

# PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

## MENTAL CALCULATIONS

These are a selection of mental calculation strategies. On an additional document you will find year group expectations for mental starters. Each week teachers must cover rapid recall, mental strategies and mental calculations.

### Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g.  $8 \times 4$  is double  $4 \times 4$

### Using multiplication facts

*Tables should be taught everyday from Y1 onwards, either as part of the mental oral starter or other times as appropriate within the day.*

Year 1      2 times table  
              5 times table  
              10 times table

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  
              8 times table  
              10 times table  
              Count in multiples of 50 and 100

Year 4      Derive and recall all multiplication facts up to  $12 \times 12$   
              Count in multiples of 6,7,  
9, 25 and 1000

Years 5 & 6 Derive and quickly recall all multiplication facts up to  $12 \times 12$ .  
              Count in steps of powers of 10 for any given number up to 1000 000

### Using and applying multiplication 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

$$13 \times 11 = (13 \times 10) + (13 \times 1)$$

$$= 130 + 13$$

$$= 143$$

### Multiplying by 10, 100, 1000

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.

Year 3      Multiply a one digit or two digit number by 10

Year 4      Multiply any one or two digit number by 10 and 100

Year 5      Multiply whole numbers and decimals by 10, 100, 1000,

Year 6      Multiply whole numbers and decimals up to 3DP by 10, 100, 1000, and give the answer to 3DP

### Partitioning

$$23 \times 4 = (20 \times 4) + (3 \times 4)$$

$$= 80 + 12$$

$$= 102$$

### Use of factors

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

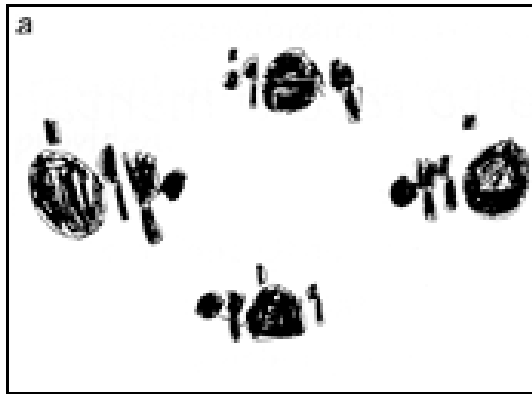
*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*

THE FOLLOWING ARE **MINIMUM** STANDARDS THAT WE EXPECT THE CHILDREN TO ACHIEVE - SOME WILL ACHIEVE BEYOND THIS EXPECTATION AND THE CHILDREN MUST NOT BE LIMITED

*'THERE IS NO LID ON LEARNING!'*

## YR

Children will experience equal groups of objects and will count in 2s, 5s and 10s. They will work on practical problem solving activities involving equal sets or groups.



## Y1

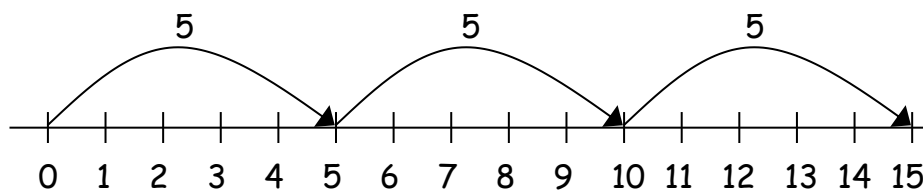
Children will develop their understanding of multiplication and use jottings to support calculation:

### ✓ **Repeated addition**

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

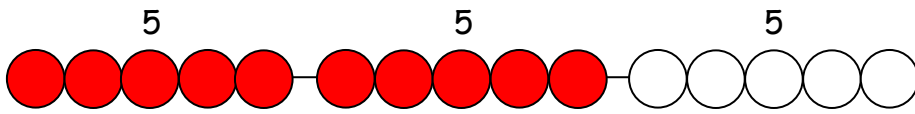
Repeated addition can be shown easily on a number line:

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



and on a bead bar:

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



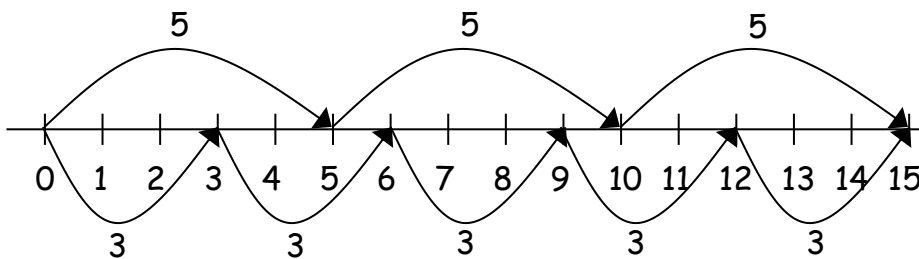
✓ **Mathematical statements**

Children will be able to read and write number sentences using the multiplication and equals symbol and answer the question with the teacher using concrete objects.

