

Calculation Policy



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National Curriculum 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 develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- * **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.

Maths Number

30-50 Months:

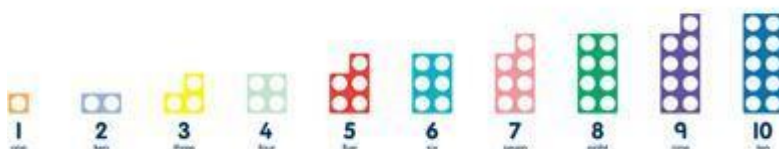
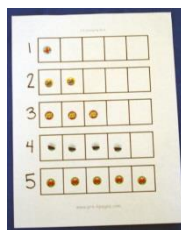
- * Use some number names and number language spontaneously.
- * Recites numbers in order to 10.
- * Knows that numbers identify how many objects are in a set.
- * Beginning to represent numbers using fingers, marks on paper or pictures.
- * Sometimes matches numeral and quantity correctly.
- * Shows curiosity about numbers by offering comments or asking questions.
- * Compares two groups of objects, saying when they have the same number.
- * Shows an interest in number problem.
- * Separates a group of three or four objects in different ways, beginning to recognise that the total is still the same.
- * Shows an interest in numerals in the environment.
- * Shows an interest in representing numbers.
- * Realises not only objects, but anything can be counted, including steps, claps, jumps.

40-60 Months:

- * Recognise some numerals of personal significance.
- * Recognises numerals 1-5.
- * Counts up to three or four objects by saying one number name after them.
- * Counts actions or objects which cannot be moved.
- * Counts objects to 10 and beginning to count beyond 10.
- * Counts out up to six objects from a larger group.
- * Selects the correct numeral to represent 1 to 5, then 1 to 10 objects.
- * Counts an irregular arrangement of up to 10 objects.
- * Estimates how many objects they can see and checks by counting them.
- * Uses the language of 'more' or 'fewer' to compare two sets of objects.
- * Finds the total number of items in two groups by counting all of them.
- * Says the number that is one more than a given number.
- * Finds one more or one less from a group of up to five objects and then ten objects.
- * In practical activities and discussion, begin to use

Maths Number

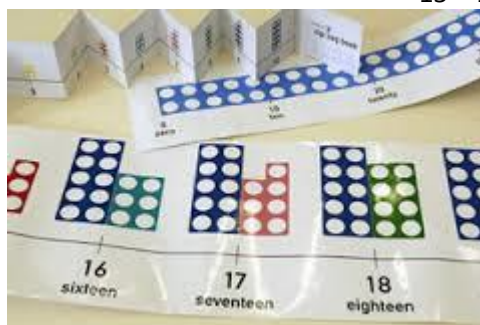
Counting and Place Value: 1:1 Correspondence



Teens Numbers: 10s and units: $13 = 10 + 3$

$$14 = 10 + 4$$

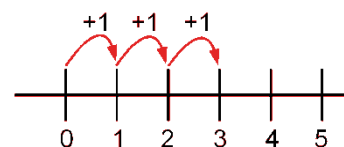
$$15 = 10 + 5$$



Ordinal Numbers:



Addition: Addition with physical objects, moving to Numberline – one MORE.



the vocabulary involved in adding and subtracting.

*Records, using marks they can interpret and explain.

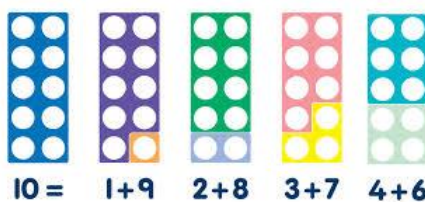
*Begins to identify own mathematical problems based on own interests and fascinations.

Early Learning Goals:

Children count reliably with numbers from one to 20, place them in order and say which number in one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.

Numberbonds to 10, including Missing Number calculations.

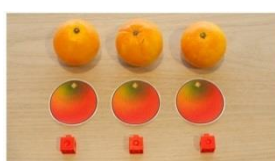
$$10 = 9 + ? \quad 8 + ? = 10$$



Subtraction: Take away with physical objects, scoring and counting back.

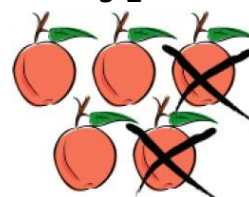
Using Physical Objects:

$$3 - 2 =$$

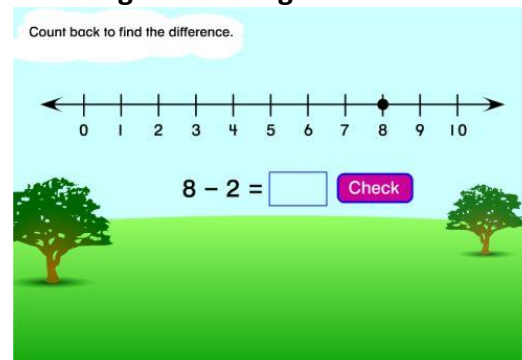


Scoring:

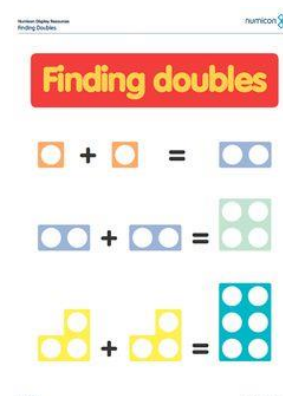
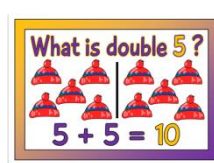
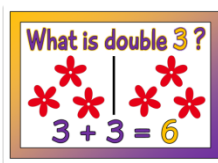
$$5 - 2 =$$



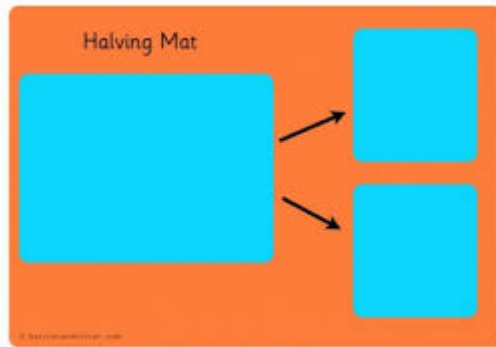
Counting Back: Using a structured Numberline – One LESS



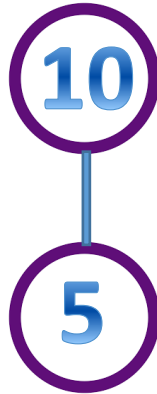
Multiplication: Doubling: Same amount again.



Division and Fractions: Halving and sharing.
Halving as TWO EQUAL groups.



Halving: Bubble Method:



Sharing physically into groups. $6 \div 3 = 2$



Problem Solving:

3 bears are going for a picnic. How many plates do they need?
How many pieces of cutlery will they need? If they each have 2 sandwiches, how many sandwiches do they need to make? If I buy 9 biscuits and share them equally, how many biscuits do the bears end up with?



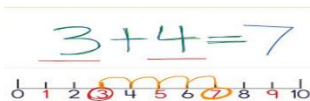
Addition

Pupils should be taught to:

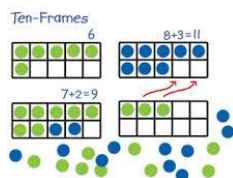
- * read, write and interpret mathematical statements involving addition (+) and equals (=) signs
- * represent and use number bonds within 20 and number bonds to 100, 10+90, 20+80.
- * add one-digit and two-digit numbers to 20, including zero
- * solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems such as $7 = 4 + ?$
- * Problems should include the terms: put together, add, altogether, total, more than, so that pupils develop the concept of addition and are enabled to use these operations flexibly.

Addition

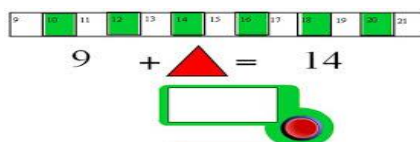
Numberlines: Knowing addition can be done in any order.



Ten Frames, for crossing 10s boundary.

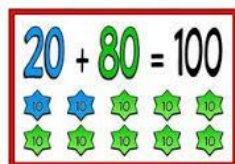


Missing number calculations:

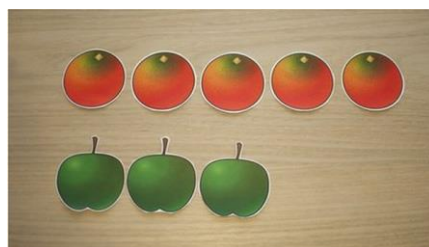


Number bonds to 20 and 100:

Using knowledge of Number bonds to 10.



Bar Model: Problem Solving:



Use of physical objects + pictures. Problem: I have 5 oranges and 3 apples. (Line them up in a line) How many pieces of fruit have I got altogether?

Subtraction

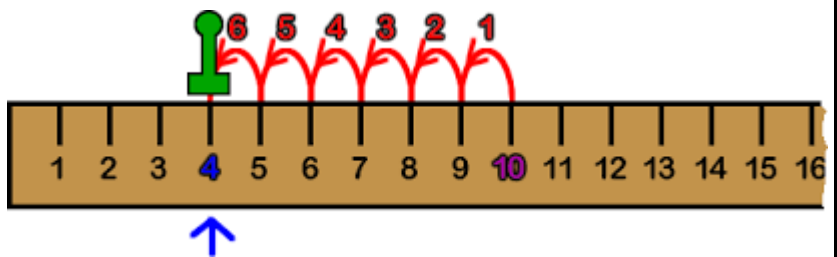
Pupils should be taught to:

- * read, write and interpret mathematical statements involving subtraction (−) and equals (=) signs
- * represent and use number bonds and related subtraction facts within 20 and number bonds to 100, 100-90, 100-80.
- * subtract one-digit and two-digit numbers to 20, including zero eg: $18 - 9$
- * solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = ? - 9$.

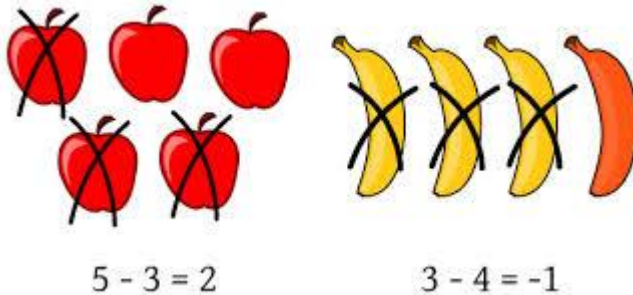
* They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms: take away, distance between, and less than, so that pupils develop the concept of subtraction and are enabled to use this operation flexibly.

Subtraction

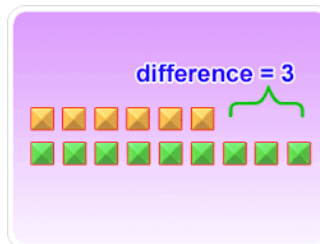
Numberlines: Concept of subtraction resulting in less. $10 - 6 = 4$



Subtraction using concrete objects:



Difference + Bar model Problem Solving:



Problem; I have 9 apples I eat and 6 apples. (Line them up in a line)
How many pieces of fruit have I got left?

Subtraction using base-ten equipment:

$$34 - 9 =$$

Think:
I have 3 tens and 4 ones. I want to take away 9 ones.

Workmat	
Tens	Ones

Think:
I need more ones. I will regroup 1 ten as 10 ones.

Workmat	
Tens	Ones

Think:
I now have 2 tens and 14 ones so I can take away 9 ones, leaving 2 tens and 5 ones.

Workmat	
Tens	Ones

2 tens 5 ones = 25

Multiplication

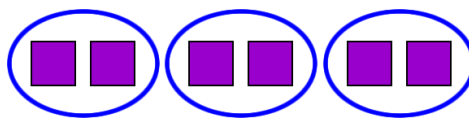
Pupils should be taught to:

- * count in multiples of twos, fives and tens
- * double and halve numbers to 20 e.g. double 3 is 6, half of 10 is 5
- * They make connections between arrays and number patterns
- * solve simple one-step problems involving multiplication calculating the answer using concrete objects, pictorial representations and arrays e.g. 8 children have 2 sweets each, how many in total?

