ST THOMAS MORE
CATHOLIC PRIMARY
CALCULATION
BOOKLET
<table>
<thead>
<tr>
<th><strong>Addition</strong></th>
<th><strong>Subtraction</strong></th>
<th><strong>Multiplication</strong></th>
<th><strong>Division</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rec</strong></td>
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<td><strong>Rec</strong></td>
</tr>
<tr>
<td>Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.</td>
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<td>Children will experience equal groups of objects. They will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.</td>
<td>Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.</td>
</tr>
<tr>
<td>Bead strings or bead bars can be used to illustrate addition:</td>
<td>Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image1" alt="Bead strings or bead bars" /></td>
<td><img src="image2" alt="Bead strings or bead bars" /></td>
<td></td>
<td><img src="image3" alt="Bead strings or bead bars" /></td>
</tr>
<tr>
<td>They use numberlines and practical resources to support calculation and teachers demonstrate the use of the numberline.</td>
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<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Y1</strong></td>
<td><strong>Y1</strong></td>
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</tr>
<tr>
<td>Using pictures</td>
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</tr>
<tr>
<td><img src="image4" alt="Bead strings or bead bars" /></td>
<td><img src="image5" alt="Bead strings or bead bars" /></td>
<td></td>
<td><img src="image6" alt="Bead strings or bead bars" /></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.</td>
<td>Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The numberline should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.</td>
<td></td>
</tr>
</tbody>
</table>
### Addition

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

**First counting on in tens and ones.**

<table>
<thead>
<tr>
<th>94</th>
<th>23</th>
<th>57</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>46</td>
<td>54</td>
</tr>
<tr>
<td>56</td>
<td>56</td>
<td>57</td>
</tr>
</tbody>
</table>

Then helping children to become more efficient by adding the units in one jump (by using the known fact $4 + 3 = 7$).

<table>
<thead>
<tr>
<th>34</th>
<th>23</th>
<th>57</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>46</td>
<td>54</td>
</tr>
<tr>
<td>56</td>
<td>56</td>
<td>57</td>
</tr>
</tbody>
</table>

Followed by adding the tens in one jump and the units in one jump.

<table>
<thead>
<tr>
<th>94</th>
<th>23</th>
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</tr>
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<tr>
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</tr>
<tr>
<td>56</td>
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<td>57</td>
</tr>
</tbody>
</table>

Bridging through ten can help children become more efficient.

<table>
<thead>
<tr>
<th>37</th>
<th>12</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>47</td>
<td>52</td>
</tr>
</tbody>
</table>

### Subtraction

Children will begin to use empty number lines to support calculation.

**Counting back:**

- First counting back in tens and ones.
  
  $47 - 23 = 24$

- Then helping children to become more efficient by subtracting the units in one jump (by using the known fact $7 - 3 = 4$).
  
  $47 - 23 = 24$

- Subtracting the tens in one jump and the units in one jump.
  
  $47 - 23 = 24$

- Bridging through ten can help children become more efficient.
  
  $42 - 20 = 22$

### Multiplication

Children will develop their understanding of multiplication and use jottings to support calculation.

Repetitive addition can be shown easily on a number line:

| 8 | $5 + 5 + 5 = 15$ | $3 \times 5 = 15$

and on a bead bar:

<table>
<thead>
<tr>
<th>5 5 5 5 5 5</th>
</tr>
</thead>
</table>

**Commutativity**

Children should know that $3 \times 5$ has the same answer as $5 \times 3$. This can also be shown on the number line.

### Division

Children will develop their understanding of division and use jottings to support calculation.

- Grouping or repeated subtraction
- There are 6 sweets, how many can each get?

| 6 6 6 |

Repeated subtraction using a number line or bead bar:

| 12 | $3 \times 4$

**Arrays**

Children should be able to model a multiplication calculation using an array. This knowledge will support the development of the grid method.

| $\times 5 = 25$
| $\times 5 = 25$

**Using symbols to stand for unknown numbers to complete equations using inverse operations**

$\square \times 2 = 4$

$20 + \square = 4$

$\square + \square = 4$
### Addition
- Children will continue to use empty number lines with increasingly large numbers, including compensation when appropriate.
- Count on from the largest number irrespective of the order of the calculation.
- Compensation

### Subtraction
- Children will continue to use empty number lines with increasingly large numbers.
- Children will begin to use informal pencil and paper methods (jottings).
- Partitioning and decomposition
  - Partitioning - demonstrated using arrow cards
  - Decomposition - base 10 materials

**NOTE** When solving the calculation 89 - 57, children should know that 57 does NOT EXIST AS AN AMOUNT. It is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

\[
89 \quad 90 - 9 = 81 \\
-57 \quad 50 - 7 = 43 \\
30 + 2 = 32
\]

- Begin to exchange.

