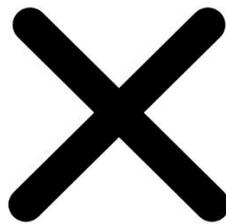# Numeracy

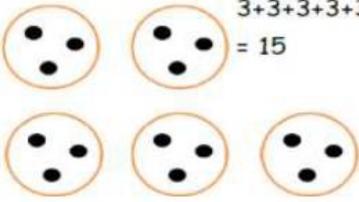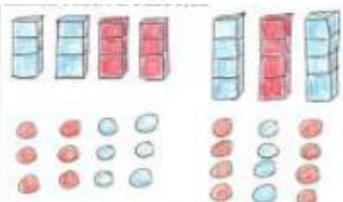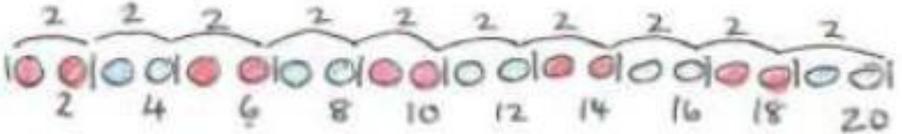# Progression in Multiplication including Written Calculations

**INTRODUCTION**

At Park we follow the New National Curriculum (September 2014) and aim to provide a systematic approach to teaching number. This document demonstrates the progression in the mathematical written methods and approaches to calculations across years 1-6. There is a considerable emphasis on teaching mental calculation strategies and up to Year 3 pupils choose an informal written method to record how they work out their answers. The Standard Written Method is introduced when the child begins to work within year 3 and has a secure understanding of place value.
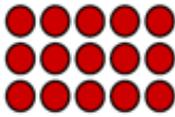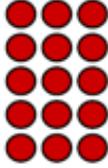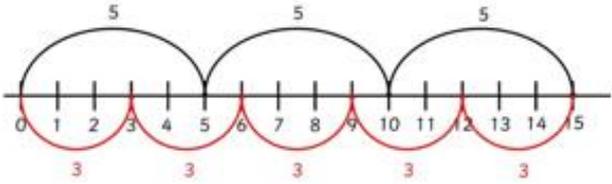
**REASONS FOR USING WRITTEN METHODS**
- To aid mental calculation by writing down some of the numbers and answers involved
- To make clear a mental procedure for the pupil
- To help communicate methods and solutions
- To provide a record of work
- To aid calculation when the problem is too difficult to be done mentally
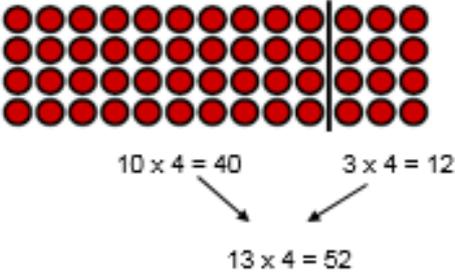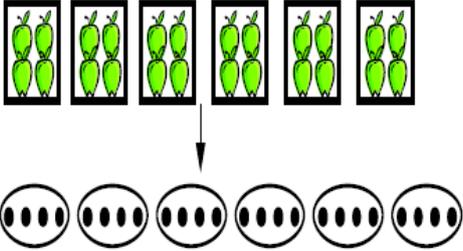- To develop and refine a set of rules for calculation

# Year 1

| Numeracy Objective | Example Method |
|---|---|
| Solve one-step problems using concrete objects, pictures and arrays.<br><br>Start to use the word 'Multiplication' but not the x symbol. | 3 plates, 2 cakes on each plate:<br><br>3 plates of 2 cakes = 6 cakes<br><br>How many legs will 3 teddies have?<br><br>2 + 2 + 2 = 6<br><br>There are 3 sweets in 1 bag. How many sweets are there in 5 bags altogether?<br><br>3+3+3+3+3<br>= 15<br><br>Use visual and concrete arrays to find the answer to '3 lots of 4'. |
| Count in multiples of 2s, 5s, 10s | 2  2  2  2  2  2  2  2  2  2<br>2  4  6  8  10  12  14  16  18  20 |

# Year 2

| Numeracy Objective | Example Method |
|---|---|
| Recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.<br><br>Calculate and write mathematical statements using the multiplication (x) and equals (=) sign.<br><br>Show that multiplication of two numbers can be done in any order (commutative). | 5 x 3          3 x 5<br><br>2 x 5 = 10    or    5 x 2= 10<br>4 x 5 = 20    or    5 x 4 = 20<br>12 = 6 x 2    or    12 = 2 x 6<br>70 = 7 x 10   or    70 = 10 x 7<br><br>Recognise odd and even numbers:<br>22 is a multiple of 2 as it is an even number.<br>45 is a multiple of 5 and is an odd number as it ends in '5'.<br>170 is a multiple of 10 and is an even number as it ends in '0'. |
| Solve problems involving multiplication using materials, arrays, repeated addition, mental methods including problems in context. | There are three sweets in one bag.<br>How many sweets are there in five bags?<br><br><br><br>Repeated addition: 5 bags of 3 sweets (5 x 3) = 3 + 3 + 3 + 3 + 3 = 15 sweets<br><br>Number line:<br><br><br>Bar Model:<br> |