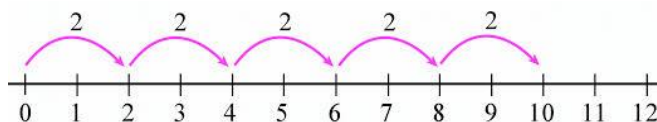
Multiplication

Multiplication:

$$2 \times 3 = 2 + 2 + 2 = 6$$



Multiplication on Numberlines:

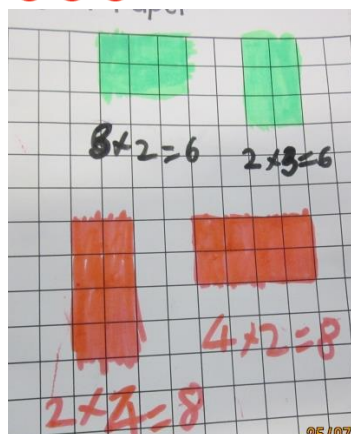


Arrays:

$$6 \times 3 = 18 \text{ (across first)}$$

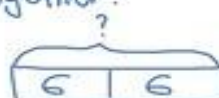


$$3 \times 6 = 18 \text{ (across first)}$$



Bar Model: Multiplication:

There are 2 baskets of apples. Each basket has 6 apples. How many apples are there altogether?



$$2 \times 6 = 12$$

Division

Pupils should be taught to:

- * solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- * double and halve numbers to 20
e.g. double 8 is 16, half of 20 is 10
- * They make connections between arrays, number patterns, and counting backwards in twos, fives and tens.

Division

Division by sharing:

12 is divided into 3 groups
= 4 in each group OR

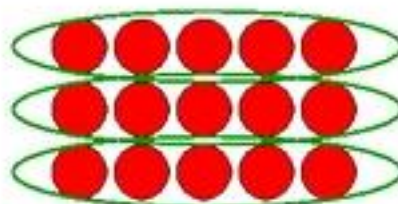


3 groups with 4 in each
= 12 altogether.

Division using Arrays:

$$15 \div 3 = 5$$

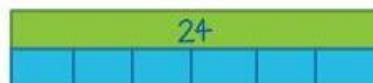
Number of counters Number of rows Number in each row



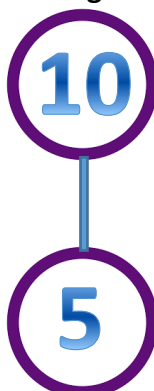
Bar Model: Division:

Courtney baked 24 cookies to share with her friends. If she shares her cookies with 6 friends, how many cookies would each friend get?

C = amount of cookies for each friend



Halving: Bubble Method:



Fractions

Pupils should be taught to:

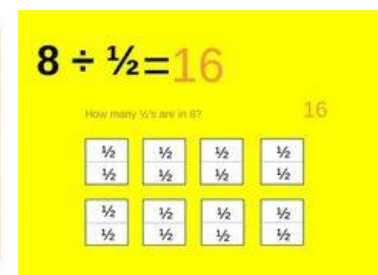
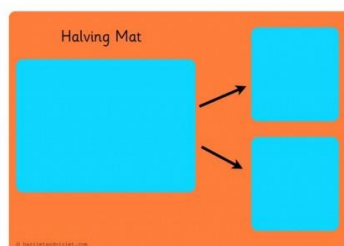
- * recognise, find and name a half as one of two equal parts of an object, shape or quantity
- * recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.

Fractions

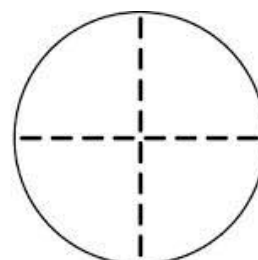
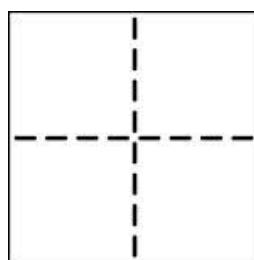
Halving and quartering: Bubble Method:



Halving Mat: For use with concrete objects:



Quartering: Use of circles/squares + quantities:



Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

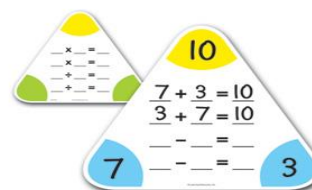
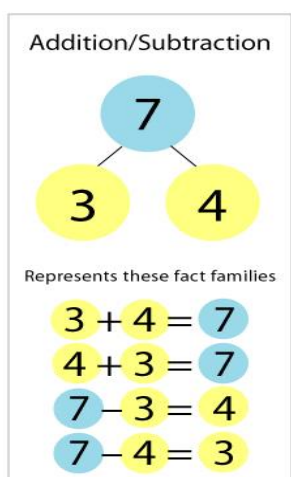
- * count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number
- * count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
- * given a number, identify one more and one less
- * identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least
- * read and write numbers from 1 to 20 in numerals and words.
- * practise counting (1, 2, 3...), ordering (for example, first, second, third...), and to indicate a quantity (for example, 3 apples, 2 centimetres), including solving simple concrete problems, until they are fluent.
- * recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by objects and pictorial representations.
- * practise counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system

Number and Place Value: Oral and Mental Starters + Counting sessions.

Place Value: Representing Numbers pictorially using dienes, place value counters, Numicon.



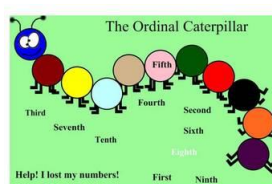
Partitioning Numbers in different ways:



Counting:

1	2	3	4	5	6	7	8	9	10	
11	12	13	14	15	16	17	18	19	20	
21	22	23	24	25	26	27	28	29	30	
31	32	33	34	35	36	37	38	39	40	
41	42	43	44	45	46	47	48	49	50	
51	52	53	54	55	56	57	58	59	60	
61	62	63	64	65	66	67	68	69	70	
71	72	73	74	75	76	77	78	79	80	
81	82	83	84	85	86	87	88	89	90	CLEAR
91	92	93	94	95	96	97	98	99	100	PRINT
										MAIN

Ordinal Numbers:



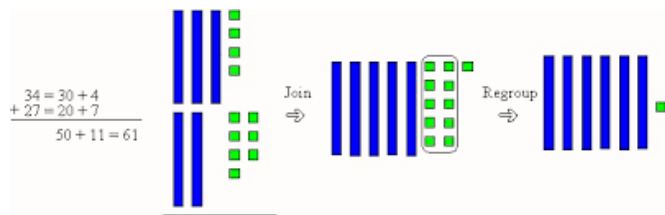
Addition

Pupils should be taught to:

- * solve problems with addition using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- * apply their increasing knowledge of mental and written methods
- * recall and use addition facts to 20 fluently, and derive and use related facts up to 100
- * add numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens
 - two two-digit numbers
- adding three one-digit numbers e.g. $6 + 7 + 4$
- * show that addition of two numbers can be done in any order (commutative)
- * recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- * Pupils extend their understanding of the language of addition to include: sum
- * Record addition in expanded columns supports place value and prepares for formal written methods with larger numbers

Addition

Addition with Base-Ten + Regrouping:

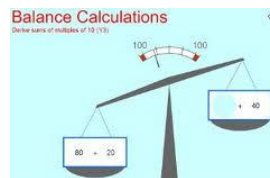


Expanded Columns:

$$\begin{array}{r} 37 + 52 = 89 \\ 30 + 7 + \\ 50 + 2 + \\ \hline 80 + 9 = 89 \end{array}$$

Equals signs and missing numbers :

$$14 + 5 = 10 + \square$$

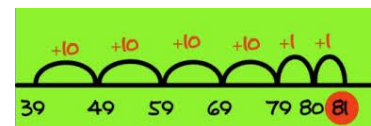
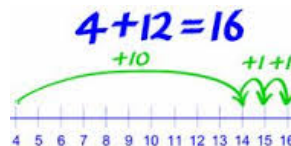


Adding three numbers :

$$32 + \square + \square = 100$$

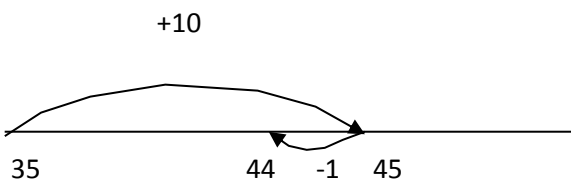
$$35 = 1 + \square + 5$$

Numberlines:

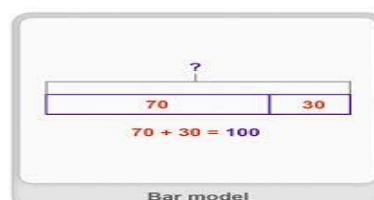


Add 9 or 11 by adding 10 and adjusting by 1

$$35 + 9 = 44$$



Bar Model: Problem Solving: 70 children attend a Dance workshop from Brandon and 30 from Thetford. How many children attend altogether?



Subtraction

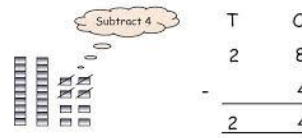
Pupils should be taught to:

- * solve problems with subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- * applying their increasing knowledge of mental and written methods
- * recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100
- * subtract numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens $87 - 30 = 57$
 - two two-digit numbers
 - subtracting three one-digit numbers
- * Understanding subtraction of one number from another cannot be done in any order.
- * recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- * Pupils extend their understanding of the language of subtraction to include sum and difference
- * Record subtraction in expanded columns supports place value and prepares for formal written methods with larger numbers

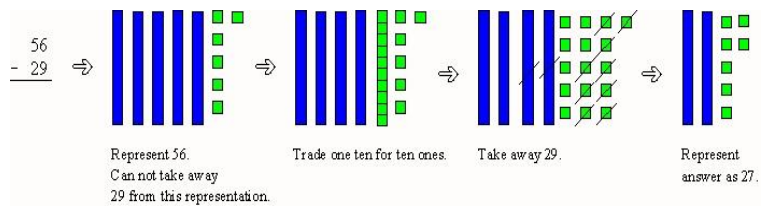
Subtraction

Subtraction with Base-Ten + Regrouping:

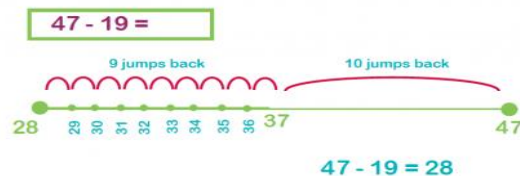
Subtract 4 from 28



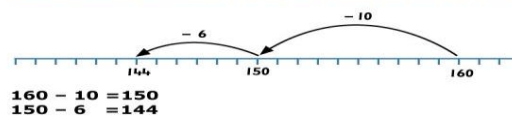
2 Tens 4 Ones are left.



Numberlines: Concept of subtraction resulting in less:



What is $160 - 16$?
Use the number line to carry out the subtraction (count back 10 from 160 to 150 and then 6 to 144).



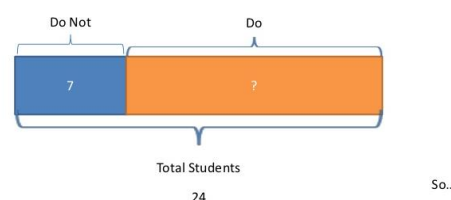
Subtraction: Expanded column: (Without regrouping)

$$47 - 24 = 23$$

$$\begin{array}{r} 40 + 7 \\ - 20 + 4 \\ \hline 20 + 3 \end{array}$$

Difference + Bar model Problem Solving:

There are 24 students in the class. 7 students do not bring in their homework! How many students bring it in?



Multiplication

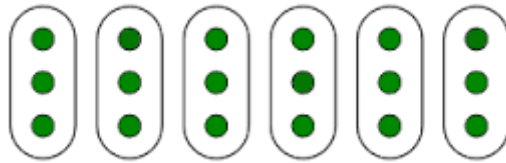
Pupils should be taught to:

- * count in multiples of twos, threes, fives and tens + recite these multiplication tables.
- * calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs
- * show that multiplication of two numbers can be done in any order (commutative) e.g $3 \times 4 = 4 \times 3$
- * solve problems involving multiplication and using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts. E.g. I have 3 bags of apples. Each bag contains 8 apples, how many apples altogether?

