

Dyscalculia and Maths Difficulties

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Outline of the presentation today



Why some of us struggle with maths and how we might find ways to assess and support learners in the classroom:

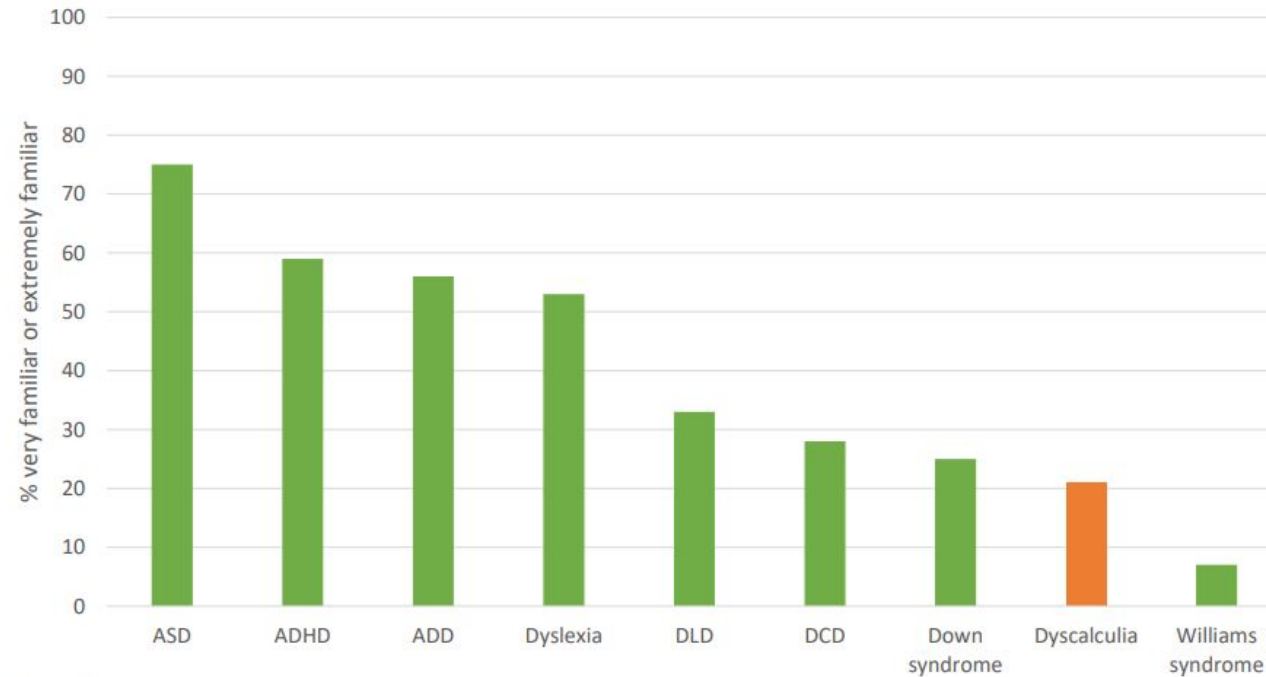
- The Dyscalculia Network
- What is Dyscalculia and maths difficulties
- Prevalence and Co-Occurrence
- Indicators of Dyscalculia and struggles with maths
- Difficulty in maths learning and understanding
- How to help in the classroom

The Dyscalculia Network - Key Aims

- Raise awareness of dyscalculia and maths learning difficulties.
- Advise and campaign for better provisions for children and adults with dyscalculia and maths learning difficulties.
- Provide UK's only exclusive dyscalculia specialist assessor and tutor directory.
- Provide training to educational establishments, workplaces, and community organisations in how best to accommodate those with dyscalculia and maths learning difficulties.



Awareness of Different SEND groups



(Van Herwegen et al., in prep)

Prevalence



Approximately 6% (six percent) of the UK population have Dyscalculia



Which doesn't sound a lot... but that is ...about 4 million (four million) people in the UK



Prevalence



or

...about 2 people in every class of 30!

What are Maths Difficulties?

Maths Difficulties are best thought of as a continuum or spectrum.

What is dyscalculia ?

Dyscalculia falls at one end of the spectrum and will be distinguishable from other maths issues due to the severity of difficulties with number sense, including subitising, symbolic and non-symbolic magnitude comparison and ordering.

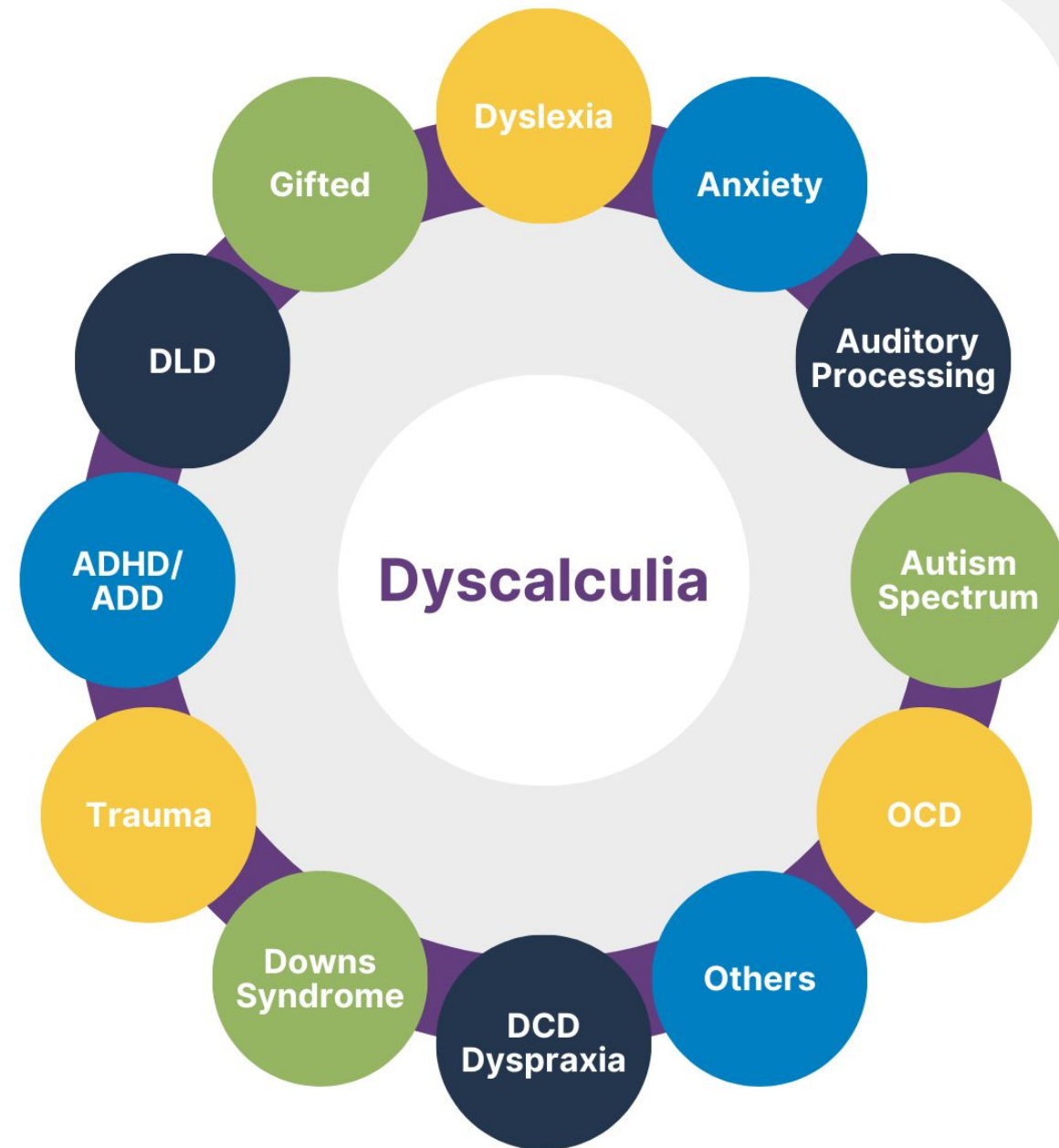
Dyscalculia is defined as a specific and persistent difficulty in understanding numbers, which can lead to a range of difficulties with mathematics.

