

Progression in Calculations. Y6

Division.

Year 6

2-digit divisors

Children build on their understanding of dividing up to 4-digits by 1-digit by now dividing by up to two digits. They use the short division method and focus on the grouping structure of division.

- Recording as long division

$$\begin{array}{r} 2 \text{ r} 25 \\ 30 \overline{) 85} \\ \underline{60} \\ 25 \end{array}$$

Short Division

Ratio chart and long division:

'Becky has 434 cm of ribbon to wrap up prizes for a school competition. Each prize needs 31 cm of ribbon. How many prizes can she wrap?'

$$434 \div 31 = ?$$

Ratio chart:

	$\times 31$
1	31
2	62
3	
4	124
5	155
6	
7	
8	248
9	
10	310

Step 1 – write the divisor, frame and dividend

$$31 \overline{) 434}$$

Step 2 – divide the hundreds

$$\begin{array}{r} 0 \\ 31 \overline{) 434} \end{array}$$

4 hundreds \div 31 = 0 hundreds r 4 hundreds

- 'Write "0" in the hundreds column of the answer line.'

Step 3 – exchange hundreds for tens, combine with the existing tens and divide...

$$\begin{array}{r} 0 \ 1 \\ 31 \overline{) 434} \\ \underline{31} \\ 31 \end{array} \quad (1 \text{ ten} \times 31 = 31 \text{ tens})$$

4 hundreds = 40 tens

40 tens + 3 tens = 43 tens

43 tens \div 31 = 1 ten and a remainder

- 'Write "1" in the tens column of the answer line and write "31" underneath the "43".'

Progression in Calculations. Y6

Division.

	<p>Step 4 – subtract to find the remainder</p> $\begin{array}{r} 0 \ 1 \\ 31 \overline{) 4 \ 3 \ 4} \\ \underline{3 \ 1} \quad (1 \text{ ten} \times 31 = 31 \text{ tens}) \\ 1 \ 2 \end{array}$ <p>43 tens – 31 tens = 12 tens</p> <ul style="list-style-type: none"> • 'Write "12" underneath the "31".' 	<p>Step 5 – exchange tens for ones and combine with the existing ones</p> $\begin{array}{r} 0 \ 1 \\ 31 \overline{) 4 \ 3 \ 4} \\ \underline{3 \ 1} \quad \downarrow \quad (1 \text{ ten} \times 31 = 31 \text{ tens}) \\ 1 \ 2 \ 4 \end{array}$ <p>12 tens = 120 ones 120 ones + 4 ones = 124 ones</p> <ul style="list-style-type: none"> • 'Write "4" after the "12".'
	<p>Step 6 – divide the ones</p> $\begin{array}{r} 0 \ 1 \ 4 \\ 31 \overline{) 4 \ 3 \ 4} \\ \underline{3 \ 1} \quad (1 \text{ ten} \times 31 = 31 \text{ tens}) \\ 1 \ 2 \ 4 \\ \underline{1 \ 2 \ 4} \quad (4 \text{ ones} \times 31 = 124 \text{ ones}) \end{array}$ <p>124 ones ÷ 31 = 4 ones (refer to the ratio chart)</p> <ul style="list-style-type: none"> • 'Write "4" in the ones column of the answer line and write "124" underneath the "124", aligning the digits.' 	<p>Step 7 – subtract to show there is no remainder</p> $\begin{array}{r} 0 \ 1 \ 4 \\ 31 \overline{) 4 \ 3 \ 4} \\ \underline{3 \ 1} \quad (1 \text{ ten} \times 31 = 31 \text{ tens}) \\ 1 \ 2 \ 4 \\ \underline{1 \ 2 \ 4} \quad (4 \text{ ones} \times 31 = 124 \text{ ones}) \\ 0 \end{array}$ <p>124 ones – 124 ones = 0 ones</p> <ul style="list-style-type: none"> • 'Write "0" underneath the "31".'

• 'Becky can wrap fourteen presents.'

