

Exercise 5.3

Solve each of the following Cryptarithms.

$$\begin{array}{r} \text{Q.1} \quad \quad 3 \quad 7 \\ + \quad A \quad B \\ \hline \quad 9 \quad A \end{array}$$

Solution: let solve for unit's place

$$7 + B = A$$

$$\text{and for ten's place } 3 + A = 9$$

which means $A = 6$, $B = -1$, which is

not possible. So There should be 1 carry for ten's place i.e

$$1 + 3 + A = 9$$

$$4 + A = 9 \Rightarrow A = 5$$

For unit place subtracting 10 as one carry is given to ten's place

$$7 + B - 10 = 5$$

$$B = 5 + 10 - 7 = 8$$

$$\therefore A = 5, B = 8.$$

Q.2

$$\begin{array}{r} A \quad B \\ + 3 \quad 7 \\ \hline 9 \quad A \\ \hline \end{array}$$

Solution: firstly $B+7=A$ For unit's place
and for ten's place
 $A+3=9$

which means $A=6$ and $B=-1$ which is not possible. So there should be one carry in ten's place.

which means $B+7 > 9$

Now solving for tens place with one carry

$$A+3+1=9$$

$$A=9-4=5$$

For unit's place subtracting 10 as one carry is given to ten's place.

$$B+7-10=5$$

$$B=5+10-7=8$$

$$\therefore A=5, B=8$$

Q.3

$$\begin{array}{r} A \quad 1 \\ + 1 \quad B \\ \hline B \quad 0 \\ \hline \end{array}$$

Solution: For unit place $1+B$ gives 0 i.e $B=9$

$\therefore$ 1 should be carry at ten's place

$$\therefore 1+A+1=9 \Rightarrow 2+A=9 \Rightarrow A=7$$

Q-4

$$\begin{array}{r} 2 \ A \ B \\ + \ A \ B \ 1 \\ \hline B \ 1 \ 8 \end{array}$$

Solution : For unit place

$$B + 1 = 8$$

$$\Rightarrow B = 8 - 1 = 7$$

Now $\therefore 7 + A$ gives 1 which means $A = -6$
which is not possible so A should be 4 and
1 carried to hundred's place

$$\therefore A = 4$$

Now $A = 4, B = 7$

Q5

$$\begin{array}{r} 1 \ 2 \ A \\ + \ 6 \ A \ B \\ \hline A \ 0 \ 9 \end{array}$$

Sol: Let us solve for unit place

$$A + B = 9$$

Now for ten's place $2 + A = 0$

$\therefore A = -2$ is not possible

Then possible value of A should be 8

Now $\therefore A + B = 9$

$$8 + B = 9, B = 1$$

$$\therefore A = 8, B = 1$$

$$\begin{array}{r}
 \text{Q.6} \quad \begin{array}{r}
 A \quad B \quad 7 \\
 + \quad 7 \quad A \quad B \\
 \hline
 9 \quad 8 \quad A \\
 \hline
 \end{array}
 \end{array}$$

Solution: Firstly let us solve for unit's place. There are two conditions. ~~$7+B \leq 9$~~

$$7+B \leq 9 \quad \text{and} \quad 7+B > 9$$

$$\text{For } 7+B \leq 9$$

$$7+B=A$$

$$\Rightarrow A-B=7 \quad \text{--- (1)}$$

Now let's solve for ten's place

$$B+A=8$$

Solving (1) and (2) simultaneously

$$2A=15, \Rightarrow A=7.5, \text{ which is not possible.}$$

So condition $7+B \leq 9$ is wrong.

Now $7+B > 9$ is correct condition.

Hence there should be one carry in ten's place and subtracting 10 from unit's place.

$$7+B-10=A$$

$$\Rightarrow B-A=3 \quad \text{--- (3)}$$

$$\text{For ten's place } B+A+1=8$$

$$B+A=7 \quad \text{--- (4)}$$

Solving (3) and (4), we get

$$B=5, A=2$$

Q.7 Show that cryptarithm does not have any solution.

$$4 \times \overline{AB} = \overline{CAB}$$

Solution: If B is multiplied by 4 then only 0 satisfies the above condition.

So for unit place to satisfy, $B = 0$.

Similarly, for ten's place only 0 satisfies the above condition.

But, AB can not be 00 as 00 is not a two digit number.

$\therefore$ This cryptarithm has no solution.