



**AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES**  
**SCHOOLS ENRICHMENT CENTRE (AIMSSEC)**

**AIMING HIGH**

**BEAUTIFUL NUMBERS**

$$\begin{aligned} ? \times 9 + 7 &= 88 \\ ? \times 9 + 6 &= 888 \\ ? \times 9 + 5 &= 8888 \\ ? \times 9 + 4 &= 88888 \\ ? \times 9 + 3 &= 888888 \\ ? \times 9 + 2 &= 8888888 \\ ? \times 9 + 1 &= 88888888 \\ ? \times 9 + 0 &= 888888888 \end{aligned}$$

Work out the numbers to replace the question marks.

How would you describe this pattern of calculations?

Can you explain how this pattern arises?

**Help**

Add up the totals in the table below and write them in place of the question marks.

Notice that, you are given the equivalent multiple of 9 on each line to help you, for example  $810 = 90 \times 9$  and  $7200 = 800 \times 9$ .

What do you notice about the patterns in these calculations?

Now go back and try the puzzle again.

$\begin{array}{r} 810 \\ +72 \\ \hline ? \end{array}$	$\begin{array}{r} 90 \times 9 \\ 8 \times 9 \end{array}$	$\begin{array}{r} 8100 \\ 720 \\ +63 \\ \hline ? \end{array}$	$\begin{array}{r} 900 \times 9 \\ 80 \times 9 \\ 7 \times 9 \end{array}$	$\begin{array}{r} 81000 \\ 7200 \\ 630 \\ +54 \\ \hline ? \end{array}$	$\begin{array}{r} 9000 \times 9 \\ 800 \times 9 \\ 70 \times 9 \\ 6 \times 9 \end{array}$	$\begin{array}{r} 810000 \\ 72000 \\ 6300 \\ 540 \\ +45 \\ \hline ? \end{array}$	$\begin{array}{r} 90000 \times 9 \\ 8000 \times 9 \\ 700 \times 9 \\ 60 \times 9 \\ 5 \times 9 \end{array}$
$\begin{array}{r} 8100000 \\ 720000 \\ 63000 \\ 5400 \\ 450 \\ +36 \\ \hline ? \end{array}$	$\begin{array}{r} 900000 \times 9 \\ 80000 \times 9 \\ 7000 \times 9 \\ 600 \times 9 \\ 50 \times 9 \\ 4 \times 9 \end{array}$	$\begin{array}{r} 81000000 \\ 7200000 \\ 630000 \\ 54000 \\ 4500 \\ 360 \\ +27 \\ \hline ? \end{array}$	$\begin{array}{r} 9000000 \times 9 \\ 800000 \times 9 \\ 70000 \times 9 \\ 6000 \times 9 \\ 500 \times 9 \\ 40 \times 9 \\ 3 \times 9 \end{array}$	$\begin{array}{r} 810000000 \\ 72000000 \\ 6300000 \\ 540000 \\ 45000 \\ 3600 \\ 270 \\ +18 \\ \hline ? \end{array}$	$\begin{array}{r} 90000000 \times 9 \\ 8000000 \times 9 \\ 700000 \times 9 \\ 60000 \times 9 \\ 5000 \times 9 \\ 400 \times 9 \\ 30 \times 9 \\ 2 \times 9 \end{array}$		

**Extension**

Replace the ? mark here:

$$987654321 \times 9 + ? = 8888888888$$