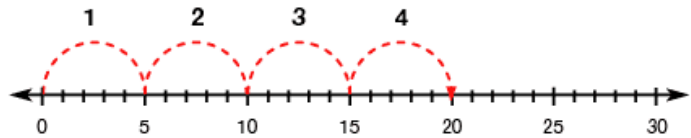
Multiplication

Multiplication:

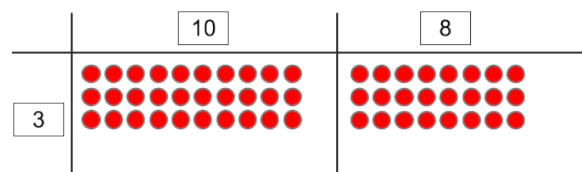
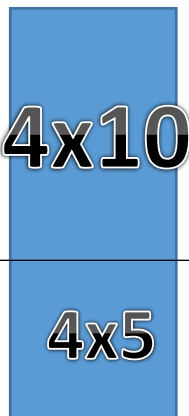
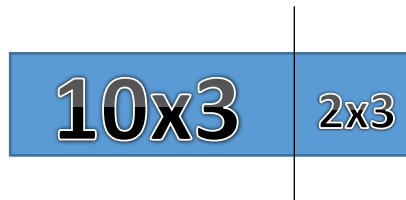
$$3 \times 6 = 3 + 3 + 3 + 3 + 3 + 3 = 18$$



Multiplication on Numberlines:

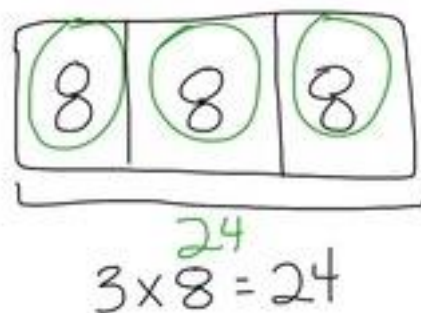


Arrays: $12 \times 3 = 36$



Bar Model: Multiplication:

Doughnuts come in packets of 8. I buy three packets. How many doughnuts do I have?



Division

Pupils should be taught to:

- * recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- * calculate division statements and write them using the division (\div) and equals (=) signs
- * show that division of one number by another is NOT commutative.
- * solve problems involving division, using materials, arrays, repeated subtraction, mental methods, and division facts, including problems in contexts
- * Pupils work with a range of materials and contexts in which division relates to grouping and sharing discrete and continuous quantities. They begin to relate these to fractions and measures (for example, $40 \div 2 = 20$, 20 is a half of 40).
- * They use commutativity and inverse relations to develop multiplicative reasoning (for example, $4 \times 5 = 20$ and $20 \div 5 = 4$)

Division

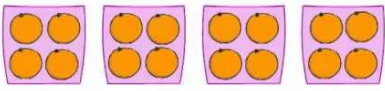
Division by sharing:

DIVISION BY SHARING

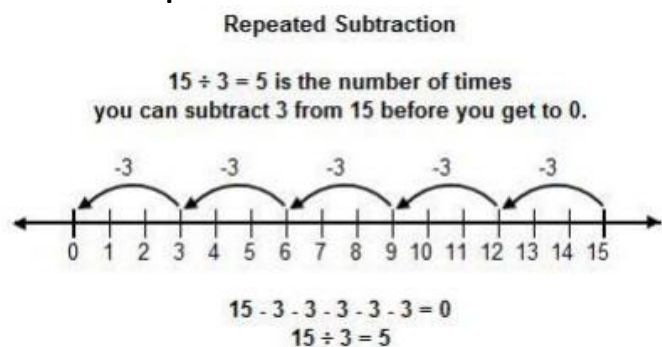
Examples

(a) Divide these 16 oranges equally between 4 families.

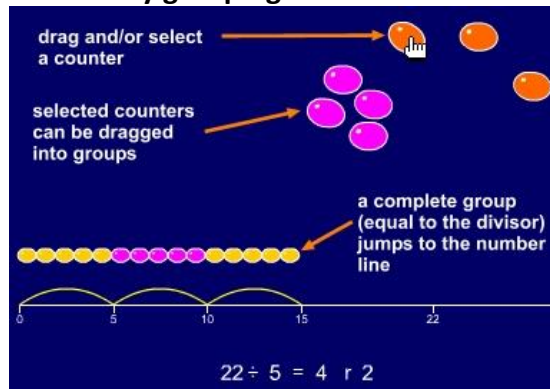
Each family gets 4 oranges.



Division as repeated subtraction:



Division by grouping:



Bar Model: Division:

Amount Per Group Unknown

Pam put the same number of apples in each of 4 bags. She ended up with 52 apples in bags. How many apples did she put in each bag?

52

?	?	?	?
---	---	---	---

Fractions

Pupils should be taught to:

- recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape, set of objects or quantity
- write simple fractions for example, $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$.

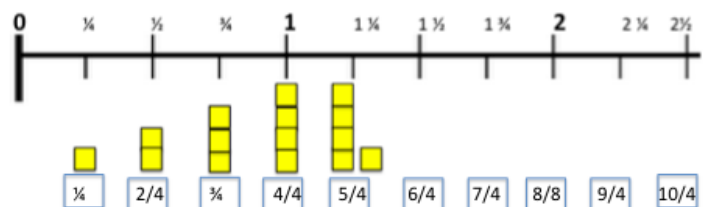
Fractions

Halving and quartering: Bubble Method:



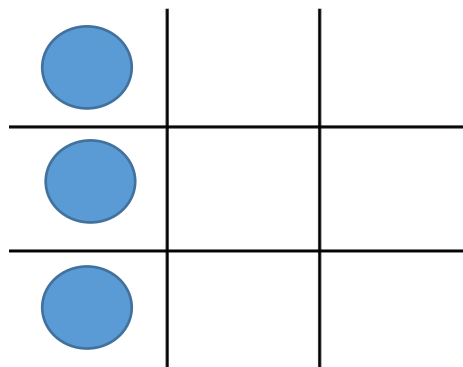
Using the above method, which is halving and quartering, the children should then be taught to find $\frac{2}{4}$ by looking at $\frac{1}{4}$ (in this case 5) and multiplying that by 2, giving $\frac{2}{4}$ which would be 10.

Fractions on Numberlines:



The importance here is recognising that $\frac{6}{4}$ is the same as 1 and $\frac{1}{2}$.

Th thirds:



Important to represent thirds as something being divided into 3 equal pieces but ALSO that it is One OUT OF every three.

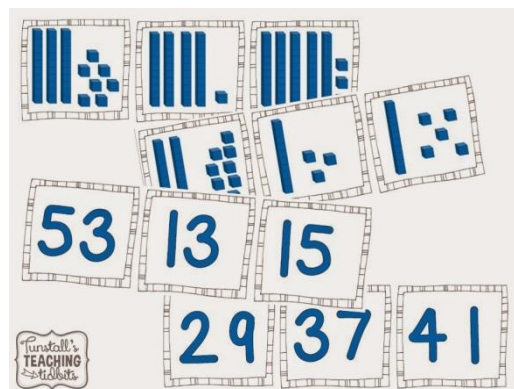
Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

- * count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward
- * recognise the place value of each digit in a two-digit number (tens, ones)
- * identify, represent and estimate numbers using different representations, including the number line
- * compare and order numbers from 0 up to 100; use <, > and = signs
- * read and write numbers to at least 100 in numerals and in words
- * use place value and number facts to solve problems.
- * count in multiples of three to support their later understanding of a third.
- * partition numbers in different ways (for example, $23 = 20 + 3$ and $23 = 10 + 13$) to support subtraction.

Number and Place Value: Oral and Mental Starters + Counting sessions.

Place Value: Representing Numbers pictorially using dienes, place value counters, Numicon.

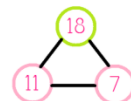
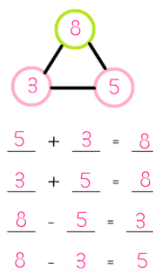


Partitioning of Numbers, different ways for the same number:

$$\begin{aligned} 23 &= 20+3 \\ &= 10 + 13 \\ &= 5+5+13 \end{aligned}$$

Solving problems using Number Facts:

Number Bonds
also known as
Fact Families



Counting in 3s:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

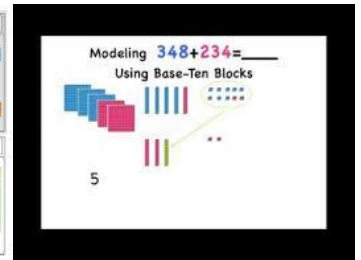
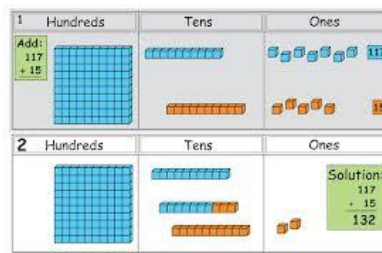
Addition

Pupils should be taught to:

- * add numbers mentally, including:
two-digit numbers, where answers could exceed 100 e.g. $63 + 59$
a three-digit number and ones
a three-digit number and tens
a three-digit number and hundreds
- * add numbers with up to three digits, using formal written methods of (expanded) columnar
- * estimate the answer to a calculation and use inverse operations to check answers
- * solve problems, including missing number problems, using number facts, place value, and more complex addition

Addition

Addition with Base-Ten + Regrouping:



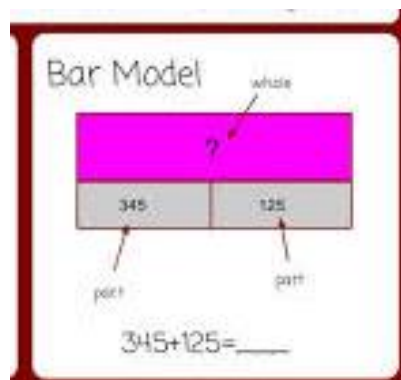
Expanded Columns:

$$\begin{array}{r} 374 = 300 + 70 + 4 \\ + 268 = 200 + 60 + 8 \\ \hline 500 + 130 + 12 \\ \quad \swarrow \quad \searrow \\ \quad 630 \quad 12 \\ \quad \quad \swarrow \quad \searrow \\ \quad \quad 642 \end{array}$$

Equals signs and missing numbers :



Bar Model: Problem Solving:



345 children from Forest School attend a Sports Festival. 125 from schools in Mildenhall attend. How many people attend altogether?

Subtraction

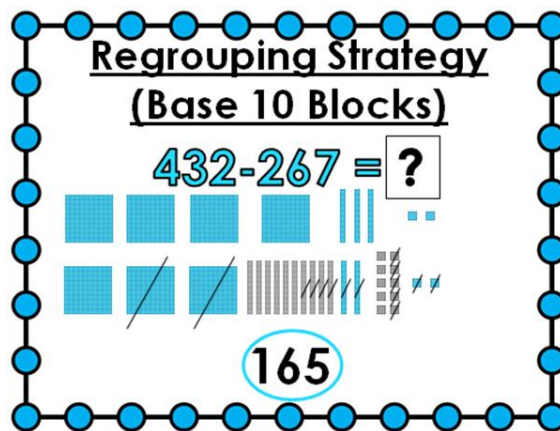
Pupils should be taught to:

- * subtract numbers mentally, including:
a three-digit number and ones
a three-digit number and tens
a three-digit number and hundreds *eg.* $858 - 300$
- * subtract numbers with up to three digits, using formal written methods of expanded columnar subtraction
- * estimate the answer to a calculation and use inverse operations to check answers
e.g. $702 - 249$ is approximately $700 - 250 = 450$
- * solve problems, including missing number problems, using number facts, place value, and more complex and subtraction.

Subtraction

Subtraction with Base-Ten + Regrouping:

Loads of regrouping practice needed.



Subtraction: Expanded column: (With regrouping)

$76 - 29 =$ (Have children do this practically with counters and dienes materials) This is how they would record to give an answer of 47.

$$\begin{array}{r} 60 \\ - 20 \\ \hline 40 \end{array} \quad \begin{array}{r} 16 \\ - 9 \\ \hline 7 \end{array} \quad +$$

Difference + Bar model Problem Solving:



An oven cost £860 pounds. The washing machine was £135 pounds less. How much was the washing machine?

Missing Number and inversion Problems:

2. A pet store had 75 goldfish in a tank. The store sold some goldfish, leaving 43 goldfish in the tank. How many goldfish did the pet store sell?



