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The Galley Method of Division

There are at least three variants: one using cross-outs (the standard form used on paper), one using erasure (probably the original form, used on a sand board) and one without either (the form a printer would have preferred). We will perform the procedure in that order, for the problem 4987 / 35.

The Cross-Out Method: First, write the dividend, followed by a bar, after which we will write the quotient. Then below the left side of the dividend, write the divisor:

$$\begin{array}{l|} 4987 \\ 35 \end{array}$$

Here, as in the modern algorithm, divide 49 by 35. The quotient is 1, so write that quotient in the answer at the right. Here this algorithm differs from the modern algorithm – multiply each digit of the divisor by the quotient digit one at a time and subtract it from the dividend, crossing out digits and replacing them above with the result of the subtraction. So $1\times 2=2$ so we subtract 2 from 3:

$$\begin{array}{l|l} 1 & \\ \not{4}987 & 1 \\ \not{3}5 & \end{array}$$

Cross out the 4 and the 3, which have been used, and wrote the difference, 1, at the top of the column. What you are doing here is subtract 3000 from 4987, leaving 1987. So the digits on top, taken together, represent what is left of the dividend, and we are going to be subtracting from that at each step.

So now we do the same with the 5, subtracting $1\times 5=5$ from 19; we don't have to touch the 1 (though we might have), but can cross out the 9 and write the difference, 4, above it:

$$\begin{array}{l|l} 14 & \\ \not{4}\not{9}87 & 1 \\ \not{3}\not{5} & \end{array}$$

So far we've subtracted 3000 and 500 from 4987, leaving $4987-3500=1487$. That takes care of the hundreds digit in the quotient.

Now write the divisor on the bottom again, shifted one place to the right, always putting each digit at the bottom of the appropriate column:

$$\begin{array}{l|l} 14 & \\ \not{4}\not{9}87 & 1 \\ \not{3}\not{5}5 & \\ 3 & \end{array}$$

Now, how many times does 35 go into 148, the number on the top above these digits? Let's try 4; we'll subtract $3\times 4=12$ from 14 (leaving a 2 in the hundreds place), and then $5\times 4=20$ from the 28 we have left after that:

$$
\begin{array}{cccc|l}
 & 2 & & & \\
\cancel{1} & \cancel{4} & & & \\
\cancel{4} & \cancel{9} & 8 & 7 & 14 \\
\cancel{3} & \cancel{5} & 5 & & \\
 & \cancel{3} & & &
\end{array}
\qquad\qquad
\begin{array}{cccc|l}
 & \cancel{2} & & & \\
\cancel{1} & \cancel{4} & 8 & & \\
\cancel{4} & \cancel{9} & \cancel{8} & 7 & 14 \\
\cancel{3} & \cancel{5} & \cancel{5} & & \\
 & \cancel{3} & & &
\end{array}
$$

So now we've subtracted 400 times 35 from the 1487 we had left, and we know that $4987 - 140 \times 35 = 87$.

Put 35 down in the columns again, shifted right by one column and we need to know how many times will 35 divide 87. Try 2, then subtract $3 \times 2 = 6$ and $5 \times 2 = 10$ from the respective columns:

$$
\begin{array}{cccc|l}
 & \cancel{2} & & & \\
\cancel{1} & \cancel{4} & 8 & & \\
\cancel{4} & \cancel{9} & \cancel{8} & 7 & 142 \\
\cancel{3} & \cancel{5} & \cancel{5} & 5 & \\
 & \cancel{3} & 3 & &
\end{array}
\qquad
\begin{array}{cccc|l}
 & \cancel{2} & 2 & & \\
\cancel{1} & \cancel{4} & \cancel{8} & & \\
\cancel{4} & \cancel{9} & \cancel{8} & 7 & 142 \\
\cancel{3} & \cancel{5} & \cancel{5} & 5 & \\
 & \cancel{3} & \cancel{3} & &
\end{array}
\qquad
\begin{array}{cccc|l}
 & & 1 & & \\
 & \cancel{2} & \cancel{2} & & \\
\cancel{1} & \cancel{4} & \cancel{8} & 7 & \\
\cancel{4} & \cancel{9} & \cancel{8} & \cancel{7} & 142 \\
\cancel{3} & \cancel{5} & \cancel{5} & \cancel{5} & \\
 & \cancel{3} & \cancel{3} & &
\end{array}
$$

In the middle 6 from 8 is 2, leaving 27, and 10 from 27 is 17. So the quotient is 142, with a remainder of 17.

Note that what we have done is the following:

$$4987 - (35 \times 1000) - (35 \times 400) - (35 \times 2) = 17.$$

So we are thinking of division as repeated subtraction.

The erasure method: This would have been used on a sand table, or today on a blackboard or whiteboard. The idea is still the same, but you erase each digit as it is used, so they don't pile up:

$$
\begin{array}{cccc|l}
4 & 9 & 8 & 7 & \\
3 & 5 & & &
\end{array}
$$

$$
\begin{array}{cccc|l}
1 & 9 & 8 & 7 & 1 \\
 & 5 & & &
\end{array}
$$

Erase the 4 and 3, and replace it with 4 – 3.

$$1487 \,|\, 1$$

Erase the 9 and 5, and replace with 9 – 5.

$$
\begin{array}{cccc|l}
1 & 4 & 8 & 7 & 14 \\
 & 3 & 5 & &
\end{array}
$$

Write the divisor again shifted to the right by one position and write the next digit in the quotient.

$$
\begin{array}{ccc|l}
2 & 8 & 7 & 14 \\
 & 5 & &
\end{array}
$$

Subtract 3×4 from 14

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$87|14$ Subtract 5×4 from 28

$\begin{array}{r|l} 87 & \\ 35 & 142 \end{array}$ Write the divisor again shifted to the right by one position and write the next digit in the quotient.

$\begin{array}{r|l} 27 & \\ 5 & 142 \end{array}$ Subtract 2×3 from 8

$17|142$ Subtract 2×5 from 27

The hard part of this method is that it could be easy to lose track of where you are, since there is no evidence as to what digit you last worked on.

Printers Method: Finally, you can do the same thing without erasing or crossing out, just remembering that only the top digit on each column is current. You have to write a zero to remove the top digit entirely:

$$\begin{array}{cccc|l} & 0 & 1 & & \\ 0 & 2 & 2 & & \\ 1 & 4 & 8 & 7 & \\ 4 & 9 & 8 & 7 & 142 \\ 3 & 5 & 5 & 5 & \\ & 3 & 3 & & \end{array}$$

This method was used in some books.

Incidentally, the name *galley method* comes from seeing the final picture as looking like a ship, with tall sails and a low keel.