ALPHANUMERICALLY TRUTHFUL EQUATIONS

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In W2004-202, Anil re-introduced the equation 11 + 2 = 12 + 1. Not only is this obviously true in this numeric form, but when written ELEVEN + TWO = TWELVE + ONE, the sum of the letter values on the left (taking A = 1 etc) equals the sum of the letter values on the right, viz 121. In this case, it is because the same letters are used on both sides.

In the same issue (page 186) the editor gave the example 257 + 80 = 287 + 50. This is obviously true, as each side is made from 200, 80, 50, and 7. When translating the numbers into words, each side has TWO HUNDRED, EIGHTY, FIFTY and SEVEN, so the sum of the letter values is bound to be the same, and is actually 337, the same as the numerical sum.

The editor found a neater example: 297 + 245 = 270 + 272. This is neater because the components of each side differ: the left has 90, 7, 40, and 5 where the right has 70, 70, and 2. For letter value equality, the letter values of NINETY etc must equal those of SEVENTY etc. They do, the sum of each side's letters being 542, the same as the numerical sum.

Consider the UK style of numbers: 1 + 250 = 50 + 201. Now look at the same equation in words: ONE + TWO HUNDRED AND FIFTY = FIFTY + TWO HUNDRED AND ONE. Because the equation uses the same elements on each side both numerically and in words, it is true in both cases, and so not neat in the sense above. However, adding the numerical equation, we get 251; and adding the letter values of TWO HUNDRED AND FIFTY ONE we get — 251! So the sum of the numbers is the same as the sum of the letters of both addends, and also the same as the sum of the letters in the total. The equation 50 + 209 = 9 + 250 shares this property, with both number and letter sums of 259. Knowing that 251 and 259 are the only numbers whose letter sums have the same value as the numbers themselves, these are the only possible totals of equations of this type, no matter what the shape of the other side of the equation.

Next consider the obsolete style of numbers, such as "four and twenty", wherein an extra AND is added to all numbers where the junior two digits form a number greater than 20, and the junior digit is not zero. 291 and 299 (like 251 and 259 above) have their letter sums equal to their values, though unfortunately do not equal the letter sum of two other numbers.

In the range 1-999, the values of the letter sums for a number name range from 34 (for ONE) to 314 for SEVEN HUNDRED SEVENTY-SEVEN; 333 for SEVEN HUNDRED AND SEVENTY-SEVEN, UK style; and 352 for SEVEN HUNDRED AND SEVEN AND SEVENTY (obsolete numbers).

In examining the numbers from 1 to 999 for US number names, with two numbers added together, I found 266 cases like 261= 11 + 250 where the letter sum of the right is the same as the numeric sum (but the letter sum of the left is quite different from the value 261). There are two equations with this sum of 251. This was the smallest left side: the largest was 600= 277 + 323 (one of four with this total).

For UK number names, I found 275 cases, ranging from 251= 1 + 250 (one of two with this total), to 624= 297 + 327 (one of four with this total). 593= 296 + 297 is a rare example where there is no other expression adding to the same value (of 593).

The obsolete numbers have 240 cases ranging from 251 (three examples, eg = 1 + 250) to 656 (= 278 + 378, single example).

In fact, there is a great tendency for sums to occur in groups. Among the groups are many "neat" cases. In the UK case, the largest group has twelve items: 406= 21 + 385 = 25 + 381 = 41 + 365 = 45 + 361 = 47 + 359 = 49 + 357 = 57 + 349 = 59 + 347 = 61 + 345 = 65 + 341 = 81 + 325 = 85 + 321.

In the US case, the largest groups contain eight items:
403= 21 + 382 = 22 + 381 = 41 + 362 = 42 + 361 = 61 + 342 = 62 + 341 = 81 + 322 = 82 + 321
405= 21 + 384 = 24 + 381 = 41 + 364 = 44 + 361 = 61 + 344 = 64 + 341 = 81 + 324 = 84 + 321
411= 22 + 389 = 29 + 382 = 42 + 369 = 49 + 362 = 62 + 349 = 69 + 342 = 82 + 329 = 89 + 322
413= 24 + 389 = 29 + 384 = 44 + 369 = 49 + 364 = 64 + 349 = 69 + 344 = 84 + 329 = 89 + 324
414= 21 + 393 = 23 + 391 = 41 + 373 = 43 + 371 = 71 + 343 = 73 + 341 = 91 + 323 = 93 + 321
422= 23 + 399 = 29 + 393 = 43 + 379 = 49 + 373 = 73 + 349 = 79 + 343 = 93 + 329 = 99 + 323
523= 125 + 398 = 128 + 395 = 145 + 378 = 148 + 375 = 175 + 348 = 178 + 345 = 195 + 328
= 198 + 325

For obsolete numbers, the largest groups have 8 members, and there are four such groups:
457= 61 + 396 = 66 + 391 = 71 + 386 = 76 + 381 = 81 + 376 = 86 + 371 = 91 + 366 = 96 + 361
465= 66 + 399 = 69 + 396 = 76 + 389 = 79 + 386 = 86 + 379 = 89 + 376 = 96 + 369 = 99 + 366
531= 104 + 427 = 107 + 424 = 124 + 407 = 127 + 404 = 203 + 328 = 208 + 323 = 223 + 308
= 228 + 303
623= 225 + 398 = 228 + 395 = 245 + 378 = 248 + 375 = 275 + 348 = 278 + 345 = 295 + 328
=298 + 325