

Foxdell Primary

Maths Fluency Progression Document

The NCETM set out 5 big ideas for mastery. These include coherence, representations, variation, mathematical thinking and fluency. They state that fluency demands more of students than memorisation of a single procedure or collection of facts. It encompasses a mixture of efficiency, accuracy and flexibility. Quick and efficient recall of facts and procedures is important in order for students to keep track of sub-problems, think strategically and solve problems. Fluency also demands the flexibility to move between different contexts and representations of mathematics, to recognise relationships and make connections, and to make appropriate choices from a whole toolkit of methods, strategies and approaches. This document aims to provide a structure in which teachers will explicitly teach these in a coherent and well thought out manner. The core mathematical concepts children need to become fluent are:

Counting concepts

- one-one principle each object counted once and given one counting tag
- stable-order principle we use the words in the same order
- cardinal principle the last number counted is the number of the set
- abstraction principle counting can apply to objects which are not tangible e.g. number of claps
- order-irrelevance principle it doesn't matter which order we count objects in

Magnitude

Understanding the size of numbers, including their proportional relation to other numbers. A pre-requisite skill for comparison.

Place Value Concept

Individual items can be grouped and thought of as a single unit. 10 ones = 1 ten (see concept unit) Units of ones, tens and hundreds can be taken apart and regrouped in different ways. The position of digits in a number denotes value. Scaling by powers of 10.

Conservation

Unless we increase or decrease the set, it will stay the same. The quantity is conserved. For example, we can muddle up 6 counters after counting but there will still be 6 counters. This is crucial for the concepts of sum and commutativity.

Flue

Mental

Difference

The answer to a subtraction

calculation. Comparison between two

values or quantities. Also linked to the

concept of magnitude and distance

between numbers.

Sum

The total of quantities combined. The concept of equal sum is linked to conservation. We can rebalance the quantities combined and the sum will stay equal. For example, 1 + 3 = 2 + 2

Equals

Where two expressions have the same value as each other. Knowing that two quantities that look different may be equivalent in value.

Unit

The idea that individual items can be grouped together to make a new unit. For example, two socks make a pair; ten ones become one ten. This concept is crucial for place value.

Scaling

A multiplicative concept in which a unit or quantity is compared to a proportionally greater or smaller amount. For example, twice as much cream, 4 pairs of socks, half of 8.

In order to achieve these, they will have to master the following skills:

Subitising	the ability to see number as pattern, such as dice patterns. This supports pupils to see numbers within numbers and better regrouping (partitioning).
Regrouping (partitioning)	the ability to break numbers up and recombine them flexibly
Counting on and counting back	in a variety of interval steps
Reordering	knowing when and how to reorder to make calculations easier
Finding complements	links to reordering, identifying useful complements pairs or trios of 1, 10, 60 etc.
Applying the inverse	use of fact family knowledge to 'undo'
Rounding	to a range of benchmark numbers
Estimation	both linear estimation on number lines and scales, and of quantities and calculations to support an increasing sense of what is reasonable
Compensation	to use rounding to add or subtract too much or too little and adjust accordingly
Rebalancing	to adjust the parts of addition and subtraction facts to make a calculation easier
x ÷ by powers of 10	
Doubling and halving	
Rearranging	to adjust the groups in multiplication and division to make a calculation easier

These are broken down below into skills which each year group should focus on.

Fluency skill	EYFS	1	2	3	4	5 and 6
Subitising	Recognise groups up to 5 without the need to count Identify 5 and use as a benchmark number e.g. Identify numbers within a whole set e.g. I can see 3 and 3 and 1. I can see 4 and 1 and 1 and 1. I can see 4 and 3.	Recognise groups (up to 5) without the need to count and use this to identify numbers up to 10				
Regrouping (partitioning)	Use 5 as a benchmark number Understand a whole = part and part Identify a group as a unit e.g. a unit is 2 teddies	'Think 10' - able to partition a number into 10 and some more e.g.	Regroup two digit numbers flexibly and in multiple ways e.g.	Regroup three digit numbers flexibly and multiple ways e.g.	Regroup four digit numbers flexibly and in multiple ways Regroup tenths and hundredths flexibly and in multiple ways e.g.	Use regrouping as a valid method in a multi- step problem e.g.





