1 Prove algebraically that

$$(2n + 1)^2 - (2n + 1) \text{ is an even number}$$

for all positive integer values of n.

(Total for Question 1 is 3 marks)

2 n is an integer greater than 1

Prove algebraically that $n^2 - 2 - (n - 2)^2$ is always an even number.

(Total for Question 2 is 4 marks)

3 Using algebra, prove that $0.1\dot{3}\dot{6} \times 0.\dot{2}$ is equal in value to $\frac{1}{33}$

(Total for Question 3 is 3 marks)

4 $x = 0.4\dot{3}\dot{6}$

Prove algebraically that x can be written as $\frac{24}{55}$

(Total for Question 4 is 3 marks)

5 n is an integer.

Prove algebraically that the sum of $\frac{1}{2}n(n+1)$ and $\frac{1}{2}(n+1)(n+2)$ is always a square number.

(Total for Question 5 is 2 marks)

6 Prove that the square of an odd number is always 1 more than a multiple of 4

(Total for Question 6 is 4 marks)

7 Given that n can be any integer such that $n > 1$, prove that $n^2 - n$ is never an odd number.

(Total for Question 7 is 2 marks)

8 Prove algebraically that the sum of the squares of any two consecutive even numbers is always a multiple of 4

(Total for Question 8 is 3 marks)