Muxton Primary School

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

Foundation stage

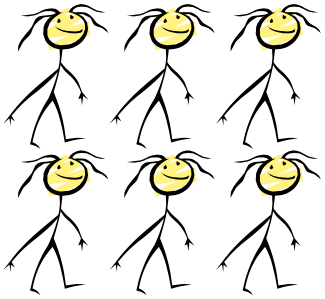
Count repeated groups of the same size

Hang up 3 bags outside for making collections. Put a number 2 on each bag. Encourage the children to collect 2 of any treasured object in each bag, for example fir cones or smooth pebbles. The collections could be used inside and outside in the learning environment for different purposes, for example as a gallery of natural objects or for adding to the making area.

Jumping along number lines in jumps of 1, 2, 5 & 10.

Learning by heart the number patterns 10s, 2's & 5's

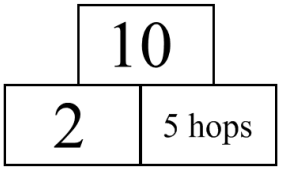
Pictures to show 2 lots of 3, or 3 lots of 2.



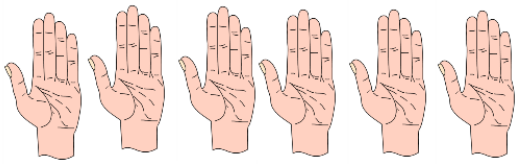
Y1

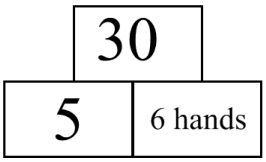
Count on or back in ones, twos, fives and tens and use this knowledge to derive the multiples of 2, 5 and 10 to the tenth multiple.
Recall the doubles of all numbers to at least 10.

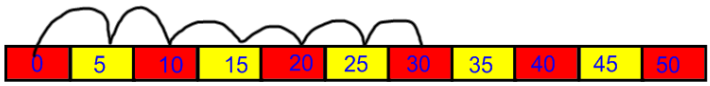
Children will experience equal groups of objects and will count in 2s, 5s and 10s and begin to count in 3s. They will work on practical problem solving activities involving equal sets or groups, e.g. Count five hops of 2 along this number track. What number will you reach? (Children will begin to move from using number tracks to number lines as appropriate through year 1 and 2)



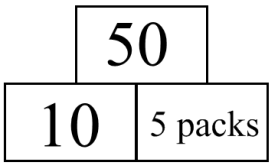
How many fingers are there altogether on six hands?

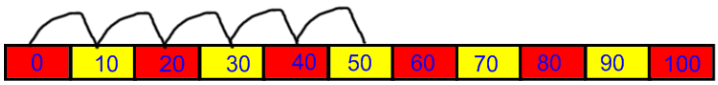






There are 10 crayons in each box.
How many crayons are there altogether?





Begin counting in 3s.

1 group of 3 = 3

2 groups of 3 = 6

Introduce the x symbol once repeated addition is understood.

3 x 2 =6 *three lots/groups of 2*

Y2

Derive and recall multiplication facts for the 2, 5 and 10 times-tables and the related division facts; recognise multiples of 2, 5 and 10.

Derive and recall doubles of all numbers to 20, and the corresponding halves.
Count in 3s and begin counting in 4s

Represent multiplication as repeated addition and arrays; use practical and informal written methods and related vocabulary to support multiplication.

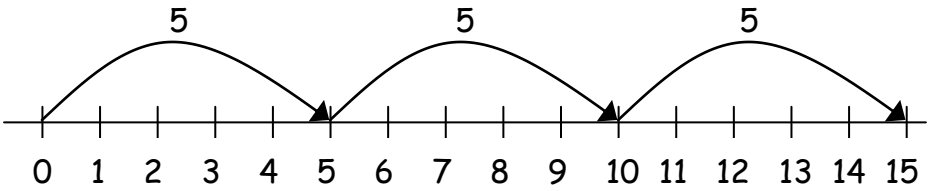
Repeated addition

Informal recording using number lines.