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<p>Division using factors</p> <p>Children use their number sense, specifically their knowledge of factors, to be able to see the relationship between the dividend (number being divided) and the divisor (number that the dividend is being divided by).</p>	<p>Calculate $780 \div 20$</p> <p>Now calculate $780 \div 10 \div 2$</p> <p>What do you notice? Why does this work?</p> <p>Use the same method to calculate $480 \div 60$</p>																																						
<p>Long Division (1)</p> <p>Children are introduced to long division as a different method of dividing by a 2-digit number.</p> <p>They divide 3-digit numbers by a 2-digit number without remainders, starting with a more expanded method (with multiples shown), before progressing to the more formal long division method.</p>	<table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td></td><td></td><td>0</td><td>3</td><td>6</td><td></td></tr> <tr><td>1</td><td>2</td><td>4</td><td>3</td><td>2</td><td>(x30)</td></tr> <tr><td></td><td>-</td><td>3</td><td>6</td><td>0</td><td></td></tr> <tr><td></td><td></td><td></td><td>7</td><td>2</td><td>(x6)</td></tr> <tr><td></td><td>-</td><td></td><td>7</td><td>2</td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td>0</td><td></td></tr> </table>			0	3	6		1	2	4	3	2	(x30)		-	3	6	0					7	2	(x6)		-		7	2						0		<p><u>Multiples of 12:</u></p> <p>$12 \times 1 = 12$</p> <p>$12 \times 2 = 24$</p> <p>$12 \times 3 = 36$</p> <p>$12 \times 4 = 48$</p> <p>$12 \times 5 = 60$</p> <p>$12 \times 6 = 72$</p> <p>$12 \times 7 = 84$</p> <p>$12 \times 8 = 96$</p> <p>$12 \times 7 = 108$</p> <p>$12 \times 10 = 120$</p>	
		0	3	6																																			
1	2	4	3	2	(x30)																																		
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<p style="color: red; text-align: center;">Long Division (2)</p> <p>Building on using long division with 3-digit numbers, children divide 4-digit numbers by 2-digits using the long division method.</p>	<p>Here is a division method.</p> <table border="1" style="display: inline-table; margin-right: 20px;"> <tbody> <tr><td></td><td>0</td><td>4</td><td>8</td><td>9</td></tr> <tr><td>15</td><td>7</td><td>3</td><td>3</td><td>5</td></tr> <tr><td>–</td><td>6</td><td>0</td><td>0</td><td>0</td></tr> <tr><td></td><td>1</td><td>3</td><td>3</td><td>5</td></tr> <tr><td>–</td><td>1</td><td>2</td><td>0</td><td>0</td></tr> <tr><td></td><td></td><td>1</td><td>3</td><td>5</td></tr> <tr><td>–</td><td></td><td>1</td><td>3</td><td>5</td></tr> <tr><td></td><td></td><td></td><td></td><td>0</td></tr> </tbody> </table> <p>(x400)</p> <p>(x80)</p> <p>(x9)</p>		0	4	8	9	15	7	3	3	5	–	6	0	0	0		1	3	3	5	–	1	2	0	0			1	3	5	–		1	3	5					0
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Long Division (3)

Children now divide using long division where answers have remainders. After dividing, they check that the remainder is smaller than the divisor.

Tommy uses this method to calculate 372 divided by 15
He has used his knowledge of multiples to help.

			2	4	r	1	2
1	5	3	7	2			
	-	3	0	0			
			7	2			
	-		6	0			
			1	2			

$$1 \times 15 = 15$$

$$2 \times 15 = 30$$

$$3 \times 15 = 45$$

$$4 \times 15 = 60$$

$$5 \times 15 = 75$$

$$10 \times 15 = 150$$

Long Division (4)

Children now divide four-digit numbers using long division where their answers have remainders. After dividing, they check that their remainder is smaller than their divisor.

Children start to understand when rounding is appropriate to use for interpreting the remainder and when the context means that it is not applicable.

Amir used this method to calculate 1,426 divided by 13

			1	0	9	r	9
1	3	1	4	2	6		
	-	1	3	0	0		
			1	2	6		
	-		1	1	7		
					9		

($\times 100$)

($\times 9$)

Progression in Calculations. Y6

Division.

Four-digit ÷ two-digit calculation without remainder:

$$4,945 \div 23 = ?$$

Long division

$$\begin{array}{r} 215 \\ 23 \overline{) 4945} \\ \underline{46} \\ 34 \\ \underline{23} \\ 115 \\ \underline{115} \\ 0 \end{array}$$

Short division

$$\begin{array}{r} 0215 \\ 23 \overline{) 4945} \\ \underline{4} \\ \\ \\ \end{array}$$

Four-digit ÷ two-digit calculation with remainder:

$$7,283 \div 28 = ?$$

Long division


$$\begin{array}{r} 260 \text{ r}3 \\ 28 \overline{) 7283} \\ \underline{56} \\ 168 \\ \underline{168} \\ 03 \end{array}$$

Short division

$$\begin{array}{r} 260 \text{ r}3 \\ 28 \overline{) 7283} \\ \underline{7} \\ \\ \\ \end{array}$$

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Division.

	<p style="text-align: center;">Partitioning</p>  <p style="text-align: center;"> $310 \div 31 = 10$ $124 \div 31 = 4$ <hr style="width: 50%; margin: 0 auto;"/> $434 \div 31 = 14$ </p>	<p style="text-align: center;">Short division</p> $\begin{array}{r} 0 \quad 1 \quad 4 \\ 31 \overline{) 4 \quad 3 \quad 1 \quad 4} \end{array}$	<p style="text-align: center;">Long division</p> $\begin{array}{r} 0 \quad 1 \quad 4 \\ 31 \overline{) 4 \quad 3 \quad 1 \quad 4} \\ \underline{3 \quad 1} \\ 1 \quad 2 \quad 4 \\ \underline{1 \quad 2 \quad 4} \\ 0 \end{array}$ <p style="text-align: right;">(1 ten \times 31 = 31 tens) (4 ones \times 31 = 124 ones)</p>										
	<i>Three-digit \div two-digit calculation with a remainder:</i>												
	<p style="text-align: center;">Ratio chart</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="background-color: #e0e0e0;">$\times 33$</td> </tr> <tr> <td>1</td> <td>33</td> </tr> <tr> <td>2</td> <td>66</td> </tr> <tr> <td>3</td> <td style="background-color: #e0e0e0;"></td> </tr> <tr> <td>4</td> <td>132</td> </tr> </table>		$\times 33$	1	33	2	66	3		4	132	<p style="text-align: center;">Short division</p> $\begin{array}{r} 0 \quad 2 \quad 1 \quad r25 \\ 33 \overline{) 7 \quad 1 \quad 5 \quad 8} \end{array}$	<p style="text-align: center;">Long division</p> $\begin{array}{r} 2 \quad 1 \quad r25 \\ 33 \overline{) 7 \quad 1 \quad 5 \quad 8} \\ \underline{6 \quad 6} \\ 5 \quad 8 \\ \underline{3 \quad 3} \\ 2 \quad 5 \end{array}$
	$\times 33$												
1	33												
2	66												
3													
4	132												

