

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.

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

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.

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

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

2. HA and AH represent two-digits numbers. If $HA - AH = 18$, what is the value of the expression $H - A$?

Answer:

9

3. In this multiplication problem, different letters stand for different digits. What digit does H stand for?

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

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

Answer:

3 or 7. Notice 345600 is divisible by 8.

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

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

Answer:

$$42 \times 24 = \boxed{1008}$$

6. If $23AB3$ is divisible by 99, what is the two-digit number AB ?

Answer:

46

7. 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 $ABCDE$.

Answer:

$\boxed{12,453}$. Note D must be 5, so $C + E$ must have a remainder of 1 when divided by 3. So one of (C, E) must be 3 and the other is either 1 or 4. Since ABC is divisible by 4, C must be even—it must be 4. Then E is 3. Then B must be 2 since 14 is not divisible by 4, and A is 1 by elimination.

8. If A, C, M, T are distinct numbers chosen from the set $3, 5, 7$ and 9 , what is the largest possible sum of $CAT + MAT + TAM$?

Answer:

we want $A = 3$ and $T = 9$ and $M = 7$. So, $539 + 739 + 937 = \boxed{2215}$

9. In this addition problem, distinct letters represent different digits. What is the result?

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

Answer:

$\boxed{31,486}$

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

Answer:

$\boxed{5}$