Orchard Park Primary School
Calculation Policy

Our primary aim is that all our pupils will develop a positive attitude to mathematics and learn to use it with confidence, understanding and enjoyment.

We aim to develop the children's skills in mathematics in order that they should:

- enjoy mathematics and develop a fascination for the subject
- be challenged to think
- develop good work habits, including persistence and perseverance in order that they may reach a standard of which they are capable
- develop confidence in their own mathematical ability
- have a sense of the size of number and where it fits into the number system
- know by heart number facts such as number bonds, multiplication and division facts, doubles and halves
- use what they know to work out facts they do not know already
- calculate accurately and efficiently, both mentally and on paper, drawing on a range of calculation strategies
- recognise when it is important to use a calculator and when it is not and be able to use a calculator effectively
- make sense of number problems and recognise the operations needed to solve them
- explain their methods and reasoning, using correct mathematical terms
- judge when their answers are reasonable, and have strategies for checking them when necessary
- know suitable units for measuring and make reasonable estimates of measurements
- read, interpret and construct graphs, diagrams, charts and tables

This calculation progression document is used to support us in achieving some of these aims.

This document should be followed by teachers in each year group to ensure that children progress through the methods of calculation for each of the four operations in a clear and logical manner. There is guidance as to which step should be introduced in each year groups. It is essential that no steps are missed out and that children are given enough opportunities to experiment with and use each step before moving on. Discussing the efficiency and suitability of different strategies is an important part of Maths and by the end of Key Stage 2 we want our children to have a bank of strategies that they could use when needed.

Teaching assistants and other adults working with children should be familiar with and use the steps of progression in order to support the children most effectively with their learning.
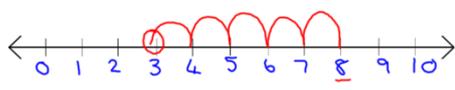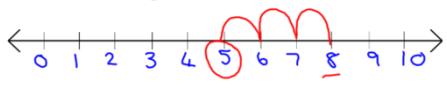
When faced with a calculation problem, children are encouraged to ask:

- Can I do this in my head?
- Could I do this in my head using drawings or jottings to help me?
- Do I need to use a written method? Which written method is most efficient?
- Should I use a calculator?

Children should be taught how to estimate and then check the answer. For each step of the progression there are key skills that children should be able to do in order to help them use the strategy being taught most effectively. It is suggested that these skills are developed in oral mental starter sessions and during morning work.
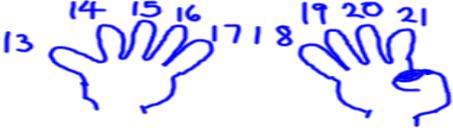
Addition

- Children are taught to understand addition as combining sets and counting on.
- Calculations are put into practical contexts so that the child sees the relevance of the method they are learning.

Reception Addition: STEP ONE Practical equipment and jottings	**2 + 3 =** At a party, I eat two cakes and my friend eats three. How many cakes did we eat altogether? 5	Children could use practical equipment and then, later, drawings to model the problem. Children may also use their hands to calculate.
	6 + 5 = Six people are on the bus. Five more people get on at the next stop. How many people are on the bus now? or 11	Children could use dots or tally marks to represent objects. Practical equipment to support jotting are still valid.
	Key Skills: • Counting out objects to 10 • Counting on from a given number. • Being able to quickly show the correct number of fingers for a number to 10.	
Reception Addition: STEP TWO Using a number line	**5 + 3 =** What is the total of the numbers on these two dice? 3+5= 0 1 2 3 4 5 6 7 8 9 10 5+3= 0 1 2 3 4 5 6 7 8 9 10 8	Children can count along a pre-printed number line, making 'jumps' to reach the answer. They can also see that the addition can be done in any order, developing awareness that it is often more efficient to put the larger number first.
	Key Skills: • To count the 'jumps' • Recognising the larger of two numbers. • Reading and writing numbers within the number range used. Eg. 10, 20, 30	