### Multiplication
- Children will continue to use:
  - Repeated addition
    - 4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4
- Children should use number lines or bead bars to support their understanding.
- Arrays
- Children should be able to model a multiplication calculation using an array. This knowledge will support the development of the grid method.

\[
\begin{array}{cccc}
\hline
& 4 & 4 & 4 \\
\hline
\hline
\hline
\end{array}
\]

### Division
- Ensure that the emphasis in Y3 is on grouping rather than sharing.
- Children will continue to use:
  - Repeated subtraction using a number line
  - Children will use an empty number line to support their calculation.
- Children should also move on to calculations involving remainders.
- Using symbols to stand for unknown numbers to complete equations using inverse operations

\[
26 = 2 \square \quad 24 = \triangle \times 12 \quad \square \times 10 = 8
\]

### Adding the least significant digits first

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>87</td>
<td>247</td>
</tr>
<tr>
<td>11 (7 + 4)</td>
<td>10 (7 + 3)</td>
</tr>
<tr>
<td>0 (60 + 60)</td>
<td>0 (60 + 90)</td>
</tr>
<tr>
<td>13</td>
<td>132</td>
</tr>
</tbody>
</table>

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

\[
132 - 89 = 43
\]
Addition

✓ Carry below the line.

\[ \begin{array}{c}
620 \\
+ 703 \\
\hline
923 \\
\end{array} \]

Subtraction

✓ Partitioning and decomposition

\[ \begin{array}{c}
764 \\
- 50 \\
\hline
714 \\
\end{array} \]

Step 1: 700 - 80 + 4
- 80 + 8
- 60 + 8

Step 2: 600 + 100 + 4 (adjust from 7 to 6)
- 120 + 8
680 + 80 + 8 = 668

This would be recorded by the children as:
680 + 100 + 4
- 120 + 8
668

✓ Decomposition

\[ \begin{array}{c}
561 \\
- 96 \\
- 60 \\
\hline
405 \\
\end{array} \]

Children should:
✓ be able to subtract numbers with different numbers of digits;
✓ using this method, children should also begin to find the difference between two three-digit sums of money, with or without adjustment from the pence to the pounds;
✓ know that decimal points should line up under each other.

\[ \begin{array}{c}
954 + 357 \quad 900 \\
9 \cdot 45 \quad 357 \\
\hline
6293 \\
\end{array} \]

Multiplication

Children will continue to use arrays where appropriate leading into the grid method of multiplication.

\[ \begin{array}{c|c|c}
6 & 10 & 3 \\
\hline
60 & 60 & 18 \\
\hline
360 & 300 & 160 \\
\hline
684 & 664 & 184 \\
\end{array} \]

✓ Grid method

TU \times U

(Short multiplication - multiplication by a single digit)

23 \times 8

Children will approximate first
23 \times 8 \approx 20 \times 8 = 160

\[ \begin{array}{c}
\times 20 \quad 3 \\
8 \quad 160 \quad 24 \\
\hline
160 + 24 \\
\hline
184 \\
\end{array} \]

Division

Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s - numbers with which the children are more familiar.

\[ \begin{array}{c}
72 + 6 \\
\hline
70 \\
\hline
2 \\
\hline
0 \\
\end{array} \]

Then onto the vertical method:
Short division TU + U

\[ \begin{array}{c}
10 + 6 \\
\hline
16 \\
\hline
6 \\
\hline
0 \\
\end{array} \]

Leading to subtraction of other multiples.

\[ \begin{array}{c}
14 + 6 \\
\hline
10 \\
\hline
10 \\
\hline
10 \\
\hline
14 \\
\end{array} \]

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 \div 2.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division.
### Addition

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>567</td>
<td>3587</td>
</tr>
<tr>
<td>+ 476</td>
<td>+ 675</td>
</tr>
<tr>
<td>1043</td>
<td>4262</td>
</tr>
</tbody>
</table>

Children should extend the carrying method to numbers with at least four digits.

Using similar methods, children will:
- add several numbers with different numbers of digits;
- begin to add two or more decimal fractions with up to three digits and the same number of decimal places; and
- know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g., 3.2 m - 280 cm.

