

Algebraic Proof

For Pearson Edexcel GCSE Mathematics (1MA1) • Higher tier

Name _____

Total marks: **30**

Answer **all** questions in the spaces provided. Show your working: marks are given for correct method.

1 n is an integer.
Write down, in terms of n , an expression for

(a) any odd number

.....
(1)

(b) the next odd number after $2n + 1$

.....
(1)

(c) the sum of the two consecutive integers n and $n + 1$

.....
(1)

(Total for Question 1 is 3 marks)

- 2** Prove algebraically that the sum of two consecutive odd numbers is always a multiple of 4

(2)

(Total for Question 2 is 2 marks)

- 3** Prove algebraically that the sum of any two consecutive even numbers is not a multiple of 4

(3)

(Total for Question 3 is 3 marks)

- 4** n is an integer.
Prove algebraically that $(3n + 1)^2 + (n - 3)^2$ is always a multiple of 10

(3)

(Total for Question 4 is 3 marks)

- 5 n is a positive integer.
Prove algebraically that $(3n + 2)(n + 4) - n(n + 6)$ is always an even number.

(3)

(Total for Question 5 is 3 marks)

- 6 Two integers have a difference of 1
Prove algebraically that the square of their sum is always 1 more than 4 times their product.

(3)

(Total for Question 6 is 3 marks)

- 7 n is a positive integer.
Prove that $\frac{n^2 + 5n + 6}{n + 2} + \frac{n^2 - 1}{n + 1}$ is always an even number.

(3)

(Total for Question 7 is 3 marks)

- 8** n is an integer.
Prove that $n^2 + 5n + 3$ is always an odd number.

(2)

(Total for Question 8 is 2 marks)

- 9** n is an integer greater than 1
Prove that $n^3 - n$ is always a multiple of 6

(3)

(Total for Question 9 is 3 marks)

10 (a) Prove that

$$(n-1)^2 + n^2 + (n+1)^2 + (n+2)^2 = 4(n^2 + n + 1) + 2$$

(3)

(b) n is an integer.

Ella says, “The sum of the squares of four consecutive integers can never be a multiple of 4”

Use your answer to part (a) to explain why Ella is correct.

(2)

(Total for Question 10 is 5 marks)