Counting on and back	Be able to count fluently. To do	Count on to find the total and difference	Count in units where units are different e.g.	Count on and back from any three digit number	Count on and back from any four digit number	
	this, children need to have mastered: The one-one principle - each object is counted once and given one counting tag The stable-order principle -we use the words in the same order	e.g. Towe work the resonance Second to the find the total and difference and link this knowledge to fact	36 = ten, twenty, thirty, one, two, three, four, five, six Count on and back from any two digit number and notice what changes	and notice what changes and what doesn't e.g.	and notice what changes and what doesn't e.g. 2236 2036 2036 2036 2036 2036 2036 2036	



Reordering and finding complements	Reorder to ensure efficient counting e.g. Theorem dianomals Theorem of the entweys can your surt the animals?	Reorder numbers to find complements when adding three one digit numbers e.g. 6+7+4 (add the 6 and 4 first to make 10)	Reorder three or more numbers up to 1000 to find complements e.g. 75+95+25 can be reordered into 75+25 to make the benchmark 100, then add 95 to total 195. Or 6+9+4+5+1 (reorder to make number bonds to 10)	Reorder three or more numbers up to 10,000 to find complements e.g. 800+240+360 310+700+30 = Reorder three or more numbers involving tenths and hundredths to find complements e.g. 1.5+3+0.5	Reorder three or more numbers to find complements where the arrangement is more complex e.g. £3.99+£7.80+£2.01
				2.5+25+5+2.5= (reorder to make wholes)	



		Iz-3+4 Iz-4 Iz-4			
		Make the connections			
		between			
		division and fractions			
		e.g.			
		Can sea a parter of 12 a open to Sand From section 13 a separat by 9			
		Destinated 12 spars 3 New Irres of 12 s 3			
Rounding			Identify the midpoint	Round to the nearest	Round to the nearest
			numbers under 1000	units such as money and	and other units such as
			(and use this in order	time	money, time, decimal
			rounding) e.g.		numbers, negative numbers
			308 is reserver to 400 liner 300 so knowings to 403.		Use rounding as an estimation for multiplication and
			ato di munda de 300.		

					division e.g. 585 : 12+ 600 mande in 709 and 76 mande in 75 The case of the off a trible close to 700 v 80. which is 50,000 7691 - 12 - 7691 - 12 - 7691 - 12 - 769 - 12 - 769 mande in 500 and 70 mande in 700. The case office 750 for the doce and 52 - 80. which in 52 - 80. which in 52 - 80. which in 52 - 80. which in 52 -
Estimation		Estimate the distance of numbers from target numbers under 100 e.g. Description of the sedence of unbers to target runder.	Estimate the distance of numbers from target numbers under 1000 to prepare for rounding e.g. 234 is 4 from 230 and 6 from 240. 240 is nearer to 230 than 240	Estimate the distance of numbers from target numbers up to 10,000, including tenths and hundredths to prepare for rounding e.g. 2134 is 34 from 2100 and 66 from 2200. 2134 is nearer to 2100 than 2200.	Estimate the distance of numbers from target numbers up to 1,000,000, including decimal numbers and negative numbers, to prepare for rounding e.g. 20,034 is 4 from 20,030 and 6 from 20,040. 20,034 is nearer to 20,030 than to 20,040.
Compensation		'Think 10', use benchmark numbers and compensate for trickier calculations e.g.	Use benchmark numbers and compensate for adding and subtracting numbers up to 1000, including money e.g. Control of the state soft of the state soft of the state soft of the state soft of the	Use benchmark numbers and compensate for adding and subtracting numbers up to 10,000, including money and time e.g. "I could think of 2550 + 490 as compensation because adding 490 is like adding 500 and taking ten away. Now my calculation looks like this: 2550 + 500 - 10 = 3040.	Use number knowledge to look for 'nearly numbers' in calculations (including decimals) The state e.g. The state to see the state to see the s

			and division calculations up to 12x tables e.g.	Compensate in multiplication and division with numbers up to 1000 e.g.	
Rebalancing		Understand the concept of equal sum (that the sum remains equal when the addends are rebalanced in addition) with numbers up to 20 e.g.	Use the equal sum concept with numbers up to 1000 as a method to solve addition calculations e.g. og 52+37 The solve 2 boogs from the 52 and give Pren is lies 35 Nor i can selve 50 + 50. It's unser. Use the equal difference concept with numbers up to 1000 as a method to solve subtraction calculations e.g.	Use the equal sum concept with numbers up to 10,000, including units of time and money, as a method to solve addition calculations e.g.	Apply the equal sum concept to a range of numbers and missing number problems (including units of time and money) e.g. 24+0=30+3. 39+52 345+100 039+55 51+27+0+48 701+72,560 The Min of Away Your No. 100 The Min of Away Your Your No. 100 The Min of Away Your No. 100 The Min of A

