PROGRESSION THROUGH CALCULATIONS FOR DIVISION

In Key Stage 1, the principal focus of mathematics teaching is to ensure that **all** children develop confidence and mental fluency with whole numbers, counting and place value. This will involve working with numerals, words and the four operations and will include the use of practical resources. By the end of year 2, children should know number bonds to 20 and use understanding of place value with numbers to at least 100.

In years 3 and 4, teaching will ensure that children become increasingly fluent with whole numbers, the four operations and place value. They will develop efficient written and mental methods and will work on calculations using increasingly large whole numbers.

The main focus for teaching in years 5 and 6 is to ensure that children extend their understanding of the number system and place value using large whole numbers (up to 10 000 000)

By the end of year 6, pupils should be fluent in written methods for all four operations and in working with fractions, decimals and percentages. They should divide numbers up to 4 digits by a 2 digit whole number using formal written method of long division or short division (where appropriate). They should interpret remainders as whole number remainders, fractions or by rounding, as appropriate for the context.

Children should not be made to go onto the next stage if:

1) They are not ready.
2) They are not confident.

Children should be encouraged to check their answers after calculation using an appropriate strategy. Children should also be encouraged to consider if a mental calculation would be more accurate and efficient before using written methods.

They are expected to use mathematical vocabulary and to read, spell and pronounce the language correctly.

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MENTAL CALCULATIONS

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

Repeated subtraction
Use as an initial way to show division, counting backwards as well as forwards will develop understanding of this concept.

Doubling and halving
Knowing that halving is dividing by 2

Deriving and recalling division facts
Tables should be introduced from Y2 onwards. Children need to recognise and use the inverse relationship between multiplication and division in calculations and knowing their times tables fluently is vital for solving division calculations efficiently.

Year 2 2 times table
5 times table
10 times table and others if appropriate

Year 3 2 times table
3 times table
4 times table
5 times table
8 times table
10 times table and others if appropriate

Year 4 Derive and recall division facts for all tables up to 12 x 12

Year 5 & 6 Derive and recall **quickly** division facts for all tables up to 12 x 12

Dividing by 10 or 100 or 1000
Knowing that the effect of dividing by 10 is to move the digits one place to the right (10 times smaller).
Knowing that the effect of dividing by 100 is to move the digits two places to the right (100 times smaller).
Knowing that the effect of dividing by 1000 is to move the digits three places to the right (1000 times smaller).

Using and applying division facts (Place value)
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?
7x3=21, 21÷ 7=3, 21÷ 3=7, 210 ÷70=3, 210÷ 7=30, etc

Use related facts
Given that 60x5=300
What is 300÷ 6, or 300÷ 5 ?

Use of factors
48 ÷ 16 = 48 ÷ 2 = 24 2 and 8 are factors of 16
24 ÷ 8 = 3

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THE FOLLOWING ARE STRATEGIES THAT WE EXPECT THE MAJORITY OF CHILDREN TO UNDERSTAND AND USE.

INITIALLY

Children should notice that groups of objects may be split up. Through practical and play opportunities children should experience sharing out objects into equal groups. Children may experience counting in 2's, 5's and 10's and then put objects into these groups.

THEN

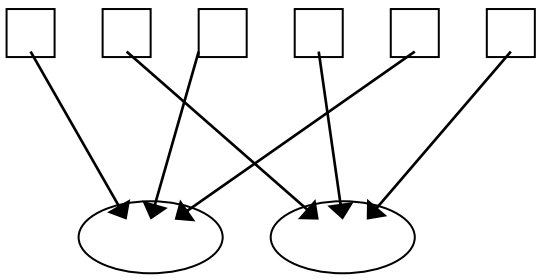
Children should use a range of number lines; horizontal, vertical, blank and also number 'ladders' to support their understanding of division (as repeated subtraction).
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s. Money is an ideal way to promote understanding of counting up and down like this, and should be widely used.
Children should develop their understanding of the relationship between doubling and halving. Children will do a lot of work on division practically, with cubes, counters, fruit etc. diagram using bar modelling

NEXT

As well as using practical apparatus to solve division problems, children will develop their understanding of division using jottings. They will be using ÷ and = signs to record.

