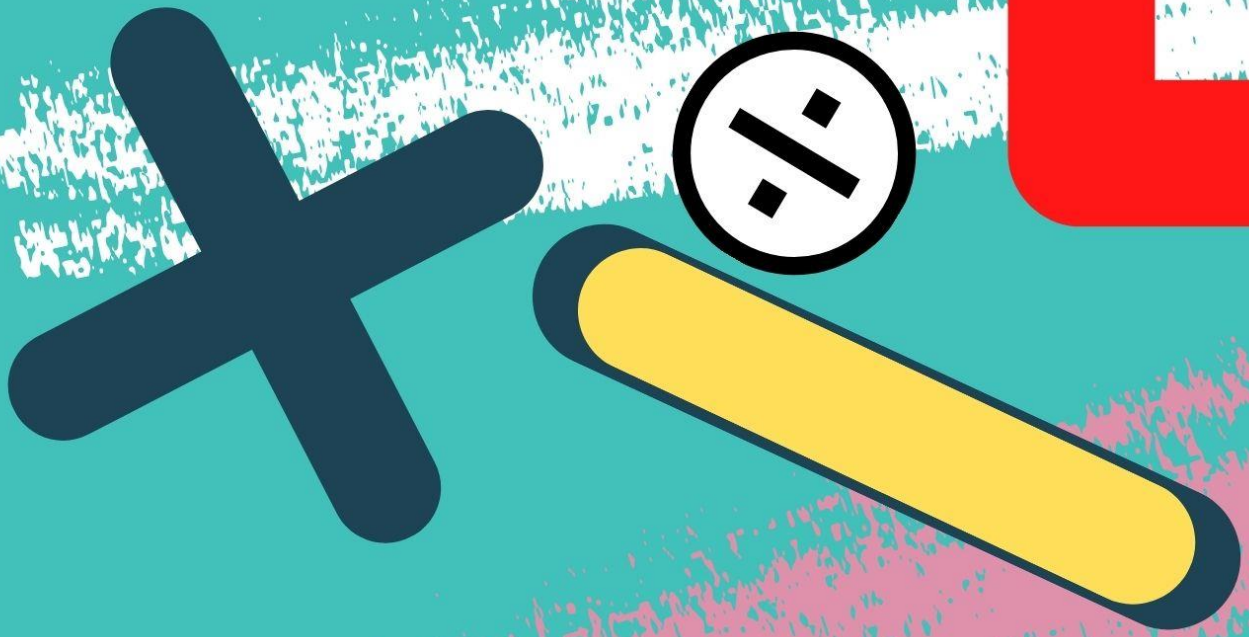
MATHS

Screener



Screener for Maths Learning Difficulties

Specific Learning Difficulties Support Service

Screening Assessment Tool for pupils with persistent Maths Learning Difficulties, including dyscalculia

This screening pack has been developed by the Northumberland HINT Specific Learning Difficulties Support Service to help schools to screen learners for maths learning difficulties (including dyscalculia) and identify other areas which may be related to their difficulties.

It contains:

- HINT Specific Learning Difficulties, Learner Profile Form (Maths)
- Pupil Checklist for Maths Learning Difficulties
- Information on Standardised Arithmetic Tests with:
  - Record of standardised maths test score
  - Record of Sandwell Test Data
- Assessment of child's level of mathematical conceptual development with:
  - Statements to help identify the child's level of concept development

Definitions

Mathematics difficulties are best thought of as a continuum, not a distinct category, and they have many causal factors. Dyscalculia falls at one end of the spectrum and will be distinguishable from other mathematics issues due to the severity of difficulties with number sense, including subitising, symbolic and non-symbolic magnitude comparison, and ordering. It can occur singly but can also co-occur with other specific learning difficulties, mathematics anxiety and medical conditions.

(SASC, 2019 Guidance on assessment of Dyscalculia and Maths Difficulties within other Specific Learning Difficulties[1])

Maths learning difficulty (MLD)

A learning disorder in mathematics can be defined as a significant degree of impairment in mathematical skills. From a medical perspective, the distinction between dyscalculia (a disorder) and MLD is not considered to be as important as the performance profile of the learner, when planning treatment.

