

Upper KS2 calculation policy

The following pages show the progression in calculation (addition, subtraction, multiplication and division) in Upper Key Stage 2 at St Mary's Fields Primary School and how this works in line with the National Curriculum. The consistent use of the CPA (concrete, pictorial, abstract) approach helps children develop mastery across all the operations in an efficient and reliable way. This policy shows how these methods develop children's confidence in their understanding of both written and mental methods.

UPPER KEY STAGE 2

In Years 5 and 6, children build on secure foundations in calculation, and develop fluency, accuracy and flexibility in their approach to the four operations. They work with whole numbers and adapt their skills to work with decimals, and they continue to develop their ability to select appropriate, accurate and efficient operations.

Key language: decimal, column methods, exchange, partition, mental method, ten thousand, hundred thousand, million, factor, multiple, prime number, square number, cube number

Addition and subtraction: Children build on their column methods to add and subtract numbers with up to seven digits, and they adapt the methods to calculate efficiently and effectively with decimals, ensuring understanding of place value at every stage.

Children compare and contrast methods, and they select mental methods or jottings where appropriate and where these are more likely to be efficient or accurate when compared with formal column methods.

Bar models are used to represent the calculations required to solve problems and may indicate where efficient methods can be chosen.

Multiplication and division: Building on their understanding, children develop methods to multiply up to 4-digit numbers by single-digit and 2-digit numbers.

Children develop column methods with an understanding of place value, and they continue to use the key skill of unitising to multiply and divide by 10, 100 and 1,000.

Written division methods are introduced and adapted for division by single-digit and 2-digit numbers and are understood alongside the area model and place value. In Year 6, children develop a secure understanding of how division is related to fractions.

Multiplication and division of decimals are also introduced and refined in Year 6.

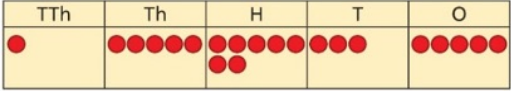
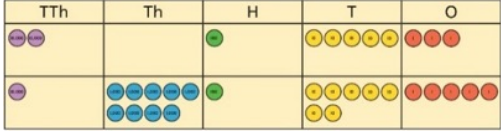
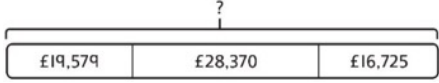
Fractions: Children find fractions of amounts, multiply a fraction by a whole number and by another fraction, divide a fraction by a whole number, and add and subtract fractions with different denominators. Children become more confident working with improper fractions and mixed numbers and can calculate with them.


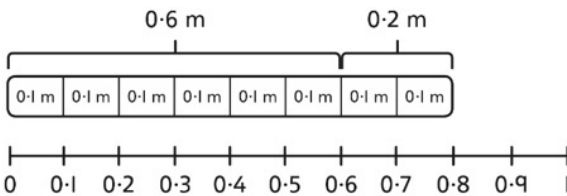
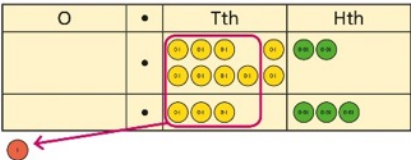

Understanding of decimals with up to 3 decimal places is built through place value and as fractions, and children calculate with decimals in the context of measure as well as in pure arithmetic.

Children develop an understanding of percentages in relation to hundredths, and they understand how to work with common percentages: 50%, 25%, 10% and 1%.

Year 5

Year 5 - Addition

	Concrete	Pictorial	Abstract
Column addition with whole numbers	<p>Use place value equipment to represent additions.</p> <p><i>Add a row of counters onto the place value grid to show $15,735 + 4,012$.</i></p> 	<p>Represent additions, using place value equipment on a place value grid alongside written methods.</p>  <p><i>I need to exchange 10 tens for a 100.</i></p> $\begin{array}{r} \text{TTh Th H T O} \\ 20153 \\ + 19175 \\ \hline 39328 \end{array}$	<p>Use column addition, including exchanges.</p> $\begin{array}{r} \text{TTh Th H T O} \\ 19175 \\ + 18417 \\ \hline 37592 \end{array}$
Representing additions		<p>Bar models represent addition of two or more numbers in the context of problem solving.</p>  <p>Jen: £2,600 Holly: £2,600 + £1,450</p> <p><i>I will use $23,000 + 8,000$ to check.</i></p> $\begin{array}{r} \text{Th H T O} \\ 2600 \\ + 1450 \\ \hline 4050 \end{array} \quad \begin{array}{r} \text{Th H T O} \\ 2600 \\ + 4050 \\ \hline 6650 \end{array}$	<p>Use approximation to check whether answers are reasonable.</p> $\begin{array}{r} \text{TTh Th H T O} \\ 23405 \\ + 7892 \\ \hline 20297 \end{array} \quad \begin{array}{r} \text{TTh Th H T O} \\ 23405 \\ + 7892 \\ \hline 31297 \end{array}$
Adding tenths	<p>Link measure with addition of decimals.</p>	<p>Use a bar model with a number line to add</p>	<p>Understand the link with adding fractions.</p>

	<p>Two lengths of fencing are 0.6 m and 0.2 m. How long are they when added together?</p> 	<p>tenths.</p>  <p>$0.6 + 0.2 = 0.8$ 6 tenths + 2 tenths = 8 tenths</p>	$\frac{6}{10} + \frac{2}{10} = \frac{8}{10}$ <p>6 tenths + 2 tenths = 8 tenths $0.6 + 0.2 = 0.8$</p>
<p>Adding decimals using column addition</p>	<p>Use place value equipment to represent additions. Show $0.23 + 0.45$ using place value counters.</p>	<p>Use place value equipment on a place value grid to represent additions. Represent exchange where necessary.</p>  <p>Include examples where the numbers of decimal places are different.</p> 	<p>Add using a column method, ensuring that children understand the link with place value.</p> $\begin{array}{r} \text{O} \cdot \text{Tth} \text{Hth} \\ 0 \cdot 2 \quad 3 \\ + 0 \cdot 4 \quad 5 \\ \hline 0 \cdot 6 \quad 8 \end{array}$ <p>Include exchange where required, alongside an understanding of place value.</p> $\begin{array}{r} \text{O} \cdot \text{Tth} \text{Hth} \\ 0 \cdot 9 \quad 2 \\ + 0 \cdot 3 \quad 3 \\ \hline 1 \cdot 2 \quad 5 \end{array}$ <p>Include additions where the numbers of decimal places are different.</p> $3.4 + 0.65 = ?$ $\begin{array}{r} \text{O} \cdot \text{Tth} \text{Hth} \\ 3 \cdot 4 \quad 0 \\ + 0 \cdot 6 \quad 5 \\ \hline \end{array}$

Year 5 - Subtraction

Column subtraction with whole numbers

Use place value equipment to understand where exchanges are required.

$$2,250 - 1,070$$



Represent the stages of the calculation using place value equipment on a grid alongside the calculation, including exchanges where required.

$$15,735 - 2,582 = 13,153$$

TTh	Th	H	T	O		TTh	Th	H	T	O
●	●●●●●	●●●●●	●●●●●	●●●●●		1	5	7	3	5
		●●	●●●●●	●●●●●	-	2	5	8	2	
										3

Now subtract the 10s. Exchange 1 hundred for 10 tens.

