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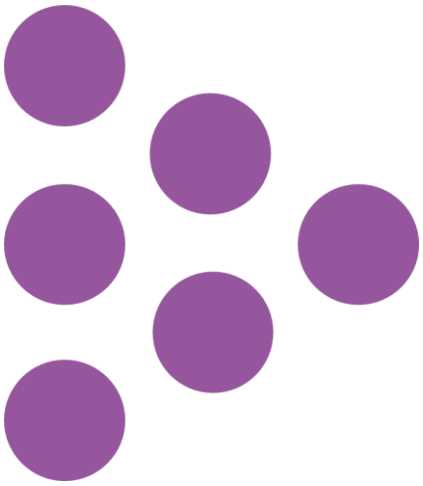
Report

# National Reference Test Results Digest 2023

## National Foundation for Educational Research (NFER)



# National Reference Test Results Digest 2023

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# Contents

# 1. Introduction

Ofqual has contracted the National Foundation for Educational Research (NFER) to develop, administer and analyse the National Reference Test (NRT) in English and maths. The first NRT took place in 2017 and established a baseline from which any future changes in standards can be detected. This report represents an overview of the findings of the 2023 testing process.

The NRT, which consists of a series of test booklets, provides evidence on changes in the performance standards in GCSE English language and maths in England at the end of key stage 4. It does this by testing content taken from the GCSE English and maths curricula. It has been designed to provide additional information to support the awarding of GCSEs in English language and maths and is based on a robust and representative sample of Year 11 students who will, in the relevant year, take their GCSEs.

More information about the NRT can be found in the NRT document collection.

The first live NRT took place in 2017. The outcomes of the 2017 GCSE examinations in English language and maths provided the baseline percentages of students at 3 grade boundaries and these were mapped to the NRT for 2017 to establish the corresponding proficiency level. The percentages of students achieving those proficiency levels in each subsequent year are calculated and compared.

The NRT structure is intended to remain the same each year. For each of English and maths, there are 8 test booklets in use. Each question is used in 2 booklets, so that effectively all the tests can be analysed together to give a single measure of subject performance. This is similar to other studies that analyse trends in performance over time, for example, international surveys such as Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS).

This report provides summarised information of the key performance outcomes for English and maths in 2023 and provides information on the changes from the baseline standards established in 2017. It also includes data on the achievement of the samples, their representativeness and the performance of the students on the tests. Further information on the nature of the tests, the development process, the survey design and its conduct, and the analysis methods used is provided in the Background Report included the accompanying document: National Reference Test: General information.

## 2. The sample

The NRT took place between 20 February and 7 March 2023. The numbers of participating schools and students are shown in Table 2.1 and Table 2.2. In 2023, the number of schools in the sample was consistent with previous years (apart from 2021, when participation was impacted by the pandemic) and was above target.

The sample was stratified by the historical attainment of schools in GCSE English language and GCSE maths and by school size. In addition, the types of schools were monitored. Checks were made on all 3 of these variables to ensure that the achieved sample reflects the sampling frame. Students at independent schools are under-represented in the NRT, which may have contributed to a slight deviation between the distribution of school historical GCSE performance for the achieved sample relative to the sampling frame at the upper end of the distribution, but this difference is small and broadly consistent across the years. Overall, the match in historical GCSE performance between the sample and population is very good, confirming the quality of the sample.

Table 2.2 shows the number of students in the final sample for whom booklets were dispatched and the number completing the tests for both English and maths. As this shows, just over 80% of students who were selected took part in the tests. In total, 1,570 students from 343 schools were recorded as non-attendees during the English NRT, which is 19% of the total number of 8,248 students allocated tests during student sampling[1] spread across the schools participating in the assessment. A total of 1,585 students from 341 schools were recorded as non-attendees during the maths NRT, which is 19% of the total number of 8,200 students allocated tests during student sampling spread across the schools participating in the test.

The pattern of non-attendance is similar in maths to English. The principal reason given for non-attendance was absence due to illness or other authorised reason, which accounted for 64% of non-attendance for English and 65% of non-attendance for maths. Students being absent from the testing session but present in school remains the second most frequently recorded reason, accounting for 13% of non-attendance in both subjects. Of the remaining reasons for non-attendance, 5% of students for both English and maths were withdrawn by the headteacher and around 5% of students were studying at a different venue (5% for English and 4% for maths).

The percentage of non-attendance in 2023 was similar to that seen in 2022 but was higher than pre-pandemic cycles of NRT. Student participation rates in 2023 were 81% for English and maths. Although very slightly higher than the attendance achieved in 2021, this is lower than the student participation rates achieved in pre-pandemic years of NRT (between 84% and 86%) but comparable with the response rate required in large scale international studies. The lower participation rates for the NRT in 2023 reflect the higher absence rates in the state secondary school population in March 2023 compared with pre-pandemic rates, indicating that students were absent from school rather than absent from the NRT administration specifically.

[1] Two schools were allocated tests but were not included in the final results; one school withdrew during the testing window due to exceptional circumstances; one school the parcel went missing in transit to NFER and arrived too late to be included in the data set.