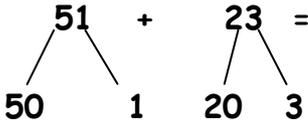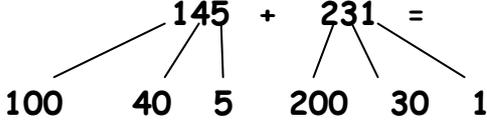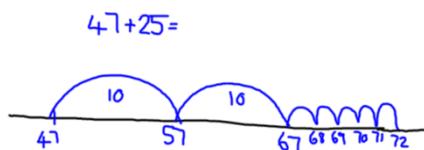|		
Year 1 Addition: STEP THREE 'Tap the head' method	**12 + 9 =** 12 birds are sitting on the grass. Nine more fly to join them. How many are there altogether? "Put 12 in your head and count on 9" 	12		Numbers greater than 10 can be worked with by holding the larger number in their head and counting on, using fingers.
	Key Skills: • Counting on from any larger number. • Counting crossing the 10s boundaries.	
Year 1 Addition: STEP FOUR Partitioning	**51 + 23 =** One shelf measures 51 cm and another shelf measures 23cm. What is their total length? 51 + 23 = 50 1 20 3 50 + 20 = 70 1 + 3 = 4 70 + 4 = 74	74 cm | This method can be used for the addition of 3 digit numbers if necessary. 145 + 231 = 100 40 5 200 30 1 100 + 200 = 300 40 + 30 = 70 5 + 1 = 6 300 + 70 + 6 = 376	376		By partitioning (splitting) both numbers into tens and units, each part can be added separately and then the answers combined to give the total. This method is initially introduced for calculations where the total units is no higher than 9. Overtime this method may become a mental calculation strategy.
	Key skills: • Place value becomes essential at this point. • Partitioning • Recombining (the opposite of partitioning) • Estimating what the answer may be. • Quick mental addition of two unit numbers.	

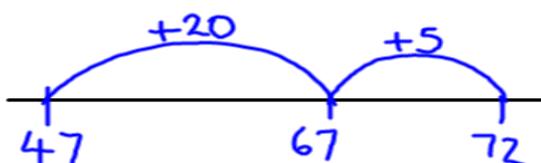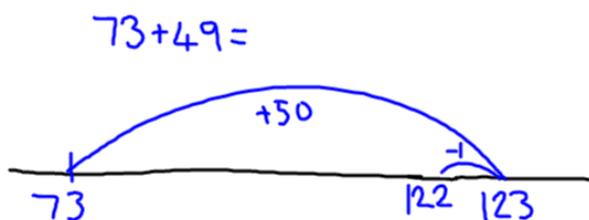|			
Year 1 Addition: STEP FIVE Open number lines	**47 + 25 =** My sunflower is 47cm tall. My friend's is 25cm taller. How tall is my friend's sunflower? 47+25= **72 cm** OR +20 +5 47 67 72 **72 cm**		Drawing an empty number line helps children to record the steps they have taken in a calculation. Start on 47, partition 25 into 20 and 5. Add on the 2 jumps of 10 and then the units. This is more efficient than counting on in ones. Empty number lines can be used with numbers of any size. Once confident children can add on the multiples of 10 at once and then the units.
	Key skills: • Knowing how many tens are in multiples of ten. • Adding ten to any given number, including crossing the 100 boundary. • Adding multiples of ten to any given number, including crossing the 100 boundary. • Reading and writing numbers larger than 100.		
Year 2 Addition: STEP SIX Compensation	**73 + 49 =** 73+49= +50 -1 73 122 123 **122**		Children continue to use an open number line. They recognise that 49 is close to 50. They add 50 and then compensate by subtracting 1. This method is generally used when adding units of 9. These open number line methods should eventually become mental methods as the children become more confident.
	Key skills: • Using the open numberline methods mentally. • Mental calculations using compensation.		

Year 3

Addition: STEP SEVEN Expanded Vertical Addition

487 + 346 =
There 487 boys and 346 girls in a school. How many children are there altogether?

```
    4  8  7
+   3  4  6
    1  3
 1  2  0
 7  0  0
 8  3  3
```

| 833 |

Children are taught written methods for those calculations they cannot do in their heads. Expanded methods build on mental methods and make the value of the digits clear to children. The language used is very important ie. 7 + 6, 80 + 40, 400 + 300.

