



Newcastle Under Lyme
Junior School

Calculations for Multiplication

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

(ongoing)

The aim at Newcastle-under-Lyme Junior School is to develop confidence and fluency in using and applying numbers from an early age

Some of the mental activities to encourage this include:

Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g. 8×4 is double 4×4

Using multiplication facts

Tables are taught frequently from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

- | | |
|---------|--|
| Year 2 | Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. |
| Year 3 | Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables. |
| Year 4 | Recall and use multiplication and division facts for multiplication tables up to 12×12 . |
| Year 5 | Derive and recall quickly all multiplication and division facts up to 12×12 . Multiply and divide numbers mentally drawing upon known facts. |
| Years 6 | Derive and recall quickly all multiplication and division facts up to 12×12 . Perform mental calculations, including with mixed operations and large numbers. |

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know $3 \times 7 = 21$, what else do I know?

$30 \times 7 = 210$, $300 \times 7 = 2100$, $3000 \times 7 = 21\ 000$, $0.3 \times 7 = 2.1$ etc

Use closely related facts already known

$$\begin{aligned} 13 \times 11 &= (13 \times 10) + (13 \times 1) \\ &= 130 + 13 \\ &= 143 \end{aligned}$$

Multiplying by 10 or 100

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning

$$\begin{aligned} 23 \times 4 &= (20 \times 4) + (3 \times 4) \\ &= 80 + 12 \\ &= 102 \end{aligned}$$

Use of factors

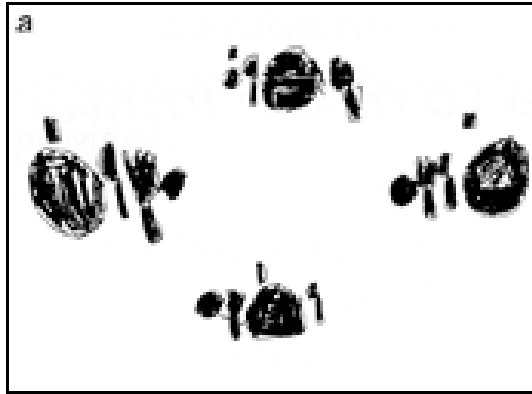
$$8 \times 12 = 8 \times 4 \times 3$$

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE

Phase 1 (YR and Y1)

Children will experience equal groups of objects and 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.



Phase 2 (Y2)

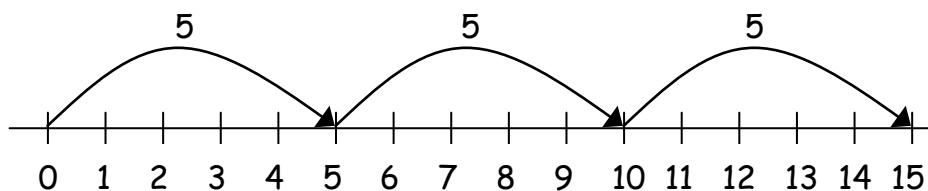
Children will develop their understanding of multiplication and use jottings to support calculation:

✓ Repeated addition

3 times 5 is $5 + 5 + 5 = 15$ or 3 lots of 5 or 5×3

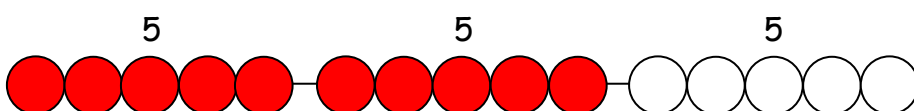
Repeated addition can be shown easily on a number line:

$$5 \times 3 = 5 + 5 + 5$$



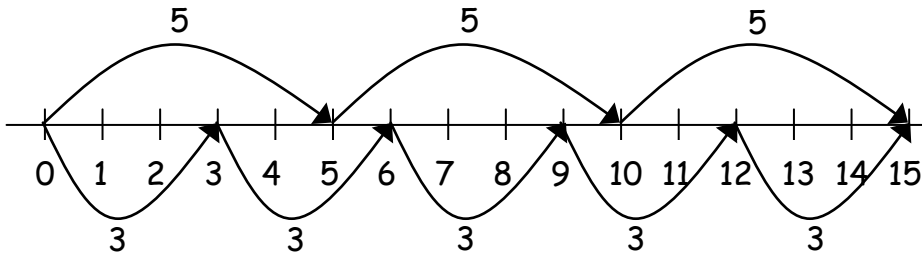
and on a bead bar:

$$5 \times 3 = 5 + 5 + 5$$



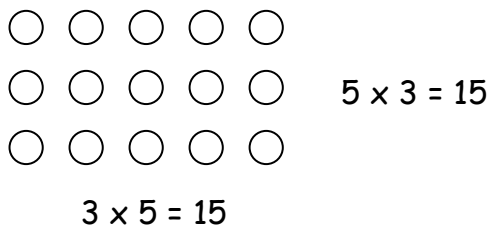
✓ **Commutativity**

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



✓ **Arrays**

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



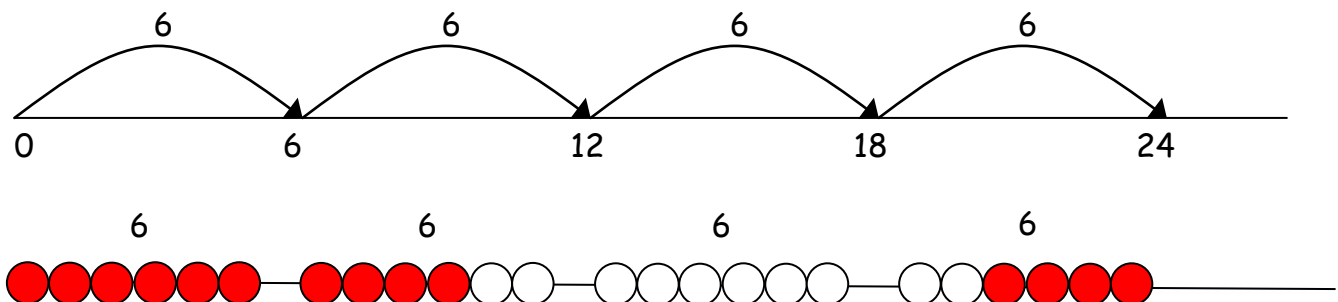
Phase 3 (Y3)

Children will continue to use:

✓ **Repeated addition**

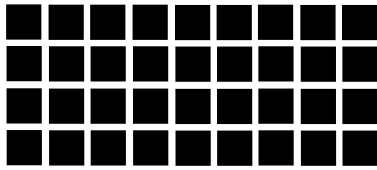
4 times 6 is $6 + 6 + 6 + 6 = 24$ or 4 lots of 6 or 6×4

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 with the development of the grid method.



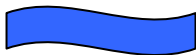
$$9 \times 4 = 36$$

$$9 \times 4 = 36$$

Children will also develop an understanding of

✓ **Scaling**

e.g. Find a ribbon that is 4 times as long as the blue ribbon



5 cm



20 cm

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

$$\square \times 5 = 20$$

$$3 \times \triangle = 18$$

$$\square \times \circ = 32$$

✓ **Partitioning**

$$\begin{aligned} 38 \times 5 &= (30 \times 5) + (8 \times 5) \\ &= 150 + 40 \\ &= 190 \end{aligned}$$

Grid method

TU × U

(Short multiplication - multiplication by a single digit)

$$23 \times 8$$

Children will approximate first

23×8 is approximately $25 \times 8 = 200$

$$\begin{array}{r} \times \quad 20 \quad 3 \\ 8 \quad \boxed{160} \quad \boxed{24} \end{array}$$

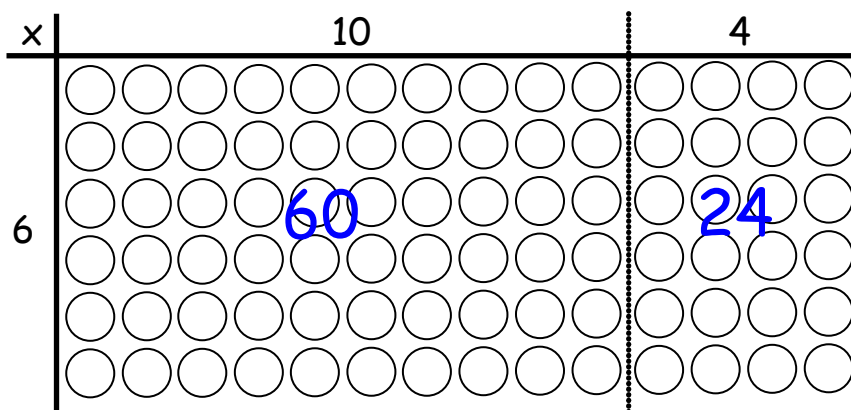
$$\begin{array}{r} 160 \\ + \quad 24 \\ \hline 184 \end{array}$$

In Year 3 the compact method will also be taught.

