CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 6

Year 6			
	Block 1	Block 2	Block 3
Calculation content	MULTIPLICATION AND DIVISION (UNIT 1) • 7 × table (r) • Efficient strategies for multiplication • Efficient strategies for division • Multiplying 3- and 4-digit numbers by 2-digit numbers (r) FRACTIONS (UNIT 1) • Finding fractions of quantities MULTIPLICATION AND DIVISION (UNIT 2) • Dividing by a 2-digit number ○ *Factors* ○ *Partitioning* ○ *Short division* ○ *Long division*	MONEY AND DECIMALS (UNIT 2) • × and ÷ numbers by 10, 100 and 1,000 (r) MULTIPLICATION AND DIVISION (UNIT 3) n/a All work is problem solving. FRACTIONS (UNIT 2) • Multiplying fractions ○ *Multiplying proper fractions by whole numbers* ○ *Multiplying mixed numbers by whole numbers* ○ *Multiplying pairs of proper fractions* • Dividing fractions ○ *Dividend is a fraction - divisor is whole number; numerator is a multiple of the whole number* ○ *Dividend is a whole number - divisor is a fraction* ○ *Dividing a fraction by a whole number where numerator is not multiple of whole number*	CALCULATION UNIT • Derive related calculations MONEY AND DECIMALS (UNIT 2) n/a

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	7 × table (r) Revision of the 7 × table consolidates understanding from earlier year groups. This includes the distributive property of multiplication, through partitioning arrays: 6 × 7 = 5 × 7 + 1 × 7. The distributive property allows a factor in a multiplication expression to be decomposed into two or more numbers, and those numbers can be multiplied by the other factor in the multiplication expression. Children's understanding of the commutative property is developed through interpreting representations on multiplication grids in two ways, eg: 6 × 7 = 42 7 × 6 = 42 Understanding about the multiplication grid is deepened through challenging tasks involving finding missing products on parts of multiplication grids.	× and ÷ numbers by 10, 100 and 1,000 (r) Children revisit multiplying and dividing numbers with up to three decimal places by 10, 100 and 1,000. (This was first encountered in Year 5, × and ÷ unit 2.) The place value chart is used to highlight what happens to the digits when we multiply or divide by 10, 100 and 1,000. Activities require children to think carefully about multiplicative relationships when multiplying and dividing by 10, 100 and 1,000.	Derive related calculations Children have used the compensation property of multiplication previously, for example, when recognising connections between multiplication table facts: 5 × 8 = 10 × 4. They have also used it as method to simplify calculations: 22 × 16 = 44 × 8. This learning is consolidated and children secure learning that if one factor is multiplied by a number, then the other factor must be divided by the same number for the product to stay the same. They use this knowledge to complete equations such as 0.4 × 240 = 4 × __ and, more generally, to help them simplify calculations. Children have learnt to scale known number facts by 10, 100, one-tenth and one-hundredth. They know that if one factor is multiplied by a number, and the other factor kept the same, then the product must be multiplied by the same number. This knowledge is applied to solve missing number problems and also as a method to simplify calculations.

Year 6

	Block 1	Block 2	Block 3
Strategies/ methods	Efficient strategies for multiplication Some calculations, often those with larger numbers, may be best solved with column methods. Understanding about how multiplication works is enhanced through familiarity with a range of methods, which also support mental calculation with smaller numbers. Efficient strategies for multiplication include: • column methods; • partitioning methods; • factors; • relationships; • compensation. Certain calculations will lend themselves more readily to one or more of the above, so encouraging proficiency in more than one method is important. It also deepens understanding.	Multiplying proper fractions and mixed numbers by whole numbers (r) Teaching about the multiplication of fractions begins by revisiting learning from Year 5 about multiplying fractions by whole numbers. ***Multiplying proper fractions by whole numbers*** The focus here is on understanding that we multiply the numerator by the whole number; we do not multiply the denominators. Repeated addition is used to help reinforce the concept: eight-tenths plus eight-tenths plus eight-tenths = twenty-four tenths = 2 and four-tenths	

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Efficient strategies for division As with multiplication, some calculations, often those with larger numbers, may be best solved with column methods. Understanding about how division works is enhanced through familiarity with a range of methods, which also support mental calculation with smaller numbers. Efficient strategies for division include: • column methods; • partitioning methods; • factors; • relationships.	***Multiplying mixed fractions by whole numbers*** Partition 3 7/20 into whole parts and fractional parts. Multiply the wholes. Multiply the fractional parts. Combine. The initial combining results in the non-conventional format of a mixed number with an improper fractional part. In this instance, 12 28/20. Whilst this is structurally correct, explain that convention means we write the mixed number so the numerator is less than the denominator.	

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Additional understanding about division Children have learnt about multiplicative change to the dividend **and** the divisor meaning the resulting quotient changes by the same scale factor. They also learn that: • if there is a multiplicative change to the dividend and the divisor remains the same, the quotient changes by the same scale factor; • but if there is a multiplicative decrease to the divisor and the dividend remains the same, the quotient increases by the same scale factor; • and if there is a multiplicative increase to the divisor and the dividend remains the same, the quotient decreases by the same scale factor.	Multiplying pairs of proper fractions Learning about multiplying pairs of proper fractions begins with addressing the misconception that multiplication makes things bigger. Teaching highlights that multiplication can make things bigger, result in no change or can make things smaller. 2 × 2 = 4 1 × 1 = 1 ½ × ½ = ¼ Teaching highlights the varied vocabulary used for the multiplication symbol and teaches children that one word that can be used for it is ‘of’. ½ of ½ = ¼ Children learn the rules for multiplying pairs of proper fractions. [1] Multiply the numerators of the fractions to get the new numerator. [2] Multiply the denominators of the fractions to get the new denominator. [3] Simplify if needed. Conceptual understanding is developed by explaining how multiplication equations connect to visual representations.	

