

## Cryptarithms

Cryptarithms are puzzles where letters stand for different digits in an arithmetic problem. The problem is usually to figure out which letters stand for which digits.

Sometimes you can narrow the possibilities for a given letter down to a small number of choices, and you just have to try them and see if there is a way to get a solution.

Sometimes it helps to write *equations* using the letters. Algebra can then be used to solve for the letters.

1. In this addition problem, different letters stand for different digits. What digit does  $A$  stand for?

$$\begin{array}{r} A \\ A \\ + A \\ \hline B A \end{array}$$

2. What digit does  $A$  stand for in this next cryptarithm?

$$\begin{array}{r} 4 A \\ + A 4 \\ \hline B C B \end{array}$$

3.  $HA$  and  $AH$  represent two-digit numbers. If  $HA - AH = 18$ , what is the value of the expression  $H - A$ ?
4. In this multiplication problem, different letters stand for different digits. What digit does  $H$  stand for?

$$\begin{array}{r} A H A \\ \times \quad A \\ \hline T A D A \end{array}$$

5. When the six-digit number  $3456X7$  is divided by 8, the remainder is 5. Give both possible values of the digit  $X$ .

6. In this multiplication problem, A and B represent different digits. What is the 4-digit product?

$$\begin{array}{r}
 \phantom{\times} \phantom{00} A B \\
 \times \phantom{00} B A \\
 \hline
 \phantom{00} \phantom{00} \square 8 \\
 \phantom{00} \square \phantom{00} \square \\
 \hline
 \square \square \square \square
 \end{array}$$

7. If  $23AB3$  is divisible by 99, what is the two-digit number  $AB$ ?
8. The digits 1,2,3,4 and 5 are each used once to write a five-digit number  $ABCDE$ . The 3-digit number  $ABC$  is divisible by 4,  $BCD$  is divisible by 5, and  $CDE$  is divisible by 3. Find the five-digit number  $ABCDE$ .
9. If  $A, C, M, T$  are distinct numbers chosen from the set 3, 5, 7 and 9, what is the largest possible sum of  $CAT + MAT + TAM$ ?
10. In this addition problem, distinct letters represent different digits. What is the result?

$$\begin{array}{r}
 F O R T Y \\
 \phantom{+} \phantom{00} T E N \\
 + \phantom{00} T E N \\
 \hline
 S I X T Y
 \end{array}$$

11. The six-digit number  $63X904$  is a multiple of 27. What is the digit  $X$ ?