Progression in calculation

Division

Children need to understand the concept of division, that it is:

- **Repeated subtraction**

They also need to understand and work with certain principles:

- **Inverse of multiplication**

- **Is not commutative**
    i.e. 15 ÷ 3 ≠ 3 ÷ 15

- **Is not associative**
    i.e. 30 ÷ (5 ÷ 2) ≠ (30 ÷ 5) ÷ 2

Key vocabulary
- divide
- share
- one each, two each, three each...
- group in pairs, threes... tens...
- equal groups
- divided by
- divided into
- remainders

Progression in calculation - division

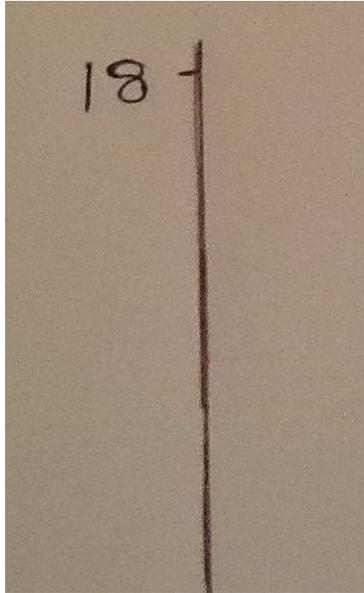|	Mental strategies	Written strategies
Reception	Practical halving Practical sharing	
Year 1	Practical sharing and grouping Halving numbers Count back in steps of 2, 5 and 10	Arrays Pictorial representation
Year 2	2, 5 and 10 multiplication and corresponding division facts	Record using ÷ = Arrays Repeated subtraction
Year 3	3, 4 and 8 multiplication and corresponding division facts ÷ 4 = divide by 2 , divide by 2	Introduce chunking on a number line
Year 4	Multiplication and corresponding division facts for up to 12 x 12 ÷ by 0, 10, 100 Use facts to work with two and three digit numbers (multiples of 10)	Chunking on a number line TU ÷ U HTU ÷ U
Year 5	Factor pairs Common factors	Introduce long division (including chunking) and short division ThHTU ÷ U Interpret remainders Divide whole numbers and decimals by 10, 100 and 1000
Year 6	Mixed operations BODMAS Estimating answers	Long division and short division ThHTU ÷ TU Interpret remainders as whole number remainders, fractions or by rounding

