10 to 100 using basic bonds facts to 10
- Partition to add two 2-digit no bridging 10
- Partition to add two 2-digit bridging 10
- Partition to add two 2-digit bridging 100

**Number Line Addition**
*Add any 3-digit numbers using counting on*

- Number line to add two 2-digit no bridging 10
- Number line to add two 2-digit bridging 10
- Number line to add two 2-digit bridging 100

**Partition Subtraction**
*Subtract pairs of 2-digit using partitioning*

- Subtract multiples of 10 from 100 (this is your number bonds practice)
- Partition to subtract two 2-digit no bridging 10
- Partition to subtract two 2-digit bridging 10

**Number Line Subtraction**
*Subtract pairs of 2-digit using counting on*

- Number line to subtract two 2-digit no bridging 10
- Number line to subtract two 2-digit bridging 10

**Double and Halve**
*Double and halve any multiple of 10 up to 100*

- Double any multiple of 10 to 100 no bridging 100
- Double any multiple of 10 to 100 bridging 100
- Halve any multiple of 10 to 100 with an even tens digit
- Halve any multiple of 10 to 100 with an odd tens digit **This will need lots of practice**

**Double & Double Again**
*Find 4 of a number by doubling and doubling*

- Find 4 of a number by doubling and doubling again (1-digit number)
- Find 4 of a number by doubling and doubling again (2-digit multiples of 10)

**Halve and Halve Again**
*Find a quarter by halving and halving again*

- Find a quarter of a number by halving and halving again

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# Year 3 Mental Calculation Strategies

Spring Term

**Near Doubles Addition**
*2-digit Near Doubles*

- Teen + teen not bridging 10 (e.g. 13 + 12)
- Teen + teen bridging 10 (e.g. 16 + 15)
- Ten + ten not bridging 100 (e.g. 40 + 30)
- Ten + ten bridging 100 (60 + 50)

**Hidden Doubles Addition**
*2-digit Hidden Doubles*

- Revisit hidden doubles within 10 (e.g. 7 + 5)
- Hidden doubles using multiples of 10 to 100 not bridging 100 (e.g. 50 + 30)
- Hidden doubles using multiples of 10 to 100 not bridging 100 (e.g. 70 + 50)

**Near Tens Addition**
*2-digit near 10s round up*

- TU + 9
- TU + 19
- TU + 29
- TU + other _9 numbers not bridging 100
- TU + other _9 numbers bridging 100

**Near Tens Subtraction**
*Subtract near multiples of 10 rounding up*

- TU - 9
- TU - 19
- TU - 29
- TU - other _9 numbers not bridging 100
- Reasoning/choice session

**Multiply by powers of 10**
*Multiply whole numbers by 10*

- Multiply 1-digit whole numbers by 10, e.g. 7 x 10 = 70
- Multiply 2-digit whole numbers that are multiples of 10 by 10, e.g. 70 x 10 = 700
- Multiply 2-digit whole numbers by 10, e.g. 72 x 10 = 720

**Divide by powers of 10**
*Divide whole numbers by 10*

- Divide 2-digit whole numbers that are multiples of 10 by 10, e.g. 70 ÷ 10 = 7
- Divide 3-digit whole numbers that are multiples of 100 by 10, e.g. 200 ÷ 10 = 20
- Divide 3-digit whole numbers that are multiples of 10 by 10, e.g. 270 ÷ 10

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# Year 3 Mental Calculation Strategies

Summer Term

**Multiply using partitioning**
*Multiply TU x U using partitioning*

- TU x U with the ones digit being one and no bridging, e.g. 31 x 3
- TU x U with no bridging, e.g. 23 x 2
- TU x U with tens boundary being crossed, e.g. 24 x 3
- TU x U with both boundaries being crossed, e.g. 42 x 8

**Use place value and known facts to multiply**
*Use place value and known facts to TU x U*

- TU x U using known facts and PV, e.g. 80 x 3, 40 x 3

**Use place value and known facts to divide**
*Use place value and known facts to HTU*

- TU ÷ U using known facts and PV, e.g. 80 ÷ 4
- HTU ÷ U using known facts and PV, e.g. 800 ÷ 4

**Double and half to multiply**
*Use double & halve to multiply ones and tens*

- Explore with calculations with at least one even number that doubling one and halving another leads to the same answer (one-digit numbers e.g. 8+6)
- Explore with calculations with at least one even number that doubling one and halving another leads to the same answer (two-digit multiples of 10 e.g. 80+60)

