

Sumdog Pathway to Multiplication Success

Using Sumdog to build **conceptual understanding** of multiplication and number in order to increase **fluency, speed, accuracy and automaticity**.

Your pathway to developing your pupils' multiplicative fluency!

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Introduction



Our multiplication mission

At Sumdog, we know that trying to develop children's mathematical fluency whilst also preparing them for high-pressure multiplication tables tests can be a real source of stress for teachers. That is why we have created the Sumdog pathway to multiplication success – a scheme of learning covering multiplication for First Level, designed to build automaticity *and* conceptual understanding.

Familiarity and proficiency with multiplication facts free up children's working memories and enable them to better apply their maths skills to more complex problems. Fluent multiplication fact recall also lays the foundations for higher learning concepts such as division, fractions, long multiplication and algebra, in both educational and 'real-life' contexts.

Understanding or memorising?

Should children therefore be forced to memorise multiplication facts?

Times table facts give children the opportunity to see for themselves the beauty within numbers and the complex patterns and relationships that lie within them. By learning to multiply, they can develop a deeper understanding of our number system - the grouping of sets, arrays, repeated addition and faster ways of adding.

Furthermore, playing with patterns and relationships leads to skip counting, doubling, halving and additional mental agility strategies that naturally bridge the gap between simply memorising the facts for quicker recall and actually understanding the concepts of multiplication.

Teaching multiplication in this way results in the organic memorisation of facts, but children need the opportunity to build their recall by practising and applying their learning. This is where Sumdog, and in particular the Sumdog multiplication table tools, can support the daily practice of tables.

Children who truly understand the underlying concepts of multiplication are able to train their brains to pay attention to detail and process complicated calculations by applying mathematical logic with accuracy, fluency and speed.

So at Sumdog, we believe that deep and meaningful memorisation comes with understanding and our fun, engaging, low-stakes practice gives children the opportunity to gain that understanding – by exploring, practising, making mistakes and enjoying the beauty of numbers.



The need for speed

At Sumdog we recognise that learning multiplication table facts can be a source of stress and anxiety for some children. This can often lead to difficulties with recall and can sadly even put them off maths for life.

While most educators agree that children being able to recall multiplication facts quickly is a good thing, insisting that they are recalled within a set time is often met with apprehension from teachers. This requirement for faster recall can often lead to children being forced to simply memorise multiplication facts.

Therefore, we have deliberately made our platform as engaging as possible for children, providing them with opportunities to learn from their mistakes through fun and interactive games. We ensure they remain motivated to continue with their practice by rewarding their effort with coins that they can spend in their Sumdog house and garden or on their avatar.

At Sumdog, we believe that all children can succeed with the right support, and this belief is at the core of our mission to close the attainment gap and ensure that every child has the opportunity to thrive.



Sumdog's Teaching Tools for Multiplication

Sumdog has created two tools to help build multiplication fluency. The multiplication tool has been designed so that teachers can set differentiated tables practice for the children to complete in any of our games. The second tool, the Multiplication Tables Check (MTC), is more like an assessment, and enables teachers to easily see which tables or multiplication facts need extra practice.

The MTC follows the following format:

- + The test checks pupil recall with 25 questions.
- + The pupil types in the answer and has six seconds to answer each question.
- + While pupils do not see their results, they receive 5 coins per correct answer and will see the total number of coins earned at the end.
- + The test focuses on tables 2-12, with a special focus on 6, 7, 8, 9 and 12 times tables.

Practice makes progress

Using our multiplication tools alongside our pathway will prepare, support and equip your pupils to confidently, accurately and fluently answer multiplication facts. This will not be achieved by simply memorising facts but through progressive, conceptual development of understanding that sets them up for P6 and beyond.

What is Sumdog's MTC?

The Sumdog multiplication tools are available to all users alongside our pathway to multiplication success. Furthermore, our heat map score report provides insight for teachers on which pupils require additional support and helps identify next steps for learners. This will allow you to plot a non-stressful pathway for your pupils to build confidence, recall and fluency that they can effectively apply to future assessments.

So in summary, our multiplication tools:

- ✓ Are available to all users.
- ✓ Assess multiplicative fluency in a fun and engaging way.
- ✓ Include insights and heat maps to identify next steps in learning.