TTh	Th	H	T	O		TTh	Th	H	T	O
●	●●●●●	●●●●●	●●●●●	●●●●●		1	5	7	3	5
		●●	●●●●●	●●●●●	-	2	5	8	2	
			●●●●●						5	3

Subtract the 100s, 1,000s and 10,000s.

TTh	Th	H	T	O		TTh	Th	H	T	O
●	●●●●●	●●●●●	●●●●●	●●●●●		1	5	7	3	5
		●●	●●●●●	●●●●●	-	2	5	8	2	
			●●●●●			1	3	1	5	3

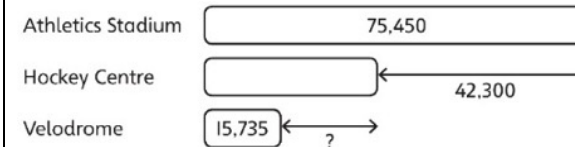
Use column subtraction methods with exchange where required.

$$\begin{array}{r} \text{TTh Th H T O} \\ \cancel{5} \cancel{8} \cancel{1} \cancel{2} \text{ } 0 \text{ } 9 \text{ } 7 \\ - 1 \text{ } 8 \text{ } 5 \text{ } 3 \text{ } 4 \\ \hline 4 \text{ } 3 \text{ } 5 \text{ } 6 \text{ } 3 \end{array}$$

$$62,097 - 18,534 = 43,563$$

Checking strategies and representing subtractions

Bar models represent subtractions in problem contexts, including 'find the difference'.



Children can explain the mistake made when the columns have not been ordered correctly.

Bella's working					Correct method						
TTh	Th	H	T	O	TTh	Th	H	T	O		
1	7	8	7	7	1	7	8	7	7		
+	4	0	1	2	+	4	0	1	2		
	5	7	9	9	7		2	1	8	8	9

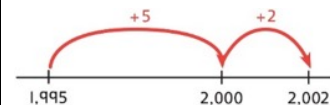
Use approximation to check calculations.

I calculated $18,000 + 4,000$ mentally to check my subtraction.

Choosing efficient methods

To subtract two large numbers that are close, children find the difference by counting on.

$$2,002 - 1,995 = ?$$



Use addition to check subtractions.

*I calculated $7,546 - 2,355 = 5,191$.
I will check using the inverse.*

Subtracting decimals

Explore complements to a whole number by working in the context of length.



$$1 \text{ m} - \boxed{} \text{ m} = \boxed{} \text{ m}$$

$$1 - 0.49 = ?$$

Use a place value grid to represent the stages of column subtraction, including exchanges where required.

$$5.74 - 2.25 = ?$$



Exchange 1 tenth for 10 hundredths.



Now subtract the 5 hundredths.

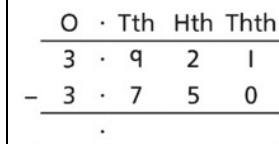


Now subtract the 2 tenths, then the 2 ones.



Use column subtraction, with an understanding of place value, including subtracting numbers with different numbers of decimal places.

$$3.921 - 3.75 = ?$$



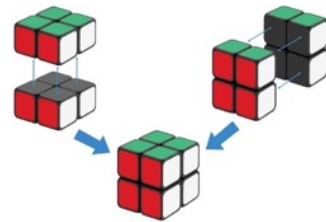
Year 5 - Multiplication

Understanding factors

Use cubes or counters to explore the meaning of 'square numbers'.

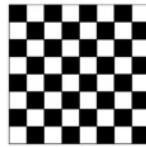
25 is a square number because it is made from 5 rows of 5.

Use cubes to explore cube numbers.



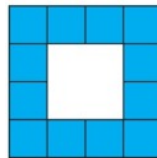
8 is a cube number.

Use images to explore examples and non-examples of square numbers.



$$8 \times 8 = 64$$

$$8^2 = 64$$



12 is not a square number, because you cannot multiply a whole number by itself to make 12.

Understand the pattern of square numbers in the multiplication tables.

Use a multiplication grid to circle each square number. Can children spot a pattern?

Multiplying by 10, 100 and 1,000

Use place value equipment to multiply by 10, 100 and 1,000 by unitising.

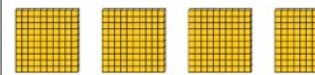
$$4 \times 1 = 4 \text{ ones} = 4$$



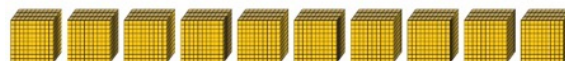
$$4 \times 10 = 4 \text{ tens} = 40$$



$$4 \times 100 = 4 \text{ hundreds} = 400$$



Understand the effect of repeated multiplication by 10.



Understand how exchange relates to the digits when multiplying by 10, 100 and 1,000.

H	T	O
	I	7

$$17 \times 10 = 170$$

$$17 \times 100 = 17 \times 10 \times 10 = 1,700$$

$$17 \times 1,000 = 17 \times 10 \times 10 \times 10 = 17,000$$

Multiplying by

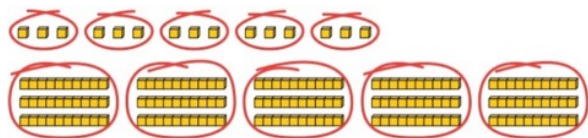
Use place value equipment to explore

Use place value equipment to represent

Use known facts and unitising to multiply.

multiples of 10, 100 and 1,000

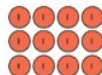
multiplying by unitising.



5 groups of 3 ones is 15 ones.
5 groups of 3 tens is 15 tens.