Dyscalculia

The Department for Education and Skills published the following definition in 2001 and it has not been updated since:

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1 https://sasc.org.uk/SASCDocuments/FINAL%20SASC%20Guidance%20on%20assessment%20of%20%20Dyscalculia%20%20November%202019.pdf taken from the PATOSS website.

> Dyscalculia is a condition that affects the ability to acquire mathematical skills. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning number facts and procedures. Even if they do produce a correct answer, or use a correct method, they may do so mechanically and without confidence. (DfES 2001, p.2)

Furthermore, the most recent SASC (2019) definition of dyscalculia states (ibid.):

> Dyscalculia is a specific and persistent difficulty in understanding numbers which can lead to a diverse range of difficulties with mathematics. It will be unexpected in relation to age, level of education and experience and occurs across all ages and abilities.

This form and associated assessments should be completed prior to any referral being made to the Specific Learning Difficulties Support Service and should be included alongside the referral form.

Rationale:

The assessment tool focuses on number because most maths learning difficulties are rooted in arithmetic and the four operations (addition, subtraction, multiplication and division) as well as aspects of number sense.

The tool is based on a concept development model, accepting that children's progression in maths is dependent on their level of conceptual understanding.

The information sought is intended to determine the nature of the difficulties and possible barriers to learning, to establish the best ways to support the individual child moving forward. This can be applied to a child who is new to a setting and is causing concern, or for a child who is failing to make progress despite Quality First Teaching.

The pack may also be used periodically within schools to assist the identification of appropriate SMART targets, as part of the graduated response and to assist the cycle of 'plan-do-review'.

The pack consists of an overview of the learner's strengths and difficulties, a checklist of observable pupil behaviours, followed by a selection of assessments that should be undertaken to help to build a picture of the learner's skills as well as guides for next steps.

The pack is not intended to provide the level of assessment required to offer a formal diagnosis of conditions such as dyscalculia and will not be used for this purpose.

HINT Specific Learning Difficulties, Learner Profile Form for Maths			
Pupil name		**DOB**	
Age in years and months		**School year group**	
School		**Maths set** (if applicable)	
Attendance	**% total:**	**% possible:**	
Pupil's reading and writing ability (e.g. can the child read an age appropriate maths word problem?)		**Standardised reading age** **date of test**	
Note areas of difficulty	**EYFS profile data / outcomes in relation to maths and literacy learning**		
Note known medical conditions. • Any co-occurring conditions such as autism, ADHD? • Hearing / ENT problems? • Sight issues / visual impairment? • Child born pre-term? • Any family history of dyslexia / dyscalculia?	**Medical Information**		
	Sight checked?	**Hearing checked?**	
• Any difficulties with fine or gross motor control? • Any OT or physio intervention, past or present?	**Motor Skills / Co-ordination**		
• Issues with punctuality / readiness for lessons, ability to follow the timetable • Reliant on copying others? • Loses belongings, presents as chaotic and flustered?	**Comment on organisational skills**		
• Note any Speech & Language / EAL support • 'Word-finding' difficulties? • Fluent and clear speech? • Uses complex sentence structure (2 clauses)? • Uses subject-specific vocabulary correctly?	**Comment on language skills**		

• Good visual memory? • Ability to remember instructions & information? • Long-term memory secure? • Visual memory for common exception words, short-term recall of new learning • Evidence of long-term recall, auditory memory ability for remembering instructions/ questions/ lists?	**Observations about the learner's memory**
Is concentration or its lack of subject based? Has a short attention span?	**Comment on concentration**
e.g. can the pupil hold a conversation whilst carrying out a practical task?	**Comment on learner's ability to multi-task**
Ability to understand sequencing tasks. Note any problems copying work from the board.	**Comment on sequencing ability** **Delete words that do not apply:** Can / cannot sequence letters in words / words in a sentence Can / cannot recite days of the week / months of the year / multiplication tables Can / cannot dress in the correct sequence after P.E.
• Learner presents as if they have not heard what is said? • Takes some time for information to register and a response to be given? • Learner gives a response to a question asked earlier after the discussion has moved on? • Struggles to 'hold onto' verbal information, needs repetitions / prompting?	**Give examples to indicate learner's speed of processing**
Note particular artistic / musical / dramatic strengths, skill levels and preferences	**Comment on learner's creative activities and abilities**

