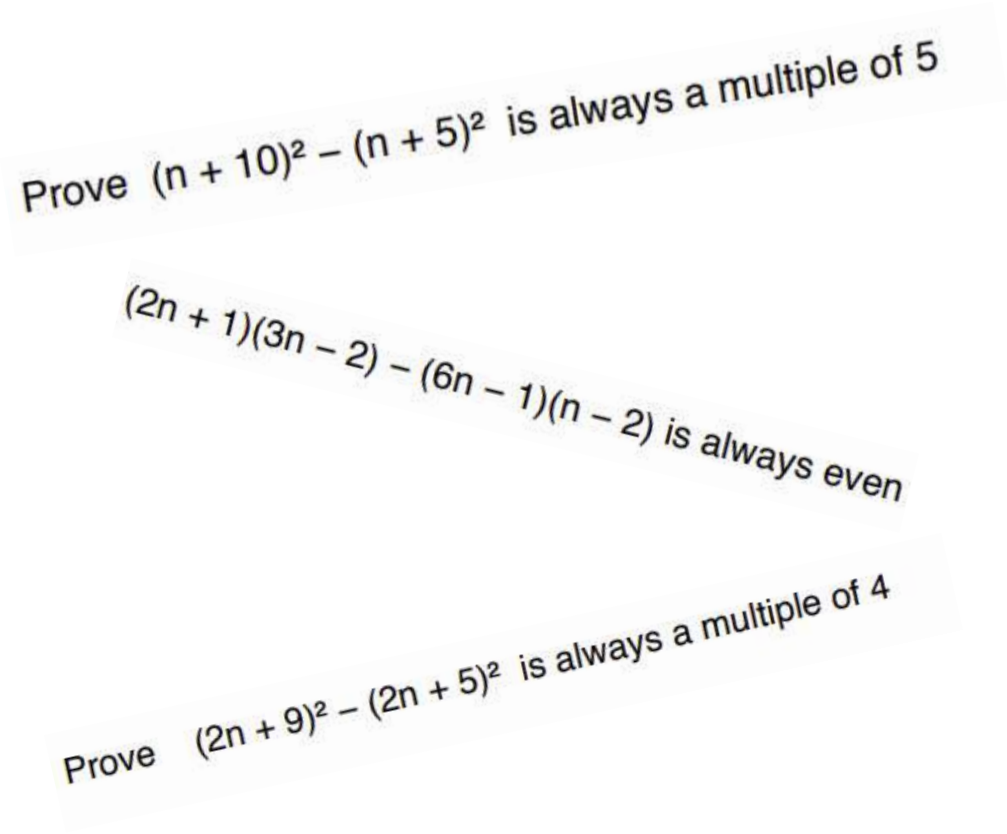
EDEXCEL IGCSE MATHEMATICS

UNIT 2 (MODULAR)

ALGEBRA – ALGEBRAIC PROOFS

QP & MS (2018 - 2025)



COMPILED BY:
SIR MUHAMMAD ABDULLAH SHAH

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EDEXCEL IGCSE MATHEMATICS MODULAR FOR MAY & OCT 2026

by Sir Muhammad Abdullah Shah

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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)

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)

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)

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)

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)

6. June 2019 2HR/Q17

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

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

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)

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 $8n^2+16n+16=4n^2+4n^2+16n+16=(2n)^2+(2n+4)^2$ *Working required*	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
					Total 3 marks

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.
					Total 3 marks

3. Jan 2021 2HR/Q15

15	eg $(2m + 1)(2n + 1)$ or eg $(2m - 1)(2n + 3)$		4	M2	Product of 2 different 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 and a conclusion **or** stating that the 3 leading terms are all even, hence result is odd.
					Total 4 marks

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 **and** a suitable conclusion SCB1 for eg $(2n)^2 - (2n - 1)^2$ or $(2n + 1)^2 - (2n)^2$ oe
					Total 3 marks

5. Jan 2020 2HR/Q25

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

6. June 2019 2HR/Q17

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