$75 - ? = 43$ solved by $75 - 43 = 32$

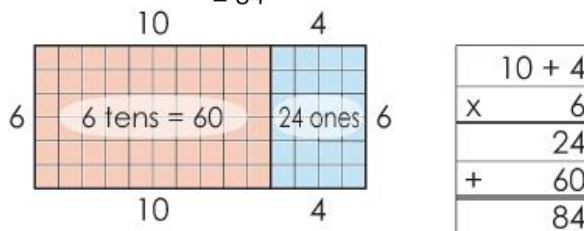
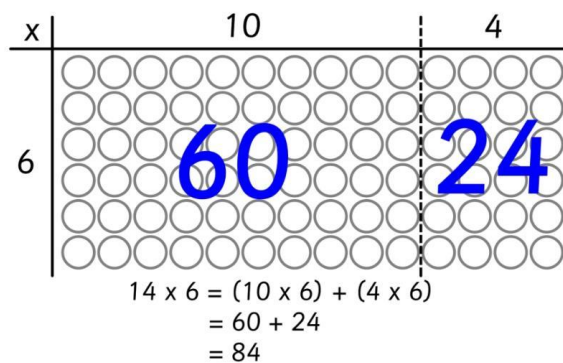
Multiplication

Pupils should be taught to:

- * count from 0 in multiples of 4, 8, 50 and 100.
- * recall and use multiplication facts for the 3, 4 and 8 multiplication tables. Through doubling, they connect the 2, 4 and 8 multiplication tables.
- * write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (grid)
- * using commutativity and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$)
- * solve problems, including missing number problems, involving multiplication and including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Multiplication

Multiplication arrays – towards grid method.



Lots of work here on place value. If we know $3 \times 7 = 21$, we know $3 \times 70 = 210$ and $30 \times 7 = 210$.

x	30	5
7	210	35

$210 + 35 = 245$

Commutativity:

Fact Family Street

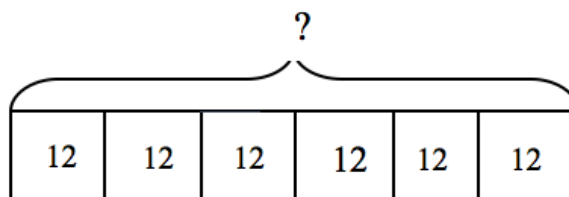
Use multiplication and division to fill in the fact family living in each house.

a. 72
 $9 \times 8 = 72$
 $8 \times 9 = 72$
 $72 \div 9 = 8$
 $72 \div 8 = 9$

b. 28
 $7 \times 4 = 28$
 $4 \times 7 = 28$
 $28 \div 7 = 4$
 $28 \div 4 = 7$

c. 30
 $6 \times 5 = 30$
 $5 \times 6 = 30$
 $30 \div 6 = 5$
 $30 \div 5 = 6$

Bar Model: Multiplication:



At the shop I buy 6 packets of doughnuts. Inside each packet is 12 doughnuts. How many do I have altogether?
 Draw a Bar Model to represent this.

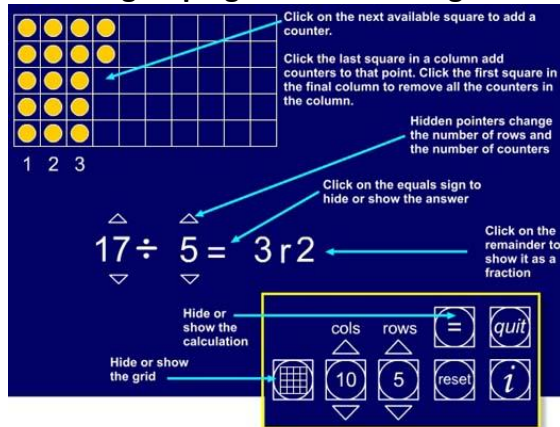
Division

Pupils should be taught to:

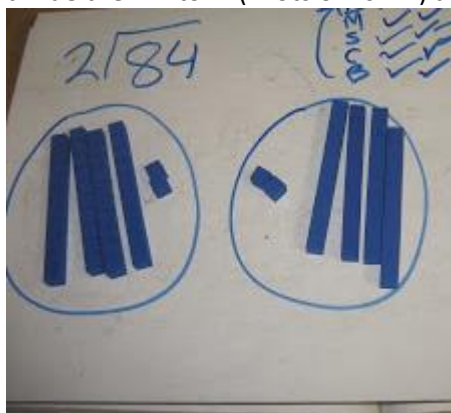
- * recall and use division facts for the 3, 4 and 8 multiplication tables
- * write and calculate mathematical statements for division using the multiplication tables that they know, using efficient mental methods eg using $12 \times 4 = 48$, $4 \times 12 = 48$, $12 \times 5 = 60$, $4 \times 5 = 20$, $20 \times 12 = 240$ and multiplication and division facts e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$ to derive related facts $30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$ and progressing to formal written methods.
- * solve problems, including missing number problems, involving division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Division

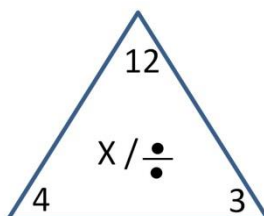
Division grouping – understanding of written method:



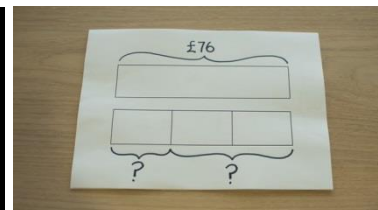
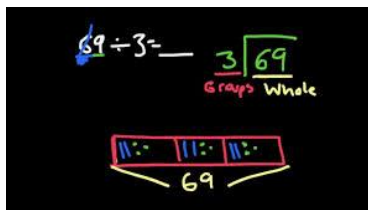
First: Have children make 80 with dienes – and divide them into 2 (making 4 lots of 10s. $4 \times 10 = 40$) now collect 4 ones/units and divide them into 2. (2 lots of $1s = 2$) answering 42.



Division Facts:



Bar Model: Division:



I have saved £69.00 for 3 games. The games are the same price. How much did each game cost?

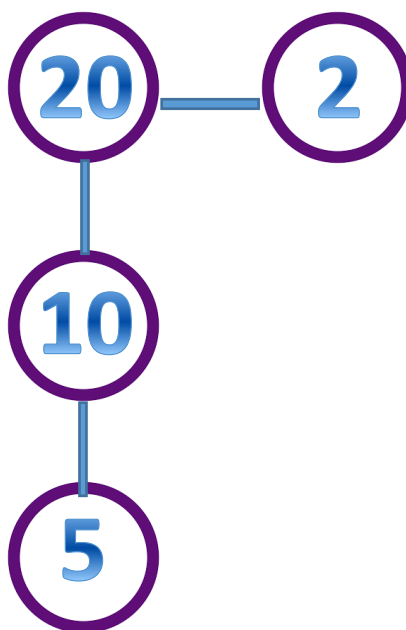
Fractions

Pupils should be taught to:

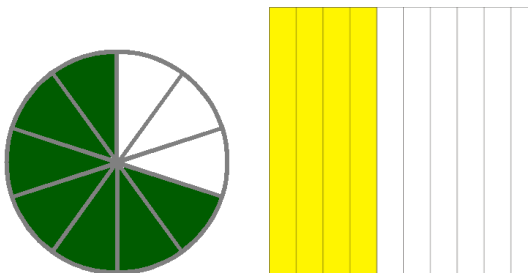
- * count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
- * recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
- * recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- * recognise and show, using diagrams, equivalent fractions with small denominators
- * add and subtract fractions with the same denominator within one whole (for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$)
- * compare and order unit fractions, and fractions with the same denominators.
- * solve problems that involve all of the above.

Fractions

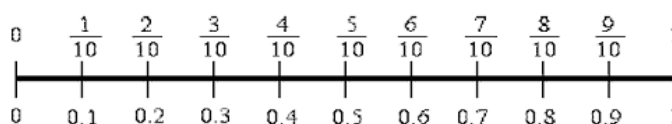
Tenths: Bubble Method & Visual Representation:



Division of the whole number 20 by 10 makes 10 EQUAL parts, giving 2. $\frac{1}{10}$ th of 20 is 2.

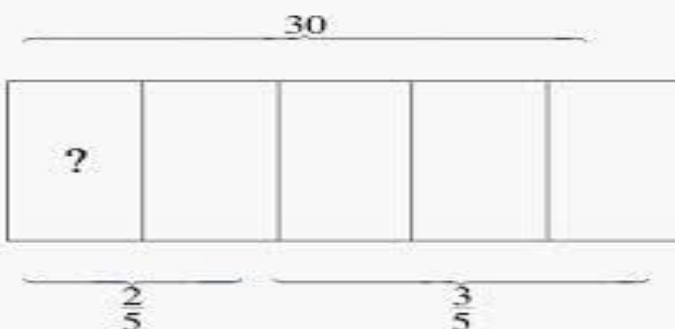


Fractions on Numberlines:



Bar Model Fractions Problems:

$\frac{2}{5}$ of the 30 singers in the choir are boys
How many boys are in the choir?
How many girls are in the choir?



Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

- * count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- * recognise the place value of each digit in a three-digit number (hundreds, tens, ones)
- * compare and order numbers up to 1000
- * identify, represent and estimate numbers using different representations
- * read and write numbers up to 1000 in numerals and in words
- * solve number problems and practical problems involving these ideas.
- * use multiples of 2, 3, 4, 5, 8, 10, 50 and 100.
- * use larger numbers to at least 1000, applying partitioning related to place value using varied and increasingly complex problems, building on work in year 2 (for example, $146 = 100 + 40$ and $6, 146 = 130 + 16$).

Number and Place Value: Oral and Mental Starters + Counting sessions.

Place Value: Representing Numbers pictorially using dienes, place value counters, Numicon.

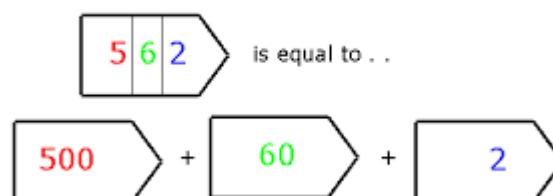
hundreds	tens	ones
2 200	4 40	7 7



Partitioning of Numbers, different ways for the same number:

47	83	61
$40 + 7 = 47$	$80 + 3 = 83$	$60 + 1 = 61$
$30 + 17 = 47$	$70 + 13 = 83$	$50 + 11 = 61$
$20 + 27 = 47$	$60 + 23 = 83$	$40 + 21 = 61$
$10 + 37 = 47$	$50 + 33 = 83$	$30 + 31 = 61$
$0 + 47 = 47$	$40 + 43 = 83$	$20 + 41 = 61$
	$30 + 53 = 83$	$10 + 51 = 61$
	$20 + 63 = 83$	$0 + 61 = 61$
	$10 + 73 = 83$	
	$0 + 83 = 83$	

I know how to partition numbers. Look!

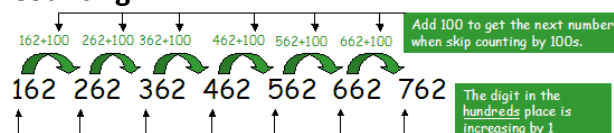


But also: $500 + 50 + 12 = 562$

$500 + 40 + 22 = 562$

$500 + 30 + 32 = 562$

Counting:



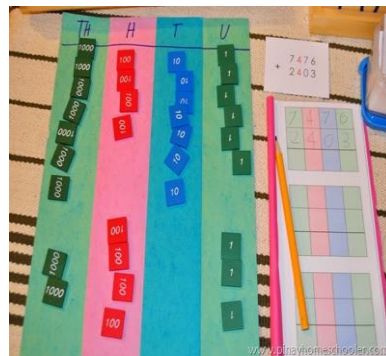
Addition

Pupils should be taught to:

- * add numbers with **up to 4 digits** using the formal written methods of columnar addition (expanded)
- * estimate and use inverse operations to check answers to a calculation eg: estimate $8203 + 499 = 8200 + 500 = 8700$. Check: 8702
- * solve addition two-step problems in contexts, deciding which operations and methods to use and why.

Addition

Addition with Base-Ten + Regrouping:



Addition

Find the sum of 5713 and 2864.

Th	H	T	U
5	7	1	3
+	2	8	6
			7

↓

15 hundreds = 1 thousand 5 hundreds

Th	H	T	U
8	5	9	9

5713 + 2864 = 8577

The sum of 5713 and 2864 is 8577.

Expanded Columns:

column addition (stretched)

	H	T	U
	2	5	2
+	4	7	6
			8 (2+6) Units
	1	2	0 (5+7+0) Tens
	6	0	0 (200+400) hundreds
	7	2	8

(shortened)

	2	5	2
+	4	7	6
	7	2	8

① ← 100 from 50+70+120

Column addition: With correct placement of digits:

	Number of hundreds			
	Number of tens			
	Number of ones			
876				
+	2	0	5	
	1	0	8	1

Th	H	T	U
7	9	4	8
1	2	2	3
9	1	7	1
1		1	

16.4	
+	31.3
	47.7

25.5	
+	35.5
	61.0

Equals signs and missing numbers :

$\square = 20$

$\square + \triangle + \triangle = \square + \square$

What is the value of \triangle ?