Learner's strengths in maths: **1.** **2.** **3.**	
Comment on the learner's perception of where they are with their maths learning and their attitude to maths	
Outline your main concerns and the support you require from a specialist teacher	
Include tracking data for the previous 2 years, (termly or half termly). Indicate school's assessment system (e.g. Mastery, Age Expected)	**Current level of attainment and tracking data in Maths**
Outline the level required to differentiate number work. e.g. Year 4 child successfully accessing Year 2 work	**Comment on level of pitch required for successful teaching and learning**
Has progress slowed or halted? Is this consistent across all maths topics?	**Comment on learner's rates of progress in Maths**
e.g. specific concrete resources: Base 10, Numicon; visual strategies, numberlines, number formation checker etc.	**Proven strategies used to successfully support pupil in school**
List Maths interventions used to date and comment on their impact	

Pupil Checklist for Maths Learning Difficulties

Please tick the appropriate boxes to indicate the young person's observable behaviour. Highlighting areas of difficulty can assist in setting SMART targets in relation to the pupil's individual needs.

Class teacher / subject teacher observations in mathematics lessons					
Please provide examples where possible. Does the pupil…	Never	Rarely	Sometimes	Often	Always
Avoid starting work?					
Have a poor / low level of participation in group activities?					
Take a long time to respond to oral maths questions?					
Not concentrate in maths classes… just not 'there'?					
Withdraw from or avoid involvement in any maths activities?					
Take a long time to do worksheets or exercise book tasks in class?					
Present work untidily?					
Miss out questions on worksheets?					
Seem anxious about maths?					
Have poor and / or slow recall of addition and subtraction facts?					
Have poor and / or slow recall of multiplication and division facts?					
Avoid and / or fail to answer mental arithmetic questions?					
Forget the question asked in mental arithmetic?					
Cannot automatically 'see' that 5 + 3 is the same as 3 + 5?					
'Sees' numbers literally and not as inter-related, e.g. counting up from 1 to get to 9, rather than using 10-1?					
Forget mathematical procedures, such as decomposing or borrowing for subtraction?					
Shows an inability to 'see' patterns or generalisations, especially ones that differ from previous patterns?					

Difficulty seeing four objects as four, and needs to count up from one?					
Relies on counting on in ones as their preferred addition strategy?					
Poor skills with money, e.g. coin recognition or calculating change?					
Unaware that £4.99 is almost £5.00?					
Find estimating impossible?					
Has difficulty writing numbers which have zeros in them?					
Cannot judge if an answer is right or nearly right?					
Becomes impulsive rather than analytical when doing maths, often rushing?					
Disrupt classes?					
Complete and hand in homework?					
Form all numerals correctly?					
Orientate all numerals correctly?					

Standardised Arithmetic Tests

Schools are expected to have standardised tests in school to enable periodic assessment of pupil progress. Those identified below are suggestions of well-known standardised tests which can provide a standardised score which compares a learner's performance to norms for their age-group.

Primary:

- *NFER Maths Tests* *https://www.nfer.ac.uk/for-schools/products-services/nfer-tests/nfer-maths-tests*
  Key stage 1 and 2 tests available to purchase for individual year groups. The test provides both standardised and standardised age scores (SAS).
  Test duration: Two tests per year.
  Content: From Year 2 onwards, there are 2 papers: arithmetic and reasoning. National curriculum test styled content.

Secondary:

- *The 15 minute norm-referenced mathematics test* examines basic computations and algebra designed to compare performances. Steve Chinn MTWM pp91-94

Primary and Secondary:

- *Progress Test in Maths* (PTM) https://www.gl-assessment.co.uk/products/progress-test-in-maths-ptm/
  Tests available for children aged 5-14 years. Levels 5 (Year 1) – level 13 (Year 9). An optional transition test is available for pupils entering Year 7.
  Test duration: 60-75 mins, the test can be administered in two parts. Two tests per year, usually administered in the Autumn and Summer terms.
  Content: one paper tests mathematical content knowledge. The second paper tests understanding and applying through reasoning and problems solving.
  Format: digital for ages 7-14, paper versions for ages 5-14.

