GCSE Maths Sample Assessment Materials:

Post-research Quantitative Review

Contents

Background

Following our recent programme of research[1] into the expected and actual difficulty of exam boards' GCSE maths sample assessments, boards were asked to adjust the difficulty of the assessments. Outlined here is the approach taken, and results from, the quantitative element of our evaluation of the extent to which adjustments to the expected difficulty of the sample assessments had been achieved.

The methodology and results are presented here in a number of phases. Phase 1 is the original piece of research as published on 21st May 2015. This phase is, therefore, based on the materials that were used for accreditation. Phase 2 is the first post-research publication review which took place in late May and involved an evaluation of revised assessment materials produced by all exam boards. Phase 3 includes an evaluation of subsequent submissions from WJEC Eduqas and Pearson (foundation tier) only. The final phase, phase 4, includes an evaluation of a further revised set of Pearson (foundation tier) sample materials.

Method

The method applied to evaluate the expected difficulty of questions and, therefore, ultimately of the question papers, closely followed that used in the original research exercise. In brief, this involved the use of PhD maths students judging the mathematical difficulty of pairs of questions in a comparative judgement framework. The judgement data were fitted to a statistical model to quantify the relative expected difficulty of individual questions on the basis of those judgements. These expected question difficulties can then be aggregated up to the question paper and/or qualification level.

Materials

The number of new items introduced by the exam boards in each phase of the evaluation varied between exam boards. To ensure that the modelled scale of expected difficulty was the same in this study as in the original study, a number of items from the original study (phase 1) were included in the comparisons, and their expected difficulty parameters fixed when fitting the model. These items are referred to as anchor items.

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[1] www.gov.uk/government/publications/gcse-maths-final-research-report-and-regulatory-summary

Shown in tables 1 and 2 are the number of items that were classed as new for the purposes of the evaluation in phases 2 and 3 respectively. Phase 4 did not involve the introduction of new items as a sufficient number of characterised items were available such that sample papers could be constructed based on previously available data.

Table 1. Items submitted for phase 2 of the evaluation

Board	Higher	Foundation	New items	Total items
AQA	106	85	191	191
Eduqas	81	78	159	159
OCR	111	104	133	215
Pearson	96	99	195	195

Table 2. Items submitted for phase 3 of the evaluation

Board	Higher	Foundation	New items
Eduqas	88	104	46
Pearson	96	116	26

Phase 2

In phase 2, OCR's revised materials contained 82 items which were also included in the original submissions. These items were, therefore, used as anchor items. To match the distribution of anchor items across boards, the same percentage of original items was included for AQA and Pearson. Eighty–two of OCR's items (38 per cent) were original items. Hence, for AQA 73 anchor items were included and for Pearson 74 anchor items were included. As Eduqas were not included in this element of the original research for timing reasons, all items were treated as new items.

The anchor items were randomly drawn from all of the items used in the original study for the board. In total 907 items were judged, which included 229 anchor items (around 25 per cent).

Phase 3

In phase 3, 50 anchor items were used as the minimum to give good coverage of the difficulty range. These 50 items were chosen randomly from the 229 anchor items

used in phase 2. The proportions across boards changed a little from phase 2 (AQA: 16 anchor items, OCR: 23 anchor items, Pearson: 11 anchor items).

In total, 122 items were judged, which included 50 anchor items.

Participants

For phase 2, 37 PhD students studying mathematics at English universities were recruited to be judges. Highly consistent judges from the original study were retained and new judges recruited. Judges were paid for their time. For phase 3, only 19 judges were required. The judges with the 20 best 'infit' values from phase 2 were invited: 18 agreed and were joined by one judge with excellent infit from phase 1 who had not judged phase 2.

Procedure

In phases 2 and 3, comparisons were conducted using the online comparative judgement platform, No More Marking.[2] Judges were given detailed instructions on how to access the platform and how to make their judgements. Pairs of items were presented side by side on the screen and the judges were prompted to indicate:

'*Which item is the more mathematically difficult to answer fully?*'

This is the same prompt as was used in the original studies. The prompt was always present on the screen.

It was left up to the judges to decide how they made their judgements; the only restriction was a date by which they had to complete them. In phase 2, each judge made 500 judgements, giving a total of 18,500 judgements (providing a minimum of 24 judgements per item). In phase 3, each judge made 180 judgements, giving a total of 3,420 judgements (providing a minimum of 51 judgements per item). In both phases the items were distributed among judges so that the items were all seen a similar number of times.

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[2] Wheadon, C. and Jones, I. (2014, June 1). Online Comparative Judgement. Retrieved April 21st, 2015, from www.nomoremarking.com

Results

Analysis

The R package, Supplementary Item Response Theory (sirt),[3] was used to estimate expected difficulty parameters for each item under the Bradley-Terry model. The node package, Comparative-Judgement (CJ),[4] which implements the same Bradley-Terry model as sirt, using the same estimation procedure, was used to estimate item and judge outfit, scale-separation reliability (SSR) and inter-rater reliability.

Judge consistency and exclusion

None of the judges was excluded from the analysis in phase 2 or 3 of the evaluation.

In phase 2, there was one borderline judge with a median judgement time of 6 seconds and an outfit of 1.4, but the influence of this judge on the final parameters was so small that he was not excluded. The range of outfit values for the other 36 judges was 0.77 to 1.24, while the range of median judgement times by judge was 9 to 37 seconds (mean = 20 seconds, 1 second longer than for the original study).

The median inter-rater reliability was assessed by repeatedly allocating judges to two groups, fitting the Bradley-Terry model independently for each group and correlating the two rank orders of the item parameters. Across 100 replications the correlation was 0.79 (sd=0.01). This was slightly higher than in the original study (phase 1). Reliability is quantified in CJ studies by an SSR statistic which is derived in exactly the same way as the person separation reliability index in Rasch analyses. It is interpreted as the proportion of 'true' variance in the estimated scale values. The SSR was 0.93, again, slightly higher than for the original study (0.87).

There was one borderline judge in phase 3 with a median judgement time of 19 seconds and an outfit of 1.35, but, again, the influence of this judge on the final parameters was so small that he was not excluded. The range of outfit values for the other judges was 0.86 to 1.24, while the range of median judgement times by judge was 7 to 33 seconds (mean = 14 seconds, 6 seconds faster than for the phase 2 study). The correlation of rank orders was 0.85 (sd=0.03). This was slightly higher than in phases 1 and 2. The SSR was 0.97.

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[3] Alexander Robitzsch (2015). sirt: Supplementary Item Response Theory Models. R package version 1.6–9. https://sites.google.com/site/alexanderrobitzsch/software.

[4] www.npmjs.com/package/comparative-judgement.

Comparative judgement analysis

Distributions of expected item difficulty parameters are shown aggregated by exam board in table 3 and figure 1. The expected difficulty parameters for all items from phases 2 and 3 can be found in appendices A and B respectively.

Table 3: Aggregated expected item difficulty parameters by exam board and phase

Foundation tier

Exam board	Phase 1			Phase 2			Phase 3			Phase 4		
	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	Sd
AQA	-0.68	-0.73	1.14	-0.51	-0.59	1.11	-0.51	-0.59	1.11	-0.51	-0.59	1.11
OCR	-0.11	-0.33	1.41	-0.37	-0.56	1.24	-0.37	-0.56	1.24	-0.37	-0.56	1.24
PEARSON	-0.09	-0.51	1.52	-0.91	-1.12	1.52	-0.71	-0.76	1.23	-0.59	-0.57	1.09
EDUQAS				-0.08	-0.28	1.27	-0.28	-0.48	1.23	-0.28	-0.48	1.23
Range (w'out EDUQAS)		0.39			0.55			0.20			0.03	