This method can be used for larger numbers as well as decimals.

Key skills:
- Addition of multiples of 10 and 100
- Correct orientation of numbers in columns.

Year 4

Addition: STEP EIGHT Compact Vertical Addition

2685 + 1746 =
2685 people visited the museum last year. The number of visitors increased by 1546 this year. How many people visited this year?

```
   2  6  8  5
+  1  7  4  6
   4  4  3  1
   1  1  1
```

| 4431 |

£365.86 + £671.45 =

```
   3  6  5 . 8  6
+  6  7  1 . 4  5
 1 0  3  7 . 3  1
     1      1    1
```

| £1037.31 |

Children move onto using more compact standard written methods when they are secure with their understanding of place value. The units column is added first with the ten carried over and placed underneath the tens column. The tens column is added up with the hundred carried over and placed underneath the hundreds column. The same process is repeated with the hundreds column and then the thousands column is added up.

This method can be used for decimals.

Key skills:
- Ensuring that the answer sounds reasonable.
- Writing the answer using the units of measure if appropriate.

Subtraction

- Children are taught to understand subtraction as 'taking away' (counting back) and also as 'finding the difference' (counting on/up).
- Calculations are put into practical contexts so that the child sees the relevance of the method they are learning.
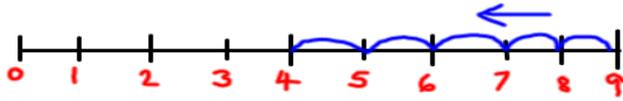
Reception Subtraction: STEP ONE Practical equipment	**5 – 2 =** I had five balloons. Two burst. How many do I have left? 3 *This example shows 'take away' or subtraction.* A teddy bear costs £5 and a ball costs £2. How much more does the bear cost? £3 *This examples shows 'find the difference'*	The use of practical equipment, such as bricks or balloons, helps to model the problem. Drawing a picture helps children to visualise the problem. It is important that the language of 'find the difference' is introduced at this early stage.
	Key Skills: • Counting out objects	
Reception Subtraction: STEP TWO Jottings	**8 – 3 =** We baked eight biscuits. I ate three. How many were left? *(Take away/subtraction)* 5 Lisa has eight felt tip pens and Tim has three. How many more does Lisa have? 5 *(Find the difference)*	Using dots or tally marks is quicker than using a picture.
	Key Skills: • Accurate counting • Reading and writing of numbers to 10.	

