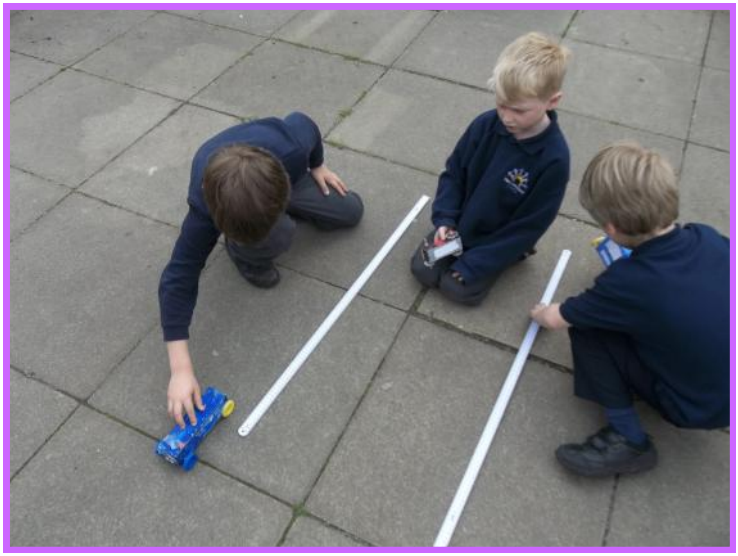
Hemingford Grey
SCHOOL

Calculation Policy



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Introduction

Throughout their school life pupils at Hemingford Grey Primary School will have many opportunities to explore numbers, look for patterns, solve problems and develop their mental and written strategies in the four operations (addition, subtraction, multiplication, division) with accuracy, speed and confidence. We have put together this booklet to guide parents and carers through the stages of development in learning about number and calculation.

For all four operations we have identified a series of steps; pupils will work through these steps as they progress in Maths.

From Foundation Stage to Year 6 pupils will be encouraged to use a range of strategies to support their learning. These include the use of counting materials (fingers, rulers, counters) and we urge parents and carers to support this when their children are learning at home. Pupils are also taught to draw pictures or to make jottings to help them in their calculations. Children are encouraged to look at a calculation with 'number sense.' This means that the child will consider **firstly** whether to do the calculation mentally, **then** with jottings **or** their written method, deciding upon the resources that they need.

Number tracks, number lines and number squares are excellent learning supports for counting forwards and back and for finding patterns and these are easy to make or available to download from a number of websites. (examples are listed at the end of this document.)

Number and calculations play a vital part in our daily lives and we want every pupil to develop a confidence in, and an enjoyment of, numeracy.

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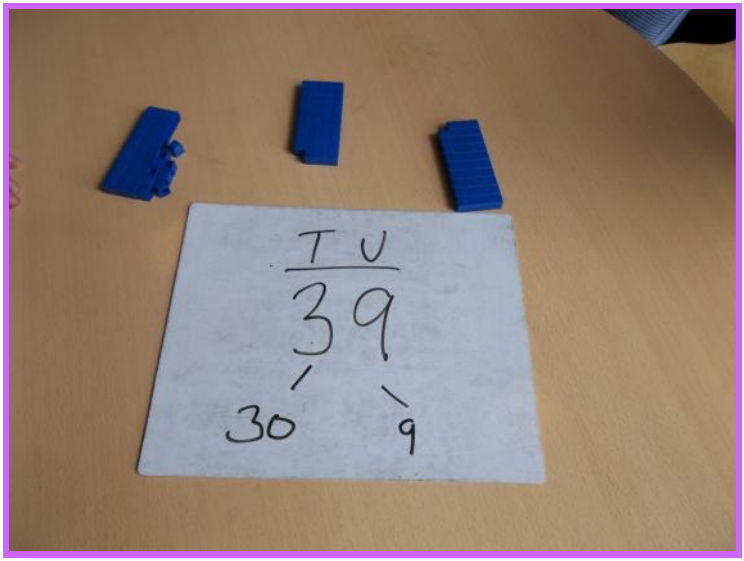
Aims

