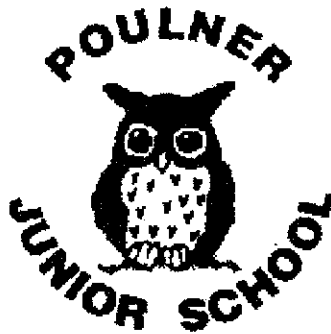


Maths at Poulner Junior School!



The methods we use for
addition, subtraction,
multiplication and
division.

March 2013

At Poulner Junior School we want our children to be confident mathematicians, who are able to carry out calculations accurately and enjoy investigating and finding patterns in number.

The aim of this booklet is to help support children's learning by providing a common reference tool for children, staff and parents, that details the way the written calculations are taught throughout the school.

There is no expectation that every child will progress through each step by the end of Year Six; each child will move on at their own pace.

Maths at home:

Out of school, children can have fun too:

- Measuring their height to see how much they have grown
- In the car—playing number plate games or using numbers on road signs
- At the shops—weighing fruit and vegetables; budgeting pocket money; checking change
- In the kitchen—weighing and measuring for cooking

Websites:

Some good websites include:

- www.numbergym.co.uk (user name: poulner password: ringwood)
- www.coolmath4kids.com
- www.mathszone.co.uk
- <http://www.woodlands-junior.kent.sch.uk/maths/>

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While this booklet focuses on the four operations, your child explores many other areas of maths in school, including:

- Number (patterns and sequences, positive and negative numbers, rounding, ordering)
- Shape and space (2D and 3D shapes, area and perimeter, symmetry, co-ordinates, angles)
- Measures (length, weight, volume, converting measures, reading scales, time)
- Data handling (collecting data, creating graphs, analysing data, averages)
- Fractions, decimals and percentages

The areas to be covered each term by your child are available on the Integrated Unit Parent Information sheets on the website.

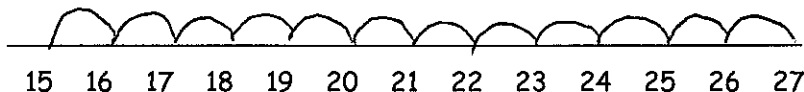
Addition

Stage 1—using structured number lines to count on in ones, tens and hundreds.

$$15 + 12 = 27$$



+1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1

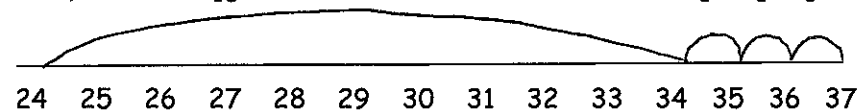


As the children become more confident in working with larger numbers, they are taught to partition the number (separate into hundreds, tens and units) and count on in this way in steps of 10 and 100. So $24 + 13 = 37$ would look like this:



+10

+1 +1 +1



Stage 2—using unstructured number lines to represent addition.

Children are shown how to draw their own number lines and the steps, always partitioning the smaller number and adding first hundreds, then tens and then units. So $245 + 168$ becomes

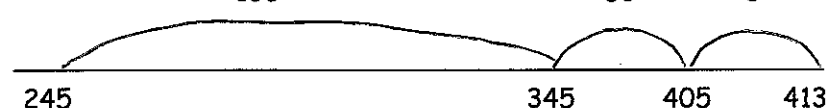
$$245 + 100 + 60 + 8$$



+100

+60

+8



Stage 3—developing a formal method.

This stage is only taught to the children once they are secure with the number line method and have sound place value knowledge.

$$83 + 42 = 125$$

$$\begin{array}{r} 80 \\ 40 \end{array} + \begin{array}{r} 3 \\ 2 \end{array}$$

$$120 + 5 = 125$$

This will progress quickly to



$$\begin{array}{r} 83 \\ 42+ \\ \hline 125 \\ 1 \end{array}$$

$$\begin{array}{r} 167 \\ 39+ \\ \hline 206 \\ 11 \end{array}$$

This method is referred to as Column Addition.