Year 6			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	Multiplying 3- and 4-digit numbers by 2-digit numbers (r) Unit 1 ends with work to consolidate understanding of long multiplication. Calculations are represented using arrays to ensure conceptual understanding of the multiplication process and attribute meaning to the long multiplication procedure. The array is used on its own and then alongside the formal algorithm for long multiplication. The process for each is the same: multiply the ones; multiply the tens; multiply the hundreds. Accurate use of language is key. Children are very familiar with multiplying by ones in the column layout, eg: 5 ones × 4 = 20 ones = 2 tens = 20; 3 tens × 4 = 12 tens = 120; 1 hundred × 4 = 4 hundreds.	Dividing a fraction by a whole number Learning to divide a fraction by a whole number begins with examples where the dividend is a fraction, the divisor is whole number and the numerator is a multiple of the whole number. For example: 6/7 ÷ 3. Pictorial representations support conceptual understanding that we are not dividing the denominator. Children need to understand that the denominator tells us about the size of the parts and the numerator tells us how many parts there are.	

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Again, accurate use of language is key: 5 ones × 20 = 100 ones = 1 hundred = 100; 3 tens × 20 = 60 tens = 6 hundreds = 600; 1 hundred × 20 = 20 hundreds = 2000. The grid method continues to be used. Whilst it is not the prime strategy, children are encouraged to make connections between the grid representation and the algorithm for long multiplication.	<u>Dividing a whole number by a unit fraction</u> Now the examples have the dividend as a whole number and the divisor is a fraction. For example: 4 ÷ 1/3. Pictorial representations support conceptual understanding. The key teaching point here is about visualising how many thirds are 'inside' the dividend. Start by getting the children to think about how many thirds are in one. Then build that up to how many thirds are in two, three and four. Highlight the relationship between the whole number and the denominator. Finally, ask if it can be solved another way. • Decimal equivalents. These will not be useful here as we are dividing by one-third. However they would be if the calculation were 4 ÷ ¼, for example. • Scaling. Multiply the fraction by 3 to obtain 1, resulting in: 12 ÷ 1 = 12.	

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Finding fractions of quantities Children have had lots of experience of finding unit fractions of quantities and, from Year 4, finding non-unit fractions of quantities. The procedure for finding fractions of quantities should be secure. In Year 6 the emphasis is largely on solving problems involving non-unit fractions of quantities. Intelligent calculation practices are also promoted. For example, finding five-sixths of £15 is not best done by dividing £15 by 6 and multiplying the result by 5. Finding one-sixth is far easier by finding one-third and then halving this to obtain one-sixth. Now five-sixths can be obtained.	Dividing a fraction by a whole number The final step in learning to divide a fraction by a whole number involves examples where the dividend is a fraction, the divisor is whole number and the numerator is *not* a multiple of the whole number. For example: 6/7 ÷ 4. Teaching helps children to understand that we need to find an equivalent fraction (in this case 12/14) where we can divide the numerator by the denominator. Pictorial representations support conceptual understanding of this process.	

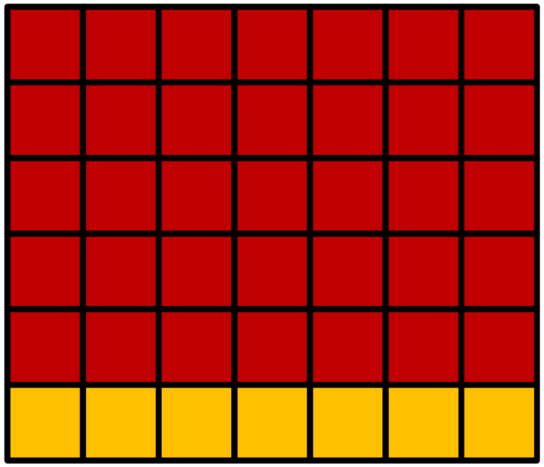
Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Dividing by a 2-digit number using factors and using partitioning Partitioning supports conceptual understanding about division. The dividend is partitioned into parts that are divisible by the divisor. There is no set number of parts to partition the dividend into. In the example shown, using chunks of 330 makes things fairly straightforward. Dividing by using factors can be effective for situations where the dividend is not a prime number. In the example shown factors of 33 are used. It does not matter which factor becomes the divisor first of all. Here, it makes sense to divide by 3 first and then 11.		

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Dividing by a 2-digit number using short and long division It is important that children realise that both short and long division can be used to divide when dividing with a 2-digit number as the divisor. One of the challenges that arises when dividing by a 2-digit number is that we cannot use division facts from our known multiplication tables. To eliminate this challenge, encourage children to make lists of multiples of the divisor and remind them of simple strategies for making this list. For example, if the divisor is 13 we can add 10 and then add 3. Use of language is key to ensuring conceptual understanding. (continued on next page)		

Year 6			
	Block 1	Block 2	Block 3
Strategies/ methods	Dividing by a 2-digit number using short and long division (ctd) **Language for 247 ÷ 13** *2 hundreds ÷ 13 = … Not enough hundreds.* *We need to exchange 2 hundreds for 20 tens.* *24 tens ÷ 13 = 1 group of 13 tens with 11 tens left over.* *Exchange 11 tens for 110 ones. We now have 117 ones ÷ 13.* *Let's use the list of multiples of 13 to help find the answer.* The language used is the same for both methods. The long division layout lets you see the remainders more easily – but this can also be confusing for some children. Where we show the regrouped digits is different in the two methods: in short division we write the regrouped digit/s in the bus stop; in long division we bring the digits down.		

