

# COMPOSITE FACTORS OF BINOMIALS AND LINEAR SYSTEMS IN ROOTS OF UNITY

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In this paper we completely classify binomials in one variable which have a nontrivial factor which is *composite*, i.e. of the shape  $g(h(x))$  for polynomials  $g, h$  both of degree  $> 1$ . In particular, we prove that, if a binomial has such a composite factor, then  $\deg g \leq 2$  (under natural necessary conditions). This is best-possible and improves on a previous bound  $\deg g \leq 24$ . This result provides evidence toward a conjecture predicting a similar bound when binomials are replaced by polynomials with any given number of terms. As an auxiliary result, which could have other applications, we completely classify the solutions in roots of unity of certain systems of linear equations.