

Welcome to the KS2 (class 3 and 4) Maths Workshop



Two to Five

Which of the numbers from 1 to 20 can you make with the digits:

**2, 3, 4
and 5**

You can use any mathematical operations but you must use all four digits once each in each calculation.

For Example $20 = 4(3 - 2) \times 5$




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Purpose of study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary in most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, and a sense of enjoyment and curiosity about the subject.

Aims

The National Curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Multi-representations and the Concrete, Pictorial, Abstract (CPA) Approach



Multi-representations:

Using the resources can you show me as many different ways of showing the number 14.



Year 3 multiply 2-digit numbers by a single digit number

Key vocabulary groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times..., **partition, grid method, multiple, product, tens, units, value**

Key Skills for multiplication at Year 3

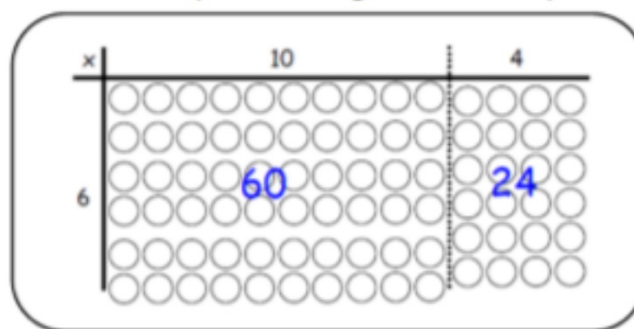
- Understand that multiplication is commutative, e.g. 4×8 is the same as 8×4 .
- **Know the 2x, 3x, 4x, 5x, 8x and 10x times tables. All tables need to be learned to the 12th multiple.**
- Multiply any 2-digit number by 10 or a single-digit number by 100;
- Understand the effect of multiplying whole numbers by 10 and 100.
- Multiply a 1 digit number by a 2 digit number starting to use the grid
- Solve multiplication problems involving missing numbers

Eg. $23 \times 8 = 184$

X	20	3
8	160	24

$$160 + 24 = 184$$

Link the layout of the grid to an array initially:



Children **MUST** be able to do the following before moving onto grid method:

- Partition numbers into tens and units
- Multiply multiples of ten by a single digit (Smile multiplication) using their knowledge of multiplication facts and times tables.
- Recall and work out multiplication facts in the 2,3,4,5,8 and 10 times tables

Smile Multiplication 😊

$$\underline{30} \times \underline{80} = \underline{2400}$$

24

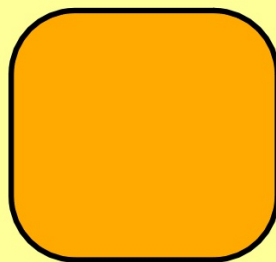
- Do the tables bit
- Count the zeros in the question
- Put the zeros on your answer!

A lorry can carry 8 cars.
There are 12 lorries in
the car park.

Each lorry is full of cars.

How many cars are
there on the lorries
in total?

Answer this question using the grid method



Year 4 Multiply 2 and 3 digits by a single digit

using all multiplication tables up to 12×12

Key vocabulary groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times..., partition, grid method, multiple, product, tens, units, value, **inverse**

Key Skills for multiplication at Year 4

- Multiply 1 and 2 digit numbers by 10, 100 and 1000; to understand place value in decimal numbers with one place.
- **Know and recite up to 12×12 all multiplication tables and know equivalent division facts** (e.g. $2 \times 7 = 14$ so $14 \div 2 = 7$)
- Multiply 1- digit numbers by 2-digit or friendly 3-digit numbers using grid method.
- Find doubles to double 100 and beyond, using partitioning
- Begin to double amounts of money
- Use doubling as strategy for multiplying by 2, 4, 8
- Count in multiples of 6, 7, 9, 25 and 1000

Expanded Method Multiplication—Multiply each digit making sure that the place value of the digit is understood and used.

$$\begin{array}{r} 38 \\ \times 7 \\ \hline 56 \\ 210 \\ \hline 266 \end{array}$$

$7 \times 8 = 56$
 $7 \times 30 = 210$

Children describe what they are doing; referring to the place value of the number

Children say 7×6 ; 7×50 , 20×6 and 20×50 to help remind children of place value so they will be ready for short multiplication

The local Scouts were planning a camping trip. In total there were 35 tents available each of which could sleep 7 children.

