

# Puzzle of the Week

## *Letter Substitutions – 2*

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Rules:

1. A letter represents a digit from 0 to 9, and has the same value throughout a single puzzle.
2. No number can start with the digit 0.
3. Within a puzzle, different letters must have different values.

$$\begin{array}{r} 8 \\ + \underline{A} \\ B \ 2 \end{array} \Rightarrow \begin{array}{r} 8 \\ + \underline{4} \\ 1 \ 2 \end{array}$$

**THE CHALLENGE:** Find the value of C, D, E, F, G, and H in these puzzles.

$$\begin{array}{r} C \\ + \underline{2} \\ D \ E \end{array} \qquad \begin{array}{r} F \\ + \underline{G} \\ F \ H \end{array}$$

**EXPLORATION:** Make some letter substitution puzzles for your friends to solve.

# Puzzle of the Week

## *Letter Substitutions – 2 – Notes*

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**THE CHALLENGE:** In problems with more letters, it is often helpful to rewrite the problem replacing each letter as you discover its value.

These problems involve an important insight about adding: if you add two single-digit numbers, including possibly a carry, the result cannot be larger than 19, so the carry is always either 0 or 1.

In the first problem, as a leading digit  $D$  cannot be 0, so it must be 1.  $C + 2$  must be at least 10, so  $C$  is 8 or 9. If  $C$  is 9, then  $DE$  would be 11 – this would cause  $D$  and  $E$  to have the same value, which is not allowed. Therefore,  $C$  is 8, and the answer is:  $8 + 2 = 10$ .

The second starts off the same way.  $F$  must be 1. The problem becomes  $1 + G = 1H$ . The only way  $1 + G$  can be 10 or higher is for  $G$  to be 9. The answer becomes:  $1 + 9 = 10$ .

**EXPLORATION:** Here are three more letter substitution puzzles to play with.

**J + J + K = K0:** As a carry,  $K$  must be 1 or 2. If  $K$  is 1, then  $J + J + 1$  is an odd number, which cannot end in 0. Therefore,  $K$  is 2. Now,  $J + J + 2 = 20$  forces  $J$  to be 9. The answer is:  $9 + 9 + 2 = 20$ .

**L + L + L = M2:** Three times  $L$  ends in 2 forces  $L$  to be 4 and  $M$  to be 1. The answer is:  $4 + 4 + 4 = 12$ .

**N + N + N = P4:** Three times  $N$  ends in 4 forces  $N$  to be 8 and  $P$  to be 2. The answer is:  $8 + 8 + 8 = 24$ .