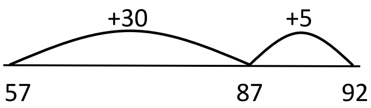
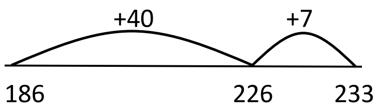
<u>Mental Addition</u>

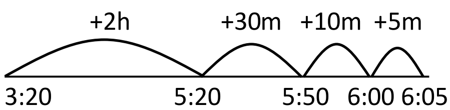
<u>Y3 I can solve addition calculations with 2-digit numbers mentally/with jottings (counting *on* with a number line).</u>
Differentiate by providing questions that do or do not go over 100.
Always start with the largest number. Jumps made can vary according to ability. For example, in the question below, a child could jump on in tens, also recording 67 and 77 under the line. They could then move on in ones, writing 88, 89, 90 and 91 under the line. A hundred square is a helpful tool when learning this method.
Some more able children may be able to perform calculations without drawing the number line.
Q: 35+57=92



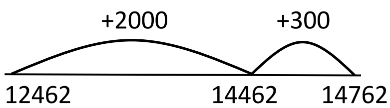
<u>Y4 I can solve addition calculations with 2 and 3-digit numbers mentally/with jottings (counting *on* with a number line).</u>
Differentiate by providing questions that do or do not cross a 100s boundary.
Always start with the largest number. Jumps made can vary according to ability. Some less able pupils may need hundred squares.
Some more able children may be able to perform calculations without drawing the number line.
Q: 186+47=233



<u>Y5 I can add numbers mentally (counting *on*).</u>
Children should perform calculations as in the lower school – starting with the largest number and with jumps varied according to ability – but without drawing the number line wherever possible. As an aid, pupils could jot down where they have got to after each jump.
(Counting *on* should be used, promoting the use of a number line, to solve time problems – analogue clocks a helpful resource.)
Q: A film begins at 3.20pm and lasts for 2 hours 45 minutes. What time does the film end? 6.05pm



<u>Y6 I can add (including large numbers) mentally (counting *on*).</u>
Children should perform calculations as in the lower school – starting with the largest number and with jumps varied according to ability – but without drawing the number line wherever possible. The visual representation of mental processes may initially be required for questions involving large numbers (one of which in a question, or both, being multiples of 10 or 100).
Q: 12462+2300=14762



(Counting *on* should be used, with a number line if necessary, to solve time problems – analogue clocks a helpful resource.)

Written Addition

Children should never be asked to use written methods for 2-digit numbers as this undermines a key message that such sized numbers should be dealt with mentally.
When teaching, talking through an algorithm, place value must be respected. For example, in the Y4 example below, modelling would involve saying "30 added to 80 is 110." (It would not be useful to say "3 added to 8 is 11.")
Place value understanding can be helped by using different colours for each column. (For consistency across the school use the following colours: Ones (not 'units')-red / Tens-blue / Hundreds-yellow / Thousands-green / 10 Thousands-purple / 100 Thousands-orange / Millions-pink). Dienes apparatus can be used to represent and undertake questions practically. Arrow cards could help some children.
Anything 'carried' into the next column should be crossed off when added on.

Y3 I can add numbers with 3 digits using a written method (compact columnar).
Some children may need to use an expanded method of columnar addition first.
Differentiate by providing questions that have a specific amount of carrying required. Some questions may result in 4-digit answers.)
Q:

```
      500→80→7
      600→70→5
1000→200→60→2
      100  10
```

```
 587
 675
1262
 11
```

Y4 I can add numbers with 3 and 4 digits using a written method (compact columnar).
Differentiate by providing questions that have a specific amount of carrying required. Some questions may result in 5-digit answers.)
Q:

```
 6537
 4982
11519
 11
```

Y5 I can add numbers with 4+ digits using a written method (compact columnar).
Pupils should be encouraged to use 0s ('place value holders') when setting out questions.
Q:

```
2654.32
0293.81
2948.13
 1  1
```

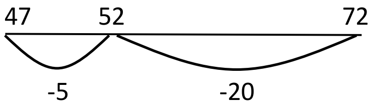
Y6 I can add numbers with 4+ digits using a written method (compact columnar).
Pupils should be encouraged to use 0s ('place value holders') when setting out questions.
Q:

```
7301.828
0053.490
7355.318
    1 1
```

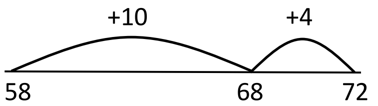
Mental Subtraction

Children need to learn when to count back and when to count up, depending on the numbers involved.