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 184 \\ 2 \end{array}$$

Phase 4 (Y4)

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



$$\begin{array}{r} (6 \times 10) + (6 \times 4) \\ 60 \quad + \quad 24 \\ 84 \end{array}$$

Grid method

TU × U

In Year 4 the children will be taught to multiply two-digit and three-digit numbers by a one digit-number

(grid multiplication - multiplication by a single digit)

$$23 \times 8$$

Children will approximate first

$$23 \times 8 \text{ is approximately } 25 \times 8 = 200$$

×	20	3	
8	160	24	
			160
			+ 24
			<hr style="width: 100%; border: 0.5px solid black;"/>
			184
			<hr style="width: 100%; border: 0.5px solid black;"/>

In Year 4 the compact method will also be taught.

$$123 \times 8$$

$$\begin{array}{r} 123 \\ \times 8 \\ \hline 984 \\ 12 \end{array}$$

Phase 5 (Y5)

Grid method

HTU × U

(Short multiplication - multiplication by a single digit)

$$346 \times 9$$

Children will approximate first

346×9 is approximately $350 \times 10 = 3500$

×	300	40	6	
9	2700	360	54	2700
				+ 360
				+ <u>54</u>
				<u>3114</u>
				1 1

TU × TU

(Long multiplication - multiplication by more than a single digit)

$$72 \times 38$$

Children will approximate first

72×38 is approximately $70 \times 40 = 2800$

×	70	2	
30	2100	60	
8	560	16	
			2100
			+ 560
			+ 60
			+ <u>16</u>
			<u>2736</u>
			1

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

e.g. 4.9×3

Children will approximate first

4.9×3 is approximately $5 \times 3 = 15$

$$\begin{array}{r}
 \times \quad 4 \quad 0.9 \\
 3 \quad \boxed{12} \quad \boxed{2.7} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 12 \\
 + \quad 2.7 \\
 \hline
 14.7 \\
 \hline
 \end{array}$$

There is no requirement to move away from the grid method. However where children are confident we aim to teach an efficient standard shortened method in Year 5. When teaching a vertical method we work from the units column rather than the tens or hundreds.

HTU \times U

(Short multiplication - multiplication by a single digit)

We teach the children to approximate first.

For example, 346×9 is approximately $350 \times 10 = 3500$

$ \begin{array}{r} 346 \\ \times 9 \\ \hline 54(6 \times 9) \\ 360(40 \times 9) \\ \underline{2700(300 \times 9)} \\ 3114 \\ 1 \end{array} $	<p>leading to</p>	$ \begin{array}{r} 346 \\ \times 9 \\ \hline 3114 \\ 45 \end{array} $
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TU x TU

(Long multiplication - multiplication by more than a single digit)

We teach the children to approximate first.

For example 72×38 is approximately $70 \times 40 = 2800$

$$\begin{array}{r} 72 \\ \times 38 \\ \hline 576(72 \times 8) \\ 2160(72 \times 30) \\ \hline 2736 \\ 1 \end{array}$$

In Year 5 the children will be taught to multiply numbers of up to 4 digits by a one- or two-digit number.

Phase 6 (Y6)

ThHTU x U

(Short multiplication - multiplication by a single digit)

$$4346 \times 8$$

Children will approximate first

4346×8 is approximately $4346 \times 10 = 43460$

x	4000	300	40	6
8	32000	2400	320	48

$$\begin{array}{r} 32000 \\ + 2400 \\ + 320 \\ + 48 \\ \hline 34768 \end{array}$$

HTU x TU

(Long multiplication - multiplication by more than a single digit)

$$372 \times 24$$

Children will approximate first

372×24 is approximately $400 \times 25 = 10000$

x	300	70	2	
20	6000	1400	40	
4	1200	280	8	

6000

+ 1400

+ 1200

+ 280

+ 40

+ 8

8928

1

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:

$$4.92 \times 3$$

Children will approximate first

$$4.92 \times 3 \text{ is approximately } 5 \times 3 = 15$$

x	4	0.9	0.02	
3	12	2.7	0.06	

12

+ 0.7

+ 0.06

12.76

There is no requirement to move away from the grid method. However where children are confident we aim to teach an efficient standard shortened method in Year 6. When teaching a vertical method we work from the units column rather than the tens or hundreds.

ThHTU × U

(Short multiplication - multiplication by a single digit)

We teach the children to approximate first.

For example, 4346×8 is approximately $4346 \times 10 = 43460$

4346	leading to	4346
<u>x 8</u>		<u>x 8</u>
48(6×8)		<u>34768</u>
320(40×8)		234
2400(300×8)		
<u>32000(4000×8)</u>		
<u>34768</u>		

ThTU × TU

(Long multiplication - multiplication by more than a single digit)

We teach the children to approximate first.

For example 372×24 is approximately $400 \times 25 = 10000$

$$\begin{array}{r} 372 \\ \times 24 \\ \hline 1488 \text{ (372} \times 4\text{)} \\ \underline{7440} \text{ (372} \times 20\text{)} \\ \hline 8928 \end{array}$$

+ - + - + - + - + - + - +

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 onto the next stage if:

- 1) they are not ready.
- 2) 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.