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**Table 2.1 Target sample sizes and achieved samples in current and previous years**

| Subject | NRT Target Sample | Achieved sample 2023 | Achieved sample 2022 | Achieved sample 2021 | Achieved sample 2020 | Achieved sample 2019 | Achieved sample 2018 | Achieved sample 2017 |
|---|---|---|---|---|---|---|---|---|
| **English:** Number of Schools | 330 | 343 | 334 | 214 | 332 | 332 | 312 | 339 |
| **Maths:** Number of Schools | 330 | 341 | 334 | 216 | 333 | 331 | 307 | 340 |

**Table 2.2. Completed student test returns for English and maths in all NRT administrations**

| Year | No. of students: dispatched English tests | No. of students: completed English tests | % of students: completed English tests | No. of students: dispatched maths tests | No. of students: completed maths tests | % of students: completed maths tests |
|---|---|---|---|---|---|---|
| 2023 | 8,200 | 6,630 | 81 | 8,152 | 6,567 | 81 |
| 2022 | 7,969 | 6,457 | 81 | 7,961 | 6,406 | 80 |
| 2021 | 5,124 | 4,030 | 79 | 5,152 | 4,143 | 80 |
| 2020 | 7,845 | 6,639 | 85 | 7,886 | 6,756 | 86 |
| 2019 | 7,928 | 6,739 | 85 | 7,917 | 6,825 | 86 |
| 2018 | 7,354 | 6,193 | 84 | 7,320 | 6,169 | 84 |
| 2017 | 8,040 | 7,082 | 88 | 8,080 | 7,144 | 88 |

## 2.1. Access arrangements

The NRT offers access arrangements consistent with JCQ requirements (for GCSE examinations) in order to make the test accessible to as many sampled students as possible. Schools were asked to contact NFER in advance of the NRT to indicate whether any of their students required modified test materials or if students' normal working practice was to use a word processor or laptop during examinations. In cases where additional time would be needed for particular students, schools were asked to discuss this need with the NFER test administrator and ensure that the extra time for the testing session could be accommodated. All requests from schools for access arrangements and the type of arrangement required were recorded. Table 2.3 shows the different types of access arrangements that were provided to students for the 2023 NRT, organised by NFER. This table includes instances where students required more than one access arrangement. These are the access arrangements facilitated by NFER for the NRT in 2023; we do not collect complete data on the permitted arrangements that are organised by the school such as readers, scribes, extra time and examination pens so they are not included in the table below. Overall, the percentage of students requesting access arrangements for the NRT has increased to 6.8% compared with 4.3% in 2022.

**Table 2.3. Number of access arrangements facilitated by NFER in 2023**

| Arrangement provided | No. of students English | No. of students maths | Total number of students | % of sampled students |
|---|---|---|---|---|
| Word processor | 366 | 255 | 621 | 4.7 |
| Different colour test paper | 129 | 132 | 261 | 2.0 |
| Modified enlarged print and enlarged copies | 10 | 7 | 17 | 0.1 |
| Braille | 0 | 0 | 0 | 0 |
| Total | **505** | **394** | **899** | **6.8%** |

NB: Due to some students having multiple access arrangements, they will be featured twice in the table.

# 3. Results for the test booklets in 2023

Details of the analysis procedures are given in the accompanying document: Background Report: National Reference Test Information. The analysis process followed a sequence of steps. Initially, the tests were analysed using Classical Test Theory to establish that they had performed well, with appropriate difficulty and good levels of reliability. The subsequent analyses used Item Response Theory (IRT) techniques to link all the tests and estimate the ability of all the students on a common scale for each subject, independent of the test or items they had taken. These ability estimates were then used for calculating the ability level at the percentiles associated with the GCSE grade boundaries in 2017. From 2018 onwards, the percentages of students achieving above these baseline ability levels are established from the NRT.

## 3.1. English

The results of the Classical Test Theory analyses are summarised in Table 3.1. This shows the range of the main test performance statistics for the 8 English test booklets used.

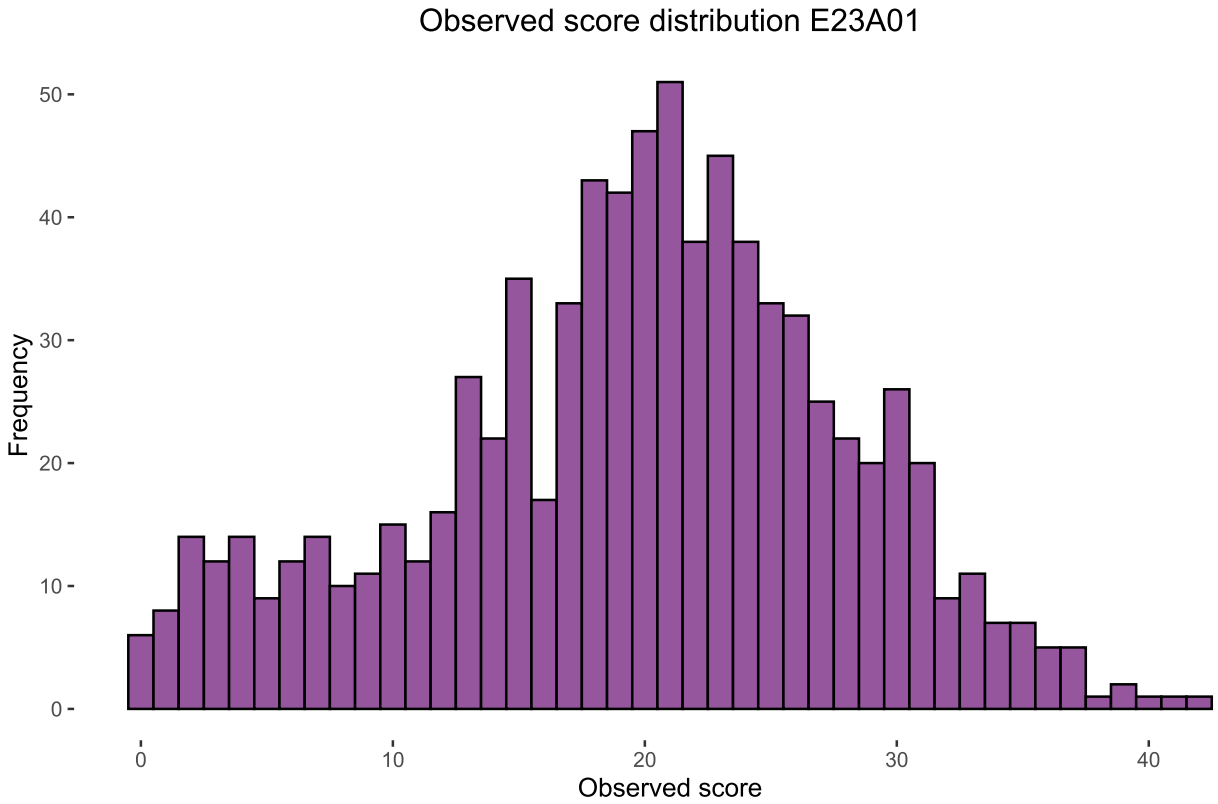
**Table 3.1. Range of Classical Test Theory statistics for the English tests in 2023**