Written calculation methods for division

Repeated subtraction on a number line (the number line can be horizontal rather than vertical)
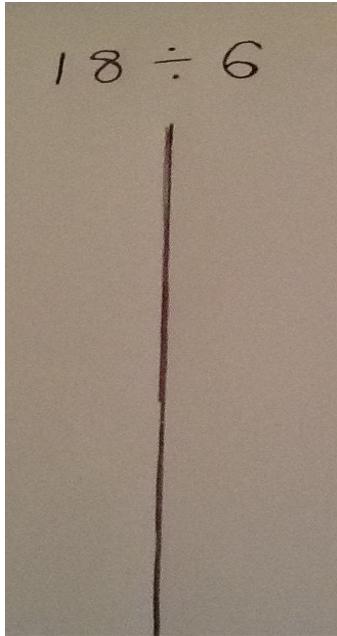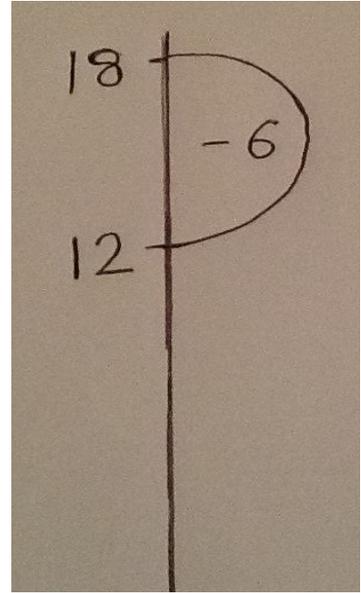
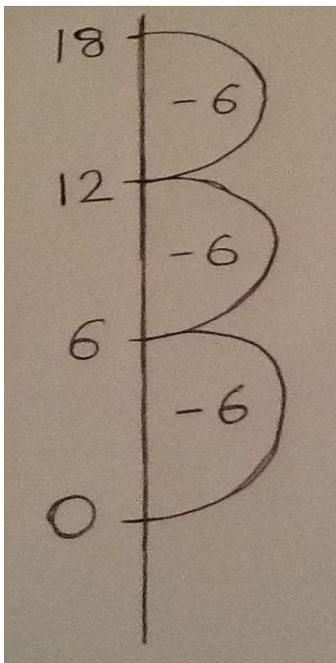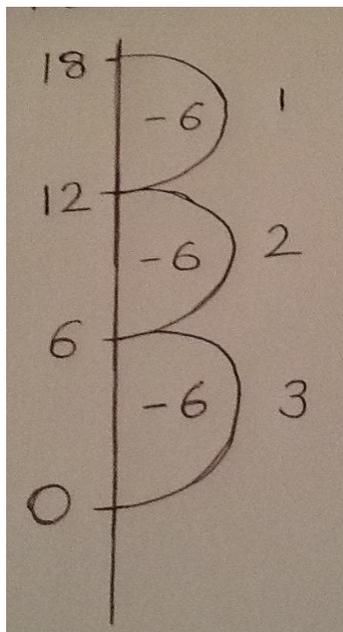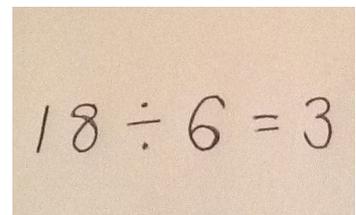| 1. Draw a vertical number line with a ruler.	2. Put the largest number at the top of the line.	3. Jump back in steps of the value you are dividing by.
$18 \div 6$	18	18 -6 12

4 Stop when you reach 0.	5. Count how many jumps you have made.	6. Complete your number sentence.
18 -6 12 -6 6 -6 0	18 -6 1 12 -6 2 6 -6 3 0	$18 \div 6 = 3$

Prior learning/skills and concepts that they need to understand:
- count up and down in jumps of the factor they are dividing by
- use ÷ sign
- place value

Written calculation methods for division
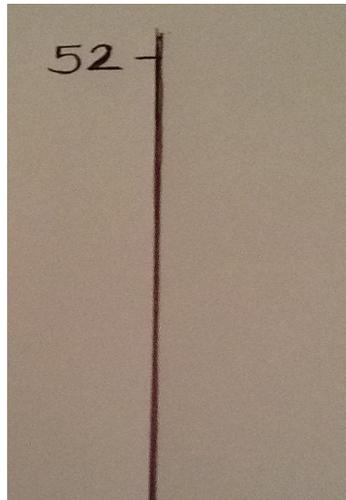## Chunking on a number line (the number line can be horizontal)

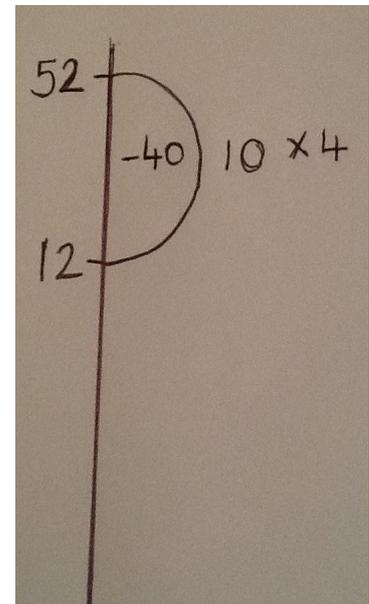**1. Write down the multiples of the number you are dividing by.**