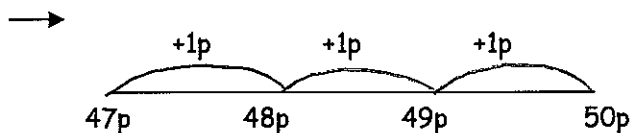
To see the full progression of all the operations, please refer to the back of the book. It is important that children are not moved on too quickly to the later stages. Although this can be tempting, the stages build up to ensure children really understand the place value of the numbers involved and the processes.

Subtraction

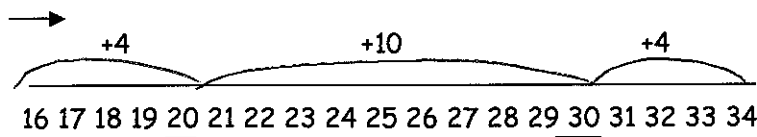
Stage 1—using structured number lines to perform

a) complementary addition (counting up from the smaller number to the larger number) and finding the difference

Children will begin by using mental and practical methods to find a small difference e.g. shopkeeper's change—"Stickers cost 47p. John pays with a 50p piece. How much change will he get?" This becomes $47p + 3p = 50p$ rather than $50p - 47p = 3p$ (counting on rather than counting back)



This skill is extended to finding larger differences. $34 - 16 = 18$ becomes $16 + ? = 34$. Children start by adding up to the nearest 10 then continuing to add up to the larger number.



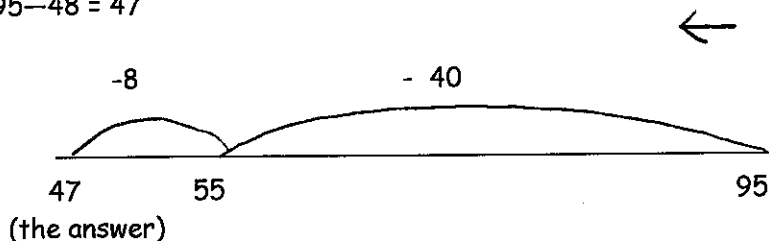
$$10 + 4 + 4 = 18$$

Children are encouraged to underline the tens numbers to emphasise their counting. This method is particularly useful when finding change in money questions.

Stage 2—using unstructured number lines to perform subtraction by counting back

As children's confidence increases, they will move onto using an unstructured (blank) number line to perform calculations with larger steps to them. Most children will start using this method in Year 3.

$$95 - 48 = 47$$



Stage 3—developing a formal method

When children are confident in this, they will be introduced to column subtraction.

$$192 - 76 = 116$$

$$\begin{array}{r} 80 \quad 1 \\ 100 + \cancel{90} + 2 \\ \underline{70 + 6 -} \\ 100 + 10 + 6 = 116 \end{array}$$

$$\begin{array}{r} 8 \quad 1 \\ \cancel{1} \cancel{9} 2 \\ \underline{76 -} \\ 116 \end{array}$$

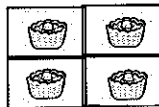
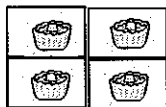
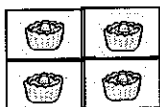
This method is referred to as decomposition. When the digit being taken away is greater than the digit it is being taken away from (eg. 2—6), we use the word exchange to describe the process; one of the tens from the 90 is exchanged for 10 ones (units) so that we now have 12—6. There are now only 8 tens in the tens column.

Multiplication

Stage 1—using pictures.

Children create their own pictures to record practical examples of multiplication.

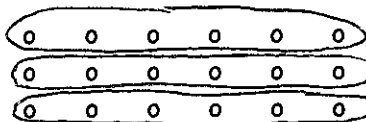
There are four cupcakes in each box. How many cupcakes are there in 3 boxes?



Stage 2—using arrays.

Children will then be encouraged to use dots instead of pictures to represent 'lots of'. They also start to recognise multiplication as repeated addition.

So 3×6 becomes '3 lots of 6' and is drawn out in rows.



