Algebraic Proof

GCSE Mathematics • **Higher Tier** • Grades 8–9 • Non-calculator

Name: _____ Class: _____ Total: _____ / 63

Show all your working. Marks are given for correct method as well as the final answer.

1. Write down an expression for an even number. **[1 mark]**

Answer: _____

2. Write down an expression for an odd number. **[1 mark]**

Answer: _____

3. Write down expressions for three consecutive integers. **[2 marks]**

Answer: _____

4. Write down expressions for two consecutive EVEN numbers. **[2 marks]**

Answer: _____

5. Prove that the sum of two even numbers is always even. **[3 marks]**

Answer: _____

6. Prove that the sum of two odd numbers is always even. **[3 marks]**

Answer: _____

7. Prove that the product of two odd numbers is always odd. **[4 marks]**

Answer: _____

8. Prove that the sum of three consecutive integers is always a multiple of 3. **[3 marks]**

Answer: _____

9. Prove that the sum of four consecutive integers is never a multiple of 4. **[4 marks]**

Answer: _____

10. Prove that the difference between the squares of two consecutive integers is always odd. **[4 marks]**

Answer: _____

11. Prove that $(n+3)^2 - (n-3)^2$ is always a multiple of 12. **[4 marks]**

Answer: _____

12. Prove that $(2n+1)^2 - (2n-1)^2$ is always a multiple of 8. **[4 marks]**

Answer: _____

13. Prove that the sum of the squares of two consecutive integers is always odd. **[4 marks]**

Answer: _____

14. Prove that the product of two consecutive integers is always even. **[3 marks]**

Answer: _____

15. Kim says n^2 *is always bigger than* n. Give a counter example. **[2 marks]**

Answer: _____

16. Sam says *every prime number is odd*. Give a counter example. **[1 mark]**

Answer: _____

17. Alex says *the square root of a number is always smaller than the number*. Give a counter example. **[2 marks]**

Answer: _____

18. Explain why one counter example is enough to disprove a statement, but examples can never prove one. **[3 marks]**

Answer: _____

19. n is an integer.

(a) Prove that $(n+1)^2 - (n-1)^2$ is always a multiple of 4. **[4 marks]**

(b) Explain why it is also always even. **[2 marks]**

Answer: _____

20. n is an integer.

(a) Prove that the sum of any five consecutive integers is a multiple of 5. **[4 marks]**

(b) Write down the middle number when that sum is 90. **[3 marks]**

Answer: _____

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