

# Notes 4 Parents

## Division



Marpool Primary School

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'Every child will have confidence in their own self-worth and an aspiration to achieve.'

**Division vocabulary** = Divided by, share, divide, share equally, divisible by, divide into, group

### To divide successfully, children need to be able to:

- understand and use the vocabulary of division - for example in  $18 \div 3 = 6$ , 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  $10 \times 10$ , 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.
- understand division as repeated subtraction
- estimate how many times one number divides into another - for example, how many sixes there are in 47, or how many 23s there are in 92
- multiply a two-digit number by a single-digit number mentally
- subtract numbers using the column method.

## Stage 1: Mental division using partitioning

### Method

Children should also be able to find a remainder mentally, for example the remainder when 34 is divided by 6.

### Example

One way to work out  $TU \div U$  mentally is to partition  $TU$  into a multiple of the divisor plus the remaining ones, then divide each part separately.

Informal recording in Year 4 for  $84 \div 7$  might be:

$$\begin{array}{r} 84 \\ 70 + 14 \\ \downarrow \quad \downarrow \div 7 \\ 10 + 2 = 12 \end{array}$$

In this example, using knowledge of multiples, the 84 is partitioned into 70 (the highest multiple of 7 that is also a multiple of 10 and less than 84) plus 14 and then each part is divided separately.

Another way to record is in a grid, with links to the grid method of multiplication.

$$\begin{array}{|c|c|c|} \hline \times & & \\ \hline 7 & 70 & 14 \\ \hline \end{array} \rightarrow \begin{array}{|c|c|c|} \hline \times & 10 & 2 \\ \hline 7 & 70 & 14 \\ \hline \end{array} \quad 10 + 2 = 12$$

As the mental method is recorded, ask: 'How many sevens in seventy?' and: 'How many sevens in fourteen?'

Also record mental division using partitioning:

$$\begin{aligned} 64 \div 4 &= (40 + 24) \div 4 \\ &= (40 \div 4) + (24 \div 4) \\ &= 10 + 6 = 16 \\ 87 \div 3 &= (60 + 27) \div 3 \\ &= (60 \div 3) + (27 \div 3) \\ &= 20 + 9 = 29 \end{aligned}$$

Remainders after division can be recorded similarly.

$$\begin{aligned} 96 \div 7 &= (70 + 26) \div 7 \\ &= (70 \div 7) + (26 \div 7) \\ &= 10 + 3 \text{ R } 5 = 13 \text{ R } 5 \end{aligned}$$

# Notes 4 Parents Division



Marpool Primary School

## Stage 2: Short division of TU ÷ U

### Method

'Short' division of TU ÷ U can be introduced as a short way to record the mental method of partitioning.

Short division of two-digit number can be introduced to children who are confident with multiplication and division facts and with subtracting multiples of 10 mentally, and whose understanding of partitioning and place value is sound.

For most children this will be at the end of Year 4 or the beginning of Year 5.

How many threes divide into 80 so that the answer is a multiple of 10? This gives 20 threes or 60, with 20 remaining. We now ask: 'What is 21 divided by three?' which gives the answer 7.

### Example

For  $81 \div 3$ , the dividend of 81 is split into 60, the highest multiple of 3 that is also a multiple 10 and less than 81, to give  $60 + 21$ . Each number is then divided by 3.

$$\begin{aligned} 81 \div 3 &= (60 + 21) \div 3 \\ &= (60 \div 3) + (21 \div 3) \\ &= 20 + 7 \\ &= 27 \end{aligned}$$

The short division method is recorded like this:

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

This is then shortened to:

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

The carry digit '2' represents the 2 tens that have been exchanged for 20 ones. In the first recording above it is written in front of the 1 to show that 21 is to be divided by 3. In second it is written as a superscript.

The 27 written above the line represents the answer: 20 + 7, or 2 tens and 7 ones.

## Stage 3: 'Expanded' method for HTU ÷ U

### Method

This method is based on subtracting multiples of the divisor from the number to be divided.

For TU ÷ U there is a link to the mental method.

As you record the division, ask: 'How many nines in 90?' or 'What is 90 divided by 9?'

Once they understand and can apply the method, children should be able to move on from TU ÷ U to HTU ÷ U quite quickly as the principles are the same.

