Houghton Regis Primary School

Year 6 Maths Calculation Guidance

Equipment

Pencils

All work in Maths lessons is completed in pencil. Pupils are provided with at least 2 pencils, as they easily break. These should be sharp and ready to use.

Ruler

A 30cm ruler is provided by school which teachers will allocate. Bendy and fold-out 30cm rulers are not useful as they do not remain straight, so lines drawn with these are often bumpy and inaccurate.

Rubber and Pencil Sharpener

Making mistakes in Maths is part of the learning process and pupils will have access to a rubber to make improvements to their work.
Pupils should have a sharp pencil; pupils will have access to sharpeners to keep all of their pencils sharp. The sharper the pencil, the more accurate Mathematical drawings can be.

Equipment NOT needed

CALCULATORS are no longer part of the KS2 curriculum so pupils do not need these at school.

PROTRACTORS are provided by the school when they are needed in lessons and therefore pupils do not need their own. The school uses 360° and 180° protractors.

PAIR OF COMPASSES are also provided by the school when they are needed.
Pupils do not need their own.

Addition

Key Vocabulary

+ add	addition	plus	and	more
altogether	total	equals	balance	sum
much	increase	same as	make	bonds

Understanding

Pupils should understand that addition is commutative
E.G. **4** + 5 is the same as 5 + **4**
Pupils should be able to label their column headings correctly.
E.G. H=hundreds T = tens O=ones

Expectations

Pupils will be expected to know their number bonds to 10 and 20 at probe speed. They should also know their number bonds to 100. Pupils should be able to use column addition for large numbers, decimals, money and measures.

Method - Column Addition

Pupils should add vertically starting with the smallest digits.

Place value understanding will be reinforced during the teaching of this method and pupils will be expected to label their column headings.

TO	HTO	HTO
63	348	539
+25	+ 237	+366
88	585	905
	1	1 1

Subtraction

Key Vocabulary

-	subtract	less than	minus	leave
difference	decrease	between	take away	
count on	left over	gone	fewer	inverse

Understanding

Pupils should understand that subtraction is NOT commutative.
EG. 7 - 3 is NOT the same as 3 - 7
Pupils should understand subtracting means finding the difference.

Expectations

Pupils will be expected to know their number bonds to 10 and 20 at probe speed and know their number bonds to 100. Pupils should be able to use column subtraction for large numbers, decimals, money and measures.

Method – Column Subtraction

Pupils should work from right to left, as with column addition.

Step 1
You can't do 5 – 7
1 ten is exchanged for 10 ones. There is now only 3 tens or 30 left.
We now do 15 - 7

H	T	U
3	~~4~~ 3	~~5~~ 15
-1	5	7
1	8	8

STEP 2
You can't do 30 – 50.
1 hundred is exchanged for 10 tens. There is now only 2 hundreds or 200 left.
We now do 130 – 50.

Avoiding common mistakes

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  72
- 68
  16
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This is the most common subtraction error. Pupils calculate 8 – 2 rather than 2 – 8. This is because from a young age children are always told that 'it's the big number take away the small number'. This is a difficult misconception to unlearn.

Pupils are encouraged to check their work but using the 'inverse calculation'. This means that pupils should add their answer to the second number in the calculation to see if there answer matches.

Multiplication

Key Vocabulary

X	multiply	product	lots of
multiplied by	sets of	multiple of	times
doubled	repeated addition	tripled	

Understanding

Pupils should understand that multiplication is commutative.

EG. 5 x 3 is the same as 3 x 5

Pupils should be able to make the connection between the inverse, decimals and matching division facts.

Expectations

Pupils will be expected to know their multiplication tables at probe speed up to 12 x 12. Pupils will be completing probes on a weekly basis and are expected to practise their tables regularly at home. Pupils are expected to apply these methods for numbers up 6 digits and decimals up to 3 decimal places.

Method

Pupils will learn to use the standard method of multiplication, as encouraged by the new National curriculum. Some teachers have also shown pupils napiers/lattice multiplication as an alternative to the standard method. Pupils should be able to identify the method they use.