**Flexible Partitioning**
*Use flexible partitioning to divide 2-digit numbers*

- Use flexible partitioning to divide a 2-digit by 1-digit with no remainders
- Use flexible partitioning to divide a 2-digit by 1-digit with remainders

**Identify the remainder when dividing by 10, 5 and 2**

- Remainder when dividing by 10 within standard tables ranges
- Remainder when dividing by 10 outside standard tables ranges
- Remainder when dividing by 5 within standard tables ranges
- Remainder when dividing by 5 outside standard tables ranges

**Rules of divisibility**

- Rules of divisibility for x3
- Rules of divisibility for x4

**Consolidation**

- Consolidation of areas less secure

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# Year 4

# Year 4 Mental Calculation Strategies

Autumn Term

## Bridging 10 Addition
*Practice make ten and then*

- Bridging the first 10 (e.g. 7 + 6)
- Bridging 100 in multiples of 10 (e.g. 70 + 60)
- Bridging other 10s (e.g. 17 + 6)

## Bridging 10 Subtraction
*Practice get back to ten and then*

- Bridging the first 10 (e.g. 7 + 6)
- Bridging 100 in multiples of 10 (e.g. 70 + 60)
- Bridging other 10s (e.g. 17 + 6)

## Place Value Addition
*Add 1000 to any 4- digit number using place value*

- THTU + 10 not bridging 100 (e.g. 4578 + 10)
- THTU + 10 bridging 100 (e.g. 4598 + 10)
- THTU + 100 not bridging 1000 (e.g. 3048 + 100)
- THTU + 100 bridging 1000 (e.g. 4987 + 100)
- THTU + 1000 not bridging 10,000 (e.g. 8907 + 1000)

## Place Value Subtraction
*Subtract 1000 from any 4-digit number using PV*

- THTU - 10 not bridging 100 (e.g. 4578 - 10)
- THTU - 10 bridging 100 (e.g. 4598 - 10)
- THTU -100 not bridging 1000 (e.g. 3048 - 100)
- THTU - 100 bridging 1000 (e.g. 4987 - 100)
- THTU - 1000 not bridging 10,000 (e.g. 8907 - 1000)

## Partition Addition
*Add any 3-digit numbers using partitioning*

- Add pairs of multiples of 10 to 100 using basic bonds facts to 10
- TU + TU not bridging 10s
- TU + TU bridging 10s
- TU + TU bridging 100
- HTU + HTU no bridging
- HTU + HTU with ones bridging
- HTU + HTU with 10s bridging
- HTU + HTU with 100s bridging
- HTU + HTU with 1000s bridging
- HTU + HTU mixed bridging

## Number Line Addition
*Add any 3-digit numbers using counting on*

- Number line to add two 3-digit no bridging (e.g. 432+231)
- Bridging ten (432+239)
- Bridging 100 (432 + 289)

## Partition Subtraction
*Subtract pairs of 3-digit using partitioning*

- HTU - HTU where all digits in minuend are larger than those in the subtrahend (e.g. 345 – 122)

## Number Line Subtraction
*Subtract any 3-digit numbers using counting on*

- HTU - HTU counting on subtrahend to minuend

## Double
*Double any multiple of 100 up to 1000*

- Double any multiple of 100 to 1000 no bridging 1000
- Double any multiple of 100 to 1000 bridging 1000

## Halve
*Halve any multiple of 100 up to 1000*

- Halve any multiple of 100 to 1000 with an even hundreds digit
- Halve any multiple of 100 to 1000 with an odd hundreds digit **This will need lots of practice**

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# Year 4 Mental Calculation Strategies

Spring Term

**Double & Double Again**
*Find 4 of a number b& quarter of a number*

- Find 4 of a number by doubling and doubling again (3-digit multiples of 100)

**Halve & Halve Again**
*Find 4 of a number b& quarter of a number*

- Find a quarter of a number by halving and halving again (3-digit multiples of 100)

**Near Doubles Addition**
*2-digit Near Doubles to 50*

- TU + TU not bridging 50 (e.g. 24+23)
- TU + TU bridging 50 (e.g. 36 + 37)

**Hidden Doubles Addition**
*2-digit Hidden Doubles to 50*

- Revisit hidden doubles within 100 (e.g. 70 + 50)
- Hidden doubles to 50 (e.g. 37 + 35)