So, I know that 5 groups of 3 thousands would be 15 thousands.

how to multiply by multiples of 10, 100 and 1,000.



$$4 \times 3 = 12$$

$$4 \times 300 = 1,200$$



$$6 \times 4 = 24$$

$$6 \times 400 = 2,400$$

$$5 \times 4 = 20$$

$$5 \times 40 = 200$$

$$5 \times 400 = 2,000$$

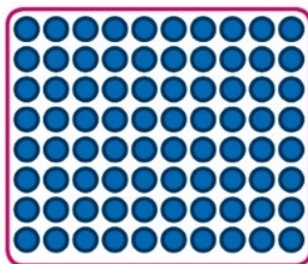
$$5 \times 4,000 = 20,000$$

$$5,000 \times 4 = 20,000$$

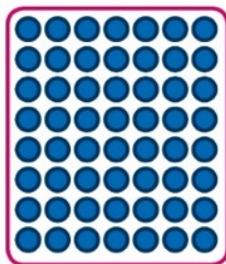
Multiplying up to 4-digit numbers by a single digit

Explore how to use partitioning to multiply efficiently.

$$8 \times 17 = ?$$



$$8 \times 10 = 80$$



$$8 \times 7 = 56$$

$$80 + 56 = 136$$

$$\text{So, } 8 \times 17 = 136$$

Represent multiplications using place value equipment and add the 1s, then 10s, then 100s, then 1,000s.

H	T	O
100	10 10 10 10 10 10 10	1 1 1
100	10 10 10 10 10 10 10	1 1 1
100	10 10 10 10 10 10 10	1 1 1
100	10 10 10 10 10 10 10	1 1 1
100	10 10 10 10 10 10 10	1 1 1

Use an area model and then add the parts.

100	60	3
5 $100 \times 5 = 500$	$60 \times 5 = 300$	$3 \times 5 = 15$

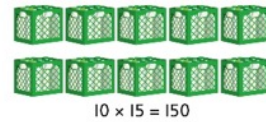
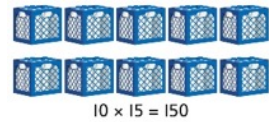
Use a column multiplication, including any required exchanges.

$$\begin{array}{r} 136 \\ \times 5 \\ \hline 816 \\ 23 \end{array}$$

Multiplying 2-digit numbers by 2-digit numbers

Partition one number into 10s and 1s, then add the parts.

$$23 \times 15 = ?$$



$$3 \times 15 = 45$$

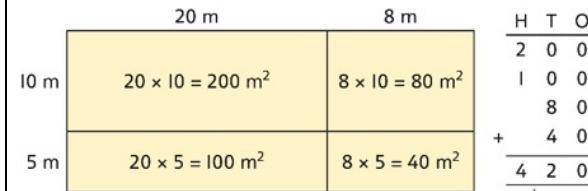
There are 345 bottles of milk in total.

	H	T	O
	1	5	0
	1	5	0
+		4	5
	3	4	5
			1

$$23 \times 15 = 345$$

Use an area model and add the parts.

$$28 \times 15 = ?$$



$$28 \times 15 = 420$$

Use column multiplication, ensuring understanding of place value at each stage.

	3	4	
x	2	7	
	2	3 ₂ 8	34×7
	3	4	

x	2	7	
	2	3 ₂ 8	34×7
	6	8	0
			34×20

	3	4	
x	2	7	
	2	3 ₂ 8	34×7
	6	8	0
	9	1	8
			1

Multiplying up

Use the area model then add the parts.

Use column multiplication, ensuring

**to 4-digits by
2-digits**

	100	40	3		Th	H	T	O
10					1	0	0	0
2					4	0	0	
					2	0	0	
					8	0		
					3	0		
					+	6		
					1	7	1	6

$$143 \times 12 = 1,716$$

There are 1,716 boxes of cereal in total.

$$143 \times 12 = 1,716$$

understanding of place value at each stage.

$$\begin{array}{r} 143 \\ \times 12 \\ \hline 286 \\ 1430 \\ \hline 1716 \end{array}$$

143 × 2
143 × 10
143 × 12

Progress to include examples that require multiple exchanges as understanding, confidence and fluency build.

$$1,274 \times 32 = ?$$

First multiply 1,274 by 2.

$$\begin{array}{r} 1274 \\ \times 32 \\ \hline 2548 \end{array}$$

1,274 × 2

Then multiply 1,274 by 30.

$$\begin{array}{r} 1274 \\ \times 32 \\ \hline 2548 \\ 38220 \end{array}$$

1,274 × 2
1,274 × 30

Finally, find the total.

$$\begin{array}{r} 1274 \\ \times 32 \\ \hline 2548 \\ 38220 \\ \hline 40768 \end{array}$$

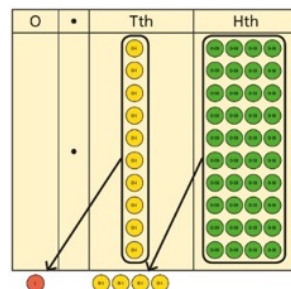
1,274 × 2
1,274 × 30
1,274 × 32

$$1,274 \times 32 = 40,768$$

Multiplying decimals by 10, 100 and 1,000

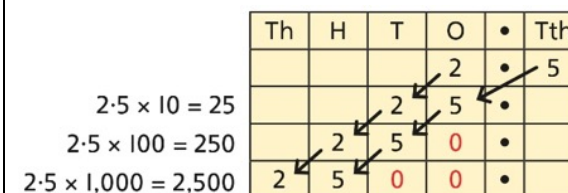
Use place value equipment to explore and understand the exchange of 10 tenths, 10 hundredths or 10 thousandths.

Represent multiplication by 10 as exchange on a place value grid.



$$0.14 \times 10 = 1.4$$

Understand how this exchange is represented on a place value chart.



Year 5 - Division

Understanding factors and prime numbers

Use equipment to explore the factors of a given number.

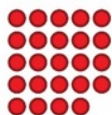


$$24 \div 3 = 8$$

$$24 \div 8 = 3$$

8 and 3 are factors of 24 because they divide 24 exactly.

$$24 \div 5 = 4 \text{ remainder } 4.$$



5 is not a factor of 24 because there is a remainder.

Understand that prime numbers are numbers with exactly two factors.

$$13 \div 1 = 13$$

$$13 \div 2 = 6 \text{ r } 1$$

$$13 \div 4 = 3 \text{ r } 1$$

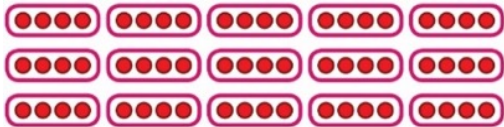
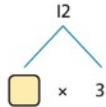
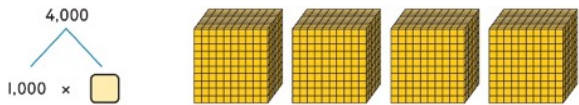
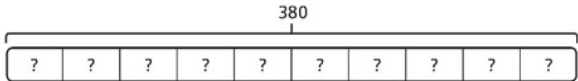
1 and 13 are the only factors of 13.
13 is a prime number.

Understand how to recognise prime and composite numbers.

I know that 31 is a prime number because it can be divided by only 1 and itself without leaving a remainder.

