> _Mental Mathematics_
>
> _It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of written methods._
>
> _The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence._
>
> _Children are taught and acquire secure mental methods of calculation and one written method of calculation for all for operations which they know they can rely on when mental methods are not appropriate._

MENTAL CALCULATION STRATEGIES ADDITION AND SUBTRACTION

STRATEGY	EXAMPLE	SKILLS & KNOWLEDGE	MODELS & IMAGES
REORDERING	- LARGEST NUMBER FIRST - PAIRS TO MAKE MULTIPLES OF 10 - CHANGE THE ORDER (28+17-18=28-18+17)	o COMMUTATIVITY FOR ADDITION o PLACE VALUE o NUMBER FACTS TO 10	Number line Bead string Number square Place Value cards ITP Counting on and back
NEAR DOUBLES	35 + 36 = 35 + 35 + 1 = 70 + 1 = 71	o KNOW DOUBLES OF NUMBERS BY HEART	Dominoes
ADJUSTMENT (COMPENSATION)	35 + 9 = 35 + 10 – 1 = 47 – 9 = 47 – 10 + 1 =	o COUNTING IN STEPS OF 10 AND 1 o ROUNDING TO THE NEAREST MULTIPLE	Number line Bead string Number square ITP Counting on and back
BRIDGING THROUGH MULTIPLES OF 10	37 + 16 = 37 + 3 + 13 = 40 + 13 = 53 93 – 36 = 93 – 30 -3 -3 = 57	o NUMBER FACTS TO 10 o NUMBER COMPLEMENTS TO 100	Number line Bead string Number square ITP Counting on and back

			ITP Bead Sticks
PARTITIONING	- INTO 10S AND ONES - TO BRIDGE THROUGH A MULTIPLE OF 10 53-26 = 53 – 3 – 23 55+26=55+20+5+1=81	○ PLACE VALUE ○ NUMBER FACTS TO 10	Place Value cards Number line Bead strings Base 10
COUNTING UP TO FIND A SMALL DIFFERENCE BETWEEN NUMBERS	304 – 287 = 17 287 + 13 = 300 300 + 4 = 304 287 + 17 = 304 Model on no. line	○ UNDERSTANDING SUBTRACTION IS THE INVERSE OF ADDITION ○ KNOWLEDGE OF RELATIVE POSITION OF NUMBERS	Number line Bead strings ITP Difference

MENTAL CALCULATION STRATEGIES FOR MULTIPLICATION AND DIVISION

STRATEGY	EXAMPLE	SKILLS & KNOWLEDGE	MODELS & IMAGES
DOUBLING & HALVING	FIND 36 X 8 72 x 4 = 288	KNOWLEDGE OF DOUBLES AND HALVES OF NUMBERS	
MULTIPLYING & DIVIDING BY MULTIPLES OF 10	FIND 40 X 7 BY KNOWING 4 X 7 AND MULTIPLYING THE ANSWER BY 10. FIND 560 ÷ 8 = 7	EFFECT OF MULTIPLYING AND DIVIDING BY 10 PLACE VALUE	ITP Moving Digits ITP Bead sticks ITP Number dials Place Value chart
PARTITIONING	17 X 8 = (10X8) + (7X8) = 80 + 56 = 136 84 ÷ 7 = (70 + 14) ÷7 10 + 2 = 12	PLACE VALUE	ITP x grid ITP Arrays

FACTORISING	18 X 7 = (2 X 9) X 7 = 2 X (9 X 7) =2 X 63 = 126 280 ÷ 20 = 280 ÷ (10X2) = (280 ÷ 10) ÷ 2 = 28 ÷ 2 = 14	FACTORS OF NUMBERS ASSOCIATIVE LAW FOR X COMMUTATIVE LAW OF X	Multiplication tables ITP Multiplication board
ADJUSTMENT (COMPENSATION)	19 X 13 = 20 X 13 – 13 = 260 – 13 = 247	PLACE VALUE ROUNDING	Arrays

<u>Use of Mathematical Symbols in Calculation</u>

<u>Equals Sign =</u>

Understanding the purpose and use of the equals sign is a stage one objective.
However it is important that throughout our school, the equals sign is used accurately.

Remember the equals sign translates as the same as. All calculations using the equals sign must be balanced.

Children will have experience of a range of word sentences in a diversity of forms:

7 + 3 = 10

7 + 3 = 8 + 2

7 + 3 = 5 x 2

7 + 3 = 20 -10

7 + 3 = 100 ÷ 10

Therefore:

3 + 4 = 7 + 8 = 15 **is not appropriate**

3 + 4 + 8 = 7 + 8 = 15 **is appropriate**

> (more than) and < (less than) symbols

Once children are confident with the concept of the equals sign in calculation, they must be given the opportunity to use > & < symbols. In the refreshed framework this is recommended as suitable from stage two onwards. Throughout the school pupils should have the opportunity to use these symbols in their calculation work.

7 + 3 > 4 x 2

76 – 32 < 23 x 2

Using Brackets

If the brackets are already in the calculation you would undertake the operations with the brackets first. However if there are no brackets use the **BODMAS** rule.

Order of Operations

Do things in Brackets First. Example:

✓	6 × (5 + 3)	= 6 × 8	=	**48**
✗	6 × (5 + 3)	= 30 + 3	=	33 (wrong)

<u>Exponents</u> (Powers, Roots) before Multiply, Divide, Add or Subtract. Example:

✔ 5×2^2 $=$ 5×4 $=$ **20**

✖ 5×2^2 $=$ 10^2 $=$ 100   (wrong)

Multiply or Divide before you Add or Subtract. Example:

✔ $2 + 5 \times 3$ $=$ $2 + 15$ $=$ **17**

✖ $2 + 5 \times 3$ $=$ 7×3 $=$ 21   (wrong)

Otherwise just go left to right. Example:

✔ $30 \div 5 \times 3$ $=$ 6×3 $=$ **18**

✖ $30 \div 5 \times 3$ $=$ $30 \div 15$ $=$ 2   (wrong)

How Do I Remember It All ... ? BODMAS !

B   **B**rackets first

O   **O**rders (ie Powers and Square Roots, etc.)

DM   **D**ivision and **M**ultiplication (left-to-right)

AS   **A**ddition and **S**ubtraction (left-to-right)

Divide and Multiply rank equally (and go left to right).

Add and Subtract rank equally (and go left to right)

After you have done "B" and "O", just go from left to right doing any "D" *or* "M" as you find them.

Then go from left to right doing any "A" *or* "S" as you find them.

Using Symbols To Develop Recording

Children will use different methods of recording mental strategies that include:

Arrow Diagrams

5 and 1 → 6   5 + 1 → 6

Number Sentences

3 + 4 = ☐   3 + 8 = ☐   59 = 5 + ☐

△ + 5 = 8   △ + △ = 71   67 + △ = 231

These should be developed throughout KS1 and KS2.