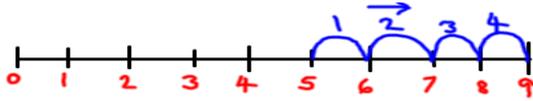|			
Year 1 Subtraction: STEP THREE Using number lines	**9 – 5 =** I had nine pence. I spent five pence. How much did I have left? **4p** The number line can also be used for counting on. **4p**		Children count backwards along a pre-printed number line, making jumps to reach the answer. They 7ecognize to start on the larger number. *(Subtraction)* Children count on from the smaller number to find the difference. *(Find the difference)*
	Key Skills: • Understanding the vocabulary related to subtraction. • Recognising the larger of two numbers. • Reading and writing of numbers within the range they are using. Ie) 10, 20, 30		
Year 1 Subtraction: STEP 4 Open number lines (subtraction)	**38– 16 =** 38 children are on a bus. 16 get off. How many children are still on the bus? **22** **84 – 27 =** I cut 27cm off a ribbon measuring 84 cm. How much is left? **57cm**		Children can count back using an empty number line. (Subtraction) They partition the smaller number and then subtract the two parts.
	Key skills: • Partitioning • Counting back in 1s. • Subtracting ten from any given number. • Subtracting multiples of 10. • Estimation of answers		
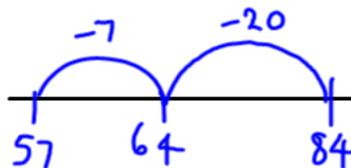
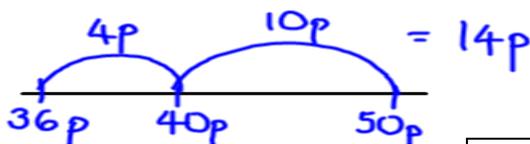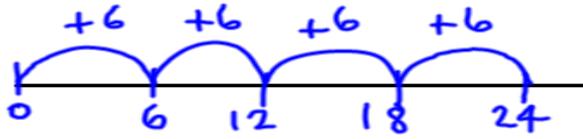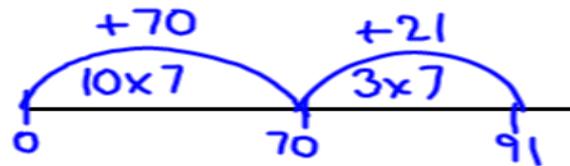|		
Year 2 Subtraction: STEP 5 Open number lines (find the difference)	**50 – 36** = I spent 36p in a shop. How much change did I get from 50p? 36p + _____p = 50p 4p 10p = 14p 36p 40p 50p 14p £2.00 - £1.53= 200 153 100 50 3 3 50 100 47 56 100 200 £0.47	Counting on using a number line is particularly useful in calculating change. Using a number line and the counting on method is particularly helpful when numbers are actually quite close to each other. Children can count up from the smallest number to the biggest using an empty number line. It is easiest to count up to a multiple of 10 or 100 ('friendly numbers'). This method can be used for numbers of any size, including decimals. These open number line methods should eventually become mental methods as the children become more confident.
	Key Skills: • Bonds to ten • Adding multiples of ten. • Adding numbers that bridge the 10, 100 or 1000 barriers. • Reading and writing numbers in the number range they are using.	
Year 4 Subtraction: STEP 6 Decomposition/vertical subtraction	**6463 – 2686** = The second hand car cost £6463. The teacher only had £2686. How much did she need to borrow to pay for the car? ⁵6̸ ¹³4̸ ¹⁵6̸ ¹3 - 2 6 8 6 3 7 7 7 £3777	Decomposition can be used with any numbers provided the child has checked that a mental strategy and a number line jotting would not be more efficient. Children are encouraged to check their calculations by adding the answer to what was taken away to see if they end up with what they started with.
	Key Skills: • Estimating. • Awareness of efficiency. • Checking answers.	

Multiplication

- Children are taught to understand multiplication as repeated addition and as an array.
- Calculations are put into practical contexts so that the child sees the relevance of the method they are learning.

Year 1	**2 x 4 =** Each child has two eyes. How many eyes do four children have? 2 + 2 + 2 + 2 8	Using practical examples and drawing pictures are helpful ways to visualise a problem.
Multiplication: STEP ONE Jottings	**5 x 3 =** There are five cakes in a pack. How many cakes are in three packs? 5 + 5 + 5 15	Dots or tally marks are often drawn in groups. This shows three lots of five. The children can clearly see the repeated addition.
	Key Skills: - Counting in steps of 1, 2, 5, 10.	
Year 1	**4 x 3 =** A chew costs four pence. How much do three chews cost? or 12	Drawing an array (3 rows of 4 or 3 columns of 4) gives children an image of the answer. It also helps the understanding that 4 x 3 is the same as 3 x 4. Real life objects can be used as good examples of arrays. (egg boxes, cupcake tins and boxes of chocolates)
Multiplication: STEP TWO Arrays	Key Skills: - Developing times table facts	

Multiplication: STEP THREE

Repeated addition and open number lines

6 x 4 =
There are four cats. Each cat has six kittens. How many kittens are there altogether?

24

Children can count on in equal steps recording each jump on an empty number line. This shows four jumps of six.

13 x 7 =
There are 13 biscuits in a packet. How many biscuits in seven packets?

91

Children can multiply lower two digit numbers by a single digit using the open number line too. When numbers get bigger, it is inefficient to do lots of smaller jumps. 13 can be partitioned (split) into 10 and 3. The calculation can be worked out on a number line.