Year 6 - Block 1 **6 × 7 = 42**

7 × table (r)

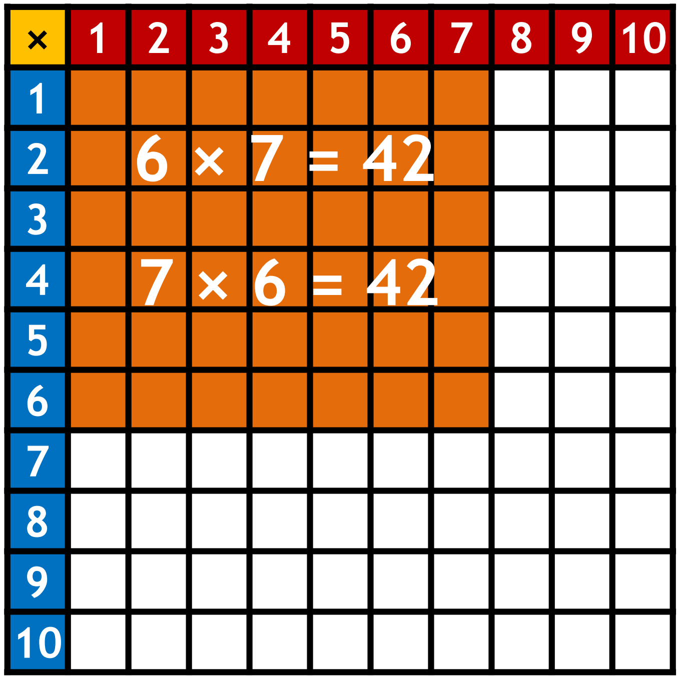


ALL: 6 × 7 = 42

PARTS: 5 × 7 = 35

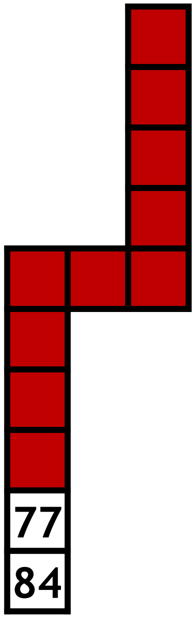
1 × 7 = 7

distributive property of multiplication reinforced through partitioned array



×	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

commutative property



finding missing products on parts of the multiplication grids

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 6

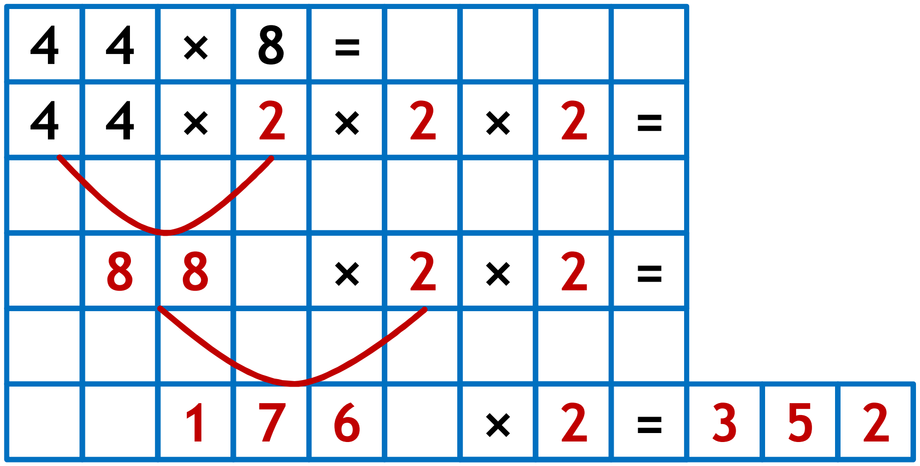
Year 6 - Block 1

44 × 8 = 352

Efficient strategies for multiplication

4	4	×	8	=			
4	0	×	8	=	3	2	0
	4	×	8	=		3	2
					3	5	2

partitioning the first factor

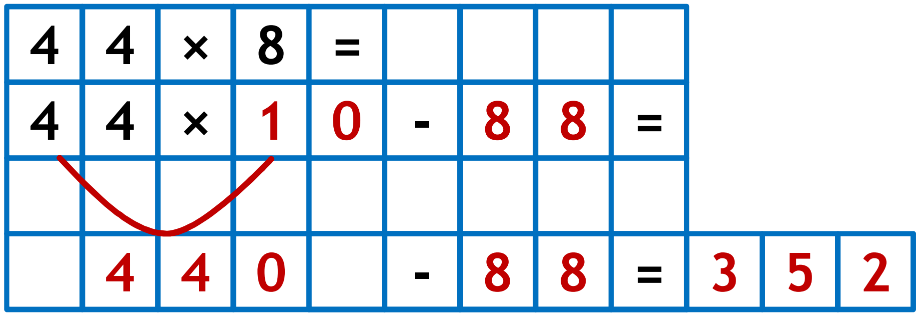


4	4	×	8	=							
4	4	×	2	×	2	×	2	=			
	8	8		×	2	×	2	=			
		1	7	6		×	2	=	3	5	2

using factors

2	2	×	1	6	=		
4	4	×	8	=	3	5	2

using relationships



4	4	×	8	=							
4	4	×	1	0	-	8	8	=			
	4	4	0		-	8	8	=	3	5	2

using compensation

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 6

Year 6 - Block 1

216 ÷ 6 = 36

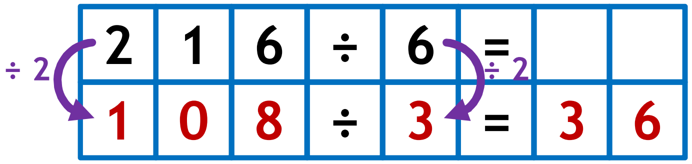
Efficient strategies for division

2	1	6	÷	6	=			
1	8	0	÷	6	=	3	0	
	3	6	÷	6	=		6	
						3	6	

partitioning the dividend

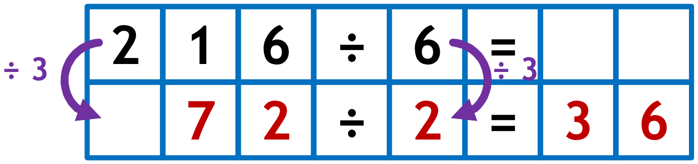
2	1	6	÷	6	=				
2	1	6	÷	2	÷	3	=		
		1	0	8	÷	3	=	3	6

using factors



2	1	6	÷	6	=		
1	0	8	÷	3	=	3	6

using relationships – multiplicative change to the dividend and the divisor (scaled down by 2) meaning the resulting quotient is also scaled

