

If f is *even* and g is *odd*, then $f(-x) = f(x)$ and $g(-x) = -g(x)$. Now $(fg)(-x) = f(-x) \cdot g(-x) = [f(x)] \cdot [-g(x)] = -[f(x) \cdot g(x)] = -(fg)(x)$, so fg is an odd function.