Sharing equally

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



'One for you, one for me'

6÷2= 3

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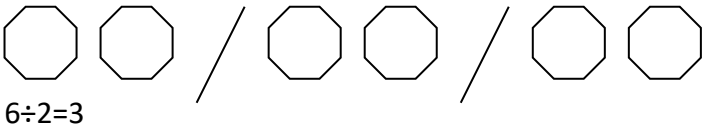
<u>Grouping</u> or repeated subtraction

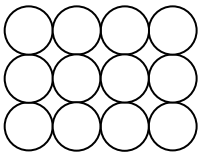
There are 6 sweets, how many people can have 2 sweets each?



'groups for each child'

6÷2=3

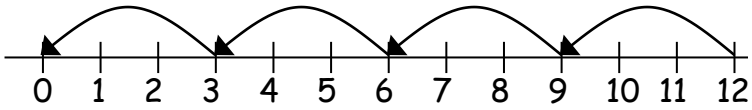
Use of arrays to show division

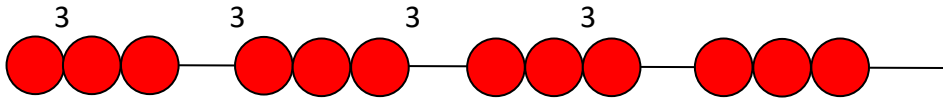


is 12÷4=3 or 12÷3=4

Repeated subtraction using a number line or bead string

12 ÷ 3 =? is 12-3-3-3-3=0





The bead string will help children with interpreting division calculations such as 12 ÷ 3 as 'how many 3s make 12?'

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

☐ ÷ 2 = 4 20 ÷ △ = 4 20÷5=÷Δ

Remainders should be introduced when children are ready, and they should record numerically as eg 25÷4= 6 r1.

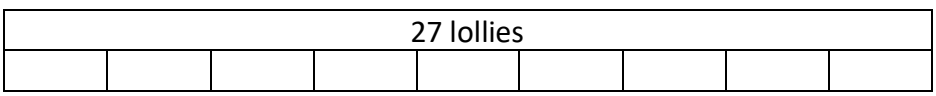
Bar Modelling

This can be introduced as a visual aid to support calculation of division problems.

Sharing

Grace has 27 lollies. She wants to share them into 9 party bags for her friends. How many lollies will go into each party bag?

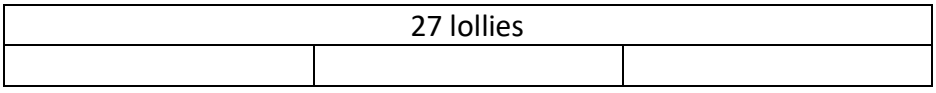
27÷9=3



Grouping

Grace has 27 lollies. She wants each friend to have 3 lollies. How many friends can she invite to the party?

27÷3=9



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AFTER THAT

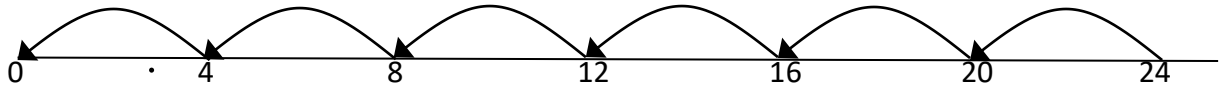
Ensure that the emphasis moves to grouping (making equal groups) rather than sharing (one for me, one for you) although both terms will be used. Continue to use arrays.

Children will continue to use:

Repeated subtraction using a number line

Children will use an empty number line to support their calculation. (Some may still need to use a structured numberline).

24 ÷ 4 = 6

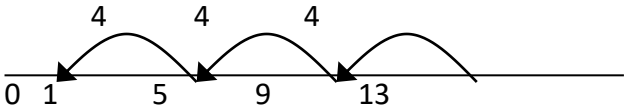


Using symbols to stand for unknown numbers to complete equations using inverse operations

26 ÷ 2 = ☐ 24 ÷ △ = 12 ☐ ÷ 10 = 8 ☐ ÷ △ = 6

Children should also move onto calculations involving remainders.