- *Access Mathematics Tests (AMT)* *https://www.hoddereducation.co.uk/accessmathematicstests*
  Tests learners aged 7-16 years. Test 1 A & B: for upper primary and lower secondary (4 levels of questioning throughout each test starting at Year 2 level through to Year 6). Test 2 A & B: for pupils aged 11-16 (the first half of the paper tests content from Years 5 and 6, the second half tests content from Years 7-9).
  The test provides both standardised and standardised age scores (SAS)
  Test duration: 45 minutes. Two tests per year, usually administered in the Autumn and Summer terms, or at the start and end of an intervention.
  Content: assesses all aspects of maths, note that in both tests 1 and 2, the balance of marks is weighted more towards measure, geometry and statistics than in national testing.
  Format: digital and paper versions

Record of standardised maths score:

Name / details of test taken ……..…….

Date of test ……

Age at time of test ……. years ……. months

Standardised score ……..

Standardised age score (if available) ……..

Pupil's maths teacher must answer the following question and sign:

In your opinion, how accurate is the standardised test score compared to your on-going formative assessment and knowledge of the pupil?

Assessment of child's level of mathematical conceptual development

Gathering standardised scores for children below the age of 8 (Year 4) is not always possible if they are working below the minimum level required for a standardised maths test. This is usually because they have not yet developed their understanding of foundational mathematical concepts at the expected rate or level. Consequently, the demands of the national curriculum may lead to some children facing the next harder (and usually more abstract) level of mathematical learning before they are conceptually ready.

To support these pupils effectively, teachers need clarity and an accurate overview of the number skills that the child has securely acquired and the conceptual level at which they are working. Appropriate next step targets can then be planned in response to this.

When used alongside age-expected levels or standardised scores, the concept development model can help teachers to understand the child's development and why they progress may have halted. Identifying the child's level of arithmetical conceptual understanding will enable the teacher to put in place suitable teaching so that the child continues to acquire and secure the fundamental arithmetic concepts successively, "only their mastery can be the basis for their sustainable future mathematical learning." (Fritz et al., see below.)

Mathematical concepts are ordered into hierarchical developmental steps. The Fritz, Elhert and Balzer model specifies six hierarchical levels, with each level characterised by a specific core concept. [2]

Understanding the conceptual levels

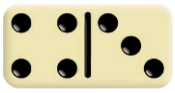
The model anticipates that both the two early core systems of representation are established in an infant's brain:

1. The Approximate Number System (ANS)

This system enables the child to make imprecise and approximate comparisons, relating to magnitude. For example, an elephant is big, a mouse is small and the piece of cheese is tiny.

[2] This concept development model was presented in an article entitled, *Development of mathematical concepts as a basis for elaborate mathematical understanding*, Fritz, A., Ehlert, A., Balzar, L, South African Journal of Childhood Education, 2023, 3(1): p38-67.

2. The Object Tracking System (OTS)
   This system enables the construction of representations of objects as complete, connected, solid bodies, that remain, the process known as subitising.



With these core systems comes the acceptance that very young children understand numerical concepts such as comparing, adding and subtracting quantities even before they acquire of language. The core systems serve as building blocks for the development of new cognitive skills.

The following level descriptors describe the understanding the pupil is expected to have fully mastered before they are ready to conceptually step up to the next level:

Level 1: Count Number

The child can distinguish small sets, count and enumerate them. At this level:

- the child understands number words
- can use one to one correspondence
- can recite a number word sequence
- can count a small collection of objects.

Level 2: Mental Number Line

The child can name the number before and after a given number on a mental number line.
Simple problems of adding and subtraction can be solved, e.g. a + b = ? a – b = ?

Level 3: Cardinality and Decomposition

The child understands that:

- a number word represents a quantity
- number quantities can be compared
- addition can be solved by counting on
- subtraction can be solved by counting back

Level 4: Class Inclusion and Embeddedness

The child understands numbers as compositions (e.g. different ways the number 6 can be shown: 6 = 5 + 1, 6 = 3 + 3, 6 = 4 + 2 etc.) and decompositions (to take numbers apart in a problem to make it easier to understand and solve, e.g. 12 – 7 = 10 – 7 plus 2**;** partial sums are based on decomposition as is trading one ten for ten ones).