- It occurs across all age ranges, levels of education and abilities.
- It can occur singly but often occurs with other conditions.



Co-occurrence

Other than dyscalculia, what else can cause difficulties with maths?



Maths Anxiety ... What is it?

the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem. There is also a considerable overlap with other subjects such as Science and Geography.

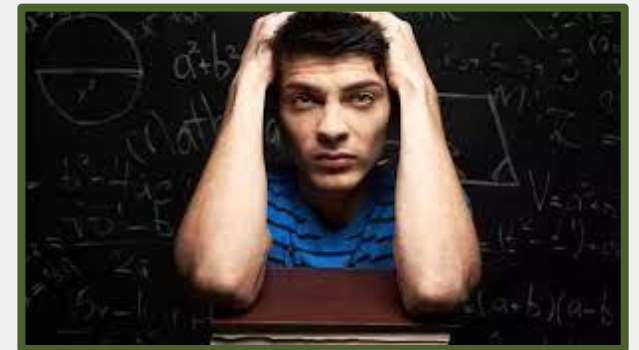
Symptoms can be:

- **Physical:**

Nausea, shortness-of-breath, sweating, heart palpitations, increased blood pressure.

- **Psychological:**

Memory loss, paralysis of thought, loss of self-confidence, negative self-talk, maths avoidance, isolation (thinking you're the only one who feels this way).



What are the Key Indicators of Dyscalculia?



Can you think of examples?

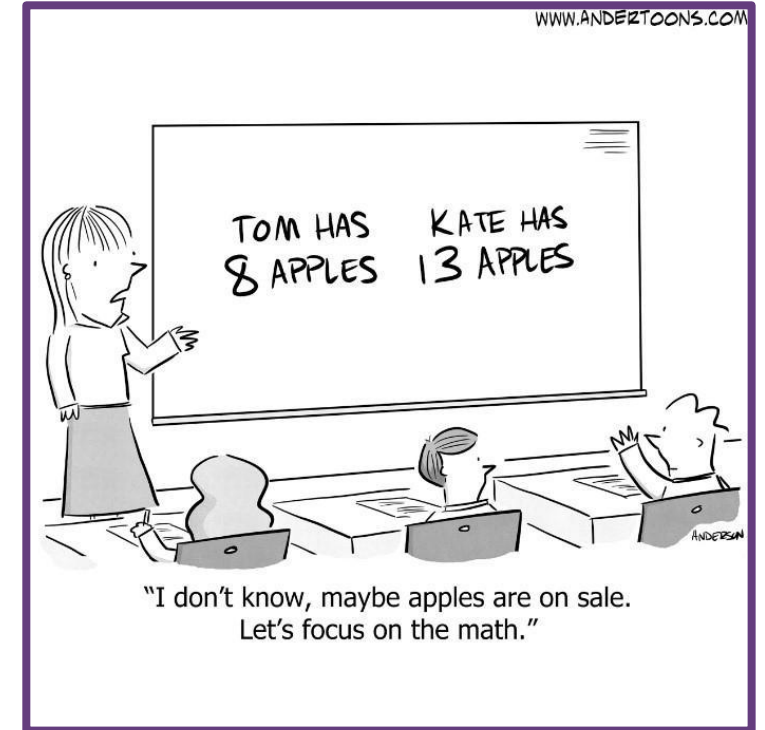
What are the Key Identifiers for Dyscalculia?

- An inability to subitise even very small quantities
- Poor number sense
 - Struggling with estimating or following patterns
 - Inability to judge if an answer is reasonable
- Slow processing speed
- Immature strategies – relying on counting in 1s



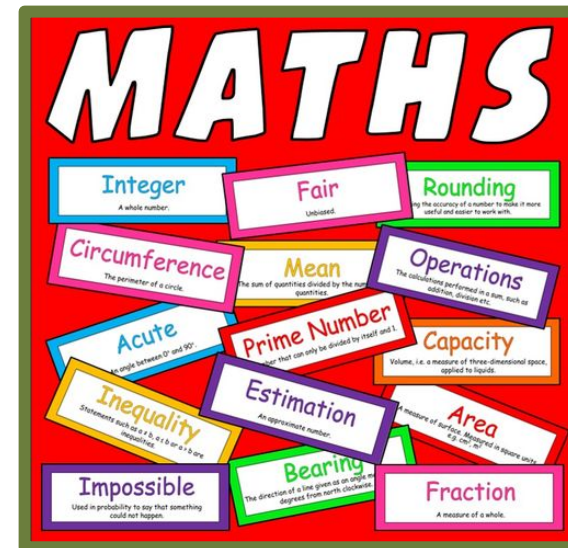
What are the Key Identifiers for Dyscalculia?

- Poor memory for facts and procedures
- Weak at making connections
e.g. $4 + 4 = 8$ therefore $14 + 4 = 18$
- Anxiety around working with numbers
- Weaknesses in both short-term and long-term memory
- Counting errors (70, 80, 90, **20**) and an inability to count backwards



What are the Key Identifiers for Dyscalculia?

- Weakness in visual and spatial orientation
- Directional confusion
 - Reversing digits and errors writing numbers (18 is written as 80 or 23 is written as 32)
- Difficulty sequencing
- Difficulty with language



What are the Key Identifiers for Dyscalculia?

- Poor memory for facts and procedures
- Difficulties in word problems and multi-step calculations
- Problems with all aspects of money
- Marked delay in learning to tell the time



Short-term and working memory

Subitising

Everyday tasks involving number e.g. money, time

Estimating

Applying number skills to solve problems

Ordering, sequencing and directionality

Scottish Dyscalculia Definition 2022

$4 + 17 = 17 + 4$

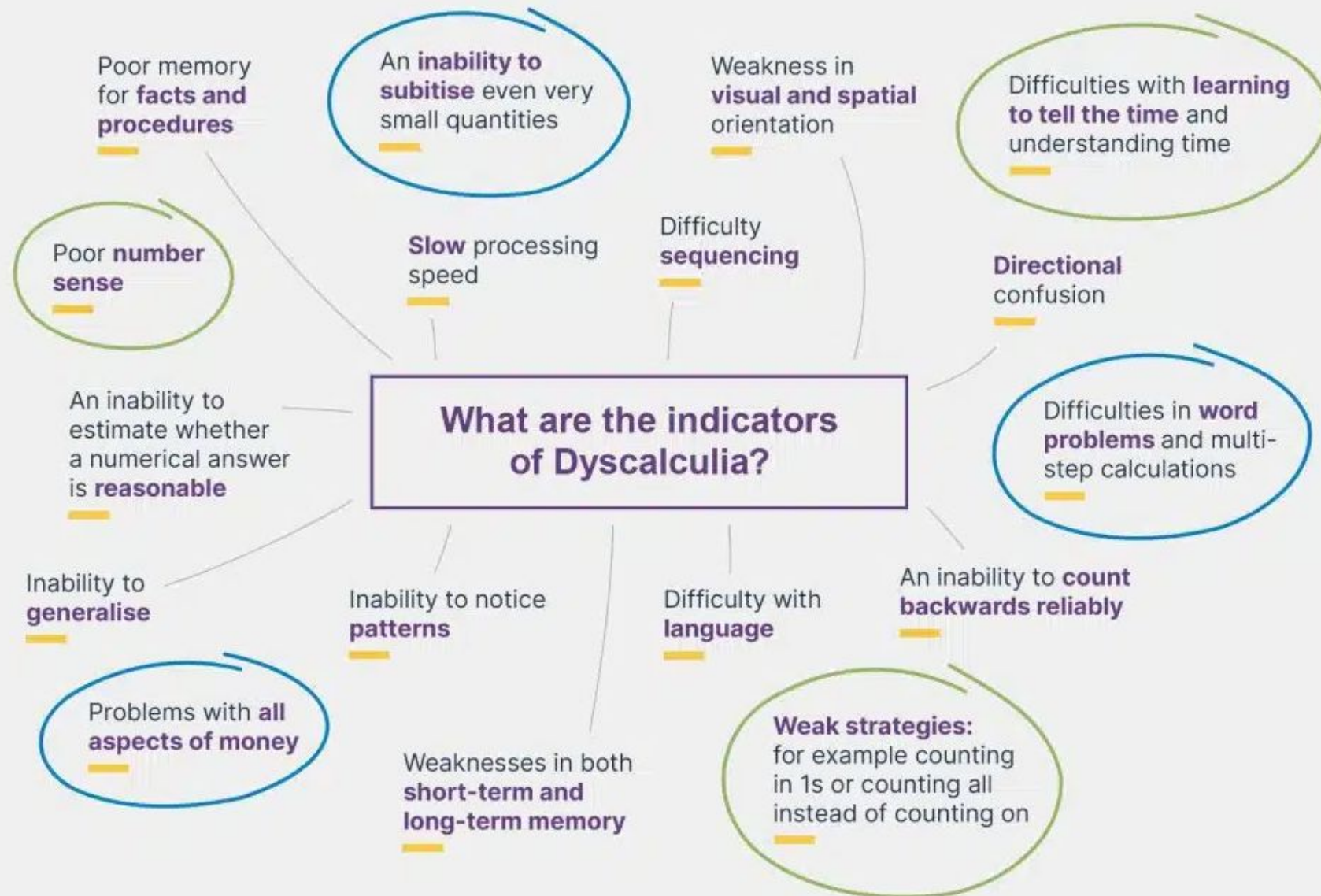
Learning and recalling basic maths facts and processes