How many Scouts could go on the trip?

Use the expanded method for multiplication to solve this.



Year 5 Multiply up to 4 digits by 1 or 2 digits.

Key vocabulary groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times..., partition, grid method, multiple, product, tens, units, value, inverse, **square, factor, integer, decimal, short/long multiplication, 'carry'**

Key Skills for multiplication at Year 5

- Know and recite all **times tables including division facts.**
- Multiply 2- and 3-digit numbers by numbers ≤ 12 using grid method; multiply 2-digit by 2-digit numbers using grid method.
- Identify multiples and factors, using knowledge of multiplication tables up to 12×12
- Scale up or down by a factor of 2, 5 or 10
- Multiply integers and decimals by 10, 100, 1000
- Recognise and use squared, cubes and their notations

Column multiplication

Introduce column multiplication by comparing a grid method calculation, and partition in order to see how the steps are related.

HTU **Short**

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 184 \\ \leftarrow 2 \text{ All} \end{array}$$

$3 \times 8 = 24$ the first part of the product
Carry the 2 in to the tens column.
 $20 \times 8 = 160 + \text{the } 20 \text{ carried} = 180$

Multiplication for multiplying by digit.

other strategies

Introduce long multiplication for multiplying by 2 digits

	10	8
10	100	80
3	30	24



		1	8
\times		1	3
		5	4
		2	
	1	8	0
	2	3	4

18×3 on the first row
($8 \times 3 = 24$, carrying the 2 for 20, then 1×3)
 18×10 on the 2nd row.
Show multiplying by 10 by putting zero in units first

Move towards more complex numbers

$$\begin{array}{r} 1234 \\ \times \quad 16 \\ \hline \end{array}$$

$$\begin{array}{r} 3652 \\ \times \quad \quad 8 \\ \hline \end{array}$$

support children with how **Children should** we

The length of a swimming pool is 25 metres and its width is 15 metres.

What is the area of the pool?



Year 6 Short and long multiplication, up to 4 digits by a 2 digit whole number **extend to decimals**

Key vocabulary groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times..., partition, grid method, multiple, product, tens, units, value, inverse, square, factor, integer, decimal, short/long multiplication, 'carry', tenths, hundredths, decimal

Key Skills for multiplication at Year 6

- Recall multiplication facts up to 12×12
- Use short multiplication to multiply a 1-digit number by a number with up to 4 digits
- Use long multiplication to multiply a 2-digit by a number with up to 4 digits
- Use short multiplication to multiply a 1-digit number by a number with one or two decimal places, including amounts of money.
- Multiply fractions and mixed numbers by whole numbers.
- Multiply fractions by proper fractions.
- Use percentages for comparison and calculate simple percentages.
- Estimate answers using rounding and approximation

Long Multiplication

$$\begin{array}{r} 327 \\ \times 53 \\ \hline 981 \\ 16350 \\ \hline 17331 \end{array}$$

← 327×3
← 327×50

Make sure children are aware that they need to multiply by the tens, then add the two products

Use this method for money and measures.

To apply these strategies in a range of different contexts.

Remind children that the single digit belongs in the units column

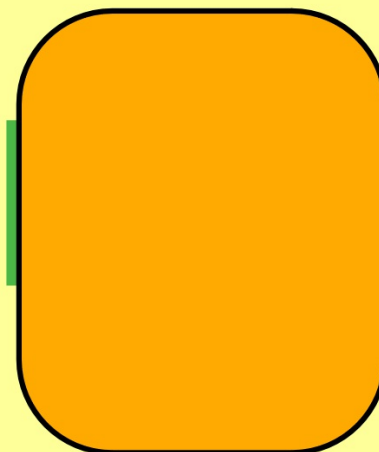
$$\begin{array}{r} 3.19 \\ \times 8 \\ \hline 25.52 \end{array}$$

Line up the decimal points in the question and the answer

Children should:

- Use rounding and place value to make approximations before calculating and use these to check validity of answers
- Use **short multiplication** (see Y5) to multiply numbers with more than 4 digits by a single digit; to multiply money and measures; and to multiply decimals up to 2 decimal places by a single digit
- Use **long multiplication** (see Y5) to multiply numbers with at least 4 digits by a 2-digit number

Becky keeps tropical fish.
She has 9 large tanks.
In each tank there are 27 fish.
She decides to buy 3 shrimps for each tank.
How many fish and shrimps does Becky have in total?