Key Skills:
- Continue developing times table facts
- Partitioning
- Multiplication by 10

Multiplication: STEP FOUR

Grid method – (TU x U)

6 x 24 =
124 books were sold. Each book cost six pounds. How much money was taken?

x	20	4
6	120	24

Mentally: 120 + 24 = 144

Vertically:

```
   120
+   24
   144
```

144

This is called the grid method. 24 is partitioned (split) into tens and units. Each part is then multiplied by six. The answers are then added together using the addition method that the children are most confident with.

Key skills:
- Times table facts
- Accurate methods of addition
- Partitioning
- Multiplication of multiples of 10,100.

Year 4 Multiplication: STEP FIVE Grid method – (TU x TU)	**72 x 34 =** A gate is 72 cm long. A fence is 34 times longer. How long is the fence? Estimation: 70 x 30 = 2100 <table><tr><td>**x**</td><td>70</td><td>2</td></tr><tr><td>30</td><td>2100</td><td>60</td></tr><tr><td>4</td><td>280</td><td>8</td></tr></table> 2100 + 60 = 2160 280 + 8 = 288 　　　　2488 **2488 cm or 24.88m**	The grid method also works for larger numbers. The numbers are partitioned (split up) and each part is multiplied separately and then each answer is added together. The grid method can be used for numbers of any size. Children are encouraged to estimate before completing the calculation.

Key skills:
- Partitioning
- Estimation
- Times tables

Year 5 Multiplication: STEP SIX Grid method – (Using decimals)	Mrs Smith buys 24 t-shirts for £2.30 each. How much does she spend? **24 x 2.30 =** Estimation: 24 x 2 = 48 <table><tr><td>x</td><td>20</td><td>4</td></tr><tr><td>2</td><td>40</td><td>8</td></tr><tr><td>0.3</td><td>6.0</td><td>1.2</td></tr></table> 40 + 8 + 6 + 1.2 = 55.2　　**£55.20**	Children can use this method to solve problems involving the multiplication of a number that includes a decimal. They should estimate the answer fist which will help them place the decimal point correctly.

Skills:
- Place value, especially of decimals.
- Multiplication of a decimal by a single digit.

Year 5 & 6 Multiplication: STEP SEVEN Multiplication:	**36 x 24=** There are 24 packets of exercise books. In each packet there are 36 books. How many books altogether? 　　3 6 　x 2 4 　1 4 4 　₁7 2 0 　───── 　8 6 4 **864**	All the previous work builds up to using the more compact standard written method for long multiplication. Children multiply the 36 by 4, carrying where necessary. Then they place a zero in the units column as they are now multiplying the 36 by 20. Finally they add the two separate lines together,

Key Skills:
- Times table facts
- Firm knowledge of place value
- Presenting work neatly in columns

Division

- Children are taught to understand division as sharing and grouping.
- Multiplication and division are interlinked.
- Calculations are put into practical contexts so that the child sees the relevance of the method they are learning.

<table>
<tr>
<td rowspan="2" style="writing-mode: vertical">Year 1 & 2

Division:
STEP ONE
Practical equipment and jottings</td>
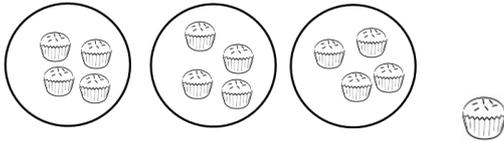<td>

Division as sharing:
Share 12 cakes between 3 plates.
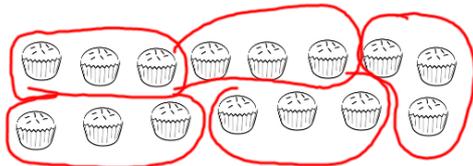

$12 \div 3 = 4$

Each child has 4 cakes

$13 \div 3 =$

4 r 1

Division as grouping:
15 cakes need to be put onto plates with 3 cakes on each plate.
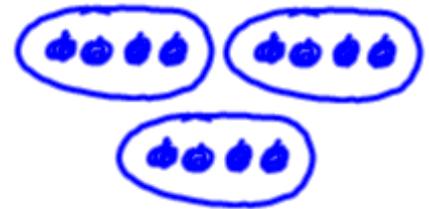

$15 \div 3 = 5$

You will need 5 plates

</td>
<td>

Practical equipment used to model and solve the problem. Drawing pictures makes it easy for the child to visualise the problem and often makes it easier to solve.

