Labour Party National Policy Forum Consultation 2023
A green and digital future
Submission from Protect Pure Maths

1. Protect Pure Maths (PPM) is delighted to provide a submission to the Labour Party's 2023 National Policy Forum.

2. The Protect Pure Maths campaign 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.

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.

4. We have focused our response on those areas where we have expertise and insight that will be of value to the Labour Party.

How can science and technology policy support growth in all regions and nations of the UK?

5. The mathematical sciences have a huge impact on the whole economy and public life. Deloitte has estimated that the mathematical sciences add more than £200bn to the UK economy, and there is a significant salary premium for advanced maths skills, calculated at £8,000.00[1]. The mathematical sciences are of fundamental importance to the UK and will be fundamental to uncovering the answers to today's most pressing policy problems: the cost of living crisis, energy security, NHS backlogs, and national security.

6. The maths we learn at school is largely about certainty, such as 7 x 9 equalling 63. But maths also provides the tools for quantifying uncertainty, underpinning decisions at all levels including personal, national, and international, and related to medicine, finance, the environment, and more. An understanding of uncertainty is crucial for making decisions about how to deploy limited resources, from hospital beds to bandwidth in the telecommunications industry.

7. There is potential for the UK to lead the world in high-tech industries in fields as diverse as AI, life sciences, quantum, fintech, and green technology. All of these industries are underpinned by the mathematical sciences.

8. Our ability to deliver the jobs and growth the country needs, requires investment in, and support for, a strong mathematical talent and research pipeline.

9. The Labour Party should demonstrate its understanding of the transformative power of mathematics by launching a Strategy for Maths to strengthen the UK's world leadership in the mathematical sciences and to equip our country to compete in a global economy increasingly influenced by data, complex systems and AI. This should

[1] Lightcast 2022

encompass education policy, support for mathematics departments in universities, and research funding.

10. The Labour Party should support the development of the National Academy for Mathematical Sciences and the Knowledge Exchange Hub for Mathematical Sciences. This would boost the UK's ability co-ordinate and leverage maths for industry, jobs, and growth.

Research funding

11. Funding for research into the mathematical sciences is key for the advancement of all areas of science and technology, and it is a vital area of science in itself.

12. In January 2020, the Government announced that it would invest £300m of additional funding into the mathematical sciences. £124m of this funding has been spent on projects of national importance, including on institutes, small and large research grants, fellowships, doctoral studentships and postdoctoral awards. However, £176m of this additional investment was not allocated and we have been advised by BEIS that *"the UKRI Board took the difficult decision to advise BEIS Ministers not to hypothecate a further uplift for the mathematical sciences at this stage."*

13. The Labour Party should commit to additional investment into mathematics research, as it underpins innovation in science and technology, which can then be translated into jobs and growth across the country.

14. We would like to see greater support for collaboration between business and academia to enable further growth of R&D and echoing the recommendations of the Bond Review, 'The Era of Mathematics'. Labour should incentivise SMEs, institutes and universities to undertake collaborative R&D projects, including those that stem from the mathematical sciences.

15. This should include support for the Knowledge Exchange Hub for the Mathematical Sciences[2]. Even with limited funding of around £500,000 per year, the hub would make a significant difference to the UK's ability co-ordinate and leverage maths for industry, government and charities.

16. The Labour Party should also support the creation of a National Academy for the Mathematical Sciences[3]. The academy would represent and advocate for the mathematical sciences and people who work in them including educators, industry and academics. It would operate across the whole of the mathematical sciences, including mathematics, statistics, data science and operational research.

17. The mathematical community welcomed the change in the 2022 Spring Statement that explicitly incorporated pure mathematics within R&D tax credits for the first time. However, since the Spring Statement, there has been some confusion in the mathematical community around implementation and accessibility of the tax credits. The Labour Party should commit to further incentives on top of current tax credits and ensuring that national investment in technology includes the mathematical sciences.

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[2] http://www.cms.ac.uk/wp/wp-content/uploads/2021/12/KE-Connected-Centres-Network-Consultation-Paper.pdf

[3] https://www.cms.ac.uk/wp/national-academy/

Supporting mathematics at universities

18. Whilst the Party may not want to intervene in institutional decisions, Labour should make clear the strategic importance of maths and should incentivise and support universities to prioritise maths, particularly beyond Russell Group universities.

19. There are concerns that mathematics is becoming an almost exclusively high-tariff degree, with huge growth 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.

20. 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 to all its mathematics courses.

21. From a social mobility perspective, students from lower-income backgrounds are much less likely to go to university outside their local area. Therefore, if maths courses become too small to be viable, we may see the emergence of 'maths deserts', which would limit access to one of the best degrees in terms of future earnings.

