

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

(ongoing)

These are a **selection** of mental calculation strategies:

See NNS Framework Section 5, pages 52-57 and Section 6, pages 58-65

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 should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day. Once the concept of multiplication is understood and strategies have been taught, children should learn multiplication tables by rote.

Year 2 2 times table
 5 times table
 10 times table

Year 3 2 times table
 3 times table
 4 times table
 5 times table
 6 times table
 10 times table

Year 4 Derive and recall all multiplication facts up to 10×10

Years 5 & 6 Derive and recall quickly all multiplication facts up to 10×10 .

It is important that the order of factors is consistent throughout school when multiplication tables are recited; the second factor should be the factor that remains the same when spoken, e.g:

'1 times 5 is 5'

'2 times 5 is 10'

'3 times 5 is 15' and so on.

Multiplication facts should be taught using strategies, models, images, games, chanting, counting in multiples and learning by rote. Children should be able to recall a fact rapidly within 5 seconds and should not depend on counting through multiples until they reach the required fact.

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

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

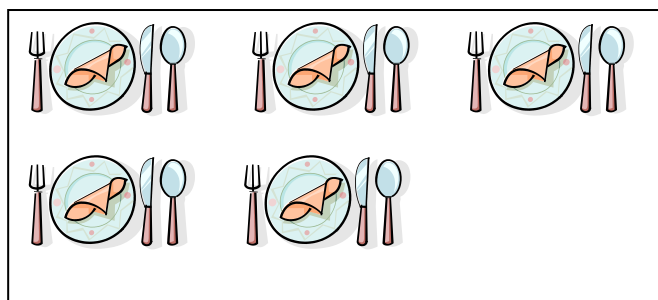
Teachers should record the methods and strategies which the children can use confidently and records should be passed to the next teacher on transition. Record sheets are provided (see appendix 2).

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.

YR and Y1

Children are given lots of practical opportunities to develop their understanding of multiplication. 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.



Y2

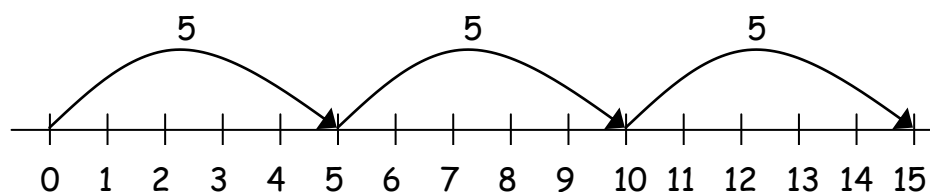
Children will develop their understanding of multiplication and use jottings to support calculation:

✓ Repeated addition

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

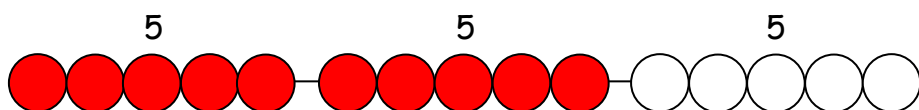
Repeated addition can be shown easily on a number line:

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



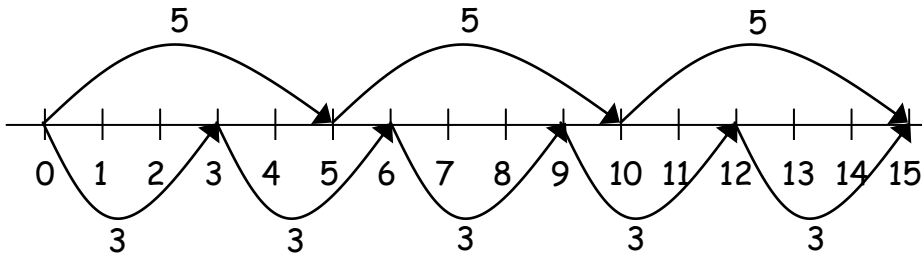
and on a bead bar:

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



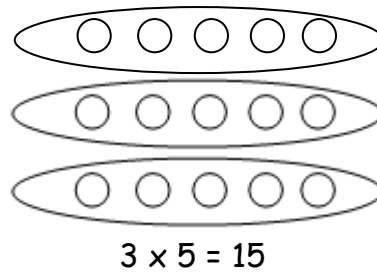
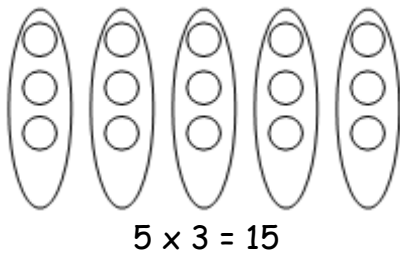
✓ **Commutativity**

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.



