Write your name here

| Surname | Other Names |
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# AS/A Level Mathematics

# Proof

**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

## Instructions

• Use **black** ink or ball-point pen.
• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
• **Fill in the boxes** at the top of this page with your name.
• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
• Answer the questions in the spaces provided
– there may be more space than you need.
• You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
• Answers should be given to three significant figures unless otherwise stated.

## Information

• The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

## Advice

• Read each question carefully before you start to answer it.
• Try to answer every question.
• Check your answers if you have time at the end.

**1** Prove that $x^2 - 4x + 7$ is positive for all values of $x$

**(Total for question 1 is 3 marks)**

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**2** Disprove the statement: $n^2 - n + 3$ is a prime number for all values of $n$

**(Total for question 2 is 2 marks)**

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**3** Prove that the sum of two consecutive odd numbers is a multiple of 4

**(Total for question 3 is 3 marks)**

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**4** Prove that $(x + y)^2 \neq x^2 + y^2$

**(Total for question 4 is 3 marks)**

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**5** (a) Prove that $n^2 + n + 11$ is prime for all integers between 1 and 5. **(3)**

(b) Prove that $n^2 + n + 11$ is not prime for all values of $n$ **(2)**

**(Total for question 5 is 6 marks)**

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**6** Prove by exhaustion that the sum of two even positive integers less than 10 is also even.

**(Total for question 6 is 3 marks)**

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**7** "If I multiply a number by 2 and add 5 the result is always greater than the original number."

State, giving a reason, whether the above statement is always true, sometimes true or never true.

**(Total for question 7 is 2 marks)**

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**8** Prove that $(2n + 3)^2 - (2n - 3)^2$ is a multiple of 6 for all values of $n$

**(Total for question 8 is 4 marks)**

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**9** Prove that the sum of the squares of two consecutive odd integers is always 2 more than a multiple of 8.

**(Total for question 9 is 4 marks)**

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**10** Prove that $n^2 + 7n + 15 > n + 3$ is true for all values of $n$

**(Total for question 10 is 4 marks)**

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