	5-3 Keguta 7-5		
	S-S securitor S-1		

			e.g. tour act 4 for sector act 4 of the sector of the sector o	T is easier 11 outernor 0.15 from each martier. The othermore of a lay be martier. The othermore of a lay be
			What analyse tid sou power? Explain way	E122.56 - E87.99 9.1 - 6.7 16.3 - 5.7
			ose equal alfference	
			simple fractions e a	
			6.4-39 66-32 77-48 ¹ 7-1	
X ÷ by powers		Understand the	Understand the concept	X and ÷ by powers of
of 10		concept of x and ÷ 10,	of x and ÷ 10, and use	10, including 2 step
		and use known facts to	known facts to multiply	problems. Includes
		multiply and divide by	and divide by 10, 100 and	decimals e.g.
		10 and 100 e.g. I know that when multiplying 3 by 40, 40 is ten times bigger than 4, so my answer will be ten times bigger than 3 x 4	1000 e.g. 4000 x 6, 240 ÷ 4, 750mm =cm.	State <th< td=""></th<>
		23		"I know that 10 million
				has 8 place values
				columns and 70's. I
		23 articles of lon		Know That 2 X 5 = 10. This should have and 0
		20 groups of ten is equal to 200. B groups of ten is equal to 30.		therefore T could use
		23 groups of to 5 squarts 230,		2000 x 5000 or 200 v
				50 000"
		$\label{eq:2.1} \begin{array}{c} 120 \mbox{ to 1} 2 \mbox{ torms} \\ 12 \mbox{ torms} \mbox{ divides } n \mbox{ to 2} \mbox{ divides } n \mbox{ to 2} \mbox{ divides } n \mbox{ to 2} \mbo$		00,000

Doubling and	Be able to find	Find doubles up to	Find doubles and near	Find doubles and near	Find doubles and near
halving	double of a number	20 and link this to	doubles with numbers	doubles with numbers	doubles with numbers up
	(up to 10) using	repeated addition		up to 1000 e.g.	to 10,000.
	concrete	e.g.		TH + CD in Sin daugue CD share 40	
		Sell Barnard Add Doole		it's also 10 less than couble 70.	Use doubling and halving
		8 8 23-11 2+3+_ 20003a_			to find unknown products
		1+(++, 2008-1%_) _++_++ 2ntm 1*			in multiples of 10 e.g. 9 x





			e.g. Pupe a have already weap of denotations and indentified by of this table, for exemple $5 \times 4 = 10 \times 2 = 20 \times 1$
			Apply the understanding to fixed one, for example: $[x,x] 0 = 0$ If we could also have the fixed term and halos the second, we can be matching the calculation for $f(x,x_{i}^{2}) = \frac{2}{n}$

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1x1											
2	2x1	2x2										
3	3x1	3x2	3x3									
4	4x1	4x2	4x3	4x4								
5	5x1	5x2	5x3	5x4	5x5							
6	6x1	6x2	6x3	6x4	6x5	6x6						
7	7x1	7x2	7x3	7x4	7x5	7x6	7x7					
8	8x1	8x2	8x3	8x4	8x5	8x6	8x7	8x8				
9	9x1	9x2	9x3	9x4	9x5	9x6	9x7	9x8	9x9			
10	10x1	10x2	10x3	10x4	10x5	10x6	10x7	10x8	10x9	10x10		
11	11x1	11x2	11x3	11x4	11x5	11x6	11x7	11x8	11x9	11x10	11x 11	
12	12x1	12x2	12x3	12x4	12x5	12x6	12x7	12x8	12x9	12x10	12x 11	12x1 2

Yellow = 42 New Year 2 facts

Blue = 21 New Year 3 facts

Red =15 New facts for year 4 (23 new facts if include x3 moved from year 4)