10 Ten

How numbers and amounts relate to each other in their representation

Recognising and understanding number symbols

The impact of dyscalculia as a barrier to learning varies in degree according to the learning and teaching environment



Assessment of maths difficulties

Key Steps

Gathering Evidence

A checklist or a screener can help educators to informally identify children or young adults who may have difficulties with maths or dyscalculia.

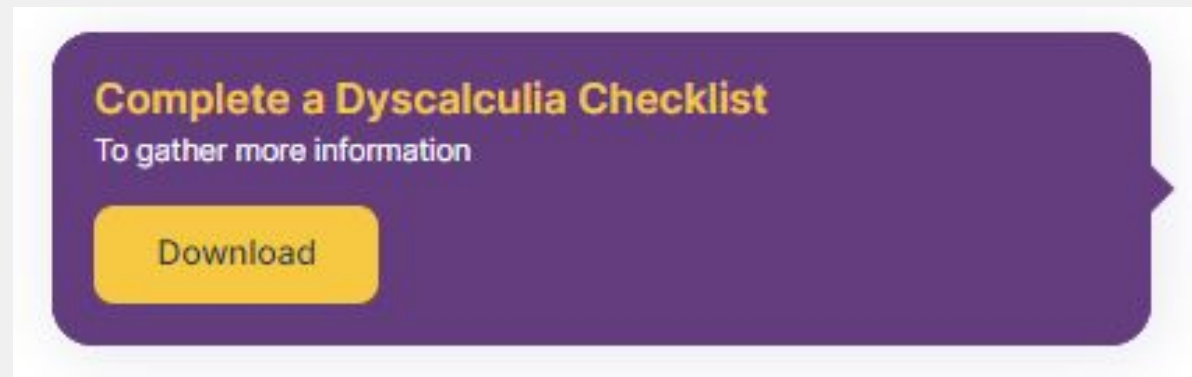
The are intended as guides NOT as diagnostic tools.

Our free dyscalculia checklist can be downloaded from our website.

The Dyscalculia Network
Dyscalculia Checklist

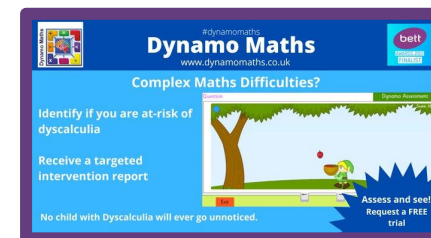
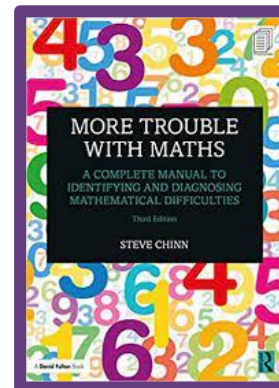
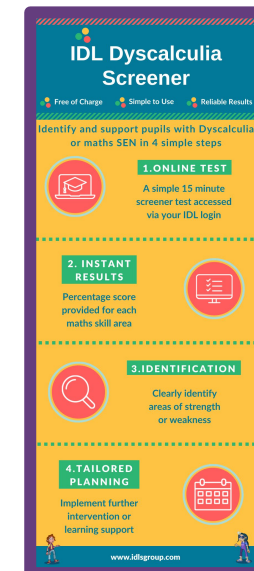
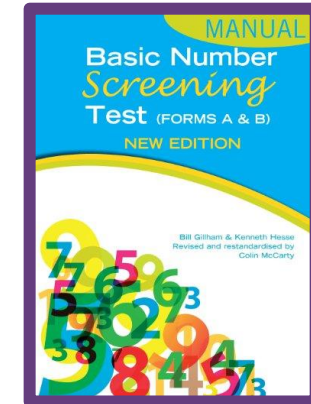
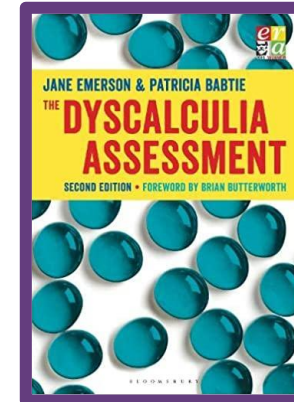
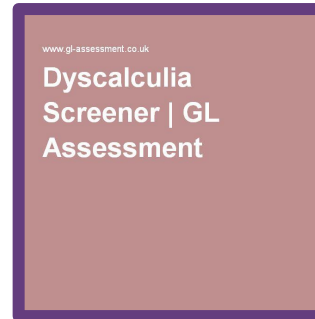
Name _____ Date of Checklist _____
Date of Birth _____ Age _____

Checklist	Red - Often seen	Orange - Sometimes seen	Green - Not seen
Has high levels of maths anxiety			
Avoids maths activities or uses diversion tactics			
Is slow to perform calculations			
Finds it difficult to follow verbal instructions			



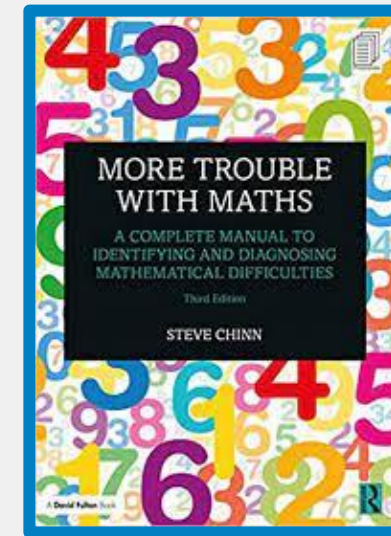
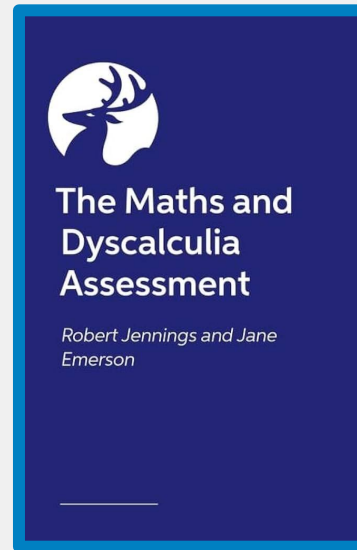
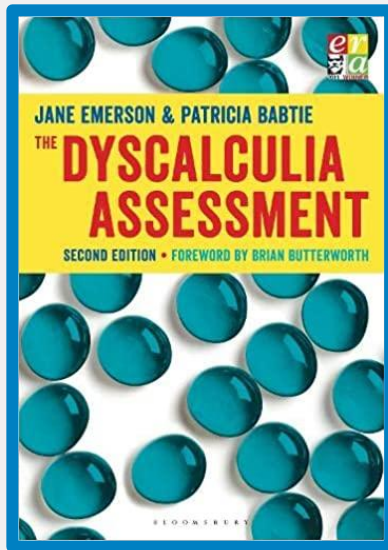
Screeners Assessments

- SNAP maths
- Basic Number Screening Test
- Dynamo maths Developmental Dyscalculia Assessment
- IDL Dyscalculia Screener
- GL Dyscalculia Screener
- More Trouble with Maths -15 Minute Test
- The Maths and Dyscalculia Assessment (MDA)



Assessment for Intervention

Once we have noted some of these indicators, it is important to undertake an assessment of the pupil to get a full 'maths' picture of their strengths and weaknesses and will give us an indication of where things are starting to go wrong.