Standard Method

123 x 5

1st Step

$$\begin{array}{r} 123 \\ \times\ \ 5 \\ \hline 5 \\ \hline \end{array}$$
1

2nd Step

$$\begin{array}{r} 123 \\ \times\ \ 5 \\ \hline 15 \\ \hline \end{array}$$
1 1

3rd Step

$$\begin{array}{r} 123 \\ \times\ \ 5 \\ \hline 615 \\ \hline \end{array}$$
1 1

$$\begin{array}{r} 2451 \\ \times\ \ 63 \\ \hline 7353 \\ 147060 \\ \hline \end{array}$$
1 2 3

Division

Key Vocabulary

divide	share	group	each	left	factor
equally	remainder		divisible		quotient
goes into	inverse	chunking		groups of	÷

Understanding

Pupils should understand that division is NOT commutative.

EG. 15 ÷ 5 is NOT the same as 5 ÷ 15

Pupils should be able to make the connection between the inverse, decimals and matching multiplication facts.

Expectations

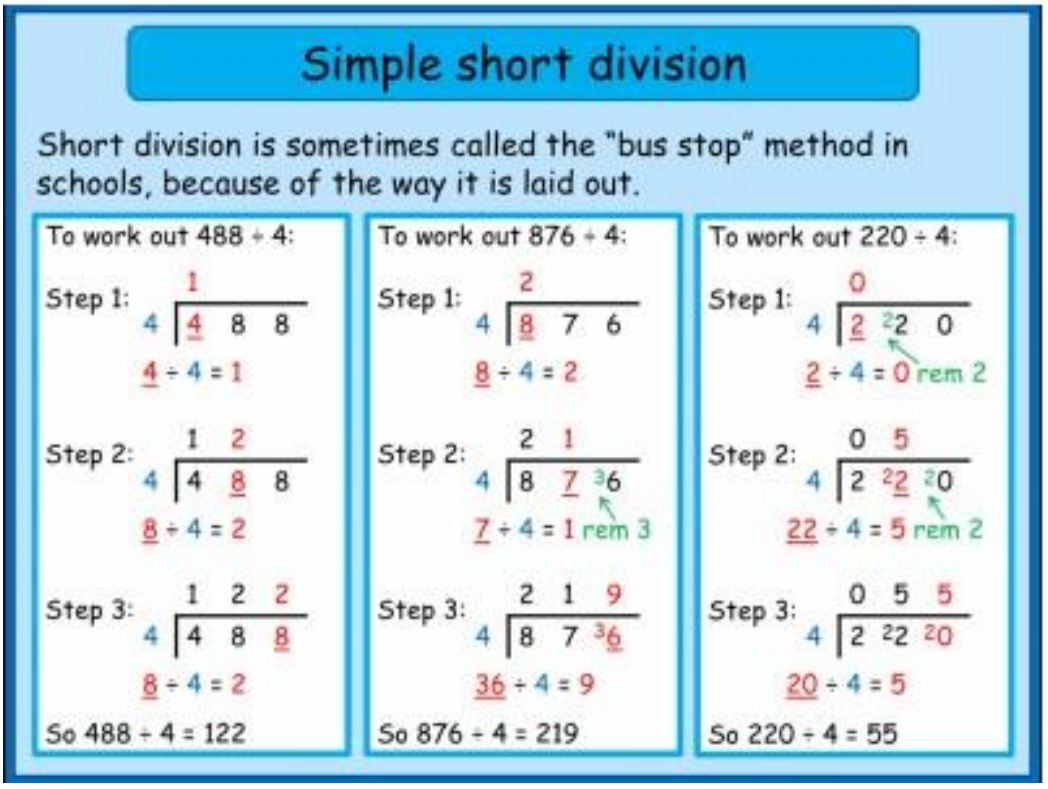
Pupils will be expected to know their multiplication tables at probe speed to 12 x 12 and in turn the inverse division calculations.

Method

All pupils will be using the bus shelter method of division and will also extend this method to divide with 2 digit numbers. Pupils will need to have secure multiplication tables knowledge and be able to complete simple mental subtractions.

Pupils must record remainders as fractions or decimals. →

$$6\overline{)843.0} = 140.5$$



Calculating with Fractions

Key Vocabulary

improper	proper	top heavy	mixed	numerator
denominator	equivalent	simplify	cancelling down	
common denominator		factors	multiples	

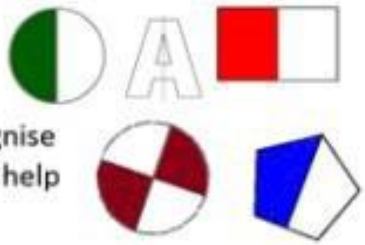
Pictures and written fractions

Here are four different ways of expressing/explaining a fraction

$\frac{1}{2}$

- 1 out of 2
- 1 divided by 2
- 1 over 2
- One half

It is important that students recognise these different representations to help them solve problems.



