Hingham Primary School

At our school, the children will progress from using concrete objects and pictorial representations to formal written methods for all four operations by the end of Key Stage Two. This reflects the expectations of the revised National Curriculum for England 2014.

Policy for Calculations

Subject leaders: Sarah Carr and Rosie Dixon

Date Adopted: September 2014

Signed:

Review Date: September 2017

MENTAL METHODS FOR ADDITION

These are a **selection** of mental calculation strategies:

Mental recall of number bonds

6 + 4 = 10 ☐ + 3 = 10

25 + 75 = 100 19 + ☐ = 20

Use near doubles

6 + 7 = double 6 + 1 = 13

Addition using partitioning and recombining

34 + 45 30+40+4+5=79

Add the nearest multiple of 10, 100 and 1000 and adjust

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

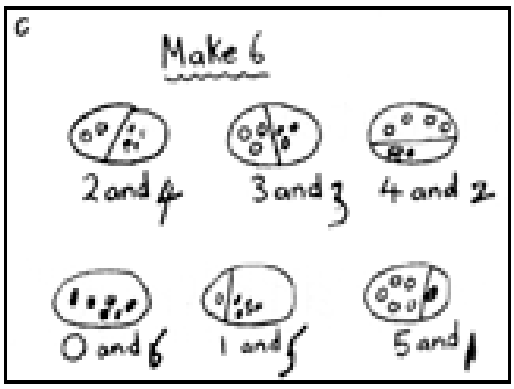
Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

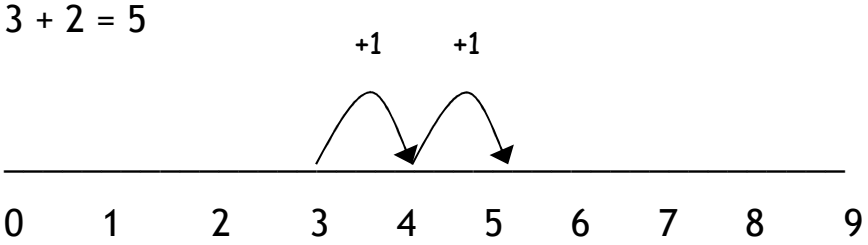
WRITTEN METHODS FOR ADDITION

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



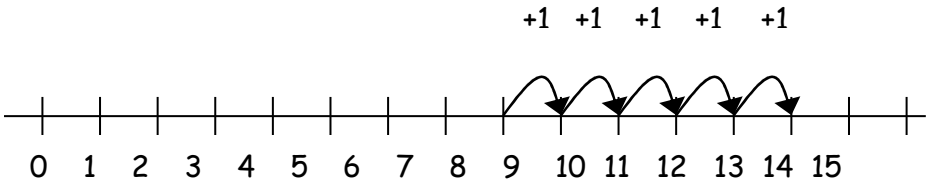
They use marked numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

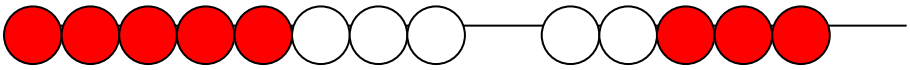


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.



Partition the numbers and record with the units/tens/hundreds etc in columns. Add downwards then add the totals.

34+45 30+4

40+5

70+9 = 79

152+63 100+50+2

60+3

100+110+5 = 215

Children should start to extend to using methods with larger numbers and decimals.

2.34+1.52 2+0.3+0.04

1+0.5+0.02

3+0.8+0.06 = 3.86

266

+ 342

500

100

Formal Written Methods:

1

6584

+ 5848

12432

1 1 1

2

0.42

64.32

7.86

0.03

+ 46.81

119.44

1 2 1

Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

MENTAL METHODS FOR SUBTRACTION

These are a **selection** of mental calculation strategies:

Mental recall of addition and subtraction facts

10 – 6 = 4

20 - 17 = 3

17 - ☐ = 11

10 - ☐ = 2

Find a small difference by counting up

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 - 52 = 34 (by counting back in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5