We are then able to put together a focused intervention plan.

It is important during the assessment to note 'how' the pupil gets their answers, rather than just noting accuracy.

Who can diagnose dyscalculia?

An Educational psychologist
or
A level 7 accredited (APC) assessor



Does it really matter if a pupil is dyscalculia or poor at maths?

* Tony Atwood of The Dyscalculia Centre says:

'... That seems to me like an important question because for many people the origin of their problem doesn't matter at all. What matters is how the individual can get help to become better at maths. Also recognising that just because an Educational Psychologist announces that a person is dyscalculic that doesn't affect the individual unless something else happens'.

* It is worth noting that as children become young adults a dyscalculia diagnosis can make them feel there is a 'reason' for their difficulty and can help them not to feel they are stupid. Lots of adults say they feel better once they know they have a diagnosis and they are not alone with their struggles with maths.

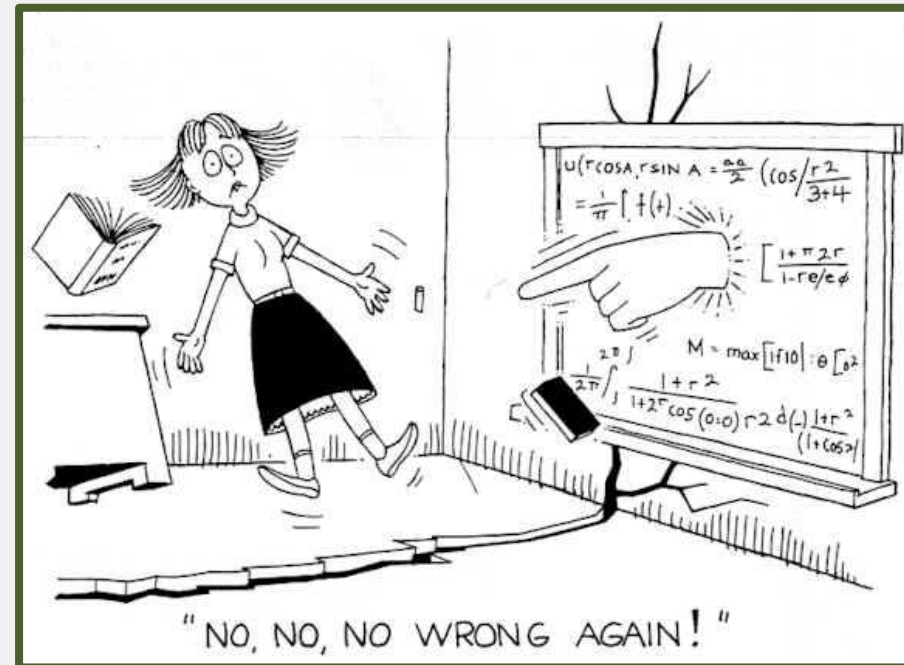
Why can't some learners 'do maths' ?

General Factors -

- Maths is a particularly abstract subject to learn
- Maths is complex involving quantity, language (some of which is unique to maths) and space

The way maths is taught in some schools –

- Too fast
- A lack of concrete resources
- Not enough repetition
- Reliance on rote learning



Rote Learning



MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216	225
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242	253	264	275
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264	276	288	300
13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325
14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308	322	336	350
15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375
16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408	425
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414	432	450
19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380	399	418	437	456	475
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500
21	42	63	84	105	126	147	168	189	210	231	252	273	294	315	336	357	378	399	420	441	462	483	504	525
22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462	484	506	528	550
23	46	69	92	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506	529	552	575
24	48	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	504	528	552	576	600
25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625

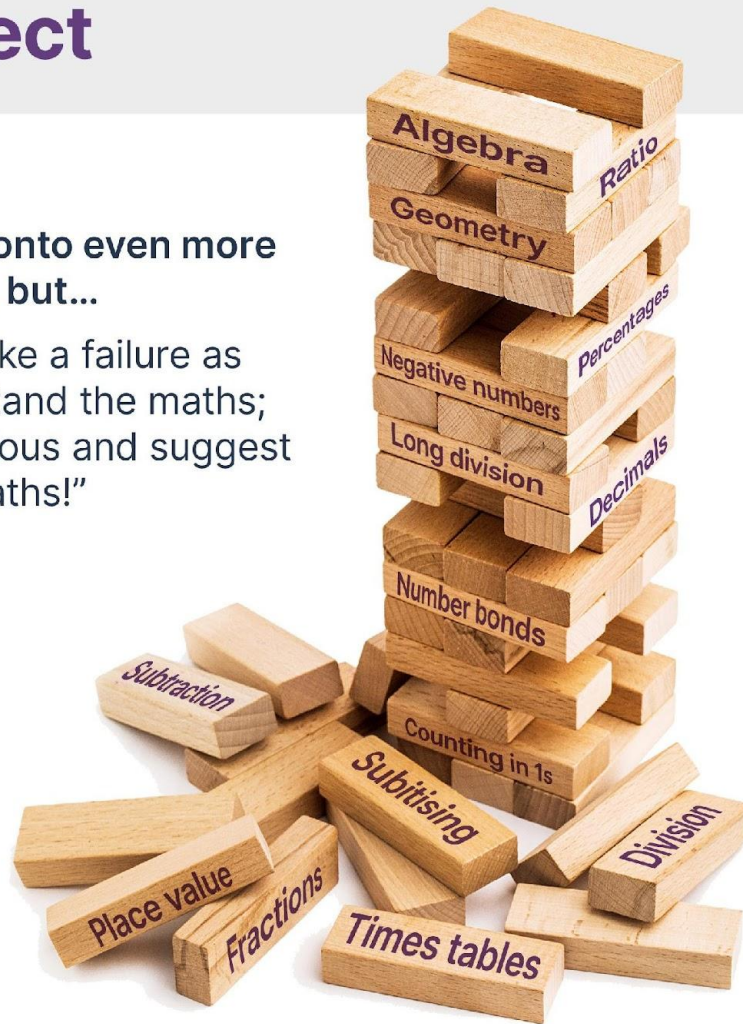
The Jenga Effect

3 Teaching moves onto even more advanced topics, but...

the learner feels like a failure as they can't understand the maths; they are very anxious and suggest that they "hate maths!"