The overall aims are that when children leave Hemingford Grey Primary School they:

- have a secure knowledge of number facts and a good understanding of the four operations;
- make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;
- have an efficient, reliable written method of calculation for each operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally;
- apply their knowledge and understanding of number and calculations to solve real-life problems;
- use estimation effectively, to help them assess the validity of their answers.
- are able to attempt challenges and investigations with confidence, drawing on and reasoning about, prior learning experiences and knowledge


40
5


T U
39
30
9

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Written methods for addition

To add successfully, children need to be able to:

- recall all addition pairs to 9 + 9 and complements in 10 and 100;
- add mentally a series of one-digit numbers, such as 5 + 8 + 4;
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways.

The models of addition explored are:

- Combining of sets
- Adding on more

add addition total plus

more than and altogether

increase equals make sum

Step 1

Using apparatus **Informal jottings** **Number tracks**

Combining groups

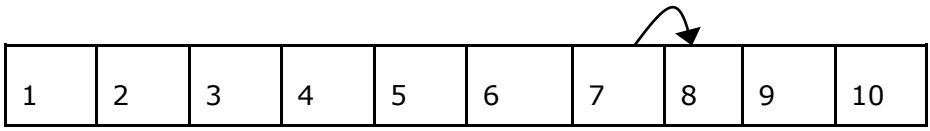
7 **add** 1 equals 8

Jen has seven oranges. Pete has 1 orange. How many do they have in total?

Adding on more

7 and 1 **more** is 8

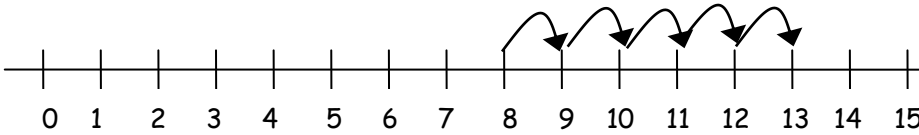
Jen has seven oranges. Pete gives her one more. How many oranges does she have now?



Step 2

Number line

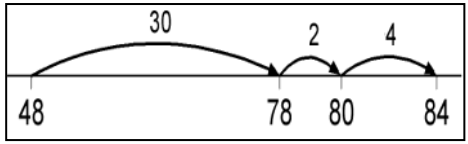
8 + 5 = 13



Step 3

Empty number line

48 + 36 = 84



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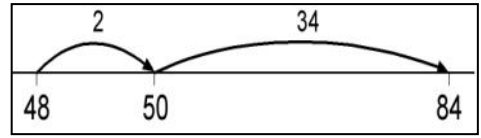
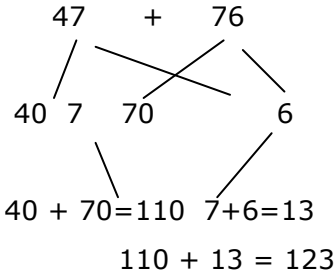


Step 4

Partitioning



The tens and ones will be added to form partial sums and then these partial sums will be added together to find the total.

Step 5

Expanded column method

$$\begin{array}{r} 67 \\ +\ 24 \\ \hline 80 \\ 11 \\ \hline 91 \end{array} \qquad \begin{array}{r} 67 \\ +\ 24 \\ \hline 11 \\ 80 \\ \hline 91 \end{array}$$

Initially children add the most significant numbers first, then move on very quickly to the least significant first.