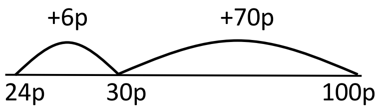
Y3 I can solve subtraction calculations with 2-digit numbers mentally/with jottings (counting *back* and counting *up* to find a difference with a number line).
Jumps made can vary according to ability. For example, in the first question below, a child could jump back in tens, also recording 62 above the line. They could then move back in ones, writing 51, 50, 49 and 48 above the line. A hundred square is a helpful tool when learning this method.
Some more able children may be able to perform calculations without drawing the number line.
Q: 72-25=47



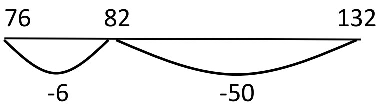
Q: 72-58=14



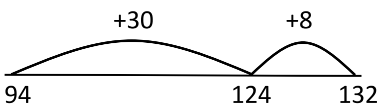
Finding change when solving problems involving money should also be undertaken by drawing a number line, counting up.
Q: I spent 24p at the school fair and used a £1 coin to pay. What was my change? 76p



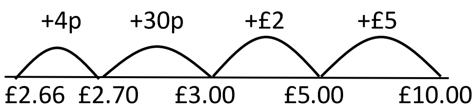
Y4 I can solve subtraction calculations with 2 and 3-digit numbers mentally/with jottings (counting *back* and counting *up* to find a difference with a number line).
Differentiate by providing questions that do or do not cross a 100s boundary.
Jumps made can vary according to ability. Some less able pupils may need hundred squares.
Some more able children may be able to perform calculations without drawing the number line.
Q: 132-56=76



Q: 132-94=38

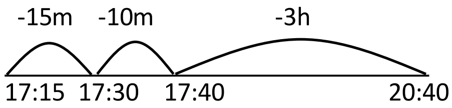


Finding change when solving problems involving money should also be undertaken by drawing a number line, counting up.
Q: What would my change from £10 be if I bought a book costing £2.66? £7.34

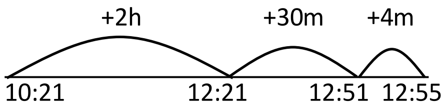


Y5 I can subtract numbers mentally (counting *back* and counting *up* to find a difference).
Children should perform calculations as in the lower school – with jumps varied according to ability – but without drawing the number line wherever possible. As an aid, pupils could jot down where they have got to after each jump.
Finding change when solving problems involving money should be calculated mentally without drawing a number line wherever possible by counting up as opposed to columnar subtraction.

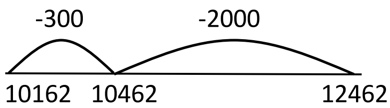
(Counting *back* and *up* should be used, promoting the use of a number line, to solve time problems – analogue clocks a helpful resource.)
Q: The man arrived in London at 20:40. His train journey took 3 hours and 25 minutes. What was his departure time earlier that day? 17:15



Q: A cake went into the oven at twenty-one minutes past ten o'clock. It was ready at five to one. How long did it bake for? Two hours and thirty-four minutes.



<u>Y6 I can subtract (including large numbers) mentally (counting *back* and counting *up* to find a difference).</u>
Children should perform calculations as in the lower school – with jumps varied according to ability – but without drawing the number line wherever possible. The visual representation of mental processes may initially be required for questions involving large numbers (one of which in a question, or both, being multiples of 10 or 100).
Q: 12462-2300=10162



Finding change when solving problems involving money should be calculated mentally without drawing a number line wherever possible by counting up as opposed to columnar subtraction.
(Counting *back* and *up* should be used, with a number line if necessary, to solve time problems – analogue clocks a helpful resource.)

Written Subtraction

Children should never be asked to use written methods for 2-digit numbers as this undermines a key message that such sized numbers should be dealt with mentally.
When teaching, talking through an algorithm, place value must be respected. For example, in the Y4 example below, modelling would involve saying “We cannot do 0 take away 600 so we need to make the top number larger. Let’s take a thousand so now we can do 1000 subtract 600 which is 400.” (It would not be useful to say “We cannot do 0 take away 6 so let’s make it 10 subtract 6 which is 4.”)
Place value understanding can be helped by using different colours for each column. (For consistency across the school use the following colours: Ones (not ‘Units’)-red / Tens-blue / Hundreds-yellow / Thousands-green / 10 Thousands-purple / 100 Thousands-orange / Millions-pink). Dienes apparatus can be used to represent and undertake questions practically. Arrow cards could help some children.
The words ‘exchanging’ and ‘borrowing’ should not be used when teaching decomposition. ‘Taking’ is more helpful.
Continually remind pupils that they do not subtract the top number from the one underneath it. For example, in the Y3 example below, a child must not put that 2-5=3 in the ones column.

