
OCR MEI Exercises

(Year 2)

Department of Mathematics



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Disclaimer

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Author

Siddhartha Nath is the founder of *PolyNath* and the author of a plethora of top-selling books (*Quantitative Finance*, *MAT*, *NLP*, *TMUA/CTMUA*).

He has an undergraduate First-Class Honours BSc Mathematics with Statistics from Imperial College London (ICL) and a postgraduate Distinction MSc Computational Statistics and Machine Learning from University College London (UCL). He has taken his education and amassed over 2 years of industry experience, having worked as a Data Scientist for PayPal and DataSpartan.

In terms of academic teaching, he is an extremely dedicated and supportive tutor, having taught for over 5 years at public and private schools, for GCSE, A-Levels and University preparation. He possesses a wealth of knowledge in all UK-based Mathematics and Computer Science admission tests, with the following accomplishments:

- Achieved a perfect score of 9.0/9.0, in the Cambridge TMUA, resulting in a top 10% ranking.
- Achieved a commendable score of 63/100, in the Oxford MAT, resulting in a top 25% ranking.
- Achieved a high score of 1, 1, 1 in the Cambridge STEP I, II and III.

Outside of academia, he enjoys music, dance, watching sports and creating content.



Preface

This document includes a breadth of questions within Chapter 1 - Proof (OCR MEI Year 2).

Happy Learning!

Chapter 1

Proof

Question 1

"Let p be a prime number such that $2 < p < 25$. Prove, by exhaustion, that for all such p , $(p - 1)(p + 1)$ is divisible by 8."

Question 2

"Prove that an integer is divisible by 5 if it is the sum of 5 consecutive integers."

Question 3

"Is it true that n^2 is odd only if n is odd?"

Question 4

- "Find a counter example to disprove the conjecture that curves of the form $y = \frac{a}{x^2} + b$ do not cross the x -axis."*
- "Find a counter example to disprove the conjecture that an asymptote cannot be crossed by a curve by considering rational functions of the form $f(x) = \frac{ax^2 + bx}{x^n}$ where $n > 2$."*

Question 5

- "Prove by contradiction that for any integer $n > 1$, n and $n + 1$ do not have a prime factor in common."*

2. "Explain why this implies that $n(n+1)$ must have at least 2 distinct prime factors."
3. "What can you conclude about the number of distinct prime factors which $n(n+1)(n(n+1)+1)$ has."

BONUS

"If the circle $(x-a)^2 + (y-b)^2 = r^2$ and the line $y = mx + c$ do not meet, prove that $m^2(r^2 - a^2) + 2am(b-c) + 2bc - b^2 - c^2 + r^2 < 0$."