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**A Level Mathematics Year 2 Exam Questions by Topic**  
**Chapter 1: Proof**

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These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: <https://amzn.to/39umfr5> and <https://amzn.to/3hE8kBL> ). There are a mixture of questions from OCR A, OCR B (MEI) and Edexcel. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

<https://mathsaurus.com/>

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OCR A 2018 Paper 2 Question 5:

- 5 Charlie claims to have proved the following statement.

“The sum of a square number and a prime number cannot be a square number.”

- (i) Give an example to show that Charlie’s statement is not true. [1]

Charlie’s attempt at a proof is below.

Assume that the statement is not true.

⇒ There exist integers  $n$  and  $m$  and a prime  $p$  such that  $n^2 + p = m^2$ .

⇒  $p = m^2 - n^2$

⇒  $p = (m - n)(m + n)$

⇒  $p$  is the product of two integers.

⇒  $p$  is not prime, which is a contradiction.

⇒ Charlie’s statement is true.

- (ii) Explain the error that Charlie has made. [1]

- (iii) Given that 853 is a prime number, find the square number  $S$  such that  $S + 853$  is also a square number. [4]
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OCR A Sample Paper 1 Question 6:

- 6** Prove by contradiction that there is no greatest even positive integer. **[3]**

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OCR B MEI Sample Paper 2 Question 11:

- 11** Suppose  $x$  is an irrational number, and  $y$  is a rational number, so that  $y = \frac{m}{n}$ , where  $m$  and  $n$  are integers and  $n \neq 0$ . Prove by contradiction that  $x + y$  is not rational. **[4]**
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