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

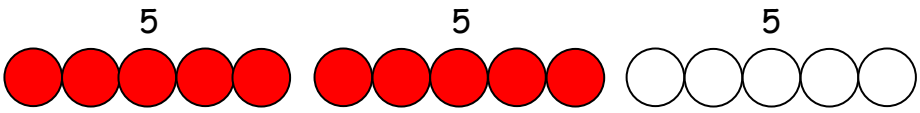
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5

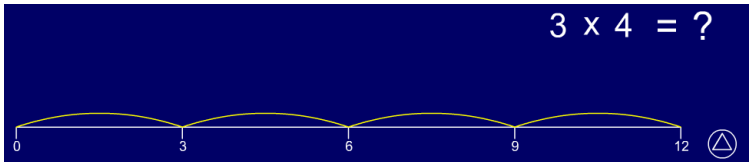


And on a bead bar:

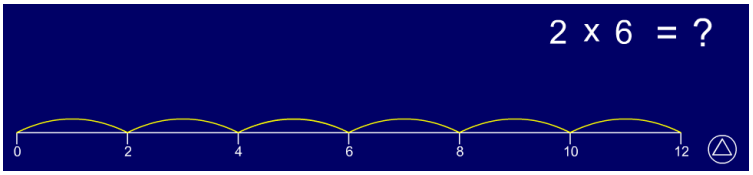
5 x 3 = 5 + 5 + 5



Show me on a number line how you could do:



3 ×4, how would 4 x 3 be different?



2 ×6, how would 6 x 2 be different?

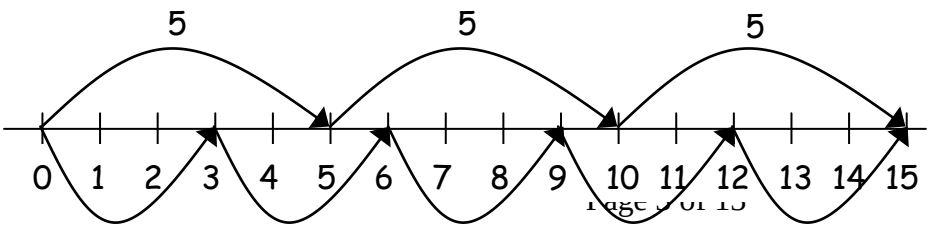
4 +4 +4 +4 +4 =20

Write this addition fact as a multiplication fact.

☐ x ☐ = ☐

Commutativity

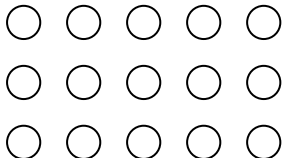
Children should know that 3 x 5 has the same answer as 5 x 3 but describes a different situation. This can also be shown on the number line.



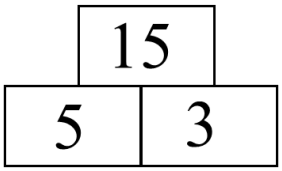
3 3 3 3 3

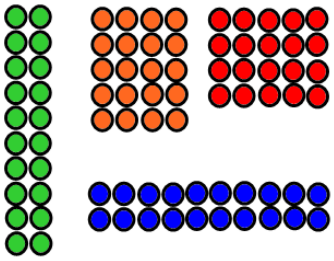
Arrays

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



5 x 3 = 15
3 x 5 = 15

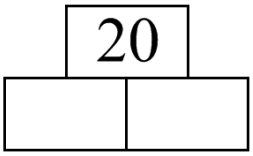




Here are 20 counters. How could you arrange them in equal rows? How could you use a number sentence to show your arrangement?
Link the above activity to missing box questions like the ones below.

What could the missing numbers be?

□ x □ = 20



Doubles are same as x2

Partitioning strategy for doubling
Double 35
30 x 2 5 x 2

Vocabulary: multiply, groups of, sets of, lots of etc.

Y3

Derive and recall multiplication facts for the 2, 3, 4, 5, 6 and 10 times-tables and the corresponding division facts.

Recognise multiples of 2, 5 or 10 up to 1000

Multiply one-digit and two-digit numbers by 10 or 100, and describe the effect.

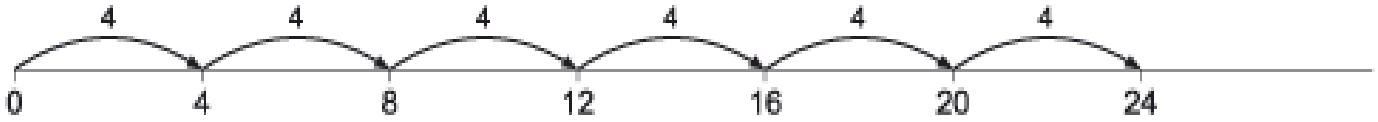
Use practical and informal written methods to multiply two-digit numbers (e.g. 13 × 3)

Understand that division is the inverse of multiplication and vice versa; use this to derive and record related multiplication and division number sentences;

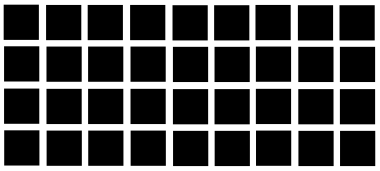
Multiply by 10 / 100, understanding the shift in the digits

Children will continue to use **repeated addition and arrays.**

Children review multiplication as repeated addition by counting hops on a number line. For example, they find 6 fours by making 6 hops of 4.