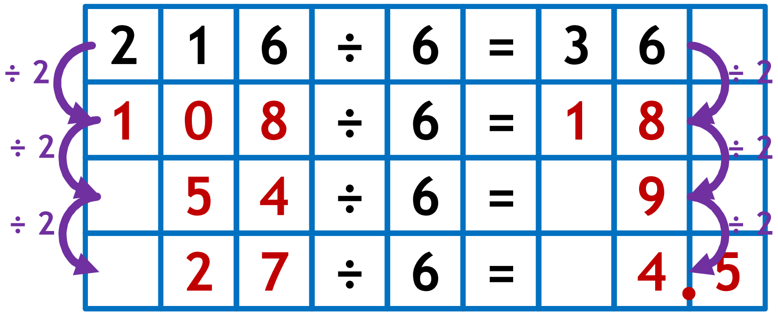


2	1	6	÷	6	=		
	7	2	÷	2	=	3	6

using relationships – multiplicative change to the dividend and the divisor (scaled down by 3) meaning the resulting quotient is also scaled

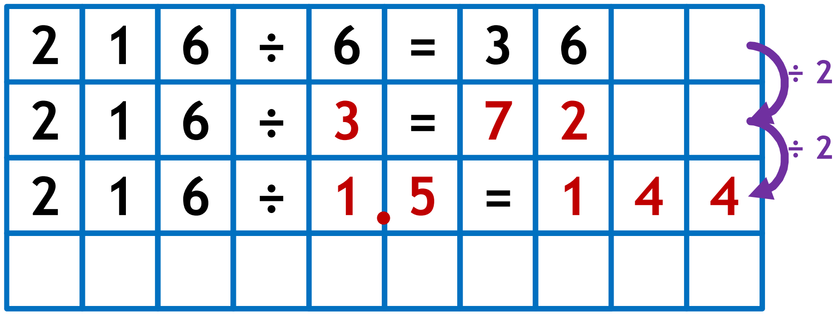
Year 6 - Block 1

Additional understanding about division



2	1	6	÷	6	=	3	6	
1	0	8	÷	6	=	1	8	
	5	4	÷	6	=		9	
	2	7	÷	6	=		4.	5

multiplicative change to the dividend and the divisor remains the same, the quotient changes by the same scale factor



2	1	6	÷	6	=	3	6		
2	1	6	÷	3	=	7	2		
2	1	6	÷	1.	5	=	1	4	4

multiplicative decrease to the divisor and the dividend remains the same, the quotient increases by the same scale factor

multiplicative increase to the divisor and the dividend remains the same, the quotient decreases by the same scale factor

Year 6 - Block 1

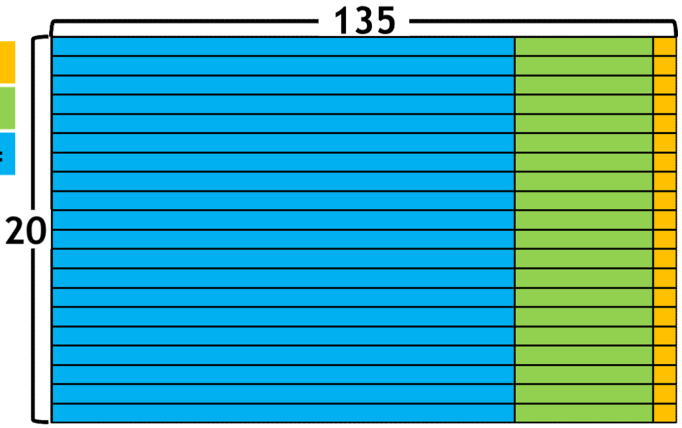
135 × 24 = 3,240

Multiplying 3- and 4-digit numbers by 2-digit numbers (r)

5 ones × 20 =

3 tens × 20 =

1 hundred × 20 =

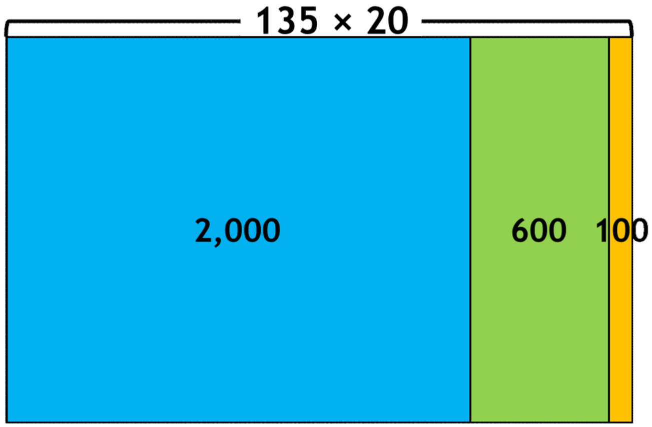


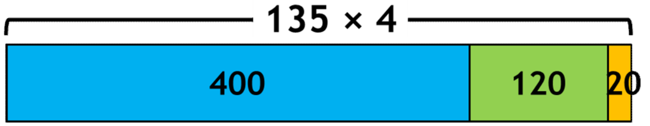
5 ones × 4 =

3 tens × 4 =

1 hundred × 4 =

	Th	H	T	O
		1	3	5
×			2	4
		5 ~~1~~	4 ~~2~~	0
+	2 ,	7 ~~1~~	0	0
	3 ,	2	4	0
	1			





×	100	30	5	
20	2,000	600	100	2,700
4	400	120	20	+ 540
				3,240

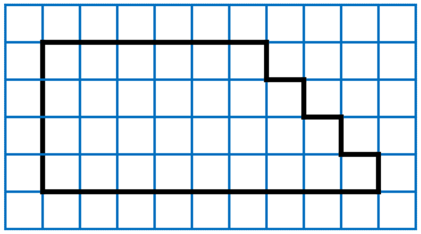
Finding fractions of quantities

1/3 of £15.00 = £5.00

1/6 of £15.00 = £2.50

5/6 of £15.00 = £12.50

procedural variation used to support calculation process



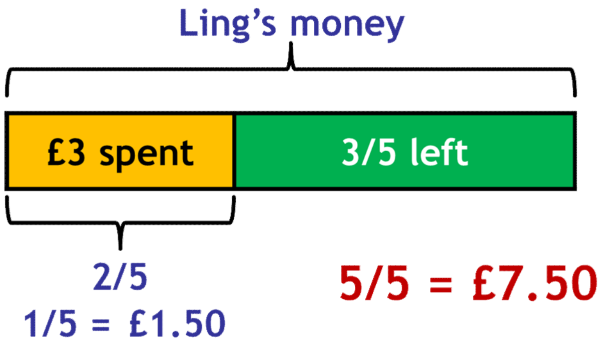
The shape needs to be coloured in as shown below.