22. These universities also provide non-traditional routes to mathematics in higher education and any closure will further set back efforts to improve diversity in the discipline.

23. Critically, this will have an impact on the ability of some regions of the UK to capitalise on the potential of high-tech industry. Where there are 'maths deserts', there will be no opportunities for a pipeline of R&D spin outs from universities, as recommended in the 'Start-Up Review' and a lack of a qualified workforce for industry. This will put Labour's plans for a reformed suite of place-based R&D programmes at risk.

The talent pipeline

24. The long-term health of mathematics is underpinned by a pipeline of talented mathematicians. Valuable IP creators increasingly come from mathematical backgrounds.

25. The Bond Review exposed the skills shortage for mathematicians across all sectors of the economy from artificial intelligence (AI) to flood management, the finance sector to national defence. Research commissioned by PPM from Lightcast has shown a significant salary premium for advanced mathematical skills and an increased demand for these skills post pandemic.

26. Our supporters from the business community are clear that the skills and expertise of mathematicians must be nurtured and grown and we are working with partners to assess current labour market shortages of mathematicians.

27. Pressing issues include the costs associated with the visa system and a lack of clarity about our future association with the Europe-wide Horizon programme have harmed the UK's reputation as an attractive place for STEM talent. This could be alleviated by lower visa costs to attract world-leading mathematicians, as well as supporting additional investment in PhD placements to ensure a sustainable pipeline.

Maths in schools

28. Labour's Strategy for Maths should also include improving mathematics provision in schools.

29. The mathematical sciences are a path for social mobility. 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[4]

30. For example, for mathematics, 42.5% of graduates who previously qualified for free school meals are in the top quintile of earners (Sutton Trust, 2021).

31. However, 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. Those who do not achieve a good pass, or have a negative experience of maths at school, are much less likely to go on to study maths at A Level or in Further Education and 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.

32. The pandemic has had a further negative impact on the disadvantage gap with just 12% of disadvantaged 11-year-olds achieving higher than the expected standard in mathematics compared with 27% of those not known to be disadvantaged.[5]

33. 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[6]. If the Labour Party wants to deliver growth and opportunities across the UK, tackling this gap will be critical.

34. In the existing school model, more 16–18-year-old students should be encouraged to take up Core Maths. The UK is an outlier in Europe for this age range, with far less than 50% studying any mathematics compared with more than 80% in Finland, Germany and Ireland.

35. The Labour Party should also commit to investing more in the recruitment, development and retention of maths teachers. This should include subject-specific CPD for all maths teachers and upskilling maths teachers without a maths degree. More maths is also increasingly needed in the sciences, social sciences and humanities subjects.

What role does the digital economy have in enabling the UK's growth?

36. Mathematical sciences provide the processes and bedrock for the digital economy and fields such as AI.

37. As the digital economy becomes increasingly complex and widespread in many walks of life, it is imperative that systems are safe, trustworthy and reliable.

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[4] Ibid

5 *The mathematics pipeline in England, Patterns, interventions and excellence,* University of Nottingham, March 2023

[6] https://analytics.ofqual.gov.uk/apps/GCSE/County/

38. This means that we need to fully grasp the mathematical processes behind concepts like AI. Not only does mathematics help us to design AI, but it helps us to understand how to use AI, and to answer questions on it, explaining what is behind the code and the application. You cannot make sense of AI, without understanding the mathematical concepts and tools that are behind it, including linear algebra, matrix theory, and vectors.

39. The mathematical sciences must therefore be central to governance of the digital economy, to ensure that algorithms are unbiased, data is protected, and decision making is clear and transparent.

What are the specific implications of policy proposals in this area for (a) women, (b) Black, Asian and minority ethnic people; (c) LGBT+ people, (d) disabled people and (e) all those with other protected characteristics under the Equality Act 2010?

40. 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.

41. 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.

42. The fact that mathematical sciences form the basis of technologies driving societal change means that we need to avoid systematic biases that may result from a lack of diversity. A well-known example of such biases is that of facial recognition technology.[7]

43. The emergence of 'maths deserts' is worrying for diversity, particularly given the socio-economic disparity at GCSE and A Level in performance. 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.

44. Better information and data management is required. We recommend improved recording of, and improved consistency in EDI data for subjects across the higher education sector. At present national and subject specific data is limited, which makes monitoring of trends and progress difficult. We also recommend better reporting of subject specific data by the Office of National Statistics (ONS) and creation of a UK maths 'dashboard' to track progress.

Contact

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[7]The Alan Turing Institute, 2020, 'Understanding bias in facial recognition technology'