Question Number	Scheme	Marks	AOs
14	Attempts n^2+2 with $n=3k+1$ **or** $n=3k+2$ o.e. Look for e.g. $(3k+1)^2+2=...$	M1	3.1a
	e.g. $(3k+1)^2+2=9k^2+6k+3=3\left(3k^2+2k+1\right)$ which is a multiple of 3.	A1	2.4
	Attempts n^2+2 with $n=3k+1$ **and** $n=3k+2$ o.e	dM1	2.1
	e.g. both $(3k+1)^2+2=9k^2+6k+3=3\left(3k^2+2k+1\right)$ which is a multiple of 3 **and** $(3k+2)^2+2=9k^2+12k+6=3\left(3k^2+4k+2\right)$ which is a multiple of 3 **and** e.g. Hence proven	A1	2.4
		(4)	
		(4 marks)	
Notes:			

Note: If using n = 3n + 1 etc. then allow maximum 1110.
Ignore any attempts at n = 3k throughout.
Ignore any spurious setting = 0 throughout.

M1: Starts to solve the problem by setting $n=3k+1$ or $n=3k+2$ o.e such as $n=3k-1$ and attempts n^2+2
Do not be concerned about their attempt to expand the brackets.
If using n = 6k + 1 etc. then score for one valid attempt.

A1: Achieves $(3k+1)^2+2=9k^2+6k+3=3\left(3k^2+2k+1\right)$ **or** $(3k+2)^2+2=9k^2+12k+6=3\left(3k^2+4k+2\right)$
or $(3k-1)^2+2=9k^2-6k+3=3\left(3k^2-2k+1\right)$ **or** $(3k-2)^2+2=9k^2-12k+6=3\left(3k^2-4k+2\right)$
and concludes that it is a multiple of 3 (or e.g. divisible by 3).
Condone e.g. "n^2+2 can be divided by 3" for this mark only.
To show it is a multiple of 3 they can either factorise or comment on each term individually.
You may also see e.g. $\dfrac{9k^2+6k+3}{3}=3k^2+2k+1$ which is acceptable.
Note that the conclusion may be seen in an overall conclusion at the end.

dM1: Attempts two cases that cover all $n\in\mathbb{N}$ that are not multiples of 3.
So, sets $n=3k+1$ **and** $n=3k+2$ o.e. such as $n=3k-1$ and attempts n^2+2
Do not be concerned about their attempt to expand the brackets.
If using n = 6k + 1 then they require 4 valid attempts that cover all $n\in\mathbb{N}$ that are not multiples of 3:
e.g. n = 6k + 1, n = 6k + 2, n = 6k + 4, n = 6k + 5

A1: Requires

- **both** $(3k+1)^2+2=9k^2+6k+3$ **and** $(3k+2)^2+2=9k^2+12k+6$ o.e. correct
- sufficient reasons to conclude that **both** expressions are multiples of 3
  - e.g. $9k^2+6k+3=3\left(3k^2+2k+1\right)$ or explains that each term is a multiple of 3
  - **and** e.g. $9k^2+12k+6=3\left(3k^2+4k+2\right)$ or explains that each term is a multiple of 3
- a minimal conclusion e.g. "hence proven" or "{when n is **not** a multiple of 3,} n^2+2 is always a multiple of 3" Condone the absence of "when n is **not** a multiple of 3". Do not condone e.g. "n^2+2 can be divided by 3" for this mark.

Alt:

M1: Starts to solve the problem by stating that if n is not a multiple of 3 then one of $(n+1)$ or $(n-1)$ must be a multiple of 3

A1: Deduces that $(n+1)(n-1)$ must be a multiple of 3

dM1: Connects the two expressions $(n+1)(n-1)+3\equiv n^2+2$

A1: Explains that as $(n+1)(n-1)$ must be a multiple of 3, $(n+1)(n-1)+3$ must also be a multiple of 3, followed by a minimal conclusion, e.g. "hence n^2+2 is always a multiple of 3".