458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction

36 + 19 = 55

55 – 19 = 36

19 + 36 = 55

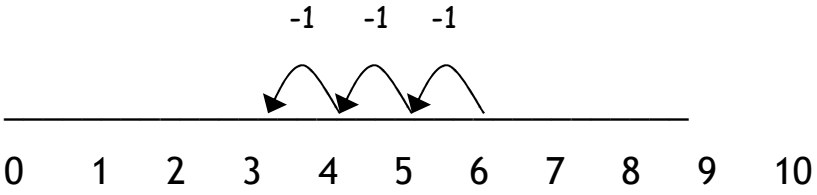
55 – 36 = 19

WRITTEN METHODS FOR SUBTRACTION

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

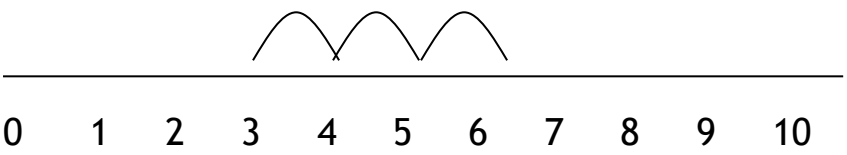
They use numberlines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

6 – 3 = 3



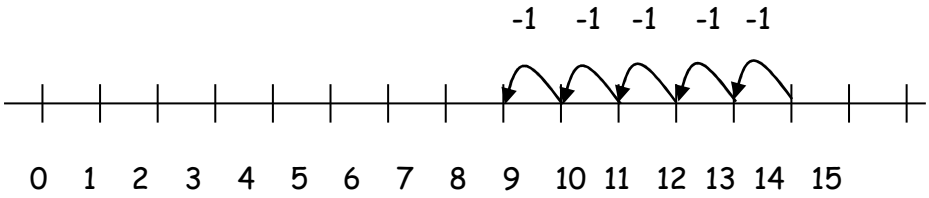
The numberline should also be used to show that 6 - 3 means the 'difference between

6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



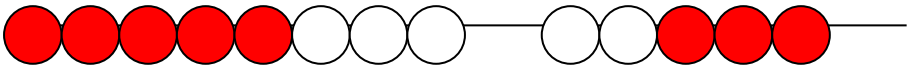
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



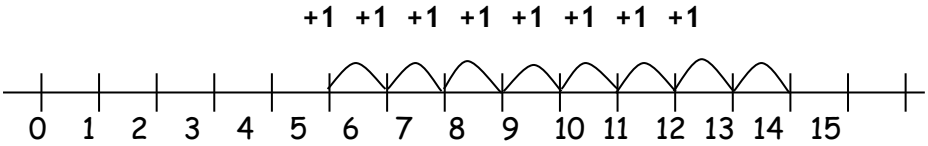
Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

13 – 5 = 8



At this stage it will be important for children to make the connection between finding the difference through "counting on" as another means of subtraction.

13 – 5 =8



Children will begin to use empty number lines to support calculations.

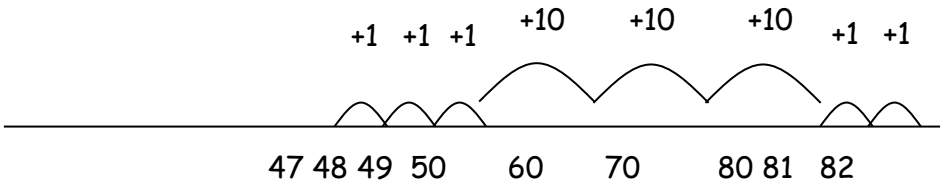
Counting on

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on.

Count up from 47 to 82 in jumps of 10 and jumps of 1.

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.

82 - 47



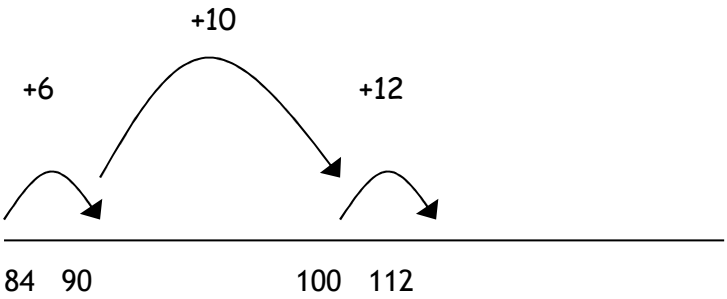
Children will continue to use empty number lines with increasingly large numbers.

Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

To help children to become more efficient with counting on by:

- ✓ Counting on the units in one jump
- ✓ Counting on the tens in one jump and the units in one jump

112 – 84 = 28



112
- 84
16 *(100)*
12 *(112)*
28

Formal Written Methods:

874 – 523 becomes

	8	7	4
–	5	2	3
	3	5	1

Answer: 351

932 – 457 becomes

	8	12	1
	9	3	2
–	4	5	7
	4	7	5

Answer: 475

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

MENTAL METHODS FOR MULTIPLICATION

Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g. 8 x 4 is double 4 x 4

Using multiplication facts

Counting in 2s, 5s and 10s should be should be taught regularly at Y1 and from Year 2 onwards, multiplication tables are taught and practised frequently.

Year 2 2 times table

5 times table

10 times table

Year 3 3 times table

4 times table

8 times table

Year 4/5/6 Recall multiplication facts up to 12 x 12

Using and applying multiplication facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Use closely related facts already known

13 x 11 = (13 x 10) + (13 x 1)

= 130 + 13

= 143

Multiplying by 10 or 100

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning

23 x 4 = (20 x 4) + (3 x 4)

= 80 + 12

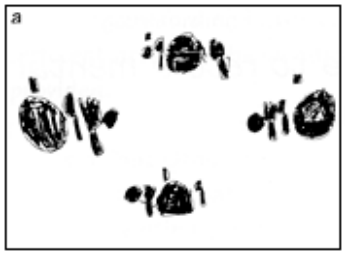
= 102

Use of factors

8 x 12 = 8 x 4 x 3

WRITTEN METHODS FOR MULTIPLICATION

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.



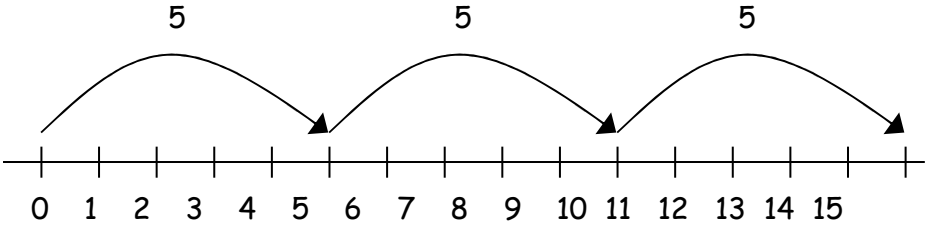
Children will develop their understanding of multiplication and use jottings to support calculation:

Repeated addition

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

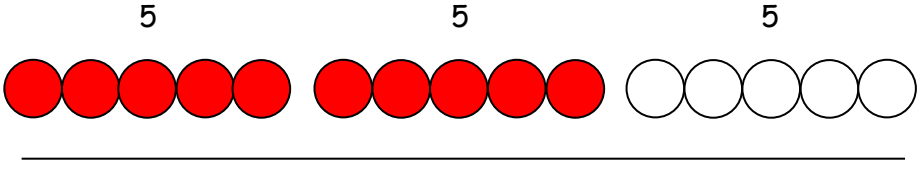
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



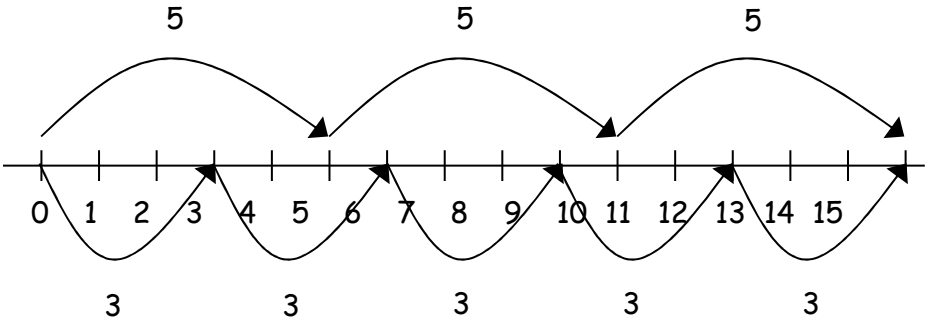
and on a bead string:

5 x 3 = 5 + 5 + 5



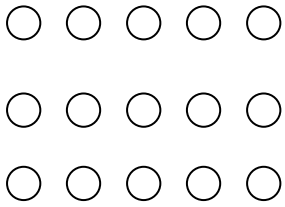
Commutativity

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



Arrays

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



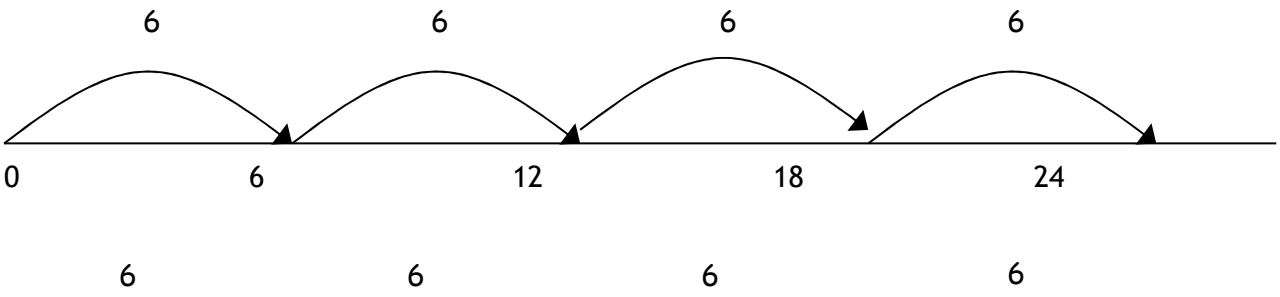
5 x 3 = 15

3 x 5 = 15

Repeated addition

4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

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



Children will also develop an understanding of :

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

☐ x 5 = 20 3 x △ = 18 ☐ x ○ = 32

Partitioning

38 x 5 = (30 x 5) + (8 x 5)

= 150 + 40

= 190

Grid method

TU x U

(Short multiplication – multiplication by a single digit)

23 x 8

Children will approximate first

23 x 8 is approximately 25 x 8 = 200

x	20	3	
8	160	24	=184

HTU x U

(Short multiplication – multiplication by a single digit)

346 x 9

Children will approximate first

346 x 9 is approximately 350 x 10 = 3500

x	300	40	6	
9	2700	360	54	Total the numbers using mental or written methods =3114

TU x TU

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

72 x 38

Children will approximate first

72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

=2736

Using similar methods, they will be able to multiply decimals with one decimal place by a single digit number, approximating first. They should know that the decimal points line up under each other.

e.g. 4.9 x 3

Children will approximate first

4.9 x 3 is approximately 5 x 3 = 15

x	4	0.9
3	12	2.7

= 14.7

ThHTU x U

(Short multiplication – multiplication by a single digit)

4346 x 8

Children will approximate first

4346 x 8 is approximately 4346 x 10 = 43460

x	4000	300	40	6
8	32000	2400	320	48

=34768

HTU x TU

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

372 x 24

Children will approximate first

372 x 24 is approximately 400 x 25 = 10000

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

=8928

For example:

4.92 x 3

Children will approximate first

4.92 x 3 is approximately 5 x 3 = 15

x	4	0.9	0.02
3	12	2.7	0.06

=12.76

Formal Written Methods:

Short multiplication

24 × 6 becomes

$$\begin{array}{r} 2\ 4 \\ \times\quad 6 \\ \hline 1\ 4\ 4 \\ \hline \quad 2 \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} 3\ 4\ 2 \\ \times\quad\quad 7 \\ \hline 2\ 3\ 9\ 4 \\ \hline \quad 2\ 1 \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} 2\ 7\ 4\ 1 \\ \times\quad\quad\quad 6 \\ \hline 1\ 6\ 4\ 4\ 6 \\ \hline \quad 4\ 2 \end{array}$$

Answer: 16 446

Long multiplication

24 × 16 becomes

$$\begin{array}{rrr} & {\scriptstyle 2} & \\ & 2 & 4 \\ \times & 1 & 6 \\ \hline 2 & 4 & 0 \\ 1 & 4 & 4 \\ \hline 3 & 8 & 4 \\ \hline \end{array}$$

Answer: 384

124 × 26 becomes

$$\begin{array}{rrrr} & & {\scriptstyle 1} & {\scriptstyle 2} \\ & & 1 & 2 & 4 \\ \times & & & 2 & 6 \\ \hline 2 & 4 & 8 & 0 & \\ & & 7 & 4 & 4 \\ \hline 3 & 2 & 2 & 4 & \\ \hline {\scriptstyle 1} & {\scriptstyle 1} & & & \end{array}$$

