1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

....

....

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

....

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

(3)
(Total 5 marks)

2. Tarish says,

‘The sum of two prime numbers is always an even number’.

He is **wrong**.
Explain why.

....

....

(Total 2 marks)

3. Prove that $(3n + 1)^2 - (3n - 1)^2$ is a multiple of 4, for all positive integer values of n.

(Total 3 marks)

1. (a) Add on 2 1

B1 ‘even numbers go up in twos’ or ‘even numbers are 2 apart’ oe

(b) $2n + 4$ 1

B1 $2n + 4$ oe

(c) $2n + 2n + 2 + 2n + 4 = 6n + 6$

$= 6(n + 1)$ 3

M1 for 2n (+) 2n + 2 (+) '2n + 4' or any 3 consecutive even numbers written as expressions; any variable may be used
A1 for "6n + 6"
A1 for "6(n + 1)" or stating there is a factor of 6 oe
SC : B1 for n + n + 2 + n + 4

[5]

2. 2 + 'prime number' is odd 2

M1 for a counter example showing intent to add 2 and another prime number; ignore incorrect examples
A1 for a correctly evaluated counter example with no examples given that involve either non-primes or incorrect evaluation

Alternative method
B2 for fully correct explanation '2 is a prime number, odd + even (or 2) = odd' oe with no accompanying incorrect statements or examples

(B1 for '2 is a prime number' ***or*** *recognition that not all prime numbers are odd* ***or*** *odd + even (or 2) = odd; ignore incorrect examples or statements)*

[2]

3. $(9n^2 + 6n + 1) - (9n^2 - 6n + 1) = 12n$
correct comment 3

M1 for $(3n)^2 + 3n + 3n + 1$ *or* $(3n)^2 - 3n - 3n + 1$ *or* $((3n + 1) - (3n - 1))((3n + 1) + (3n - 1))$
A1 for 12n from correct expansion of both brackets
A1 for 12n is a multiple of 4 or $12n = 3 \times 4n$ *or* $12n = 4 \times 3n$ *or* $\frac{12n}{4} = 3n$ *or* $\frac{12n}{3} = 4n$
NB: Trials using different values for n score no marks.

[3]

1. There was a mixed response to part (a) with many variations of the correct answer. Part (b) was answered well but some pupils wrote $4n + 2$ instead of $2n + 4$. Very few pupils gained marks on part (c). Candidates did not follow the lead given in the earlier parts of the question. Many gave a purely numerical answer and $n + (n + 2) + (n + 4)$ was frequently seen.

2. Many candidates thought that 1 was a prime number. Others had trouble with the word "sum", misinterpreting it as product.

Successful candidates usually offered a correct counter example, frequently 2 + 3 = 5, and often backed this up by a written explanation. On occasions, a correct counter-example worthy of full marks was spoiled by further embellishment including incorrect statements or other examples involving non-primes.

3. Many candidates struggled with the requirement for an algebraic proof and instead opted to substitute various values for n. Those attempting to simplify the expression often made errors with $(3n)^2$, expressing it as $9n$, $6n^2$ or $3n^2$. Sign errors and omission of brackets around the second half of the expansions accounted for many of the other errors with $1 \times 1 = 2$ causing a severe loss of marks for a few. A difference of two squares method was seen on a small number of occasions. Some candidates correctly simplified to $12n$ but failed to justify the final mark often stating that 12 rather than $12n$ was a multiple of 4.