Year 3 Divide 2-digit numbers by a single digit

Grouping on a number line first without, then with remainders

Key vocabulary share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, **inverse, short division, 'carry', remainder, multiple**

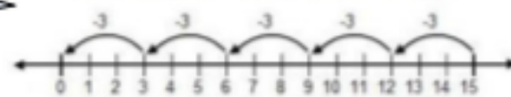
Key Skills for division at Year 3

- Recall and use division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables
- Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one digit
- Solve problems, in contexts, and including missing number problems, involving division.
- Pupils develop efficient mental methods, for example, using division facts (e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts ($30 \times 2 = 60$, so $60 \div 3 = 20$ and $20 = 60 \div 3$).
- Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers using a ENL.
- Halve even numbers up to 50 and multiples of ten to 100
- Perform divisions within the tables including those with remainders, e.g. $38 \div 5$.

Repeated subtraction first on a number line then move to an empty number line

Repeated Subtraction

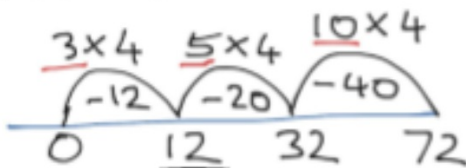
$15 \div 3 = 5$ is the number of times you can subtract 3 from 15 before you get to 0.



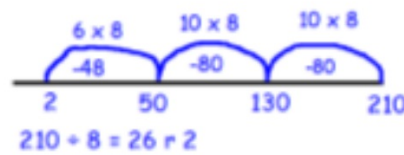
$$15 - 3 - 3 - 3 - 3 - 3 = 0$$

$$15 \div 3 = 5$$

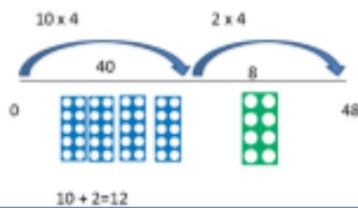
$$72 \div 4 = 18$$



Chunking on an empty number line using known multiplication facts helps children work quickly through harder more complex division.



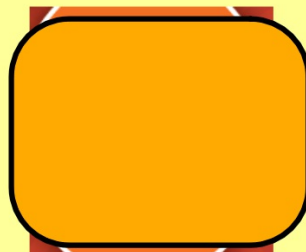
With remainders as chunking, the amount left over is the remainder.



Model first using **Dienes**, then using **bead bar** to show link to ENL

By the pool, there
are 24 sunbeds.
The lifeguard stacks the
sunbeds in piles of three.

How many stacks of
3 can he make?



Year 4 Divide up to 3-digit numbers by a single digit.

Key vocabulary share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, **divisible by, factor**

Key Skills for division at Year 4

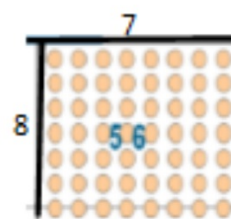
- Use a written method to divide a 2-digit or a 3-digit number by a single-digit number.
- Give remainders as whole numbers.
- Recall multiplication and division facts for all numbers up to 12×12 .
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
- Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example $200 \times 3 = 600$ so $600 \div 3 = 200$
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Short division: Limit numbers to NO remainders in the answer OR carried (each digit must be a multiple of the divisor).

$$\begin{array}{r} 32 \\ 3 \overline{)96} \end{array}$$

Remind children of correct place value, that 96 is equal to 90 and 6. Use Dienes to demonstrate.

Once children are secure with division as grouping, demonstrate this using number lines, arrays etc., short division for larger 2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. Start by introducing the layout of short division by comparing it to an array.



