Pearson Edexcel

A Level Mathematics 9MA0

Unit Test

1 Proof

Time allowed: 50 **minutes**

School:

Name:

Teacher:

Question	Points	Score
1	4	
2	3	
3	5	
4	5	
5	4	
6	4	
7	4	
8	5	
9	10	
10	6	
Total:	50	

1. It is suggested that the sequence $a_k = 2^k + 1, k \geq 1$ produces only prime numbers.

   (a) Show that a_1, a_2 and a_4 produce prime numbers. [2]

   (b) Prove by counter example that the sequence does not always produce a prime number. [2]

   Total: 4

2. Prove by exhaustion that [3]

$$1 + 2 + 3 + \cdots + n \equiv \frac{n(n+1)}{2}$$

   for positive integers from 1 to 6 inclusive.

3. Use proof by contradiction to prove the statement: 'The product of two odd numbers is odd.' [5]

4. Prove by contradiction that if n is odd, $n^3 + 1$ is even. [5]

5. Use proof by contradiction to show that there exist no integers a and b for which $25a + 15b = 1$. [4]

6. Use proof by contradiction to show that there is no greatest positive rational number. [4]

7. Use proof by contradiction to show that, given a rational number a and an irrational number b, $a - b$ is irrational. [4]

8. Use proof by contradiction to show that there are no positive integer solutions to the statement $x^2 - y^2 = 1$. [5]

9. (a) Use proof by contradiction to show that if n^2 is an even integer then n is also an even integer. [4]

   (b) Prove that $\sqrt{2}$ is irrational. [6]

   Total: 10

10. Prove by contradiction that there are infinitely many prime numbers. [6]