Question	Scheme	Marks	AOs
15(a)	n^3+4n		
	Attempts n^3+4n for any 2 natural numbers.	M1	1.1b
	$1^3+4\times1=5$ prime and e.g. $2^3+4\times2=16$ not prime $\therefore$ sometimes true.	A1	2.4
		(2)	

Condone the use of *n* for e.g. *k* for both marks.

All methods require attempting n^3+4n when $n=1$ for full marks.

Way 1:

M1: Attempts n^3+4n for any 2 natural numbers.

A1: Requires:

- obtains $n^3+4n=5$ when $n=1$ and states "prime" or "true" or ✓
- correct evaluation for any other natural number and states "not prime" or "composite" or "not true" or ✗
- states "sometimes true"

You can ignore any other incorrectly evaluated examples or e.g. use of negative numbers as long as these conditions are met.

Way 2 (factorisation):

M1: Attempts to factorise $n^3+4n=n\left(n^2+4\right)$

Allow for $n^3+4n=n\left(n^2+\ldots\right)$ or $n^3+4n=n\left(\ldots+4\right)$

A1: Requires:

- uses $n=1$ and obtains $n^3+4n=5$ and states "prime" or "true"
- correct factorisation and states $n^3+4n=n\left(n^2+4\right)$ is "composite" or "not prime" or "not true" (when $n>1$)
- states "sometimes true"

Way 3 (odd/even):

M1: Attempts to substitute $n=2k$ oe **or** $n=2k+1$ oe

A1: Requires:

- uses $n=1$ and obtains $n^3+4n=5$. Here the value for $n=1$ might be found using $k=1$ for $n=2k-1$ or $k=0$ for $n=2k+1$ and states "prime" or "true"
- correctly factorises any one correct form for odd or even e.g. $8k^3+8k=8k\left(k^2+1\right)$ and concludes "not prime" or "composite" or "not true" (only one form needed here)
- states "sometimes true"

(b)	$n^3 + 5n$		
	$n^3 + 5n = n\left(n^2 + 5\right)$	M1	3.1a
	Since $1^3 + 5\times 1 = 6$, $n^3 + 5n$ is not prime for $n = 1$ For all other n, $n^3 + 5n = n\left(n^2 + 5\right)$ is not prime as it is the product of two other numbers not equal to 1. Hence never true.	A1	2.4
		(2)	
			(4 marks)

Notes:

Condone the use of *n* for e.g. *k* for both marks.

Way 1 (Factorisation):

M1: Attempts to factorise $n^3 + 5n = n\left(n^2 + 5\right)$

Allow $n^3 + 5n = n\left(n^2 + ...\right)$ or $n^3 + 5n = n\left(... + 5\right)$

A1: Requires:

- Correct factorisation $n^3 + 5n = n\left(n^2 + 5\right)$
- Substitution of $n = 1$: $1^3 + 5\times 1 = 6$
  or states $n^3 + 5n \neq 2$ oe e.g. $n^3 + 5n > 2$ oe
- "Never true"

Way 2 (Odd/Even):

M1: Attempts to substitute $n = 2k$ **and** either $n = 2k + 1$ or $n = 2k - 1$ oe

A1: Requires:

- Correctly factorising both even and odd forms
  e.g. $8k^3 + 10k = 2k\left(4k^2 + 5\right)$ **and**
  e.g. $\left(2k+1\right)^3 + 5\left(2k+1\right) = \left(2k+1\right)\left(\left(2k+1\right)^2 + 5\right)$ or e.g. $2\left(2k+1\right)\left(2k^2 + 2k + 3\right)$
  (in this part both cases are needed)
- Substitution of $n = 1$: $1^3 + 5\times 1 = 6$, or e.g. $k = 1$ for $n = 2k - 1$ or $k = 0$ for $n = 2k + 1$
  or states $n^3 + 5n \neq 2$ oe e.g. $n^3 + 5n > 2$ oe
  e.g. $2k\left(4k^2 + 5\right)$ and $2\left(2k+1\right)\left(2k^2 + 2k + 3\right)$ are > 2 or $\neq 2$
- "Never true"

Way 3 (Odd/Even via logic):

M1: Considers $n^3 + 5n$ with "odds" and "evens" e.g.

If n is **odd** then $n^3 + 5n$ = odd + odd = even

or e.g. $n^3 + 5n = n\left(n^2 + 5\right)$ = odd(odd + odd) = odd×even = even

If n is **even** then $n^3 + 5n$ = even + even = even

or e.g. $n^3 + 5n = n\left(n^2 + 5\right)$ = even(even + odd) = even×odd = even

A1: Requires:

- Fully correct argument for both odds and evens
- A full justification of any assumed results e.g. n odd $\Rightarrow n^3$ is odd via algebra or e.g. n odd means n^3 = odd×odd×odd = odd
- When $n = 1$, $n^3 + 5n = 6$ so $n^3 + 5n \neq 2$
- "Never true"