Address: Missing digits

Use all the number cards shown in the calculation to make a number LESS than 55.

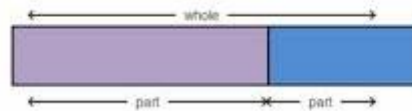
Write the missing digit in the boxes.

5	1	2	7
+			

4	7
+	3 6
1	8
+	4
6	3 9
+	8 1 2
3	0
+	4 3
2	8
+	1
5	2 6
+	6 0 5

Page 1

Bar Model: Problem Solving:



On a shopping trip I spent £398.98 on some clothes and £234.45 on some shoes. How much did I spend overall.

Subtraction

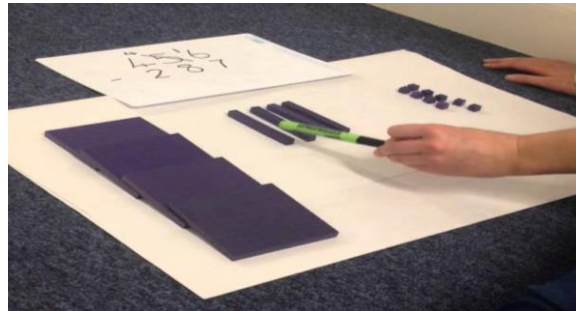
Pupils should be taught to:

- * subtract numbers with **up to 4 digits** using the formal written methods of columnar subtraction (expanded)
- * estimate and use inverse operations to check answers to a calculation eg: estimate e.g. $8702 - 499$ is approximately $9000 - 500 = 8500$;
- * solve subtraction two-step problems in contexts, deciding which operations and methods to use and why.

Subtraction

Subtraction with Base-Ten + Regrouping:

Loads of regrouping practice needed – with apparatus counters/dienes.



Subtraction: Expanded column: (With regrouping)

$$\begin{array}{r} 615 \\ 753 \\ -491 \\ \hline 262 \end{array}$$

Difference + Bar model Problem Solving:

Word Problem
47 students signed up for an acting class. There were 22 fourth grade students and 13 fifth grade students. The rest of the students were in second grade. How many second grade students signed up for the acting class?

Add numbers to your model. Use a ? to show the missing number.

total students

second grade students

fourth grade students

fifth grade students

Check

Feedback
Excellent work! Blocks and labels have been placed correctly. Now you can add numbers to the model.

Menu

22

?

47

13

Tracking Mode

Read The Problem
The sum of two numbers is 146. The bigger number is 88. What is the difference between the two numbers?

Build Your Model

smaller

?

?

88

146 Total

CHECK

Your Math Tutor Says
Your THINKING BLOCKS are in position!

Problem Solving Steps
Step 1. Use the blocks to model the problem.
Step 2. Type the correct numbers in the spaces provided. You will need two question marks (?) to show all the missing information.

Multiplication

Pupils should be taught to:

- *count in multiples of 6, 7, 9, 25 and 1000
- *recall multiplication and division facts for multiplication tables up to 12×12
- *use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers
- *recognise and use factor pairs and commutativity in mental calculations e.g. factor pairs of 20 are 1 and 20, 2 and 10, 4 and 5, multiplication are commutative e.g. $4 \times 6 = 6 \times 4$
- *multiply two-digit and three-digit numbers by a one-digit number using formal written layout (grid method)
- *solve problems involving multiplying using the distributive law including using the distributive law e.g. $34 \times 6 = (30 \times 6) + (4 \times 6)$ to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Multiplication

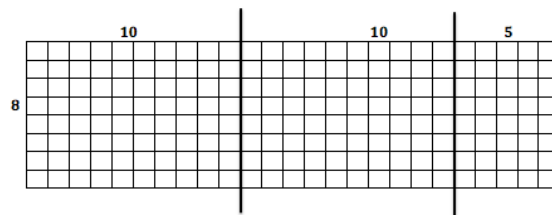
Multiplication arrays – towards grid method

Lots of work here on place value. If we know $3 \times 7 = 21$, we know $3 \times 70 = 210$ and $30 \times 7 = 210$.

×	30	5
7	210	35

$$210 + 35 = 245$$

$$25 \times 8 = 80 + 80 + 40 = 200$$

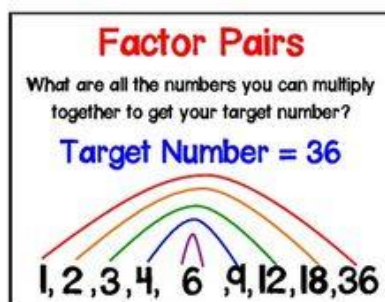


$$8 \times 549 =$$

	500	+	40	+	9
8	$8 \times 500 = 4000$		$8 \times 40 = 320$		$8 \times 9 = 72$

$$8 \times 549 = 8 \times (500 + 40 + 9) = 4000 + 320 + 72 = 4392$$

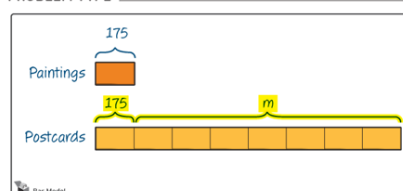
Factor Pairs:



Bar Model: Multiplication:

Dylan sold 175 paintings. He sold 8 times as many postcards. How many more postcards than paintings did he sell?

PROBLEM TYPE *Compare Problem*



$$m = 7 \times 175 = 1225$$

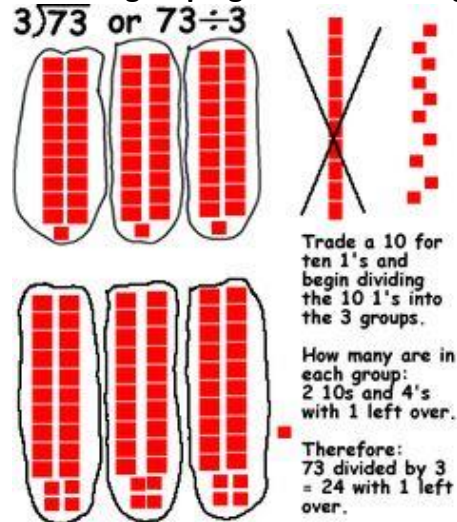
Division

Pupils should be taught to:

- * recall division facts for multiplication tables up to 12×12
- * use place value, known and derived facts to divide mentally, including: dividing by 1;
- * recognise and use factor pairs and commutativity in mental calculations
- * Pupils practise mental methods and extend this to three-digit numbers to derive facts,
(for example $600 \div 3 = 200$ can be derived from $2 \times 3 = 6$).
- * Use efficient written method for division with exact answers when dividing by a one-digit number

Division

Division grouping – understanding of written method:



Division Facts: Learn the patterns.

$600 \div 3 = 200$	$800 \div 2 = 400$
$600 \div 30 = 20$	$800 \div 20 = 40$
$600 \div 300 = 2$	$800 \div 200 = 4$

Bar Model: Division:

Word Problem: Chef Nina had 84 cups of sugar. She used 24 cups of sugar to make muffins and still had enough to make 6 batches of fudge. How many cups of sugar are needed for each batch?

Add numbers to your model. Use a ? to show the missing value.

total amount

amount per batch

amount for muffins

Check

Feedback
Excellent work! Blocks and labels have been placed correctly. Now you can add numbers to the model.

More Than One Operation

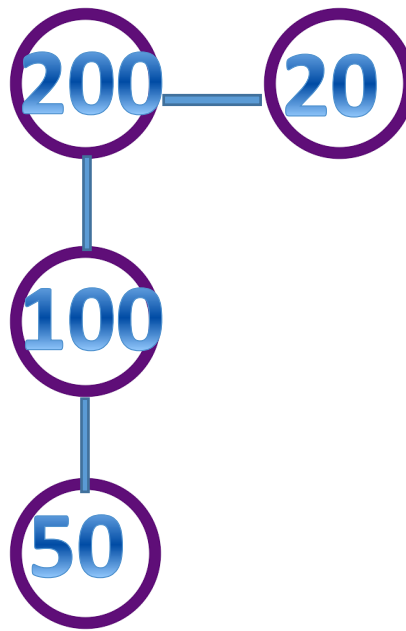
Fractions

Pupils should be taught to:

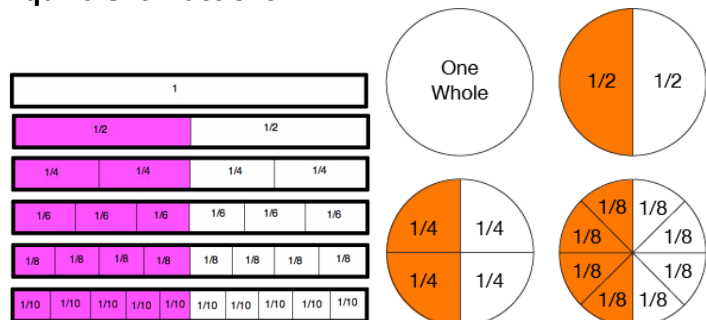
- * recognise and show, using diagrams, families of common equivalent fractions
- * solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
- * add and subtract fractions with the same denominator
- * recognise and write decimal equivalents to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$
- * solve simple measure and money problems involving fractions.
- * extend the use of the number line to connect fractions, numbers and measures
- * practise adding and subtracting fractions with the same denominator, to become fluent through a variety of increasingly complex problems beyond one whole.
- * practise counting using simple fractions both forwards and backwards.

Fractions

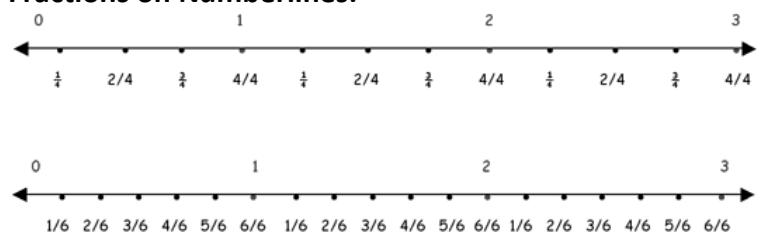
Tenths: Bubble Method & Visual Representation:



Equivalent Fractions:



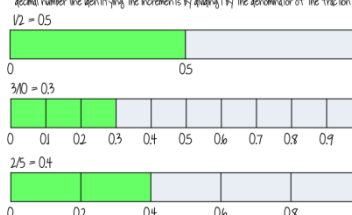
Fractions on Numberlines:



Fractions to decimals:

Fractions to decimals and vice versa

Now students have an understanding of the decimal number line, they can put it onto a bar model to convert between fractions and decimals. Draw the bar model. Fraction first then put on the decimal number line identifying the increments by dividing by the denominator of the fraction.

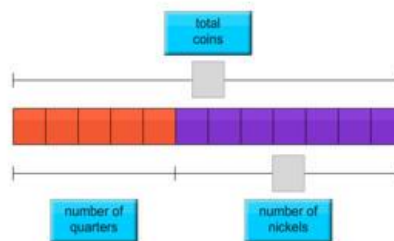


Bar Model Fractions Problems:

Word Problem: A tip cup contains 36 coins. $\frac{5}{12}$ of the coins are quarters and the rest are nickels. How many nickels are there?



Add numbers to your model. Use a ? to show the missing number.



Check

Feedback

Excellent work! Blocks and labels have been placed correctly. Now you can add numbers and question marks to the model.

Fraction of a Number



Finding fractions of amounts

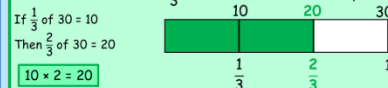
The **denominator** tells us how many parts to divide into.

Finding $\frac{1}{3}$ of an amount is the same as dividing that amount by 3.



The **numerator** tells us how many parts we want.

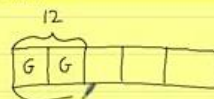
If we're asked to find $\frac{2}{3}$ of an amount, we need 2 parts.



Model Drawing Fractions



Two-fifths of the children have green backpacks. If 12 children have green backpacks, how many children are there altogether?