Children understand the relationship between multiplication and division. For example, they state two multiplication sentences and two division sentences that relate to a particular array, for example:

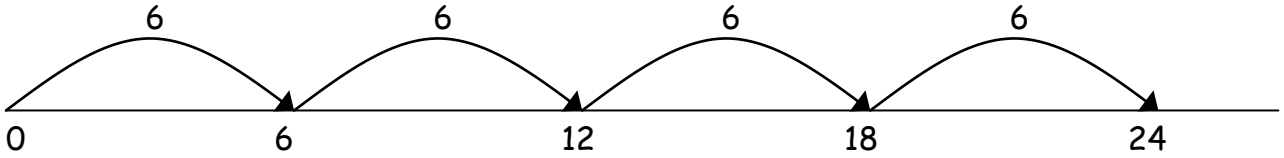


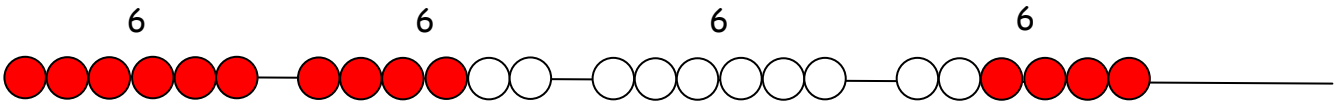
4 x 9 = 36

9 x 4 = 36

They use the image of an array to explain why, for example, 2×5 gives the same answer as 5×2. They also use the image to show how many fives make 10 and how many twos make 10.

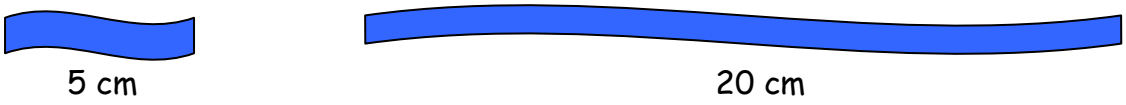
Children should use number lines or bead bars to support their understanding.





How many sides do six triangles have?

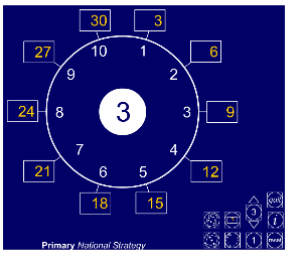
Children will be introduced to **Scaling**
e.g. Find a ribbon that is 4 times as long as the blue ribbon

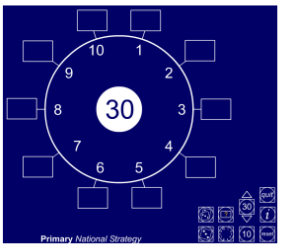


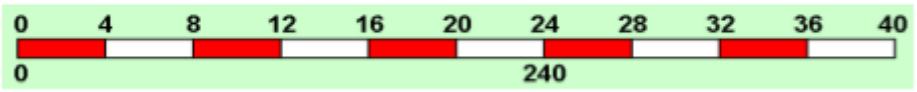
5 cm

20 cm

Use facts from the first number grid (Number grid ITP) to derive facts on the second.



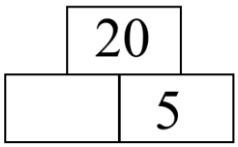




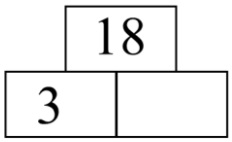
Use the counting stick to find how many 4s make 24.

Answer questions such as: 40 x 6, 4 x 60 by scaling up the product by a factor of 10.

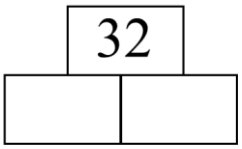
Using symbols to stand for unknown numbers to complete equations using inverse operations



□ x 5 = 20



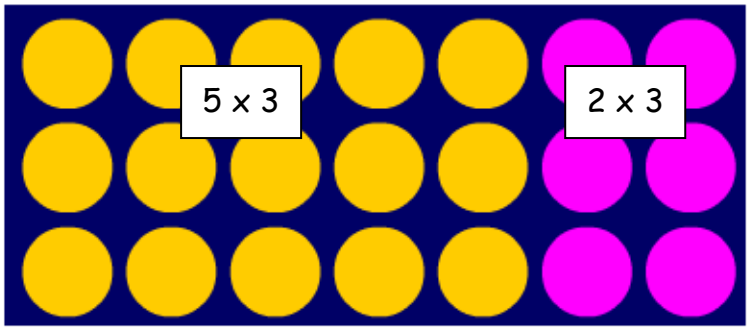
3 x △ = 18



□ x O = 32

Partitioning

Children use partitioning to encourage them to use knowledge of 2, 5 and 10 times tables to work out multiples of 7, e.g. partition 7 into 5 and 2 to calculate 7 x 3, i.e.