# Year 3

| Numeracy Objective | Example Method |
|---|---|
| Recall and use multiplication facts for the 2,3,4,5, 8 and 10 times tables. | 1 x 4 = 4                2 x 4 = 8                3 x 4 = 12 |
| Write and calculate mathematical statements for multiplication, including for two-digit numbers times one-digit numbers (TUXU). Do this mentally and progress to a formal written method. | Multiply by decomposing digits into known values:<br><br>13 x 4 = 52<br>10 x 4 = 40<br>3 x 4 = 12<br><br><br><br>10 x 4 = 40          3 x 4 = 12<br><br>13 x 4 = 52<br><br>TUXU using the grid method:<br><br>| x | T<br>10 | U<br>3 |<br>|---|---|---|<br>| 4 | 40 | 12 |<br><br>40 + 12 = 52<br><br>TUXU using the short formal method:<br><br>  13<br>  X4<br>  12 (3 x 4)<br>+ 40 (10 x 4)<br>  52 |
| Solve problems related to multiplication, including missing number problems. | There are four apples in a box. How many apples in six boxes?<br><br> |

Missing number problems:

8 x ___ = 48

____ = 4 x 8

7 x ____ = 56

$\bigcirc$ x $\bigcirc$ = 32

x

$\bigcirc$ 5

$\bigcirc$

=

$\bigcirc$ 40

# Year 4

| Numeracy Objective | Example Method |
|---|---|
| Recall multiplication facts and tables up to 12 x 12. | 6 x 12 = 74          4 x 9 = 36          72 = 9 x 8<br>12 x 12 = 144          88 = 11 x 8          6 x 6 = 36 |
| Use place value, known and derived facts to multiply mentally, including: multiplying by 1 and 0; multiplying together three numbers. | 70 x 9 = 630 can be derived from 7 x 9 = 63<br>600 x 3 = 1800 can be derived from 6 x 3 = 18<br><br>7 x 0 = 0          7 x 1 = 7<br>0 x 3 = 0          1 x 3 = 3<br>0 = 8 x 0          8 = 1 x 8<br><br>2 x 3 x 5 = 30  (3 x 2 = 6, 6 x 5 = 30)<br>3 x 3 x 8 = 72  (3 x 3 = 9, 9 x 8 = 72)<br>3 x 5 x 0 = 0   (3 x 5 = 15, 15 x 0 = 0) |
| Recognise and use factor pairs in calculations. | Factor pairs are a set of two numbers that when multiplied together result in a number.<br><br>Diagrams to show factor pairs for 18:<br><br><br>Factor rainbow for 36:<br><br><br>Factor RAINBOW for 36<br>1, 2, 3, 4, 6, 9, 12, 18, 36<br><br>40          72          57<br>1 x 40          1 x 72          1 x 57<br>2 x 20          2 x 36          3 x 19<br>4 x 10          3 x 24<br>5 x 8          4 x 18<br>          6 x 12<br>          8 x 9 |

| Multiply two-digit and three-digit numbers by a one-digit number using a formal written layout.<br>TU X U<br>HTU X U | The grid Method:<br><br>43 x 6 =<br><br>| | T | U |<br>|---|---|---|<br>| x | 40 | 3 |<br>| 6 | 240 | 18 |<br><br>40 x 6 = 240<br>+3 x 6 =  18<br>     258<br><br>Expanded vertical method:<br><br>237 x 4 =<br><br>Estimate is 250 x 4 = 1000<br><br>   237<br>  X  4<br>    28   (4 x  7)<br>  120   (4 x 30)<br>  800   (4 x 200)<br>  948<br><br>The short formal method:<br><br>24 × 6 becomes        342 × 7 becomes<br><br>   2  4          3  4  2<br>×    6          ×      7<br>1  4  4       2  3  9  4<br>   2              2  1<br><br>Answer: 144         Answer: 2394 |
| Multiply by 10 and 100 by moving the digits up the place value line. | 23 x 10 =<br><br>TU   Times by 10, move one place to the left    HTU    Put zero in as space filler    HTU<br>23   →   23   →   230<br><br>46 x 100 =<br><br>TU   Times by 100, move two place to the left    ThHTU    Put 2 zero in as space filler    ThHTU<br>46   →   46   →   4600 |
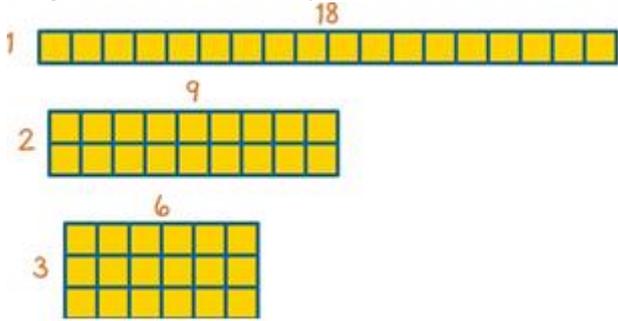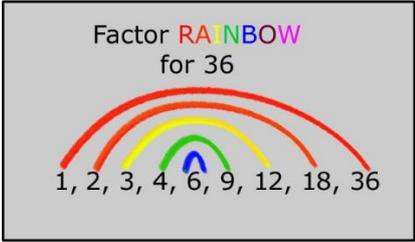
# Year 5