Level 5: Relationality

The child understands congruent intervals between numbers on the number line, e.g. the distance for 0 to 5 is the equivalent distance from 5 to 10. The child is therefore able to solve comparison problems, e.g. A has 8 marbles, B has 5 marbles, how many more does A have?

Level 6: Units in Numbers

The child understands bundling and unbundling. The child knows that bundles can be formed on a number line, e.g. 3 x 4. Conversely the child knows that numbers can be decomposed into partial quantities, e.g. 12 ÷ 4 = 3. The child can see that four is one unit of four, so three lots of four is 12. 12 can be grouped into 4 groups of three or three groups of 4.

The following set of statements will enable a better understanding of the conceptual development level at which the pupil is currently working and will help to identify where early gaps in arithmetic understanding are preventing the child from making progress.

If you are unsure whether the pupil has fully secured a particular aspect, you will need to undertake further assessment to drill down further. Sometimes this can simply mean asking the child to orally answer a specific question or complete a short practical task to demonstrate their competence. Observing the child and how they attempt to solve a task or question and explain their thinking will help you determine the level of mastery. Various published assessment tools and resources, as well as your school's own assessment systems, will assist you in gathering the information required for making teaching judgements, for example:

- The Sandwell Early Numeracy Test assessments https://www.gl-assessment.co.uk/products/sandwell-early-numeracy-test-sent/ enable teachers to assess a pupil's ability with numbers, through exploring five strands of basic numeracy skills: identification, oral counting, value, object counting and language. A SAS score can be obtained. The images in the materials are engaging and relate the tasks to recognisable everyday activities. Excellent resource for dynamic assessment. Can be used for tracking purposes (6 monthly) or at the start and end of interventions.
  Age range: 4-14 Years. A revised edition for pupils aged 4-8 (SENT-R) and a version to enable the assessment of older pupils experiencing difficulties with numbers suitable for pupils aged 8 to 14 years (SENT KS2–KS3).
  Test duration: 10-30 minutes
  Test format: Paper, with practical tasks, delivered one to one

  For schools using Sandwell, please use the data to complete the following table. Please include the last 4 cycles of testing if you have them:

Record of Sandwell Test Data							
Test date	**Child's age in years and months at time of test**	**Child's maths age based on test score**	**Record of sub-section scores**				
			Identification of numbers **Score/total possible**	**Oral counting** **Score/total possible**	**Value /Computation** **Score/total possible**	**Mathematical language** **Score/total possible**	**Object counting** **Score/total possible**

- Numicon: https://global.oup.com/education/content/primary/series/numicon/send/?region=uk

The Closing the Gap with Numicon resource has now been replaced (go to website for similar resources). Section 3 of the original Closing the Gap kit contains practical assessment tasks and tools that will enable you to gather some of the information required to answer the statements set out below.

- Tests of basic facts (addition, subtraction, multiplication and division)

These simple tests are especially helpful for secondary pupils and those facing difficulties in later key stage 2. Some such tests provide norm-referencing data which should be used as guidance, rather than for absolute conclusions.

These tests favour children who are slow processors, have poor short-term and / or working memories because the facts are presented visually rather than as a 'quick-fire' test. The tests are designed to be short, with only one operation per sheet and the time limits (60 and 120 seconds) are intended to limit the time spent on each test (not to put the child under pressure). Explaining this to the child is recommended. Information gathered from these tests will be enhanced if the teacher carrying them out is able to observe and then ask questions such as 'can you tell me how you got that answer?' to help understand the child's thinking. In this way, you can identify if the child vocalises or sub-vocalises as they are working, or if they use counting strategies or finger methods all of which provide valuable assessment information.

Steve Chinn has produced his own versions: *The 60 second test for addition, The 60 second test for subtraction, The 120 second test for multiplication* and *The 120 second test for division* with norm-referenced test scores in his publication *More Trouble with Maths*.