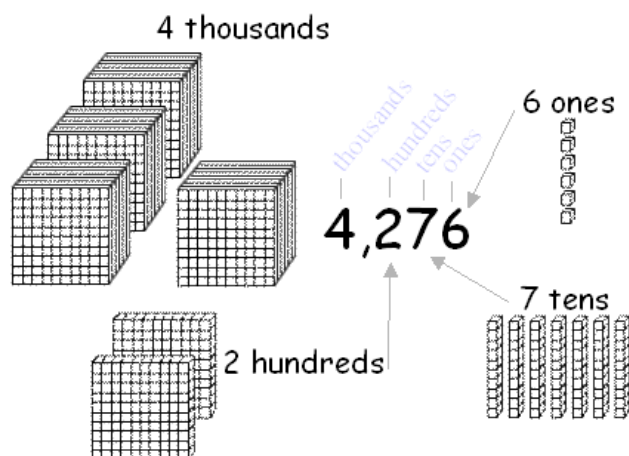
Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

- * count in multiples of 6, 7, 9, 25 and 1000
- * find 1000 more or less than a given number
- * count backwards through zero to include negative numbers
- * recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)
- * order and compare numbers beyond 1000
- * identify, represent and estimate numbers using different representations
- * round any number to the nearest 10, 100 or 1000
- * solve number and practical problems that involve all of the above and with increasingly large positive numbers
- * read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.

Number and Place Value: Oral and Mental Starters + Counting sessions.

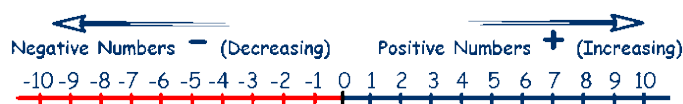
Place Value: Representing Numbers pictorially using dienes and place value counters.



Counting:



Negative Numbers:



Roman Numerals:

I = 1		V = 5		X = 10		L = 50		C = 100		M = 1000	
1	I	2	II	3	III	4	IV	5	V	6	VI
7	VII	8	VIII	9	IX	10	X	11	XI	12	XII
13	XIII	14	XIV	15	XV	16	XVI	17	XVII	18	XVIII
19	XIX	20	XX	21	XXI	22	XXII	23	XXIII	24	XXIV
25	XXV	26	XXVI	27	XXVII	28	XXVIII	29	XXIX	30	XXX
31	XXXI	32	XXXII	33	XXXIII	34	XXXIV	35	XXXV	36	XXXVI
37	XXXVII	38	XXXVIII	39	XXXIX	40	XL	41	XLI	42	XLII
43	XLIII	44	XLIV	45	XLV	46	XLVI	47	XLVII	48	XLVIII
49	XLIX	50	L	51	LI	52	LII	53	LIII	54	LIV
55	LV	56	LVI	57	LVII	58	LVIII	59	LIX	60	LX
61	LXI	62	LXII	63	LXIII	64	LXIV	65	LXV	66	LXVI
67	LXVII	68	LXVIII	69	LXIX	70	LXX	71	LXXI	72	LXXII
73	LXXIII	74	LXXIV	75	LXXV	76	LXXVI	77	LXXVII	78	LXXVIII
79	LXXIX	80	LXXX	81	LXXXI	82	LXXXII	83	LXXXIII	84	LXXXIV
85	LXXXV	86	LXXXVI	87	LXXXVII	88	LXXXVIII	89	LXXXIX	90	XC
91	XCI	92	XCII	93	XCIII	94	XCIV	95	XCV	96	XCVI
97	XCVII	98	XCVIII	99	XCIX	100	C				

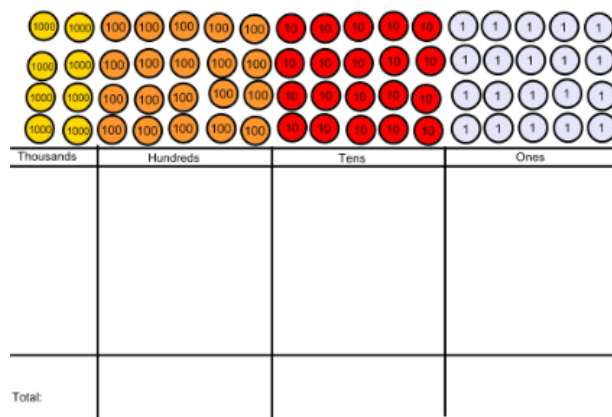
Addition

Pupils should be taught to:

- * add whole numbers with **more than 4 digits**, including using formal written methods (columnar addition)
- * add numbers mentally with increasingly large numbers
- * use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- * solve addition multi-step problems in contexts, deciding which operations and methods to use and why.

Addition

Addition with Base-Ten + Regrouping:



Column addition: With correct placement of digits:

Th	H	T	U	
7	9	4	8	
1	2	2	3	+
9	1	7	1	
1		1		

'Compact Column Addition to Add a Pair of 5-digit numbers'

$$\begin{array}{r} \text{TTh} \quad \text{Th} \quad \text{H} \quad \text{T} \quad \text{U} \\ 2 \quad 0 \quad 3 \quad 7 \quad 1 \\ + 4 \quad 6 \quad 0 \quad 8 \quad 5 \\ \hline \end{array}$$

$$20,371 + 46,085$$

H	T	U	1/10	1/100
4	2	3		
3	1	4		
7	3	7		

Equals signs and missing numbers :

$$(\square \times 6) + 5 = 35$$

$$7 \times 4 = 5 - (\square \times 3)$$

$$21 \div (\square - 2) = 7$$

$$12 = 20 - (\square \div 2)$$

$$(\square + 15) - 7 = 2 + (7 \times 3)$$

$$(4 \times \square) + 5 = (9 \times 5) - 8$$

$$(24 - 17) \times 2 = (4 \times 6) - \square$$

$$8 + (6 \times 5) = (\square + 14) \times 2$$

Bar Model: Problem Solving:



Last year I bought a house. It cost £127,456 and then my car broke, so I bought a new car, that cost £12,569 – how much did I spend altogether?

Subtraction

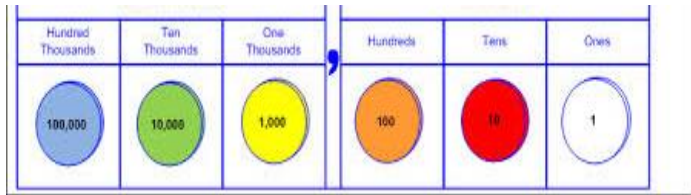
Pupils should be taught to:

- * subtract whole numbers with **more than 4 digits**, including using formal written methods (columnar subtraction)
- * subtract numbers mentally with increasingly large numbers e.g. $12\,462 - 2\,300 = 10\,162$
- * use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- * solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Subtraction

Subtraction with Place Value Counters + Regrouping:

Loads of regrouping practice needed – with apparatus counters/dienes.



Subtraction: Compact Column: (With regrouping)

$$\begin{array}{r}
 \text{T Th} \quad \text{Th} \quad \text{H} \quad \text{T} \quad \text{O} \\
 7 \quad 4 \quad 5 \quad 2 \quad 12 \\
 - 2 \quad 2 \quad 6 \quad 2 \quad 3 \\
 \hline
 5 \quad 2 \quad 9 \quad 0 \quad 9
 \end{array}$$

$$\begin{array}{r}
 8.97 - 2.82 \\
 \hline
 6.15
 \end{array}$$

Line up the decimal points... and just drag that decimal point straight down!

Subtract as usual!

$$\begin{array}{r}
 16.34 - 3.18 \\
 \hline
 13.16
 \end{array}$$

Line up the decimal points... borrow (regroup) if you need to!

Difference + Bar model Problem Solving:



Comparsion Model

- Show the relationship between 2 quantities when they are compared
- E.g. compared by showing the difference



The total amount I had in the Bank was £34,567. I spent £7,992 on a new car. How much did I have left?

Multiplication

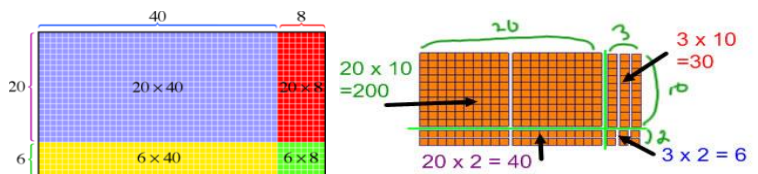
Pupils should be taught to:

- * continue to use all the multiplication tables to 12×12 in order to maintain their fluency
- * identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- * know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers e.g. prime factors of $60 = 5 \times 3 \times 2 \times 2$
- * establish whether a number up to 100 is prime and recall prime numbers up to 19
- * 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.
- * multiply numbers mentally drawing upon known facts of all tables.
- * multiply whole numbers and those involving decimals by 10, 100 and 1000
- * recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)
- * solve problems involving multiplication using their knowledge of factors and multiples, squares and cubes (for example, $4 \times 35 = 2 \times 2 \times 35$);
- * solve problems involving multiplication including scaling by simple fractions and problems involving simple rates.

Multiplication

Multiplication Arrays to Grid Method to Long multiplication.

2 digit multiplied by 2 digit number.



$$75 \times 429 =$$

x	400	20	9
70	28,000	1400	630
5	2000	100	45

$$75 \times 429 = 28,000 + 1400 + 630$$

$$75 \times 429 = 32,175$$

Long Multiplication: Formal Written Method.

Multiply the ones first.

Then multiply the tens and place the result underneath. Remember, the 3 in 34 is signifying 30.

Then add.

$$\begin{array}{r} 34 \\ \times 5 \\ \hline 20 \end{array}$$

$5 \times 4 = 20$

$$\begin{array}{r} 34 \\ \times 5 \\ \hline 20 \\ 150 \end{array}$$

$5 \times 30 = 150$

$$\begin{array}{r} 34 \\ \times 5 \\ \hline 20 \\ + 150 \\ \hline 170 \end{array}$$

Stack the numbers on top of each other

Multiply the top number by the ones place in the bottom number ($7 \times 6 = 42$, carry the 4. $6 \times 2 = 12$)

Put a 0 in the ones place on the next line. Multiply the top number by the tens place in the bottom number. $27 \times 1 = 27$

To get your answer, add the two lines of multiplication together. $162 + 270 = 432$

$$\begin{array}{r} 27 \\ \times 16 \\ \hline \end{array}$$

$$\begin{array}{r} 27 \\ \times 16 \\ \hline 162 \end{array}$$

$$\begin{array}{r} 27 \\ \times 16 \\ \hline 162 \\ 270 \end{array}$$

$$\begin{array}{r} 27 \\ \times 16 \\ \hline 162 \\ + 270 \\ \hline 432 \end{array}$$

Multiplying by 10,100,1000:

Multiplying and Dividing by 10, 100 and 1000

10 000	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Multiplying

X 10 digits move LEFT 1 space
X 100 digits move LEFT 2 spaces
X 1000 digits move LEFT 3 spaces



Dividing

$\div 10$ digits move RIGHT 1 space
 $\div 100$ digits move RIGHT 2 spaces
 $\div 1000$ digits move RIGHT 3 spaces



0-01	0-02	0-03	0-04	0-05	0-06	0-07	0-08	0-09
0-1	0-2	0-3	0-4	0-5	0-6	0-7	0-8	0-9
1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900
1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	20000	30000	40000	50000	60000	70000	80000	90000

Factor Pairs and Multiples, Prime Numbers:

Factor Pairs
What are all the numbers you can multiply together to get your target number?
Target Number = 36

1, 2, 3, 4, 6, 9, 12, 18, 36

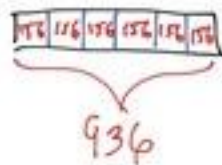
What's a Multiple?
The product of a number when it is multiplied by other numbers.
Example:
Multiples of 12 are:
12, 24, 36, 48
(12x1) (12x2) (12x3) (12x4)
*** Counting by a number. In this case, it was counting by 12s.