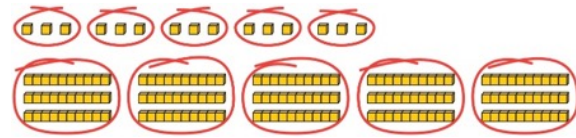
I know that 33 is not a prime number as it can be divided by 1, 3, 11 and 33.

I know that 1 is not a prime number, as it has only 1 factor.

<p>Understanding inverse operations and the link with multiplication, grouping and sharing</p>	<p>Use equipment to group and share and to explore the calculations that are present.</p> <p><i>I have 28 counters.</i></p> <p><i>I made 7 groups of 4. There are 28 in total.</i></p> <p><i>I have 28 in total. I shared them equally into 7 groups. There are 4 in each group.</i></p> <p><i>I have 28 in total. I made groups of 4. There are 7 equal groups.</i></p>	<p>Represent multiplicative relationships and explore the families of division facts.</p>  <p>$60 \div 4 = 15$ $60 \div 15 = 4$</p>	<p>Represent the different multiplicative relationships to solve problems requiring inverse operations.</p> <p> $12 \div 3 = \square$ $12 \div \square = 3$ $\square \times 3 = 12$ $\square \div 3 = 12$ </p>  <p>Understand missing number problems for division calculations and know how to solve them using inverse operations.</p> <p> $22 \div ? = 2$ $22 \div 2 = ?$ $? \div 2 = 22$ $? \div 22 = 2$ </p>								
<p>Dividing whole numbers by 10, 100 and 1,000</p>	<p>Use place value equipment to support unitising for division.</p> <p>$4,000 \div 1,000$</p>  <p>$4,000$ is 4 thousands.</p> <p>$4 \times 1,000 = 4,000$</p> <p>So, $4,000 \div 1,000 = 4$</p>	<p>Use a bar model to support dividing by unitising.</p> <p>$380 \div 10 = 38$</p>  <p> 380 $10 \times \square$ </p> <p>380 is 38 tens.</p> <p> $38 \times 10 = 380$ $10 \times 38 = 380$ So, $380 \div 10 = 38$ </p>	<p>Understand how and why the digits change on a place value grid when dividing by 10, 100 or 1,000.</p> <table border="1" data-bbox="1541 874 1966 960"> <thead> <tr> <th>Th</th> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>2</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>$3,200 \div 100 = ?$</p> <p>$3,200$ is 3 thousands and 2 hundreds.</p> <p> $200 \div 100 = 2$ $3,000 \div 100 = 30$ $3,200 \div 100 = 32$ </p> <p>So, the digits will move two places to the right.</p>	Th	H	T	O	3	2	0	0
Th	H	T	O								
3	2	0	0								

**Dividing by
multiples of 10,
100 and 1,000**

Use place value equipment to represent known facts and unitising.



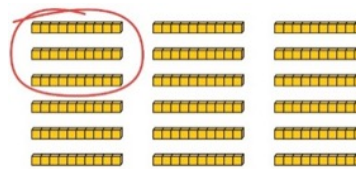
15 ones put into groups of 3 ones. There are 5 groups.

$$15 \div 3 = 5$$

15 tens put into groups of 3 tens. There are 5 groups.

$$150 \div 30 = 5$$

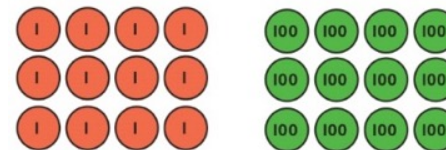
Represent related facts with place value equipment when dividing by unitising.



180 is 18 tens.

18 tens divided into groups of 3 tens. There are 6 groups.

$$180 \div 30 = 6$$



12 ones divided into groups of 4. There are 3 groups.

12 hundreds divided into groups of 4 hundreds. There are 3 groups.

$$1200 \div 400 = 3$$

Reason from known facts, based on understanding of unitising. Use knowledge of the inverse relationship to check.

$$3,000 \div 5 = 600$$

$$3,000 \div 50 = 60$$

$$3,000 \div 500 = 6$$

$$5 \times 600 = 3,000$$

$$50 \times 60 = 3,000$$

$$500 \times 6 = 3,000$$

Dividing up to four digits by a single digit using short division

Explore grouping using place value equipment.

$$268 \div 2 = ?$$

There is 1 group of 2 hundreds.

There are 3 groups of 2 tens.

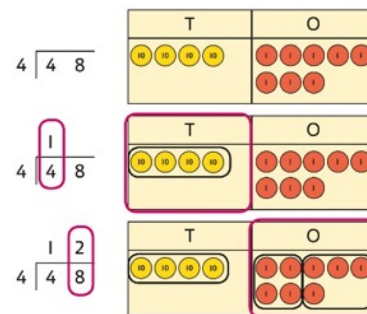
There are 4 groups of 2 ones.

$$264 \div 2 = 134$$

Use place value equipment on a place value grid alongside short division.

The model uses grouping.

A sharing model can also be used, although the model would need adapting.

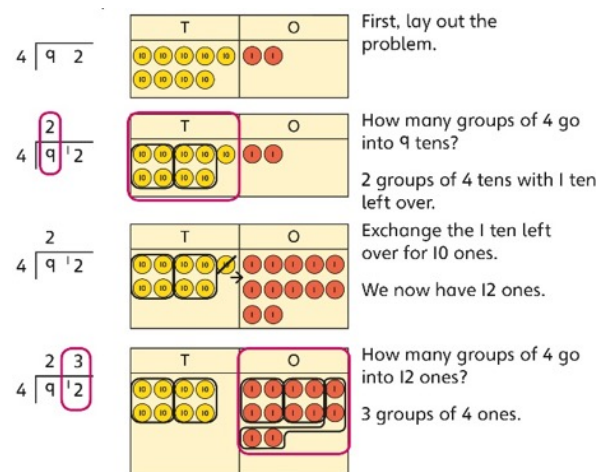


Lay out the problem as a short division.

There is 1 group of 4 in 4 tens.

There are 2 groups of 4 in 8 ones.

Work with divisions that require exchange.



Use short division for up to 4-digit numbers divided by a single digit.

$$\begin{array}{r} 0 \ 5 \ 5 \ 6 \\ 7 \overline{) 3 \ 8 \ 9 \ 2} \end{array}$$

$$3,892 \div 7 = 556$$

Use multiplication to check.


