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# EDEXCEL IGCSE MATHEMATICS

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PAPER 2H & 2HR (LINEAR)

**ALGEBRAIC PROOFS**

QP & MS (2018 - 2025)

Prove  $(n + 10)^2 - (n + 5)^2$  is always a multiple of 5

$(2n + 1)(3n - 2) - (6n - 1)(n - 2)$  is always even

Prove  $(2n + 9)^2 - (2n + 5)^2$  is always a multiple of 4

COMPILED BY:  
SIR MUHAMMAD ABDULLAH SHAH



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# EDEXCEL IGCSE MATHEMATICS LINEAR FOR MAY & OCT 2026


by Sir Muhammad Abdullah Shah

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# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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1. Jan 2023 2HR/Q19

Prove algebraically that, for any three consecutive even numbers,

the sum of the squares of the smallest even number and the largest even number is 8 more than twice the square of the middle even number.



(Total for Question 19 is 3 marks)



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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2. Jan 2022 2H/Q18

Prove that when the sum of the squares of any two consecutive odd numbers is divided by 8, the remainder is always 2

Show clear algebraic working.



(Total for Question 18 is 3 marks)

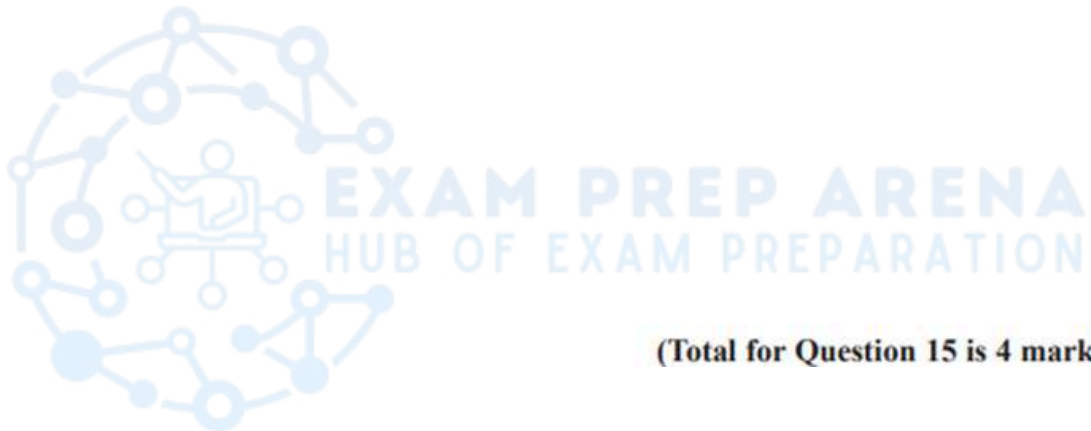


EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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3. Jan 2021 2HR/Q15

Prove algebraically that the product of any two odd numbers is always an odd number.



(Total for Question 15 is 4 marks)



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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4. Jan 2020 2H/Q17

Prove that the difference between two consecutive square numbers is always an odd number.  
Show clear algebraic working.



**(Total for Question 17 is 3 marks)**



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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5. Jan 2020 2HR/Q25

$N$  is a multiple of 5

$$A = N + 1$$

$$B = N - 1$$

Prove, using algebra, that  $A^2 - B^2$  is always a multiple of 20



(Total for Question 25 is 3 marks)



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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6. June 2019 2HR/Q17

The table gives information about the first six terms of a sequence of numbers.

<b>Term number</b>	1	2	3	4	5	6
<b>Term of sequence</b>	$\frac{1 \times 2}{2}$	$\frac{2 \times 3}{2}$	$\frac{3 \times 4}{2}$	$\frac{4 \times 5}{2}$	$\frac{5 \times 6}{2}$	$\frac{6 \times 7}{2}$

Prove algebraically that the sum of any two consecutive terms of this sequence is always a square number.



(Total for Question 17 is 4 marks)



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

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## MARKING SCHEME

1. Jan 2023 2HR/Q19

19	eg $2n, 2n+2, 2n+4$ or $2n-2, 2n, 2n+2$ etc		3	M1 for 3 consecutive even numbers in algebraic form (any letter can be used)
	eg $(2n)^2 + (2n+4)^2 = 4n^2 + 4n^2 + 16n + 16 = 8n^2 + 16n + 16$ or $2(2n+2)^2 = 2(4n^2 + 8n + 4) = 8n^2 + 16n + 8$ or $2(2n+2)^2 + 8 = 2(4n^2 + 8n + 4) + 8 = 8n^2 + 16n + 16$			M1 for the sum of the squares of the largest and smallest even numbers and adding or the square of the middle even number multiplied by 2 (no need to expand or simplify for this mark)
	eg $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $2(2n+2)^2 + 8 = 8n^2 + 16n + 16$ or $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $2(2n+2)^2 = 8n^2 + 16n + 8$ and $8n^2 + 16n + 16 - (8n^2 + 16n + 8) = 8$ or $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $8n^2 + 16n + 16 = 8n^2 + 16n + 8 + 8 = 2(2n+2)^2 + 8$ or $2(2n+2)^2 + 8 = 8n^2 + 16n + 16$ and $8n^2 + 16n + 16 = 4n^2 + 4n^2 + 16n + 16 = (2n)^2 + (2n+4)^2$  <i>Working required</i>	Correctly shown		A1 dep on M2 for use of algebra to show correct conclusion  (SCB1 for eg $(p+4)^2 + p^2$ or $2(p+2)^2$ or $2(p+2)^2 + 8$ )  (SCB2 for use of eg $(p+4)^2 + p^2 = 2p^2 + 8p + 16$ and $2(p+2)^2 + 8 = 2p^2 + 8p + 16$ )  If the student shows this and also says "it is true for all numbers, so it must be true for even numbers" oe or defines $p, p+2, p+4$ as even numbers, then this would gain M2A1
				<b>Total 3 marks</b>