Y2

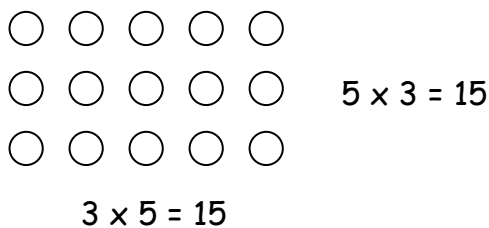
✓ **Commutativity**

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



✓ **Arrays**

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



✓ **Mathematical statements**

Children will be able to record and interpret number sentences using the multiplication and equals symbol.

✓ **Finding missing numbers**

Children will be able to calculate the value of an unknown in a number sentence, eg  $3 \times \square = 15$

**Y3**

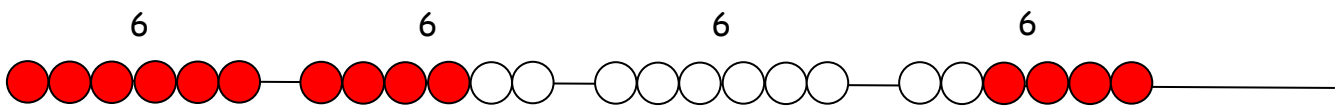
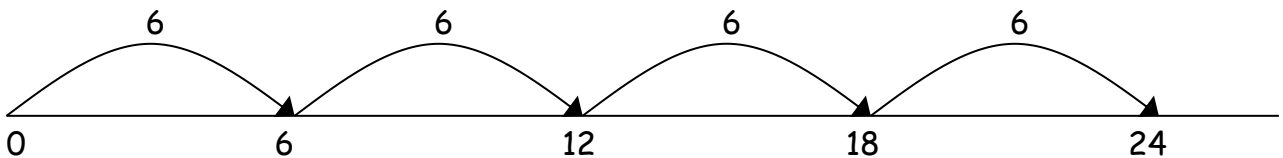
The children will be developing written methods to multiply a one digit number by a two digit number.

Children will continue to use:

✓ **Repeated addition**

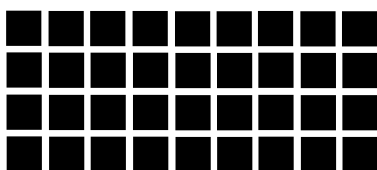
4 times 6 is  $6 + 6 + 6 + 6 = 24$  or 4 lots of 6 or  $6 \times 4$

Children could use number lines or bead bars to support their understanding.



✓ **Arrays**

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



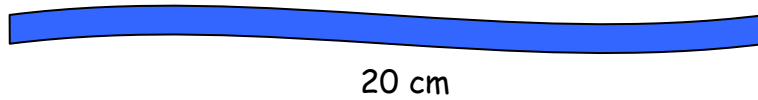
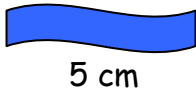
$9 \times 4 = 36$

$9 \times 4 = 36$

Children will also develop an understanding of

✓ **Scaling**

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



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

$$\square \times 5 = 20$$

$$3 \times \triangle = 18$$

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

✓ **Grid method**

Children should progress to using formal written methods

**TO x O**

(Progressing to formal short multiplication method for multiplication by a single digit)