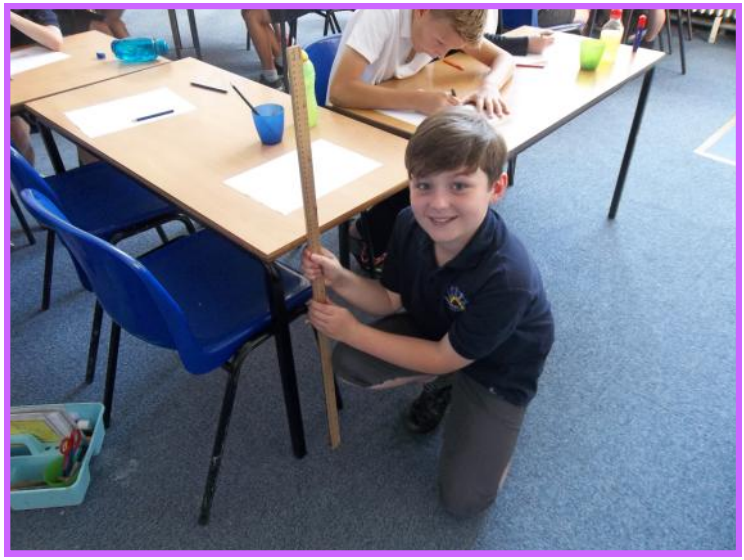
Step 6

Column method

$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ 11 \end{array}$$

Carry digits are recorded below the line, using the words 'carry ten' or 'carry one hundred'.

Children need to have number sense and make decisions about how to solve a calculation. 325 + 99 = may be best completed by adding 100



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Written methods for subtraction

To subtract successfully, children need to be able to:

- recall all addition and subtraction facts to 10, 100;
- subtract multiples of 10 (such as 160 – 70) using the related subtraction fact,16 – 7, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

The models of subtraction explored are:

- Taking away
- Finding the difference

subtract **subtraction**

take away **minus** **less than**

difference **decrease** **leave**

how many left

Step 1

Using apparatus Informal jottings Number tracks

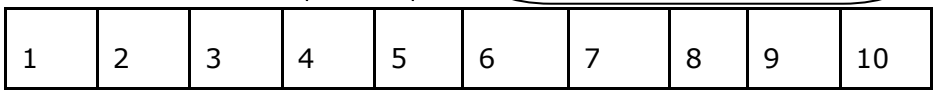
Taking away (physical removal)

2 **less** than 5 is 3

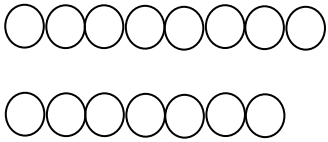
5 **subtract** 2equals 3

Fred has 5 sweets.

He eats 2. How many does he have left?



Finding the difference (comparison)

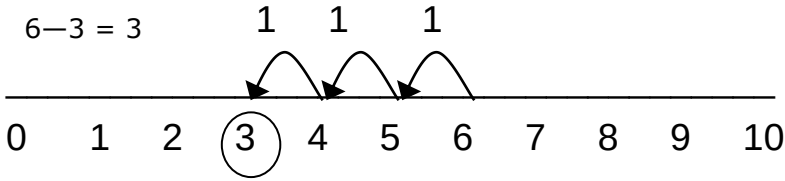


Using practical resources: I have 8 oranges, James has 7 oranges. How many more do I have?

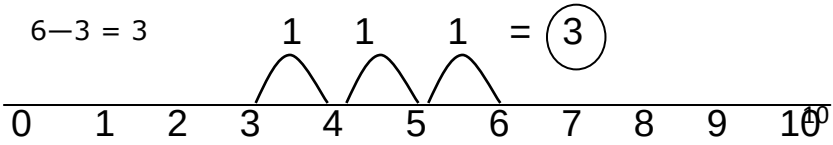
Step 2

Number line

Taking away



Finding the difference

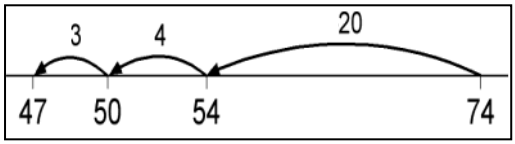


Step 3

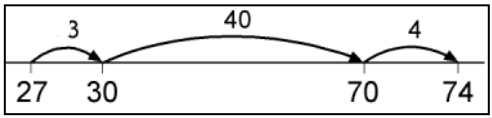
Empty number line

Taking away

74 – 27 = 47



Finding the difference



Where numbers are close together, calculations may best be solves by counting up.