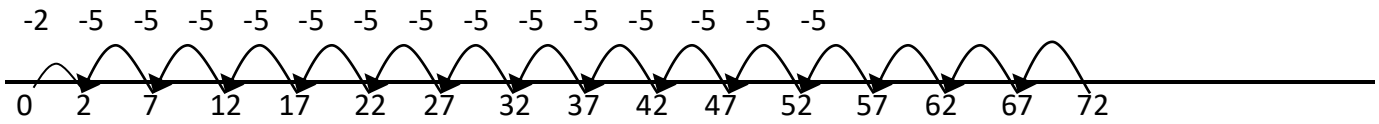
13 ÷ 4 = 3 r 1



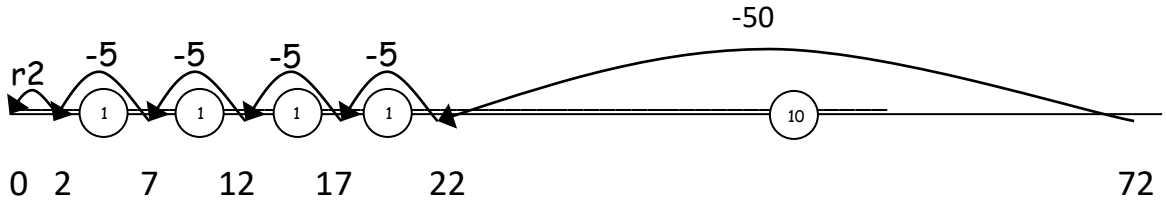
WHEN READY

Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.

72 ÷ 5



Moving onto taking a 'chunk':



Then onto the vertical method (chunking):

The next steps are not compulsory but they can help the children to understand the process of short division. Short division MUST be taught.

Division TU ÷ U

70 ÷ 5

```
      14
5 )   70
    - 50      10x5
      20
    - 20      4x5
      00
```

Answer: 14

72 ÷ 3

```
      24
3 )   72
    - 30      10x3
      42
    - 30      10x3
      12
    -  6      2x3
       6
    -  6      2x3
       0
```

Answer : 24

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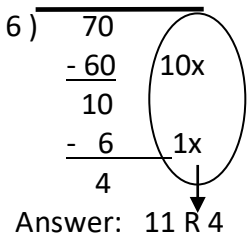
Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

70 ÷ 6



Answer: 11 R 4

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 62 ÷ 8 is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?
Answer: 7 (the remaining 6p is not enough to buy another sweet)

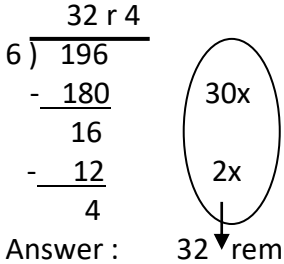
Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?
Answer: 8 (the remaining 6 apples still need to be placed into a box)

MOVING ON TO

Children should subtract larger multiples of the divisor, e.g. 30x, so that they are reaching an answer in the least number of steps possible.

Division HTU ÷ U

196 ÷ 6 Approximate answer 180 ÷ 6 = 30



Answer : 32 remainder 4 or 32 r 4

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children should begin to decide whether any remainders could be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in it's lowest terms.

Division HTU ÷ TU

972 ÷ 36

```
      27
36 ) 972
   - 720      20x
     252
   - 252       7x
       0
```

Answer : 27

Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in it's lowest terms.

Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other and again, use place value to assist them.

E.g. 7 x 5 = 35, so 7 x 0.5 = 3.5 or

x by 10 to make a whole number (87.5 becomes 875), then ÷ the answer by 10

87.5 ÷ 7

```
     12.5
7 ) 87.5
    70.0      10x
    17.5
  - 14.0       2x
     3.5
  -  3.5     0.5x
     0
```

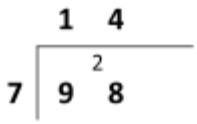
Answer : 12.5

FINALLY

Children will be encouraged to use efficient written methods of division.