The Sumdog Pathway to Multiplication Success

By following the Sumdog pathway to multiplication success, you will use our platform as a way to bring fun into daily fluency practice. Our Curriculum for Excellence-aligned Sumdog skills provide a means to naturally develop greater recall and understanding of multiplication facts, using our broad range of progressive and varied question content.

The Sumdog pathway to success in multiplication can be used alongside any existing schemes of work or resources you use within your classroom, and is certainly not designed to replace them. Instead, the pathway outlines how Sumdog can be used to complement, supplement and enhance your existing curriculum.

Unlike other ed-tech companies, Sumdog does not just provide opportunities to practise and develop recall speed and fluency. Our structured pedagogy and progressive question content develop pupils' conceptual understanding of multiplication, which in turn leads to increased accuracy speed, overall fluency and the application of skills beyond P5.

Our pathway encourages you to explore your pupils' thinking – using what, why and how they learn to form strategies for overcoming challenges.

Sumdog develops conceptual understanding and supports teaching and learning.



- 2. Sumdog pedagogy and journey
- 3. Low-stakes assessments
- 4. Reporting and insights
- 5. Home learning links



Sumdog <u>ALSO</u> provides opportunity to build speed and fluency, in a fun and engaging way.





- 3. Challenges to motivate
- **4.** Competition to gain recognition
- 5. Contests that boost confidence





Conceptual Understanding vs Automaticity

If you are training to become a swimming champion, the ultimate goal is to be the fastest swimmer.

However, to become the fastest, you don't just jump in and swim as fast as you can. Over the course of your training, you develop different skills such as strokes, turns and breathing. Then as these skills develop, your overall pace increases.

Automaticity of multiplication facts learned by rote can be counter productive. Pupils may have

memorised their times tables, but would they necessarily know that 4×8 is the same as 8×4 without remembering each fact individually?

At Sumdog, we build **conceptual understanding** of multiplication from P2 and provide you with a range of tools to build on this foundation. This multiplication pathway will give your pupils the opportunity to explore strategies, enquire and problem solve, alongside developing their **automaticity, fluency, accuracy and speed**.

Conceptual understanding

- + Progressive questions that develop strategies
- + Commutative, associative and distributive properties explored
- + Pathway to success
- + In game practice with thinking time
- + Patterns and relationships



Automaticity

- + Timed daily practice opportunties
- + Sumdog MTC tool to assess speed, accuracy and fluency
- + Build pupil confidence with Sumdog garden, house and avatar personalisation
- + Sumdog contests to motivate and inspire

As pupils enter Second Level, you can use the Sumdog MTC planning documentation to focus and consolidate times table knowledge and develop automaticity alongside conceptual understanding.



Sumdog Premium

The Sumdog pathway to multiplication success recommends the use of features which are included with a Premium Sumdog account. Visit **sumdog.com** to try our multiplication tools with a 30-day trial.

Premium Features

Over 30 engaging games for children to choose from

Set challenges on curriculum-aligned topics that directly match in-class teaching

Set personalised practice for times tables and use our student chooser to easily and subtly differentiate

Practise for the MTC with our MTC assessment replica

Compete in online regional and national contests every term

Create custom formative assessments or choose ready-made curriculum-aligned assessments to target intervention

Instant reporting to identify gaps in understanding

Demonstrate impact with tracking reports for your whole school, year groups, classes and individuals