Answer: 3224

124 × 26 becomes

$$\begin{array}{rrrr} & & {\scriptstyle 1} & {\scriptstyle 2} \\ & & 1 & 2 & 4 \\ \times & & & 2 & 6 \\ \hline & & 7 & 4 & 4 \\ 2 & 4 & 8 & 0 & \\ \hline 3 & 2 & 2 & 4 & \\ \hline {\scriptstyle 1} & {\scriptstyle 1} & & & \end{array}$$

Answer: 3224

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MENTAL METHODS FOR DIVISION

Doubling and halving

Knowing that halving is dividing by 2

Deriving and recalling division facts

Year 2	2 times table
	5 times table
	10 times table
Year 3	3 times table
	4 times table
	8 times table
Year 4/5/6	Recall multiplication and division facts up to 12 x 12

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know 21 ÷ 3 = 7, what else do I know?

210 ÷ 7 = 30 , 2100 ÷ 7 = 300, 21 000 ÷ 7 = 3000, 2.1 ÷ 7 = 0.3 etc

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

378 ÷ 21	378 ÷ 3 = 126	378 ÷ 21 = 18
	126 ÷ 7 = 18	

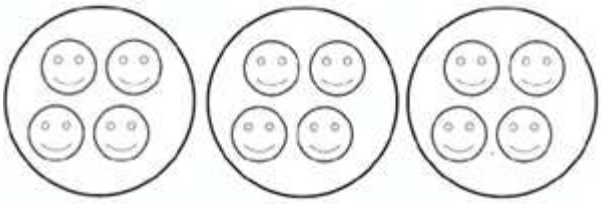
Use related facts

Given that 1.4 x 1.1 = 1.54

What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

WRITTEN METHODS FOR DIVISION

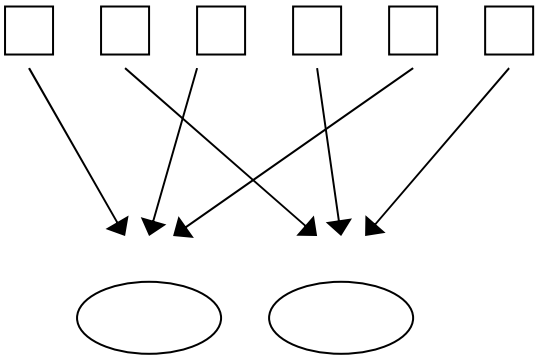
Children will understand equal groups and share items out in play and problem solving. They will count in 2s, 5s and 10s.



Children will develop their understanding of division and use jottings to support calculation.

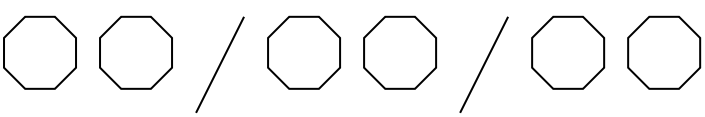
Sharing equally

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



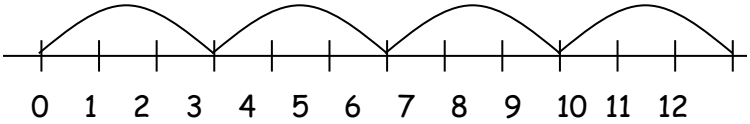
Grouping or repeated subtraction/addition (using concept of times tables)

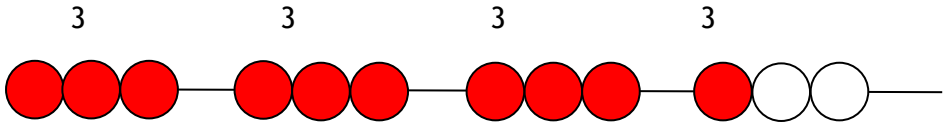
There are 6 sweets, how many people can have 2 sweets each?



Repeated addition using a number line or bead bar

12 ÷ 3 = 4





The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?'

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

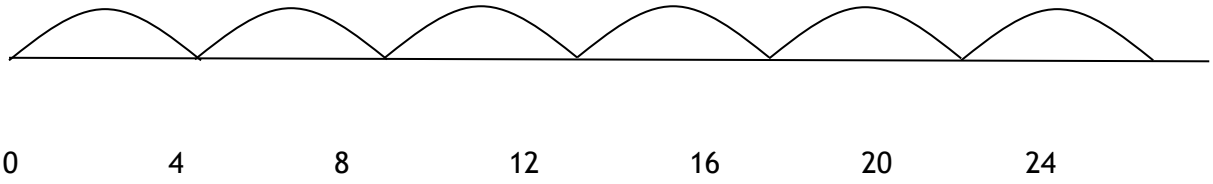
□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

Ensure that the emphasis is on grouping rather than sharing.