PRIME NUMBERS			
2	3	5	7
11	13	17	19
23	29	31	37
41	43	47	53
59	61	67	71
73	79	83	89
97			

Bar Model: Multiplication:

For 6 weeks, I saved £156.00. How much did I save in total?

$$6 \times 156 = 936$$



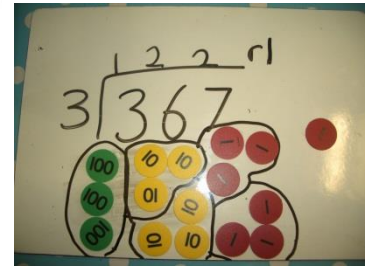
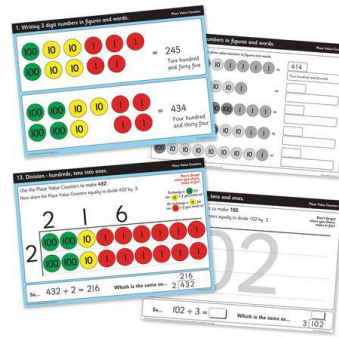
Division

Pupils should be taught to:

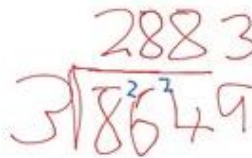
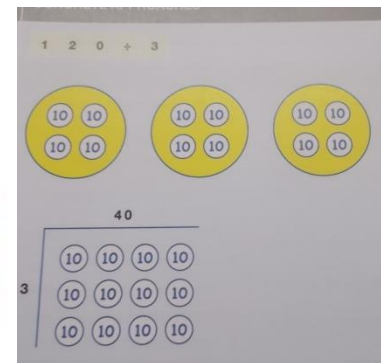
- * know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- * establish whether a number up to 100 is prime and recall prime numbers up to 19
- * use a formal written method, including long division for two-digit numbers
- * divide numbers mentally drawing upon known facts e.g. $630 \div 9$
- * 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
- * divide whole numbers and those involving decimals by 10, 100 and 1000 e.g. $456 \div 100 = 4.56$
- * solve problems involving division including using their knowledge of factors and multiples, squares and cubes
- * solve problems involving division, including scaling by simple fractions and problems involving simple rates.
- * Pupils 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 (for example, $98 \div 4 = 4/98 = 24 \text{ r}2$)

Division

Division grouping – understanding of written method:



$$120 \div 3 = 40$$



Division Facts: Learn the patterns.

$$630 \div 9 = 70$$

$$630 \div 90 = 7$$

$$630 \div 900 = 0.7$$

Dividing by 10,100,1000:

Multiplying and Dividing by 10, 100 and 1000

10 000	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Multiplying

X 10
X 100
X 1000



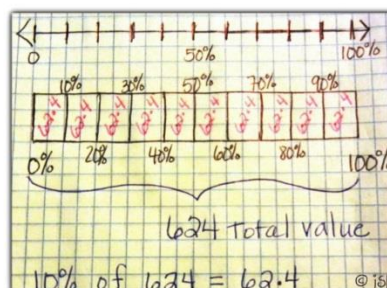
Dividing

$\div 10$
 $\div 100$
 $\div 1000$



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Bar Model Division Problems:



Fractions

Pupils should be taught to:

- * compare and order fractions whose denominators are all multiples of the same number
- * identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- * recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, $2/5 + 4/5 = 6/5 = 1 + 1/5$]
- * add and subtract fractions with the same denominator and denominators that are multiples of the same number
- * multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- * read and write decimal numbers as fractions [for example, $0.71 = 71/100$]
- * solve problems which require knowing percentage and decimal equivalents of $1/2$, $1/4$, $1/5$, $2/5$, $4/5$ and those fractions with a denominator of a multiple of 10 or 25.
- * practise adding and subtracting fractions to become fluent through a variety of increasingly complex problems. They extend their understanding of adding and subtracting fractions to calculations that exceed 1 as a mixed number.
- * practise counting forwards and backwards in simple fractions.

Fractions

Comparing Fractions:

Compare Fractions

In this math program, you will practice comparing fractions.

Examples: $\frac{3}{4} > \frac{5}{9}$ $\frac{3}{8} < \frac{1}{2}$ $\frac{3}{12} = \frac{1}{4}$

How To: $\frac{3}{5} ? \frac{7}{9}$

Step 1: Find a common denominator $5 \times 9 = 45$

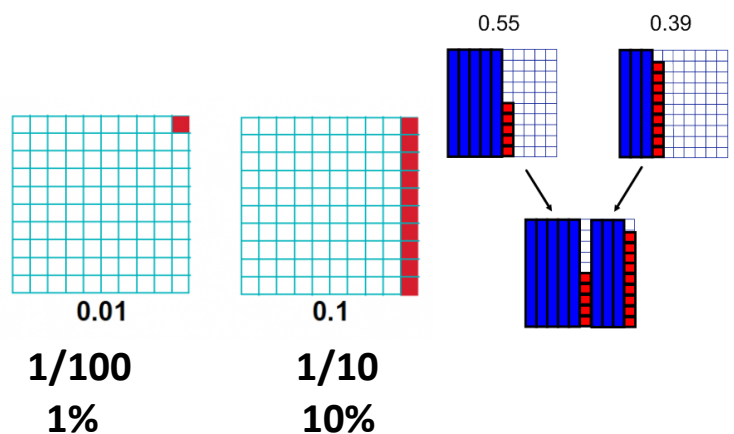
Step 2: Make equivalent fractions with the new denominator $\frac{3}{5} = \frac{27}{45}$ $\frac{7}{9} = \frac{35}{45}$

Step 3: Compare the numerators $27 < 35$ so $\frac{3}{5} < \frac{7}{9}$

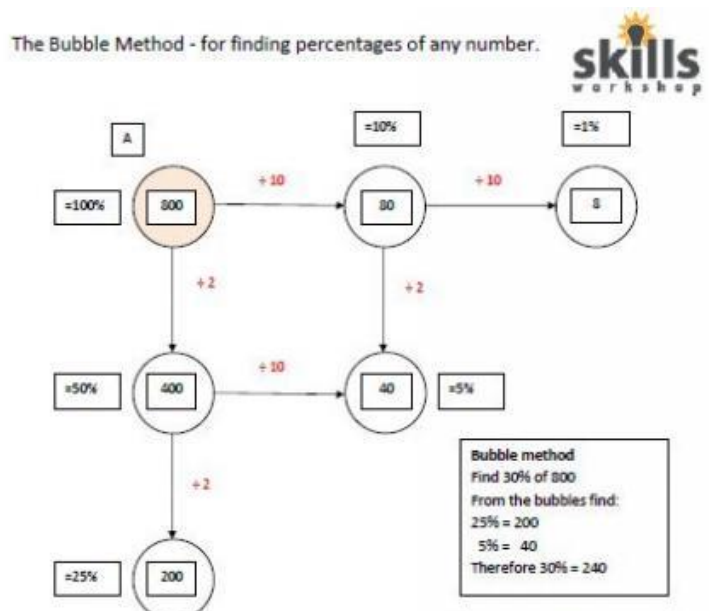
Short Cut $\frac{3}{5} \times \frac{9}{9} = \frac{27}{45}$ $\frac{7}{9} \times \frac{5}{5} = \frac{35}{45}$

Start

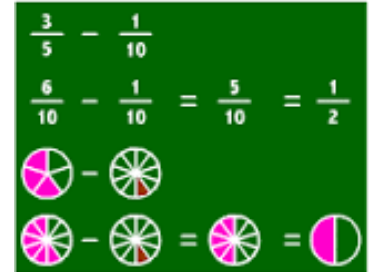
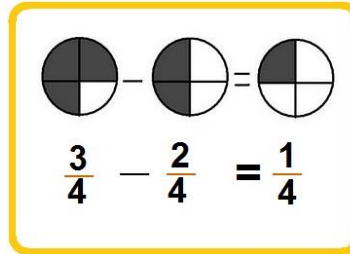
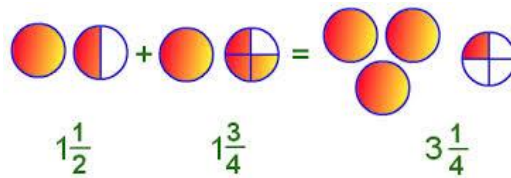
Tenths and Hundredths – decimals/fractions/percentages



Full Bubble Method:

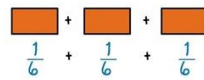
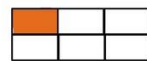


Adding and Subtracting Fractions:



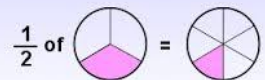
Multiplying Proper Fractions:

Core Lesson



$$\frac{1}{6} \times 3 = \frac{3}{6}$$

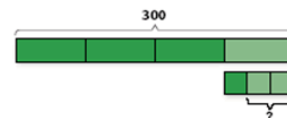
$$\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$$



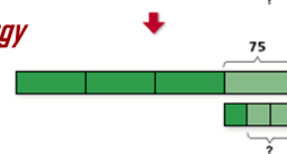
Fractions: Bar Model:

Examples of Singapore's Bar Model Technique

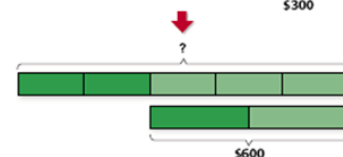
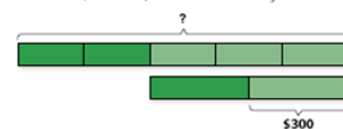
1. Marisol made 300 tarts. She sold $\frac{3}{4}$ of them and gave $\frac{1}{5}$ of the remainder to her neighbor. How many tarts did she have left?



This brilliant strategy enables younger students to grasp algebra concepts visually



2. Mr. Anderson gave $\frac{2}{5}$ of his money to his wife and spent $\frac{1}{2}$ of the remainder. If he had \$300 left, how much money did he have at first?



New Mathematics Calculation Policy: Year 5

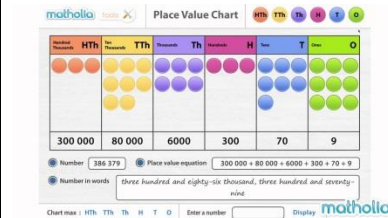
Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

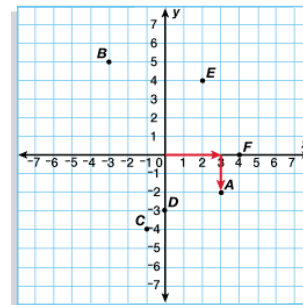
- * read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- * count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- * interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- * round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- * solve number problems and practical problems that involve all of the above
- * read Roman numerals to 1000 (M) and recognise years written in Roman numerals.

Number and Place Value: Oral and Mental Starters + Counting sessions.

Place Value: Representing Numbers pictorially using dienes and place value counters.



Negative Numbers:



Roman Numerals to 1000:

1 I	14 XIV	90 XC
2 II	15 XV	100 C
3 III	16 XVI	200 CC
4 IV	17 XVII	300 CCC
5 V	18 XVIII	400 CD
6 VI	19 XIX	500 D
7 VII	20 XX	600 DC
8 VIII	30 XXX	700 DCC
9 IX	40 XL	800 DCCC
10 X	50 L	900 CM
11 XI	60 LX	1,000 M
12 XII	70 LXX	2,000 MM
13 XIII	80 LXXX	3,000 MMM

Addition

Pupils should be taught to:

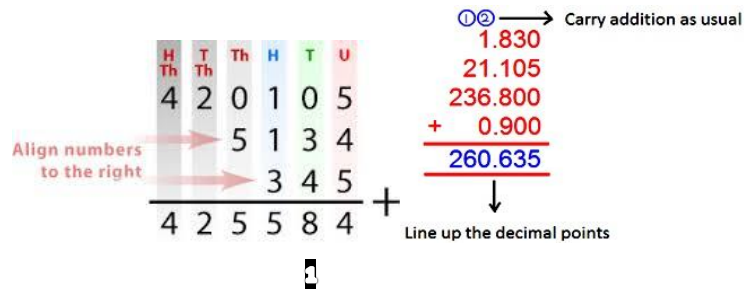
- * add whole numbers with **more than 4 digits**, including using formal written methods (columnar addition)
- * solve addition multi-step problems in contexts, deciding which operations and methods to use and why.

Addition

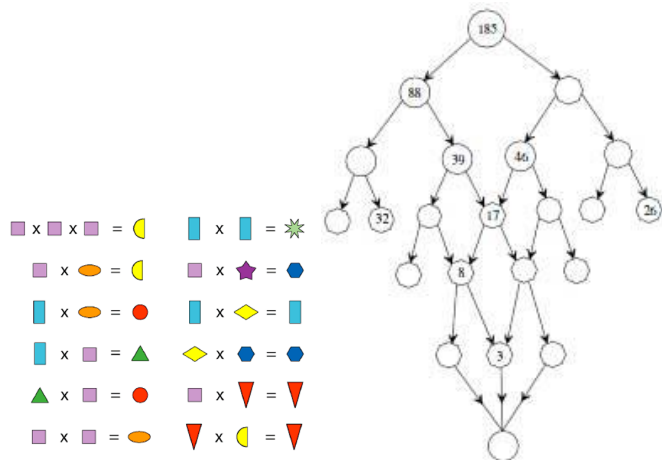
Addition with place value Counters: using a counter which represents 100,000 + practically with multilink cubes for addition of decimal numbers.