**Near Tens Addition**
*2-digit near 10s round up*

- TU + 9
- TU + 19
- TU + other _9 numbers not bridging 100
- Same with bridging
- TU + 11
- TU + 21
- TU + other _1 numbers not bridging 100
- Same with bridging

**Near Tens Subtraction**
*Subtract near multiples of 10 rounding up*

- TU - 9
- TU - 19
- TU - other _9 numbers not bridging 100
- TU – 11
- TU – 21
- TU - other _1 numbers not bridging 100

**Multiply by powers of 10**
*Multiply whole numbers by 10 and 100*

- Multiply whole numbers by 10
- Multiply whole numbers by 100
- Multiply whole numbers and decimals by 10 and 100 mixed

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# Year 4 Mental Calculation Strategies

Summer Term

**Divide by powers of 10**
*Divide whole numbers by 10 and 100*

- Divide whole numbers by 10
- Divide whole numbers by 100
- Divide whole numbers and decimals by 10 and 100 mixed

**Use place value and known facts to multiply**
*Use place value and known facts to HTU x U, e.g. 400 x 3*

- 2-digit multiples of 10 multiplied by a single-digit number, e.g. 30 x 4 = 120
- Repeat for 3-digit multiple of 100, e.g. 300 x 4 = 1200

**Use place value and known facts to divide**
*Use place value and known facts to THTU ÷ U, e.g. 1200 ÷ 3*

- 3-digit multiples of 10 divided by a single-digit number, e.g. 120 ÷ 4 = 30
- 4-digit multiples of 100 divided by a single-digit number, e.g. 1200 ÷ 4 = 300

**Multiply using partitioning**
*Multiply HTU x U using partitioning*

- No crossing of any boundaries, e.g. 213 x 3
- Crossing tens boundary, e.g. 214 x 3
- Crossing hundreds boundary, e.g. 478 x 2
- Crossing all boundaries, e.g. 346 x 6

**Double and half to multiply**
*Use double & halve to multiply ones and tens*

- Explore with calculations with at least one even number that doubling one and halving another leads to the same answer (three-digit multiples of 100 e.g. 800+600)

**MTC**

- The first 3 weeks of this half term should be set aside for MTC practice

**Flexible Partitioning**
*Use double & halve to multiply ones and tens*

- Use flexible partitioning to divide a 2-digit by 1-digit with no remainders
- Use flexible partitioning to divide a 3-digit by 1-digit with no remainders
- Use flexible partitioning to divide a 3-digit by 1-digit with remainders

**Multiply more than two numbers**
*Multiply 3 numbers*

- Multiply three 1-digit numbers to develop understanding of the associative property

# Year 5

# Year 5 Mental Calculation Strategies

Autumn Term

## Place Value Addition
*Use place value to add powers of 10 to 1,000,000*

- Add 10 to each place value size of numbers (e.g. 3- digit + 10, 7-digit + 10)
- Add 100 as above
- Add 1,000 as above
- Add 10,000 as above
- Add 100,000 as above

## Place Value Subtraction
*Use PV to subtract powers of 10 up to 1,000,000*

- Subtract 10 from each PV size of numbers
- Subtract 100 as above
- Subtract 1,000 as above
- Subtract 10,000 as above
- Subtract 100,000 as above
- Subtract 1,000,000 as above

## Partition Addition
*Add any U.t pairs (e.g. 3.5 + 2.8) using partitioning*

- HTU + HTU no bridging
- HTU + HTU with ones bridging
- HTU + HTU with 10s bridging
- HTU + HTU with 100s bridging
- U.t + .t not bridging whole
- U.t + .t bridging whole

## Number Line Addition
*Add any U.t pairs (e.g. 3.5 + 2.8) using counting on*

- U.t + U.t no boundary crossing (e.g. 7.4 + 2.1)
- U.t + U.t with one boundary crossed (e.g. 4.5 + 2.9)

## Partition Subtraction
*Subtract any U.t pairs using partitioning*

- Subtract U.t – U.t no exchanging

## Number Line Subtraction
*subtract any U.t pairs using counting on*

- Subtract U.t – U.t counting on subtrahend to minuend

## Double

- Double 3-digit multiples of 10 (e.g. 270)
- Double any O.t number not bridging ones boundary (e.g 3.2)
- Double any O.t number bridging ones boundary (e.g 3.6)

## Halve

- Halve 3-digit multiples of 10 with no odd digits
- Halve 3-digit multiples of 10 with odd digits
- Halve any whole number with even digits
- Halve whole numbers with odd digits