Numerator and Denominator

Numerator
Number of pieces we are talking about

$\frac{N}{D}$

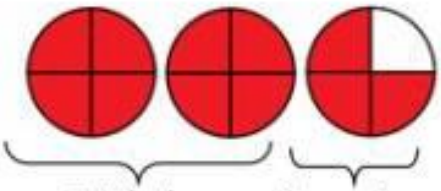
Denominator
The Divisor: Number of equal pieces the amount is being divided into

Mixed numbers/top heavy/improper/Proper

$\frac{3}{4}$ Is a proper fraction because the numerator is smaller than the denominator

$\frac{11}{4}$ Is an improper fraction because the numerator is bigger than the denominator

Sometimes we call this a top-heavy fraction



2 Wholes 3 quarters

or

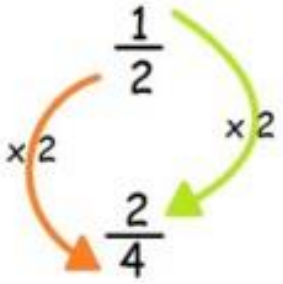
8 quarters 3 quarters

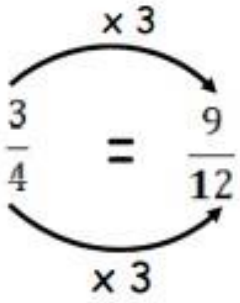
$2\frac{3}{4}$ This is a mixed number with a whole number and a fraction

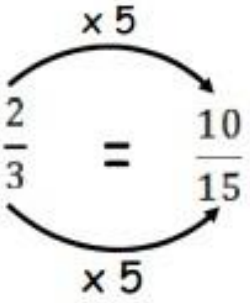
$\frac{11}{4}$ This is an improper/Top Heavy Fraction

Finding Equivalent Fractions

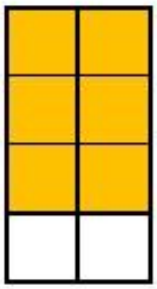
It is difficult to compare fractions unless they are alike and have a common denominator. This is a common multiple of all the denominators and is often the lowest common multiple (LCM).



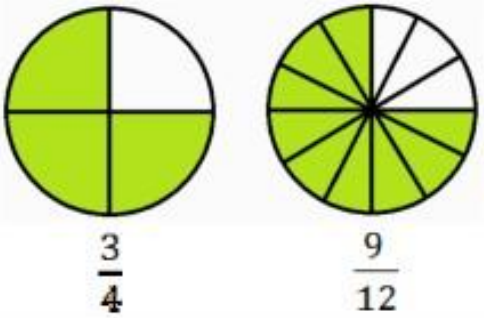




Using diagrams can help pupils visualise the problem.



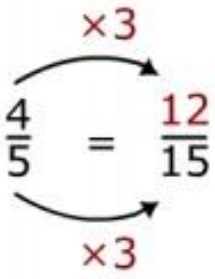
6 out of 8 squares is shaded.
Or you could say that 3 out of 4 rows are shaded.



Pictures are used to reinforce proportionality. The same amount of the circle is shaded - but we can represent this with different fractions.

The 1st bar is split into 5 equal parts.

4 parts need to be shaded.



The 2nd bar is split into 3 times as many parts.

3 times as many parts need to be shaded.

Every 3 fifteenths make up 1 fifth.

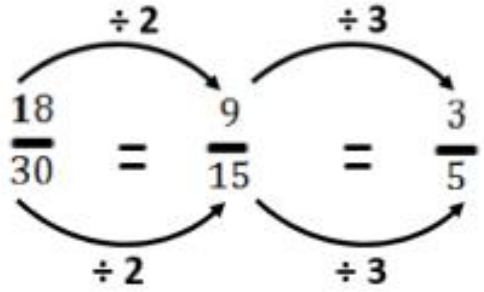
4 fifths = 12 fifteenths

$\frac{1}{5}$			$\frac{1}{5}$			$\frac{1}{5}$			$\frac{1}{5}$			$\frac{1}{5}$		
$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{15}$

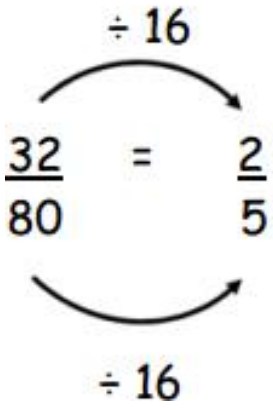
Simplifying Fractions

Fractions can be simplified by looking for common factors and dividing by these numbers.

