2.2.1. Writing the product matrices in term of their elements,

\[ AB = \left( \sum_m a_{im} b_{mk} \right), \quad BC = \left( \sum_n b_{in} c_{nk} \right), \]

\[ (AB)C = \left( \sum_n \left( \sum_m a_{im} b_{mn} \right) c_{nk} \right) = \sum_{mn} a_{im} b_{mn} c_{nk} \]

\[ = A(BC) = \left( \sum_m a_{im} \left( \sum_n b_{mn} c_{nk} \right) \right), \]

because products of real and complex numbers are associative the parentheses can be dropped for all matrix elements.

2.2.4. A factor \((-1)^n\) can be pulled out of each row giving the \((-1)^n\) overall.

2.2.6. \(n = 6\).

2.2.13. By direct matrix multiplication we verify all claims.

2.2.17. Taking the trace, we find from \([M_i, M_j] = iM_k\) that

\[ i \text{ trace}(M_k) = \text{trace}(M_i M_j - M_j M_i) = \text{trace}(M_i M_j) - \text{trace}(M_i M_j) = 0. \]

2.2.18. Taking the trace of \(A(BA) = -A^2B = -B\) yields \(-\text{tr}(B) = \text{tr}(A(BA)) = \text{tr}(A^2B) = \text{tr}(B)\).

5.4.1. (a) \((A + A^\dagger)^\dagger = A + A^\dagger, [i(A - A^\dagger)]^\dagger = -i(A^\dagger - A) = i(A - A^\dagger).\)

(b) \(A = \frac{1}{2}(A + A^\dagger) - \frac{i}{2}i(A - A^\dagger).\)

5.4.3. \((AB - BA)^\dagger = (iC)^\dagger = B^\dagger A^\dagger - A^\dagger B^\dagger = -iC^\dagger = BA - AB = -iC.\)