E.g. 1007-993 = 14

Step 4

Expanded layout

89—57 = 32

80 9

50 7

30 2 = 32

74—27 = 47

6 0 1 4

~~7~~ 0 ~~4~~

- 2 0 7

4 0 7

Step 5

Column method for decomposition

741—327 = 414

3 1

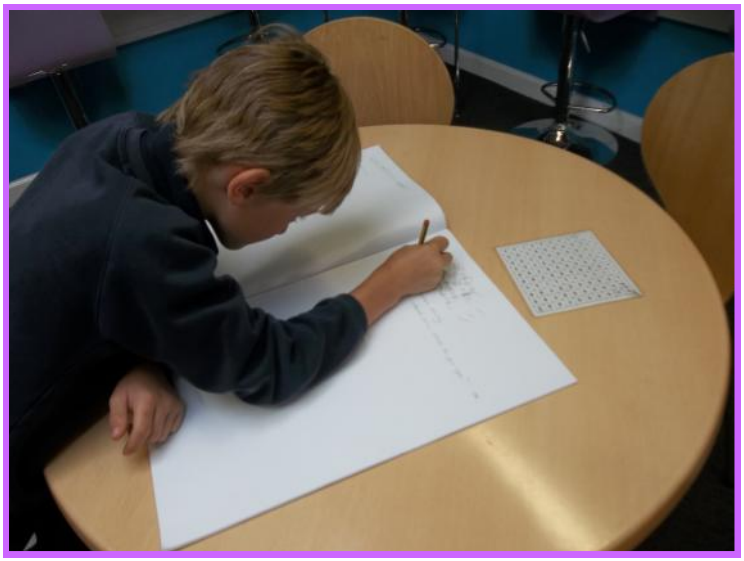
~~7~~ ~~4~~ ~~1~~

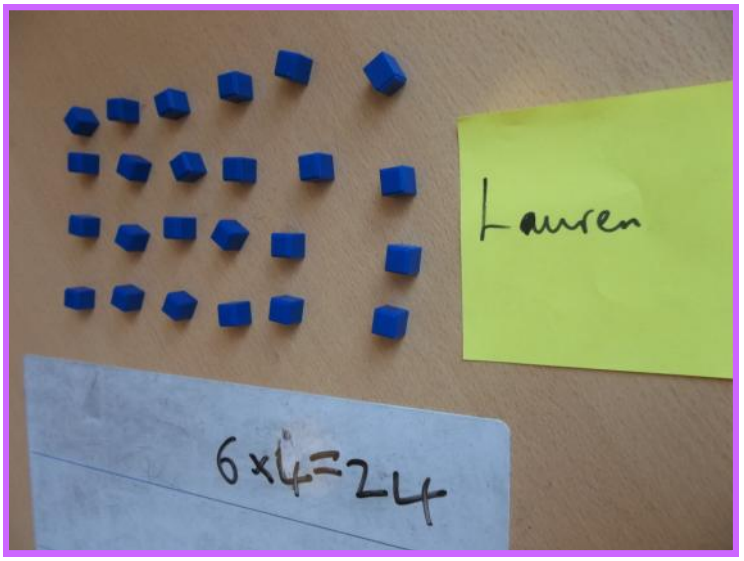
- 327

414

The terminology is exchanging, not borrowing.

Calculations requiring a lot of exchanging would make the column method error prone. Number sense would suggest that a number line could still be used. Eg 1007-989 is best on a number line.