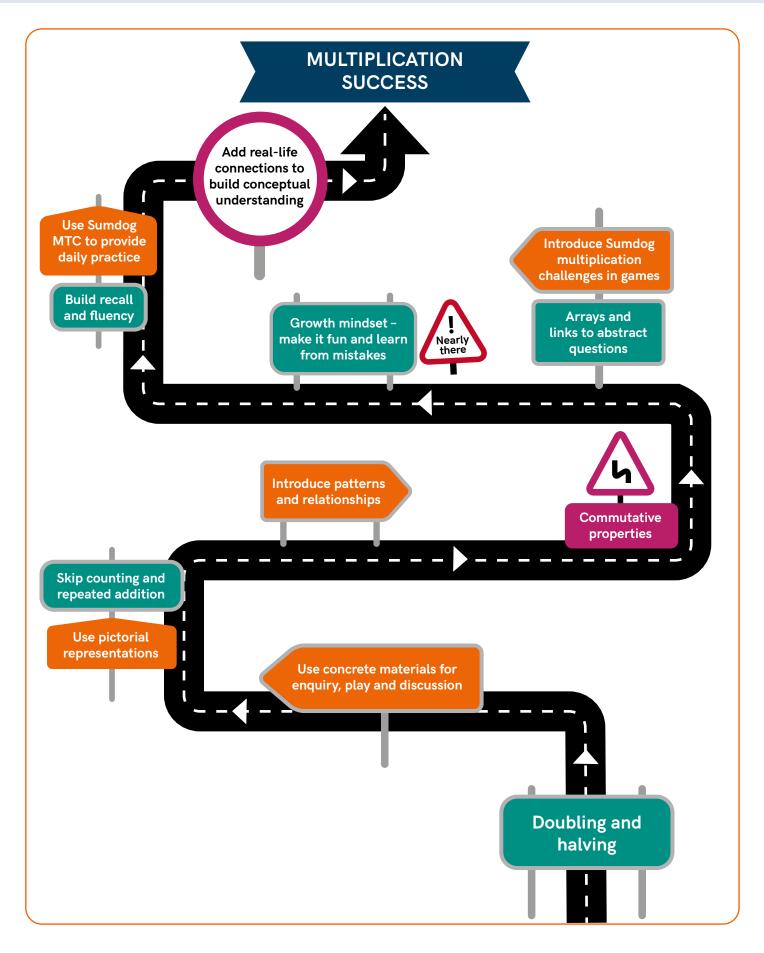
Full support with set-up and regular communication from our Support team

"We know short bursts of just 10–15 minutes on Sumdog each day can have a big impact." Neil Kelsall, National Lead Practitioner for Oasis Community Learning



The Sumdog Pathway to Multiplication Success – A Visual Guide



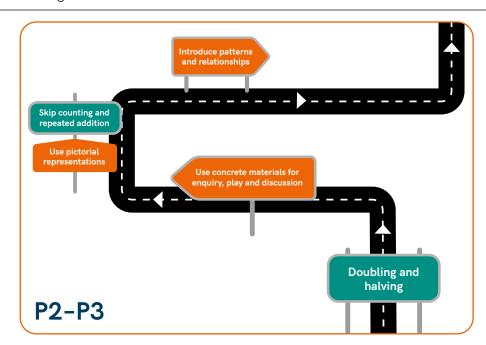


P2-P3



Teaching focus

The principal focus of mathematics teaching in P2 and P3 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the 4 operations, inclusive of using practical resources [for example, concrete objects and measuring tools].



The first half of our Sumdog learner journey focuses on the key principles of multiplication in P2 and P3.

- + Developing learner confidence through our fun and engaging games.
- + Increasing fluency through regular Sumdog practice, Curriculum for Excellence-aligned focus skills for challenges and easy-to-use pictorial representations to support and scaffold learning.
- + Supporting teachers to build on learning organically, in line with the requirements of Curriculum for Excellence benchmarks.



CfE E/Os and benchmarks

I have investigated how whole numbers are constructed, can understand the importance of zero within the system and can use my knowledge to explain the link between a digit, its place and its value.

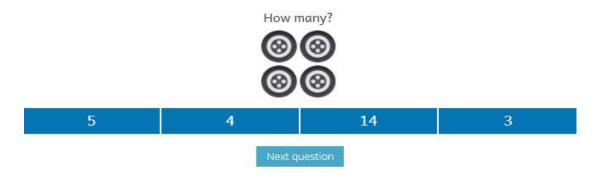
MNU 1-02a

- Counts forwards and backwards in 2s, 5s, 10s and 100s.
- Demonstrates understanding of the commutative law, for example, 6 + 3 = 3 + 6 or $2 \times 4 = 4 \times 2$.
- Applies strategies to determine multiplication facts, for example, repeated addition, grouping, arrays and multiplication facts.

P2 - Sumdog pathway to multiplication success

Children are provided with the opportunity to skip count in 2s, 5s, and 10s and to explore number through engaging pictorial representations.

Our adaptive learning algorithm works with our skills to progressively scaffold and support learning, enabling children to make connections with number so they start to recognise the patterns and natural beauty of numerical relationships, particularly by using pictorial arrays.



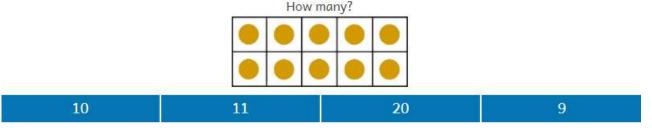
Sample questions such as the above begin to introduce the idea of sets and groupings of objects, and arrays are made up of rows and columns which are commutative in nature.