1 The foundations of maths are taught, but..

the learner didn't really understand and started to feel a bit wobbly and anxious about maths



2 Teaching moves onto the next steps, but...

the learner feels like nothing makes sense and begins to believe they 'can't do maths'

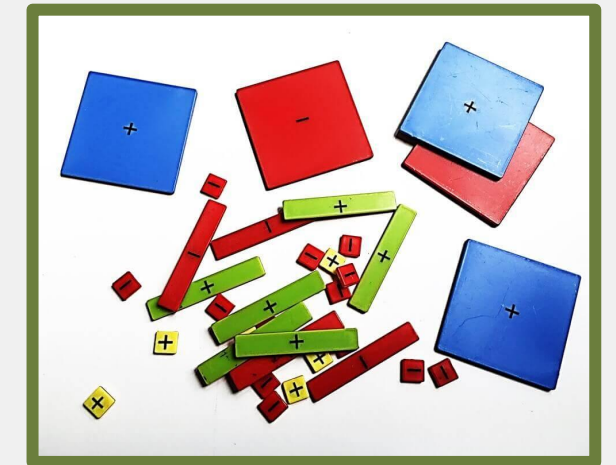
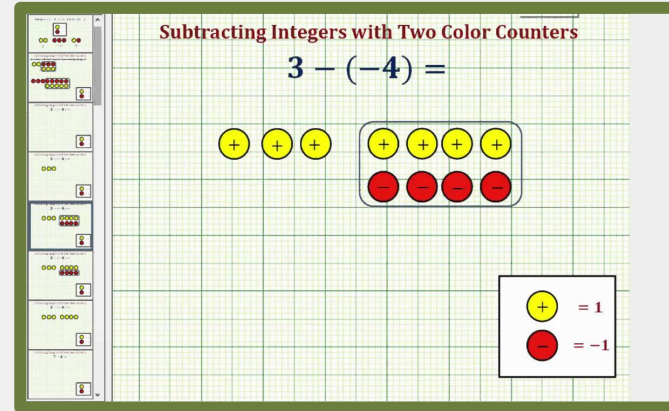
An effective maths intervention in a Learning Centre should:

- Assess where the learners are in their current knowledge and understanding
- Begin intervention early and just before the level of breakdown
- Use the Concrete, Pictorial, Visualise, Verbalise, Abstract approach
- Scaffold learning
- Provide lots of practice opportunities.



An effective maths intervention in a school should:

- Allow learners plenty of time
- Take time to explicitly teach vocabulary
- Involve playing lots of Maths games
- Praise and celebrate every success
- Try and make lessons fun and enjoyable



Supporting at school:

Intervention – Top Tips

- + Dyscalculic learners in Primary Schools
- + Dyscalculic learners in Secondary Schools
- + Dyscalculic learners in Further Education



<https://dyscalculianetwork.com/dyscalculia-for-educators/>

Reading and Recording Large Numbers





- Chunk numbers into the groups: millions, thousands & HTU
- Thirteen million....
Five hundred and eighty-six thousand ...
and seventy-nine
- Use gaps or commas to break up larger number (right to left / small to larger)

Millions			Thousands					
H	T	O	H	T	O	H	T	O
	1	3	5	8	6	0	7	9

Understanding Decimal Place Value

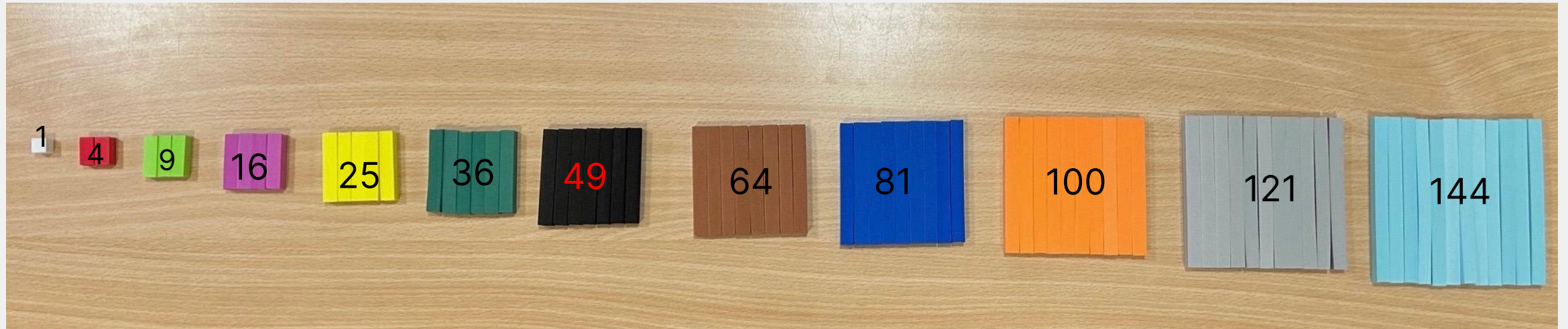


Decimal Place Value Chart

T (tens)	U (units)	10th / $\frac{1}{10}$ / (tenths)	100th / $\frac{1}{100}$ / (hundredths)
			

Squared Numbers and Square Roots

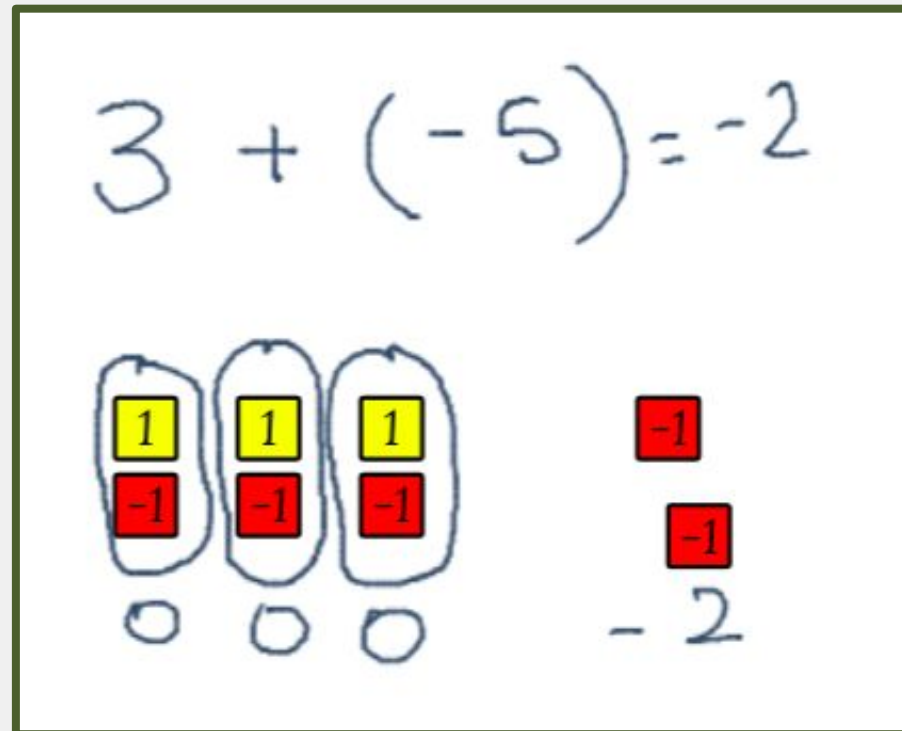
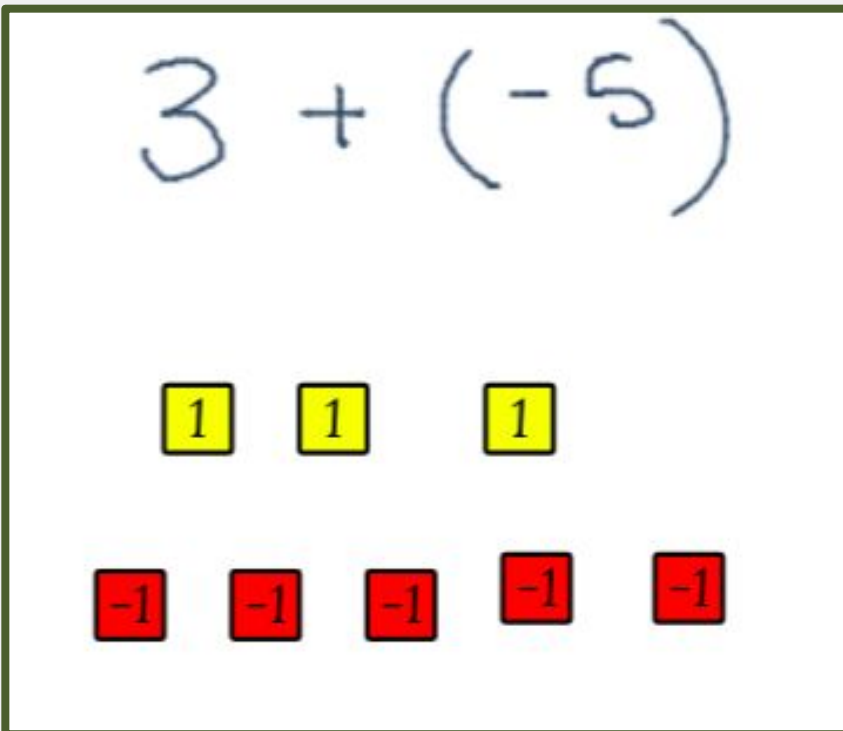
Squared numbers are the inverse of the square root of a number