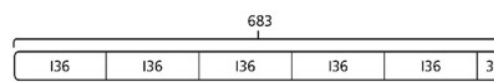
$$556 \times 7 = ?$$

$$6 \times 7 = 42$$

$$50 \times 7 = 350$$

$$500 \times 7 = 3500$$

$$3,500 + 350 + 42 = 3,892$$

Understanding remainders	<p>Understand remainders using concrete versions of a problem.</p> <p>80 cakes divided into trays of 6.</p>  <p>80 cakes in total. They make 13 groups of 6, with 2 remaining.</p>	<p>Use short division and understand remainders as the last remaining 1s.</p> <div><div>$\begin{array}{r} 6 \overline{) 80} \\ 6 \overline{) 8} \\ \hline 20 \end{array}$</div><div><table><tr><th>T</th><th>O</th></tr><tr><td>80</td><td></td></tr></table><p>Lay out the problem as short division.</p><table><tr><th>T</th><th>O</th></tr><tr><td>130</td><td></td></tr></table><p>How many groups of 6 go into 8 tens? There is 1 group of 6 tens. There are 2 tens remaining.</p><table><tr><th>T</th><th>O</th></tr><tr><td>132</td><td>20</td></tr></table><p>How many groups of 6 go into 20 ones? There are 3 groups of 6 ones. There are 2 ones remaining.</p></div></div>	T	O	80		T	O	130		T	O	132	20	<p>In problem solving contexts, represent divisions including remainders with a bar model.</p>  <p>$683 = 136 \times 5 + 3$ $683 \div 5 = 136 \text{ r } 3$</p>																																										
T	O																																																								
80																																																									
T	O																																																								
130																																																									
T	O																																																								
132	20																																																								
Dividing decimals by 10, 100 and 1,000	<p>Understand division by 10 using exchange.</p> <p>2 ones are 20 tenths.</p> <p>20 tenths divided by 10 is 2 tenths.</p>	<p>Represent division using exchange on a place value grid.</p> <div><table><tr><th>O</th><th>•</th><th>Tth</th><th>Hth</th></tr><tr><td>2</td><td></td><td></td><td></td></tr></table><table><tr><th>O</th><th>•</th><th>Tth</th><th>Hth</th></tr><tr><td>20</td><td></td><td></td><td></td></tr></table><table><tr><th>O</th><th>•</th><th>Tth</th><th>Hth</th></tr><tr><td></td><td></td><td>2</td><td></td></tr></table></div> <p>1·5 is 1 one and 5 tenths. This is equivalent to 10 tenths and 50 hundredths. 10 tenths divided by 10 is 1 tenth. 50 hundredths divided by 10 is 5 hundredths. 1·5 divided by 10 is 1 tenth and 5 hundredths. $1 \cdot 5 \div 10 = 0 \cdot 15$</p>	O	•	Tth	Hth	2				O	•	Tth	Hth	20				O	•	Tth	Hth			2		<p>Understand the movement of digits on a place value grid.</p> <div><table><tr><th>O</th><th>•</th><th>Tth</th><th>Hth</th><th>Thth</th></tr><tr><td>0</td><td></td><td>8</td><td>5</td><td></td></tr><tr><td>0</td><td></td><td>0</td><td>8</td><td>5</td></tr></table><p>$0 \cdot 85 \div 10 = 0 \cdot 085$</p></div> <div><table><tr><th>O</th><th>•</th><th>Tth</th><th>Hth</th><th>Thth</th></tr><tr><td>8</td><td></td><td>5</td><td></td><td></td></tr><tr><td>0</td><td></td><td>0</td><td>8</td><td>5</td></tr></table><p>$8 \cdot 5 \div 100 = 0 \cdot 085$</p></div>	O	•	Tth	Hth	Thth	0		8	5		0		0	8	5	O	•	Tth	Hth	Thth	8		5			0		0	8	5
O	•	Tth	Hth																																																						
2																																																									
O	•	Tth	Hth																																																						
20																																																									
O	•	Tth	Hth																																																						
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0		0	8	5																																																					
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8		5																																																							
0		0	8	5																																																					

Understanding the relationship between fractions and division

Use sharing to explore the link between fractions and division.

*1 whole shared between 3 people.
Each person receives one-third.*



Use a bar model and other fraction representations to show the link between fractions and division.



$$1 \div 3 = \frac{1}{3}$$

Use the link between division and fractions to calculate divisions.

$$5 \div 4 = \frac{5}{4} = 1\frac{1}{4}$$

$$11 \div 4 = \frac{11}{4} = 2\frac{3}{4}$$

Year 6

Year 6 - Addition

Comparing and selecting efficient methods

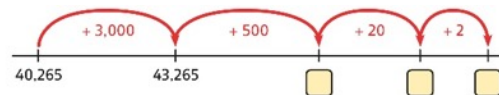
Concrete

Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods.

M	HTh	TTh	Th	H	T	O
●●	●●●●	●	●	●●●		●

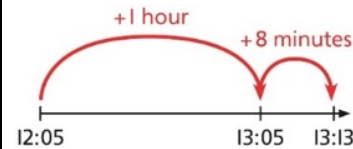
Pictorial

Discuss similarities and differences between methods, and choose efficient methods based on the specific calculation. Compare written and mental methods alongside place value representations.



TTh	Th	H	T	O
●●●●		●●	●●●●●	●●●●●
	●●	●●●●●	●●	●●

Use bar model and number line representations to model addition in problem-solving and measure contexts.



Abstract

Use column addition where mental methods are not efficient. Recognise common errors with column addition.

$$32,145 + 4,302 = ?$$


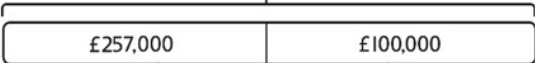
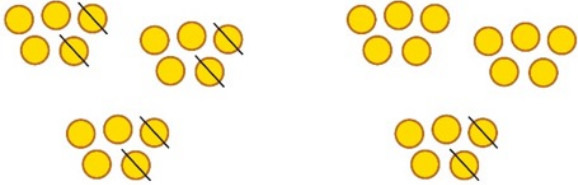
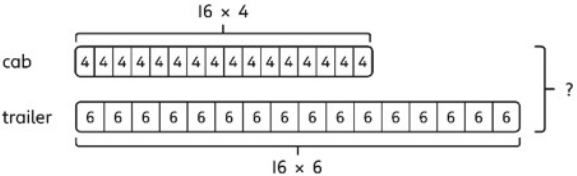
TTh	Th	H	T	O
3	2	1	4	5
+	4	3	0	2
3	6	4	4	7

Which method has been completed accurately?

What mistake has been made?

Column methods are also used for decimal additions where mental methods are not efficient.