For children to engage fully with their learning, they should be equipped with the vocabulary necessary to make connections and build their metacognition. Opportunities to explore and enquire around their learning in practical ways can lead to a deeper understanding of number.

How many lots (sets)?
How many (how much) altogether, per, each?

There are 100s of iterations of each Sumdog question, giving your pupils plenty of practice of concepts within the games they play.



Questions such as the above introduce the commutative principle in multiplication, i.e. $a \times b$ and $b \times a$ are equal, 2 lots of 5 are the same as 5 lots of 2. Why not display a Sumdog question on your smartboard using the Question Viewer and begin these rich discussions around arrays?

At Sumdog, we would encourage the use of concrete materials throughout all stages of mathematics to allow pupils to manipulate, explore and investigate the patterns and relationships physically, before moving on to Sumdog practice activities. This process can be achieved by applying a play approach and by integrating Sumdog into the everyday classroom environment early.

Sumdog Assessment Opportunity

Our pre-made assessments group our questions to cover and assess the Curriculum for Excellence benchmarks for P2. They provide a means to assess pupil progress in a low-stakes, formative way. They also familiarise children with the process of completing assessments online and outside of our games. The reporting and insights that our assessment reports provide will allow you to plan the next step in the pathway.



CfE E/Os and benchmarks

I have investigated how whole numbers are constructed, can understand the importance of zero within the system and can use my knowledge to explain the link between a digit, its place and its value.

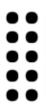
MNU 1-02a

- Counts forwards and backwards in 2s, 5s, 10s and 100s.
- Demonstrates understanding of the commutative law, for example, 6 + 3 = 3 + 6 or $2 \times 4 = 4 \times 2$.
- Applies strategies to determine multiplication facts, for example, repeated addition, grouping, arrays and multiplication facts.

P3 - Sumdog pathway to multiplication success

As the use of Sumdog increases within your classroom, why not try setting some focus skills around multiplication that children can try at home? The platform will be one they are familiar with and there is no marking for you to do, Sumdog will provide you with all the insights and reporting you need.

Begin to formally introduce the concept of doubling and halving to children, increasing the use of skip-counting and familiarity with simple multiplication facts.



2+2+2+2 2+2+2+2+2 10+10+10+10+10

2+2+2+2+2



Sample questions such as the above begin to expand on the use of arrays in developing the conceptual understanding of multiplication.

We recommend still using concrete materials within the classroom to support this understanding, but as the children develop their metacognition abilities you can begin to expand and challenge their thinking around the concepts by posing questions verbally. For example:

I am not sure whether 2 x 5 is the same as 5 x 2?

Our pictorial questions make use of rectangular arrays to make the commutative property self-evident. And as always, you can set specific focus skills on Sumdog or let our algorithm adapt to your pupils. Sumdog questions such as the following example help cement the foundations of multiplicative relationships.



In turn, this leads to the development of mathematical language skills to communicate those foundations.

Similarly, as we begin to introduce doubling and halving children become aware of the scaling properties of multiplication and the repeated aggregation of numbers. Children begin to make the connection that unlike addition where we increase a quantity by a certain amount, with multiplication we are increasing a quantity by a scaling factor and the connections between numbers begin to fall into place. For example:

If I have 4 sets of 2 counters then how many counters altogether?

Sumdog is the perfect platform to set low-stakes practice to bridge the gap between concrete materials and pictorial and abstract representations of number. By the end of P3, children should know their 2, 5, 10 times tables, which form the basis of necessary understanding for upcoming work in P4 and P5.



Ideas for using Sumdog effectively to build fluency in P2-P3:

- Display our sample questions on your smart board using the Question Viewer and use this as the basis to develop metacognition and the vocabulary of multiplication as a class.
- Set challenges on specific focus skills for use in the classroom and at home, making use of our extensive teaching reports to identify gaps in multiplication recall and inform next steps.
- Make use of our low-stakes pre-made assessments to formatively assess your pupils' understanding and use our enhanced reporting to track and monitor progress.
- Encourage play, enquiry and the use of concrete materials in your classroom, and begin to connect concrete arrays to Sumdog pictorial questions. Most of our questions are read-aloud at this stage.
- Why not set your own, fun classroom competition or challenge focussed on the 2, 5 or 10 times tables? You can choose how many questions the pupils answer and reward them for their effort in our Sumdog house and garden.