$$23 \times 8$$

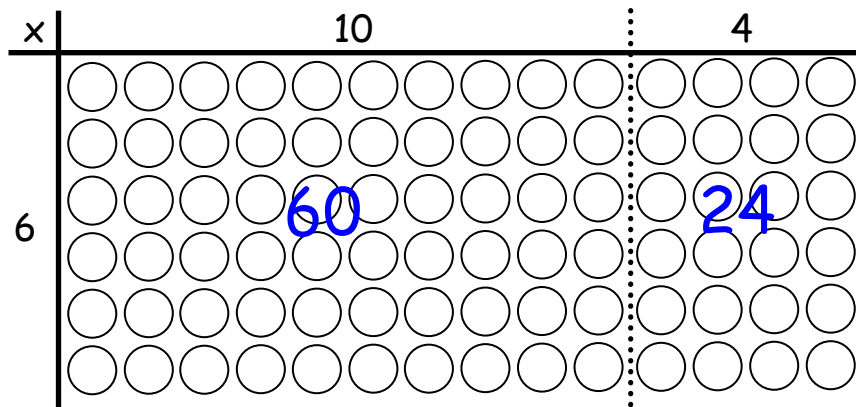
Children will approximate first

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

x	20	3	
8	160	24	
			160
			+ 24
			<hr style="width: 50%; margin: 0;"/>
			184

## Y4

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



$$(6 \times 10) + (6 \times 4)$$

$$60 + 24$$

$$84$$

### ✓ Grid method

HTO x O

$$426 \times 9$$

Children will approximate first

$$426 \times 6 \text{ is approximately } 400 \times 6 = 2400$$

x	400	20	6
6	2400	120	36

$$2400$$

$$+ 120$$

$$+ \underline{36}$$

$$\underline{\underline{2556}}$$

### ✓ Short multiplication

(Short multiplication - multiplication by a single digit)

$$\begin{array}{r} 38 \\ \times 7 \\ \hline 5 \\ \hline \underline{\underline{266}} \end{array}$$

Moving digits into another column needs to go above the answer.

## Y5

Children will work on multiplying ThHTO  $\times$  O, ThHTO  $\times$  TO and TO  $\times$  TO using formal short multiplication and formal long multiplication.

### Grid method

#### ThHTO $\times$ O

$$3462 \times 9$$

Children will approximate first

$$3462 \times 9 \text{ is approximately } 3500 \times 10 = 35000$$

$\times$	3000	400	60	2
9	27000	3600	540	18

$$\begin{array}{r} 27000 \\ + 3600 \\ + 540 \\ + 18 \\ \hline \phantom{00}11 \\ \hline \underline{\underline{31158}} \end{array}$$

#### TO $\times$ TO

$$72 \times 38$$

Children will approximate first

$$72 \times 38 \text{ is approximately } 70 \times 40 = 2800$$

$\times$	70	2	
30	2100	60	= 2160
8	560	16	= 576



$$\begin{array}{r}
 2160 \\
 576 \\
 \hline
 1 \\
 \hline
 2736
 \end{array}$$

Formal Long multiplication - multiplication by more than a single digit)  
 THTO X TO , HTO X TO, TO X TO

Children will begin by multiplying the digit in the ones column then move to the tens column.

$$\begin{array}{r}
 \phantom{X} \phantom{00} 56 \\
 X \phantom{00} 24 \\
 \hline
 \phantom{00} 224 \\
 \phantom{0} 1120 \\
 \hline
 \phantom{00} 1344
 \end{array}$$

**Short Multiplication:**

24 × 6 becomes

$$\begin{array}{r}
 \phantom{0} 2 \ 4 \\
 \times \phantom{0} 6 \\
 \hline
 \phantom{0} 1 \ 4 \ 4 \\
 \hline
 \phantom{0} 2
 \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r}
 \phantom{00} 3 \ 4 \ 2 \\
 \times \phantom{00} 7 \\
 \hline
 \phantom{00} 2 \ 3 \ 9 \ 4 \\
 \hline
 \phantom{00} 2 \ 1
 \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r}
 \phantom{000} 2 \ 7 \ 4 \ 1 \\
 \times \phantom{000} 6 \\
 \hline
 \phantom{000} 1 \ 6 \ 4 \ 4 \ 6 \\
 \hline
 \phantom{000} 4 \ 2
 \end{array}$$

Answer: 16 446

*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 × 3 = 15

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

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

$$372 \times 24$$

Children will approximate first

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

x	300	70	2	
20	6000	1400	40	=7440
4	1200	280	8	=1488

$$\begin{array}{r} 7440 \\ 1488 \\ \quad 1 \\ \hline 8928 \end{array}$$

## Y6

Children will work on multiplying multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

Children will multiply one-digit numbers with up to two decimal places by whole numbers.

Children will be confident using short and long multiplication methods.

Decimals:

$4.92 \times 3$

Children will approximate first

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

x	4	0.9	0.02	
3	12	2.7	0.06	

	12	
+	0.7	
+	<u>0.06</u>	
	<u>12.76</u>	

✓ Column method

$$\begin{array}{r} 7 \\ X \quad 3.8 \\ \hline 5 \\ \hline 26 \ .6 \end{array}$$

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

**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.**