

Long Multiplication

Take the sum 46×37 .

Step 1:

Write the sum vertically using HTU headers as follows:

$$\begin{array}{r} \text{H T U} \\ 46 \\ \times 37 \\ \hline \end{array}$$

Step 2:

Find an estimate of your answer. We do this by rounding each number to the nearest ten. In this example, 46 rounds to 50 and 37 rounds to 40.

We multiply 50 by 40 to get our estimate as follows:

$$\begin{array}{r} \text{H T U} \\ 46 \\ \times 37 \\ \hline \end{array} \quad \begin{array}{r} \text{Th H T U} \\ 50 \\ \times 40 \\ \hline 2000 \end{array}$$

Because we are multiplying by 4 tens we put down a zero and then say 4 times 0 is 0 and 4 times 5 is 20.

Our estimate is therefore 2000 and we would expect our answer to be in the region of 2000.

Step 3:

We now return to the original sum. 46 multiplied by 37 is the same as saying 46 multiplied by 7 plus 46 multiplied by 30 as follows:

$$46 \times 37 = (46 \times 7) + (46 \times 30)$$

Our first step is therefore to find 46×7 :

$$\begin{array}{r} \text{H T U} \\ 46 \\ \times 37 \\ \hline \end{array} \quad \begin{array}{r} \text{Th H T U} \\ 50 \\ \times 40 \\ \hline 2000 \end{array}$$

We begin by multiplying 7 by 6. 7 times 6 gives us 42 units. We write 2 units under the units and we regroup 40 units as four tens and write this over the tens column ('T').

$$\begin{array}{r}
 4 \\
 \text{H T U} \\
 46 \\
 \times 37 \\
 \hline
 2
 \end{array}
 \quad
 \begin{array}{r}
 \text{Th H T U} \\
 50 \\
 40 \\
 \hline
 2000
 \end{array}$$

Next, multiply the 7 units by the 4 tens. This gives us an answer of 28 tens. To this we add the 4 tens which we regrouped earlier and this gives us 32 tens. Cross out the 4 above the tens column ('T') and then place the 2 tens below the line under the tens and regroup the 30 tens as 3 hundreds and place this below the line under the hundreds as follows:

$$\begin{array}{r}
 4 \\
 \text{H T U} \\
 46 \\
 \times 37 \\
 \hline
 322
 \end{array}
 \quad
 \begin{array}{r}
 \text{Th H T U} \\
 50 \\
 40 \\
 \hline
 2000
 \end{array}$$

Step 4:

Our next step is to multiply 46 by 30 (3 tens).

$$\begin{array}{r}
 4 \\
 \text{H T U} \\
 46 \\
 \times 37 \\
 \hline
 322
 \end{array}
 \quad
 \begin{array}{r}
 \text{Th H T U} \\
 50 \\
 40 \\
 \hline
 2000
 \end{array}$$

We are multiplying by a multiple of ten and therefore the first thing we do is put down a zero.

$$\begin{array}{r}
 4 \\
 \text{H T U} \quad \text{Th H T U} \\
 \quad \quad 4 \ 6 \quad \longrightarrow \quad \quad \quad 5 \ 0 \\
 \text{X} \quad 3 \ 7 \quad \longrightarrow \quad \text{X} \quad \quad 4 \ 0 \\
 \hline
 3 \ 2 \ 2 \quad \quad \quad 2 \ 0 \ 0 \ 0 \\
 0
 \end{array}$$

Then we multiply the 3 tens by the 6 units to get 18 tens. We write the 8 tens under the tens on the next line and then we regroup the 10 tens as one hundred and we write it above the hundreds column ('H') as follows:

$$\begin{array}{r}
 1 \ 4 \\
 \text{H T U} \quad \text{Th H T U} \\
 \quad \quad 4 \ 6 \quad \longrightarrow \quad \quad \quad 5 \ 0 \\
 \text{X} \quad 3 \ 7 \quad \longrightarrow \quad \text{X} \quad \quad 4 \ 0 \\
 \hline
 3 \ 2 \ 2 \quad \quad \quad 2 \ 0 \ 0 \ 0 \\
 8 \ 0
 \end{array}$$

Next we multiply the 3 by the 4 tens in the top row to get 12 hundreds. To this we add the 1 hundred we just placed above the hundreds column and we get 13 hundreds. We cross out the 1 over the hundreds column as we have now used it and we do not need it anymore. Then we place the 3 hundreds under the hundreds column and we regroup the 10 hundreds as 1 thousand and place it under the thousands column as follows:

$$\begin{array}{r}
 \cancel{1} \ 4 \\
 \text{Th H T U} \quad \text{Th H T U} \\
 \quad \quad 4 \ 6 \quad \longrightarrow \quad \quad \quad 5 \ 0 \\
 \text{X} \quad 3 \ 7 \quad \longrightarrow \quad \text{X} \quad \quad 4 \ 0 \\
 \hline
 3 \ 2 \ 2 \quad \quad \quad 2 \ 0 \ 0 \ 0 \\
 1 \ 3 \ 8 \ 0
 \end{array}$$

Step 5:

Our next step is to add 322 (the answer we got when we multiplied 46 by 7) and 1380 (the answer we got when we multiplied 46 by 30) as follows:

$$\begin{array}{r} \begin{array}{cccc} & & \cancel{1} & \cancel{4} \\ & \text{Th} & \text{H} & \text{T} & \text{U} \\ & & & 4 & 6 \\ \times & & & 3 & 7 \\ \hline & & 3 & 2 & 2 \\ + & 1 & 3 & 8 & 0 \\ \hline 1 & 7 & 0 & 2 & \end{array} & \longrightarrow & \begin{array}{cccc} & \text{Th} & \text{H} & \text{T} & \text{U} \\ & & & 5 & 0 \\ \times & & & 4 & 0 \\ \hline & 2 & 0 & 0 & 0 \end{array} \end{array}$$

Step 6:

Our final step is to check our answer against the estimate. 1702 is close to 2000 so it is likely that the answer is correct.