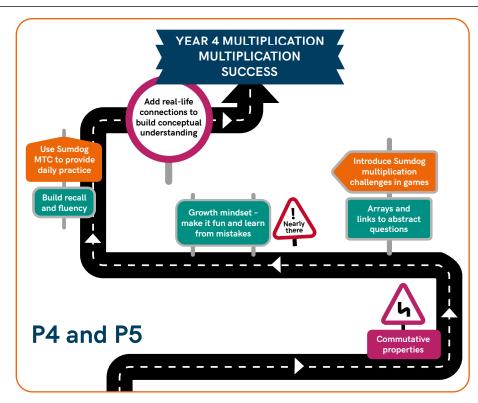
P4-P5



Teaching focus

The principal focus of mathematics teaching in P4-P5 is to ensure that pupils become increasingly fluent with whole numbers and the 4 operations.

By the end of P5, pupils should have memorised their times tables and should be able to show precision and fluency in their work.



As pupils continue their Sumdog learner journey, we begin to focus on the key principles of multiplication in P4 and P5:

- + Introducing and expanding on the commutative properties of multiplication.
- + Building recall and fluency through the use of the Sumdog MTC tool and real-life connections.
- + Encouraging a growth mindset approach to learning; children are going to make mistakes in their recall and should be reminded that this is OK.



CfE E/Os and benchmarks

I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.

MNU 1-03a

- Uses multiplication and division facts to solve problems within the number range 0 to 1000.
- Applies strategies to determine multiplication facts, for example, repeated addition, grouping, arrays and multiplication facts.

P4 - Sumdog pathway to multiplication success

By this stage children will be familiar with the Sumdog platform, they will likely have used the coins they have been earning to decorate their house and garden, and will be used to taking part in school competitions and challenges and nationwide contests.

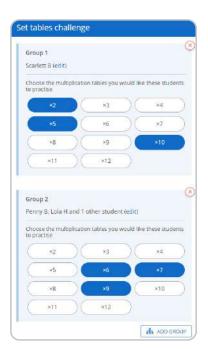
This stage presents an ideal opportunity to begin to introduce the Sumdog MTC. If you can build your confidence using the Sumdog MTC, then you are setting your pupils up for success in other areas of numeracy and maths.

Your pupils do not need to worry, panic or stress as Sumdog is a familiar environment, but will still give them the opportunity to practise their recall and build fluency, as well as enabling you to identify the next steps in their learning.

We make it easy for you to differentiate the multiplication practice for your pupils.

Find out how on the next page!



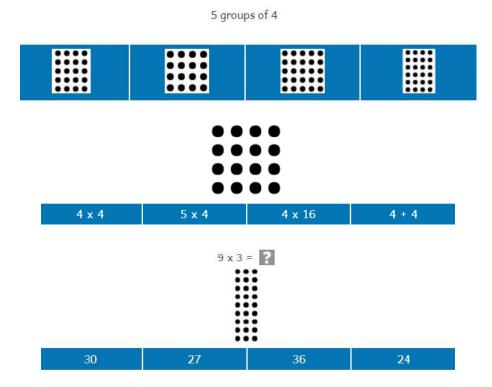


Using our enhanced pupil chooser, you can select which tables you want individual pupils to practise – allowing you to subtly differentiate the learning in a supportive context that doesn't make any pupil feel inferior.

From your pupils' perspective, they are simply playing Sumdog, but you know the specific tables that you have set for each pupil or group.

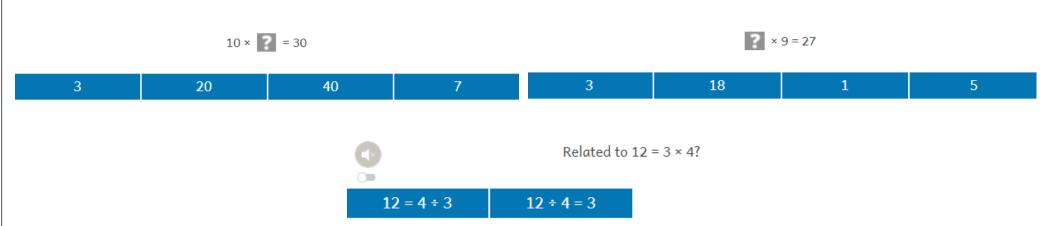
At Sumdog we continue to give you the tools to increase your pupils' confidence as they build their fluency.