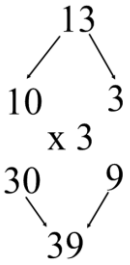


5 x 3	+	2 x 3
15	+	6
	21	

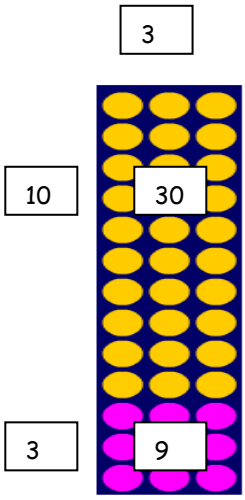
Children use partitioning to **multiply two-digit numbers by one-digit numbers**. For example, they work out 13 × 3 by finding 10 × 3 and adding 3 × 3. They record their working using informal methods:

$$13 \times 3 = \underset{3}{(13)} + \underset{3}{(13)} + \underset{3}{(13)}$$
$$\underset{10}{} \quad \underset{10}{} \quad \underset{10}{}$$
$$= 30 + 9$$
$$= 39$$

or



Begin to use the grid method to represent larger arrays



Y4

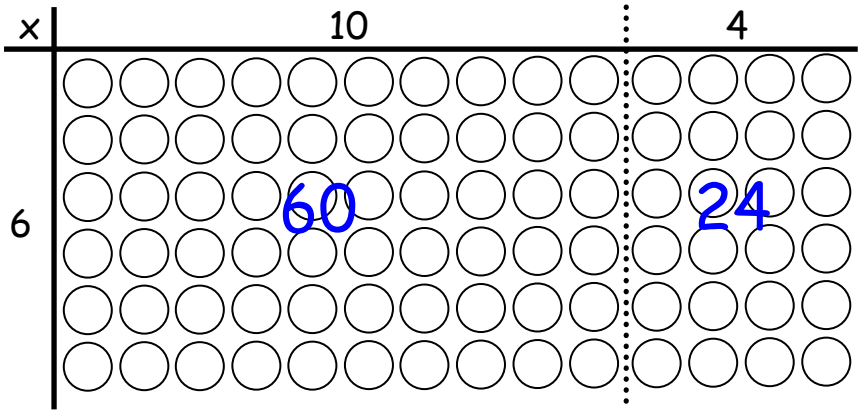
Derive and recall multiplication facts up to 10 x 10, the corresponding division facts, and Recognise multiples of numbers to 10 up to the tenth multiple.

Calculate doubles of multiples of 10 and 100 and derive the corresponding halves

Multiply and divide numbers to 1000 by 10 and then 100 (whole-number answers), understanding the effect; relate to scaling up or down.

Develop and use written methods to record, support and explain multiplication of two-digit numbers by a one-digit number (e.g. 15 x 9)

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



(6 x 10) + (6 x 4)

60 + 24

84

23 x 8
Children will approximate first
23 x 8 is approximately
25 x 8 = 200

x	20	3
8	160	24

160
+ 24
184

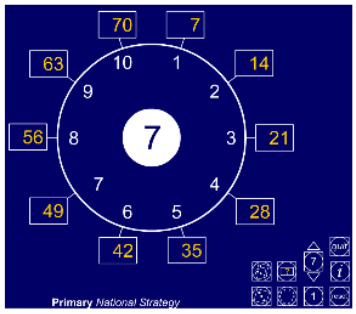
Introduce column multiplication for TU x U

23
x 7
140 (20 x7)
21 (3 x 7)
161

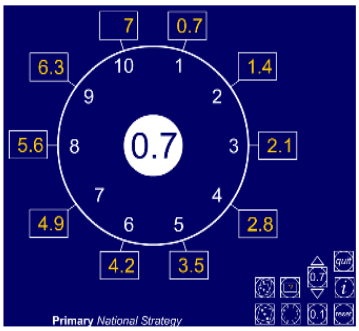
Y5

Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts

Extend mental-methods for whole-number calculations, for example to multiply a two-digit by a one-digit number (e.g. 12 x 9), to multiply by 25 (e.g. 16 x 25);
Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000



Use facts from the first number grid (Number grid ITP) to derive facts on the second by scaling down by a factor of 10.