| Classical Test Theory statistic | Minimum | Maximum |
|---|---|---|
| Number of students taking each test booklet | 818 | 863 |
| Maximum score attained (out of 50) | 40 | 44 |
| Average score attained | 18.84 | 20.28 |
| Standard deviation of scores attained | 8.36 | 9.38 |
| Reliability of the tests (Coefficient Alpha) | 0.77 | 0.80 |
| Average percentage of students attempting each item (%) | 91 | 94 |

These results show that the English test booklets functioned well, and similarly to previous years. The booklets were challenging, with few students attaining more than 40 marks and average scores somewhat less than half of the available marks. Maximum raw scores ranged from 40 to 44 across the 8 booklets, showing a narrower range compared with 2022 where maximum raw scores were between 40 and 47. The standard deviation shows that the scores were well spread out, allowing discrimination between the students. This is confirmed by the reliability coefficients, which are at a good level for an English test of this length. Finally, the average percentage of students attempting each item was more than 90% for all booklets, indicating that the students were engaging with the test and attempting to answer the majority of questions.

These results were confirmed by the distribution of scores students achieved on the tests. This is shown for one of the tests in Figure 3.1. It is an example of one test booklet only but the distributions were similar for the other tests. The figure shows that students were spread across the range, although no students attained the very highest marks.

**Figure 3.1. Score distribution for one of the English tests**




In addition, a full item analysis was carried out for each test, in which the difficulty of every question and its discrimination were calculated. These indicated that all the questions had functioned either well or, in a small number of cases, adequately and there was no need to remove any items from the analyses. Additionally, an analysis was conducted to establish if any items had performed markedly differently in 2023 compared with the previous years. Where there are such indications, a formal procedure is followed for reviewing the items to establish whether there could be an external reason for the change. In 2023, no items were removed from the link between years, so all items were treated as common with the previous year.

Using the common items, the IRT analysis equated the 8 tests. The IRT analysis also used the items common between years to equate the tests over years, allowing ability estimates for students in all 7 years to be on the same scale. After this had been done, the results showed that the mean ability scores for students were similar for all the tests, confirming that the random allocation to tests had been successful. The results also showed that the level of difficulty of the 8 tests was fairly consistent, with only small differences between them.

Both the Classical Test Theory results and the IRT results for the English tests showed that these had functioned well to provide good measures of the ability of students, sufficient for estimating averages for the sample as a whole.

## 3.2. Maths

The results of the Classical Test Theory analyses are summarised in Table 3.2. This shows the range of the main test performance statistics for the 8 maths tests used.

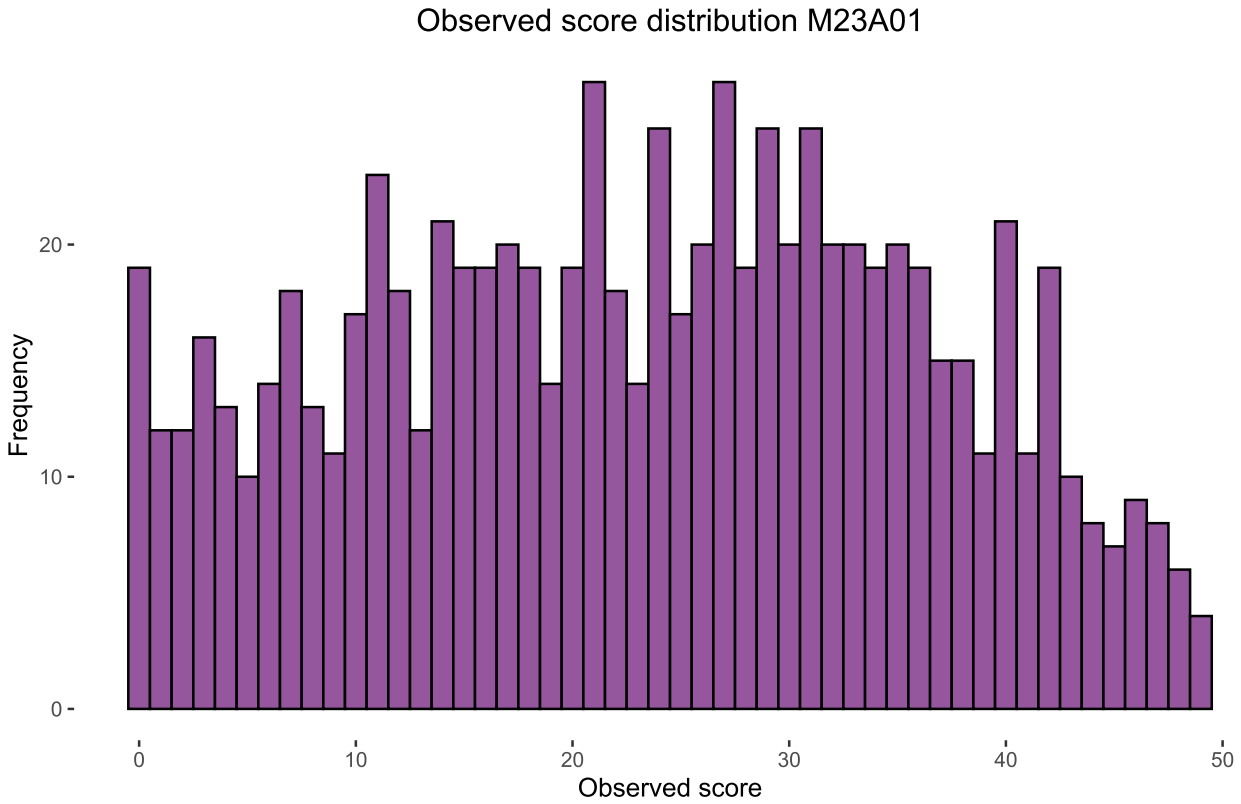
**Table 3.2. Range of Classical Test Theory statistics for the maths tests in 2023**