Y3 I can subtract numbers with 3 digits using a written method (expanded version of columnar).
Differentiate by providing questions that have a specific amount of decomposition required.
Q:

70
600→~~80~~→^{1}2
300→40→ 5
300→30→ 7

Y4 I can subtract numbers with 3 and 4 digits using a written method (compact version of columnar).
Differentiate by providing questions that have a specific amount of decomposition required.
Q:

7 4
~~8~~^{1}0 ~~5~~^{1}1
4 6 2 8
3 4 2 3

Y5 I can subtract numbers with 4+ digits using a written method (compact columnar).
Pupils should be encouraged to use 0s (‘place value holders’) when setting out questions.
Q:

7 ^{1}4 ^{1}1
~~8~~ ~~5~~ ~~2~~ .^{1}8 7
0 9 3 . 9 4
7 5 8 . 9 3

Y6 I can subtract numbers with 4+ digits using a written method (compact columnar).
Pupils should be encouraged to use 0s (‘place value holders’) when setting out questions.
Q:

4 7 2
4 ~~5~~^{1}3 ~~8~~.^{1}2 ~~3~~^{1}0
0 0 8 7 . 3 0 2
4 4 5 0 . 9 2 8

Mental Multiplication

Y3 I can multiply 2-digit numbers by a 1-digit number mentally/with jottings (grid method).

Concepts needs exploration with practical equipment/visuals e.g. Multiplication Array ITP. Repeated addition and counting up in multiples should be shown on number lines.

Differentiate by providing questions that require specific times table facts.

Q: 35x8=280

X	8
30	240
5	40

=280

Y4 I can multiply 2-digit numbers by a 1-digit number mentally/with jottings (grid method).

Differentiate by providing questions that require specific times table facts.

Some more able children may be able to perform calculations without drawing the grid.

Q: 9x78=702

X	9
70	630
8	72

=702

Y5 I can multiply numbers mentally.

Children should perform calculations as above – partitioning – but without drawing a grid wherever possible. Pupils multiply each digit then add up the partial products. As an aid, pupils could make jottings.

For a U.txU question, pupils can multiply the decimal number by 10. After the mental multiplication is completed, the final answer then needs to be divided by 10.

Q: 9x7.8=70.2

Note-Only some of the working out shown below, perhaps none of it, would be jotted down.

7.8x10=78 (Make a decimal into a whole number.)

70x9=630   8x9=72   630+72=702

702÷10=70.2 (Make the whole number answer into a decimal number.)

Less able children may need to continue using the grid method. See Y4 example.

Y6 I can multiply numbers mentally.

Children should perform calculations as in the lower school – partitioning – but without drawing a grid wherever possible. Pupils multiply each digit then add up the partial products. As an aid, pupils could make jottings.

For a U.txU question, pupils can multiply the decimal number by 10. After the mental multiplication is completed, the final answer then needs to be divided by 10.

Some more able children may undertake HTUxU questions mentally, rather than use the written method. However, their work would need to be checked with a written algorithm.

Q: 238x6=1428

Note-Only some of the working out shown below, perhaps none of it, would be jotted down.

200x6=1200   30x6=180   8x6=48   1200+180+48=1428

Written Multiplication

When teaching, talking through an algorithm, place value must be respected. For example, in the Y4 example below, modelling would involve saying “20 times 5 is 100. We need to add on the 40 that we had carried so altogether, that is 140.” (It would not be useful to say “2 times 5 is 10. We need to add on the 4 that we had carried, so altogether, that is 14.”) Place value understanding can be helped by using different colours for each column. (For consistency across the school use the following colours: Ones (not ‘units’)-red / Tens-blue / Hundreds-yellow / Thousands-green / 10 Thousands-purple / 100 Thousands-orange / Millions-pink).
Anything ‘carried’ into the next column should be crossed off when added on. This is especially important in long multiplication where carrying could accidentally be added up with partial products when calculating the final answer.

Y4 I can multiply 2 and 3-digit numbers by a 1-digit number using a written method (expanded version of short multiplication).
Differentiate by providing questions that require specific times table facts.
Some children may need to record what each step is to the right of their calculation. Some will not.
Q:

```
  476
    8
   48 (6x8)
  560 (70x8)
 3200 (400x8)
 3808
 1
```

Y5 I can multiply 4-digit numbers by a 1-digit number using a written method (compact version of short multiplication).
Q:

```
  6729
     5
 33645
 314
```

Y5 I can multiply 3 and 4-digit numbers by a 2-digit number using a written method (long multiplication).
Although the grid method is a means of recording steps when multiplying mentally, and should not be required by the upper school, it could be used to show what is happening during the multiplication of an amount by a two-digit number, comparing the working out to the written method required (shown below).
It is crucial that place value is made clear when calculating the second line. Explanation for the example below would be “30x4=120 and we need to write those digits in the correct place.”
Q:

```
   5274
     32
  10548
     1
 158220
    21
 168768
```

Y6 I can multiply numbers with 4+ digits using a written method (short multiplication).
Q:

```
  367.39
       8
 2939.12
  553 7
```

Y6 I can multiply 4-digit numbers by a 2-digit number using a written method (long multiplication).