Using our curriculum-aligned Sumdog skills and adaptive learning algorithm, we expand the knowledge gained from arrays and begin to make direct links to multiplication and the mathematical language that has been developed at the start of First Level as pupils tackle new times tables. Remember, our questions have 100s of iterations, so the potential for practice is enormous!





At this stage, the understanding of multiplication as repeated addition is well established through play, enquiry and the concrete and pictorial representations of numbers, and your pupils will be well versed in their 2, 5 and 10 times tables. By the end of First Level, pupils will be expected to know their 3, 4 and 8 times tables and our questions at this level will begin to encourage children to spot patterns and relationships, using questions formats such as missing numbers and abstract representations of questions.



We give plenty of opportunity for children to practise multiplication statements.

This learning begins to build on the commutative foundations from P2-P3 and introduces the laws of associative and distributive properties.

Commutative - 5 x 28 is the same as 28 x 5 = 140

Associative -
$$(5 \times 14) \times 2 = 140$$

Distributive - $(20 \times 5) + (8 \times 5) = 140$



Understanding these properties highlights differing strategies for children to increase their mental agility in answering more complicated multiplication questions, within real-life contexts in particular.



A store has 8 boxes of eggs. There are 8 eggs in each box. How many eggs will there be altogether?

8 × 8	16 × 8	8 - 8	8+8

Remember - Sumdog is about more than just memorisation and practice.

We help you to develop your pupils' multiplication fluency and understanding, leading in turn to speed, accuracy and fluency.

The Sumdog MTC, multiplication practice and sample questions are ideal components to incorporate into your lesson planning, classroom environment and home learning opportunities.

Using our platform will support your teaching of multiplication fluency and provide the opportunity for low-stakes practice that is not time-pressured or demotivating.





CfE E/Os and benchmarks

Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.

MNU 2-03a

• Uses multiplication and division facts to the 10th multiplication table.

P5 - Sumdog pathway to multiplication success

As the Sumdog pathway to multiplicative fluency reaches its destination, it is now important that your pupils can recall all their multiplication facts.

For some pupils, we know this can seem a huge milestone but we hope that by following our structured approach the foundations have been laid and that they will be confident in recalling and using their times tables.

The combination of the Sumdog MTC and our competitions, challenges, contests and low-stakes assessments continues to give you opportunities to direct and focus learning and for the children to continue to build confidence, fluency and recall.

At Sumdog, we believe that in order for children to experience continuous development and success in mathematics, the groundwork must be laid from P2 onwards and our platform has been designed to help teachers provide this.

There will of course be pupils at this stage who are still struggling to grasp certain multiplication concepts, and Sumdog can also function as an early intervention solution to get them back on track. We would also recommend that you:

- Provide pupils the opportunity to build on their confidence with ad-hoc methods of tackling multiplication.
- Provide them with plenty of practice in mental multiplication by 1, 2, 5 and 10.
- Make explicit the patterns and relationships within multiplication.

These patterns and relationships can be a massive help to children who are struggling. For example, if a pupil cannot reliably calculate the product of 6 and 8, then start with $6 \times 2 = 12$ before doubling it to get $6 \times 4 = 24$ and doubling again to get $6 \times 8 = 48$.

Similarly, if a pupil cannot remember what 7×8 is but they are more comfortable with $6 \times 8 = 48$, then suggest they work out 7×8 by adding on another 8 = 56. Alternatively, they could use $5 \times 8 = 40$ and $2 \times 8 = 16$ to deduce that $7 \times 8 = 40 + 16 = 56$.



By using Sumdog, by P5 your pupils will be well acquainted with the commutative, associative and distributive properties which will both support them and encourage them to spot the patterns and relationships within the numbers that lead to faster recall.

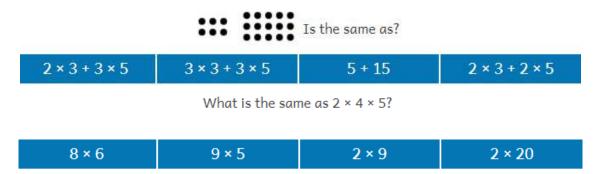
When a pupil is struggling, use Sumdog to encourage and motivate them to practise their times tables and use your in-class teaching to highlight the particular areas and strategies you want to focus on. These types of patterns and relationships provide the basis for pupil enquiry-based learning and the development of metacognition.

