

National curriculum assessments

Key stage 2

Multiplication tables check assessment framework

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Summary

This assessment framework specifies the purpose, format, content and cognitive demand of the multiplication tables check (MTC).

Who is this publication for?

The framework is written primarily for those who write assessment materials and to guide subsequent development and assessment construction. It is available to a wider audience for openness and transparency.

1. Overview

1.1 Purpose of the MTC assessment

The purpose of the MTC is to determine whether year 4 pupils can fluently recall¹ their multiplication tables. Although the check will help schools to identify pupils who require additional support, it is not intended as a diagnostic tool.

1.1.1 Use of data

Once the assessment is statutory, the data will be used in the following different ways:

- school-level results and individual pupil results will be made available to schools. This will allow them to provide additional support to pupils who require it
- as is the case with the Phonics Check, school-level results will be available to selected users including Ofsted via the Analyse School Performance (ASP) data system²
- national results will be reported by the Department for Education (DfE) to track standards over time
- national and local authority results will be reported by the DfE to allow schools to benchmark the performance of their pupils

School level results will not be published in performance tables.

1.2 About this framework

The framework provides guidance for the development of the MTC assessment. It provides details of the content of the MTC, which is based on one element of the national curriculum (2014) for mathematics. The cognitive processes that are central to the MTC are also detailed.

Also included in this framework is an assessment specification from which valid, reliable and comparable assessments can be constructed each year. Validity and reliability evidence is generated as part of the test development process used by the Standards and Testing Agency (STA). The evidence is collected through expert review, trialling and targeted research. The assessment framework does not provide detail of the validity and

¹ The quick retrieving of known information with ease and accuracy

² ASP is a secure system where Department for Education users, schools, academies, multi-academy trusts (MATs), local authorities (LAs), Ofsted inspectors and school governors can access detailed school performance data to help support school improvement.

reliability of individual assessments. This will be provided in the assessment handbook, which will be published following the first live administration of the MTC.

The assessment framework should be used with the national curriculum (2014). Once the assessment becomes statutory in the 2019/20 academic year, it should also be used with the annual assessment and reporting arrangements (ARA) document.

2. About the MTC

The MTC is a key stage 2 (KS2) assessment to be taken by pupils at the end of year 4.

The MTC is focused on the fluent recall of multiplication facts. This is included in the national curriculum (2014) statutory programme of study for mathematics at key stage 1 (KS1) and KS2.

The MTC will be delivered as an online, on-screen digital assessment. Under standard administration, the check will take each pupil less than 5 minutes to complete. It will be automatically scored, and results will be available to schools once the assessment window closes.

2.1 Population to be assessed

The MTC will be available as a voluntary check in the 2018/19 academic year. Schools can decide whether they wish to participate.

Subject to approval from Parliament, the MTC will be statutory from the 2019/20 academic year. All eligible year 4 pupils who are registered at maintained schools, special schools or academies (including free schools) in England will be required to take the check.

Some pupils may be withdrawn from the assessments. Further details will be provided in the ARA, which will be published in autumn 2019.

2.2 Requirements for administering the MTC

The MTC will be delivered on-screen (using a computer or tablet) and online (using an internet connection). Schools will need to provide appropriate IT equipment to take the check. Information on IT equipment and operating systems are covered more comprehensively in the MTC administration guidance. This will be available before the national voluntary rollout in the 2018/19 academic year.

No other equipment or resources are required.

Resources that would assist a pupil with working out the answers (such as calculators), or provide the answers to multiplication questions (including wall displays), should be removed from the room in which the MTC is administered.

3. Content domain

The content domain for the MTC is based on the national curriculum (2014). The national curriculum states, 'By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work'.

The year 4 programme of study for mathematics also states, 'Pupils should be taught to recall multiplication and division facts for multiplication tables up to 12×12 '. The MTC only assesses the instant recall of multiplication facts. Multiplication and division in a wider context will continue to be assessed through the KS1 and KS2 mathematics assessments.

You can find further details on the assessment and question format, and assessment content, in section 5.