2/5 = red; 3/10 = orange; 1/6 = green; 2/15 = blue.

Calculate the number of squares needed for each colour.

solving increasingly complex problems

Ling had some money.
She spent £1.10 on a drink.
She spent £1.90 on a sandwich.
She has three fifths of her money left.
How much money did Ling have to start with?



Ling's money

£3 spent

3/5 left

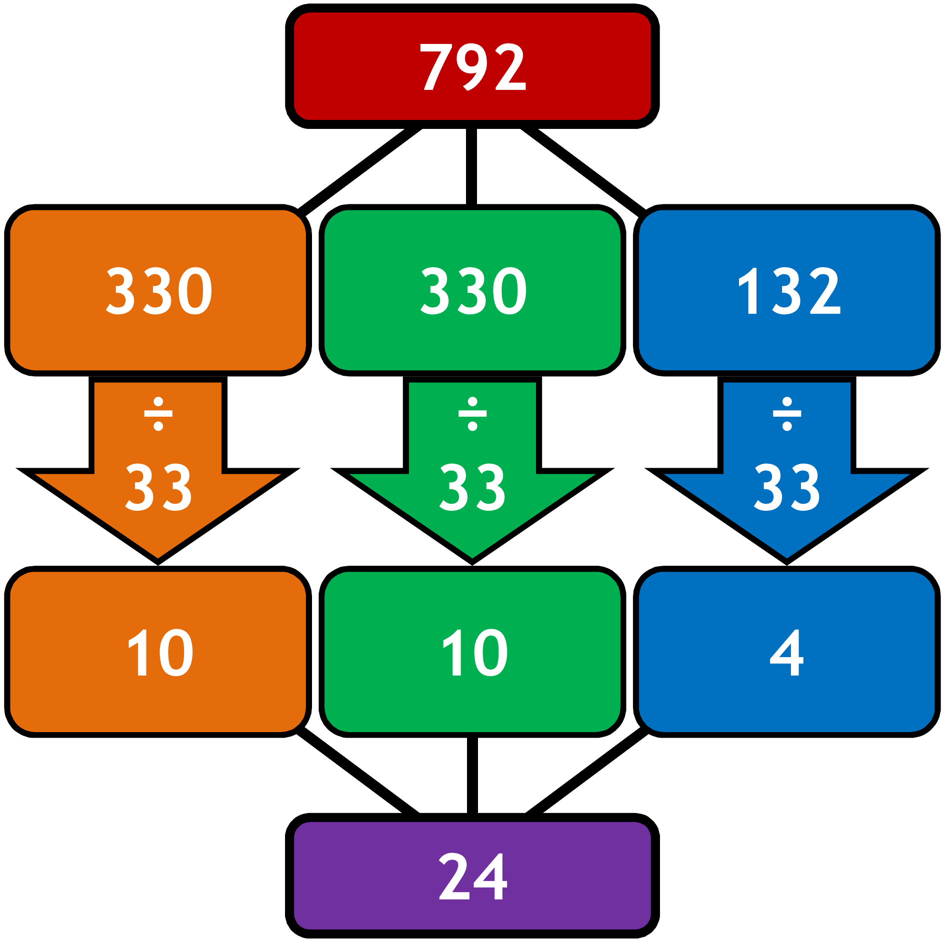
2/5
1/5 = £1.50

5/5 = £7.50

continuing to use bar model representations to support problem solving

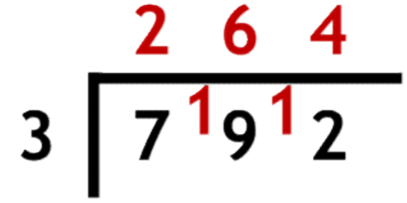
792 ÷ 33 = 24

Dividing by a 2-digit number using factors and using partitioning

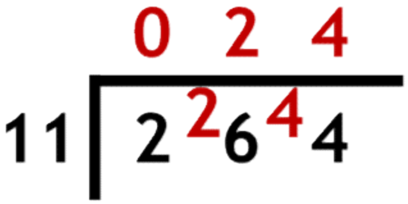


partitioning the dividend to divide - numeric representation

$$792 \div 33 = 792 \div 3 \div 11$$



264 ÷ 11 =

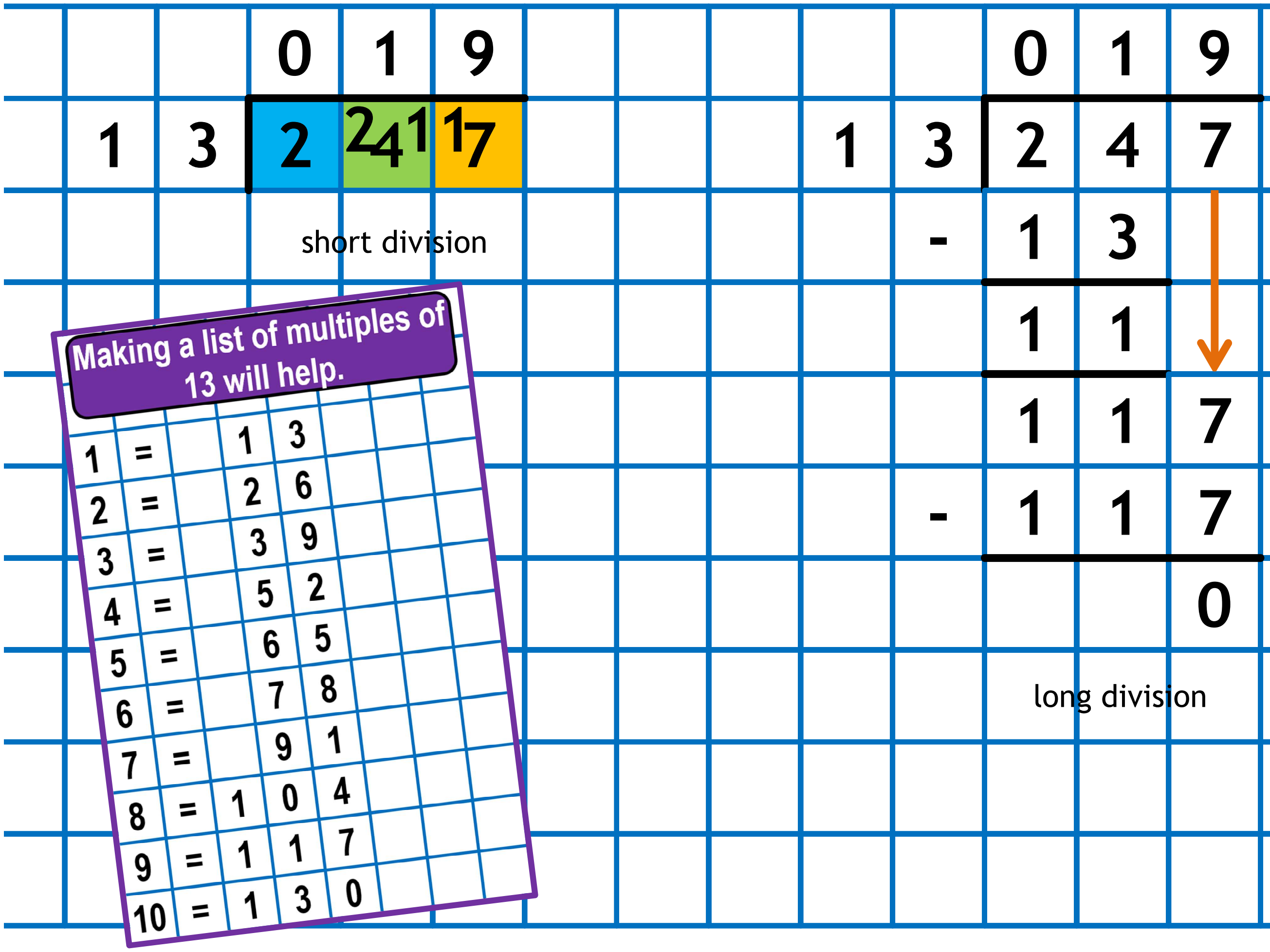


