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$$(a_n^2 - a_{n-1}^2) - (a_{n-1}^2 - a_{n-2}^2) =$$

$$(a_n - a_{n-1})(a_n + a_{n-1}) - (a_{n-1} - a_{n-2})(a_{n-1} + a_{n-2}) =$$

$$d(a_n + a_{n-1}) - d(a_{n-1} + a_{n-2}) =$$

$$d(a_n + a_{n-1} - a_{n-1} - a_{n-2}) =$$

$$d(a_n - a_{n-2}) = 2d^2$$