| Classical Test Theory statistic | Minimum | Maximum |
|---|---|---|
| Number of students taking each test booklet | 807 | 839 |
| Maximum score attained (out of 50) | 49 | 50 |
| Average score attained | 20.58 | 23.40 |
| Standard Deviation of scores attained | 11.86 | 14.05 |
| Reliability of the tests (Coefficient Alpha) | 0.89 | 0.92 |
| Average percentage of students attempting each item (%) | 83 | 88 |

These results show that the maths tests also functioned well. The maximum score, or one mark short of it, was attained on all booklets. The average scores were less than half marks for all booklets which is similar to 2022 but lower than in pre-pandemic years of the NRT. The standard deviation shows that the scores were well spread out, allowing discrimination between the students. This is confirmed by the reliability coefficients which are at a very good level for a maths test of this length and higher than for English, which is usual. Finally, the average percentage of students attempting each item (between 83% and 88%) is similar to the percentages seen in 2022. As has been the case in previous years, the average percentage of students attempting each item for maths was also lower than that seen for the English test. However, there are more individual items for students to attempt in the maths test.

These results were confirmed by the distribution of scores achieved on the tests. This is shown for one of the tests in Figure 3.2. The distributions were similar for the other tests. The figure shows that scores were attained over the range of possible marks and that the students were fairly evenly spread over the range.

**Figure 3.2. Score distribution for one of the maths tests**




In addition, a full item analysis was carried out for each test, in which the difficulty of every question and its discrimination were calculated. These indicated that all the questions had functioned either well or, in a small number of cases, adequately. All items were therefore retained for the IRT analyses. Additionally, an analysis was conducted to establish if any items had performed markedly differently in 2023 compared with the previous years. Where there are such indications, a formal procedure is followed for reviewing the items to establish whether there could be an external reason for the change and if there is sufficient evidence to remove the item from the link between years. In 2023, no items were removed from the link. There was also no evidence that the provision of formulae sheets for GCSE maths exams this summer had an impact on performance on the NRT items.

Using the common items, the IRT analysis was used to equate the 8 tests. The IRT analysis also used the items common between years to equate the tests over years, allowing ability estimates for students in all 7 years to be on the same scale. After this had been done, the results showed that the mean ability scores for students were similar for all the tests, confirming that the random allocation to tests had been successful. The results also showed that the level of difficulty of the 8 tests was fairly consistent, with only small differences between them.

Both the Classical Test Theory results and the IRT results for the maths tests showed that these had functioned well to provide good measures of the ability of students, sufficient for estimating averages for the sample as a whole.

## Summary

These initial stages of the analysis, the Classical Test Theory evaluation of test functioning and the IRT equating of the tests, indicate that the NRT performed as well in 2023 as it had in previous years. This allowed the final stages of the analysis, the estimation of the percentages of students above the same ability thresholds as in 2017 and the calculation of their precision, to be undertaken with confidence. These are described in Sections 4 and 5 for English and maths respectively.

# 4. Performance in English in 2023

The objective of the NRT is to get precise estimates of the percentages of students each year achieving at a level equivalent to 3 key GCSE grades in 2017: these key grades are 4, 5 and 7. For the NRT in 2017, these baseline percentages were established from the 2017 GCSE population percentages. The NRT ability distribution, based on the IRT analysis, was then used to establish the ability thresholds which corresponded to those percentages. From 2018 onwards, the thresholds correspond to the same level of student ability as the thresholds established in 2017, thus allowing us to estimate the percentage of students above each of those thresholds and track performance over time. Alongside this, based on the sample achieved and the reliability of the tests, we can model the level of precision with which the proportion of students achieving the ability thresholds can be measured. The target for the NRT is to achieve a 95% confidence interval of plus or minus no more than 1.5 percentage points from the estimate at each ability threshold.

Ofqual provided the percentages of students at or above the 3 relevant grades (grades 4, 5 and 7) taken from the 2017 GCSE population. These are shown in Table 4.1. These percentages were mapped to 3 ability threshold scores in the NRT in 2017.

**Table 4.1. English 2017 NRT baseline thresholds**

| Threshold | Percentage of students above threshold from 2017 GCSE |
|---|---|
| Grade 7 and above | 16.8 |
| Grade 5 and above | 53.3 |
| Grade 4 and above | 69.9 |

In 2023, the NRT data for the years 2017 to 2023 were analysed together using IRT modelling techniques. By analysing all the data concurrently, ability distributions can be produced for the samples for each year on the same scale. The percentages of students at each of the 3 GCSE grade boundaries, fixed on the 2017 distribution, can then be mapped on to the distributions for the subsequent years to produce estimates of the percentage of students at the same level of ability in those years. For example, the percentage of students at the ‘Grade 4 and above’ threshold in the 2017 GCSE population was 69.9%. This is mapped on to the 2017 distribution to read off an ability value at that grade boundary. The same ability value on the distributions for all other years can then be found, and the percentage of students at this threshold or above in those years can be established. In this way, we are able to estimate the percentage of students at the same level of ability as represented in the 2017 GCSE population for each year of the NRT going forward. The precision of these estimates is dependent on both the sample achieved and the reliability of the tests as measures.

Table 4.2 presents the percentages of students achieving above the specified grade boundaries for the years 2017 to 2023. Confidence intervals for percentages are provided in brackets alongside the estimates. This is important as it shows that, although there have been changes in

performance, these are often within the confidence intervals. The statistical interpretation of the differences is discussed below.

**Table 4.2. Estimated percentages at grade boundaries in English**

| Year | Estimated percentages at Grade 4 and above | Estimated percentages at Grade 5 and above | Estimated percentages at Grade 7 and above |
|---|---|---|---|
| 2017 | 69.9 (68.3-71.5) | 53.3 (51.6-55.0) | 16.8 (15.6-18.0) |
| 2018 | 69.3 (67.5-71.0) | 53.4 (51.6-55.3) | 17.4 (16.2-18.7) |
| 2019 | 66.1 (64.4-67.8) | 50.2 (48.5-52.0) | 16.7 (15.5-17.9) |
| 2020 | 68.2 (66.6-69.9) | 52.8 (51.1-54.5) | 18.4 (17.1-19.7) |
| 2021 | 67.6 (65.5-69.6) | 53.2 (51.1-55.3) | 19.8 (18.1-21.6) |
| 2022 | 65.9 (64.1-67.7) | 50.2 (48.4-52.0) | 17.4 (16.0-18.7) |
| 2023 | 66.2 (64.4-67.9) | 51.0 (49.2-52.7) | 17.8 (16.4-19.1) |

The 2017 figures in the table above are based on the NRT study, rather than the 2017 GCSE percentages. Note that, because of the way in which they have been computed, they match closely with the GCSE percentages. The confidence intervals for them reflect the fact that the NRT 2017 outcomes carry the statistical error inherent in a sample survey, as per the subsequent years.

In each year of the NRT, the percentages for previous years are re-estimated due to the concurrent calibration approach which analyses all of the data together in a single IRT model. Some degree of variation is therefore expected with the addition of more data, and the differences seen are generally small.

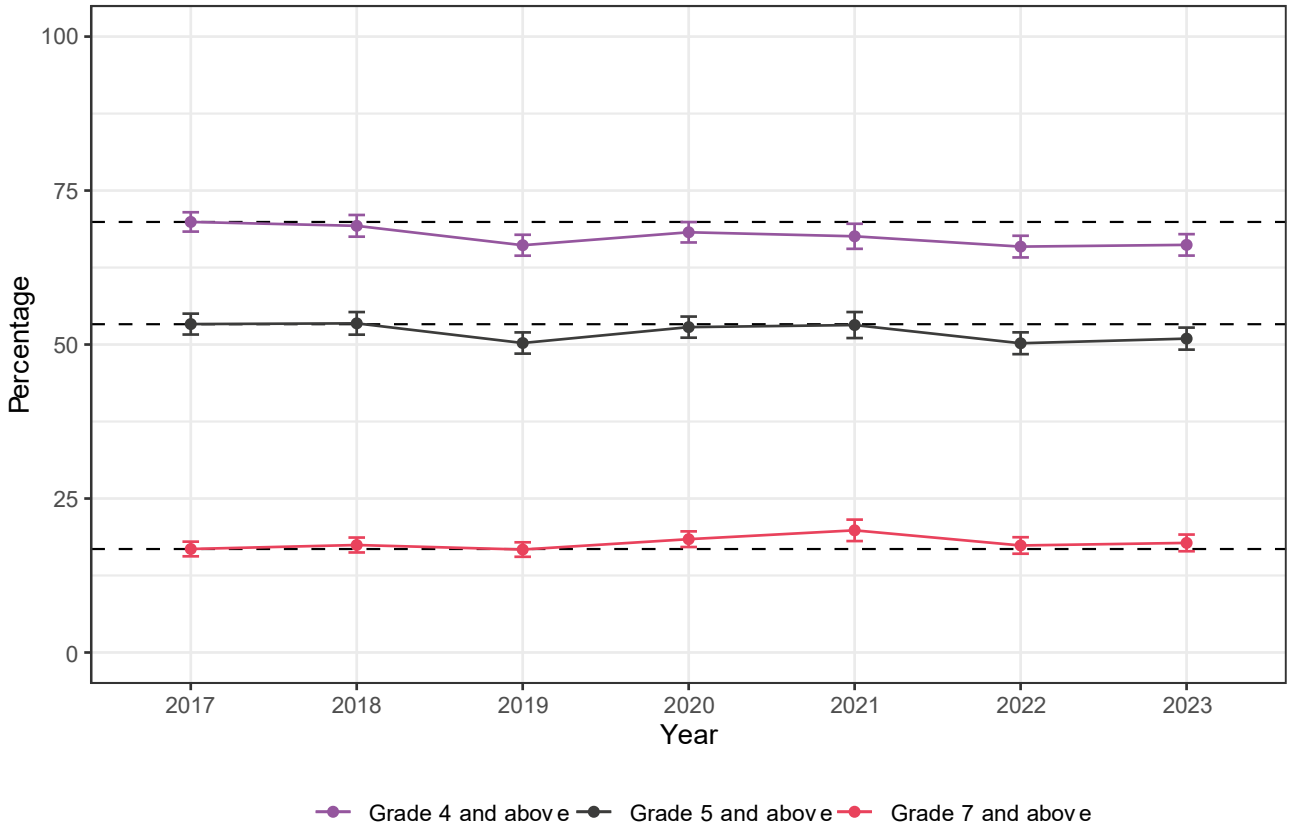
Table 4.3 shows the half widths of the confidence intervals. The confidence intervals for all years are narrower than those reported previously, following a change in the way precision is calculated for the NRT. The confidence intervals for 2021 are wider than other years, reflecting the smaller sample size in that year. For NRT 2023, the precision for all 3 grade boundaries is in line with the values for other years.

### Table 4.3. English NRT half width of confidence intervals each year

| Year | Half width of confidence intervals: Grade 4 and above | Half width of confidence intervals: Grade 5 and above | Half width of confidence intervals: Grade 7 and above |
|---|---|---|---|
| 2017 | 1.6 | 1.7 | 1.2 |
| 2018 | 1.8 | 1.8 | 1.2 |
| 2019 | 1.7 | 1.7 | 1.2 |
| 2020 | 1.7 | 1.7 | 1.3 |
| 2021 | 2.0 | 2.1 | 1.7 |
| 2022 | 1.8 | 1.8 | 1.3 |
| 2023 | 1.7 | 1.8 | 1.4 |

Figure 4.1 presents 95% confidence intervals around the percentages achieving at least the specified grade boundary in 2023, as compared with previous years and the 2017 population baseline percentages. The 2017 population percentages are represented as dotted lines and the trend lines across years as solid lines. This format has been used to encourage the reader to compare the point estimate confidence bands for each year with the 2017 baseline population percentages, bearing in mind the confidence intervals.

**Figure 4.1. Long term changes in NRT English over time from 2017 baseline**




Some patterns in the results can be observed from the chart, though care should be taken not to over-interpret small differences which may arise due to statistical uncertainty around the measurements. Nevertheless, the chart suggests that performance in English in 2023 has improved very slightly relative to 2022. There had previously been a small decline in the percentage of students achieving at-or-above both grades 4 and 5 from the baseline in 2017 to 2019, but 2020 had seen an upturn in performance, bringing performance much closer to that seen in 2017. This performance then remained stable in 2021, despite the impact of school closures due to the pandemic. In 2022, there was a return to levels of performance similar to those seen in 2019, with some recovery now seen in 2023. At grade 7 and above, performance has been relatively consistent across the years, with a slight improvement in 2020 and 2021 followed by a small dip.

A key question arising for the NRT results in a given year is to determine if differences in outcomes across the years are statistically significant. For the NRT, several comparisons could be made between different pairs of years at different grade boundaries, and this gives rise to the possibility that changes arising by chance may seem real. Hence, the criteria for significance that have been used are adjusted for multiple comparisons. For more information, see Appendix A.

The research question NFER was asked to address is to compare the performance in 2023 with the performance in the baseline year of 2017 at each of the 3 grade boundaries. Adjusting for 3

comparisons, the NRT English data shows that there has been a statistically significant drop in performance between 2017 and 2023 at the grade 4 boundary, significant at the 1% level of significance. There are no statistically significant differences in performance between 2017 and 2023 at the grade 5 and grade 7 grade boundaries.[2]

[2] The results of a given year's NRT can be compared with the NRT results from a previous year (both are sample surveys, and the statistical error is therefore reflected in confidence intervals for each administration) or with the GCSE percentages of 2017, regarded as external constants. The *2018 Results Digest* reported comparisons with the GCSE 2017 population percentages. However, in order to make ongoing comparisons from year to year it was decided, for 2019 onwards, that comparing the outcomes between NRT studies (e.g. making statistical comparisons with the 2017 NRT study, rather than 2017 GCSE percentages) would be more informative.

# 5. Performance in maths in 2023

The objective of the NRT is to get precise estimates of the percentages of students each year achieving at a level equivalent to 3 key GCSE grades in 2017: these key grades are 4, 5 and 7. For the NRT in 2017, these baseline percentages were established from the 2017 GCSE population percentages. The NRT ability distribution, based on the IRT analysis, was then used to establish the ability scores which corresponded to those percentages. From 2018 onwards, the thresholds correspond to the same level of student ability as the thresholds established in 2017, thus allowing us to estimate the percentage of students above each of those thresholds and track performance over time. Alongside this, based on the sample achieved and the reliability of the tests, we are able to model the level of precision with which the proportion of students achieving the ability scores can be measured. The target for the NRT is to achieve a 95% confidence interval of plus or minus no more than 1.5 percentage points from the estimate at each ability threshold.

Ofqual provided the percentages of students at or above 3 relevant grades (grades 4, 5 and 7) taken from the 2017 GCSE population. These are shown in Table 5.1. These percentages were mapped to 3 ability threshold scores in the NRT in 2017.

**Table 5.1. Maths 2017 NRT baseline thresholds**

| Threshold | Percentage of students above threshold from 2017 GCSE |
|---|---|
| Grade 7 and above | 19.9 |
| Grade 5 and above | 49.7 |
| Grade 4 and above | 70.7 |

In 2023, the NRT data for the years 2017 to 2023 were analysed together using IRT modelling techniques. By analysing all the data concurrently, ability distributions can be produced for the samples for each year on the same scale. The percentages of students at each of the 3 GCSE grade boundaries, fixed on the 2017 distribution, can then be mapped on to the distributions for the subsequent years to produce estimates of the percentage of students at the same level of ability in those years. For example, the percentage of students at the 'Grade 4 and above' threshold in the 2017 GCSE population was 70.7%. This is mapped on to the 2017 distribution to read off an ability value equivalent to that grade boundary. The same ability value on the distributions for all other years can then be found, and the percentage of students at this threshold or above in those years can be established. In this way, we are able to estimate the percentage of students at the same level of ability as represented in the 2017 GCSE population for each year of the NRT going forward. The precision of these estimates is dependent on both the sample achieved and the reliability of the tests as measures.

Table 5.2 presents the percentages of students achieving above the specified grade boundaries for the years 2017 to 2023. Confidence intervals for percentages are provided in brackets alongside the estimates. This is important as it shows that although there have been changes in

performance, these are often within the confidence intervals. The statistical interpretation of the differences is discussed below.

**Table 5.2. Estimated percentages at grade boundaries in maths**

| Year | Estimated percentages at Grade 4 and above | Estimated percentages at Grade 5 and above | Estimated percentages at Grade 7 and above |
|---|---|---|---|
| 2017 | 70.7 (69.3-72.1) | 49.7 (48.1-51.3) | 19.9 (18.6-21.2) |
| 2018 | 73.4 (72.0-74.7) | 52.4 (50.8-54.0) | 21.4 (20.1-22.8) |
| 2019 | 73.2 (71.8-74.6) | 51.9 (50.3-53.5) | 22.6 (21.3-24.0) |
| 2020 | 74.6 (73.3-75.9) | 54.9 (53.4-56.4) | 24.3 (23.0-25.7) |
| 2021 | 70.2 (68.3-72.1) | 49.9 (47.9-52.0) | 21.9 (20.0-23.9) |
| 2022 | 71.7 (70.2-73.1) | 50.3 (48.6-51.9) | 21.2 (19.8-22.6) |
| 2023 | 70.2 (68.7-71.6) | 48.8 (47.2-50.3) | 19.9 (18.7-21.1) |

The 2017 figures in the table above are based on the NRT study, rather than the 2017 GCSE percentages. Note that, because of the way in which they have been computed, they match closely with the GCSE percentages. The confidence intervals for them reflect the fact that the NRT 2017 outcomes carry the statistical error inherent in a sample survey, as per the subsequent years.

Since the percentages for previous years have been re-estimated following the concurrent calibration with the 2023 data, these figures differ slightly from those reported in previous years. Some degree of variation is expected given the addition of more data, and the differences seen are small.

Table 5.3 shows the half widths of the confidence intervals. The confidence intervals for all years are similar to those reported previously, despite a change in the way precision is calculated for the NRT. The confidence intervals for 2021 are wider than other years, reflecting the smaller sample size in that year. For NRT 2023, the precision for all 3 grade boundaries is in line with the values for other years.

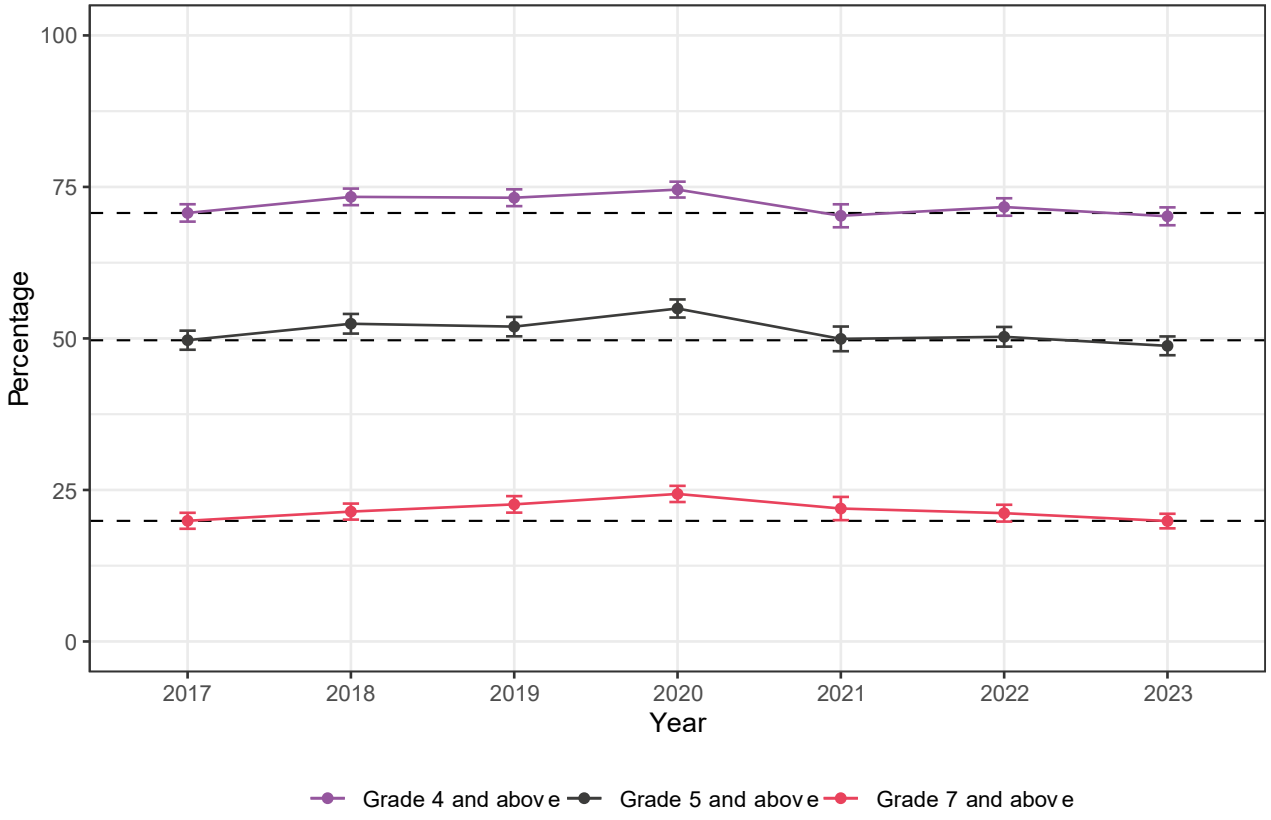
**Table 5.3. Maths NRT half width of confidence intervals each year**

| Year | Half width of confidence intervals Grade 4 and above | Half width of confidence intervals Grade 5 and above | Half width of confidence intervals Grade 7 and above |
|---|---|---|---|
| 2017 | 1.4 | 1.6 | 1.3 |
| 2018 | 1.4 | 1.6 | 1.3 |
| 2019 | 1.4 | 1.6 | 1.4 |
| 2020 | 1.3 | 1.5 | 1.3 |

| Year | Half width of confidence intervals Grade 4 and above | Half width of confidence intervals Grade 5 and above | Half width of confidence intervals Grade 7 and above |
|---|---|---|---|
| 2021 | 1.9 | 2.0 | 1.9 |
| 2022 | 1.4 | 1.6 | 1.4 |
| 2023 | 1.5 | 1.5 | 1.2 |

Figure 5.1 presents 95% confidence intervals around the percentages achieving at least the specified grade boundary in 2023, as compared with previous years and the 2017 population baseline percentages. The 2017 population percentages are represented as dotted lines and the trend lines across years as solid lines. This format has been used to encourage the reader to compare the point estimate confidence bands for each year with the 2017 baseline population percentages, bearing in mind the confidence intervals.

**Figure 5.1. Long term changes in NRT maths over time from 2017 baseline**




Some patterns in the maths results can be observed from the chart, though care should be taken not to over-interpret small differences which may arise due to statistical uncertainty around the measurements. Nevertheless, the chart shows a relatively steady increase in the percentage of

students achieving at-or-above all 3 grade boundaries from 2017 to 2020, followed by a sharp drop in 2021, back to around the 2017 level of performance. In 2022 we see a slight improvement at grade 4, suggesting some recovery, but a slight decline at grade 7, while performance at grade 5 was stable. In 2023 performance at all 3 grades has declined very slightly relative to last year, and is still visibly close to the 2017 levels of performance. A key question arising for the NRT results in a given year is to determine if differences in outcomes across the years are statistically significant. For the NRT, several comparisons could be made and this gives rise to the possibility that changes arising by chance may seem real. Hence, the criteria for significance that have been used are adjusted for multiple comparisons. For more information, see Appendix A.

The research question NFER was asked to address is to compare the performance in 2023 with the performance in 2017 at each of the 3 grade boundaries. Adjusting for 3 comparisons, the NRT maths data shows that there are no statistically significant differences in performance between 2017 and 2023 at any of the 3 grade boundaries.[3]

[3] The results of a given year's NRT can be compared with the NRT results from a previous year (both are sample surveys, and the statistical error is therefore reflected in confidence intervals for each administration) or with the GCSE percentages of 2017, regarded as external constants. The *2018 Results Digest* reported comparisons with the GCSE 2017 population percentages. However, in order to make ongoing comparisons from year to year it was decided, for 2019 onwards, that comparing the outcomes between NRT studies (e.g. making statistical comparisons with the 2017 NRT study, rather than 2017 GCSE percentages) would be more informative.

# 6. Appendix A: A brief summary of the NRT

## English

The English test takes one hour to administer and follows the curriculum for the reformed GCSE in English language. In each of the 8 English test booklets, there are 2 components; the first is a reading test and the second a writing test. Each component carries 25 marks and students are advised to spend broadly equal time on each component.

The reading test is based on an extract from a longer prose text, or 2 shorter extracts from different texts. Students are asked 5, 6 or 7 questions that refer to the extract(s). Some questions of one to 4 marks require short responses or require the student to select a response from options provided. In each booklet, the reading test also includes a 6-mark question and a 10-mark question, where longer, more in-depth responses need to be given. These focus on analysis and evaluation of aspects of the text or a comparison between texts.

The writing test is a single, 25-mark task. This is an extended piece of writing, responding to a stimulus. For example, students may be asked to describe, narrate, give and respond to information, argue, explain or instruct.

## Maths

For maths, a separate sample of students is also given one hour to complete the test. The test includes questions on number, algebra, geometry and measures, ratio and proportion, and statistics and probability – the same curriculum as the reformed GCSE. Each of the 8 test booklets has 13 or 14 questions with a total of 50 marks and each student takes just one of the test booklets.

## Analysis

The analysis process followed a sequence of steps. Initially, the tests were analysed using Classical Test Theory to establish that they had performed well, with appropriate difficulty and good levels of reliability. The subsequent analyses used Item Response Theory techniques to link all the tests together from 2017 to 2023 and estimate the ability of all the students on a common scale for each subject for each year, independent of the test or items they had taken. These ability estimates were then used for calculating the ability level at the percentiles associated with the GCSE grade boundaries in 2017 and mapping these on to the distributions for subsequent years to generate percentile estimates for those years.

## Multiple Comparisons

The statistical significance of the difference between 2 percentages estimated in 2 years, say 2017 and 2023, may be approached with a two-sample $t$-statistic. Because of the huge number of degrees of freedom, the value can be compared with the standard normal distribution rather than the $t$-distribution. For a comparison of 2 percentages, say the percentage of students at grade 4 or higher between 2 years, the critical value at a confidence level of 0.05 (5%) would usually be 1.96. However, since there are 3 grade thresholds across multiple years, there are several comparisons

which could be made (up to 63 if all pairs of years were compared across all 3 grade boundaries). As the number of simultaneous comparisons grows, the probability that some of them are significant by chance rapidly increases. To guarantee that the chosen level of significance is guaranteed overall, we have implemented a Bonferroni adjustment for multiple comparisons.

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