Using 'Cuisenaire Rods' we can demonstrate what are the square numbers as they
Visually display 'squares' when lined up together: $7 \times 7 = 49$

Algebra

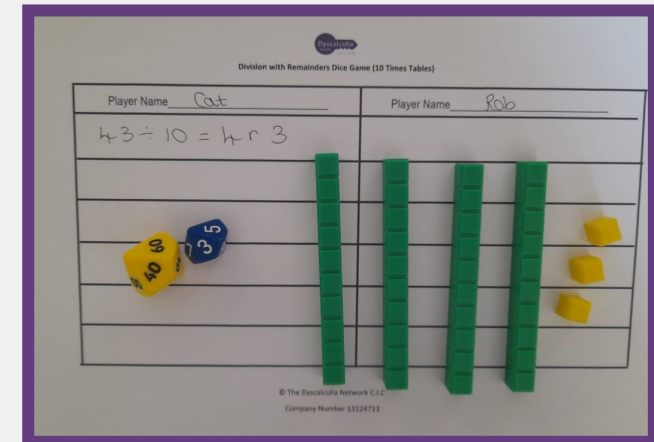
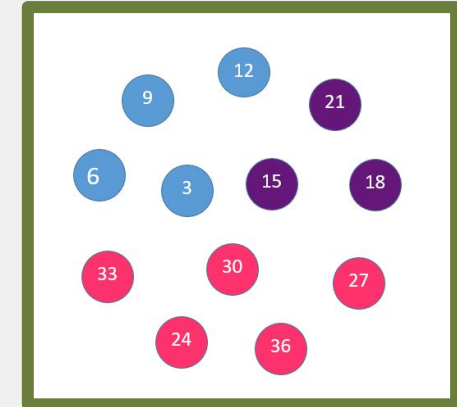
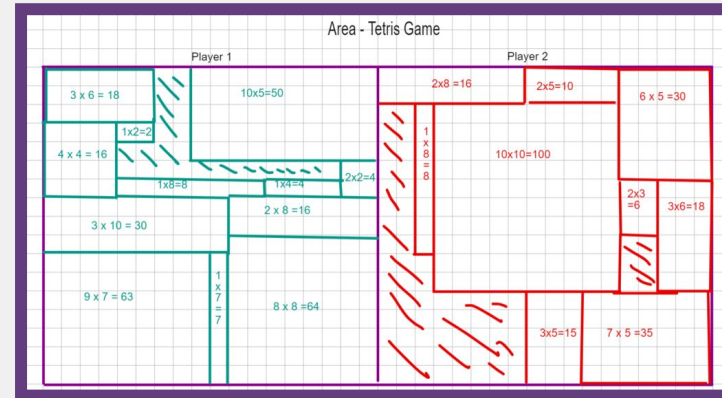
Algebra tiles can be used to help understand calculations with negative numbers



Why play Maths games?

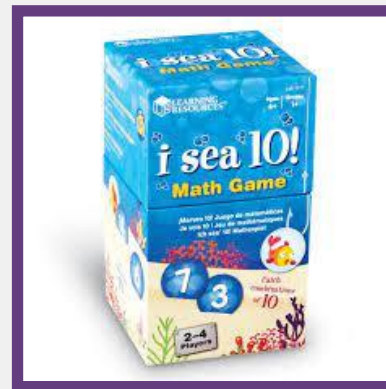
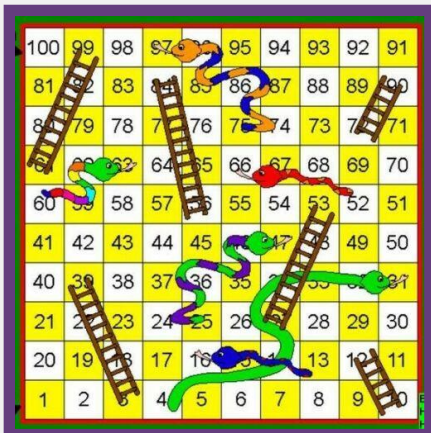
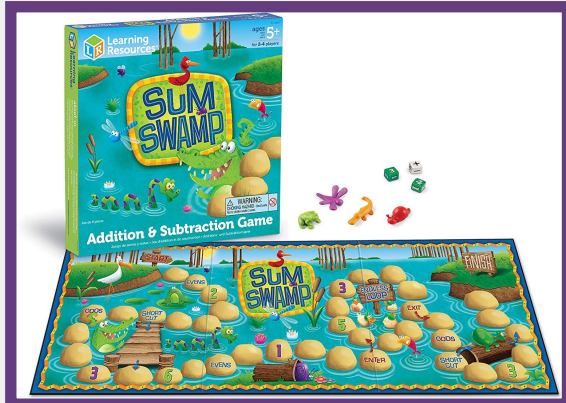
Why play maths games?

- Play the 'right' maths game
- The learner doesn't realise they are learning!
- The learner is usually more productive
- The help the learner make sense of number
- Games can be used to reinforce skills or extend skills
- Learners are less likely to 'give up' in a game setting
- Games can be differentiated for different groups, pairs, individual learners
- 1:1 can ensure a positive outcome for the learner!
- There is instant feedback for the learner
- Informal assessment
- Games help to reduce maths anxiety



ACTIVITIES IMPROVE THE CONFIDENCE OF THE LEARNER

Maths Activities to buy



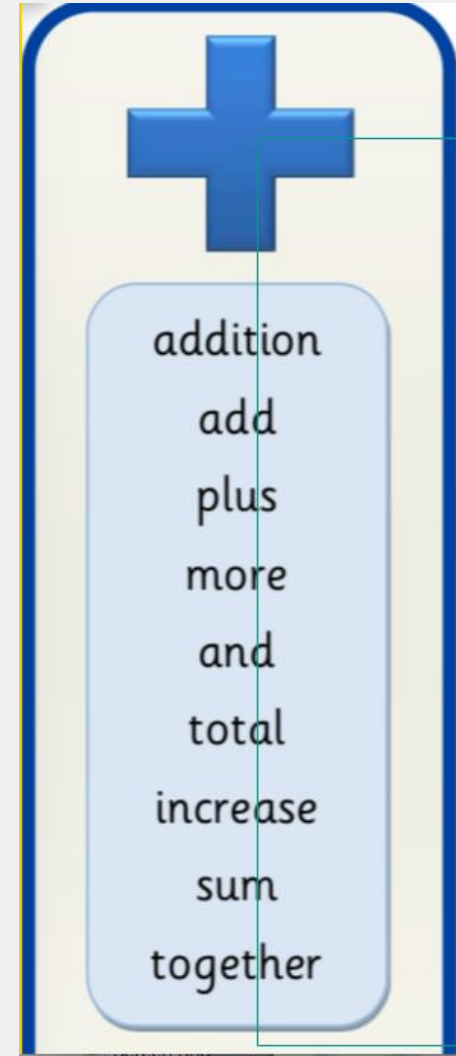
Key Calculation Strategies:

- Addition
- Subtraction
- **Multiplication**
- **Division**



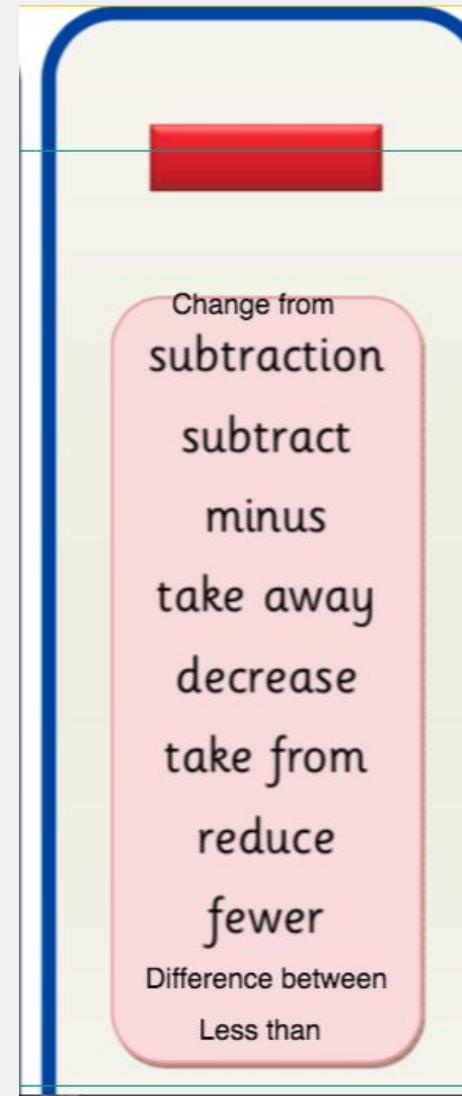
Addition:

- Underpins all of the maths we undertake
- Lots of different techniques
- Avoid counting in ones up and back
- Language

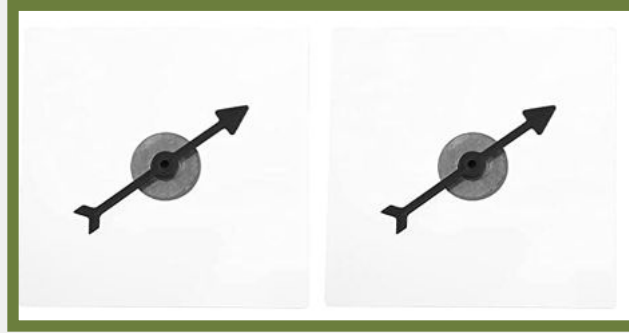
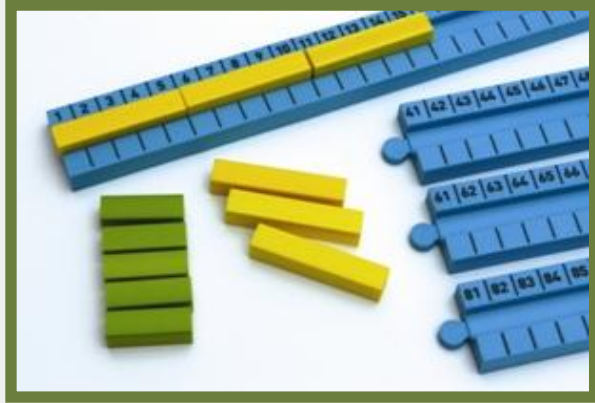


Subtraction:

- The Inverse operation to addition
- Lots of different techniques
- Avoid counting in ones up and back
- Language



Resources – Addition and Subtraction



Intervention - Addition and Subtraction

Connect 4

Connect 4
Addition

2	5	8	12	6	3	7	4
6	3	2	4	9	5	11	10
9	11	8	3	2	6	12	7
10	4	12	6	7	3	8	2
5	9	11	2	5	10	4	9
8	10	6	4	7	6	11	2
9	4	7	10	2	4	8	5
6	9	8	5	7	6	9	11
12	5	10	7	12	6	8	5

First to get four in a row wins

Connect 4
Subtraction

2	1	5	2	4
5	0	3	1	2
3	4	2	0	1
2	0	5	4	3
4	1	0	2	3
1	5	3	0	4

First to get four in a row wins

Multiplication and Division - Teaching Intervention

- Testing our Times Tables – Memory or Understanding?
- Multiplication as viewed as repeated addition - ‘Step Counting’
- Pre-requisite skills needed
- Language

Pre-Requisites for Times tables


What pupils need to know:


- Capable addition and subtraction ability
- Bonds for 10 (addition and subtraction)
- Doubling and Halving
- Bridging through 10
- Adding and Subtracting to/from a tens number
- Step counting forward and backwards
- Key Vocabulary





Step Counting


5 Times Table

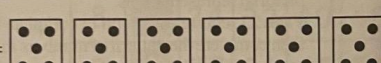
1 x 5 =  =


2 x 5 =  =

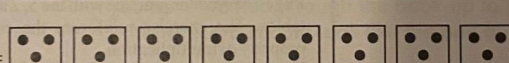
3 x 5 =  =


4 x 5 =  =

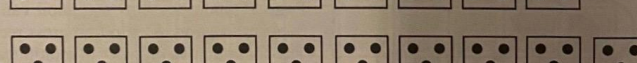
5 x 5 =  =

6 x 5 =  =

7 x 5 =  =

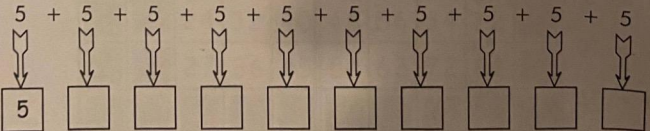
8 x 5 =  =





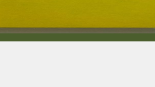
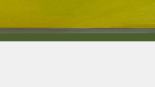
9 x 5 =  =

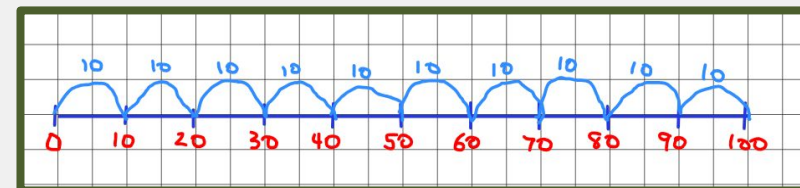
10 x 5 =  =

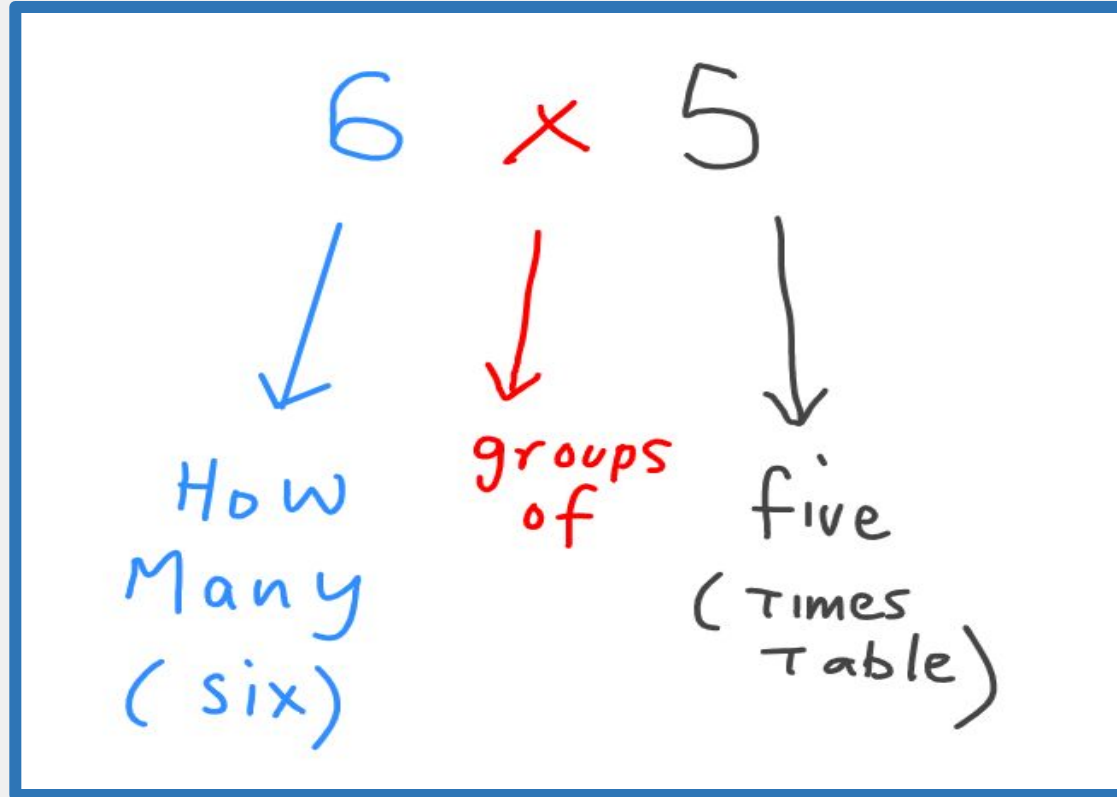
If you multiply it is the same as if you keep adding on the same number.