Lauren
6x4=24

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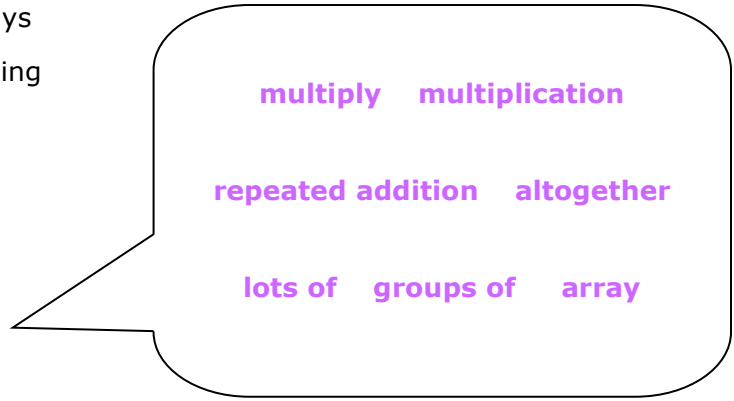
Written methods for multiplication

To multiply successfully, children need to be able to:

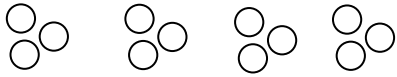
- recall all multiplication facts to 12 × 12;
- partition number into multiples of one hundred, ten and one;
- work out products such as 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value;
- add two or more single-digit numbers mentally;
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- add combinations of whole numbers using the column method

The models of multiplication explored are:

- Repeated addition
- Arrays
- Scaling



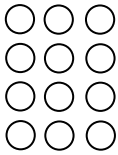
Step 1: repeated addition and arrays using apparatus and informal jottings



4 lots of 3 is 12

3 multiplied by 4 = 12

3 four times



3 four times

4 lots of 3

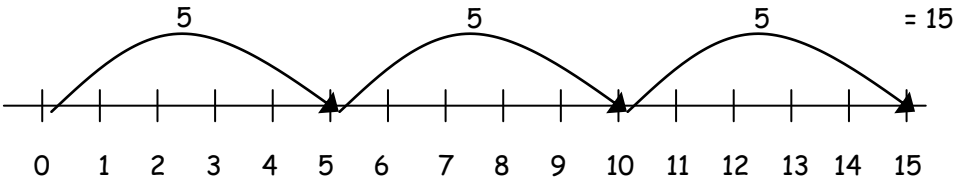
3 multiplied by 4

Scaling: build a tower with 2 cubes. Now build it 3 times taller.