using factors to divide

Year 6 - Block 1

247 ÷ 13 = 19

Dividing by a 2-digit number using short and long division



Making a list of multiples of 13 will help.

1	=	13
2	=	26
3	=	39
4	=	52
5	=	65
6	=	78
7	=	91
8	=	104
9	=	117
10	=	130

Divide the hundreds

2 hundreds ÷ 13 =

Exchange 2 hundreds for 20 tens

24 tens ÷ 13 =

Find the remainder

24 tens - 13 tens =

Exchange 11 tens for 110 ones

117 ones ÷ 13 =

Find the remainder

117 ones - 117 ones =

Year 6 - Block 2

× and ÷ numbers by 10, 100 and 1,000 (r)

3 ÷ 10

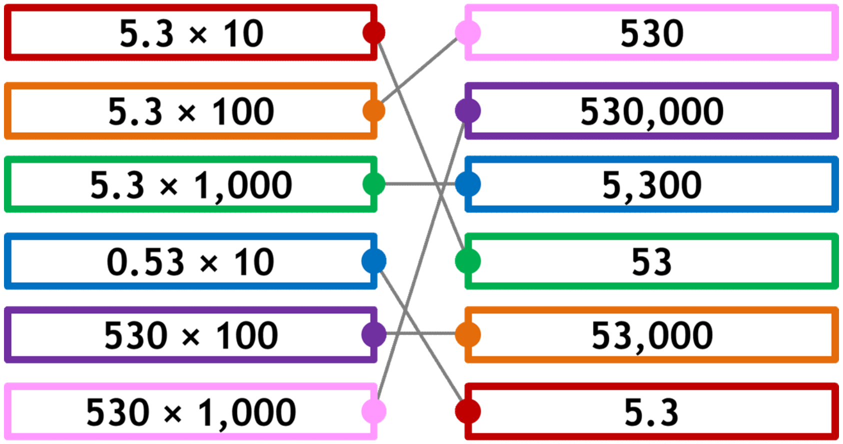
Th	H	T	O	t	h	th
			3			
			0.	3		

3 ÷ 100

Th	H	T	O	t	h	th
			3			
			0.	0	3	

3 ÷ 1,000

Th	H	T	O	t	h	th
			3			
			0.	0	0	3



5.3 × 10	530
5.3 × 100	530,000
5.3 × 1,000	5,300
0.53 × 10	53
530 × 100	53,000
530 × 1,000	5.3