2. Jan 2022 2H/Q18

18	eg $(2n+1)^2 + (2n-1)^2$ or $(2n+1)^2 + (2n+3)^2$ oe		3	M1 for setting up a correct algebraic expression (any letter can be used) must have intention to add (may come after expanding)
	Eg $4n^2 + 4n + 1 + 4n^2 - 4n + 1$ or $8n^2 + 2$ or $4n^2 + 4n + 1 + 4n^2 + 12n + 9$ or $8n^2 + 16n + 10$ oe			M1 correct expansion of brackets and correct signs or a correct result.
	eg $8 \times n^2 + 2$  $\frac{8n^2 + 16n + 10}{8} = n^2 + 2n + \frac{10}{8}$ which shows a remainder of 2 or $10 - 8 = 2$ or  $\frac{8n^2 + 16n + 10}{8} = n^2 + 2n + 1$ remainder 2 oe  $\frac{8n^2 + 16n + 10}{8} = n^2 + 2n + 1 + \frac{2}{8}$ oe  $8(n^2 + 2n + 1) + 2$ oe	shown clearly		A1 conclusion dep on M2 for eg $8n^2 + 2$ and a suitable conclusion (may be shown as a calculation/in numbers). The conclusion must be an intention to show that the result is a multiple of 8 and there is 2 remaining.
				<b>Total 3 marks</b>



# EDEXCEL IGCSE MATHEMATICS LINEAR 2H & 2HR – ALGEBRAIC PROOFS

COMPILED BY SIR MUHAMMAD ABDULLAH SHAH

## 3. Jan 2021 2HR/Q15

15	eg $(2m+1)(2n+1)$ or eg $(2m-1)(2n+3)$		4	M2 Product of 2 <u>different</u> odd numbers (in the form $2n+k$ where $k$ is odd). Must have different letters/variables. (M1 for the product of same or different odd numbers where the variable is the same eg $(2n+1)(2n-1)$ or $(2n+1)(2n+3)$ )
	eg $4mn+2m+2n+1$ or eg $4n^2+4n+1$ or eg $4n^2-1$ or eg $4n^2+8n+3$			M1 dep M1 Multiplying out the two brackets with odd numbers correctly.
	eg $2(2mn+m+n)+1$ therefore odd	Proved		A1 dep M3 Factorising <u>and</u> a conclusion <b>or</b> stating that the 3 leading terms are all even, hence result is odd.
				<b>Total 4 marks</b>

## 4. Jan 2020 2H/Q17

17	e.g. $n^2 - (n-1)^2$ or $(n+1)^2 - n^2$		3	M1 for setting up a correct algebraic expression (any letter can be used)
	e.g. $n^2 - n^2 + 2n - 1$ or $n^2 + 2n + 1 - n^2$			M1 Correct expansion of brackets and correct signs or a correct result
		e.g. $2n-1$ is always odd		A1 dep on M2 for eg $2n-1$ or $2n+1$ or $-(2n+1)$ oe <b>and</b> a suitable conclusion  SCB1 for eg $(2n)^2 - (2n-1)^2$ or $(2n+1)^2 - (2n)^2$ oe
				<b>Total 3 marks</b>

## 5. Jan 2020 2HR/Q25

Question	Working	Answer	Mark	Notes
25	$(N+1)^2 = (N^2 + 2N + 1)$ and $(N-1)^2 = (N^2 - 2N + 1)$ ----- $(N^2 + 2N + 1) - (N^2 - 2N + 1) = 4N$	$N = 5x$ oe Therefore $4N = 20x$	3	M1 M1 Must reach $4N$ correctly A1 Dep. on M2. A correct conclusion (i.e. $20 \text{ "x"}$ ) following fully correct working
	Alt: $N = 5x$ oe in both $A$ and $B$ $(5x+1)^2 = (25x^2 + 10x + 1)$ and $(5x-1)^2 = (25x^2 - 10x + 1)$			M1 M1
		$(25x^2 + 10x + 1) - (25x^2 - 10x + 1) = 20x$		A1 Dep. on M2. Subtraction of two correct brackets to reach $20 \text{ "x"}$
	Alt: $A^2 - B^2 = (A+B)(A-B)$ $A+B = 2N$ and $A-B = 2$ $A^2 - B^2 = 2N \times 2 = 4N$			M1 M1
		$N = 5x$ oe Therefore $4N = 20x$		A1 Dep. on M2. A correct conclusion (i.e. $20 \text{ "x"}$ ) following fully correct working
				<b>Total 3 marks</b>

## 6. June 2019 2HR/Q17

Question	Working	Answer	Mark	Notes
17	(Term $n$ ) $\frac{1}{2}n(n+1)$ or (Term $n+1$ ) $\frac{1}{2}(n+1)(n+2)$ $\frac{1}{2}n(n+1) + \frac{1}{2}(n+1)(n+2)$ $\frac{1}{2}(n+1)(n+n+2) = \frac{1}{2}(n+1)(2n+2)$ or $\frac{1}{2}n^2 + \frac{1}{2}n + \frac{1}{2}n^2 + \frac{1}{2}n + n + 1 \rightarrow n^2 + 2n + 1$	$(n+1)^2$ shown	4	M1 Algebraic representation of one of the two consecutive terms in sequence M1 Adding two consecutive terms M1 Factorisation or multiplying out correctly to get to $n^2 + 2n + 1$ A1 Dep on M3
				<b>Total 4 marks</b>