### Subtraction

<table>
<thead>
<tr>
<th>Problem</th>
<th>Method</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>567 - 476</td>
<td>Partitioning and decomposition</td>
<td>500 - 400 = 100, 67 - 67 = 0, 7 - 7 = 0</td>
</tr>
<tr>
<td>1043</td>
<td></td>
<td>1000 - 800 = 200, 43 - 43 = 0</td>
</tr>
</tbody>
</table>

This would be recorded by the children as:

\[
\begin{align*}
567 & - 476 \\
\hline
1000 & - 800 \\
43 & - 43 \\
7 & - 7 \\
1000 & - 800 \\
43 & - 43 \\
7 & - 7 \\
\end{align*}
\]

### Multiplication

<table>
<thead>
<tr>
<th>Problem</th>
<th>Method</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid method HTU x U</td>
<td>(Short multiplication - multiplication by a single digit)</td>
<td>346 x 9</td>
</tr>
<tr>
<td>Children will approximate first</td>
<td>346 x 9 is approximately 350 x 10 = 3500</td>
<td></td>
</tr>
<tr>
<td>x 350 = 36</td>
<td>[3700 \times 300 = 108000]</td>
<td>360</td>
</tr>
<tr>
<td>x 360 = 36</td>
<td>[360 \times 36 = 12960]</td>
<td>360</td>
</tr>
<tr>
<td>36</td>
<td>[36 \times 36 = 1296]</td>
<td>360</td>
</tr>
</tbody>
</table>

**Answer:** 3114

### Division

<table>
<thead>
<tr>
<th>Problem</th>
<th>Method</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short division HTU ÷ U</td>
<td></td>
<td>196 ÷ 8</td>
</tr>
<tr>
<td>[32 \times 4]</td>
<td></td>
<td>[32 \times 4]</td>
</tr>
<tr>
<td>[32 \times 4]</td>
<td></td>
<td>[32 \times 4]</td>
</tr>
<tr>
<td>[32 \times 4]</td>
<td></td>
<td>[32 \times 4]</td>
</tr>
</tbody>
</table>

Any remainders should be shown as integers, i.e., 14 remainder 2 or 14 r 2.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division.
Addition

Children should extend the carrying method to number with any number of digits.

<table>
<thead>
<tr>
<th>7648</th>
<th>6584</th>
<th>42</th>
</tr>
</thead>
<tbody>
<tr>
<td>2354</td>
<td>2423</td>
<td>79</td>
</tr>
<tr>
<td>111</td>
<td>111</td>
<td>7</td>
</tr>
</tbody>
</table>

Using similar methods, children will:
- Add several numbers with different numbers of digits.
- Begin to add two or more decimal fractions with up to four digits and either one or two decimal places.
- Know that decimal places should line up under each other, particularly when adding or subtracting mixed amounts, e.g., 40.2 + 26.85 = 67.

Subtraction

Decomposition

<table>
<thead>
<tr>
<th>6867</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 2884</td>
</tr>
<tr>
<td>3783</td>
</tr>
</tbody>
</table>

Children should:
- Be able to subtract numbers with different numbers of digits.
- Be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places.
- Know that decimal points should line up under each other.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

Multiplication

THHTU × U
(Short multiplication - multiplication by a single digit)

4364 × 8
Children will approximate first 4394 × 10 = 4360

<table>
<thead>
<tr>
<th>x</th>
<th>4000</th>
<th>300</th>
<th>40</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>16000</td>
<td>1200</td>
<td>320</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>30</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>12</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

HTU × TU
(Long multiplication - multiplication by more than one digit)

372 × 24
Children will approximate first 372 × 24 is approximately 400 × 25 = 10000

<table>
<thead>
<tr>
<th>x</th>
<th>306</th>
<th>70</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>920</td>
<td>210</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>2000</td>
<td>380</td>
<td>8</td>
</tr>
</tbody>
</table>

Using similar methods, they will be able to multiply decimals with up to two decimal places by a single digit number and then two digit numbers, approximating first. They should know that the decimal points line up under each other.

For example:

4.92 × 3
Children will approximate first 4.92 × 3 is approximately 5 × 3 = 15

<table>
<thead>
<tr>
<th>x</th>
<th>4</th>
<th>09</th>
<th>0.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>12</td>
<td>27</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Division

Children will continue to use written methods to solve short division TU ÷ U and HTU ÷ TU.

Long division HTU ÷ TU

<table>
<thead>
<tr>
<th>972</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>87</td>
<td>50</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
</tr>
</tbody>
</table>

Any remainders should be shown as fractions, i.e., if the children were dividing 32 by 10, the answer should be shown as 3 3/5 which could then be written as 3 3/5 in its lowest terms.

Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other.

<table>
<thead>
<tr>
<th>673 ÷ 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>37</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Answer: 97.5

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go on to the next stage if:
- They are not ready.
- They are not confident.

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.