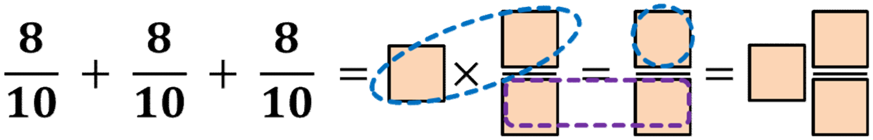
230 ÷ 10 = ☐ ÷ 100

230 ÷ 100 = 23 ÷ ☐

☐ ÷ 1,000 = 2.3 ÷ 100

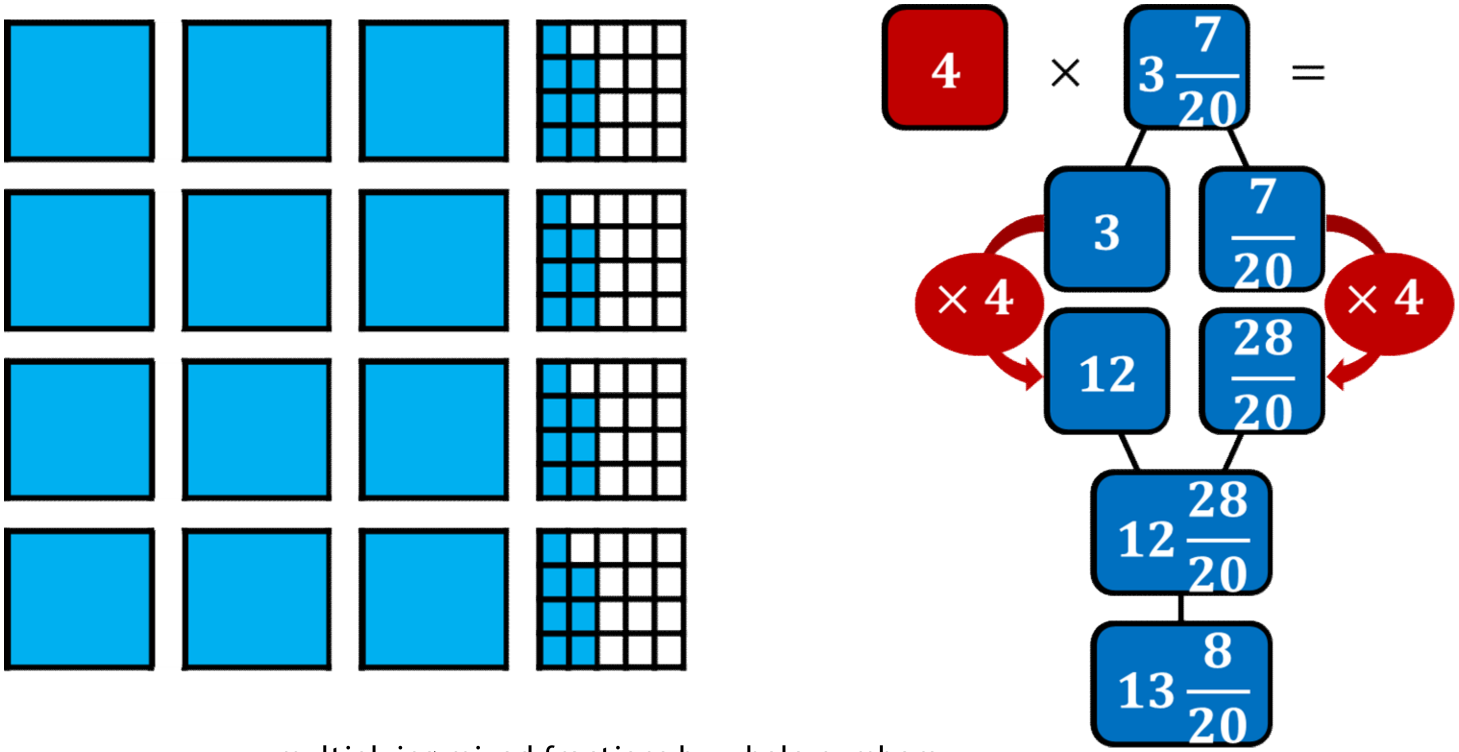
Year 6 - Block 2

Multiplying proper fractions and mixed numbers by whole numbers (r)



$$\frac{8}{10}+\frac{8}{10}+\frac{8}{10}=\square\times\frac{\square}{\square}=\frac{\square}{\square}=\square\frac{\square}{\square}$$

multiplying proper fractions by whole numbers

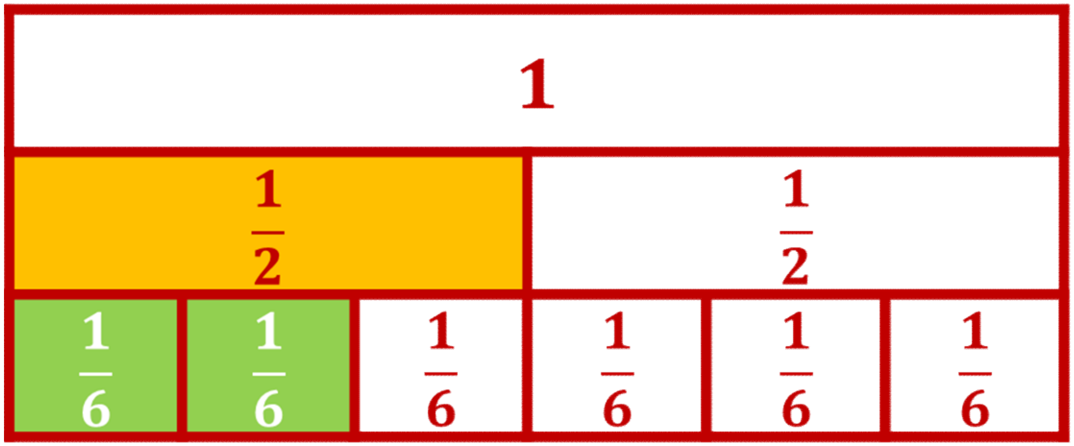


multiplying mixed fractions by whole numbers

Year 6 - Block 2

Multiplying pairs of proper fractions

$$\frac{2}{3} \times \frac{1}{2} = \frac{2}{6} = \frac{1}{3}$$

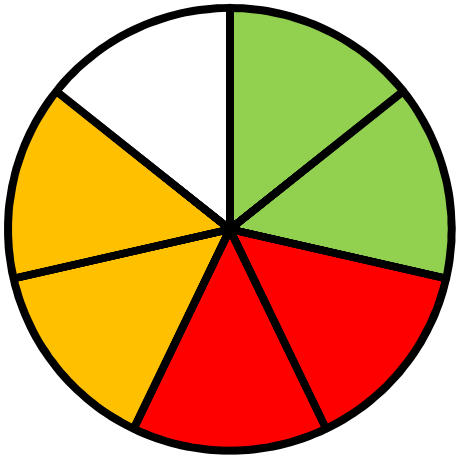


2/3 ***of*** 1/2 = 2/6 = 1/3

conceptual understanding is developed by explaining how multiplication equations connect to visual representations

