

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.

Year 2 2 times table
 10 times table
 Begin to know the 5 times table

Year 3 2 times table
 5 times table
 10 times table
 Begin to know the 3 and 4 times tables

Year 4 2 times table
 3 times table
 4 times table
 5 times table
 10 times table
 Begin to know 6, 7, 8 and 9 times tables

Year 5 & 6 Know by heart all multiplication facts up to 10×10

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

$13 \times 11 = (13 \times 10) + (13 \times 1)$
 $= 130 + 13$
 $= 143$

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What impact does professional development of mathematics have within the Six Key Areas of Learning?



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.

Multiply by 9 or 99, by multiplying by 10/100 then adjust

$$35 \times 99$$

$$35 \times 100 = 3500$$

$$35 \times 99 = (3500 - 35) = 3465$$

Multiply by 5 by multiplying by 10, then halving, i.e.

$$5 \times 68$$

$$10 \times 68 = 680$$

$$5 \times 68 = 340$$

Multiply by 25 by multiplying by 100, then halving twice, i.e.

$$14 \times 25$$

$$14 \times 100 = 1400$$

$$14 \times 50 = 700$$

$$14 \times 25 = 350$$

Partitioning

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

$$= 80 + 12$$

$$= 102$$

Use of factors

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

Multiply by 2, 4, 6, 8, 16, 32 etc by repeated doubling and halving, i.e.

$$16 \times 27$$

$$= 8 \times 54$$

$$= 4 \times 108$$

$$= 2 \times 216$$

$$= 1 \times 432$$

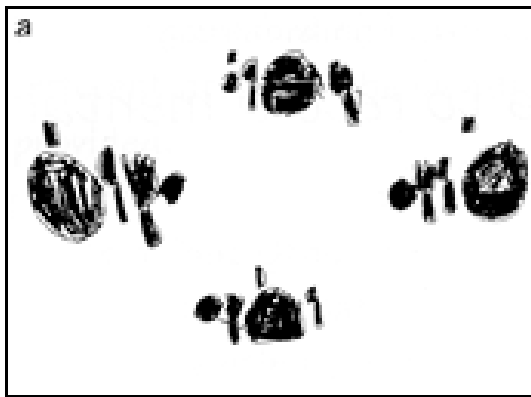
$$= 432$$

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.

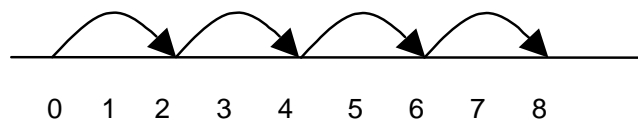
YR and Y1

- Children 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.



Higher attaining pupils will also be able to:

- Record jumps of 2s, 5s or 10s on a completed number line.
E.g.



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:

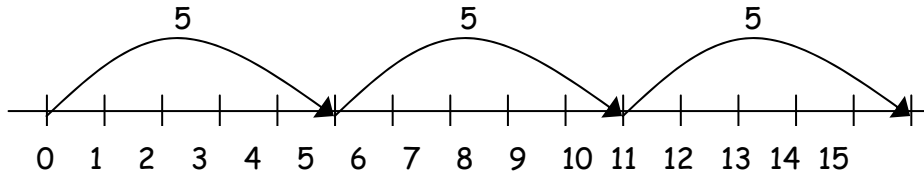
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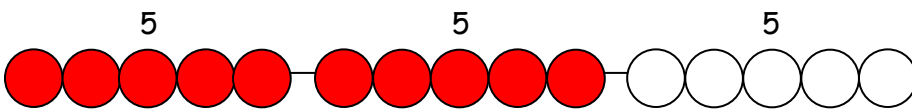
What impact does professional development of mathematics have within the Six Key Areas of Learning?



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

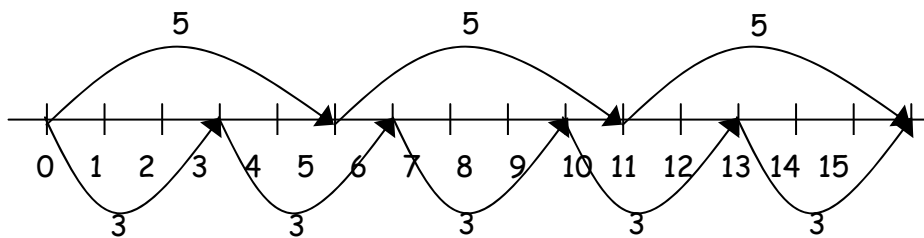


$$5 \times 3 = 5 + 5 + 5$$



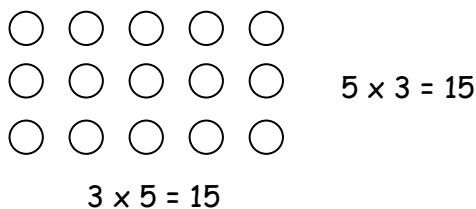
- **Commutativity**

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.