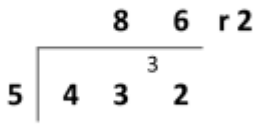
Short Division

98 ÷ 7 becomes



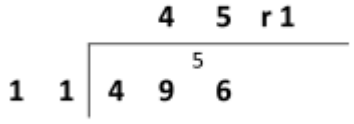
Answer: 14

432 ÷ 5 becomes



Answer: 86 remainder 2

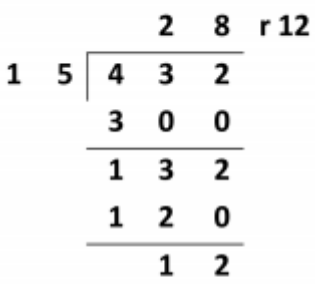
496 ÷ 11 becomes



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

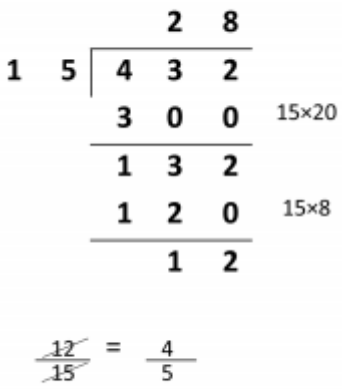
Long Division

432 ÷ 15 becomes



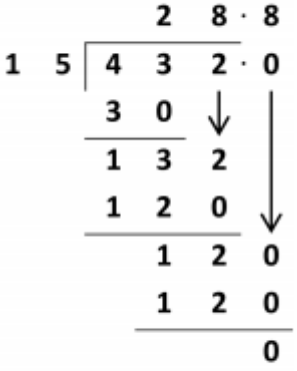
Answer: 28 remainder 12

432 ÷ 15 becomes



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

432 ÷ 15 becomes



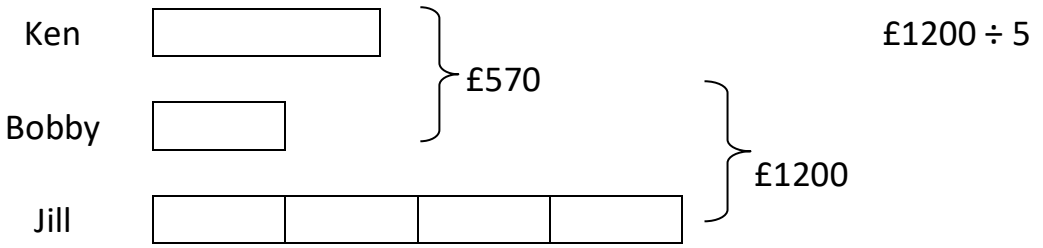
Answer: 28·8

Bar modelling is particularly useful when solving multi-step word problems.

For example:

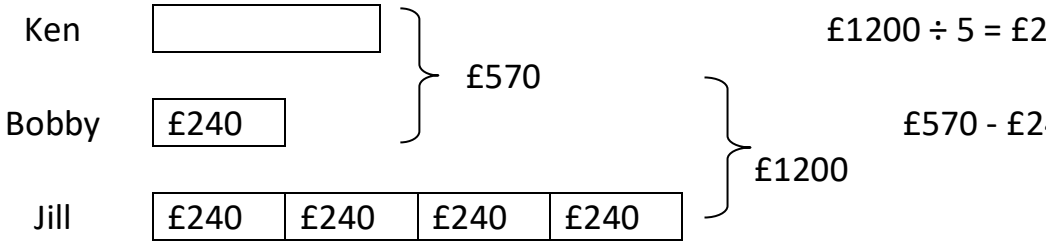
Ken and Bobby have a total of £570.
Bobby and Jill have a total of £1200.
Jill has 4 times as much money as Bobby.
How much money does Ken have?

Step 1



£1200 ÷ 5

Step 2



£1200 ÷ 5 = £240

£570 - £240

Ken has £330