Children will be introduced to the concept of 'remainders' through problems where items can't be shared fairly (13 cakes put onto 3 plates for example)

Drawings will then become simple jottings. Eg.

Dots or tally marks can either be shared out one at a time or split up into groups.
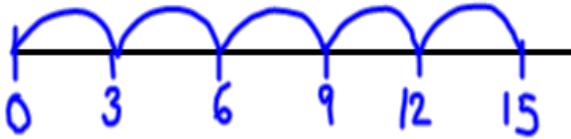
</td>
</tr>
</table>

Key Skills:
- Accurate counting
- Recognition of equal amounts.
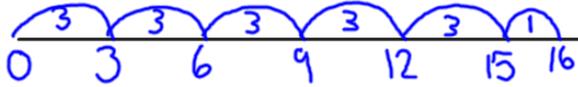- Writing and reading numerals to 20.

15 ÷ 3 =
How many threes in 15?

6 9 12
3   15

5

To work out how many threes there are, children can use their fingers to count up in groups of three.

0   3   6   9   12   15

5

They can also draw these as jumps along a number line. This shows you need five jumps.

16 ÷ 3 =

3   3   3   3   3   1
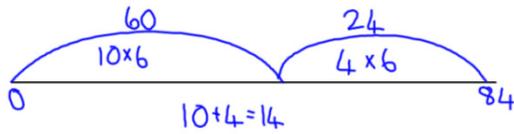0   3   6   9   12   15 16

5 r 1

They are given problems that involve remainders. This shows 16 being made of 5 jumps of 3 with 1 left over.

Key Skills:
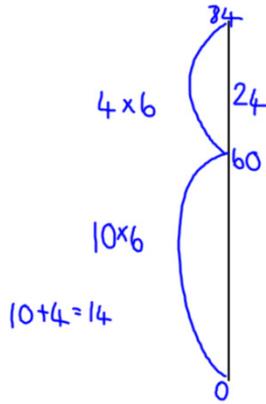- Counting in 2s, 5s, 10s and other groups of numbers.

Year 4

Division:
STEP THREE
Open Number Lines with chunking

84 ÷ 6 =

Each ladybird has six legs. How many ladybirds are there if there are 84 legs?

60
10 x 6

24
4 x 6

0   84

10 + 4 = 14

14

This could be represented on a vertical number line.

84

4 x 6   24
               60

10 x 6

10 + 4 = 14

0

I know
10 x 6 = 60
20 x 6 = 120 (too many)
11 x 6 = 66

14

103 ÷ 9 =

90
10 x 9

9
1 x 9

0   90   99 100 101 102 103   107

10 + 1 = 11 jumps of 9 r 4
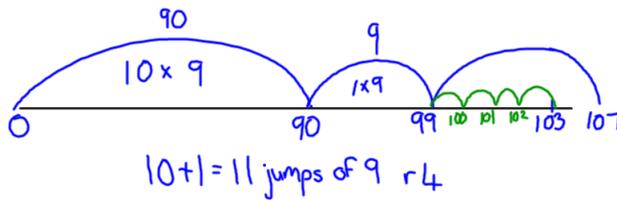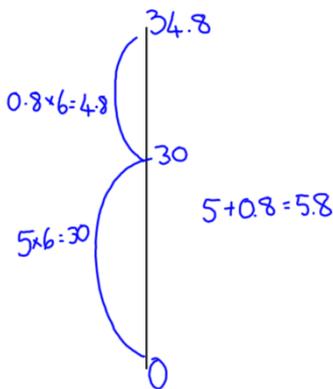
I know
10 x 9 = 90
20 x 9 = 180 (too many)

11 r 4

Again, this could be represented vertically.