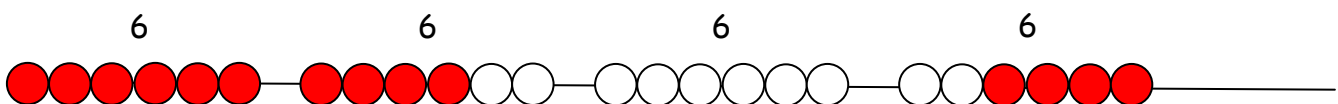
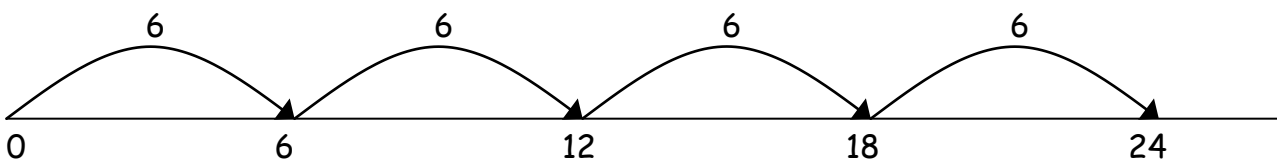
Y3

Children will continue to use:

✓ **Repeated addition**

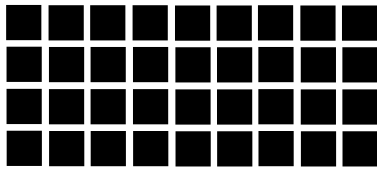
4 times 6 is $6 + 6 + 6 + 6 = 24$ or 4 lots of 6 or 6×4

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.



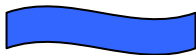
$$9 \times 4 = 36$$

$$9 \times 4 = 36$$

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**

$$\square \times 5 = 20$$

$$3 \times \triangle = 18$$

$$\square \times \star = 32$$

✓ **Partitioning**

$$38 \times 5 = 190$$

$$30 \times 5 = 150$$

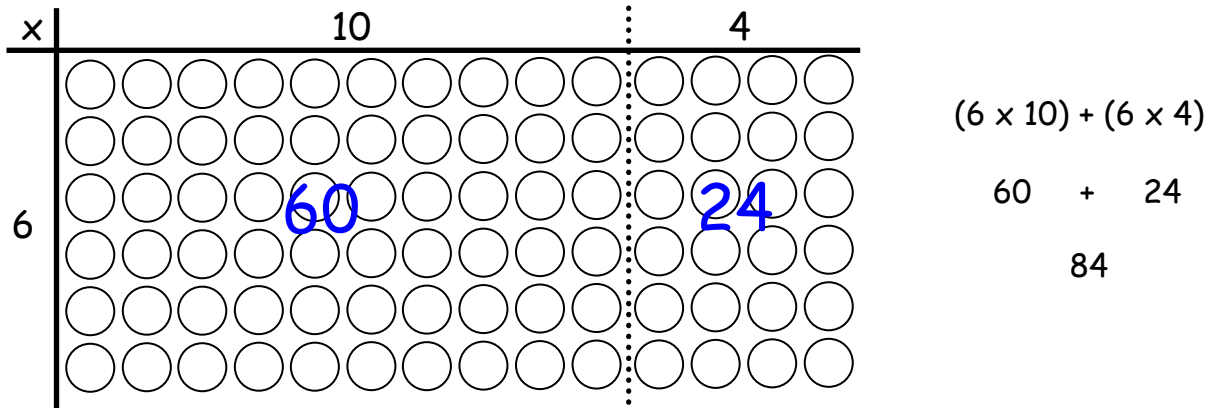
$$8 \times 5 = 40$$

$$150 + 40 = 190$$

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Y4

Children will continue to use arrays where appropriate leading into the grid method of multiplication. The Interactive Teaching Programme (ITP) 'Multiplication Array' should be used to model the use of the grid method of multiplication.



Grid method

TU x U

(Short multiplication - multiplication by a single digit)

$$23 \times 8$$

Children will approximate first

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

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

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

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 |
| | | | | + 54 |
| | | | | <hr style="width: 100%; border: 0.5px solid black;"/> |
| | | | | 3114 |
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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 |
| | | | + 16 |
| | | | <hr style="width: 100%; border: 0.5px solid black;"/> |
| | | | 2736 |
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| | | | 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 $5 \times 3 = 15$

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

$$\begin{array}{r} 12 \\ + \quad 2.7 \\ \hline 14.7 \end{array}$$

Y6

ThHTU \times U

(Short multiplication - multiplication by a single digit)

4346×8

Children will approximate first

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

$$\begin{array}{r} \times \quad 4000 \quad 300 \quad 40 \quad 6 \\ 8 \quad \boxed{32000} \quad \boxed{2400} \quad \boxed{320} \quad \boxed{48} \end{array}$$

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

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 | 6000 |
| 4 | 1200 | 280 | 8 | + 1400 |

| | | | | |
|--|--|--|--|-------------|
| | | | | + 1200 |
| | | | | + 280 |
| | | | | + 40 |
| | | | | + 8 |
| | | | | <u>8928</u> |
| | | | | 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

4.92×3 is approximately $5 \times 3 = 15$

| | | | | |
|---|----|-----|------|----|
| x | 4 | 0.9 | 0.02 | |
| 3 | 12 | 2.7 | 0.06 | 12 |

| | | | | |
|--|--|--|--|--------------|
| | | | | + 0.7 |
| | | | | + 0.06 |
| | | | | <u>12.76</u> |

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 use practical apparatus until they are confident without it.

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.

Children who use English as an additional language or children who arrive from other schools may already have efficient methods for calculating. The children should be encouraged to use their methods but they should also be able to explain the methods they are using. If it is apparent that a child is unable to explain the method they are using (and this is not due to a lack of English language) or they have a lack of understanding of the method they are using, then the children should be taught the methods in the calculation policy with an emphasis on explaining how the method works.