= 18 dots

Stage 3—using the grid method

Once calculations are beyond times tables, the children need to partition numbers bigger than 10. They record this using the grid method.

$$14 \times 5$$

X	5
10	50
4	20

$$50 + 20 = 70$$

The adding stage may be done using different methods according to the child's ability.

$$37 \times 3 = (30 \times 3) + (7 \times 3)$$

X	3		90
30	90		+ 21
7	21		111

This idea is then extended to the multiplication of larger numbers and decimals.

$$126 \times 13$$

x	100	20	6		
10	1000	200	60		1260
3	300	60	18		+ 378

$$1000 + 200 + 60 = 1260$$

$$300 + 60 + 18 = 378$$

$$\begin{array}{r} 1260 \\ + 378 \\ \hline 1638 \\ \hline 1 \end{array}$$

Stage 4—developing a formal method

When children are confident in this, they will be introduced to long and then short multiplication. The long method uses the same separate calculations as above but sets them out vertically.

$$63 \times 37 = 2331$$

63		63
37 x		37 x
21	(7 x 3)	441
420	(7 x 60)	1890
90	(30 x 3)	2331
1800	(30 x 60)	11
2331		
1		

Division

Stage 1—pictures.

Children are shown how to use pictures to represent practical examples of sharing and grouping.

12 children are grouped in teams of four. How many teams are there?

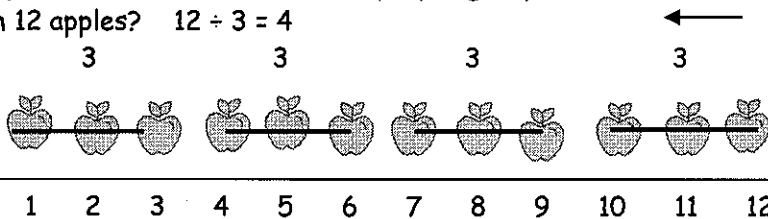


Mrs. Brown has made 15 cakes. She shares them equally between her three children. How many cakes do they get each?

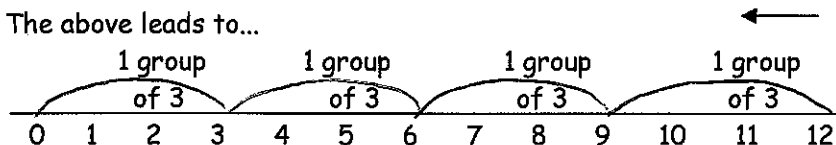


Stage 2—using structured number lines.

Number lines should be used to model division (sharing or grouping) as repeated subtraction. How many equal groups of 3 can be made from 12 apples? $12 \div 3 = 4$



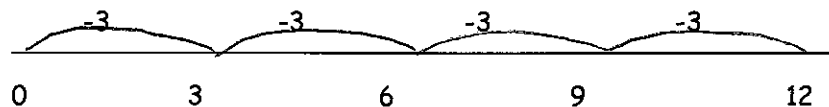
The above leads to...



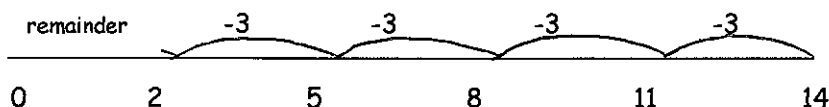
Stage 3—using unstructured number lines

Starting from a blank numberline, children put the number to be divided at the right hand end then jump back in equal groups until they reach zero, or no more groups can be made.

$$12 \div 3 = 4$$



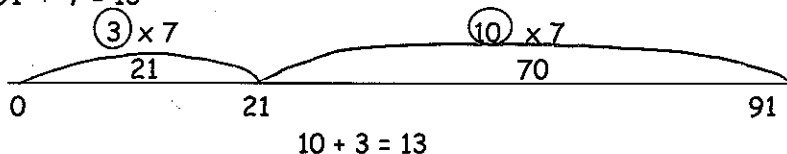
$$14 \div 3 = 4 \text{ r } 2$$



Stage 4—chunking on a number line.

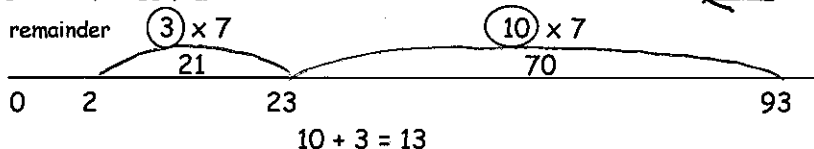
Children are taught to apply their quick mental recall of multiplication facts in order to divide a number by groups of the dividing number.

$$91 \div 7 = 13$$



Children will also experience 'remainders' after some calculations.

$$93 \div 7 = 13 \text{ r } 2$$



As children become more confident with this method, they will be begin to convert remainders into fractions and then decimals.

