**Algebraic Proof with Multiples**

(a) Show that $4\left(n+3\right)-n $is a multiple of $3$ for all integer values of $n$

(b) Show that $(n+2)^{2}+3n^{2}$ is a multiple of $4$ for all integer values of $n$

(c) Show that $(3n-1)^{2}-(2n+1)^{2}$ is a multiple of $5$ for all integer values of $n$

(d) Show that

$\left(2n+1\right)\left(4n-3\right)-\left(n+2\right)^{2}-n$ is a multiple of $7$ for all integer values of $n$

(a) Show that the sum of three consecutive integers is always a multiple of $3$

(b) Show that the sum of three consecutive even numbers is always a multiple of $6$

(c) Show that the product of two consecutive even numbers is always a multiple of $4$

(a) Prove algebraically that the sum of three consecutive square numbers is never a multiple of $3$

(b) Prove algebraically that the sum of the squares of any two odd numbers is never a multiple of $4$

(c) Prove algebraically that the product of two consecutive odd numbers is never a multiple of $4$

(a) Prove algebraically that the product of three consecutive even numbers is always a multiple of $8$

(b) Prove algebraically that the sum of the cubes of two consecutive even numbers is always a multiple of $8$

(c) Prove algebraically that the product of the squares of two odd numbers is always one more than a multiple of $4$

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