

Edexcel IAL P2 Mathematical Proof Practice Exam

Pearson Edexcel International A Level Mathematics · 12 questions · 45 marks

Name _____

Date _____

Score / 45

- Answer every question. Show your working: most marks are for method.
- Calculator allowed.
- Topics: Mathematical proof.
- The mark scheme is a separate free PDF: [alevelmathrevision.com/alevel-frontend/downloads/practice-exams/ial/edexcel-ial-p2-mathematical-proof-practice-exam-mark-scheme.pdf](https://www.alevelmathrevision.com/alevel-frontend/downloads/practice-exams/ial/edexcel-ial-p2-mathematical-proof-practice-exam-mark-scheme.pdf)

1. Show, by finding a counter-example, that the statement [2]
“ $n^2 + 3n + 1$ is a prime number for every positive integer n ”
is false.

2. Show, by means of a counter-example, that the statement [2]
“for all real numbers x , $(x + 1)^2 > x^2$ ”
is not true.

3. Prove that the sum of any four consecutive integers is never a multiple of 4. [3]

4. Prove by exhaustion that no two-digit square number is one more than a prime number. [3]

5. Prove that one more than the product of two consecutive even numbers is always a square number. [3]



6. Given that x and y are real numbers, prove that [3]

$$x^2 + 4y^2 \geq 4xy$$

and state the condition for equality.



7. (a) Write $4x^2 - 12x + 11$ in the form $(ax + b)^2 + c$, where a , b and c are integers. [2] [4]

(b) Hence prove that $4x^2 - 12x + 11 > 0$ for all real values of x . [1]

(c) Write down the least value of $4x^2 - 12x + 11$. [1]



8. (a) Prove by exhaustion that the square of any integer leaves a remainder of 0, 1 or 4 when it is divided by 5. [4] [5]

(b) Hence show that the last digit of a square number is never 2, 3, 7 or 8. [1]



9. The points $A(1, 2)$, $B(7, 4)$, $C(9, 10)$ and $D(3, 8)$ are the vertices of the quadrilateral $ABCD$. [4]
Prove that $ABCD$ is a rhombus but not a square.



10. (a) Given that p is a positive real number, prove that [5]

$$p + \frac{9}{p} \geq 6.$$

[3]

(b) Show, by means of a counter-example, that the inequality in part (a) is not true for all non-zero real numbers p . [2]



11. Jo claims that $3^n > n^3$ for every positive integer n . [5]

(a) Show that Jo's claim is false. [2]

(b) Prove by exhaustion that $3^n > n^3$ for every integer n with $4 \leq n \leq 7$. [3]

12. Prove that $n^4 - n^2$ is a multiple of 12 for every integer n . [6]

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