Similar tests are available without the norm-referencing for teachers to use, or you can create your own, use the following as a guide:

Addition test: suggested format, 2 to 3 columns of sums presented as follows:

2 + 1 =
3 + 7 =
(Range 2 + 1 = to 9 + 9)

Subtraction test: suggested format 2 to 3 columns of calculations presented as follows:

2 - 1 =
5 - 2 =
(Range 2 – 1 = to 18 – 9 =)

Multiplication test: suggested format 2 to 3 columns of calculations presented as follows:

1 x 2 =
6 x 4 =
(Range 0 x 2 = to 10 x 9 =)

Division test: 2 to 3 columns of calculations presented as follows:

2 ÷ 1 =
72 ÷ 8 =
(Range division facts within 1x1 to 10 x 9)

The outcomes of the following statements will help you determine which level of concept development you feel the child is functioning at currently:

Statements to help identify the child's level of concept development

Please read the following statements and tick if the child is secure (has mastered) the skill:

Aspect	Level of concept development	Statement	Tick if pupil is secure
Object counting	1	Can represent numbers to 10 using objects	
	1	Can represent objects to 10 using pictures	
		Represents numbers to 20 using objects or pictures	
	1	Can set / sort objects to 10	
	1	Can use finger representations to 10	
	1	Has accurate 1:1 correspondence to 10	
	3	Uses mathematical models to represent numbers to 20	
		Has accurate 1:1 correspondence to 50 using representations of 10s and 1s	
Mathematical vocabulary & symbols	1	Understands number words (oral) to 10	
	2	Number recognition to 10	
	2	Can understand and use: add, subtract, take-away	
	2	Can understand and use: equal to, more than, less than	
	2	Recognises and can write numerals to 20	
		Can read and write number words to 20	
	3	Can read and write mathematical statements (number sentences) with + / -	
	5	Knows, uses and applies term 'double' for numbers 1, 2, 3, 5	
	5	Knows, uses and applies term 'halves' for numbers 2, 4, 10	
	5	Knows, uses and applies term 'double' for numbers 4, 6, 7, 8, 9	
	5	Knows, uses and applies term 'halves' for numbers 6, 8, 12	
	5?	Identifies near doubles**,** applying knowledge & understanding when calculating	
	5	Can understand and use terms: odd, even	
Counting and Sequencing	1	Count to 10 forwards	
	1	Count back from 10 to 0	
	2	Can order numbers to 10	
	2	Count to 20 and back	
	2	Can order numbers to 20	
		Can count in ones to 50	
		Can order numbers to 50	

		Can count in ones to 112	
	5	Can identify odd and even numbers to 20	
	5	Can count in tens to 50, starting at 0	
	5	Can count in tens to 110, starting at 0	
	5	Can count on and back in 10s from any 2-digit number	
	5	Can count in fives to 100, starting at 0	
	5	Can count in twos to 20	
		Can count on in 1s from any number	
		Can count on and back in 5s and 2s from different starting points	
Number patterns / subitising	1	Can recognise objects to 10 as visual clusters	
	1	Number pattern (visual cluster) recognition to 6	
	1	Can subitise numbers to 6	
	1	Number pattern (visual cluster) recognition to 10 by regrouping	
	1	Can subitise numbers to 10	
	2	Can recognise objects to 20 as visual clusters	
	2	Knows 1 more and 1 less (numbers to 20)	
	5	Can identify and show doubling and halving using objects and as equal counting on a number line	
Partitioning	3	Can split numbers to 10, regrouping (e.g. 4 into 3+1, 2+2 4+0)	
	3	Can solve missing number problems to 10 (e.g. 4 = ? + 6)	
	4	Can decompose and recompose numbers to 20	
Addition and subtraction	1	Can +/- to 10 using blocks / concrete materials	
	3	Can add crossing 10 barrier to 20	
		Can add crossing 10 barrier to 100	
	3	Can find the difference by counting on	
	5	Can subtract through difference lines (e.g. number lines and bar models)	
		Can subtract from 20 crossing 10 barrier through strategies: reverse doubles; bonds of 10; finding the difference	
		+/- to 100 strategies: extended doubles/halves; near doubles; difference lines	
	4	Can calculate and mentally recall 45 sight facts relating to all numbers to 10 by regrouping, addition and subtraction e.g. fact families: 2 + 1 = 3 1 + 2 = 3 3 – 2 = 1 3 – 1 = 2	
	4	Can recall, use and apply bonds of 10	
		Can recall, use and apply bonds of 20	
		Can recall, use and apply bonds of 100	
	4	Can use reverse bonds of 10 for subtraction	
	5	Can use halves for subtraction	