H	T	O	·	Tth	Hth
1	4	0	·	0	9
+	4	9	·	8	9
1	8	9	·	9	8

<p>Selecting mental methods for larger numbers where appropriate</p>	<p>Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods.</p>  <p>$2,411,301 + 500,000 = ?$</p> <p><i>This would be 5 more counters in the HTh place.</i></p> <p><i>So, the total is 2,911,301.</i></p> <p>$2,411,301 + 500,000 = 2,911,301$</p>	<p>Use a bar model to support thinking in addition problems.</p> <p>$257,000 + 99,000 = ?$</p>  <p><i>I added 100 thousands then subtracted 1 thousand.</i></p> <p>$257 \text{ thousands} + 100 \text{ thousands} = 357 \text{ thousands}$</p> <p>$257,000 + 100,000 = 357,000$ $357,000 - 1,000 = 356,000$</p> <p><i>So, $257,000 + 99,000 = 356,000$</i></p>	<p>Use place value and unitising to support mental calculations with larger numbers.</p> <p>$195,000 + 6,000 = ?$</p> <p>$195 + 5 + 1 = 201$</p> <p><i>195 thousands + 6 thousands = 201 thousands</i></p> <p><i>So, $195,000 + 6,000 = 201,000$</i></p>
<p>Understanding order of operations in calculations</p>	<p>Use equipment to model different interpretations of a calculation with more than one operation. Explore different results.</p> <p>$3 \times 5 - 2 = ?$</p>  <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> $\begin{array}{r} 3 \times 5 - 2 \\ \downarrow \quad \downarrow \\ 3 \times 3 = 9 \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{r} 3 \times 5 - 2 \\ \downarrow \quad \downarrow \\ 15 - 2 = 13 \end{array}$ </div> </div>	<p>Model calculations using a bar model to demonstrate the correct order of operations in multi-step calculations.</p>  <p>This can be written as: $16 \times 4 + 16 \times 6$</p> <div style="text-align: center;"> $\begin{array}{r} 16 \times 4 + 16 \times 6 \\ 64 + 96 = 160 \end{array}$ </div>	<p>Understand the correct order of operations in calculations without brackets.</p> <p>Understand how brackets affect the order of operations in a calculation.</p> <p>$4 + 6 \times 16$ $4 + 96 = 100$</p> <p>$(4 + 6) \times 16$ $10 \times 16 = 160$</p>

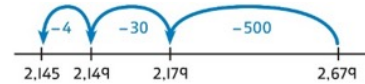
Year 6 - Subtraction

Comparing and selecting efficient methods

Use counters on a place value grid to represent subtractions of larger numbers.

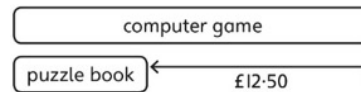


Compare subtraction methods alongside place value representations.



$$\begin{array}{r} \text{Th} \quad \text{H} \quad \text{T} \quad \text{O} \\ 2 \quad 6 \quad 7 \quad 9 \\ - \quad 5 \quad 3 \quad 4 \\ \hline 2 \quad 1 \quad 4 \quad 5 \end{array}$$

Use a bar model to represent calculations, including 'find the difference' with two bars as comparison.

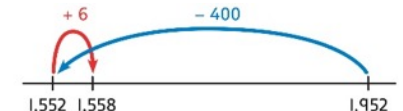


Compare and select methods.

Use column subtraction when mental methods are not efficient.

Use two different methods for one calculation as a checking strategy.

Th	H	T	O
1	8	14	2
-	1	5	5
	3	9	4



Use column subtraction for decimal problems, including in the context of measure.

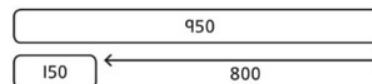
H	T	O	·	Tth	Hth
3	0	9	·	6	0
-	2	0	·	4	0
	1	0	·	2	0

Subtracting mentally with larger numbers

Use a bar model to show how unitising can support mental calculations.

$$950,000 - 150,000$$

That is 950 thousands - 150 thousands



So, the difference is 800 thousands.

$$950,000 - 150,000 = 800,000$$

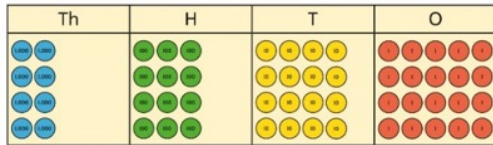
Subtract efficiently from powers of 10.

$$10,000 - 500 = ?$$

Year 6 - Multiplication

Multiplying up to a 4-digit number by a single digit number

Use equipment to explore multiplications.



4 groups of 2,345

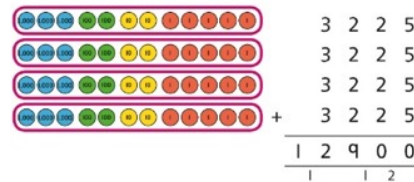
This is a multiplication:

$$4 \times 2,345$$

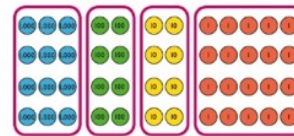
$$2,345 \times 4$$

Use place value equipment to compare methods.

Method 1



Method 2



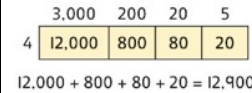
$$4 \times 3,000 \quad 4 \times 200 \quad 4 \times 20 \quad 4 \times 5$$

$$12,000 + 800 + 80 + 20 = 12,900$$

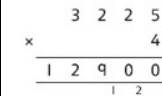
Understand area model and short multiplication.

Compare and select appropriate methods for specific multiplications.

Method 3



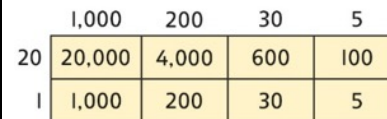
Method 4



Multiplying up to a 4-digit number by a 2-digit number

Use an area model alongside written multiplication.

Method 1



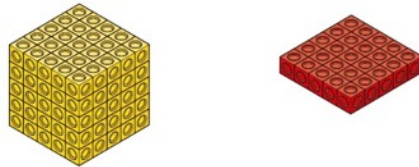
$$\begin{array}{r} 1 \ 2 \ 3 \ 5 \\ \times \quad 2 \ 1 \\ \hline 5 \quad 1 \times 5 \\ 3 \ 0 \quad 1 \times 30 \\ 2 \ 0 \ 0 \quad 1 \times 200 \\ 1 \ 0 \ 0 \ 0 \quad 1 \times 1,000 \\ 1 \ 0 \ 0 \quad 20 \times 5 \\ 6 \ 0 \ 0 \quad 20 \times 30 \\ 4 \ 0 \ 0 \ 0 \quad 20 \times 200 \\ 2 \ 0 \ 0 \ 0 \ 0 \quad 20 \times 1,000 \\ \hline 2 \ 5 \ 9 \ 3 \ 5 \end{array}$$

Use compact column multiplication with understanding of place value at all stages.

