Letter Substitution

Math Concepts: Add / Subtract - multi-digit numbers
Materials: Paper, pencil
Players: 1+

Challenge: Find the values of the letters in these puzzles. The three rules for letters are:

- A given letter is always the same digit (0 to 9)
- The leftmost digit of a number is never 0
- Different letters must be different digits

Create: Make these puzzles by taking an addition or subtraction problem and replacing one or more of the digits, as in the following examples:

$$\begin{array}{r} 23 \\ +46 \\ \hline 69 \end{array} \quad\dashrightarrow\quad \begin{array}{r} 23 \\ +4A \\ \hline A9 \end{array} \quad \begin{array}{r} B3 \\ +4A \\ \hline A9 \end{array}$$

Create puzzles to make interesting problem-solving challenges for your students. Note that the values of the letters do not carry over from puzzle to puzzle.

$$\begin{array}{r} B \\ +8 \\ \hline C \end{array} \quad \begin{array}{r} B \\ +B \\ \hline 8 \end{array} \quad \begin{array}{r} A \\ +A \\ \hline C4 \end{array} \quad \begin{array}{r} A \\ +2 \\ \hline BC \end{array} \quad \begin{array}{r} A \\ +B \\ \hline AC \end{array} \quad \begin{array}{r} A \\ +BB \\ \hline A7 \end{array} \quad \begin{array}{r} B \\ +AB \\ \hline BA \end{array} \quad \begin{array}{r} BA \\ +BB \\ \hline CAB \end{array}$$

$$\begin{array}{r} AC \\ +BC \\ \hline BDD \end{array} \quad \begin{array}{r} AA \\ +BA \\ \hline BBC \end{array} \quad \begin{array}{r} AA \\ +CB \\ \hline BBC \end{array} \quad \begin{array}{r} AA \\ +AA \\ \hline BBC \end{array} \quad \begin{array}{r} AA \\ +AB \\ \hline CAC \end{array} \quad \begin{array}{r} BE \\ +BE \\ \hline SEE \end{array} \quad \begin{array}{r} TO \\ +GO \\ \hline OUT \end{array}$$

– DISCUSSION AND TIPS –

One very useful observation is that when you add two numbers in a column, even if there is a carry of 1 into that column, the largest possible carry out of that column is 1 (9 + 9 + 1 = 19). For example, in the problem above where BA + BB = CAB, the value of C must be 1. Also, anytime you spot something like A + B = B, as in that problem, that will force A = 0 (as long as there is no carry into that column, which there isn't).

Any problem involving the addition of two numbers can be rewritten as a subtraction problem instead. For example, BA + BB = CAB is the same as CAB - BA = BB.