$52 \div 4$

$1 \times 4 = 4$
$2 \times 4 = 8$
$3 \times 4 = 12$
$4 \times 4 = 16$
$5 \times 4 = 20$
$6 \times 4 = 24$
$7 \times 4 = 28$
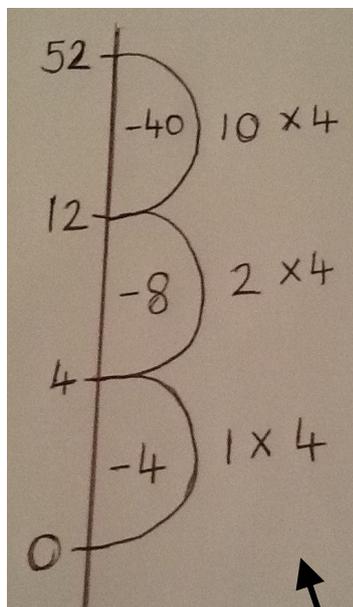$8 \times 4 = 32$
$9 \times 4 = 36$
$10 \times 4 = 40$

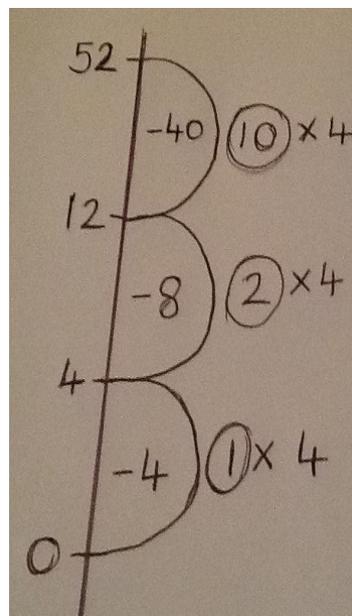**2. Draw a vertical number line with a ruler and place the number you are dividing at the top.**

52

3. Take away the biggest/ easiest chunk.

52
-40 10×4
12

4. Continue to subtract chunks until you reach 0.

52
-40 10×4
12
-8 2×4
4
-4 1×4
0

5. Add up all the chunks you have taken away.

52
-40 10×4
12
-8 2×4
4
-4 1×4
0

6. Complete your number sentence.

$52 \div 4 = 13$

If, in the jump before you reach 0, the number you have left is smaller than the number you are dividing by that will be your remainder.

Prior learning/skills and concepts that they need to understand:
- times table and division facts
- use of number line
- mental subtraction

Written calculation methods for division
Standard written method (long division)

1. Draw a division frame (bus stop) with the number to divide on the inside and value you are dividing by outside.

$$753 \div 3$$

$3\overline{)753}$

2. Divide the number on the outside into the first number on the inside and write the answer on top.

$3\overline{)753}$ with 2 on top

3 into 7

3. Multiply the number on top by the number on the outside and write it underneath.

$3\overline{)753}$ with 2 on top, 6 underneath

2 × 3

4. Subtract.

$3\overline{)753}$ with 2 on top, 6 underneath, 1 below

7-6

5. Pull the next number inside the bus stop down.

$3\overline{)753}$ with 2 on top, 6 underneath, 15 below

6. Repeat the divide, multiply, subtract loop with the new number, until you reach 0.

$3\overline{)753}$ with 251 on top, 6, 15, 15, 03, 3, 0

If, in the jump before you reach 0, the number you have left is smaller than the number you are dividing by that will be your remainder.

7. Complete your number sentence.

$$753 \div 3 = 251$$

Prior learning/skills and concepts that they need to understand:
- times table and division facts
- use of number line
- vertical subtraction

Written calculation methods for division
Standard written method (long division with chunking)

1. Draw a division frame (bus stop) with the number to divide on the inside and value you are dividing by outside.	2. Subtract the biggest / easiest chunk e.g. 10 x 14	3. Repeat step 2. Subtract the biggest / easiest chunk.
$354 \div 14$ 14) 354	14) 354 - 140 (10 × 14) ‾‾‾‾‾‾ 214	14) 354 - 140 (10 × 14) 2¹4 - 140 (10 × 14) ‾‾‾‾‾‾ 74