Ad	Adding I Bonds to 10		<mark>5 10</mark>	Adding 10			Bridging/ compensating			YI f	
Ad	ding 2		Adding	, 0	0	oubles		Near do	oubles		
+	0	I	2	3	4	5	6	7	8	9	10
0	0 + 0	0 + 1	0 + 2	0 + 3	0 + 4	0 + 5	0 + 6	0 + 7	0 + 8	0 + 9	0 + 10
Ι	I + 0	+	1 + 2	+ 3	+ 4	+ 5	I + 6	I + 7	+ 8	+ 9	I + I0
2	2 + 0	2 + 1	2 + 2	2 + 3	2 + 4	2 + 5	2 + 6	2 + 7	2 + 8	2 + 9	2 + 10
3	3 + 0	3 + 1	3 + 2	3 + 3	3 + 4	3 + 5	3 + 6	3 + 7	3 + 8	3 + 9	3 + 10
4	4 + 0	4+1	4 + 2	4 + 3	4+4	4 + 5	4 + 6	4 + 7	4 + 8	4 + 9	4 + 10
5	5 + 0	5 + 1	5 + 2	5 + 3	5 + 4	5 + 5	5 + 6	5 + 7	5 + 8	5 + 9	5 + 10
6	6 + 0	6 + 1	6 + 2	6 + 3	6 + 4	6 + 5	6 + 6	6 + 7	6 + 8	6 + 9	6 + 10
7	7 + 0	7 +	7 + 2	7 + 3	7 + 4	7 + 5	7 + 6	7 + 7	7 + 8	7 + 9	7 + 10
8	8 + 0	8 + I	8 + 2	8 + 3	8 + 4	8 + 5	8 + 6	8 + 7	8 + 8	8 + 9	8 + 10
9	9 + 0	9+1	9 + 2	9 + 3	9 + 4	9 + 5	9 + 6	9 + 7	9 + 8	9 + 9	9 + 10
10	10 + 0	10 + 1	10 + 2	10 + 3	10 + 4	10 + 5	10 + 6	10 + 7	10 + 8	10 + 9	10 + 10

Fluency also means automatic recall of key facts. These are the facts which children should be able to recall at the end of each year group. They will need to explicitly be taught strategies (doubles and near doubles, compensating etc.) to work them out as well as lots of practice in order to achieve automaticity in recall.

[-]	0	I	2	3	4	5	6	7	8	9	10
1	1-0	1-1									
2	2-0	2+1	2-2								
3	3-0	3+1	3+2)-)							
4	4-0	4-1	4-2	4-3	4-4						
5	5-0	\$+1	5-2	5-3	5-4	5-S					
6	6 - 9	6-1	6-2	6-3	6-4	6-5	6-6				
7	7 -0	7+1	7-2	7-3	7-4	7-5	7-6	7-7			
8	8 - 0	8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8		
9	9 - 0	9 - 1	9-2	9-3	9-4	9-5	9-6	9.7	9 - 8	9-9	
10	10-0	10 - 1	10-2	10 - 3	10 - 4	10 - 5	10 - 6	10 - 7	ID - B	10 - 9	10 - 10
Ш		11-1	11-2	11-3	11-4	11-5	11-6	11-7	11-8	11 - 9	11-10
12			12-2	12 - 3	12 - 4	12 - 5	12 - 6	12 - 7	12 - 8	12 - 9	12-10
13				13 - 3	13+4	13 - 5	13 - 6	13 - 7	13 - 8	13 - 9	13 - 10
14					12+4	14+5	14+6	14 - 7	14-8	14 - 9	14 10
15						15-5	15+6	15+7	15+8	15+9	15 - 10
16							16-6	16 - 7	16 - 8	16 - 9	16-10
17								17 - 7	17-8	17 - 9	17-10
18									18 - 8	18- 9	18-10
19										19 - 9	19-10
20											20 - 10

By the end of an academic year, pupils should be able to recall the Key Instant Recall Facts for

their year group quickly (within 5 seconds) and complete counting activities confidently and fluently. Children should also be able to recall the **Key Instant Recall Facts** for all previous year groups within the same amount of time