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# Year 5 Mental Calculation Strategies

Spring Term

## Addition & Subtraction (7 weeks)

**Near Doubles Addition**
*2-digit Near Doubles to 100*

- TU + TU not bridging 100 (e.g. 47 + 46)
- TU + TU bridging 100 (e.g. 76 + 77)

**Hidden Doubles Addition**
*2-digit Hidden Doubles to 100*

- Revisit hidden doubles within 100 (e.g. 70 + 50)
- Hidden doubles to 100 (e.g. 77 + 75)

**Near Tens Addition**
*Add near hundreds*

- HTU + 199
- HTU + 299
- HTU + _99
- HTU + 198
- HTU + 298
- HTU + _98

**Near Tens Subtraction**
*Subtract near hundreds*

- HTU - 199
- HTU - 299
- HTU - _99
- HTU - 198
- HTU - 298
- HTU - _98

## Multiplication & Division (5 weeks)

**Multiply by powers of 10**
*Multiply whole numbers by 10, 100, 1000*

- Multiply whole numbers by 10
- Multiply whole numbers by 100
- Multiply whole numbers by 1000
- Multiply whole numbers by 10, 100, 1000 mixed

**Divide by powers of 10**
*Divide whole numbers by 10, 100, 1000*

- Divide whole numbers by 10
- Divide whole numbers by 100
- Divide whole numbers and decimals by 10 and 100 mixed

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# Year 5 Mental Calculation Strategies

Summer Term

## Multiply using partitioning
*Multiply U.t using partitioning*

- No boundaries being crossed, e.g. 3.2 x 3
- One boundary being crossed, e.g. 2.4 x 3
- Ones and tens being crossed, e.g. 4.7 x 8

## Use place value and known facts to multiply
*Use place value and known facts to THTU x U, e.g. 8000 x 3*

- 2-digit multiples of 10 multiplied by a single-digit number, e.g. 30 x 4 = 120
- Repeat for 3-digit multiple of 100, e.g. 300 x 4 = 1200
- Repeat for 4-digit multiple of 100, e.g. 3000 x 4 = 12000

## Use place value and known facts to divide
*Use place value and known facts to THTU ÷ U, e.g. 1200 ÷ 3*

- 3-digit multiples of 10 divided by a single-digit number, e.g. 120 ÷ 4 = 30
- 4-digit multiples of 100 divided by a single-digit number, e.g. 1200 ÷ 4 = 300
- 5-digit multiples of 1000 divided by a single-digit number, e.g. 12000 ÷ 4 = 3000

## Double and half to multiply
*Use double & halve to multiply any 2-digit number*

- Explore with calculations with at least one even number that doubling one and halving another leads to the same answer for any pair of 2-digit numbers where at least one is even (e.g. 25 x 36 = 50 x 18 = 100 x 9)

## Multiply 3 numbers

- Multiply 3 1-digit numbers

## Multiply by 50 by multiplying by 100 and halving

- TU (both digits even) x100 then halved (e.g. 42 x 50 = 42 x 100 = 4200 ÷ 2)

## Multiply by 25 by multiplying by 100 and halving and halving again

- TU (both digits even) x100 then halved and halved again (e.g. 42 x 25 = 42 x 100 = 4200 ÷ 2 = 2100 ÷ 2 = 1050)

## Multiply by 20 by multiplying by 10 and doubling

- TU x10 then doubled
- HTU x10 then doubled
- THTU x10 then doubled
- Progress to decimals

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# Year 6

# Year 6 Mental Calculation Strategies

Autumn Term

## Place Value Addition
*Use PV to add powers of 10 to any number*

- Add 10 to each PV size of numbers
- Add 100 as above
- Add 1,000 as above
- Add 10,000 as above
- Add 100,000 as above
- Add 1,000,000 as above

## Place Value Subtraction
*Use PV to subtract powers of 10 from any number*

- Subtract 10 from each PV size of numbers
- Subtract 100 as above
- Subtract 1,000 as above
- Subtract 10,000 as above
- Subtract 100,000 as above
- Subtract 1,000,000 as above

## Partition Addition
*Add any U.th pairs (e.g. 3.52 + 2.87)*

- U.th + .th no bridging
- U.t + .th bridging tenth
- U.th + U.th bridging whole (e.g. 3.51 + 2.32)

## Number Line Addition
*Add any U.th pairs (e.g. 3.52 + 2.87) counting on*

- U.th + U.th no boundary crossing (e.g. 7.42 + 2.13)
- U.th + U.th with tenth boundary crossed (e.g. 4.56 + 2.99) then ones