$$\begin{array}{r} 1 \ 2 \ 3 \ 5 \\ \times \quad 2 \ 1 \\ \hline 1 \ 2 \ 3 \ 5 \quad 1 \times 1,235 \\ 2 \ 4 \ 7 \ 0 \ 0 \quad 20 \times 1,235 \\ \hline 2 \ 5 \ 9 \ 3 \ 5 \quad 21 \times 1,235 \end{array}$$

Using knowledge of factors and partitions to compare methods for multiplications

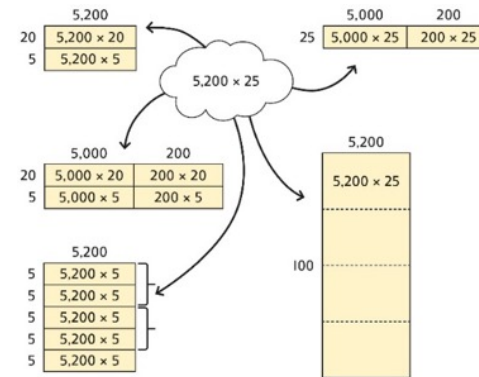
Use equipment to understand square numbers and cube numbers.



$$5 \times 5 = 5^2 = 25$$

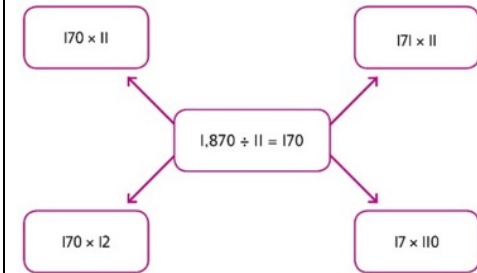
$$5 \times 5 \times 5 = 5^3 = 25 \times 5 = 125$$

Compare methods visually using an area model. Understand that multiple approaches will produce the same answer if completed accurately.



Represent and compare methods using a bar model.

Use a known fact to generate families of related facts.



Use factors to calculate efficiently.

$$15 \times 16$$

$$= 3 \times 5 \times 2 \times 8$$

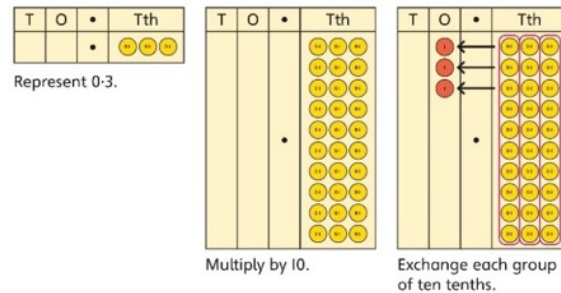
$$= 3 \times 8 \times 2 \times 5$$

$$= 24 \times 10$$

$$= 240$$

Multiplying by 10, 100 and 1,000

Use place value equipment to explore exchange in decimal multiplication.



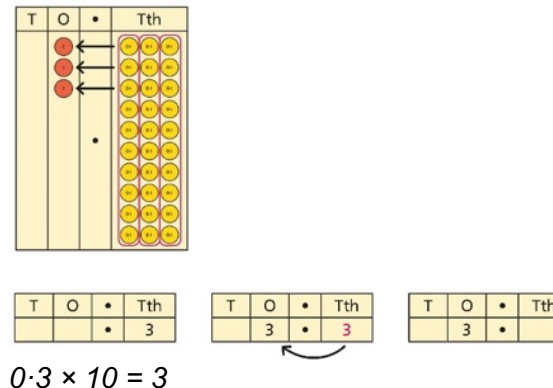
$$0.3 \times 10 = ?$$

0.3 is 3 tenths.

10 x 3 tenths are 30 tenths.

30 tenths are equivalent to 3 ones.

Understand how the exchange affects decimal numbers on a place value grid.



Use knowledge of multiplying by 10, 100 and 1,000 to multiply by multiples of 10, 100 and 1,000.

$$8 \times 100 = 800$$

$$8 \times 300 = 800 \times 3$$

$$= 2,400$$

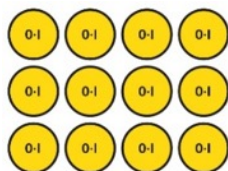
$$2.5 \times 10 = 25$$

$$2.5 \times 20 = 2.5 \times 10 \times 2$$

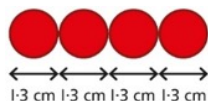
$$= 50$$

Multiplying decimals

Explore decimal multiplications using place value equipment and in the context of measures.



3 groups of 4 tenths is 12 tenths.
4 groups of 3 tenths is 12 tenths.



$$4 \times 1 \text{ cm} = 4 \text{ cm}$$

$$4 \times 0.3 \text{ cm} = 1.2 \text{ cm}$$

$$4 \times 1.3 = 4 + 1.2 = 5.2 \text{ cm}$$

Represent calculations on a place value grid.

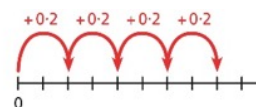
$$3 \times 3 = 9$$

$$3 \times 0.3 = 0.9$$

T	O	•	Tth

Understand the link between multiplying decimals and repeated addition.

T	O	•	Tth



Use known facts to multiply decimals.

$$4 \times 3 = 12$$

$$4 \times 0.3 = 1.2$$

$$4 \times 0.03 = 0.12$$

$$20 \times 5 = 100$$

$$20 \times 0.5 = 10$$

$$20 \times 0.05 = 1$$

Find families of facts from a known multiplication.

I know that $18 \times 4 = 72$.

This can help me work out:

$$1.8 \times 4 = ?$$

$$18 \times 0.4 = ?$$

$$180 \times 0.4 = ?$$

$$18 \times 0.04 = ?$$

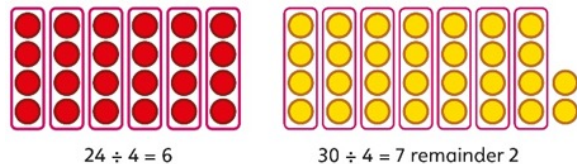
Use a place value grid to understand the effects of multiplying decimals.

	H	T	O	•	Tth	Hth
2×3			6	•		
0.2×3			0	•	6	
0.02×3				•		

Year 6 - Division

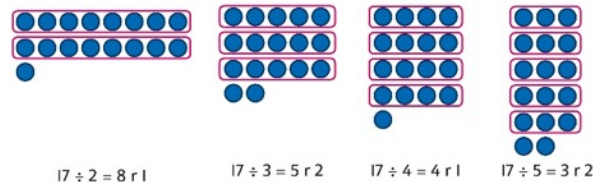
Understanding factors

Use equipment to explore different factors of a number.



4 is a factor of 24 but is not a factor of 30.

Recognise prime numbers as numbers having exactly two factors. Understand the link with division and remainders.

