3	$\dfrac{d}{dx}\left(x\cos x\right)=\cos x-x\sin x=(-1)^1(x\sin x-(2(1)-1)\cos x)$
	Assume true for $n=k$, so $\dfrac{d^{2k-1}}{dx^{2k-1}}\left(x\cos x\right)=\left(-1\right)^k\left(x\sin x-(2k-1)\cos x\right)$
	Then $\dfrac{d^{2k}}{dx^{2k}}\left(x\cos x\right)=(-1)^k(x\cos x+2k\sin x)$
	$\dfrac{d^{2k+1}}{dx^{2k+1}}\left(x\cos x\right)=(-1)^k\left(-x\sin x+\cos x+2k\cos x\right)$ $=(-1)^{k+1}\left(x\sin x-\left(2k+1\right)\cos x\right)$
	So, it is also true for $n=k+1$. Hence, [by induction], $\dfrac{d^{2n-1}}{dx^{2n-1}}\left(x\cos x\right)=\left(-1\right)^n\left(x\sin x-(2n-1)\cos x\right)$ is true for all positive integers.

3(a)	$u_1<5$ (given)
	Assume that $u_k<5$ for some positive integer k.
	Then $5-u_{k+1}=5-\dfrac{6u_k+5}{u_k+2}=\dfrac{5u_k+10-6u_k-5}{u_k+2}$
	$=\dfrac{5-u_k}{u_k+2}>0$.
	Hence, by induction, $u_n<5$ for all positive integers n.
3(b)	$u_{n+1}-u_n=\dfrac{6u_n+5}{u_n+2}-u_n=\dfrac{6u_n+5-u_n{}^2-2u_n}{u_n+2}=\dfrac{-u_n{}^2+4u_n+5}{u_n+2}$
	$=\dfrac{\left(5-u_n\right)\left(1+u_n\right)}{u_n+2}$. So $u_n<5\Rightarrow u_{n+1}-u_n>0$

1	LHS $=\left(\frac{6}{5}\right)^1=\frac{6}{5}$ RHS $=1+\frac{1}{5}=\frac{6}{5}$
	Assume that $\left(\frac{6}{5}\right)^k \geqslant 1+\frac{1}{5}k$ for some positive integer k.
	Then $\left(\frac{6}{5}\right)^{k+1} \geqslant \left(\frac{6}{5}\right)\left(1+\frac{1}{5}k\right)$
	$=\frac{6}{5}+\frac{6}{25}k \geq \frac{6}{5}+\frac{1}{5}k=1+\frac{1}{5}(k+1)$
	Hence, by induction, $\left(\frac{6}{5}\right)^n \geqslant 1+\frac{1}{5}n$ is true for every positive integer n.

3(a)	$u_1=5=6^1-1$
	Assume that it is true for $n=k$, so $u_k=6^k-1$.
	Then $u_{k+1}=6(6^k-1)+5=6^{k+1}-1$.
	So, it is also true for $n=k+1$. Hence, by induction, $u_n=6^n-1$ is true for all positive integers.
3(b)	$\frac{u_{2n}}{u_n}=\frac{6^{2n}-1}{6^n-1}=\frac{(6^n-1)(6^n+1)}{6^n-1}=6^n+1$

2	$2025+47-2=2070=45\times 46$ is divisible by 46.
	Assume that 2025^k+47^k-2 is divisible by 46 for some positive integer k.
	Then $2025^{k+1}+47^{k+1}-2=(2024+1)2025^k+(46+1)47^k-2$
	is divisible by 46 because $2024\times 2025^k+46\times 47^k=46(44\times 2025^k)+46\times 47^k$ is divisible by 46
	Hence, [by induction], true for every positive integer n.