It is possible to take different steps depending on which numbers we chose to divide with.



There are no more common factors of both 3 and 5, so the fraction is fully simplified. Prime numbers as numerators and/or denominators are usually but not always an indication that a fraction cannot be simplified further. This is because prime numbers only have 2 factors; 1 and itself.



This example has been simplified in one step because the highest common factor (HCF) of 32 and 80 is 16 and so finds the answer in one step.

The number of steps does not matter BUT fewer steps speeds up the simplifying process.

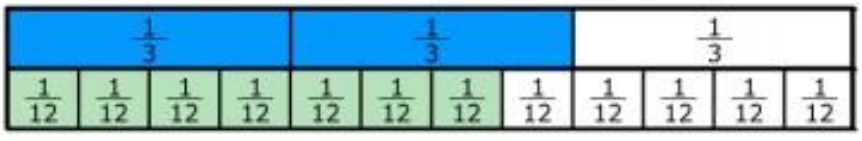
Ordering and Comparing Fractions

Initially this can be done by using a fraction wall and comparing fractions visually.

Which is bigger?

$\frac{2}{3}$ or $\frac{7}{12}$

Shade in two of the thirds
Shade in seven of the twelfths



So $\frac{2}{3}$ is bigger than $\frac{7}{12}$.

This should then move onto finding a common denominator of all of the fractions and then converting them to their equivalent fractions. This is especially useful when having to put fractions into ascending or descending order.

Now we change each fraction to the common denominator of 24.

$$\begin{array}{ccccc} \frac{3}{4} & \frac{2}{3} & \frac{1}{2} & \frac{5}{6} & \frac{7}{8} \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow \\ \frac{18}{24} & \frac{16}{24} & \frac{12}{24} & \frac{20}{24} & \frac{21}{24} \end{array}$$

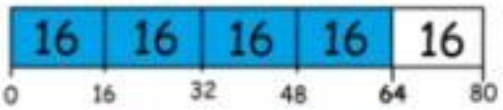
Next, place the fractions in order from least to greatest.

$$\frac{12}{24} < \frac{16}{24} < \frac{18}{24} < \frac{20}{24} < \frac{21}{24}$$

Calculating Fractions of Amounts

Pupils may need to visualise the question using diagrams to build an understanding of the two steps. Once confident pupils should be able to find fractions of amounts by dividing by the denominator and multiplying by the numerator.

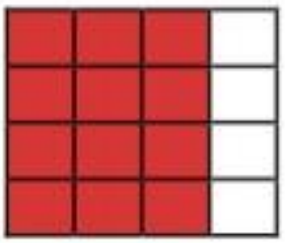
$\frac{4}{5}$ of 80



$\frac{1}{5}$ of $80 = 80 \div 5 = 16$

so $\frac{4}{5}$ of $80 = 4 \times 16 =$ ☐

$\frac{3}{4}$ of 16



Shade in 3 out of every 4 boxes

$\frac{3}{4}$ of 16 is 12

Adding and Subtracting Fractions

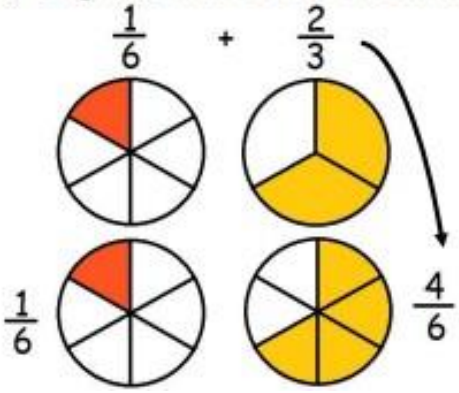
There are a number of ways addition and subtraction of fractions can be demonstrated. Pupils usually need to visualise the problem first before developing the confidence to move onto working with just the fractions.

1) Diagrams with common denominators.

