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Theorem:
If a is any odd integer and b is any even integer then $2a + 3b$ is even

Proof: Let a be any odd integer and b be any even integer

$a = 2c + 1$ Def of odd

$b = 2d$ Def of even

$2a = 4c + 2$ substitution

$3b = 6d$ substitution

$2a + 3b = 4c + 2 + 6d$ by substitution

$= 2(2c + 3d + 1)$ factorization

let $(2c + 3d + 1)$ = some integer k. Closure of $\mathbb{Z}$

$2a + 3b = 2k$ def of even

$\therefore 2a + 3b$ is even