Step 2

Repeated addition recorded on a number line

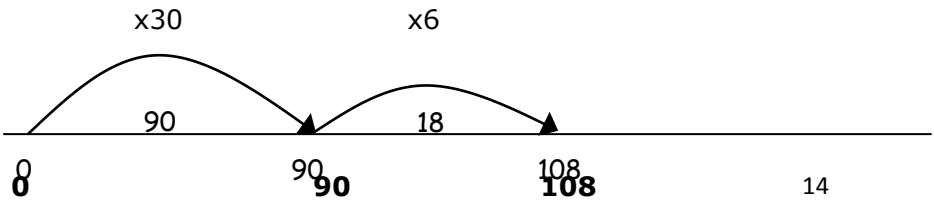
5 x 3 = 15



Step 3

Empty number line

36 x 3 = 108



Step 4

Grid method

14 x 6 = 84

x	10	4
6	60	24

60
+24
84

286 × 29 = 8294

x	200	80	6
20	4000	1600	120
9	1800	720	54

4000
1800
1600
720
120
+ 54
8294
2

Step 5

Expanded short multiplication

14
x 6
24
60
84

Stage 6

Short multiplication

342 × 7 becomes

3 4 2
× 7
2 3 9 4
2 1

Answer: 2394

2741 × 6 becomes

2 7 4 1
× 6
1 6 4 4 6
4 2

Answer: 16 446

Stage 7

Long multiplication

Refer to the place value in the column when carrying

24 × 16 becomes

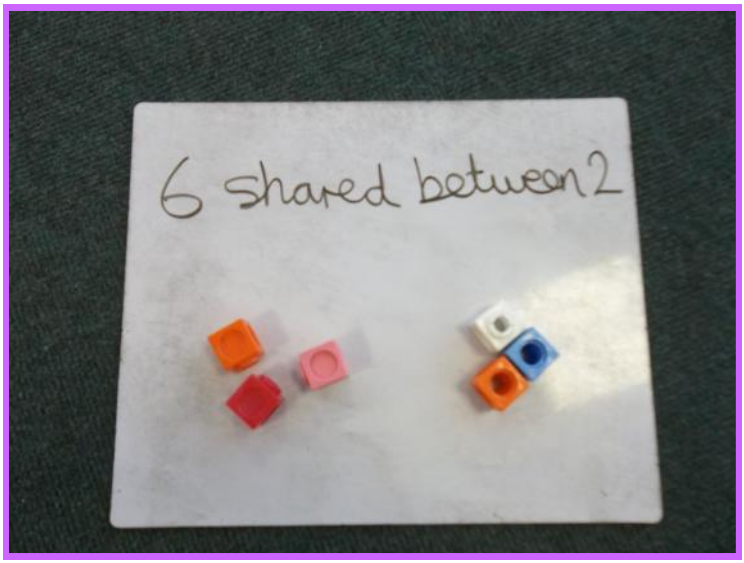
2
2 4
× 1 6
2 4 0
1 4 4
3 8 4

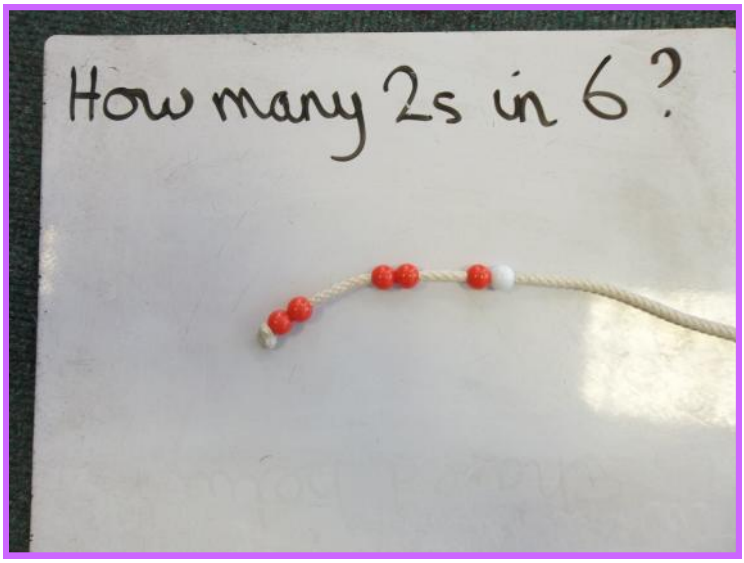
Answer: 384

124 × 26 becomes

1 2
1 2 4
× 2 6
2 4 8 0
7 4 4
3 2 2 4
1 1

Answer: 3224


6 shared between 2


How many 2s in 6?

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Written methods for division

To divide successfully, children need to be able to:

- understand and use the vocabulary of division. For example in 18 ÷ 3 = 6, the 18 is the dividend, the 3 is the divisor and the 6 is the quotient;
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways;
- recall multiplication and division facts to 12 × 12;
- recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value;
- know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5;
- understand and use multiplication and division as inverse operations.

The models of division explored are:

- Sharing equally
- Grouping
- Linking

with fractions

divide **division** **divided by**

share **sharing** **equal** **equally**

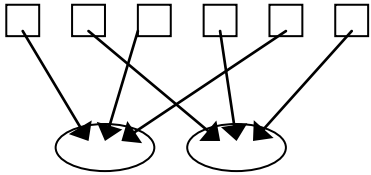
Step 1

Using apparatus **Informal jottings**

Sharing equally

$6 \div 2 = 3$

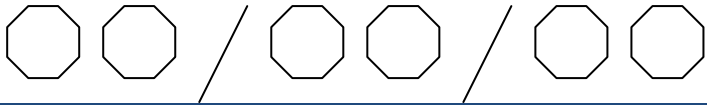
6 sweets shared between 2 people, how many do they each get?



Grouping or repeated subtraction

$6 \div 2 = 3$

There are 6 sweets, how many people can have 2 sweets each?