Higher attaining pupils will also be able to:

- Use the grid method to double multiples of 5 up to 50 using the grid method

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$$\begin{array}{r|l|l} \times & 10 & 5 \\ \hline 2 & 20 & 10 \end{array}$$

- How many socks are there in 12 pairs?
- Sita worked out the correct answer to 16×5 . Her answer was 80. Show how she could have worked out her answer.

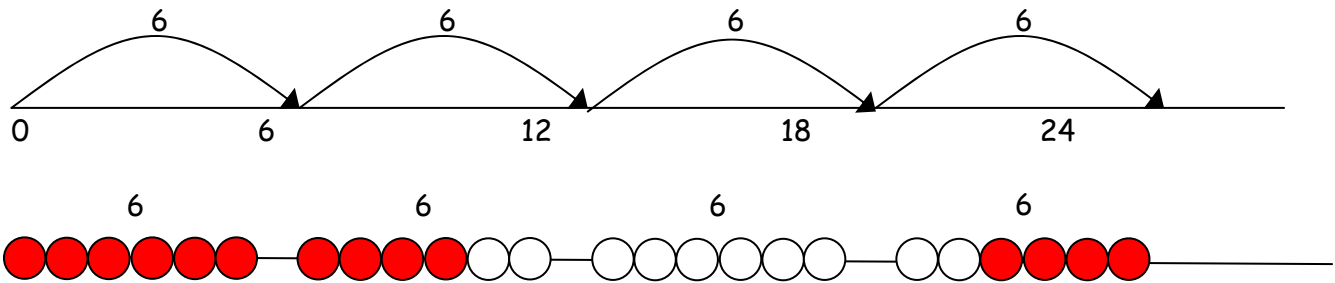
Y3

Children will continue to use:

- **Repeated addition**

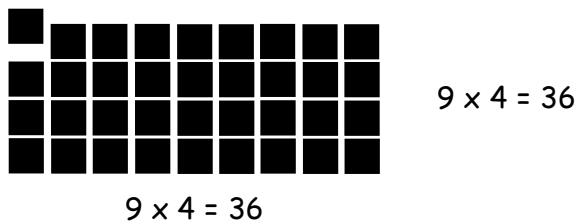
4 times 6 is $6 + 6 + 6 + 6 = 24$ or 4 lots of 6 or 6×4

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.



Children will also develop an understanding of

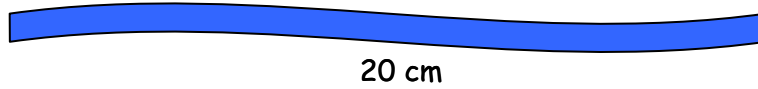
- **Scaling**

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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

$$\square \times 5 = 20$$

$$3 \times \triangle = 18$$

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

- Partitioning

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

- Use the grid method to double 35

x	30	5
2	60	10

Use the grid method to solve 32×5

x	30	2
5	150	10

Higher attaining pupils will be able to solve worded problems involving $\times 3$ and $\times 4$ and units, e.g.

- A baker puts 6 buns in each of 4 rows. How many buns does she bake
- Alex has 4 stickers. Jo has 3 times as many stickers as Alex. How many stickers does Jo have?

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Y4

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

x	10	⋮	4	
6				$(6 \times 10) + (6 \times 4)$ $60 + 24$ 84

Grid method

TU × U

(Short multiplication - multiplication by a single digit)

$$23 \times 8$$

Children will approximate first
 23×8 is approximately $25 \times 8 = 200$

x	20	3	
8	160	24	
			160
			+ 24
			<u>184</u>

- Use the grid method to solve 346×9 (is approximately $350 \times 10 = 3500$)

x	300	40	6
9	2700	360	54

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Y5

Grid method

HTU x U

(Short multiplication - multiplication by a single digit)

$$346 \times 9$$

Children will approximate first

$$346 \times 9 \text{ is approximately } 350 \times 10 = 3500$$

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

TU x TU

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

$$72 \times 38$$

Children will approximate first

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

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

Using similar methods, more able children 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.

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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 \times TU

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

372×24

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What impact does professional development of mathematics have within the Six Key Areas of Learning?



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

x	300	70	2	
20	6000	1400	40	7440
4	1200	280	8	<u>+1488</u>
				<u>8928</u>

Using similar methods, more able children 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 $5 \times 3 = 15$

x	4	0.9	0.02	
3	12	2.7	0.06	12
				+ 0.7
				<u>+ 0.06</u>
				<u>12.76</u>

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 always be encouraged to approximate their answers before calculating. Children should always be encouraged to consider if a mental calculation would be appropriate before using written methods.