For example:

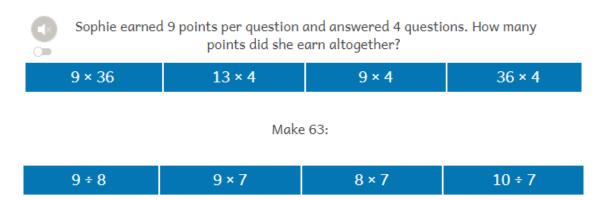
- There is no 1 times table to learn as the product is the same as the original number, reducing the number of facts to learn.
- The 10 times table was taught comprehensively at P2 and P3 so most pupils will be able to quickly and easily recall this.
- Similarly, the 11 times table builds on the 1 times table and the duplicating of the tens and unit digits means it is one that pupils often find easier.
- The 2 times table is doubling and through the use of concrete materials alongside skip-counting methodologies they should be familiar with this.
- Learning times tables in pairs can make it easier for children, particularly if they have the conceptual understanding of commutative laws that Sumdog has been building, e.g. $3 \times 7 = 21$ and $7 \times 3 = 21$.
- An understanding of squared numbers can also support pupils, as well as an appreciation of multiplication as repeated addition, e.g. if you know 3 x 8 is 24 then you can work out 3 x 9 is 27.
- The 9 times table has a very distinctive pattern of going up and down.
- Answers in the 5 times table end in a 5 or a 0.
- Odd factors x odd factors = odd products, odd factors x even factors = even products, even factor x even factor = even product.



The following sample questions clearly show the progression within our product as we encourage pupils to make connections to times tables for themselves and build their understanding of patterns and relationships around multiplication facts.



We continue to create real-life connections and scenarios that allow pupils to apply their knowledge of multiplication to familiar contexts, allowing them to see how multiplicative fluency will continue to be a valuable asset.





2 × 8 = 16 8 × 12 = 96 2 × 32 = 64 12 × 8 = 96

Related to $9 \times 1 = 9$?

1 × 9 = 9 9 × 9 = 9

Finally, we make links to the abstract way that children learn to multiply large numbers, using chimney or column sums, in preparation for their journey into the world of long multiplication.

Which is true?



By playing Sumdog from P2, your pupils will have experienced 100s of practice questions in a range of formats and styles that build their conceptual understanding of multiplication.

The following page provides teachers with a structured approach to using Sumdog to build automaticity of the multiplication facts within your classroom. This plan could be accompanied by in-class times table songs, games and chants and is ideal for use as a home learning plan.



Building automaticity with Sumdog using the Sumdog multiplication tools

When your pupils select the tables challenge that you have set, they will be presented with it within the familiarity of our engaging and fun games. You will be able to view the results and plan targeted support in your teaching.

Times table challenges can be set for home learning or integrated within the classroom and you can decide how many questions each pupil needs to answer. The plan below is a suggested structured guide, but by using our pupil chooser you can easily differentiate the focus for individuals or groups.

TERM 1	TERM 2	TERM 3
Week 1 – 2 times table	Week 8 - Sumdog MTC	Week 15 - Sumdog MTC
Week 2 – 4 times table	Week 9 – 8 times table	Week 16 – 3, 4, 5, 6 times tables
Week 3 – 3 times table	Week 10 – 9 times table	Week 17 - Sumdog MTC
Week 4 – 6 times table	Week 11 – 3, 4 and 5 times table	Week 18 – 7, 8, 9, 10 times tables
Week 5 – 5 times table	Week 12 – 10 times table	Week 19 – 11 and 12 times tables
Week 6 – 7 times table	Week 13 - Sumdog MTC	Week 20 - 3, 4, 5, 6, 7, 8 times tables
Week 7 – 6 and 7 times table	Week 14 - 11 and 12 times tables	Week 21 - 9, 10, 11, 12 times tables

Our Assessment Library also contains a range of pre-made assessments for all year groups on curriculum-aligned topics such as 'Estimation & Rounding', and can be used to accurately assess pupils' conceptual understanding and ability to apply their knowledge in a range of contexts.



Contact us today to start your pupils on their pathway to multiplication success.

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www.sumdog.com