This method, often referred to as 'chunking', is based on subtracting multiples of the divisor, or 'chunks'.

Initially children subtract several chunks, but with practice they should look for the biggest multiples of the divisor that they can find to subtract.

Chunking is useful for reminding children of the link between division and repeated subtraction.

However, children need to recognise that chunking is inefficient if too many subtractions have to be carried out. Encourage them to reduce the number of steps and move them on quickly to finding the largest possible multiples.

### Example

$$97 \div 9$$

$$\begin{array}{r} 6 \overline{) 196} \\ - \underline{60} \quad 6 \times 10 \\ \quad 136 \\ - \underline{60} \quad 6 \times 10 \\ \quad \quad 76 \\ - \underline{60} \quad 6 \times 10 \\ \quad \quad \quad 16 \\ - \underline{12} \quad 6 \times 2 \\ \quad \quad \quad \quad 4 \quad 32 \end{array}$$

Answer: 10 R 4

Answer: 32 R 4

# Notes 4 Parents Division



Marpool Primary School

## Stage 3: 'Expanded' method for $HTU \div U$ , chunking

### Method

The key to the efficiency of chunking lies in the estimate that is made before the chunking starts.

Estimating has two purposes when doing a division: to help to choose a starting point for the division; to check the answer after the calculation.

Children who have a secure knowledge of multiplication facts and place value should be able to move on quickly to the more efficient recording on the right.

### Example

To find  $196 \div 6$ , we start by multiplying 6 by 10, 20, 30, ... to find that  $6 \times 30 = 180$  and  $6 \times 40 = 240$ . The multiples of 180 and 240 trap the number 196. This tells us that the answer to  $196 \div 6$  is between 30 and 40.

Start the division by first subtracting 180, leaving 16, and then subtracting the largest possible multiple of 6, which is 12, leaving 4.

$$\begin{array}{r} 6 \overline{) 196} \\ - \underline{180} \quad 6 \times 30 \\ \quad 16 \\ - \quad \underline{12} \quad 6 \times 2 \\ \quad \quad 4 \quad 32 \end{array}$$

Answer: 32 R 4

The answer 32 (with a remainder of 4) lies between 30 and 40, as estimated.

## Stage 4: Short division of $HTU \div U$

### Method

'Short' division of  $HTU \div U$  can be introduced as an alternative recording. No chunking is involved since the links are to partitioning, not repeated subtraction.

The accompanying pattern is 'How many threes in 290?' (the answer must be a multiple of 10). This gives 90 threes or 270, with 20 remaining. We now ask: 'How many threes in 21?' which has the answer 7.

Short division of a three-digit number can be introduced to children who are confident with multiplication and division facts and with subtracting multiples of 10 mentally, and whose understanding of partitioning and place value is sound.

For most children this will be at the end of Year 5 or the beginning of Year 6.

### Example

For  $291 \div 3$ , because  $3 \times 90 = 270$  and  $3 \times 100 = 300$ , we use 270 and split the dividend of 291 into  $270 + 21$ . Each part is then divided by 3.

$$\begin{aligned} 291 \div 3 &= (270 + 21) \div 3 \\ &= (270 \div 3) + (21 \div 3) \\ &= 90 + 7 \\ &= 97 \end{aligned}$$

The short division method is recorded like this:

$$\begin{array}{r} 90 + 7 \\ 3 \overline{) 290 + 1} = 3 \overline{) 270 + 21} \end{array}$$

This is then shortened to:

$$\begin{array}{r} 97 \\ 3 \overline{) 291} \end{array}$$

The carry digit '2' represents the 2 tens that have been exchanged for 20 ones. In the first recording above it is written in front of the 1 to show that a total of 21 ones are to be divided by 3.

The 97 written above the line represents the answer: 90 + 7, or 9 tens and 7 ones.

# Notes 4 Parents

## Division



Marpool Primary School

### Stage 3: 'Expanded' method for $HTU \div U$ , chunking

#### Method

The next step is to tackle  $HTU \div TU$ , which for most children will be in Year 6.

The layout on the right, which links to chunking, is in essence the 'long division' method.

The 20, or 2 tens, and the 3 ones forming the answer are recorded above the line, as in the second recording.