Refine and use efficient written methods to multiply and divide HTU ×U, TU × TU, U.t ×U and HTU ÷U

Grid method
Children **develop and refine written methods for multiplication**. They move from expanded layouts (such as the grid method) towards a compact layout for HTU ×U and TU × TU calculations. They suggest what they expect the approximate answer to be before starting a calculation and use this to check that their answer sounds sensible. For example, 56 ×27 is approximately 60 ×30 =1800.

HTU x U
(Short multiplication – multiplication by a single digit)

346 x 9
Children will approximate first
346 x 9 is approximately 350 x 10 = 3500

x	300	40	6
9	2700	360	54

2700
+ 360
+ 54
3114

Leading to:
346
x 9
2700 (300 x 9)
360 (40 x 9)
54 (6 x 9)
3114

For more able, leading to compact multiplication:
346
x 9
3114

TU x TU
(Long multiplication – multiplication by more than a single digit)

72 x 38

Children will approximate first
72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

2100
+ 560
+ 60
+ 16
2736

For more able, leading to:
72
x 38
576 (8 x 72)
2160 (30 x 72)
2736

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.

4.9 x 3
Children will approximate first
4.9 x 3 is approximately 5 x 3 = 15

x	4	0.9
3	12	2.7

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

- **use and discuss mental strategies for special cases of harder types of calculations, for example to work out**

The written steps below illustrate the process children might mentally go through, and does not necessarily need to be recorded each time a mental calculation takes place.	
- even number x multiple of 5, - e.g. 35 x 14 35 x (2 x 7) (35 x 2) x 7 70 x 7 Ans: 490	-near 10 12 x 19 (12 x 20) -12 120-12 Ans: 108
- multiplying by 25 (or 50) e.g. 24 x 25 24 x 100 ÷2 ÷2 2400 ÷2 ÷2 1200 ÷2 Ans: 600	- power of 2, e.g. 17 x 32 17 x2 =34 17 x4 =68 17 x8 =136 17 x16 =272 17 x32 =544

Y6

Children use knowledge of place value and multiplication facts to 10 ×10 to derive related multiplication and division facts involving decimals (e.g. 0.8 ×7, 4.8 ÷6)
Calculate mentally with integers and decimals: U.t ±U.t, TU ×U, TU ÷U, U.t ×U, U.t ÷U

Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer

Written methods described above refined to efficient written methods and extended to HTUxTU and decimals.

ThHTU x U
(Short multiplication – multiplication by a single digit)

4346 x 8
Children will approximate first
4346 x 8 is approximately 4346 x 10 = 43460

x	4000	300	40	6
8	32000	2400	320	48

32000
+ 2400
+ 320
+ 48
34768

Leading to standard compact method:

4346
x 8
34768

HTU x TU
(Long multiplication – multiplication by more than a single digit)

372 x 24
Children will approximate first
372 x 24 is approximately 400 x 25 = 10000

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

6000
+ 1400
+ 1200
+ 280
+ 40
+ 8
8928

Leading to standard compact method:
372
x 24
1488
7440
8928

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.

4.92 x 3

Children will approximate first

4.92 x 3 is approximately 5 x 3 = 15

x	4	0.9	0.02
3	12	2.7	0.06

12
+ 0.7
+ 0.06
14.76

Leading to: 4.92
x 3
14.76

mental strategies

The written steps below illustrate the process children might mentally go through, and does not necessarily need to be recorded each time a mental calculation takes place.	
- even number x multiple of 5, - e.g. 3.5 x 14 3.5 x (2 x 7) (3.5 x 2) x 7 7 x 7 Ans: 49	-near 10 12 x £1.99 (12 x £2.00) –12p £24.00-12p Ans: £23.88
- multiplying by 25 (or 50) e.g. 24 x 2.5 24 x 10 ÷2 ÷2 240 ÷2 ÷2 120 ÷2 Ans: 60	- power of 2, e.g. 1.7 x 32 1.7 x2 =3.4 1.7 x4 =6.8 1.7 x8 =13.6 1.7 x16 =27.2 1.7 x32 =54.4

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.

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 will go onto the next stage if:

1) **They are ready.**
2) **They are confident.**

Children should always be encouraged to:

Approximate their answers before calculating.

Check their answers after calculation using an appropriate strategy.

Consider if a mental calculation would be appropriate before using written methods.