## Partition Subtraction
*Subtract any U.th pairs (e.g. 3.52 - 2.31)*

- U.th – U.th not bridging where all digits in minuend are larger than those in the subtrahend (e.g. 7.36 – 2.12)

## Number Line Subtraction
*subtract any U.t pairs using counting on*

- U.th – U.th counting on subtrahend to minuend

## Double
*Double any number including to 2dp*

- Double U.th with all digits same and no bridging, e.g. 3.33
- Double U.th with no bridging, e.g. 4.23
- Double with tenth boundary being crossed, e.g. 4.27
- Double with tenth and whole being crossed, e.g. 4.68
- Double with further integer boundaries being crossed

## Halve
*Halve any number including 2dp*

- 2-digit 1dp with only even digits
- 3-digit 2 dp with only even digits
- 2-digit 1dp with only odd tenths digits
- 3-digit 2 dp with odd tenths
- 3-digit 2dp with odd tenths and hundredths

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# Year 6 Mental Calculation Strategies

Spring Term

**Near Doubles Addition**
*Near doubles to tenths*

- U.t + U.t not bridging ones (e.g. 2.3 + 2.2)
- U.t + U.t bridging ones (e.g. 1.7 + 1.6)

**Hidden Doubles Addition**
*Hidden Doubles to tenths*

- Hidden doubles to 100 (e.g. 0.7 + 0.5)

**Near Tens Addition**
*Near tens to tenths*

- U.t + 0.9 > 1.9 >_.9
- U.t + 0.8 > 1.8 > _.8
- U.t + 1.1 > 2.1 > _.1

**Near Tens Subtraction**
*Subtract using near tens to tenths*

- U.t - 0.9 > 1.9 >_.9
- U.t - 0.8 > 1.8 > _.8
- U.t - 1.1 > 2.1 > _.1

**Multiply by powers of 10**
*Multiply decimals by 10, 100, 1000*

- Multiply decimals by 10
- Multiply decimals by 100
- Multiply decimals by 1000
- Multiply whole numbers and decimals by 10, 100, 1000 mixed

**Divide by powers of 10**
*Divide decimals by 10, 100, 1000*

- Divide decimals by 10
- Divide decimals by 100
- Divide decimals by 1000
- Divide whole numbers and decimals by 10, 100, 1000 mixed

**Multiply using partitioning**
*Multiply U.th x U using partitioning*

- No boundaries being crossed, e.g. 3.22 x 3
- tenth boundary being crossed, e.g. 3.24 x 3
- ones boundary now being crossed, e.g. 3.45 x 4

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# Year 6 Mental Calculation Strategies

Summer Term

## Use place value and known facts to multiply

*Use place value and known facts for decimals, e.g. 0.3 x 4*

- 2-digit multiples of 10 multiplied by a single-digit number, e.g. 30 x 4 = 120
- Repeat for 3-digit multiple of 100, e.g. 300 x 4 = 1200
- Repeat for 4-digit multiple of 100, e.g. 3000 x 4 = 12000
- Repeat for tenths 0.3 x 4 and reverse

## Use place value and known facts to divide

*Use place value and known facts for decimals, e.g. 3.2 ÷ 8*

- 3-digit multiples of 10 divided by a single-digit number, e.g. 120 ÷ 4 = 30
- 4-digit multiples of 100 divided by a single-digit number, e.g. 1200 ÷ 4 = 300
- 5-digit multiples of 1000 divided by a single-digit number, e.g. 12000 ÷ 4 = 3000
- Repeat for tenths: 3.2 ÷ 8

## Double and half to multiply

*Use double & halve to multiply any 2-digit number*

- Explore with calculations with at least one even number that doubling one and halving another leads to the same answer for any pair of 2-digit numbers where at least one is even (e.g. 25 x 36 = 50 x 18 = 100 x 9)

## Divide by 50 by dividing by 100 and doubling

- Dividing 3-digit multiples of 100
- Dividing 3-digit multiples of 50
- Any 3-digit number divided by 50

## Divide by 25 by dividing by 100 and double and double again

- Dividing 3-digit multiples of 100
- Dividing 3-digit multiples of 50
- Dividing 3-digit multiples of 25

## Divide by 20 by dividing by 10 and halving

- Dividing 3-digit multiples of 100
- Dividing 3-digit multiples of 20