Higher tier

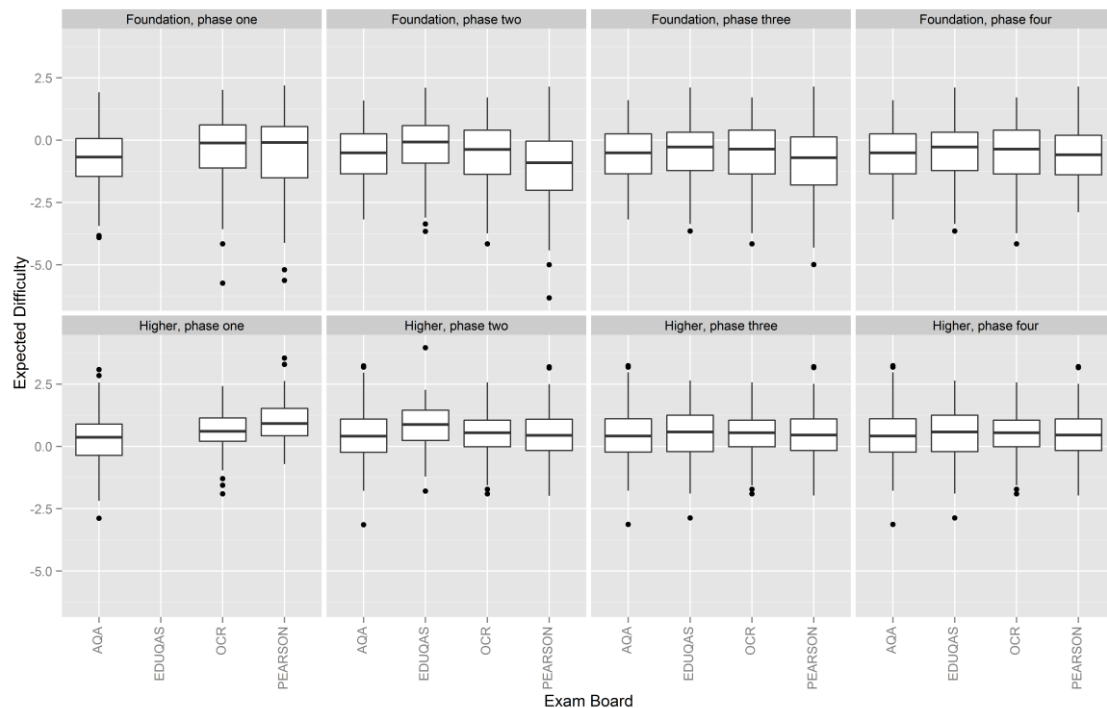| Exam board	Phase 1			Phase 2			Phase 3			Phase 4		
	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd
AQA	0.37	0.28	1.06	0.42	0.43	1.12	0.42	0.43	1.12	0.42	0.43	1.12
OCR	0.61	0.65	0.79	0.55	0.47	0.84	0.55	0.47	0.84	0.55	0.47	0.84
PEARSON	0.92	0.98	0.87	0.45	0.44	1.00	0.45	0.44	1.00	0.45	0.44	1.00
EDUQAS				0.88	0.77	0.95	0.59	0.48	1.05	0.59	0.48	1.05
Range (w'out EDUQAS)		0.70			0.04			0.04			0.04	

Figure 1. Box plots showing median and interquartile ranges of expected item difficulty parameters for the original sample assessments and the re-submitted sample assessments

Phase 2

Foundation tier: The data presented show that, based on Phase 2, the spread of expected difficulty on the foundation tier had increased between the exam boards. This was due to a relatively sharp change in the expected difficulty of Pearson sample assessments. The expected difficulty of Pearson's phase 2 assessments was judged to be, on aggregate, lower than that of AQA's original sample assessments. The expected difficulty of AQA's new sample assessments had increased and was very similar to that of OCR's new assessments. The expected difficulty of OCR's assessments was lower than that of their original assessments. The expected difficulty of Eduqas's new assessments was greater than any of the other boards' original assessments were judged to be.

Higher tier: For phase 2 on the higher tier, the spread of expected difficulty across the boards had decreased. Indeed, it was very low if Eduqas's assessments were removed (matching those boards included in the original study). The expected difficulty of AQA's new sample assessments was higher than that of their original assessments. The expected difficulty of OCR's and Pearson's assessments had decreased. Eduqas's new assessments were expected to be more difficult than OCR's original assessments were judged to be, but not as hard as those of Pearson. Eduqas's new assessments stand out in terms of expected difficulty.

Phase 3

The expected difficulty of Eduqas's higher and foundation tier assessments in this phase were judged to be broadly comparable to those of AQA and OCR. The expected difficulty of Pearson's revised foundation tier assessments had moved in the expected direction (increased expected difficulty) but remained lower than those judged of lowest expected difficulty in the original study.

Phase 4

Due to the large amount of available item characterisation data arising from the original research and the subsequent evaluation phases, Pearson were able to construct their foundation tier sample assessment for phase 4 with a relatively high level of precision. Table 3 shows that the resulting spread of expected difficulty between exam boards on the foundation tier following phase 4 was very low (range=0.03).

Conclusions

The data presented here have shown that based on the judgements of expected difficulty made within the comparative judgement framework the final sample materials produced by the exam boards are of comparable difficulty. Excluding WJEC Eduqas due to their non-inclusion in Study 1 of the original research, the range of aggregated expected difficulty on the higher and foundation tiers has reduced from 0.70 and 0.39, respectively, to less than 0.05 for each tier.

Appendix A: Item difficulty parameters from phase 2

AQA foundation tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
AQA_1F_Q_1_x	-3.18	AQA_2F_Q_1_x	-2.75	AQA_3F_Q_1a_x	-1.44
AQA_1F_Q_2_x	0.1	AQA_2F_Q_2_x	-2.04	AQA_3F_Q_1b_x	-1.57
AQA_1F_Q_3_x	-1.68	AQA_2F_Q_3_x	-2.93	AQA_3F_Q_2_x	-1.05
AQA_1F_Q_4_x	-1.73	AQA_2F_Q_4_x	-2.06	AQA_3F_Q_3_x	-1.63
AQA_1F_Q_5_x	-2.49	AQA_2F_Q_5_x	-2.31	AQA_3F_Q_4_x	-0.33
AQA_1F_Q_6_x	-0.51	AQA_2F_Q_6_x	-1.03	AQA_3F_Q_5_x	0.16
AQA_1F_Q_7_x	-1.98	AQA_2F_Q_7_x	-1.6	AQA_3F_Q_6a_x	-0.16
AQA_1F_Q_8_x	-2.86	AQA_2F_Q_8a_x	-2.4	AQA_3F_Q_6b_x	-0.13
AQA_1F_Q_9_x	-1.17	AQA_2F_Q_8b_x	-0.74	AQA_3F_Q_7a_x	-1.35
AQA_1F_Q_10a_x	-2.52	AQA_2F_Q_8c_x	-2	AQA_3F_Q_7b_x	0.54
AQA_1F_Q_10b_x	-1.34	AQA_2F_Q_9_x	-0.12	AQA_3F_Q_8_x	-2.64
AQA_1F_Q_10c_x	-0.84	AQA_2F_Q_10_x	-0.32	AQA_3F_Q_9_x	-0.92
AQA_1F_Q_11_x	0.78	AQA_2F_Q_11_x	0.5	AQA_3F_Q_10a_x	-0.96
AQA_1F_Q_12_x	-1.35	AQA_2F_Q_12a_x	-1.94	AQA_3F_Q_10b_x	-0.24
AQA_1F_Q_13a_x	-0.94	AQA_2F_Q_12b_x	-1.39	AQA_3F_Q_10c_x	0.71
AQA_1F_Q_13b_x	-0.95	AQA_2F_Q_13a_x	0.61	AQA_3F_Q_11a_x	-0.3
AQA_1F_Q_14_x	-0.17	AQA_2F_Q_13b_x	0.3	AQA_3F_Q_11b_x	0.53
AQA_1F_Q_15_x	-0.72	AQA_2F_Q_14_x	-0.3	AQA_3F_Q_11c_x	0.43
AQA_1F_Q_16_x	-0.04	AQA_2F_Q_15_x	0.87	AQA_3F_Q_12a_x	-0.2
AQA_1F_Q_17a_x	-0.64	AQA_2F_Q_16a_x	-0.8	AQA_3F_Q_12b_x	-0.68
AQA_1F_Q_17b_x	-0.48	AQA_2F_Q_16b_x	0.28	AQA_3F_Q_13_x	1.21
AQA_1F_Q_18_x	0.25	AQA_2F_Q_16c_x	1.59	AQA_3F_Q_14a_x	-0.87
AQA_1F_Q_19_x	0.56	AQA_2F_Q_17_x	0.55	AQA_3F_Q_14b_x	-0.94
AQA_1F_Q_20a_x	-0.73	AQA_2F_Q_18_x	0.89	AQA_3F_Q_15_x	-1.12
AQA_1F_Q_20b_x	-0.07	AQA_2F_Q_19_x	-0.63	AQA_3F_Q_16_x	-1.13
AQA_1F_Q_21a_x	-1.75	AQA_2F_Q_20_x	-1.27	AQA_3F_Q_17_x	0.14
AQA_1F_Q_21b_x	-1.78	AQA_2F_Q_21_x	-0.1	AQA_3F_Q_18_x	-1.59
AQA_1F_Q_21c_x	-2.54	AQA_2F_Q_22a_x	-0.72	AQA_3F_Q_19_x	-1.27
AQA_1F_Q_22a_x	0.3	AQA_2F_Q_22b_x	0.34	AQA_3F_Q_20_x	-3.14
AQA_1F_Q_22b_x	0.25	AQA_2F_Q_23a_x	0.01	AQA_3F_Q_21_x	-1.52
AQA_1F_Q_22c_x	0.08	AQA_2F_Q_23b_x	0.44	AQA_3F_Q_22_x	-0.9
AQA_1F_Q_23_x	0.05	AQA_2F_Q_24_x	-0.36	AQA_3F_Q_23_x	0.16
AQA_1F_Q_24_x	-0.21	AQA_2F_Q_25_x	-0.8	AQA_3F_Q_24a_x	-0.12
AQA_1F_Q_25_x	-0.44	AQA_2F_Q_26_x	0.2	AQA_3F_Q_24b_x	-1.39
AQA_1F_Q_26_x	-0.65	AQA_2F_Q_27_x	-0.88	AQA_3F_Q_25_x	0.77
AQA_1F_Q_27_x	1.23	AQA_2F_Q_28_x	0.16	AQA_3F_Q_26_x	-1.06
AQA_1F_Q_28_x	0.64	AQA_2F_Q_29_x	-0.29	AQA_3F_Q_27_x	1.17
AQA_1F_Q_29a_x	0.82	AQA_2F_Q_30_x	1.59	AQA_3F_Q_28_x	1.23
AQA_1F_Q_29b_x	0.87			AQA_3F_Q_29_x	1.16
AQA_1F_Q_30_x	1.12				

OCR foundation tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
OCR_1F_Q_1a_x	-2.38	OCR_2F_Q_1a_1	-3.74	OCR_3F_Q_1ai_1	-3.37
OCR_1F_Q_1b_x	-0.82	OCR_2F_Q_1b_1	-3.65	OCR_3F_Q_1aii_1	-4.16
OCR_1F_Q_1c_x	-2.72	OCR_2F_Q_2a_5	-2.63	OCR_3F_Q_1aiii_1	-3.05
OCR_1F_Q_2_1	-1.91	OCR_2F_Q_2b_5	-1.33	OCR_3F_Q_1bi_1	-1.75
OCR_1F_Q_3_1	0.58	OCR_2F_Q_3a_1	-1.32	OCR_3F_Q_1bii_1	-1.56
OCR_1F_Q_4a_x	0.30	OCR_2F_Q_3b_1	-1.05	OCR_3F_Q_2_3	-0.03
OCR_1F_Q_4b_x	1.02	OCR_2F_Q_4_3	-0.01	OCR_3F_Q_3a_1	-1.39
OCR_1F_Q_5_4	0.19	OCR_2F_Q_5a_1	-1.82	OCR_3F_Q_3b_1	0.12
OCR_1F_Q_6_5	-1.11	OCR_2F_Q_5b_1	-0.77	OCR_3F_Q_3c_1	-0.72
OCR_1F_Q_7a_1	-1.99	OCR_2F_Q_5c_1	-0.76	OCR_3F_Q_4_3	0.31
OCR_1F_Q_7b_1	-0.34	OCR_2F_Q_5d_1	-1.24	OCR_3F_Q_5_1	-1.09
OCR_1F_Q_8_4	-0.44	OCR_2F_Q_6a_4	-2.36	OCR_3F_Q_6a_1	-2.13
OCR_1F_Q_9a_6	-1.48	OCR_2F_Q_6b_4	0.33	OCR_3F_Q_6b_1	0.49
OCR_1F_Q_9b_6	-1.38	OCR_2F_Q_7a_1	-2.11	OCR_3F_Q_6c_1	0.19
OCR_1F_Q_9c_6	-0.90	OCR_2F_Q_7b_1	-1.50	OCR_3F_Q_7a_4	-1.13
OCR_1F_Q_10ai_1	-3.35	OCR_2F_Q_8a_1	-0.80	OCR_3F_Q_7b_4	1.71
OCR_1F_Q_10aii_1	-3.18	OCR_2F_Q_8b_1	0.52	OCR_3F_Q_8a_2	0.35
OCR_1F_Q_10aiii_1	-2.69	OCR_2F_Q_9a_1	0.00	OCR_3F_Q_8bi_2	-0.50
OCR_1F_Q_10b_1	-1.83	OCR_2F_Q_9b_1	1.40	OCR_3F_Q_8bii_2	-0.13
OCR_1F_Q_11_2	-1.15	OCR_2F_Q_9c_1	0.77	OCR_3F_Q_9ai_5	-0.39
OCR_1F_Q_12a_3	-0.85	OCR_2F_Q_10ai_6	-0.64	OCR_3F_Q_9aii_5	-0.22
OCR_1F_Q_12b_2	0.04	OCR_2F_Q_10aii_6	-0.50	OCR_3F_Q_9aiii_5	0.55
OCR_1F_Q_12c_2	0.92	OCR_2F_Q_10bi_6	-0.71	OCR_3F_Q_9b_5	0.83
OCR_1F_Q_12d_2	0.62	OCR_2F_Q_10bii_6	1.20	OCR_3F_Q_10a_1	-2.11
OCR_1F_Q_13ai_2	-0.96	OCR_2F_Q_10biii_6	0.71	OCR_3F_Q_10b_1	-2.16
OCR_1F_Q_13aii_2	-0.05	OCR_2F_Q_10c_6	-0.49	OCR_3F_Q_10c_1	-2.25
OCR_1F_Q_13bi_2	-0.50	OCR_2F_Q_11a_3	-1.20	OCR_3F_Q_11a_1	-0.64
OCR_1F_Q_13bii_2	0.26	OCR_2F_Q_11b_3	0.80	OCR_3F_Q_11b_1	-0.91
OCR_1F_Q_14a_1	-1.53	OCR_2F_Q_11c_3	1.33	OCR_3F_Q_14a_5	-0.09
OCR_1F_Q_14b_1	-1.72	OCR_2F_Q_12a_2	-1.65	OCR_3F_Q_14b_5	0.47
OCR_1F_Q_14b_1	0.79	OCR_2F_Q_12b_2	0.50	OCR_3F_Q_15a_4	0.73
OCR_1F_Q_15_1	-0.25	OCR_2F_Q_13a_3	-0.96	OCR_3F_Q_15b_4	0.61
OCR_1F_Q_16a_3	-0.46	OCR_2F_Q_13b_3	0.24	OCR_3F_Q_16_1	0.75
OCR_1F_Q_16b_3	0.20	OCR_2F_Q_14a_4	-0.35	OCR_3F_Q_17a_3	0.20
OCR_1F_Q_16c_3	0.60	OCR_2F_Q_14a_4	1.33	OCR_3F_Q_17b_3	1.23
OCR_1F_Q_17a_2	-0.76	OCR_2F_Q_15a_1	0.08	OCR_3F_Q_18ai_2	-1.38
OCR_1F_Q_17b_2	-0.66	OCR_2F_Q_15b_3	0.42	OCR_3F_Q_18aii_2	-1.56
OCR_1F_Q_18_3	0.29	OCR_2F_Q_15c_3	0.55	OCR_3F_Q_18b_2	-1.90
OCR_1F_Q_19_3	0.44	OCR_2F_Q_16a_5	-0.32	OCR_3F_Q_18c_2	0.67
OCR_1F_Q_20_2	0.18	OCR_2F_Q_16b_5	0.27	OCR_3F_Q_19a_3	0.68
OCR_1F_Q_21_5	0.67	OCR_2F_Q_16c_5	1.02	OCR_3F_Q_19b_3	-0.29
		OCR_2F_Q_17a_1	-1.26		
		OCR_2F_Q_17b_1	-0.23		
		OCR_2F_Q_17c_2	-0.13		
		OCR_2F_Q_17d_4	0.16		
		OCR_2F_Q_18a_2	0.92		
		OCR_2F_Q_18b_2	0.04		
		OCR_2F_Q_19a_1	0.97		

Pearson foundation tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
PEARSON_1F_Q1a_x	-2.94	PEARSON_2F_Q1_x	-2.81	PEARSON_3F_Q1_x	-2.64
PEARSON_1F_Q1b_x	-2.09	PEARSON_2F_Q2_x	-2.84	PEARSON_3F_Q2_x	-3.59
PEARSON_1F_Q2_x	-2.89	PEARSON_2F_Q3a_x	-1.40	PEARSON_3F_Q3a_a	-5.00
PEARSON_1F_Q3_x	-3.54	PEARSON_2F_Q3b_x	-2.62	PEARSON_3F_Q3b_x	-4.05
PEARSON_1F_Q4a_x	-3.56	PEARSON_2F_Q4_x	-6.33	PEARSON_3F_Q4_x	-1.39
PEARSON_1F_Q4b_x	-3.22	PEARSON_2F_Q5_x	-1.84	PEARSON_3F_Q5a_x	-2.45
PEARSON_1F_Q5_x	-3.25	PEARSON_2F_Q6a_x	-2.00	PEARSON_3F_Q5b_x	-2.11
PEARSON_1F_Q6_x	-0.73	PEARSON_2F_Q6b_x	-1.52	PEARSON_3F_Q5c_x	-0.66
PEARSON_1F_Q7_x	-1.22	PEARSON_2F_Q6c_x	-1.35	PEARSON_3F_Q6a_x	-3.63
PEARSON_1F_Q8a_x	-2.09	PEARSON_2F_Q7_x	-1.56	PEARSON_3F_Q6b_x	-4.00
PEARSON_1F_Q8b_x	-0.66	PEARSON_2F_Q8_x	1.03	PEARSON_3F_Q6c_x	-1.88
PEARSON_1F_Q9_x	-3.26	PEARSON_2F_Q9_x	-1.75	PEARSON_3F_Q6d_x	-0.49
PEARSON_1F_Q10_x	-1.39	PEARSON_2F_Q10_x	-0.43	PEARSON_3F_Q7a_x	-1.61
PEARSON_1F_Q11a_x	-3.56	PEARSON_2F_Q11_x	-1.81	PEARSON_3F_Q7b_x	-0.97
PEARSON_1F_Q11b_x	-1.58	PEARSON_2F_Q12a_x	-4.42	PEARSON_3F_Q7c_x	0.54
PEARSON_1F_Q12a_x	-2.62	PEARSON_2F_Q12b_x	-3.76	PEARSON_3F_Q8a_x	-2.68
PEARSON_1F_Q12b_x	-0.60	PEARSON_2F_Q12c_x	-0.89	PEARSON_3F_Q8b_x	-0.06
PEARSON_1F_Q12c_x	-0.45	PEARSON_2F_Q13a_x	-1.80	PEARSON_3F_Q9_x	-3.05
PEARSON_1F_Q12d_x	-0.15	PEARSON_2F_Q13b_x	-0.75	PEARSON_3F_Q10_x	-0.58
PEARSON_1F_Q13a_x	-0.85	PEARSON_2F_Q14a_x	-0.70	PEARSON_3F_Q11_x	-1.98
PEARSON_1F_Q13b_x	-0.11	PEARSON_2F_Q14b_x	-0.59	PEARSON_3F_Q11i_x	-2.34
PEARSON_1F_Q14a_x	-1.31	PEARSON_2F_Q15_x	0.87	PEARSON_3F_Q11ii_x	-2.40
PEARSON_1F_Q14b_x	-0.64	PEARSON_2F_Q16_x	2.15	PEARSON_3F_Q12_x	0.82
PEARSON_1F_Q15_x	-1.89	PEARSON_2F_Q17_x	-1.55	PEARSON_3F_Q13ai_x	-1.25
PEARSON_1F_Q16a_x	-0.15	PEARSON_2F_Q18_x	0.14	PEARSON_3F_Q13aii_x	-0.93
PEARSON_1F_Q16b_x	0.08	PEARSON_2F_Q19_x	-2.02	PEARSON_3F_Q13b_x	1.49
PEARSON_1F_Q17_x	-1.37	PEARSON_2F_Q20a_x	-1.59	PEARSON_3F_Q14_x	0.29
PEARSON_1F_Q18a_x	-1.33	PEARSON_2F_Q20b_x	-1.40	PEARSON_3F_Q15a_x	-2.64
PEARSON_1F_Q18b_x	-2.23	PEARSON_2F_Q21_x	-0.71	PEARSON_3F_Q15b_x	0.86
PEARSON_1F_Q19_x	-0.44	PEARSON_2F_Q22a_x	-0.92	PEARSON_3F_Q16a_x	0.46
PEARSON_1F_Q_20_x	-1.98	PEARSON_2F_Q22b_x	0.65	PEARSON_3F_Q16b_x	0.14
PEARSON_1F_Q_21_x	-1.07	PEARSON_2F_Q_23_x	0.71	PEARSON_3F_Q17a_x	0.13
PEARSON_1F_Q_22_x	1.55	PEARSON_2F_Q_24_x	0.44	PEARSON_3F_Q17b_x	0.18
PEARSON_1F_Q_23a_x	-0.44	PEARSON_2F_Q_25a_x	-0.17	PEARSON_3F_Q_18_x	0.75
PEARSON_1F_Q_23b_x	-0.06	PEARSON_2F_Q_25b_x	-0.11	PEARSON_3F_Q_19a_x	-1.33
PEARSON_1F_Q_24_x	0.96	PEARSON_2F_Q_26_x	0.73	PEARSON_3F_Q_19b_x	-0.79
PEARSON_1F_Q_25_x	0.15	PEARSON_2F_Q_27a_x	-0.78	PEARSON_3F_Q_19c_x	0.16
PEARSON_1F_Q_26_x	0.66	PEARSON_2F_Q_27b_x	-0.16	PEARSON_3F_Q_20a_x	-0.26
PEARSON_1F_Q_27_x	1.21	PEARSON_2F_Q_28_x	1.42	PEARSON_3F_Q_20b_x	-0.02
PEARSON_1F_Q28_x	0.34	PEARSON_2F_Q29_x	-0.04	PEARSON_3F_Q_20c_x	0.92
PEARSON_1F_Q29_x	-1.38			PEARSON_3F_Q_21a_x	0.39
				PEARSON_3F_Q_21b_x	-0.04
				PEARSON_3F_Q_22_x	0.66
				PEARSON_3F_Q23a_x	-0.49
				PEARSON_3F_Q23b_x	-0.48

EDUQAS foundation tier

Id	Expected difficulty	Id	Expected difficulty
EDUQAS_1F_Q_1_x	-0.95	EDUQAS_2F_Q_1_x	0.93
EDUQAS_1F_Q_2a_x	-2.79	EDUQAS_2F_Q_2_x	-1.22
EDUQAS_1F_Q_2b_x	-1.72	EDUQAS_2F_Q_3_x	-1.65
EDUQAS_1F_Q_2c_x	-0.83	EDUQAS_2F_Q_4_x	-0.05
EDUQAS_1F_Q_3a_x	-0.19	EDUQAS_2F_Q_5_x	0.46
EDUQAS_1F_Q_3b_x	-0.80	EDUQAS_2F_Q_6a_x	-3.11
EDUQAS_1F_Q_4a_x	-2.71	EDUQAS_2F_Q_6b_x	-3.66
EDUQAS_1F_Q_4b_x	-0.52	EDUQAS_2F_Q_6c_x	-2.30
EDUQAS_1F_Q_4c_x	-0.58	EDUQAS_2F_Q_7a_x	-1.80
EDUQAS_1F_Q_4d_x	-0.24	EDUQAS_2F_Q_7b_x	1.29
EDUQAS_1F_Q_4e_x	2.10	EDUQAS_2F_Q_8_x	-1.17
EDUQAS_1F_Q_4f_x	1.27	EDUQAS_2F_Q_9_x	0.60
EDUQAS_1F_Q_5a_x	-3.03	EDUQAS_2F_Q10a_x	-0.43
EDUQAS_1F_Q_5b_x	-0.19	EDUQAS_2F_Q10b_x	0.12
EDUQAS_1F_Q_6a_x	-0.20	EDUQAS_2F_Q11a_x	1.30
EDUQAS_1F_Q_6b_x	-0.55	EDUQAS_2F_Q11b_x	0.37
EDUQAS_1F_Q_7a_x	-2.43	EDUQAS_2F_Q12_x	0.92
EDUQAS_1F_Q_7b_x	-3.36	EDUQAS_2F_Q13_x	0.69
EDUQAS_1F_Q_7c_x	-2.40	EDUQAS_2F_Q14_x	-0.64
EDUQAS_1F_Q_7d_x	-2.51	EDUQAS_2F_Q15a_x	-0.99
EDUQAS_1F_Q_8_x	-0.29	EDUQAS_2F_Q15b_x	-0.79
EDUQAS_1F_Q_9a_x	0.02	EDUQAS_2F_Q16_x	1.07
EDUQAS_1F_Q_9b_x	-0.07	EDUQAS_2F_Q17a_x	0.35
EDUQAS_1F_Q_10a_x	-1.56	EDUQAS_2F_Q17b_x	-0.51
EDUQAS_1F_Q_10b_x	-1.23	EDUQAS_2F_Q18_x	0.52
EDUQAS_1F_Q_10c_x	-1.29	EDUQAS_2F_Q19_x	0.03
EDUQAS_1F_Q_10d_x	0.28	EDUQAS_2F_Q20a_x	-0.45
EDUQAS_1F_Q_11_x	0.04	EDUQAS_2F_Q20b_x	1.82
EDUQAS_1F_Q_12_x	0.29	EDUQAS_2F_Q21_x	1.87
EDUQAS_1F_Q_13ai_x	-0.27	EDUQAS_2F_Q_23_x	0.30
EDUQAS_1F_Q_13aii_x	-0.56	EDUQAS_2F_Q_26_x	-0.45
EDUQAS_1F_Q_13bi_x	0.68	EDUQAS_2F_Q_27_x	1.56
EDUQAS_1F_Q_13bii_x	-0.75	EDUQAS_2F_Q28a_x	0.95
EDUQAS_1F_Q_14_x	1.08	EDUQAS_2F_Q28b_x	0.51
EDUQAS_1F_Q_15ai_x	-0.08		
EDUQAS_1F_Q_15aii_x	-0.15		
EDUQAS_1F_Q_15b_x	1.13		
EDUQAS_1F_Q_16a_x	0.25		
EDUQAS_1F_Q_16b_x	0.72		
EDUQAS_1F_Q_17a_x	-1.41		
EDUQAS_1F_Q_17b_x	0.85		
EDUQAS_1F_Q_18a_x	0.53		
EDUQAS_1F_Q_18b_x	0.02		
EDUQAS_1F_Q_18c_x	0.40		
EDUQAS_1F_Q_20ai_x	0.20		
EDUQAS_1F_Q_20aii_x	0.76		
EDUQAS_1F_Q_20b_x	0.87		
EDUQAS_1F_Q_21_x	0.03		
EDUQAS_1F_Q_22_x	1.49		
EDUQAS_1F_Q_23_x	0.03		
EDUQAS_1F_Q_24_x	1.44		
EDUQAS_1F_Q_25_x	-1.21		

AQA higher tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
AQA_1H_Q_1_x	-1.78	AQA_2H_Q_1_x	-1.27	AQA_3H_Q_1_x	-1.59
AQA_1H_Q_2_x	-1.39	AQA_2H_Q_2_x	-0.80	AQA_3H_Q_2_x	-1.27
AQA_1H_Q_3_x	-1.13	AQA_2H_Q_3_x	-1.36	AQA_3H_Q_3_x	-3.14
AQA_1H_Q_4_x	-0.47	AQA_2H_Q_4_x	-0.88	AQA_3H_Q_4_x	-1.06
AQA_1H_Q_5_x	0.21	AQA_2H_Q_5_x	-0.36	AQA_3H_Q_5_x	-0.90
AQA_1H_Q_6_x	0.05	AQA_2H_Q_6a_x	-0.72	AQA_3H_Q_6_x	1.17
AQA_1H_Q_7_x	-0.44	AQA_2H_Q_6b_x	0.34	AQA_3H_Q_7_x	0.16
AQA_1H_Q_8_x	-0.65	AQA_2H_Q_7a_x	0.01	AQA_3H_Q_8a_x	-1.39
AQA_1H_Q_9_x	1.23	AQA_2H_Q_7b_x	0.44	AQA_3H_Q_8b_x	-0.12
AQA_1H_Q_10_x	0.64	AQA_2H_Q_8_x	0.16	AQA_3H_Q_9_x	-0.21
AQA_1H_Q_11_x	0.08	AQA_2H_Q_9a_x	-0.40	AQA_3H_Q_10_x	1.16
AQA_1H_Q_12_x	1.12	AQA_2H_Q_9b_x	0.10	AQA_3H_Q_11_x	1.23
AQA_1H_Q_13a_x	0.82	AQA_2H_Q_10_x	0.16	AQA_3H_Q_12a_x	-1.52
AQA_1H_Q_13b_x	0.87	AQA_2H_Q_11_x	-0.29	AQA_3H_Q_12b_x	-0.57
AQA_1H_Q_14a_x	-0.61	AQA_2H_Q_12_x	-0.21	AQA_3H_Q_12c_x	0.19
AQA_1H_Q_14b_x	-0.39	AQA_2H_Q_13_x	0.44	AQA_3H_Q_13_x	0.06
AQA_1H_Q_14c_x	0.67	AQA_2H_Q_14a_x	1.59	AQA_3H_Q_14a_x	0.01
AQA_1H_Q_15_x	0.29	AQA_2H_Q_14b_x	1.84	AQA_3H_Q_14b_x	0.24
AQA_1H_Q_16_x	1.01	AQA_2H_Q_15_x	1.25	AQA_3H_Q_15_x	0.63
AQA_1H_Q_17a_x	-0.39	AQA_2H_Q_16_x	0.70	AQA_3H_Q_16_x	0.90
AQA_1H_Q_17b_x	1.14	AQA_2H_Q_17a_x	0.39	AQA_3H_Q_17_x	0.99
AQA_1H_Q_18_x	2.65	AQA_2H_Q_17b_x	0.51	AQA_3H_Q_18_x	0.56
AQA_1H_Q_19_x	1.12	AQA_2H_Q_18a_x	0.23	AQA_3H_Q_19_x	0.64
AQA_1H_Q_20a_x	0.60	AQA_2H_Q_18b_x	0.72	AQA_3H_Q_20_x	2.21
AQA_1H_Q_20b_x	0.75	AQA_2H_Q_19_x	-0.17	AQA_3H_Q_21_x	0.77
AQA_1H_Q_21_x	3.23	AQA_2H_Q_20_x	0.15	AQA_3H_Q_22_x	2.21
AQA_1H_Q_22_x	-0.23	AQA_2H_Q_21_x	0.73	AQA_3H_Q_23a_x	1.09
AQA_1H_Q_23a_x	0.25	AQA_2H_Q_22_x	0.25	AQA_3H_Q_23b_x	1.58
AQA_1H_Q_23b_x	-0.04	AQA_2H_Q_23_x	3.18	AQA_3H_Q_24_x	1.07
AQA_1H_Q_23c_x	0.33	AQA_2H_Q_24a_x	2.96	AQA_3H_Q_25a_x	2.69
AQA_1H_Q_24a_x	0.84	AQA_2H_Q_24b_x	2.37	AQA_3H_Q_25b_x	1.20
AQA_1H_Q_24b_x	1.28	AQA_2H_Q_24c_x	2.79	AQA_3H_Q_26a_x	-0.24
AQA_1H_Q_25_x	1.10	AQA_2H_Q_25a_x	0.94	AQA_3H_Q_26b_x	0.93
AQA_1H_Q_26_x	-0.24	AQA_2H_Q_25b_x	1.22	AQA_3H_Q_27_x	0.47
AQA_1H_Q_27_x	0.52	AQA_2H_Q_26_x	1.99	AQA_3H_Q_28_x	1.37
AQA_1H_Q_28_x	1.84				

OCR higher tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
OCR_1H_Q_1_x	-0.25	OCR_2H_Q_1a_4	-0.35	OCR_3H_Q_1a_3	0.20
OCR_1H_Q_2a_4	-0.62	OCR_2H_Q_1b_4	1.33	OCR_3H_Q_1b_3	1.23
OCR_1H_Q_2b_4	0.34	OCR_2H_Q_2a_3	0.08	OCR_3H_Q_2ai_2	-1.38
OCR_1H_Q_3a_1	-1.53	OCR_2H_Q_2b_3	0.42	OCR_3H_Q_2aii_2	-1.56
OCR_1H_Q_3b_1	-1.72	OCR_2H_Q_2c_3	0.55	OCR_3H_Q_2b_2	-1.90
OCR_1H_Q_3c_1	0.79	OCR_2H_Q_3a_5	-0.32	OCR_3H_Q_2c_2	0.67
OCR_1H_Q_4ai_2	-0.96	OCR_2H_Q_3b_5	0.27	OCR_3H_Q_3a_3	0.68
OCR_1H_Q_4aii_2	-0.05	OCR_2H_Q_3c_5	1.02	OCR_3H_Q_3b_3	-0.29
OCR_1H_Q_4bi_2	-0.50	OCR_2H_Q_4a_3	0.12	OCR_3H_Q_4ai_1	-0.73
OCR_1H_Q_4bii_2	0.26	OCR_2H_Q_4b_3	1.23	OCR_3H_Q_4aii_1	0.16
OCR_1H_Q_5_1	-0.25	OCR_2H_Q_5_2	0.97	OCR_3H_Q_4b_1	0.16
OCR_1H_Q_6_3	0.44	OCR_2H_Q_6_5	0.34	OCR_3H_Q_4c_1	1.29
OCR_1H_Q_7a_5	0.38	OCR_2H_Q_7_1	0.61	OCR_3H_Q_5a_3	0.18
OCR_1H_Q_7b_5	0.35	OCR_2H_Q_8_1	0.08	OCR_3H_Q_5b_3	0.48
OCR_1H_Q_7c_5	1.24	OCR_2H_Q_9_1	0.62	OCR_3H_Q_5c_3	1.49
OCR_1H_Q_8ai_2	0.13	OCR_2H_Q_10a_1	0.17	OCR_3H_Q_6ai_6	0.49
OCR_1H_Q_8aii_2	0.22	OCR_2H_Q_10b_1	-0.11	OCR_3H_Q_6aii_6	1.52
OCR_1H_Q_8b_2	1.01	OCR_2H_Q_10c_1	0.64	OCR_3H_Q_6b_6	1.53
OCR_1H_Q_9a_3	2.33	OCR_2H_Q_10d_1	0.97	OCR_3H_Q_7_1	0.15
OCR_1H_Q_9b_3	1.28	OCR_2H_Q_11a_3	0.66	OCR_3H_Q_8a_1	0.02
OCR_1H_Q_10_4	0.12	OCR_2H_Q_11b_3	1.13	OCR_3H_Q_8b_1	-0.70
OCR_1H_Q_11a_1	0.32	OCR_2H_Q_12_4	2.40	OCR_3H_Q_9_3	0.98
OCR_1H_Q_11b_1	1.30	OCR_2H_Q_13a_6	-0.88	OCR_3H_Q_10a_3	0.74
OCR_1H_Q_12a_1	-0.12	OCR_2H_Q_13b_6	-0.17	OCR_3H_Q_10b_3	-0.22
OCR_1H_Q_12b_1	2.00	OCR_2H_Q_13c_6	0.62	OCR_3H_Q_10c_3	0.59
OCR_1H_Q_13_3	1.23	OCR_2H_Q_13d_6	-0.17	OCR_3H_Q_11a_5	0.31
OCR_1H_Q_14ai_6	-0.35	OCR_2H_Q_14_2	0.81	OCR_3H_Q_11bi_5	1.03
OCR_1H_Q_14aii_6	-0.17	OCR_2H_Q_15a_1	-0.23	OCR_3H_Q_11bii_5	0.98
OCR_1H_Q_14b_6	1.07	OCR_2H_Q_15b_1	-0.44	OCR_3H_Q_12_3	1.17
OCR_1H_Q_14c_6	0.55	OCR_2H_Q_16_2	0.75	OCR_3H_Q_13_4	1.10
OCR_1H_Q_15_3	1.09	OCR_2H_Q_17a_4	-1.29	OCR_3H_Q_14_2	0.89
OCR_1H_Q_16a_4	1.08	OCR_2H_Q_17b_4	-0.07	OCR_3H_Q_15_1	0.27
OCR_1H_Q_16b_4	1.61	OCR_2H_Q_18_4	2.57	OCR_3H_Q_16ai_4	0.94
OCR_1H_Q_17_5	0.93	OCR_2H_Q_19_3	1.07	OCR_3H_Q_16aii_4	1.46
OCR_1H_Q_18_4	0.78	OCR_2H_Q_20a_2	1.28	OCR_3H_Q_16b_4	1.41
OCR_1H_Q_19a_2	0.72	OCR_2H_Q_20b_2	1.00	OCR_3H_Q_17_2	0.97
OCR_1H_Q_19b_2	1.09				
OCR_1H_Q_20a_2	0.50				
OCR_1H_Q_20b_2	1.14				

Pearson higher tier

Id	Expected difficulty	Id	Expected difficulty	Id	Expected difficulty
PEARSON_1H_Q_1_x	-1.98	PEARSON_2H_Q_1_x	0.71	PEARSON_3H_Q_1_x	0.75
PEARSON_1H_Q_2_x	-1.07	PEARSON_2H_Q_2_x	0.44	PEARSON_3H_Q_2a_x	-1.33
PEARSON_1H_Q_3_x	1.55	PEARSON_2H_Q_3a_x	-0.17	PEARSON_3H_Q_2b_x	-0.79
PEARSON_1H_Q_4a_x	-0.44	PEARSON_2H_Q_3b_x	-0.11	PEARSON_3H_Q_2c_x	0.16
PEARSON_1H_Q_4b_x	-0.06	PEARSON_2H_Q_4_x	0.73	PEARSON_3H_Q_3a_x	-0.26
PEARSON_1H_Q_5_x	0.96	PEARSON_2H_Q_5a_x	-0.78	PEARSON_3H_Q_3b_x	-0.02
PEARSON_1H_Q_6_x	0.15	PEARSON_2H_Q_5b_x	-0.16	PEARSON_3H_Q_3c_x	0.92
PEARSON_1H_Q_7_x	0.66	PEARSON_2H_Q_6_x	1.42	PEARSON_3H_Q_4a_x	0.39
PEARSON_1H_Q_8_x	1.21	PEARSON_2H_Q_7a_x	-1.56	PEARSON_3H_Q_4b_x	-0.04
PEARSON_1H_Q_9_x	-1.59	PEARSON_2H_Q_7b_x	-1.86	PEARSON_3H_Q_5_x	0.66
PEARSON_1H_Q_10a_x	-1.44	PEARSON_2H_Q_7c_x	-1.62	PEARSON_3H_Q_6_x	0.92
PEARSON_1H_Q_10b_x	0.34	PEARSON_2H_Q_8_x	-0.47	PEARSON_3H_Q_7a_x	-0.25
PEARSON_1H_Q_11a_x	0.12	PEARSON_2H_Q_9_x	1.28	PEARSON_3H_Q_7b_x	0.10
PEARSON_1H_Q_11b_x	-0.36	PEARSON_2H_Q_10a_x	1.02	PEARSON_3H_Q_7c_x	1.57
PEARSON_1H_Q_12_x	-0.88	PEARSON_2H_Q_10b_x	-0.54	PEARSON_3H_Q_8_x	-0.48
PEARSON_1H_Q_13_x	0.39	PEARSON_2H_Q_11_x	3.19	PEARSON_3H_Q_9a_x	-0.31
PEARSON_1H_Q_14a_x	0.14	PEARSON_2H_Q_12a_x	0.21	PEARSON_3H_Q_9b_x	-0.73
PEARSON_1H_Q_14b_x	0.72	PEARSON_2H_Q_12b_x	1.22	PEARSON_3H_Q_9c_x	-0.40
PEARSON_1H_Q_15_x	0.78	PEARSON_2H_Q_13_x	-0.46	PEARSON_3H_Q_10a_x	1.50
PEARSON_1H_Q_16_x	0.01	PEARSON_2H_Q_14_x	1.02	PEARSON_3H_Q_10b_x	1.48
PEARSON_1H_Q_17_x	0.25	PEARSON_2H_Q_15_x	1.26	PEARSON_3H_Q_11_x	1.13
PEARSON_1H_Q_18_x	1.44	PEARSON_2H_Q_16a_x	0.44	PEARSON_3H_Q_12a_x	0.79
PEARSON_1H_Q_19_x	0.58	PEARSON_2H_Q_16b_x	0.77	PEARSON_3H_Q_12b_x	0.69
PEARSON_1H_Q_20a_x	0.46	PEARSON_2H_Q_17_x	0.62	PEARSON_3H_Q_13_x	1.74
PEARSON_1H_Q_20b_x	0.16	PEARSON_2H_Q_18_x	0.55	PEARSON_3H_Q_14a_x	1.35
PEARSON_1H_Q_21a_x	0.54	PEARSON_2H_Q_19a_x	0.23	PEARSON_3H_Q_14b_x	-0.29
PEARSON_1H_Q_21b_x	0.74	PEARSON_2H_Q_19b_x	0.22	PEARSON_3H_Q_14c_x	0.87
PEARSON_1H_Q_22_x	0.00	PEARSON_2H_Q_20_x	2.03	PEARSON_3H_Q_15a_x	0.15
PEARSON_1H_Q_23_x	0.41	PEARSON_2H_Q_21a_x	2.04	PEARSON_3H_Q_15b_x	1.23
PEARSON_1H_Q_24_x	1.36	PEARSON_2H_Q_21b_x	1.38	PEARSON_3H_Q_16_x	3.15
PEARSON_1H_Q_25_x	1.19	PEARSON_2H_Q_22_x	1.67	PEARSON_3H_Q_17a_x	0.65
				PEARSON_3H_Q_17b_x	2.00
				PEARSON_3H_Q_17c_x	1.08
				PEARSON_3H_Q_18_x	2.50

EDUQAS higher tier

Id	Expected difficulty	Id	Expected difficulty
EDUQAS_1H_Q_1_x	-1.21	EDUQAS_2H_Q_1a_x	-0.81
EDUQAS_1H_Q_2_x	0.03	EDUQAS_2H_Q_1b_x	-0.78
EDUQAS_1H_Q_3a_x	-0.04	EDUQAS_2H_Q_2_x	0.30
EDUQAS_1H_Q_3b_x	0.87	EDUQAS_2H_Q_3a_x	-1.79
EDUQAS_1H_Q_4_x	0.03	EDUQAS_2H_Q_3b_x	-0.67
EDUQAS_1H_Q_5ai_x	-0.89	EDUQAS_2H_Q_3c_x	-1.20
EDUQAS_1H_Q_5aii_x	-0.19	EDUQAS_2H_Q_3d_x	1.28
EDUQAS_1H_Q_6_x	1.44	EDUQAS_2H_Q_4a_x	0.04
EDUQAS_1H_Q_7a_x	1.51	EDUQAS_2H_Q_4b_x	1.45
EDUQAS_1H_Q_7b_x	0.91	EDUQAS_2H_Q_5a_x	0.53
EDUQAS_1H_Q_8_x	1.49	EDUQAS_2H_Q_5b_x	1.09
EDUQAS_1H_Q_9a_x	1.23	EDUQAS_2H_Q_6_x	1.56
EDUQAS_1H_Q_9b_x	0.73	EDUQAS_2H_Q_7a_x	-1.08
EDUQAS_1H_Q_10_x	0.76	EDUQAS_2H_Q_7bi_x	-0.30
EDUQAS_1H_Q_11a_x	1.52	EDUQAS_2H_Q_7bii_x	0.70
EDUQAS_1H_Q_11b_x	1.21	EDUQAS_2H_Q_7c_x	0.24
EDUQAS_1H_Q_12a_x	-0.32	EDUQAS_2H_Q_7d_x	1.54
EDUQAS_1H_Q_12b_x	1.45	EDUQAS_2H_Q_8_x	-0.45
EDUQAS_1H_Q_12c_x	0.26	EDUQAS_2H_Q_9a_x	-0.38
EDUQAS_1H_Q_12d_x	0.58	EDUQAS_2H_Q_9b_x	1.08
EDUQAS_1H_Q_13a_x	0.52	EDUQAS_2H_Q_10a_x	0.90
EDUQAS_1H_Q_13b_x	1.52	EDUQAS_2H_Q_10b_x	1.00
EDUQAS_1H_Q_14_x	0.31	EDUQAS_2H_Q_11a_x	0.67
EDUQAS_1H_Q_15a_x	1.27	EDUQAS_2H_Q_11b_x	1.29
EDUQAS_1H_Q_15b_x	0.44	EDUQAS_2H_Q_12a_x	0.37
EDUQAS_1H_Q_16a_x	-0.11	EDUQAS_2H_Q_12b_x	0.59
EDUQAS_1H_Q_16b_x	0.77	EDUQAS_2H_Q_13_x	2.13
EDUQAS_1H_Q_17_x	0.84	EDUQAS_2H_Q_14_x	-0.32
EDUQAS_1H_Q_18_x	1.53	EDUQAS_2H_Q_15a_x	0.59
EDUQAS_1H_Q_19a_x	1.04	EDUQAS_2H_Q_15b_x	0.50
EDUQAS_1H_Q_19b_x	0.54	EDUQAS_2H_Q_16a_x	1.58
EDUQAS_1H_Q_19c_x	1.43	EDUQAS_2H_Q_16b_x	1.71
EDUQAS_1H_Q_20ai_x	0.12	EDUQAS_2H_Q_17_x	1.70
EDUQAS_1H_Q_20aii_x	2.27	EDUQAS_2H_Q_18a_x	1.25
EDUQAS_1H_Q_20bi_x	1.72	EDUQAS_2H_Q_18b_x	1.94
EDUQAS_1H_Q_20bii_x	1.22	EDUQAS_2H_Q_19_x	2.27
EDUQAS_1H_Q_21_x	1.75	EDUQAS_2H_Q_20a_x	1.25
		EDUQAS_2H_Q_20b_x	1.58
		EDUQAS_2H_Q_20c_x	0.94
		EDUQAS_2H_Q_21a_x	1.48
		EDUQAS_2H_Q_21b_x	1.31
		EDUQAS_2H_Q_21c_x	3.96
		EDUQAS_2H_Q_22a_x	0.88
		EDUQAS_2H_Q_22b_x	1.71

Appendix B: Item difficulty parameters from phase 3

Id	True score	Id	True score	Id	True score
EDUQAS_1F_Q_1_x	-0.95	EDUQAS_1F_Q_9b_x	-0.55	EDUQAS_1F_Q_19_x	1.08
EDUQAS_1F_Q_2a_x	-2.79	EDUQAS_1F_Q_10_x	-0.76	EDUQAS_1F_Q_20ai_x	-0.08
EDUQAS_1F_Q_2b_x	-1.71	EDUQAS_1F_Q_11a_x	-2.43	EDUQAS_1F_Q_20aii_x	-0.15
EDUQAS_1F_Q_2c_x	-0.82	EDUQAS_1F_Q_11b_x	-3.36	EDUQAS_1F_Q_20b_x	1.13
EDUQAS_1F_Q_3a_x	-0.19	EDUQAS_1F_Q_11c_x	-2.4	EDUQAS_1F_Q_21_x	0.25
EDUQAS_1F_Q_3b_x	-0.8	EDUQAS_1F_Q_11d_x	-2.51	EDUQAS_1F_Q_22a_x	1.24
EDUQAS_1F_Q_4a_x	-2.79	EDUQAS_1F_Q_12_x	0.3	EDUQAS_1F_Q_22b_x	0.73
EDUQAS_1F_Q_4b_x	-1.72	EDUQAS_1F_Q_13_x	-0.29	EDUQAS_1F_Q_23a_x	0.53
EDUQAS_1F_Q_4c_x	-0.83	EDUQAS_1F_Q_14a_x	0.02	EDUQAS_1F_Q_23b_x	0.02
EDUQAS_1F_Q_5_x	0.27	EDUQAS_1F_Q_14b_x	-0.07	EDUQAS_1F_Q_23c_x	0.4
EDUQAS_1F_Q_6a_x	-2.71	EDUQAS_1F_Q_15a_x	-1.56	EDUQAS_1F_Q_24a_x	-0.49
EDUQAS_1F_Q_6b_x	-0.52	EDUQAS_1F_Q_15b_x	-1.23	EDUQAS_1F_Q_24b_x	-0.14
EDUQAS_1F_Q_6c_x	-0.58	EDUQAS_1F_Q_15c_x	-1.29	EDUQAS_1F_Q_24c_x	0.64
EDUQAS_1F_Q_6d_x	-0.24	EDUQAS_1F_Q_15d_x	0.28	EDUQAS_1F_Q_25_x	0.03
EDUQAS_1F_Q_6e_x	2.1	EDUQAS_1F_Q_16_x	0.04	EDUQAS_1F_Q_26_x	0.03
EDUQAS_1F_Q_6f_x	1.27	EDUQAS_1F_Q_17_x	0.29	EDUQAS_1F_Q_27_x	1.44
EDUQAS_1F_Q_7_x	-0.17	EDUQAS_1F_Q_17a_x	-1.41	EDUQAS_1F_Q_28_x	-1.21
EDUQAS_1F_Q_8a_x	-3.03	EDUQAS_1F_Q_18ai_x	-0.27	EDUQAS_1F_Q_29a_x	1.23
EDUQAS_1F_Q_8b_x	-0.19	EDUQAS_1F_Q_18aii_x	-0.56	EDUQAS_1F_Q_29b_x	0.73
EDUQAS_1F_Q_9a_x	-0.2	EDUQAS_1F_Q_18b_x	-0.75		

Id	True score	Id	True score	Id	True score
EDUQAS_2F_Q_1a_x	-1.93	EDUQAS_2F_Q_10b_x	1.29	EDUQAS_2F_Q20b_x	-0.51
EDUQAS_2F_Q_1b_x	-2.34	EDUQAS_2F_Q_11_x	-1.17	EDUQAS_2F_Q21_x	0.52
EDUQAS_2F_Q_1c_x	-1.24	EDUQAS_2F_Q_12_x	0.6	EDUQAS_2F_Q22_x	0.03
EDUQAS_2F_Q_2_x	-1.22	EDUQAS_2F_Q13a_x	-0.43	EDUQAS_2F_Q23a_x	-0.45
EDUQAS_2F_Q_3a_x	-1.64	EDUQAS_2F_Q13b_x	0.12	EDUQAS_2F_Q23b_x	1.82
EDUQAS_2F_Q_3b_x	-2.01	EDUQAS_2F_Q_14a_x	-1.11	EDUQAS_2F_Q_24a_x	-0.81
EDUQAS_2F_Q_4_x	-1.22	EDUQAS_2F_Q_14b_x	0.02	EDUQAS_2F_Q_24b_x	-0.78
EDUQAS_2F_Q_5_x	-1.65	EDUQAS_2F_Q15a_x	1.3	EDUQAS_2F_Q_25_x	0.3
EDUQAS_2F_Q_6_x	-0.05	EDUQAS_2F_Q15b_x	0.37	EDUQAS_2F_Q_26_x	0.04
EDUQAS_2F_Q_7_x	-1.83	EDUQAS_2F_Q16_x	0.69	EDUQAS_2F_Q_27a_x	0.53
EDUQAS_2F_Q_8_x	-1.16	EDUQAS_2F_Q17_x	-0.64	EDUQAS_2F_Q_27b_x	1.09
EDUQAS_2F_Q_9a_x	-3.11	EDUQAS_2F_Q18a_x	-0.99	EDUQAS_2F_Q_28_x	-0.45
EDUQAS_2F_Q_9b_x	-3.66	EDUQAS_2F_Q18b_x	-0.79	EDUQAS_2F_Q_29_x	1.86
EDUQAS_2F_Q_9c_x	-2.3	EDUQAS_2F_Q19_x	1.07	EDUQAS_2F_Q30a_x	0.95
EDUQAS_2F_Q_10a_x	-1.8	EDUQAS_2F_Q20a_x	0.35	EDUQAS_2F_Q30b_x	0.51

Id	True score	Id	True score	Id	True core
EDUQAS_1H_Q_1a_x	-2.87	EDUQAS_1H_Q_9b_x	0.73	EDUQAS_1H_Q_17_x	0.52
EDUQAS_1H_Q_1b_x	-1.89	EDUQAS_1H_Q_10_x	1.44	EDUQAS_1H_Q_18_x	0.31
EDUQAS_1H_Q_1c_x	-1.8	EDUQAS_1H_Q_11_x	1.49	EDUQAS_1H_Q_19_x	0.44
EDUQAS_1H_Q_2_x	-1.21	EDUQAS_1H_Q_12a_x	1.23	EDUQAS_1H_Q_20a_x	-0.11
EDUQAS_1H_Q_3_x	0.03	EDUQAS_1H_Q_12b_x	0.73	EDUQAS_1H_Q_20b_x	0.77
EDUQAS_1H_Q_4a_x	-0.49	EDUQAS_1H_Q_13ai_x	-0.83	EDUQAS_1H_Q_21_x	0.84
EDUQAS_1H_Q_4b_x	-0.14	EDUQAS_1H_Q_13aii_x	0.33	EDUQAS_1H_Q_22a_x	1.04
EDUQAS_1H_Q_4c_x	0.64	EDUQAS_1H_Q_13b_x	0.91	EDUQAS_1H_Q_22b_x	0.54
EDUQAS_1H_Q_5_x	-0.48	EDUQAS_1H_Q_14_x	0.76	EDUQAS_1H_Q_22c_x	1.43
EDUQAS_1H_Q_6_x	0.03	EDUQAS_1H_Q_15_x	2.64	EDUQAS_1H_Q_23ai_x	0.12
EDUQAS_1H_Q_7ai_x	-0.89	EDUQAS_1H_Q_16a_x	-0.32	EDUQAS_1H_Q_23aii_x	1.49
EDUQAS_1H_Q_7aii_x	-0.19	EDUQAS_1H_Q_16b_x	1.45	EDUQAS_1H_Q_23bi_x	1.72
EDUQAS_1H_Q_8_x	1.49	EDUQAS_1H_Q_16c_x	0.26	EDUQAS_1H_Q_23bii_x	1.22
EDUQAS_1H_Q_9a_x	1.24	EDUQAS_1H_Q_16d_x	0.58	EDUQAS_1H_Q_24_x	1.75

Id	True score	Id	True score	Id	True score
PEARSON_1F_Q1_x	-2.09	PEARSON_1F_Q13a_x	-2.62	PEARSON_1F_Q19_x	-1.89
PEARSON_1F_Q2_x	-2.89	PEARSON_1F_Q13b_x	-0.60	PEARSON_1F_Q20_x	-0.44
PEARSON_1F_Q_3_x	-1.69	PEARSON_1F_Q13c_x	-0.45	PEARSON_1F_Q_21_x	-1.98
PEARSON_1F_Q_4_x	-4.31	PEARSON_1F_Q13d_x	-0.15	PEARSON_1F_Q_22_x	-1.07
PEARSON_1F_Q_5_x	-2.96	PEARSON_1F_Q14a_x	-0.85	PEARSON_1F_Q_23_x	1.55
PEARSON_1F_Q_6_x	0.10	PEARSON_1F_Q14b_x	-0.11	PEARSON_1F_Q_24a_x	-0.44
PEARSON_1F_Q7_x	-1.22	PEARSON_1F_Q15a_x	-1.31	PEARSON_1F_Q_24b_x	-0.06
PEARSON_1F_Q8_x	-2.09	PEARSON_1F_Q15b_x	-0.64	PEARSON_1F_Q_25_x	0.96
PEARSON_1F_Q_9_x	-2.89	PEARSON_1F_Q_16_x	1.07	PEARSON_1F_Q_26_x	0.15
PEARSON_1F_Q_10_x	-2.36	PEARSON_1F_Q17a_x	-0.15	PEARSON_1F_Q_27_x	0.66
PEARSON_1F_Q11_x	-1.37	PEARSON_1F_Q17b_x	0.08	PEARSON_1F_Q_28_x	1.21
PEARSON_1F_Q_12a_x	-2.00	PEARSON_1F_Q18a_x	-1.33	PEARSON_1F_Q29_x	0.34
PEARSON_1F_Q12b_x	-1.58	PEARSON_1F_Q_18b_x	-0.78	PEARSON_1F_Q30_x	-1.38

Id	True score	Id	True score	Id	True score
PEARSON_2F_Q1_x	-2.81	PEARSON_2F_Q12a_x	-1.80	PEARSON_2F_Q21_x	-0.71
PEARSON_2F_Q2_x	-2.84	PEARSON_2F_Q12b_x	-0.75	PEARSON_2F_Q22a_x	-0.92
PEARSON_2F_Q3a_x	-1.40	PEARSON_2F_Q13a_x	-0.70	PEARSON_2F_Q22b_x	0.65
PEARSON_2F_Q3b_x	-2.62	PEARSON_2F_Q13b_x	-0.59	PEARSON_2F_Q_23_x	0.71
PEARSON_2F_Q4_x	-1.84	PEARSON_2F_Q14_x	0.87	PEARSON_2F_Q_24_x	0.44
PEARSON_2F_Q_5_x	-1.34	PEARSON_2F_Q15_x	2.15	PEARSON_2F_Q_25a_x	-0.17
PEARSON_2F_Q6_x	-1.56	PEARSON_2F_Q16_x	-1.55	PEARSON_2F_Q_25b_x	-0.11
PEARSON_2F_Q7_x	1.03	PEARSON_2F_Q_17_x	-1.39	PEARSON_2F_Q_26_x	0.73
PEARSON_2F_Q_8_x	-0.81	PEARSON_2F_Q18_x	0.14	PEARSON_2F_Q_27a_x	-0.78
PEARSON_2F_Q9_x	-0.43	PEARSON_2F_Q19_x	-2.02	PEARSON_2F_Q_27b_x	-0.16
PEARSON_2F_Q10_x	-1.81	PEARSON_2F_Q20a_x	-1.59	PEARSON_2F_Q_28_x	1.42
PEARSON_2F_Q_11a_x	-2.29	PEARSON_2F_Q_20b_x	0.52	PEARSON_2F_Q29_x	-0.04
PEARSON_2F_Q_11b_x	-2.07				

Id	True score	Id	True score	Id	True score
PEARSON_3F_Q1_x	-2.64	PEARSON_3F_Q8_x	-0.06	PEARSON_3F_Q17b_x	0.18
PEARSON_3F_Q_2a_x	-2.48	PEARSON_3F_Q_9_x	-1.88	PEARSON_3F_Q_18_x	0.76
PEARSON_3F_Q_2b_x	-1.83	PEARSON_3F_Q10_x	-0.58	PEARSON_3F_Q_19a_x	-1.33
PEARSON_3F_Q_3_x	0.09	PEARSON_3F_Q11i_x	-2.34	PEARSON_3F_Q_19b_x	-0.79
PEARSON_3F_Q4a_x	-2.45	PEARSON_3F_Q11ii_x	-2.40	PEARSON_3F_Q_19c_x	0.16
PEARSON_3F_Q4b_x	-2.11	PEARSON_3F_Q12_x	0.82	PEARSON_3F_Q_20a_x	-0.26
PEARSON_3F_Q4c_x	-0.66	PEARSON_3F_Q13ai_x	-1.25	PEARSON_3F_Q_20b_x	-0.02
PEARSON_3F_Q5_x	-0.73	PEARSON_3F_Q13aii_x	-0.93	PEARSON_3F_Q_20c_x	0.92
PEARSON_3F_Q_6a_x	-0.87	PEARSON_3F_Q13b_x	1.49	PEARSON_3F_Q_21a_x	0.39
PEARSON_3F_Q6b_x	-1.88	PEARSON_3F_Q14_x	0.29	PEARSON_3F_Q_21b_x	-0.04
PEARSON_3F_Q6c_x	-0.49	PEARSON_3F_Q_15_x	0.73	PEARSON_3F_Q_22_x	0.67
PEARSON_3F_Q7a_x	-1.61	PEARSON_3F_Q_16_x	0.21	PEARSON_3F_Q23a_x	-0.49
PEARSON_3F_Q7b_x	-0.97	PEARSON_3F_Q17a_x	0.13	PEARSON_3F_Q23b_x	-0.48
PEARSON_3F_Q7c_x	0.54				

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