

How to Solve

Each Alphametic puzzle is constructed from up to 10 letters. Each letter represents a number between 0 and 9. Two letters can not represent the same letter. The objective is to determine the number used to exchange for each letter. The only obvious clue is that a word can not start with a zero.

The following is an example to illustrate how to solve a simple Alphametic using logic.

$$\begin{array}{rcccc} & 1 & 2 & 3 & 4 & \text{(Column)} \\ & & & \mathbf{A} & \mathbf{N} & \\ + & \mathbf{C} & \mathbf{A} & \mathbf{N} & & \\ \hline \mathbf{N} & \mathbf{E} & \mathbf{E} & \mathbf{D} & & \end{array}$$

A good first step is to look for the number 0. Since the conventions outline that no word may start with 0, we know that neither A, C or N are 0.

Next we attempt to establish whether any columns add up to more than 10 (e.g. $4 + 7 = 11$), which indicates this column carries over to the next column. From the example, column 1 contains only the letter N. For this to happen, the addition from the preceding column must have generated a carry, therefore $N = 1$. From column 4, if $N + N = D$, this means that $D = 2$.

From column 2, $C = 9$ as any number less than 9 would not have produced a carry to column 1. By the same reasoning, column 3 must also produce a carry. Using this we can determine that $E = 0$ from column 2.

Finally, in column 3, $A + A = 0$. This means that $A = 5$ as we have already determined that column 4 had no carry.

We have now replaced all the letters with numbers, providing the solution: $A=5, C=9, D=2, E=0, N=1$.

Tips and Tricks

The following is a selection of tips and tricks to help in solving Alphametics using logic. There are many more tips and tricks that you will discover as you progress through the puzzles.

$\begin{array}{r} \text{A} \\ + \text{B} \\ \hline \text{A} \end{array}$	If this occurs in the right end column, then B is clearly the number 0 as any number plus 0 leaves that number unchanged.
$\begin{array}{r} \text{A X} \\ + \text{B Y} \\ \hline \text{A Z} \end{array}$	If the previous situation occurs but not in the right end column, B must be either 0 or 9 depending on whether the preceding column has a carry.
$\begin{array}{r} \text{A} \\ + \text{A} \\ \hline \text{B} \end{array}$	If this occurs in the right end column, then B is an even number and A is not 0.
$\begin{array}{r} \text{A X} \\ + \text{Y} \\ \hline \text{B Z} \end{array}$	This arrangement tells you that B is 1 more than A.
$\begin{array}{r} \text{A} \\ + \text{B} \\ \hline \text{C} \end{array}$	If it can be shown that this column has no carry, the smallest A or B can be is 1 and the smallest C can be is 3. In addition neither A or B can be 9.

Using Solving Aids

Each puzzle has a PDF file attached to it which contains several aids to help in solving the puzzle. These solving aids can reduce the complexity of the problem by working through the logic of the problem visually, rather than in your head. When you start out it is a good idea to use these as it will help you to understand the process for solving the puzzles.

A	D	E	G	M	N	P	R	S	T
0					1				
0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

You use the first solving aid to help record what each letter could be and what it is not. As you solve the puzzle you will discover the certain letters can not logically be certain numbers, cross these out on the table (*shown here in grey*).

Eventually there will be only one number associated with each letter. You will have solved the puzzle.

The second solving aid is also used to eliminate numbers, by associating letters in a sum. It helps in applying your logic while solving a puzzle. When you discover a range of values for a letter, use the table to see the effect on other letters.

For example, the third tip ($A + A = B$) is shown in the first table. If later we determine that A is less than 5, the

second table shows you that B must be 2, 4, 6, or 8 and has no carry.

		(0 , 1) carry									
A	0	1	2	3	4	5	6	7	8	9	
A	0	1	2	3	4	5	6	7	8	9	
B	0	1	2	3	4	5	6	7	8	9	
	10	11	12	13	14	15	16	17	18	19	

		(0 , 1) carry									
A	0	1	2	3	4	5	6	7	8	9	
A	0	1	2	3	4	5	6	7	8	9	
B	0	1	2	3	4	5	6	7	8	9	
	10	11	12	13	14	15	16	17	18	19	