Year 6 - Block 2

Dividing a fraction by a whole number
(dividend is a fraction - divisor is a whole number - numerator is a multiple of the whole number)



numerator is a multiple of the whole number

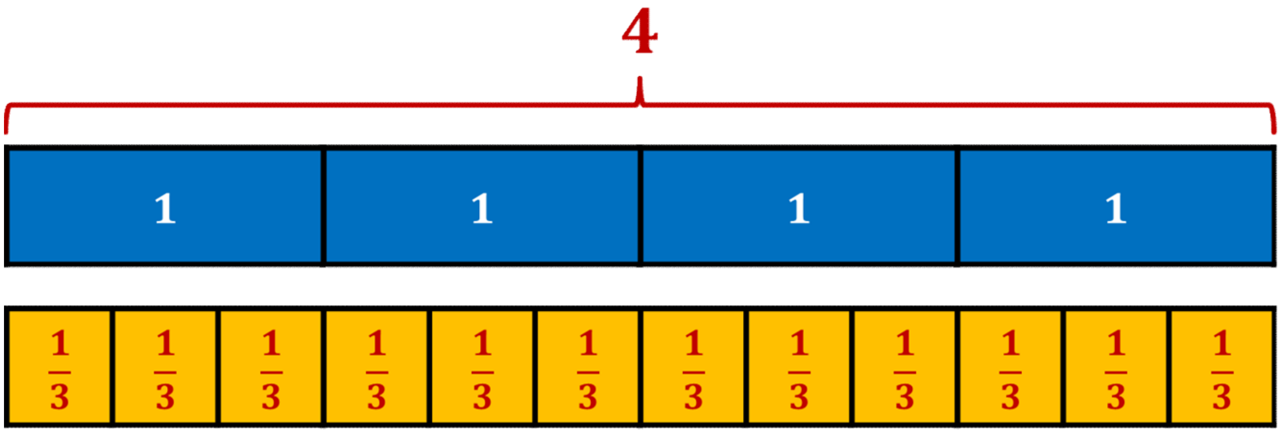
$$\frac{6}{7} \div 3 = \frac{2}{7}$$

dividend is a fraction

divisor is a whole number

Year 6 - Block 2

Dividing a whole number by a unit fraction
(dividend is a whole number - divisor is a fraction)



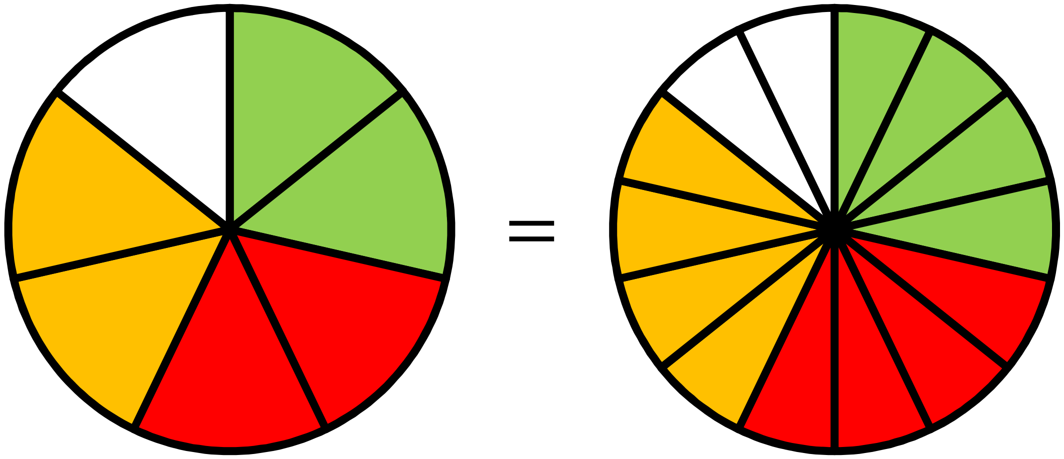
$$4 \div \frac{1}{3} = 12$$

dividend is a whole number

divisor is a fraction

Year 6 - Block 2

Dividing a fraction by a whole number
(dividend is a fraction - divisor is a whole number - numerator is *not* a multiple of the whole number)



numerator
is *not* a
multiple of the whole number –
so we need an equivalent fraction where the numerator is: twelve-fourteenths

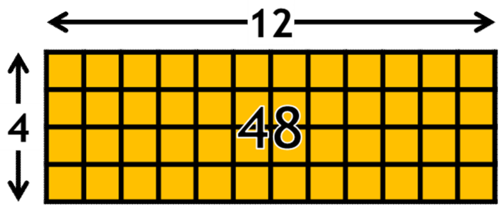
$$\frac{6}{7} \div 4 = \frac{3}{14}$$

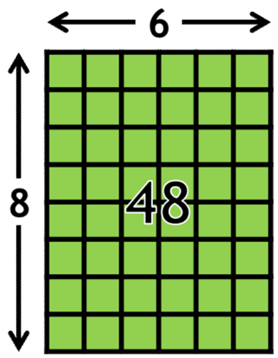
dividend is a fraction

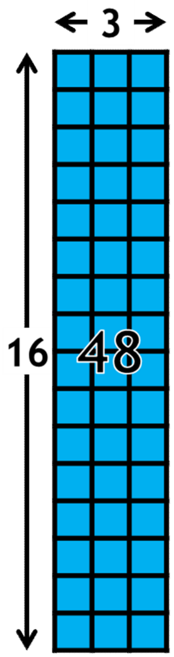
divisor is a whole number

Year 6 - Block 3

Derive related calculations







12 × 4 = 48

6 × 8 = 48

3 × 16 = 48

$1\frac{1}{2}$ × 32 = 48

if one factor is multiplied by a number, then the other factor must de divided by the same number for the product to stay the same

0.4 × 240 = 4 × ☐

0.6 × 180 = 6 × ☐

800 × 120 = 96,000

80 × 120 = 9,600

8 × 120 = 960

0.8 × 120 = 96

0.08 × 120 = 9.6

if one factor is multiplied by a number, and the other factor kept the same, then the product must be multiplied by the same number