Example without remainder:

$$81 \div 3$$

81 is partitioned into multiples of 3 which are then each divided by 3

$$\begin{array}{r} 10 + 10 + 7 \\ 3 \overline{)30 + 30 + 21} \end{array}$$

Over time, this is refined so that the dividend is partitioned into the highest multiple of the divisor that is also a multiple of 10, plus any remaining ones

$$\begin{array}{r} 20 + 7 \\ 3 \overline{)60 + 21} \end{array}$$

Model this expanded division using denes

Example with remainder:

Move to short division with remainders, modeling process as expanded division first as seen above.

$$\begin{array}{r} 27 \\ 3 \overline{)81} \end{array}$$

$$\begin{array}{r} 47r2 \\ 6 \overline{)284} \end{array}$$

A class of 36 children are travelling to an 'outdoor' pursuit centre together. They travel by mini bus. Each mini bus will hold 8 passengers. How many mini buses are needed to transport the children? How many spare seats will there be?



Year 5 Divide up to 4 digits by a single digit

< or = to 12, including answers with remainders.

Key vocabulary share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor **quotient, prime number, prime factors, composite number (non-prime)**

Key Skills for division at Year 5

- Recall multiplication and division facts for all numbers up to 12×12 (as in Y4).
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two number.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime, and recall prime numbers to 19
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- Use multiplication and division as inverses. Interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding

$$\begin{array}{r} 0663 \text{ r } 5 \\ 8 \overline{) 53029} \end{array}$$

The answer could be expressed as 663 remainder 5 or 663 and $\frac{5}{8}$ or as a decimal.

Once children's understanding of this method is secure they might shorten their dialogue to:

"How many 6s in 28?"

"4 remainder 4"

"How many 6s in 44?"

Division should be given in a real life context, including using money and measures, so that pupils know to round the answer up or down.

Answers could also be given as remainders, decimals or fractions.

$$\begin{array}{r} 47 \text{ r } 2 \\ 6 \overline{) 284} \end{array}$$

BUT ensure children have a secure understanding of what they are doing and are able to use their knowledge of related facts to either make a rough estimate first or have an idea about whether their final answer is reasonable or not.

Year 6 Divide at least 4-digit numbers by single and 2-digit numbers (including decimals).

Key vocabulary share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor quotient, prime number, prime factors, composite number (non-prime) **common factor**

Key Skills for division at Year 6

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Short division (for dividing by a single digit including decimals)

$$\begin{array}{r} 0812.125 \\ 8 \overline{) 6497.000} \end{array}$$

Children should continue to use short division with remainders. They need to learn how to express an answer as a remainder, a fraction or as a decimal as in this example.

It is important for children to start from real life problem solving contexts and for them to consider how best to express their answer.

Long division by **chunking** for dividing by 2 digits

Useful list:

$1x = 36$

$10x = 360$

$100x = 3600$

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ - 720 \\ \hline 252 \\ - 252 \\ \hline 0 \end{array}$$

Answer :

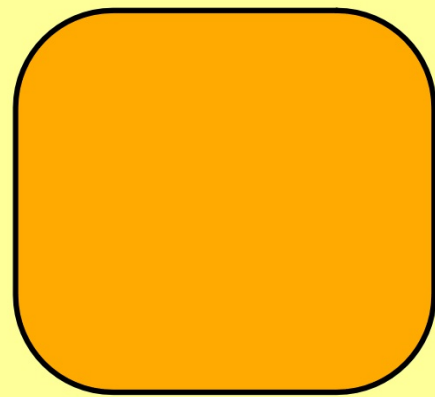
27

Find out 'How many 36s are in 972?' by subtracting 'chunks' of 36, until zero is reached (or until there is a remainder).

Teach pupils to write a 'useful list' first at the side that will help them decide what chunks to use.

Introduce the method in a simple way by limiting the choice of chunks to 'Can we use 10 lots? Can use 100 lots?' As children become confident with the process, encourage more efficient chunks to get to the answer more quickly (e.g. 20x, 5x), and expand on their 'useful' lists.

Rhys decided to climb Mount Everest which is 29,035 feet high. He accomplished this in 25 days. To the nearest foot, how many feet did he climb per day?



Please take a copy of the calculation booklet and the slides we used today.