4. Cognitive domain

The cognitive domain seeks to make explicit the thinking skills and intellectual processes required for the MTC. As all questions in the MTC follow the same format and require the same recalling of facts from long term memory, and the same type of response, all questions are considered to have the same level of cognitive demand and are therefore not rated individually. The requirement to recall multiplication facts quickly will be the main source of cognitive demand for items in the MTC. The requirement to answer at speed is key to assessing fluent recall of multiplication tables. A time limit of 6 seconds per item has been set for the MTC. This allows pupils the time required to demonstrate their recall of multiplication tables, whilst limiting pupils' ability to work out answers to the questions³.

³ The 6-second time limit was informed by research undertaken by STA. 1124 pupils took part and 3 time limits were trialled. Six seconds was deemed the most appropriate time to allow children to recall and input their responses without allowing enough time to work out the answer. Further information about the research will be provided in the assessment handbook, which will be published following the first live administration of the MTC.

5. Assessment specification

This section provides details of the specification used to construct check forms for the MTC.

5.1 Assessment format

The MTC will be administered as an online, on-screen assessment. The MTC will be administered to pupils in year 4. The check will be available over a 3 week window in June each year. Schools can choose to administer the check at any time within this window. Further detail will be available in the ARA.

The assessment will consist of multiple, equivalent forms and each pupil will be randomly assigned one of the available forms. If, for any reason, a pupil needs to restart the check, they will be randomly assigned a different form. Each form consists of 25 questions worth one mark each. Items are not ordered according to difficulty. Questions will all follow the same format⁴:

$$n1 \times n2 = \boxed{}$$

Pupils will have 6 seconds to enter a response to the question. The 6 seconds start as soon as the question appears. Pupils will be able to input their response using the computer keyboard, a mouse (or equivalent) and the on-screen number pad, or a touchscreen device and the on-screen number pad. Once the pupil has input their answer, they can press enter to proceed, or wait until the time expires. Once the question is answered, there will be a 3 second pause before the next question appears.

Pupils and schools will be able to access a practice area prior to the check window opening, in order to become familiar with the MTC format.

5.2 Assessment content

Items will be selected from the 121 items that make up the 2 to 12 multiplication tables. The one multiplication table is not included in the check, although questions from the one multiplication table may be included as practice questions.

⁴ Question is shown at the size it will appear in the check.

In order to check if pupils have fluent recall of the multiplication tables, a breadth of items will be included in each check. This will include items of different difficulties and representation from the different multiplication tables, with an emphasis on multiplication tables taught at KS2. Tables 1 and 2 set out the maximum and minimum number of items in each check form from each multiplication table⁵.

5.2.1 Table 1 – Multiplication table limits in the MTC

Multiplication Table	Minimum number of items in each form	Maximum number of items in each form
1	Not applicable	Not applicable
2	0	2
3	1	3
4	1	3
5	1	3
6	2	4
7	2	4
8	2	4
9	2	4
10	0	2
11	1	3
12	2	4

Table 1 shows the upper and lower limits for the number of items from each multiplication table that can be included in each check form.

There is an emphasis on the 6, 7, 8, 9 and 12 multiplication tables because these have been determined to be the most difficult multiplication tables.

⁵ When constructing tests the first number in the question will denote the multiplication table the question is part of, for example, 4×12 would be considered part of the 4 multiplication table. The maximum and minimum numbers in tables 1 and 2 will be applied to the first number in the multiplication. However, the secondary number will also be monitored to ensure instances of each number are within +/-1 of the minimum and maximum parameters.

5.2.2 Table 2 – KS1 and KS2 item limits in the MTC

Key Stage	Items available	Minimum number of items in each form	Maximum number of items in each form
KS1	33	3	7
KS2	88	18	22

Table 2 shows the upper and lower limits for the number of KS1 items (the 2, 5 and 10 multiplication tables) and KS2 items to be included in each check form. As a KS2 assessment of multiplication tables mastery, the majority of the items in each form will be drawn from the KS2 curriculum. Multiplication tables taught at KS1 will be minimised, but are included to ensure an appropriate breadth of coverage.

