Elementary (My Dear Watson) Differential Equation

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TABLES 1–5 give, for $n=4, 6, 8, 12, 20$, respectively, all polynomials of form (1) which satisfy conditions (a)—(c). The numberings of the faces of the die which are associated with each polynomial are also given. In the tables the standard die is listed first, followed by pairs of dice which have the same sum probabilities as two standard dice. In TABLES 3–5 some unpaired dice remain. To see that every polynomial corresponds to a die which is contained in some set with the same sum probabilities as a set of standard dice, observe that $\{O_8, O_9, O_{10}\}$ has the same sum probabilities as three copies of O_1. Each of the sets $\{D_{16}, D_{17}, D_{18}\}$, $\{D_2, D_{10}, D_{19}\}$, $\{D_3, D_{13}, D_{20}\}$, $\{D_7, D_{13}, D_{21}\}$, and $\{D_4, D_{10}, D_{22}\}$ has the same sum probabilities as three copies of D_1. Finally, three copies of I_1 have the same sum probabilities as each of $\{I_{16}, I_{17}, I_{18}\}$, $\{I_2, I_{10}, I_{19}\}$, $\{I_3, I_{13}, I_{20}\}$, $\{I_7, I_{13}, I_{21}\}$, and $\{I_4, I_{10}, I_{22}\}$.

There do remain several open questions. It is a straightforward, though tedious, exercise to determine which polynomials satisfy the conditions of the theorem, provided n is small. However, for arbitrary n, there remains the problem of determining, other than by direct computation, all polynomials with non-negative coefficients which are products of cyclotomic polynomials. With the aid of the tables, one could find all ways to combine non-standard Platonic dice to get sets with the same sum probabilities as sets of standard Platonic dice. (We leave this as an exercise for the reader.) Note that if not all dice in the set have the same number of faces, some very strange sets emerge. For example, $\{T_1, O_1, D_1, I_1\}$ has the same sum probabilities as $\{T_3, O_4, D_{13}, I_{12}\}$ and two copies of T_1 have the same probabilities as $\{P_1, O_6\}$, where P_1 is a fair coin whose sides are numbered 1 and 2.

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It was hot for this London fall day—70°F. Holmes arrived at Barker Street Annex to find the inspector hunched over the body. "It is important that we determine the exact time of death, sir, for in that way we may immediately determine the motive," said the inspector. Not wishing to pursue the unpursuable non sequitur, Holmes took out his r----- thermometer and after a few moments of discrete (!) investigation, announced, "I say! 94.6°F. (What, no metric system?) And it is presently noon." With that he departed into the London fog, to return to the body at the same spot in one hour. After performing another investigation Holmes declared, "93.4°F at 1 o'clock." And then silence....

"Inspector, the murder occurred at exactly 8:58.51204 o'clock a.m. Good day to you, sir!"

Later in their chambers Watson asked, "I say! (The British always say by saying, unlike the Hsitirb's who say by not saying.) How did you do that, Holmes?" "Elementary, my dear Watson. A simple application of a law of Newton," said Holmes.

"Here, here Holmes, you don't mean to say he fell out of a window?" snapped Watson, sensing the gravity of the issue. Remaining *cool* Holmes began at the beginning, where he always began with Watson, "You see...."