Year 3	Year 4	Year 5	Year 6
To know the number bonds for all numbers up to 20. Count in 50's and 100's. Count in 3's. To know multiplication and division	To know number bonds to 100. Count in 25's and 1000's. Count in 6's. To know multiplication and division	Identify prime numbers up to 20 (2, 3, 5, 7, 11, 13, 17, 19). Recall metric conversions (1 kilogram = 1000 grams, 1 kilometre = 1000	Convert between decimals, fractions 1/2 0.5 50% 1/4 0.25 25% 3/4 0.75 75% 1/5 0.2 20% 1/10 0.1 10% 2/5 0.4 40%
Count in 3's. To know multiplication and division facts for the 3 times table. Count in 4's. To know multiplication and division facts for the 4 times table. Count up and down in tenths. Recognise decimal equivalents of tenths. Count in 8's. To know multiplication and division facts for the 8 times table. Recall facts about durations of time (seconds in a minute, minutes in an hour, hours in a day). To multiply and divide 1 digit numbers by 10. Sums and differences between pairs of numbers which are multiples of 10 and 100. Doubles and halves of multiples of 10 or 100. Complements to 100. Complements to 60 (time). Complements of fractions with the	To know multiplication and division facts for the 6 times table. Count in 9's and 11's. To know multiplication and division facts for the 9 and 11 times table. Count in 7's and 12's. To know multiplication and division facts for the 7 and 12 times table. To recognise decimal equivalents of fractions $(1/2, \frac{1}{4}, \frac{3}{4}, tenths and$ hundredths). Multiply and divide 1 and 2 digit numbers by 10 and 100. Doubles and halves of multiples of 10, 100 or 1000 (6 + 6, 60 + 60, 600 + 600, 6000 + 6000). Multiplication and division by zero and one facts. Conversion of kilometres to metres, hours to minutes, years to months, weeks to days. Complements of tenths that make 1. Complements of hundredths that make 1.	1000 grams, 1 kilometre = 1000 metres, 1 metre = 100 centimetres, 1 metre = 1000 millimetres, 1 centimetre = 10 millimetres, 1 litre = 1000 millilitres). Recall square numbers up to 12 squared and their square roots. Read Roman numerals to 1000. Know angles on a straight line = 180 degrees. Know angles in a triangle = 180 degrees. Know angles around a point = 360 degrees.	1/50,220%1/100,110%2/50,440%1/1000.009%21/1000.011%9/1000.055%Identify prime numbers up to 50 (2, 3,5, 7, 11, 13, 17, 19, 23, 27, 29, 31, 37,41, 43, 47).Illustrate and name parts of a circle,including radius, diameter andcircumference and know that thediameter is twice the radius.
same denominator that make 1 e.g. 3/7 + 4/7 = 1 Number of days in each month and in a year including a leap year. Recognise right angles. Recognise parallel and perpendicular lines.	fractions for $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$ and any number of tenths and hundredths . Read roman numerals to 100. Know right angles = 90 degrees. Know the types of triangle (isosceles, equilateral, scalene).		

Sources and references

Herts for Learning Progression in Mental Maths: <u>http://tannerswood.herts.sch.uk/wp-content/uploads/2016/04/Progression_mental_mathematics_september_2017.pdf</u>

White Rose Primary and EYFS schemes of learning: <u>https://whiterosemaths.com/resources/schemes-of-learning/primary-sols/</u>

Power Maths by Pearson: <u>https://www.activelearnprimary.co.uk/start#powermaths</u>

Fluent in Five by Third Space Learning

Progression in Geometry document, Woodlands School: https://www.woodlands-sch.org.uk/wp-content/uploads/2015/08/Progression-in-geometry-doc.pdf

Mathematics Programme of Study: key stages 1 and 2. National curriculum in England: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf

Daniel Willingham: Is it true that some people just can't do math? <u>https://www.aft.org/sites/default/files/periodicals/willingham.pdf</u>

Jo Boaler, What is Number Sense: <u>https://www.youcubed.org/resources/what-is-number-sense/</u>

Jo Boaler, Fluency Without Fear: <u>https://www.youcubed.org/evidence/fluency-without-fear/</u>

Jenny Field, A whole school intervention for teaching, learning and understanding times tables: file:///C:/Users/staff/OneDrive/2019-2020/Maths%20Lead/Research/26932%20FIELD_A_Whole_School_Intervention_for_Teaching_Learning_and%20Understanding_Jan%202020.pdf

Cambridge Maths Espresso: What are the issues in learning and assessing times tables? <u>file:///C:/Users/staff/OneDrive/2019-</u> 2020/Maths%20Lead/Research/espresso 1 learning and assessing times tables.pdf

Archemides NE Maths Hub: Teaching Times Tables: A Whole school Approach <u>https://carmelarchimedesmathshub.org.uk/wp-content/uploads/2018/10/Times-Table-A-Whole-School-Approach.pdf</u>

NCETM sources:

https://www.ncetm.org.uk/resources/50006

https://www.ncetm.org.uk/resources/40533

https://www.ncetm.org.uk/resources/45233

https://www.ncetm.org.uk/files/111737428/Fluency+handout.pdf

https://www.ncetm.org.uk/resources/49037

KIRFS: https://redmile.leics.sch.uk/pdfs/curriculum/maths-kirfs.pdf

https://www.crownmeadow.worcs.sch.uk/news/detail/all-things-kirfs

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This policy has been adapted from the Fluency Progression document from Portland Spencer Academy