How Numeracy grows at Hayes.
Introduction

As a school we need to know what methods to steer students towards in order to support their Numeracy skills, whatever lesson they are in. The aim of this document is to support staff in all areas to understand key methods and facts that students need.

Why do we need this?

- Consistency in methods taught throughout the school.
- Progression from informal / practical methods of recording to written methods for each of the four operations (+, -, x, ÷).
- An aid to parents’ and carers understanding in their child’s stages of learning.
Contents:
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10. Time

No more of this...!
1. Things to Remember

- Understand and use appropriate mathematical language
- Use practical equipment and models and images throughout all key stages
- Ensure children can represent problems pictorially
- Children need to know number bonds (pairs of numbers that add up to 10) and multiplication facts by heart
- Children can partition numbers in different ways to support particular calculations and be confident (e.g. $35 - 18 = 35 - 5 - 3 - 10$)
- Children should experience both models of subtraction (counting back and counting on)
- Children who make persistent mistakes should return to the method that they can use accurately until ready to move on – it may be they stay with that method as long as they can adapt it to larger, more difficult numbers
- When revising or extending to harder numbers, refer back to their ‘safe’ methods. This helps reinforce understanding and reminds children that they have an alternative to fall back on if they are having difficulties.
2. Stages in Addition

Informal counting methods:

Counting songs/rhymes

1) Use of blank number lines

2) $8 + 6 = 14$

3) $8 + 6 = 14$
More formal methods

4) $48 + 24 = 72$

5) $48 + 24 = 72$

6) $48 + 24 = 72$
7) Partitioning (support with pictorial representation using 100, 10, units place values)

\[
\begin{align*}
76 + 47 &= 123 \\
70 + 40 &= 110 \\
6 + 7 &= 13 \\
110 + 13 &= 123 \\
76 + 47 &= 123
\end{align*}
\]

8) Vertical layout

\[
\begin{align*}
76 \\
+ 47 \\
\hline
13 \\
110 \\
123
\end{align*}
\]

Remember to add the units first

9) Vertical layout,

Contracting the working to a more compact, efficient form:

\[
\begin{align*}
47 &\quad \rightarrow \quad 40 + 7 \\
\hline
\quad + 76 &\quad \rightarrow \quad 70 + 6 \\
\hline
110 + 13 &= 123
\end{align*}
\]

Bigger numbers and decimals

Extend to adding three two-digit numbers, two three and four digit numbers and decimals.

Remember to line the decimal points up under each other when adding mixed numbers.
3. Stages in Subtraction

Informal methods:

1) Counting songs/rhymes

Use of blank number lines to count back a small number

2) $9 - 5 = 4$

Pictorial Subtraction

3) $9 - 5 = 4$
More formal methods
4) $78 - 45 = 33$
5) $78 - 45 = 33$
6) $78 - 45 = 33$
7) $78 - 45 = 33$

8) $78 - 45 = 33$

9) Vertical layout, contracting the working to a compact efficient form:

$$\begin{array}{cccccc}
6 & 1 & \underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} \\
\downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
\underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} & \underline{\phantom{-}} \\
-48 & & & & & 28
\end{array}$$

**Bigger numbers and decimals**

Extend to subtracting three two-digit numbers, two three and four digit numbers and decimals. Remember to line the decimal points up under each other when subtracting mixed numbers.
4. Stages in Multiplication

1) 3 lots of 3, how many fish are there?

Introduce groups – 3 groups of 2 is the same as 2 groups of 3

3 x 2 = 6

2 x 3 = 6
2) \( 3 \times 4 = 12 \)

3) \( 13 \times 3 = \)

4) Mental method using partitioning \( 38 \times 7 \)

\[
38 \times 7 = (30 \times 7) + (8 \times 7) = 210 + 56 = 266
\]
5) Grid Layout

38 x 7

\[
\begin{array}{ccc}
X & 30 & 8 \\
7 & 210 & 56 \\
\end{array}
\]

\[
\begin{array}{r}
210 \\
+ \ 56 \\
\hline
266
\end{array}
\]

Extend to bigger numbers: 56 x 27

\[56 \times 27 = (50 + 6) \times (20 + 7)\]

\[
\begin{array}{ccc}
X & 50 & 6 \\
20 & 1000 & 120 \\
7 & 350 & 42 \\
\end{array}
\]

\[
\begin{array}{r}
1120 \\
1120 \\
392 \\
\hline
1512
\end{array}
\]

6) Vertical multiplication compact method

– but comes with a health warning.