#### Example

How many packs of 24 can we make from 560 biscuits?  
Start by multiplying 24 by multiples of 10 to get an estimate.  
As  $24 \times 20 = 480$  and  $24 \times 30 = 720$ , we know the answer lies between 20 and 30 packs. We start by subtracting 480 from 560.

$$\begin{array}{r} 24 \overline{)560} \\ 20 \underline{-480} \quad 24 \times 20 \\ \quad 80 \\ \quad 3 \underline{-72} \quad 24 \times 3 \\ \quad \quad 8 \end{array}$$

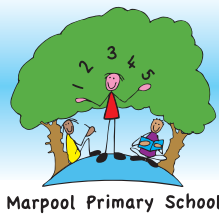
Answer: 23 R 8

In effect, the recording is the long division method.

$$\begin{array}{r} \quad 23 \\ 24 \overline{)560} \\ \underline{-480} \\ \quad 80 \\ \underline{-72} \\ \quad \quad 8 \end{array}$$

Answer: 23 R 8

# Notes 4 Parents Division



Marpool Primary School

## Key objectives for division

Year group	Objective
Foundation	<ul style="list-style-type: none"> <li>Share objects into equal groups and count how many in each group</li> </ul>
Year 1	<ul style="list-style-type: none"> <li>Solve practical problems that involve combining groups of 2, 5 or 10, or sharing into equal groups</li> </ul>
Year 2	<ul style="list-style-type: none"> <li>Represent sharing and repeated subtraction (grouping) as division; use practical and informal written methods and related vocabulary to support multiplication and division, including calculations with remainders</li> <li>Use the symbol <math>\div</math> and <math>=</math> to record and interpret number sentences involving all four operations; calculate the value of an unknown in a number sentence (e.g. <math>\square \div 2 = 6</math>)</li> </ul>
Year 3	<ul style="list-style-type: none"> <li>Use practical and informal written methods to divide two-digit numbers (e.g. <math>50 \div 4</math>); round remainders up or down, depending on the context</li> <li>Understand that division is the inverse of multiplication and vice versa; use this to derive and record related multiplication and division number sentences</li> <li>Find unit fractions of numbers and quantities (e.g. <math>\frac{1}{2}</math>, <math>\frac{1}{3}</math>, <math>\frac{1}{4}</math> and <math>\frac{1}{6}</math> of 12 litres)</li> </ul>
Year 4	<ul style="list-style-type: none"> <li>Use a calculator to carry out one-step and two-step calculations</li> <li>Find fractions of numbers, quantities or shapes (e.g. <math>\frac{1}{5}</math> of 30 plums, <math>\frac{3}{8}</math> of a 6 by 4 rectangle)</li> <li>Develop and use written methods to record, support and explain division of two-digit numbers by a one-digit number, including division with remainders (e.g. <math>98 \div 6</math>)</li> <li>Divide numbers to 1000 by 10 and then 100 (whole-number answers), understanding the effect; relate to scaling up or down</li> </ul>
Year 5	<ul style="list-style-type: none"> <li>Extend mental-methods for whole-number calculations.</li> <li>Use understanding of place value to divide whole numbers and decimals by 10, 100 or 1000</li> <li>Refine and use efficient written methods to divide <math>\text{HTU} \div \text{U}</math></li> <li>Find fractions using division (e.g. of 5 kg), and percentages of numbers and quantities (e.g. 10%, 5% and 15% of £80)</li> <li>Use a calculator to solve problems, including those involving decimals or fractions (e.g. find <math>\frac{3}{4}</math> of 150 g); interpret the display correctly in the context of measurement</li> </ul>
Year 6	<ul style="list-style-type: none"> <li>Calculate mentally with integers (whole numbers) and decimals: <math>\text{TU} \div \text{U}</math>, <math>\text{U.t} \div \text{U}</math></li> <li>Use efficient written methods to divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer</li> <li>Relate fractions to division (e.g. <math>6 \div 2 = \frac{1}{2}</math> of 6 = <math>6 \times \frac{1}{2}</math>); express a quotient as a fraction or decimal (e.g. <math>67 \div 5 = 13.4</math> or <math>13 \frac{2}{5}</math>); find fractions and percentages of whole-number quantities (e.g. of 96, 65% of £260)</li> <li>Use a calculator to solve problems involving multi-step calculations</li> </ul>