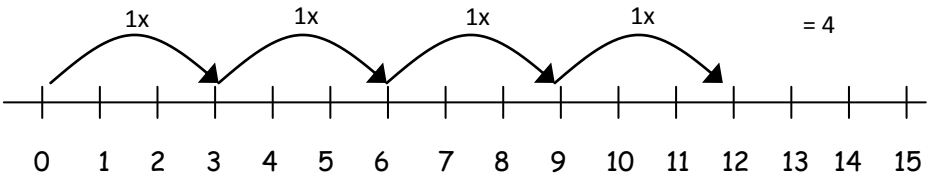


Step 2

Number line

$12 \div 3 = 4$

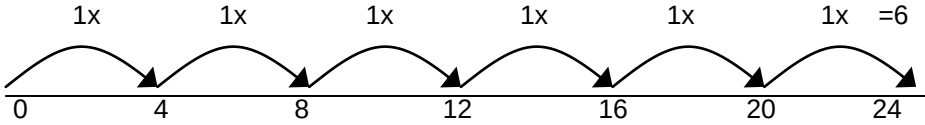
'How many 3s in 12?'



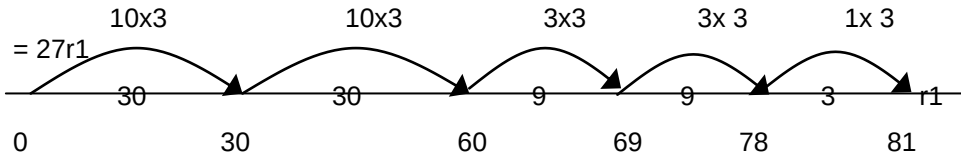
Step 3

Empty number line

24 ÷ 4 = 6



82 ÷ 3 = 27r1



Step 4

Chunking (grouping model)

96 ÷ 6 = 16

6	96	
	- 60	10x6
	36	
	- 36	6x6
	0	= 16

82 ÷ 3 = 27r1

3	82	
	- 60	20x3
	22	
	- 21	7x3
	1	= 27r1

Chunking is inefficient if too many subtractions need to be carried out. Reduce the number of steps to encourage finding the largest possible multiples.

Step 5

Short division (sharing model)

98 ÷ 7 becomes

$$7\overline{)98} = 14$$

Answer: 14

432 ÷ 5 becomes

$$5\overline{)432} = 86\ r2$$

Answer: 86 remainder 2

Step 6

Long division

432 ÷ 15 becomes

			2	8 r12
1	5	4	3	2
		3	0	0
		1	3	2
		1	2	0
			1	2

Answer: 28 remainder 12

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Useful Websites

www.bbc.co.uk/schools

www.durham.schooljotter.com/coxhoe

www.ictgames.com

www.mathszone.co.uk

www.multiplication.com

www.woodlands-junior.kent.sch.uk/maths

Glossary

BRIDGING through 10 is when two single-digit numbers are added together to make a quantity bigger than 10, eg 7+8

CHUNKING is adding or subtracting the multiples of a divisor

Eg 165 divided by 15 equals 11 because 10x15=150 and 1x15=15

COMPLEMENTs are pairs of number that equal a number when added

DIGITS are the numerals 0 1 2 3 4 5 6 7 8 9

Eg 352 has 3 digits; 5692 has 4 digits

DIVISOR is the number used to divide by

Eg 100 divided by 5 (5 is the divisor)

FACTOR a whole number that divides exactly into another number

Eg FACTORS of 10 are 1, 2 and 5

MULTIPLE a number that can be divided by another number equally Eg 20,30,40 and 50 are all multiples of 10

NUMBER BONDS known addition facts of pairs of numbers up to and totalling 10 Eg 5+5=10 and 4+6=10 and 3+7=10

PARTITIONING is to split a number by its place value (H,T,U)

Eg 392 is 300 + 90 + 2

PLACE VALUE is the value of each digit in a number

Eg In 462 the 4 is 4 hundreds and the 6 is 6 tens and the 2 is 2 units

PRODUCT is the answer when two or more numbers are multiplied

Eg 50 is the product of 5x10

QUOTIENT is the result of division