$\frac{1}{5}$ + $\frac{3}{5}$ = $\frac{4}{5}$

1 fifth + 3 fifth = 4 fifths

2) Diagrams to show conversion to equivalent fractions with common denominators.



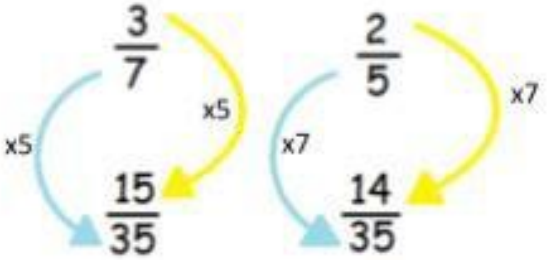
Is the same as

Then ... $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$

3) Finding common denominators when the fractions have different denominators.

$\frac{3}{7} + \frac{2}{5}$

Equivalent fractions with a common denominator can be found in order to be able to add the fractions together.



This calculation becomes ... $\frac{14}{35} + \frac{15}{35} = \frac{29}{35}$

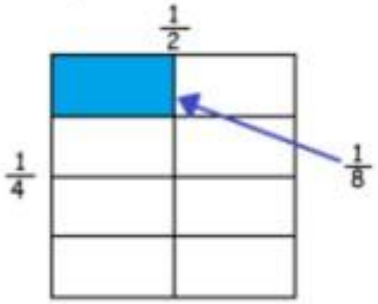
If the answer is an improper fraction then it should be simplified as a mixed number.

Multiplying Fractions

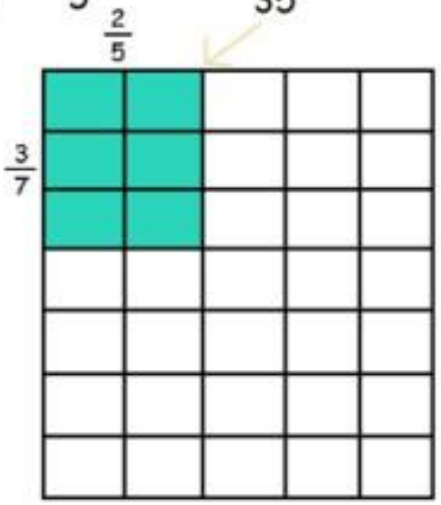
1) The use of diagrams can be used to explain the effect of multiplying two fractions together.

$\frac{1}{4} \times \frac{1}{2}$

"a quarter of a half"



$\frac{3}{7} \times \frac{2}{5} = \frac{6}{35}$



2) Multiplying without the use of diagrams.

$$\frac{2}{15} \times \frac{3}{8} = \frac{2 \times 3}{15 \times 8} = \frac{6}{120} = \frac{3}{60} = \frac{1}{20}$$

Pupils should always check to see if their answer can be simplified.

3) Multiplying with mixed numbers.

Remember ...

$2\frac{2}{5} =$  $= \frac{12}{5}$

$2\frac{2}{5} \times 3\frac{4}{7}$

$= \frac{12}{5} \times \frac{25}{7}$

Convert the fractions to improper fractions

Remember that multiplying the whole numbers together first and then adding the answer to the fractions multiplied together will <u>not</u> give the same answer.

Dividing Fractions

!) Diagrams can be used to explain vi sually what happens when fr acti onsare divi ded.

$3 + \frac{1}{2}$

How many - 's In 3?

2 1

1. How many :! 's are In 1? There are 2

2. How many $\frac{1}{2}$ - 's are in 3? There are **6**

u..
diagrams
to help

2) Dividing using the multiplicative inverse is the most efficient way of dividing fractions.

Multiplying by ½ is the same as dividing by 2
Dividing by 1/3 is the same as multiplying by 3

Multiplying by $\frac{1}{2}$ is the same as dividing by 2

Dividing by $\frac{1}{3}$ is the same as multiplying by 3

$2\frac{}{3} \div 4 = \frac{2}{3} \times \frac{1}{4}$ (Dividing by 4 is the same as multiplying by a quarter)

$\frac{5}{6}$ $\frac{3}{7}$ $\frac{5}{6} \times \frac{7}{3}$ $\frac{5 \times 7}{6 \times 3}$ $\frac{35}{18}$ $1\frac{17}{18}$

Pupils should always check that their answers can't be simplified.
If the answer is an improper fraction, it should be converted to a mixed number.