Division (cont.)

Stage 5—long division

When the children are secure with recording jottings on a numberline, they are ready to move on to a standard algorithm.

$$81 \div 3$$

$$\begin{array}{r} 81 \\ - 30 \quad (10 \times 3) \\ \hline 51 \\ - 30 \quad (10 \times 3) \\ \hline 21 \\ - 21 \quad (7 \times 3) \\ \hline 0 \end{array}$$

Answer: 27 (groups of 3)

$$249 \div 6$$

$$\begin{array}{r} 249 \\ - 120 \quad (20 \times 6) \\ \hline 129 \\ - 120 \quad (20 \times 6) \\ \hline 9 \\ - 6 \quad (1 \times 6) \\ \hline 3 \end{array}$$

Answer: 41 r 3 or 41.5
(the remainder $3/6 = 0.5$)

Stage 6—short division

Some children may be confident enough with this method to be introduced to short division, initially set out as on the left to bridge the gap in their understanding.

$$\begin{array}{r} 41 \text{ r } 3 \\ \hline 6 \overline{) 249} \\ - 240 \quad (40 \times 6) \\ \hline 9 \\ - 6 \quad (1 \times 6) \\ \hline 3 \quad 41 \end{array}$$

$$\begin{array}{r} 78 \text{ r } 3 = 78.75 \\ \hline 4 \overline{) 315} \end{array}$$

Progression

This page shows the common route of progression that children will be encouraged to take through each of the four operations. It is important to recognise that each child will progress through these stages at their own pace.

Th = Thousands

H = Hundreds

T = Tens

U = Units

Addition

U + U (e.g. $4 + 7$)

TU + U (eg. $23 + 6$)

TU + U (e.g. $26 + 8$ crossing the 10s boundary)

TU + TU (e.g. $45 + 32$)

TU + TU (eg. $45 + 79$ crossing the 100s boundary)

HTU + TU (e.g. $148 + 73$)

HTU + HTU (e.g. $528 + 396$)

Using money (e.g. $\pounds 2.42 + \pounds 3.78$)

ThHTU + ThHTU (e.g. $1\ 592 + 3\ 618$)

Using decimal numbers (e.g. $28.83 + 47.79$)

Progression (cont.)

Subtraction

TU—U (e.g. $19-7$)

TU—U (e.g. $42-8$ crossing 10s boundary)

TU—TU (e.g. $68-23$)

HTU—TU (e.g. $124-65$)

HTU—HTU (e.g. $391-158$)

ThHTU—HTU (e.g. $1\,438-729$)

Using money (e.g. $\pounds 8.34 - \pounds 5.56$)

ThHTU—ThHTU (e.g. $4\,272-2\,318$)

Using decimal numbers (e.g. $71.65-34.97$)

Multiplication

TU $\times$ U (e.g. 34×7)

HTU $\times$ U (e.g. 263×4)

TU $\times$ TU (e.g. 83×36)

ThHTU $\times$ U (e.g. $1\,326 \times 8$)

HTU $\times$ TU (e.g. 678×53)

ThHTU $\times$ TU ($2\,318 \times 26$)

Using decimal numbers (e.g. 4.13×6)

Division

TU $\div$ U (e.g. $84 \div 4$)

HTU $\div$ U (e.g. $157 \div 6$)

HTU $\div$ TU (e.g. $924 \div 17$)

Using decimal numbers (e.g. $36.5 \div 5$)

Vocabulary

Each of the four operations in maths has a wide range of vocabulary associated with it. It is important that your child recognises which terms belong with which operation.

Addition

Plus	Sum	Total
Add	Increase	More than
Together	And	Altogether

Subtraction

Take away	Decrease	Difference between
Subtract	Take from	Minus
Fewer	Reduce	Less than

Multiplication

Multiplied by	Groups of	Repeated addition
Product	Multiply	
Lots of	Times	

Division

Shared	Group	Shared equally
Groups of	Divide into	Divisible by
Divided by	Share	Quotient
Chunking		