This method can be used to calculate problems involving decimals.

34.8 ÷ 6 =

34.8

0.8 x 6 = 4.8

30

5 + 0.8 = 5.8

5 x 6 = 30

0

I know
1 x 6 = 6
2 x 6 = 12
5 x 6 = 30

0.1 x 6 = 0.6
0.2 x 6 = 1.2
0.5 x 6 = 3
0.8 x 6 = 4.8

5.8

Key Skills:
• Multiplication facts
• Quick mental addition
• Multiplying decimals by single digits

It would take a long time jump in sixes to 84, so children can jump on in bigger 'chunks'. A jump of 10 lots takes you to 60. Then you need another 4 lots of six to reach 84. Altogether that is 14 sixes. You can also subtract chunks on the number line until your reach zero. Then you count up how many chunks you have used to reach zero.

It can be helpful to make jottings to show useful facts. At this point children are estimating what a feasible answer could be.

In this example, multiplication facts are used to count up in whole number and decimal steps. Children are taught to divide with decimals when they have really strong mental maths skills and confident times tables knowledge.

Division: STEP FOUR Chunking

196 ÷ 7 =

196 chairs are needed for a concert. They are arranged in rows of seven. How many rows of chairs are needed?

$$7\overline{)196}$$
$$-140 \quad (20 \times 7)$$
$$56 \quad (8 \times 7)$$
$$-56$$
$$0 \quad 20 + 8 = 28$$

28 rows

This method is known as chunking. In this example, you are taking away chunks of seven. First subtract 140 (20 lots of 7) and you are left with 56. Then subtract 56 (8 lots of seven). Altogether that is 28 sevens. So 28 rows are needed.

184 ÷ 7 =

184 chairs are needed for a concert. They are arranged in rows of seven. How many rows of chairs are needed?

$$7\overline{)184}$$
$$-140 \quad (20 \times 7)$$
$$44 \quad (6 \times 7)$$
$$-42$$
$$2$$

29 rows

In this example, you are taking away chunks of seven. First subtract 140 (20 lots of 7) and you are left with 44. Then subtract 42 (6 lots of 7) leaving 2. Altogether that is 28 sevens with 2 remainder so 29 rows are needed.

347 ÷ 24 =

24 apples can fit into a box. How many boxes are needed for 347 apples?

$$24\overline{)347}$$
$$-240 \quad (10 \times 24)$$
$$107 \quad (2 \times 24)$$
$$48$$
$$59 \quad (2 \times 24)$$
$$-48$$
$$11 \quad 10 + 2 + 2 = 14 r 11$$

15 boxes

The chunking method works equally well when dividing by a two digit number. This time you are taking away chunks of 24. First subtract 240 (10 lots of 24) and you are left with 107. Then subtract 48 (2 lots of 24) and you are left with 59. Then subtract 48 (2 lots of 24) and you are left with 11. The answer to the problem then is 14 boxes are needed and 11 apples left over. So, 15 boxes in total to pack all the apples away.

Key Skills:
- Multiplication facts
- Quick mental addition
- Vertical subtraction
- Multiplying single digits by multiples of 10

**Division:
STEP Five
The Bus Stop**

138 ÷ 6 =

138 chairs are needed for a concert. They are arranged in rows of six. How many rows of chairs are needed?

$$
\begin{array}{r}
0\ 2\ 3 \\
6\overline{)1\ ^13\ ^18}
\end{array}
$$
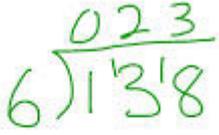
23
rows

This method is known as 'the bus stop'. In this example you are finding sets of 6. As you cannot get a set of 6 out of 1, the 1 carries over to become 13. There are 2 sets of 6 in 13 (the 2 gets written on the top, in the tens column) and 1 left over – this again carries over to become 18. You can get 3 sets of 6 in 18, and the 3 gets written on the top, in the units column. The final answer on top of the 'bus stop' is 23.

Key Skills:
- Multiplication facts
- Quick mental subtraction to find remainders
- Understanding of place value