Repeated addition using a number line

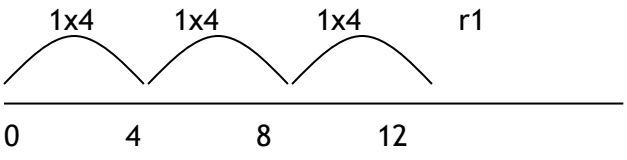
Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



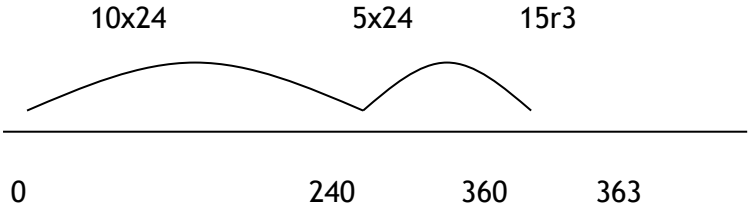
Using symbols to stand for unknown numbers to complete equations using inverse operations

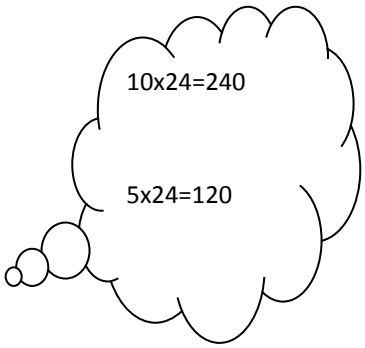
26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

Repeated addition using a number line

Using larger numbers, children will use an empty number line to support their calculation. A thought bubble can be a useful way for children to record the facts they may need for the calculation.

363 ÷ 24 = 15r3





Vertical chunking

Use of a vertical presentation linking closely with the counting on numberline method.

26 r1

14 | 365

140 (**10**x14)

140 (**10**x14)

280

70 (**5**x14)

350

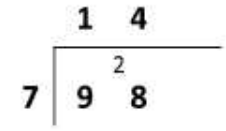
14 (**1**x14)

364

Formal Written Methods:

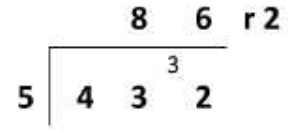
Short division

98 ÷ 7 becomes



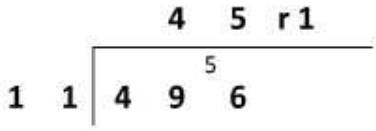
Answer: 14

432 ÷ 5 becomes



Answer: 86 remainder 2

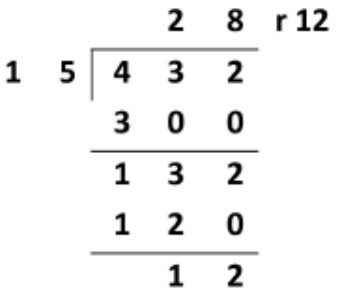
496 ÷ 11 becomes



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

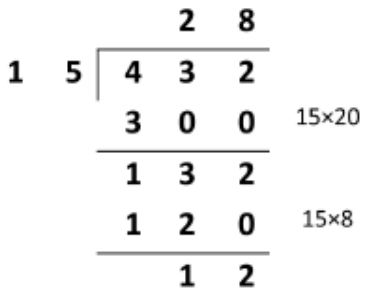
Long division

432 ÷ 15 becomes



Answer: 28 remainder 12

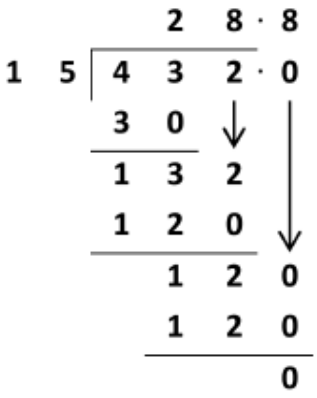
432 ÷ 15 becomes



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

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

432 ÷ 15 becomes



Answer: 28·8

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

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