Question	Scheme	Marks	AOs
11	$n\left(n^2+5\right)$		
	Attempts even **or** odd numbers Sets $n=2k$ **or** $n=2k\pm1$ oe and attempts $n\left(n^2+5\right)$	M1	3.1a
	Achieves $2k\left(4k^2+5\right)$ (for $n=2k$) and states "even" **Or** achieves $(2k+1)\left(4k^2+4k+6\right)=2(2k+1)\left(2k^2+2k+3\right)$ (for $n=2k+1$) and states "even" Or e.g. achieves $(2k-1)\left(4k^2-4k+6\right)=2(2k-1)\left(2k^2-2k+3\right)$ (for $n=2k-1$) and states "even"	A1	2.2a
	Attempts even **and** odd numbers Sets $n=2k$ **and** $n=2k\pm1$ oe and attempts $n\left(n^2+5\right)$	dM1	2.1
	Achieves $2k\left(4k^2+5\right)$ (for $n=2k$) and states "even" **and** achieves $(2k\pm1)\left(4k^2\pm4k+6\right)=2(2k\pm1)\left(2k^2\pm2k+3\right)$ (for $n=2k\pm1$) and states "even" Correct work and states even for both WITH a final conclusion showing that true for all $n(\in\mathbb{N})$ or e.g. true for all even and odd numbers.	A1	2.4
		(4)	
			(4 marks)

Notes:

M1: For the key step attempting to find $n\left(n^2+5\right)$ when $n=2k$ **or** $n=2k\pm1$ or equivalent representation of odd or even e.g. $n=2k+2$ **or** $n=2k\pm7$

Condone the use of e.g. $n = 2n$ and $n = 2n\pm1$

A1: Achieves $2k\left(4k^2+5\right)$ or e.g. $2\left(4k^3+5k\right)$ and deduces that this is even at the appropriate time.

Or achieves $(2k\pm1)\left(4k^2\pm4k+6\right)=2(2k\pm1)\left(2k^2\pm2k+3\right)$ oe e.g. $2\left(4k^3+6k^2+8k+3\right)$ and deduces that this is even.

Note that if the bracket is expanded to e.g. $8k^3+12k^2+16k+6$ then stating "even" is insufficient – they would need to say e.g. even + even + even + even = even or equivalent

Note it is also acceptable to use a divisibility argument e.g. $\dfrac{8k^3+10k}{2}=4k^3+5k$ so $8k^3+10k$ must be even.

There should be no errors in the algebra but allow e.g. invisible brackets if they are "recovered".

dM1: Attempts $n\left(n^2+5\right)$ when $n=2k$ **and** $n=2k\pm1$ or equivalent representation of odd or even e.g. $n=2k+2$ **and** $n=2k\pm7$

A1: Correct work and states even for both WITH a final conclusion e.g. so true for all $n(\in\mathbb{N})$.

There should be no errors in the algebra but allow e.g. invisible brackets if they are "recovered".

A "solution" via just logic.

E.g.

If n is odd, then $n\left(n^2+5\right)$ is odd×(odd + odd) = odd × even = even

If n is even, then $n\left(n^2+5\right)$ is even×(even + odd) = even × odd = even

Both cases must be considered to score any marks and scores SC 1010 if fully correct

OR

E.g. $n\left(n^2+5\right)=n^3+5n$

If n is odd, then n^3 is odd and $5n$ is odd, so n^3+5n is odd + odd = even

If n is even, then n^3 is even and $5n$ is even, so n^3+5n is even + even = even

Both cases must be considered to score any marks and scores SC 1010 if fully correct

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A solution via contradiction.

M1 A1: There exists a number n such that $n\left(n^2+5\right)$ is odd, and so deduces that both n and n^2+5 are odd. Note that M1A0 is not possible via this method.

dM1: Sets $n^2+5=2k+1$ (for some integer k) $\Rightarrow n^2=2k-4=2\left(k-2\right)$ which is even
Must use algebra here for this approach and not a "logic" argument.

A1: States that "this is a contradiction as if n^2 is even, then n is even" and then concludes so "$n\left(n^2+5\right)$ is even for all n."

Attempts at proof by induction should be sent to review