

X Advanced Multiplication at Firbeck Academy

Step 6: the Formal Written Method for short multiplication (multiplying by a one-digit number). This is a useful alternative to the Grid Method and extends into The Formal Written Method for long multiplication (see below).

- Write the numbers being multiplied in a column, the larger number at the top (in this example, 18×6).
- Multiply the unit numbers together and write the answer underneath, carrying any tens (in this example $8 \times 6 = 48$, so we write in the 8 and carry the 4).
- Now multiply the tens with the units. Write the answer directly to the left of the first answer, adding on any carried numbers from stage (b). (In this example, $1 \times 6 = 6$, but we add on the carried 4 to make 10. There is no need to carry the 1 as we have multiplied all the numbers in the problem.)
- If using this method for HTU \times U or larger numbers, keep multiplying and carrying as necessary until all numbers have been used.

$$\begin{array}{r} 18 \\ \times 6 \\ \hline 108 \\ \hline \end{array}$$

Step 7: the Formal Written Method for long multiplication (multiplying a two-digit number by a two-digit number, or greater).

- Write the numbers being multiplied in a column, the larger number at the top (in this example, 24×16).
- Multiply the first pair of numbers together and write the answer underneath, carrying any tens (in this example $4 \times 6 = 24$, so we write in the 4 and carry the 2).
- Now multiply the second pair of numbers. Write the answer directly to the left of the first answer, adding on any carried numbers from stage (b). (In this example, $2 \times 6 = 12$, but we add on the carried 2 to make 14. There is no need to carry the 1 as we have multiplied all the numbers in this line of the problem.)
- Now add in a 0 as a place holder at the end of the second row; this is because we are about to multiply 'the tens', so it will make our answer ten times bigger.
- Now we multiply the next two numbers together (in this case $1 \times 4 = 4$, and write the answer straight in just to the left of the 0. There are no digits to be carried in this case.)
- Now we multiply the final two numbers together (in this case $2 \times 1 = 2$, and write the answer straight in just to the left of the 0. There are no digits to be carried in this case.)
- Finally, add up the answer using Column Addition.
- If using this method for HTU \times TU or larger numbers, keep multiplying and carrying as necessary until all numbers have been used. HTU numbers will add a third row of answers with 00 used as a place holder, ThTU numbers will add a fourth row with 000 as a place holder, and so on.

$$\begin{array}{l} \text{a)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline \end{array} \quad \text{c)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 4^{\neq}0 \\ \hline \end{array} \\ \text{b)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 4 \\ 2 \end{array} \quad \text{f)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 24^{\neq}0 \\ \hline \end{array} \\ \text{e)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 2 \end{array} \quad \text{g)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 24^{\neq}0 \\ 384 \end{array} \\ \text{d)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 20 \end{array} \quad \text{h)} \quad \begin{array}{r} \text{TU} \\ 24 \\ \times 16 \\ \hline 144 \\ 20 \end{array} \end{array}$$

Handwritten notes in the diagrams: (g) 24x6, (h) 24x10, Answer, place holder

Multiplying decimals

You can multiply decimals using either **Grid Method** or the **Formal Written Methods of Short and Long Multiplication**. First, you need to adjust the decimal number so that it is a whole number, e.g. if it has 1 decimal place, multiply the number mentally by 10, if it has 2 decimal places, multiply by 100 etc. Then solve the problem as usual, but remember to adjust the answer back by dividing by the relevant number, e.g. if your original number had 1 decimal place, remember to divide the answer by 10 (making it 10 times smaller).

$$\begin{array}{l} 3.2 \times 7 = 22.4 \\ \text{Make } 10 \times \text{ bigger so:} \\ 32 \times 7 = 224 \\ \text{30} \quad \frac{1}{2} \\ \begin{array}{r} 210 \\ \times 30 \quad 2 \\ \hline 7210 \quad 14 \\ \hline 224 \end{array} \\ \text{Then make } 10 \times \text{ smaller so:} \\ 3.2 \times 7 = 22.4 \end{array}$$