It is crucial that place value is made clear when calculating the second line. Explanation for the example below would be "30x9=270 and we need to write those digits in the correct place."

Q:

```
 2049
   36
12294
  2 5
61470
 1 2
73764
 1
```

Mental Division

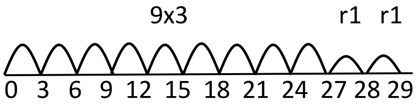
Y3 I can divide 2-digit numbers by a 1-digit number mentally/with jottings (counting with a number line).

Concepts need exploration with practical equipment/visuals e.g. Grouping ITP. Repeated subtraction then counting up in multiples (which is easier) should be shown on number lines.

Differentiate by providing questions that require specific times table facts. Questions can remain between the 1st and 12th multiple of the divisor, in which case number lines should not be necessary once counting up through times tables is secure.

Some more able children may be able to perform calculations where the dividend is between the 10th and 20th multiple of the divisor.

Q: 29÷3=9r2

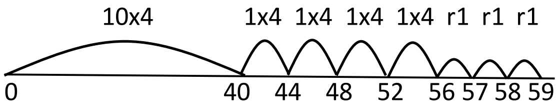


Y4 I can divide 2-digit numbers by a 1-digit number mentally/with jottings (counting/chunking with a number line).

Differentiate by providing questions that require specific times table facts and the size of the dividend. Questions can remain between the 10th and 20th multiple of the divisor.

Some more able children may be able to perform calculations without drawing the number line.

Q: 59÷4=14r3



Y5 I can divide numbers mentally.

Children should perform calculations as above – chunking – but without drawing the number line wherever possible. Pupils subtract the largest 'chunk' of the divisor from the dividend then mentally calculate the rest using times tables facts. As an aid, pupils could make jottings.

For a U.t÷U question, pupils can multiply the decimal number by 10. After the mental division is completed, the final answer (not including remainder) then needs to be divided by 10.

Q: 5.9÷4=1.4r3

Note-Only some of the working out shown below, perhaps none of it, would be jotted down.

5.9x10=59 (Make a decimal dividend into a whole number.)

40÷4=10 59-40=19 19÷4=4r3

14÷10=1.4 (Make the whole number answer into a decimal number.)

Less able children may need to continue using the number line. See Y4 example.

Y6 I can divide numbers mentally.

Children should perform calculations as above – chunking – but without drawing the number line wherever possible. Pupils subtract the largest 'chunk' of the divisor from the dividend then mentally calculate the rest using times tables facts. As an aid, pupils could make jottings.

For a U.t÷U question, pupils can multiply the decimal number by 10. After the mental division is completed, the final answer (not including remainder) then needs to be divided by 10.

Some more able children may undertake HTU÷U questions mentally, rather than use the written method. However, their work would need to be checked with a written algorithm.

Q: 143÷6=23r5

Note-Only some of the working out shown below, perhaps none of it, would be jotted down.

120÷6=20 143-120=23 23÷6=3r5

Written Division

Y4 I can divide 2 and 3-digit numbers by a 1-digit number using a written method ('bus stop'-short division).

Differentiate by providing questions that require specific times table facts.

Q:

1 2 3 r5
6) $7^{1}4^{2}3$

Y5 I can divide 4-digit numbers by a 1-digit number using a written method ('bus stop'-short division).

Some more able children may be able to use the method to divide amounts by two-digit numbers. Multiples of the divisor should be worked out in a logical order and written out first.

Questions should also be completed to give a remainder as a decimal.

Q:

3 5 3. 7 5
8) $2^{2}8^{4}3^{3}0.^{6}0^{4}0$

Q:

2 0 2 r2
14) $2^{2}8\ 3^{3}0$

Y6 I can divide 4+ digit numbers by a 1-digit number using a written method ('bus stop'-short division).

Questions should also be completed to give a remainder as a decimal, rounded as required.

Q:

7 7. 6 5
7) $5^{5}4^{5}3.^{4}5^{3}5$

Y6 I can divide 3 and 4-digit numbers by a 2-digit number using written methods (long division).

Multiples of the divisor should be worked out in a logical order and written out first.

Some pupils will benefit from using the short division method to divide amounts by two-digit numbers, rather than trying to learn the long division algorithm too soon.

Questions should also be completed to give a remainder as a decimal, rounded as required.

Q

2 8. 8
15) 4 3 2. 0
3 0 ↓
1 3 2
1 2 0 ↓
1 2 0
1 2 0
0