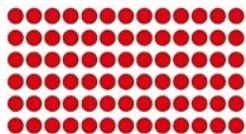


Recognise and know primes up to 100. Understand that 2 is the only even prime, and that 1 is not a prime number.

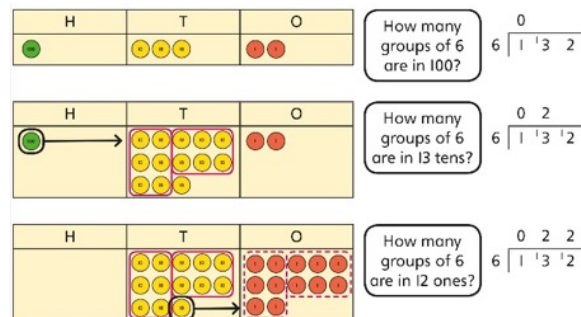
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

Dividing by a single digit

Use equipment to make groups from a total.



*There are 78 in total.
There are 6 groups of 13.
There are 13 groups of 6.*



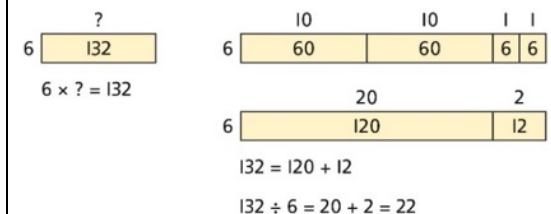
Use short division to divide by a single digit.

$$\begin{array}{r} 0 \\ 6 \overline{) 132} \end{array}$$

$$\begin{array}{r} 0 \ 2 \\ 6 \overline{) 132} \end{array}$$

$$\begin{array}{r} 0 \ 2 \ 2 \\ 6 \overline{) 132} \end{array}$$

Use an area model to link multiplication and division.



**Dividing by a
2-digit number
using factors**

Understand that division by factors can be used when dividing by a number that is not prime.

Use factors and repeated division.

$$1,260 \div 14 = ?$$



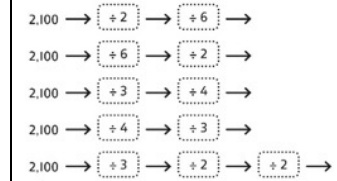
$$1,260 \div 2 = 630$$

$$630 \div 7 = 90$$

$$1,260 \div 14 = 90$$

Use factors and repeated division where appropriate.

$$2,100 \div 12 = ?$$



Dividing by a 2-digit number using long division

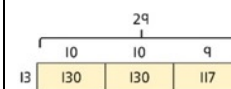
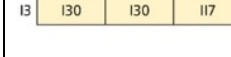
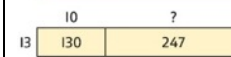
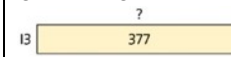
Use equipment to build numbers from groups.



*182 divided into groups of 13.
There are 14 groups.*

Use an area model alongside written division to model the process.

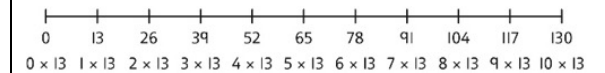
$$377 \div 13 = ?$$



$$377 \div 13 = 29$$

Use long division where factors are not useful (for example, when dividing by a 2-digit prime number).
Write the required multiples to support the division process.

$$377 \div 13 = ?$$



$$\begin{array}{r} 13 \overline{) 377} \\ - 130 \quad 10 \\ \hline 247 \\ - 130 \quad 10 \\ \hline 117 \\ - 117 \quad 9 \\ \hline 0 \end{array}$$

$$377 \div 13 = 29$$

A slightly different layout may be used, with the division completed above rather than at the side.

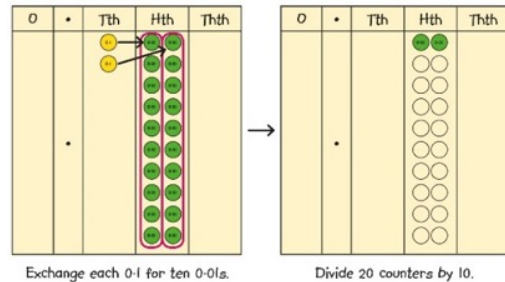
$$\begin{array}{r} 3 \\ 21 \overline{) 798} \\ - 630 \\ \hline 168 \end{array}$$

$$\begin{array}{r} 38 \\ 21 \overline{) 798} \\ - 630 \\ \hline 168 \\ - 168 \\ \hline 0 \end{array}$$

Divisions with a remainder explored in problem-solving contexts.

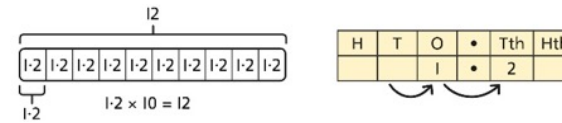
Dividing by 10, 100 and 1,000

Use place value equipment to explore division as exchange.



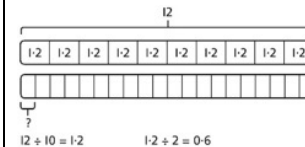
0.2 is 2 tenths.
2 tenths is equivalent to 20 hundredths.
20 hundredths divided by 10 is 2 hundredths.

Represent division to show the relationship with multiplication. Understand the effect of dividing by 10, 100 and 1,000 on the digits on a place value grid.



Understand how to divide using division by 10, 100 and 1,000.

$$12 \div 20 = ?$$



Use knowledge of factors to divide by multiples of 10, 100 and 1,000.

$$40 \div 50 = \square$$

$$40 \rightarrow \div 10 \rightarrow \div 5 \rightarrow ?$$

$$40 \rightarrow \div 5 \rightarrow \div 10 \rightarrow ?$$

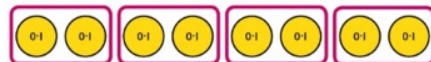
$$40 \div 5 = 8$$

$$8 \div 10 = 0.8$$

$$\text{So, } 40 \div 50 = 0.8$$

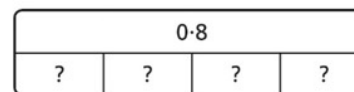
Dividing decimals

Use place value equipment to explore division of decimals.



8 tenths divided into 4 groups. 2 tenths in each group.

Use a bar model to represent divisions.



$$4 \times 2 = 8$$

$$8 \div 4 = 2$$

$$\text{So, } 4 \times 0.2 = 0.8$$

$$0.8 \div 4 = 0.2$$

Use short division to divide decimals with up to 2 decimal places.

$$8 \overline{) 4.24}$$

$$0.8 \overline{) 4.24}$$

$$0.5 \overline{) 4.24}$$

$$0.53 \overline{) 4.24}$$