**DON’T USE IT** - too easy to get the place values wrong

\[
\begin{array}{c}
536 \\
\times \ 49 \\
\hline
4824 \\
21440 \\
26264
\end{array}
\]
5. Stages in Division

To introduce division it should be practical, using equipment to demonstrate. Children need to understand division as putting into groups.

1) Put 6 flowers into 2 equal groups. How many in each group?

6 ÷ 2 = 3 (link to arrays in multiplication)

Place 6 bricks into groups of 2
2) \(15 \div 5 = 3\)

\[
\begin{array}{cccc}
0 & 5 & 10 & 15 \\
-5 & -5 & -5 & -5
\end{array}
\]

3) \(17 \div 5 = 3\) remainder 2

\[
\begin{array}{cccc}
0 & 2 & 7 & 12 \\
-5 & -5 & -5 & -5
\end{array}
\]

**DO NOT** allow students to use ‘chunking’ method, where they keep subtracting blocks of 10 and units, as they are unable to see what to combine at the end.
4) Classic method, bus stop

\[ \frac{84}{2} = 42 \]
\[ \frac{346}{2} = 173 \]

5) Dealing with remainders – ability to add a decimal point and as many zeros as necessary

\[ \frac{346}{5} = 69.5 \]
6. **Key Skills – double and halve**

Pupils are at a great advantage if they can use double and half in practical situations as it provides a problem solving skill.

1) **Whole tens** - they should be encouraged to double by counting on or writing it as a repeated adding sum.

2) **Tens and units** – double the tens and double the units separately then add them back together.

3) In same way half whole tens

4) **Tens and units** – half the tens and half the units separately then add them back together.

**Tricks:** did you know that 4x table is double the 2’s?
Also your 8x table is double, double the 2’s?
7. Times tables

Start by running through them as number patterns.
  2’s and 10’s easiest to start
  Then move to 5’s
Can they recognise odd and even numbers?

  Learn 3 and 5 times tables. (Do they realise that 6x is double the 3x table?)

Learn up to 10 times each number

  Can they do the 9x table using their fingers?

Hardest is 7 times table – can be done by ‘chunking 3 times + 4 times the number…
  BUT is the sum do-able the other way round?? e.g. 5 lots of 7 = 7 lots of 5!
8. Negative Numbers

Students find it this hard because of the mixed language used. Try to avoid the word ‘minus’ – a number is negative, so -3 is negative 3 and the operation is take away.

Best link to everyday life is a vertical number line thought of as a thermometer, so that you can talk about the temperature going up and down.

Start at the first number in the sum, the sum signs tells them direction to move and the third how many steps. Answer is where you land.

  e.g. -5 + 3, start on -5, count 3 steps up, land on -2 which is your answer.
9. Basic Fractions

Students first need to be able to recognise half and quarter of a shape, visually. Then progress onto these fractions in numbers \( \frac{1}{2} \) and \( \frac{1}{4} \).

Now comes the understanding of the bottom number telling them how many pieces in a shape and the top saying how many are shaded in.

Build up with other fractions such as \( \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5} \)

Language needed is to know that \( \frac{2}{5} \) is said as two fifths.

If possible students should be encouraged to notice that \( \frac{1}{5} \) and \( \frac{1}{5} \) make \( \frac{2}{5} \).

At this stage just the ability to recognise and draw fractions is enough. DO NOT worry about adding fractions with different denominators.
10. Time

Most students can tell the time, but it is frightening that this is only on digital clocks. Take every available opportunity to question them on time.

Basics start at hour, half past and quarter past/to.

Progress onto minutes before and after the hour.

Extend eventually to am/pm and 24 hour clock.

Make sure that children can read an analogue clocks as well as digital clocks and have a concept of time passing.

**TOP TIP** for practise: questions involving TV programs work well with students having to find one of these pieces of information when given the other 2

Time start; Time finish; Length of program