| Numeracy Objective | Example Method |
|---|---|
| Find all factor pairs of a number and common factors of two numbers. | Find the common factor pairs for 12 and 30:<br><br>| Factors of 12 | Factors of 30 |<br>|---|---|<br>| 12 = 1 × 12 | 30 = 1 × 30 |<br>| 12 = 2 × 6 | 30 = 2 × 15 |<br>| 12 = 3 × 4 | 30 = 3 × 10 |<br>| | 30 = 5 × 6 |<br><br>Factors of 12: 1, 2, 3, 4, 6, 12<br><br>Factors of 30: 1, 2, 3, 5, 6, 10, 15, 30<br><br>1, 2, 3, and 6 are all factors of both 12 and 30.<br><br>1, 2, 3, and 6 are called the common factors of 12 and 30. |
| Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers. | Use of long multiplication:<br><br>256 x 18<br>(estimate: 250 x 20 = 5000)<br><br>```<br>        256<br>   X     18<br>       2048<br>   +   2560<br>       4608<br>          1<br>```<br><br>Use of the expanded method to multiply four digit numbers (ThHTU) by a single digit number (U):<br><br>2327 x 8    (estimate: 2300 x 10 = 23 000)<br><br>```<br>       2327<br>   X      8          Units first<br>         56<br>        160<br>       2400<br>      16000<br>      18616<br>``` |

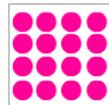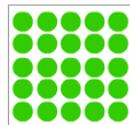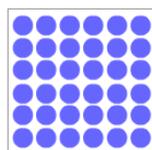| | Use of the compact vertical method to multiply decimals (U.t) by single digit numbers (U), using an estimate to check: |
|---|---|
| | $4.7 \times 8 =$<br><br>Estimate $5 \times 8 = 40$<br><br>$\begin{array}{r} 4.7 \\ \times\ \ 8 \\ \hline 45.6 \\ \small 5 \end{array}$ |
| Recognise and use square and cube numbers, and the notation for squared ($_2$) and cubed ($_3$). | **Square Numbers**<br>A square number is the product of multiplying a number by itself.     **Cube Numbers**<br>This is the product of multiplying the same number three times.<br><br>$2^2$ or $2 \times 2 = 4$     1 is the first cube number, because $1 \times 1 \times 1 = 1$<br><br>$3^2$ or $3 \times 3 = 9$     8 is the second cube number, because $2 \times 2 \times 2 = 8$<br><br>$4^2$ or $4 \times 4 = 16$     27 is the third cube number, because $3 \times 3 \times 3 = 27$<br><br>$5^2$ or $5 \times 5 = 25$     64 is the fourth cube number, because $4 \times 4 \times 4 = 64$<br><br>$6^2$ or $6 \times 6 = 36$<br><br><u>Square Numbers</u><br>$1 \times 1 = 1^2 = 1$<br>$2 \times 2 = 2^2 = 4$<br>$3 \times 3 = 3^2 = 9$<br>$4 \times 4 = 4^2 = 16$<br>$5 \times 5 = 5^2 = 25$<br><br><u>Cube Numbers</u><br>$1 \times 1 \times 1 = 1^3 = 1$<br>$2 \times 2 \times 2 = 2^3 = 8$<br>$3 \times 3 \times 3 = 3^3 = 27$<br>$4 \times 4 \times 4 = 4^3 = 64$<br>$5 \times 5 \times 5 = 5^3 = 125$ |
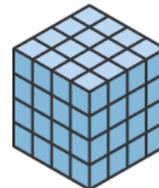
# Year 6

| Numeracy Objective | Example Method |
|---|---|
| Multiply multi-digit numbers up to 4 digits by a two-digit number using the formal written method of long multiplication. | Long multiplication:<br><br>5,280 × 25<br>26400<br><br>5,280 × 25<br>26400<br>105600<br><br>5,280 × 25<br>26400<br>+105600<br>132,000 |
| Solve multi-step problems in contexts, deciding which operations and methods to use and why. Use estimation to check answers. | A football club has an average attendance of 859 people to each match. What is the total attendance for the 29 matches played in a season?<br><br>6. Grace wants to buy seven of her friends a Christmas gift. She intends to buy each friend the same gift. She has £38.75 to spend. She has to choose between a mirror for £5.50 and a notepad and pen set for £5.60. Explain what Grace will do. |