Write the right numbers in the boxes.

$5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5$


1	2	3	4	5
				
				
				



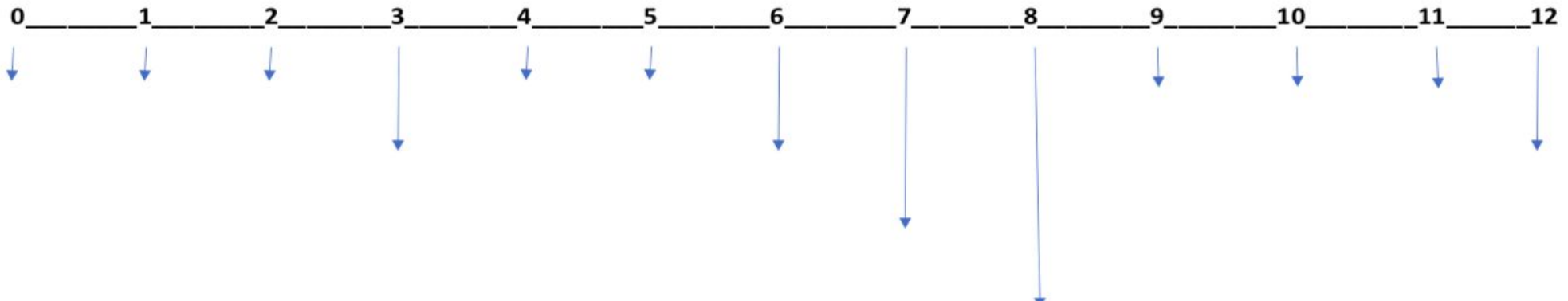


The KEYS to times tables

X



Write in your 10x 5x and 2x keys first



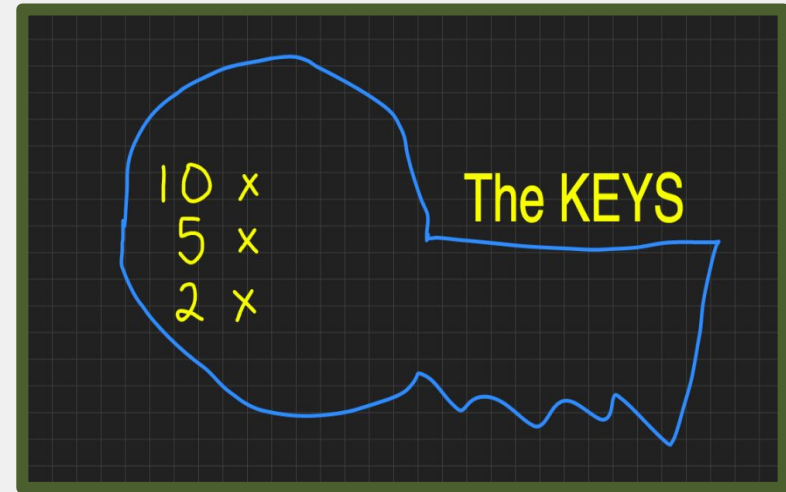
Reasoning (Not Rote!)

- Use the KEYS for any times table
- Step count

• For example, $6 \times 8 = ?$

• I know from my KEYS to 8x table that $5 \times 8 = 40$,

So ... 6 lots of 8 will be $40 + 8$ which is 48!



It is important to understand that there are **two different concepts**:

Grouping: Where the quantity in each group is known. (This links directly to how we teach multiplication.

For example, there are 12 girls and they need to get into teams of 3. This means there will be four teams.

Sharing: The number of groups is known.

For example, 12 biscuits and there are 6 plates. There will be 2 on each plate.

Division is the only operation which is NOT closed ... there may be a remainder.

The strategy for division should be derived from multiplication facts and identifies division as the inverse of multiplication

Teaching Division

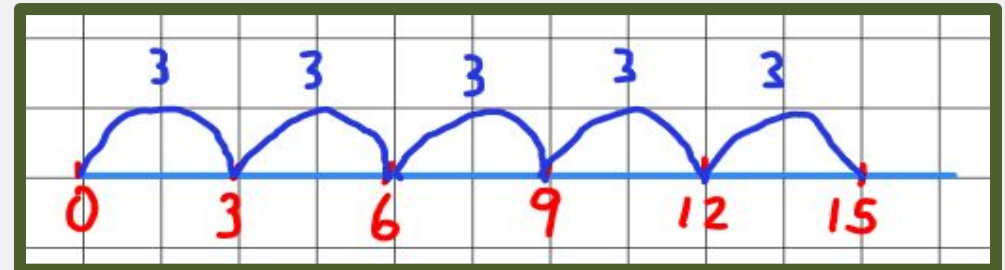
- Concrete materials (multiplication mat and bowls)

For example, take 12 counters and put 3 counters in each bowl.

How many bowls are needed?

- Repeat using different numbers and groups until the pupil feels comfortable using the bowls and then move onto the multiplication mat.
- Use a number line to record thinking.

15 divided by 3 ... is 5 jumps.



Teaching Division

- Relate division to 'repeated subtraction'

For example, if we start with 30 counters and want to know how many groups of 5 can be made?

$$30 \div 5 =$$

We can use a number line to show 'jumps' back from 30 in fives.

- We need to think about subtracting equal sized groups, where the answer is found in the number of groups we take away.
- Division as inverse of multiplication

$$18 \div 6 = 3$$
$$3 \times 6 = 18$$

Multiplication and Division

Games – Bob's Bingo

BOB'S BINGO - 4 X TABLE

28	40	24	36	4	12
4	28	16	32	8	20
12	32	8	20	16	36
16	20	24	4	32	12
36	40	40	28	24	8

	40	24			12
4				8	
	32	8		16	
	20		4		12
36			28		

Four in a row bingo using a ten-sided dice is a great fun way to practice multiplication and division skills.

Ask... ask ... ask questions!

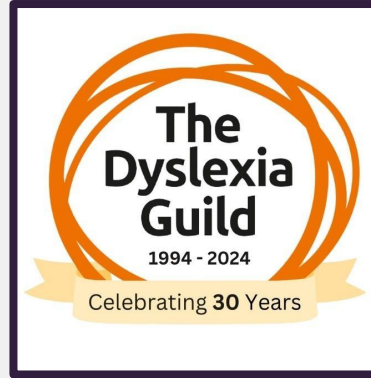
PETER'S CHALLENGES WITH DYSCALCULIA






- Diagnosed at 10 years old – discrepancy between literacy and numeracy skills
- Maths support was initially not great - maths teachers didn't know what dyscalculia was in late 1990s/early 2000s and it is still not compulsory for maths teachers to learn about dyscalculia in Maths PGCEs
- Reading numbers (11,000, eleven thousand, 11000)
- Inability to do 'mental maths'
- Has no concept of what percentages or fractions actually are
- Can only memorise numbers if he can associate them with something
- Struggles with budgeting and is anxious with money
- Difficulty with time, bus schedules ... perennially late.
- Estimating numbers is challenging 'How much do you think that costs?'



Lack of awareness of dyscalculia and the culture around Maths has had a huge impact on his mental health; still to this day, he feels a sense of shame.....

Thank you!



-  [thedyscalculianetwork2548](https://www.youtube.com/channel/UC2548)
-  [dyscalculianetwork](https://www.facebook.com/dyscalculianetwork)
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