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Long division – remainder expressed as a whole number:

‘Sue has seven hundred and thirty books. She packs them into boxes of twenty-five.’

- *‘How many full boxes are there?’*
- *‘How many boxes does she need to pack all of the books?’*
- *‘How many books are not in a full box?’*

$$730 \div 25 = ?$$

$$\begin{array}{r} 29 \text{ r } 5 \\ 25 \overline{) 730} \\ \underline{50} \\ 230 \\ \underline{225} \\ 005 \end{array}$$

	× 25
1	25
2	50
4	100
5	125
8	200
10	250

- So, $730 \div 25 = 29 \text{ r } 5$

Full boxes: 29

Boxes needed: 30

Books not in a full box: 5

Short division alternative:

$$\begin{array}{r} 0 \quad 2 \quad 9 \quad \text{r } 5 \\ 25 \overline{) 7 \quad 3 \quad 0} \end{array}$$

Progression in Calculations. Y6

Division.

Long division – remainder converted to decimal fraction:

'Dinesh sells twenty-five jumpers, each for the same amount, and makes a total of £730. How much did each jumper sell for?'

$$730 \div 25 = ?$$

Step 1 – calculate the whole-number quotient:

$$\begin{array}{r} 29 \\ 25 \overline{)730} \\ \underline{50} \\ 230 \\ \underline{225} \\ 5 \end{array}$$

- $73 \text{ tens} \div 25 = 2 \text{ tens}$ and a remainder
'Write "2" in the tens column of the answer line and write "50" underneath the "73".'
- $73 \text{ tens} - 50 \text{ tens} = 23 \text{ tens}$
'Write "23" underneath the "50".'
- $23 \text{ tens} = 230 \text{ ones}$
'Write "0" after the "23".'
- $230 \text{ ones} \div 25 = 9 \text{ ones}$ and a remainder
'Write "9" in the ones column of the answer line and write "225" underneath the "230".'
- $230 \text{ ones} - 225 \text{ ones} = 5 \text{ ones}$
'Write "5" underneath the "225".'

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Division.

Step 2 – introduce the decimal point:

$$\begin{array}{r} 29. \\ 25 \overline{) 730.0} \\ \underline{50} \\ 230 \\ \underline{225} \\ 5 \end{array}$$

- *There is a remainder. To represent this as a decimal fraction, first write a decimal point after the ones digit of both the dividend and the quotient. Write a placeholder zero in the tenths column of the dividend.*

Progression in Calculations. Y6

Division.

Step 3 – continue:

$$\begin{array}{r} 29. \\ 25 \overline{) 730.0} \\ \underline{50} \\ 230 \\ \underline{225} \\ 50 \end{array}$$

- 5 ones = 50 tenths
Write "0" after the "5".

Step 4 – complete the calculation:

$$\begin{array}{r} 29.2 \\ 25 \overline{) 730.0} \\ \underline{50} \\ 230 \\ \underline{225} \\ 50 \\ \underline{50} \\ 0 \end{array}$$

- 50 tenths + 25 = 2 tenths
Write "2" in the tenths column of the answer line and write "50" underneath the "50".
- 50 tenths – 50 tenths = 0 tenths
Write "0" underneath the "50".
- So, $730 \div 25 = 29.2$
- 'Each jumper sold for £29.20.'

Short division alternative:

$$\begin{array}{r} 029.2 \\ 25 \overline{) 730.50} \end{array}$$

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Division.

354 ÷ 15 = ?		
$\begin{array}{r} 23 \text{ r}9 \\ 15 \overline{) 354} \\ \underline{30} \\ 54 \\ \underline{45} \\ 9 \end{array}$	$\begin{array}{r} 23 \frac{9}{15} \\ 15 \overline{) 354} \\ \underline{30} \\ 54 \\ \underline{45} \\ 9 \end{array}$	$\begin{array}{r} 23.6 \\ 15 \overline{) 354.0} \\ \underline{30} \\ 54 \\ \underline{45} \\ 90 \\ \underline{90} \\ 0 \end{array}$
So, $354 \div 15 = 23 \text{ r}9$	$\frac{9}{15} = \frac{3}{5}$ So, $354 \div 15 = 23\frac{3}{5}$	So, $354 \div 15 = 23.6$