Multiple check forms will be constructed for each administration. Because of the limited pool of items, and to meet the assessment specification above, there will be an overlap of questions between each form. However, no form should have more than 30% of the same items as any one other form. This ensures that if a pupil requires a restart of the MTC, the benefit of having already taken another form will be minimised.

Each question can only appear once in any one form, and reversals of a question will not appear in the same form (for example 3×8 would not appear in the same form as 8×3). Reversals will not be counted within the 30% overlap discussed above.

5.3 Scoring

The system will automatically score the MTC. Only numeric inputs will register as a response, and every numeric input made by a pupil is shown on-screen. When a pupil presses 'enter', or the time runs out, the numbers displayed on-screen are accepted as the pupil's response and scored accordingly.

5.4 Results and reporting

At the end of the assessment window, a total score out of 25 will be reported to each school for all of their pupils who took the check.

There will be no expected standard threshold for the MTC.

5.5 Desired psychometric properties

The check will determine whether a pupil can fluently recall multiplication tables. Therefore, there is no standard for the MTC beyond the number and percentage of pupils who achieve full marks. Multiple forms are used in the MTC and equivalent forms are

constructed by using item difficulty information (collected during pre-testing) and adhering to the assessment specification outlined in section 5. Fluency is the focus of the MTC, and check forms are constructed to effectively assess this. However, it must also measure a pupil's ability across the spectrum of attainment. The assessment must aim to minimise the standard error of measurement at every point on the ability scale.

6. Diversity and inclusion

The Equality Act 2010 sets out the principles by which the national curriculum assessments and associated development activities are conducted. During the development of the check, STA will make provision to overcome barriers to fair assessment for individuals and groups, wherever possible.

Assessments are also required to meet [Ofqual's regulatory framework](#)⁶ which states, 'An assessment should minimise bias, differentiating only on the basis of each pupil's level of attainment. A pupil should not be disadvantaged by factors that do not relate to what is being tested.'

The MTC should:

- use appropriate means to allow all pupils to demonstrate their knowledge of multiplication tables
- provide opportunities for all pupils to achieve, irrespective of gender, including pupils with special educational needs, pupils with disabilities, pupils from all social and cultural backgrounds and those from diverse linguistic backgrounds
- use materials that are familiar to pupils and for which they are adequately prepared
- not be detrimental to pupils' self-esteem or confidence

The MTC development process uses the principles of universal design. Whilst the MTC is predominantly number-based, the instructions and layout have been prepared using the principles of plain English and universal design wherever possible. Consultation and user research have taken into account feedback from a range of pupils, teachers, and other educational professionals. Special educational needs and disabilities (SEND) organisations and experts have been consulted. Issues likely to be encountered by pupils with specific learning difficulties have been considered in detail and addressed for the standard assessment and through access arrangements where appropriate.

An equalities impact assessment for the MTC will be published prior to the national rollout of the assessment in 2020.

⁶ <https://www.gov.uk/government/publications/regulatory-framework-for-national-assessments>

6.1 Access arrangements

Once the MTC is statutory, the range of access arrangements applicable to the MTC will be set out in the ARA document. In the 2018/19 academic year, details about access arrangements will be provided in the MTC administration guidance.

Appendix 1: Glossary of terminology used in the MTC assessment framework

Assessment framework	A document that sets out the principles, rationale and key information about the assessment and contains an assessment specification.
Assessment specification	A detailed specification of what is to be included in an assessment in any single cycle of development.
Check form	The MTC will consist of various forms, and each pupil will take one check form. Each form will contain 25 questions and will be of an equivalent difficulty.
Cognitive domain	Cognitive processes refer to the thinking skills and intellectual processes that occur in response to a stimulus. The cognitive domain makes explicit the thinking skills associated with an assessment.
Content domain	The body of subject knowledge to be assessed by the assessment.
National curriculum	For each subject and key stage, the national curriculum outlines the content and skills that should be taught in schools.
Online assessment	An assessment that is delivered via the internet.
On-screen assessment	An assessment that is delivered using an electronic device such as a computer or tablet.
Programme of study	The statutory curriculum of subject knowledge, skills and understanding for a key stage. The KS1 and KS2 programmes of study are published on GOV.UK ⁷ .

⁷ www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum



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