4. Subtract the easiest chunk. In this example 5 x 14.	5. Finally work out the answer.
14) 354 - 140 (10 × 14) ‾‾‾‾‾‾ 2¹4 140 (10 × 14) ‾‾‾‾‾‾ 74 - 70 (5 × 14) ‾‾‾‾‾‾ 4	25 r 4 14) 354 - 140 (10 × 14) 2¹4 - 140 (10 × 14) ‾‾‾‾‾‾ 74 - 70 (5 × 14) ‾‾‾‾‾‾ 4 This tells you that there are 25 lots of 14 in 354 This is the remainder

Written calculation methods for division
Standard written method (short division)

Division with a whole number remainder

1. Draw a division frame (bus stop) with the number to divide on the inside and the value you are dividing by outside.	2. Divide the first number by the value you are dividing by. If this can't be done you need to move the number to the next column. E.g. 2 cannot be divided by 5 so it moves to the tens column to make 27. There are 5 lots of 5 in 27 so you need to write 5 above the line.	3. If you have any left over that number needs to move to the next column. E.g. with 27 divided by 5 the answer is 5 with 2 left over.
$276 \div 5$ $5 \overline{)276}$	$5 \overline{)2\,^276}$ (answer 5 above)	$5 \overline{)2\,^27\,^26}$ (answer 5 above)

|	
4. Divide the next number by the value you are dividing by and put the number above the line.	5. If you have any left over that is your remainder which you write above the line after an r for remainder. E.g. 26 divided by 5 was 5 with a remainder of 1.
$5 \overline{)2\,^27\,^26}$ (answer 55 above)	$5 \overline{)2\,^27\,^26}$ (answer 55 r 1 above)

Written calculation methods for division
## Standard written method (short division)

Interpreting remainders into decimals

Follow the steps in the example on the previous page.   Instead of putting 1 at the top as your remainder move it to the tenths column. Then divide the number in the tenths column by the number you are dividing by. In the example 10 is divided by 5.

$$5 \overline{)\ 2\,7^2\,6\cdot{}^1 0} = 55\cdot2$$
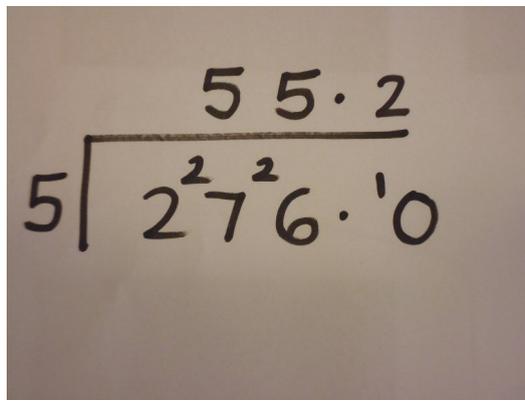
Interpreting remainders into fractions

Follow the steps in the example on the previous page. Once you have worked out the remainder you divide it by the value you are dividing by. E.g. 1 divided by 5 = 1/5

$$5 \overline{)\ 2^2\,7^2\,6} = 55\ \tfrac{1}{5}$$
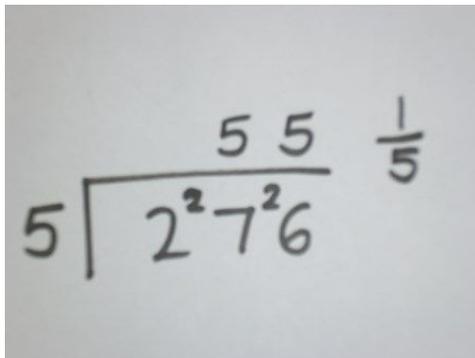
What is BODMAS? It stands for 'brackets', 'other', 'division', 'multiplication', 'addition' and 'subtraction'. The order in which we carry out a calculation is important.

Order of operation

What is 2 + 3 x 4 ?

If we calculate the '2 + 3' part first, we get:

(2 + 3) x 4 = 5 x 4
= 20

If we calculate the '3 x 4' part first, we get:

2 + (3 x 4) = 2 + 12
=14

These are obviously two different answers — but which one is correct?

BODMAS tells us that 'multiplication' comes before 'addition', so the **second** answer is correct:

2 + 3 x 4 = 2 + 12 = 14