Column addition:



Equals signs and missing numbers : Algebra, Addition Trees and



Bar Model: Problem Solving:



Last year I bought a house. It cost £927,456 and then my roof leaked broke, so I bought a new roof, that cost £102,569 – how much did I spend altogether?

Subtraction

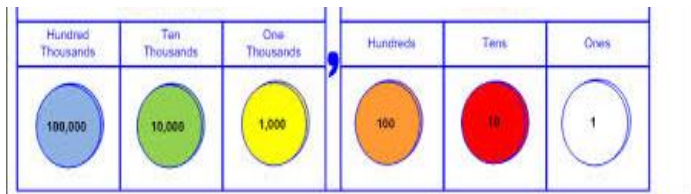
Pupils should be taught to:

- * subtract whole numbers with **more than 4 digits**, including using formal written methods (columnar subtraction)
- * solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Subtraction

Subtraction with Place Value Counters + Regrouping:

Loads of regrouping practice needed – with apparatus counters/dienes. Inclusive of decimal subtraction too!



Subtraction: Compact Column: (With multiple regrouping)

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & 7 & 9 & 14 & 10 & & \\
 \cancel{9} & \cancel{8} & \cancel{0} & \cancel{5} & \cancel{0} & & \\
 - 7 & 2 & 9 & 5 & 3 & & \\
 \hline
 2 & 5 & 0 & 9 & 7 & &
 \end{array}
 \end{array}$$

Difference + Bar model Problem Solving:



Comparison Model

- Show the relationship between 2 quantities when they are compared
- E.g. compared by showing the difference



The total amount I had in the Bank was £134,567. I spent £17,998 on a new car. How much did I have left?

Multiplication

Pupils should be taught to:

- *continue to use all the multiplication tables to 12×12 in order to maintain their fluency
- *multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- * identify common factors, common multiples and prime numbers
- * solve problems involving, multiplication
- * use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Multiplication

Short multiplication

24×6 becomes

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ 2 \end{array}$$

Answer: 144

342×7 becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ 21 \end{array}$$

Answer: 2394

2741×6 becomes

$$\begin{array}{r} 2741 \\ \times 6 \\ \hline 16446 \\ 42 \end{array}$$

Answer: 16 446

Long multiplication

24×16 becomes

$$\begin{array}{r} 24 \\ \times 16 \\ \hline 144 \\ 240 \\ \hline 384 \end{array}$$

Answer: 384

124×26 becomes

$$\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$$

Answer: 3224

124×26 becomes

$$\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$$

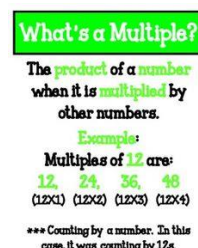
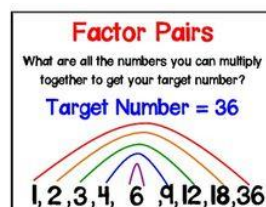
Answer: 3224

Multiplication:

Times Table - 12×12

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Factor Pairs and Multiples, Prime Numbers:



Bar Model Multiplication:

At a dance school there are 4 girls to every 3 boys. There are 63 children altogether. How many girls are there?

7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)	7 (4+3)
------------	------------	------------	------------	------------	------------	------------	------------	------------

So 9 groups: $3 \times 9 = 27$ Boys. $4 \times 9 = 36$ girls. $27 + 36 = 63$

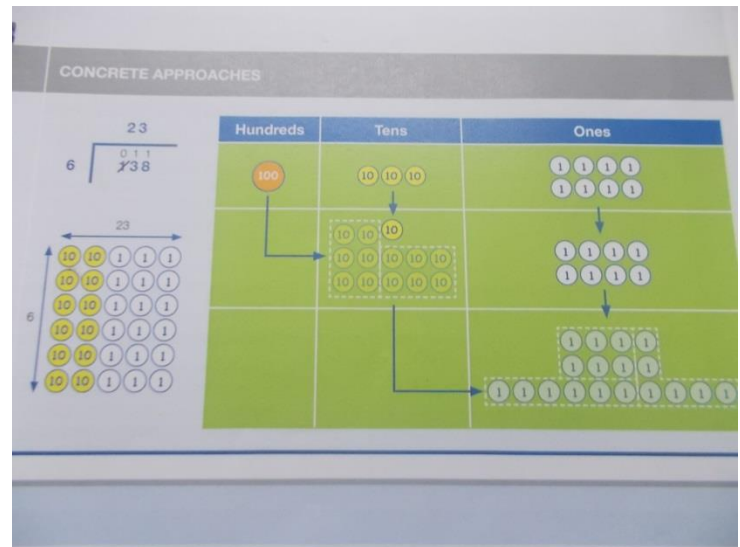
Division

Pupils should be taught to:

- * 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
- * divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- * solve problems involving division and use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Division

Division grouping – understanding of written method:
Short Davison:



496 ÷ 11 becomes

$$\begin{array}{r} 45 \text{ r } 1 \\ 11 \overline{) 496} \\ \underline{44} \\ 56 \\ \underline{55} \\ 1 \end{array}$$

Answer: $45 \frac{1}{11}$

Long division:

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

$\frac{12}{15} = \frac{4}{5}$

Answer: $28 \frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

Division Facts: Learn the patterns.

$630 \div 9 = 70$

$630 \div 90 = 7$

$630 \div 900 = 0.7$

Dividing by 10,100,1000:

Multiplying and Dividing by 10, 100 and 1000

10 000	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Multiplying

X 10
X 100
X 1000

digits move LEFT 1 space
digits move LEFT 2 spaces
digits move LEFT 3 spaces



Dividing

÷ 10
÷ 100
÷ 1000

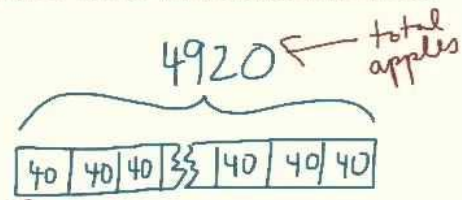
digits move RIGHT 1 space
digits move RIGHT 2 spaces
digits move RIGHT 3 spaces



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Bar Model Division Problems:

Frank has 4920 apples. He needs to put them into baskets of 40. How many baskets does he need?



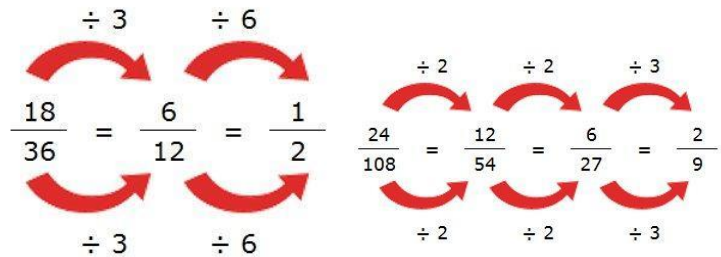
Fractions

Pupils should be taught to:

- *use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- * compare and order fractions, including fractions > 1
- * add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- * multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]
- * divide proper fractions by whole numbers [for example, $\frac{1}{3}$ divided by $2 = \frac{1}{6}$]
- * associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]
- * recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.
- * practise, use and understand the addition and subtraction of fractions with different denominators by identifying equivalent fractions with the same denominator. They should start with fractions where the denominator of one fraction is a multiple of the other (for example, $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$) and progress to varied and increasingly complex problems.
- *use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, for example as parts of a rectangle.
- *Pupils use their understanding of the relationship between unit fractions and division to work backwards by multiplying a quantity that represents a unit fraction to find the whole quantity (for example, if $\frac{1}{4}$ of a length is 36cm, then the whole length is $36 \times 4 = 144\text{cm}$).
- *They practise calculations with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators.

Fractions

Simplifying Fractions:



Adding and Subtracting Fractions:

Adding Fractions

In this math program, you will practice adding fractions with different denominators. There are 10 problems in each set.

Example: $\frac{1}{8} + \frac{2}{3} = \frac{19}{24}$

How To:

Step 1: Find a common denominator

$$8 \times 3 = 24$$

Step 2: Make equivalent fractions with the new denominator

$$\frac{1}{8} = \frac{3}{24} \quad \frac{2}{3} = \frac{16}{24}$$

Step 3: Add the numerators

$$\frac{3}{24} + \frac{16}{24} = \frac{19}{24}$$

Step 4: Reduce the fraction if needed

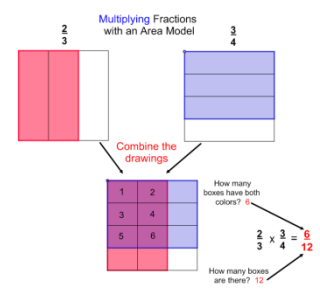
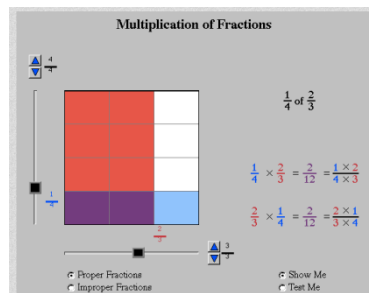
Start

$$\frac{3}{4} - \frac{1}{3} = \frac{3 \times 3}{4 \times 3} - \frac{1 \times 4}{3 \times 4}$$

$$= \frac{9}{12} - \frac{4}{12}$$

$$= \frac{5}{12}$$

Multiplying and dividing Fractions:



- Multiply the numerators $\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$
- Multiply the denominators $\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$
- Reduce the fraction if necessary $\frac{6}{20} = \frac{3}{10}$

$$\frac{8}{10} \div \frac{2}{5} = \frac{4}{2} \text{ or } 2$$



There are 2 groups of $\frac{2}{5}$ in $\frac{8}{10}$!

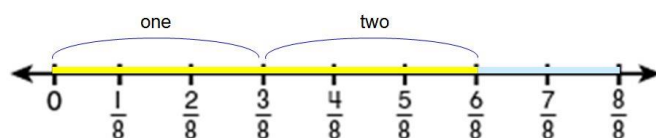
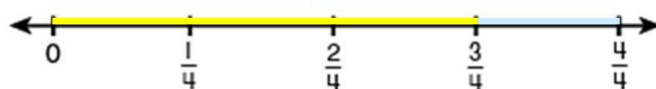
LEARNMILLION

NUMBER LINE – 6.NS.A.1

$$\frac{3}{4} \div \frac{3}{8} = 2$$

How many $\frac{3}{8}$ parts can be partitioned from $\frac{3}{4}$?

Two $\frac{3}{8}$ parts



Invert the fraction that you are dividing by

$$\frac{4}{5} \div \frac{2}{3} = \frac{4}{5} \times \frac{3}{2}$$

Multiply the numerators and denominators

$$\frac{4}{5} \times \frac{3}{2} = \frac{12}{10}$$

Simplify the fraction if necessary

$$\frac{12}{10} = 1\frac{1}{5}$$

Number and Place Value: Oral and Mental Starters + Counting sessions.

Pupils should be taught to:

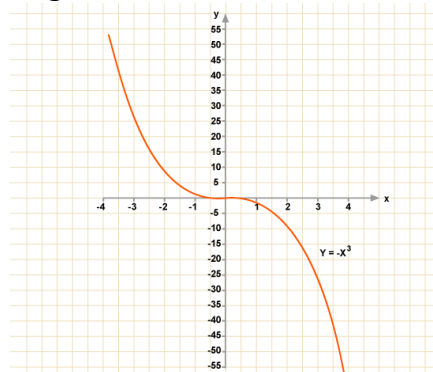
- * read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- * round any whole number to a required degree of accuracy
- * use negative numbers in context, and calculate intervals across zero
- * solve number and practical problems that involve all of the above.
- * use the whole number system, including saying, reading and writing numbers accurately.

Number and Place Value: Oral and Mental Starters + Counting sessions.

Place Value: Representing Numbers pictorially using dienes and place value counters.

Place Value Chart								
Millions			Thousands			Ones		
Hundred Million	Ten Million	Million	Hundred Thousands	Ten Thousands	Thousands	Hundred	Tens	Ones
100,000,000	10,000,000	1,000,000	100,000	10,000	1,000	100	10	1

Negative Numbers:



Number System:

