

## Written evidence submitted by Protect Pure Maths

### 1. Background

- 1.1 Protect Pure Maths (PPM) is delighted to provide a submission to the Education Select Committee's inquiry into Teacher recruitment, training and retention.
- 1.2 PPM exists to protect and promote all the mathematical sciences. It was founded in collaboration with the London Mathematical Society (LMS) and works in close partnership with the Institute of Mathematics and its Applications (IMA), as well as the UK's other leading mathematical societies. The campaign was originally established in response to concerns that some universities were cutting their mathematics research provision.
- 1.3 PPM seeks to engage with the academic community, industry, and government to: (i) ensure that maths funding properly reflects the value of maths to society; (ii) prevent further cuts to university maths departments; (iii) encourage more people to consider further study of mathematics, and (iv) strengthen the voice of industry in maths policymaking and advance mathematical sciences in the UK.
- 1.4 Mathematics education at all levels presents huge opportunities for individuals' career advancement. Numeracy is fundamental to an individual's life chances; mathematics is one of the top three subjects for graduate earnings; and research into the mathematical sciences is estimated to directly create employment for 2.8 million people in the UK<sup>i</sup>.
- 1.5 The mathematical sciences are a path for social mobility. According to the Sutton Trust, 42.5% of mathematics graduates who previously qualified for free school meals are in the top quintile of earners.<sup>ii</sup>
- 1.6 PPM is supportive of the principle that the UK should align with the majority of OECD countries and require some form of maths education up to the age of 18. We therefore welcomed the Prime Minister's announcement that all pupils in England will study maths up to the age of 18. However, the successful delivery of this policy will require addressing challenges with recruitment, qualifications, professional development and retention of teachers of mathematics.
- 1.7 We have focused our submission on recruitment, training and retention as it relates to the teaching of mathematics and the impact on the broader mathematics 'pipeline'. This submission is supported by the London Mathematical Society and the Institute for Mathematics and its Applications.

### 2. The current situation regarding teacher recruitment and retention

- 2.1 Shortages of and retention challenges for suitably qualified teachers of mathematics impacts how many students are engaged and on track to study mathematics at GCSE, A Level and university. In particular, the primary-secondary transition is "*a crucial point in the maths pipeline, where attainment and attitudes drop*".<sup>iii</sup>
- 2.1.1 A report from the University of Nottingham released in March 2023 analysed the 'mathematics pipeline' in England for all young people in schools from age 4 to 16, A level, undergraduate, and postgraduate. The report highlights the importance of the quality of mathematics teaching, particularly in Key Stage Three (ages 11-14; Years 7-9), for keeping students engaged and on track to continue studying mathematics at GCSE, A Level, and university (the mathematics 'excellence stream').

- 2.1.2 This stage is where students, and in particular students from economically disadvantaged backgrounds, are most likely to drop out of the “maths excellence stream” despite showing ability. According to research from XTX Markets, only 52% of the most deprived students (IDACI quintile 1) who attained Level 5U-6 in KS2 maths went on to attain grade 7-9 in GCSE maths, compared to nearly three-quarters (73.5%) of the least deprived students (IDACI quintile 5).<sup>iv</sup>

### Teacher qualifications

- 2.1 Currently, primary teachers are required to have achieved at least grade 4 in GCSE maths. In the majority of cases, this is their highest maths qualification. Only around 44% of secondary teachers of mathematics have a maths-related degree, compared with 65% of English teachers who have a degree in English<sup>v</sup>.
- 2.2 Subject knowledge and professional experience is particularly important for teacher quality in STEM subjects, as acknowledged in the Commons Science and Technology Committee’s March 2023 inquiry report on “Diversity and Inclusion in STEM.”<sup>vi</sup> According to interviews conducted by the University of Nottingham, effective teachers enhance students’ mathematical engagement, progress and attainment, and teachers’ own connections with the subject can influence how they teach the subject<sup>vii</sup>.

### Teacher shortages and recruitment

- 2.3 There are currently around 250,000 FTE teachers teaching maths in state-funded nursery, primary and secondary schools in England, accounting for over half of all teachers in the country.
- 2.4 The shortage of teachers of mathematics at the secondary level in particular has been a policy concern for successive governments. PPM’s analysis of school data from DfE and Ofqual found that the persistent under-recruitment of new maths teachers has resulted in around 4,000 ‘missing’ maths teachers since 2015.<sup>viii</sup> The National Foundation for Education Research found in its analysis of the 2022 teacher labour market that the recruitment target for teachers of maths has decreased by 39% from 2019/20 to 2022/23 despite persistent under-recruitment for the subject since 2011/12.<sup>ix</sup>
- 2.4.1 The NFER report notes: *“Recruitment targets set by the TWM [Department for Education’s Teacher Workforce Model] are supposed to increase if a subject has substantially under-recruited in previous years. However, despite persistent under-recruitment, the maths target has fallen since the pandemic. Little explanation has been provided by DfE as to why the target has fallen so dramatically when targets for other similar subjects have increased”*.<sup>x</sup>
- 2.4.2 In addition to under-recruitment, teaching of mathematics at schools in England is also hindered by teacher retention challenges. According to NFER, between 2011/12 and 2017/18, leaving rates for teachers of mathematics and other science subjects were above the average rate, with many leaving education entirely and 10% of working age teachers of mathematics leaving the state sector in 2017/2018. In 2017/18, approximately 10% of working age teachers of mathematics left teaching in the state sector.<sup>xi</sup>

### Managing the shortage of qualified teachers and its impact on students

- 2.5 Senior school leaders are likely to manage teacher shortages by placing more experienced and better qualified teachers with GCSE and A Level students where the stakes are higher.<sup>xii</sup>

This means that the shortage of qualified teachers has a particular impact at certain points of the mathematics pipeline, for example at Key Stage 3 or students aged 11-14.

- 2.6 Furthermore, the University of Nottingham found that in areas with deprivation, *“there are often insufficient teachers with appropriate professional experience and qualifications to teach classes preparing for high-stakes assessment”*, thereby impacting the quality of provision of A Level Mathematics and Further Mathematics in these areas.<sup>xiii</sup>
- 2.7 Just 25% of disadvantaged pupils achieve a good pass in GCSE maths. The attainment gap between the lowest and highest achievers is also wider than the Organisation for Economic Co-operation and Development (OECD) average.
- 2.8 More broadly, student outcomes for mathematics vary by region, with a worrying correlation between affluence and higher achievement. Geographical analysis of student outcomes for mathematics indicates that a larger proportion of the highest GCSE grades (7-9) are achieved in the more affluent south of England<sup>xiv</sup>.
- 2.9 Those who do not achieve a good pass, or have a negative experience of maths at school, are more likely to drop out of the ‘excellence stream’, meaning they are much less likely to go on to study maths at A Level or in Further Education. They are therefore inadvertently locked out of the system and denied the multiple opportunities that education and qualifications in STEM can offer in the long-term.

### **3. *What particular challenges exist in teacher recruitment, training and retention for teachers from different demographic backgrounds?***

- 3.1 There is significant underrepresentation of women, LGBTQ+ communities, ethnic minorities, people with disabilities and those from disadvantaged socioeconomic backgrounds across many STEM disciplines, including the mathematical sciences. The low participation rates of individuals with protected characteristics in mathematics, particularly at the higher levels of research and teaching, makes our discipline poorer and represents missed opportunities for the advancement of mathematics and for the teaching of mathematics. There is a clear need for more mathematics graduates to enter the teaching profession.
- 3.2 Many of those entering the profession with an undergraduate mathematics degree will have come from lower tariff universities. However, we are increasingly concerned that mathematics is becoming an almost exclusively high-tariff degree, with huge growth in student numbers at many high-tariff universities. For example, one leading mathematics department in England has successfully increased its intake from 300 to 600 undergraduates per year.
  - 3.2.1 According to UCAS data, the number of prospective mathematics undergraduates accepted to university has been flat for about 10 years leading up to 2020. However, this period has also seen a fall in the number of UK domiciled students studying mathematics degrees and an increase in international students. This is likely to be having a much larger impact on lower and medium-tariff institutions overall, which are losing lucrative international students to high tariff institutions<sup>xv</sup>.
  - 3.2.2 Further research is required to determine how many international mathematics graduates remain in the UK and go on to become teachers at schools in the UK; though we would hypothesise that this number is quite small.

- 3.3 Conversely, some low-tariff universities, many of which are highly regarded, are contracting. For example, one university has gone from 150 to 35 undergraduates per year. Leicester University cut its mathematics provision back in 2021, and Birkbeck recently announced significant cuts to university teaching staff of mathematics and statistics. Brighton has also stopped recruiting for all its mathematics courses.
- 3.4 Contracting of courses at lower tariff universities could impact the number of mathematics graduates from lower-income backgrounds who are less likely to go to university outside their local area.
- 3.5 It is important to ensure geographical provision of mathematics at HE, given the barriers of entry presented by the cost of accommodation and travel for prospective mathematics students. Equally, it is therefore critical that geographical diversity and access to mathematics courses is maintained so that they can be accessed by more diverse groups of people. This means supporting mathematics departments in under-represented institutions and geographical locations and supporting them to widen access and participation<sup>xvi</sup>.
- 3.6 We urge the Select Committee to press Government on its plans to support and encourage lower tariff universities to maintain their undergraduate degree offer.

#### 4. Recommendations

- 4.1 Protect Pure Maths believes that urgent action must be taken to improve teacher recruitment and retention for mathematics in particular.
- 4.2 Government should invest more in the recruitment, development and retention of teachers of maths. This should include subject-specific CPD for all teachers of maths and upskilling teachers of maths without a maths degree. Providing ongoing teacher development has potential to improve teacher retention while improving teaching methods.
- 4.3 Government should make clear the strategic importance of maths and to incentivise and support universities to prioritise maths. The Department for Education and the Department for Science, Innovation and Technology must ensure maths is valued and financially supported, enabling strong and sustainable mathematics departments at universities in all regions of the country.
  - 4.3.1 PPM has previously written to The Rt Hon Gillian Keegan MP, Secretary of State for Education, and The Rt Hon Michelle Donelan MP, Secretary of State for Science, Innovation and Technology, regarding the future of mathematical sciences at UK universities and the cuts to mathematics departments at lower-tariff universities.
- 4.4 PPM supports the recommendations from the Commons Science and Technology Committee Inquiry report on “Diversity and Inclusion in STEM” as they relate to the teaching of mathematics at school:
  - 4.4.1 *“The Government should set a target for every child to be taught STEM subjects by teachers with qualifications or experience in that subject by 2030.”<sup>xvii</sup>*
  - 4.4.2 *“The Government should assess the impact of further salary increases on recruitment targets for STEM subjects with particularly acute shortages; and detail its findings in its response to this Report. It should also tell us what further interventions are planned for subjects where recruitment targets are unlikely to be met, whether it has undertaken any assessment of the impact that increased numbers of STEM graduates from university courses would have of teaching workforce shortages, and whether it has any plans to grow the number of STEM graduates entering the teaching workforce.”<sup>xviii</sup>*

<sup>i</sup> <https://analytics.ofqual.gov.uk/apps/GCSE/County/>

<sup>ii</sup> “Universities and Social Mobility”, The Sutton Trust, November 2021. Available at:

<https://www.suttontrust.com/wp-content/uploads/2021/11/Universities-and-Social-Mobility-Summary.pdf>

<sup>iii</sup> “Maths Excellence Pathways”, XTX Markets, March 2023. Available at: [https://www.linkedin.com/posts/xtx-markets\\_xtx-markets-maths-excellence-pathways-activity-7044686239488200706-OgdC/](https://www.linkedin.com/posts/xtx-markets_xtx-markets-maths-excellence-pathways-activity-7044686239488200706-OgdC/)

<sup>iv</sup> “Maths Excellence Pathways”, XTX Markets, March 2023. Available at: [https://www.linkedin.com/posts/xtx-markets\\_xtx-markets-maths-excellence-pathways-activity-7044686239488200706-OgdC/](https://www.linkedin.com/posts/xtx-markets_xtx-markets-maths-excellence-pathways-activity-7044686239488200706-OgdC/)

<sup>v</sup> Allen, Rebecca and Sims, Sam, “How do shortages of maths teachers affect the within-school allocation of maths teachers to pupils?”, Nuffield Foundation, 2018. Available at:

[https://www.nuffieldfoundation.org/wp-content/uploads/2018/06/Within-school-allocations-of-maths-teachers-to-pupils\\_v\\_FINAL.pdf](https://www.nuffieldfoundation.org/wp-content/uploads/2018/06/Within-school-allocations-of-maths-teachers-to-pupils_v_FINAL.pdf)

<sup>vi</sup> Science and Technology Select Committee, “Diversity and inclusion in STEM”, House of Commons, March 2023. Available at: <https://committees.parliament.uk/publications/34531/documents/190060/default/>

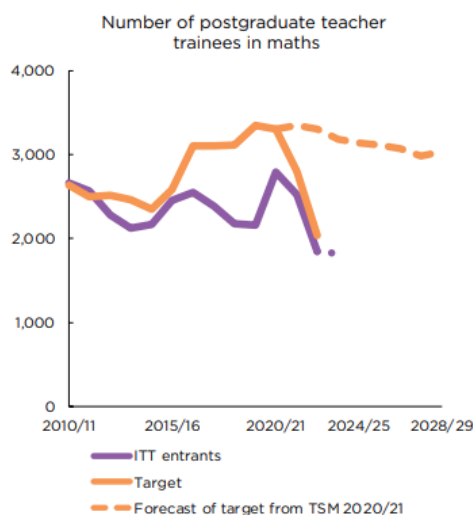
<sup>vii</sup> Noyes, Andrew et. al, “The mathematics pipeline in England: Patterns, interventions and excellence”, University of Nottingham, March 2023. Available at:

<https://www.nottingham.ac.uk/research/groups/crme/documents/maths-pipeline-report.pdf>

<sup>viii</sup> See Appendix: *Protecting Pure Maths and Advancing the Mathematical Sciences: Working Paper June 2022*, “A Dashboard for Maths”, pages 4-5, produced by PPM, June 2022.

<sup>ix</sup> NFER, “Teacher Labour Market in England: Annual Report 2023”, available at:

<https://www.nfer.ac.uk/teacher-labour-market-in-england-annual-report-2023/>. Chart on postgraduate teacher trainees in maths on page 11:



Note: Purple dotted line represents NFER's forecasted maths recruitment for 2023/24.

Sources: ITT Census, Teacher Supply Model 2020/21, NFER analysis of DfE Apply data.

<sup>x</sup> NFER, “Teacher Labour Market in England: Annual Report 2023”, available at:

<https://www.nfer.ac.uk/teacher-labour-market-in-england-annual-report-2023/>

<sup>xi</sup> Worth, Jack and Van den Brande, Jens, “Retaining Science Mathematics and Computing Teachers”, National Foundation for Educational Research, 2019, available at:

[https://www.nfer.ac.uk/media/3784/retaining\\_science\\_mathematics\\_and\\_computing\\_teachers.pdf](https://www.nfer.ac.uk/media/3784/retaining_science_mathematics_and_computing_teachers.pdf)

<sup>xii</sup> Noyes, Andrew et. al, “The mathematics pipeline in England: Patterns, interventions and excellence”, University of Nottingham, March 2023. Available at:

<https://www.nottingham.ac.uk/research/groups/crme/documents/maths-pipeline-report.pdf>

<sup>xiii</sup> Noyes, Andrew et. al, “The mathematics pipeline in England: Patterns, interventions and excellence”, University of Nottingham, March 2023. Available at:

<https://www.nottingham.ac.uk/research/groups/crme/documents/maths-pipeline-report.pdf>

<sup>xiv</sup> <https://analytics.ofqual.gov.uk/apps/GCSE/County/>

<sup>xv</sup> See: <https://www.ucas.com/data-and-analysis/undergraduate-statistics-and-reports/ucas-undergraduate-end-cycle-data-resources-2020/2020-entry-provider-level-end-cycle-data-resources>

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Follow Acceptances>> Subject group (JACS3)

Select Group G mathematical sciences in the Accepted Applicants by Subject Group

<sup>xvi</sup> Tillmann, Ulrike, "The UK cannot afford to cut the M from STEM", Times Higher Education, 5 February 2023, available at: <https://www.timeshighereducation.com/blog/uk-cannot-afford-cut-m-stem>

<sup>xvii</sup> Science and Technology Select Committee, "*Diversity and inclusion in STEM*", House of Commons, March 2023. Available at: <https://committees.parliament.uk/publications/34531/documents/190060/default/>

<sup>xviii</sup> Science and Technology Select Committee, "*Diversity and inclusion in STEM*", House of Commons, March 2023. Available at: <https://committees.parliament.uk/publications/34531/documents/190060/default/>

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