Unit 4, Lesson 5

Standard Algorithm: Multi-digit Numbers, without Composing

Let's use the standard algorithm to multiply three-digit numbers by two-digit numbers.

Warm-up

Number Talk: Partial Products

Find the value of each product mentally.

- 20×3
- 24×3
- 120×3
- 140×3

Activity 1

Compare Two Algorithms

Here are two algorithms that represent finding the value of 413×21.

$$
\begin{array}{rrrrl}
 & & 4 & 1 & 3 \\
\times & & & 2 & 1 \\
\hline
 & & & & 3 \quad \text{step 1} \\
 & & & 1 & 0 \quad \text{step 2} \\
 & & 4 & 0 & 0 \quad \text{step 3} \\
 & & & 6 & 0 \quad \text{step 4} \\
 & & 2 & 0 & 0 \quad \text{step 5} \\
+ & 8, & 0 & 0 & 0 \quad \text{step 6} \\
\hline
 & 8, & 6 & 7 & 3 \quad \text{step 7}
\end{array}
$$

step 1

$$
\begin{array}{rrrr}
 & 4 & 1 & 3 \\
\times & & 2 & 1 \\
\hline
 & & & 3
\end{array}
$$

step 2

$$
\begin{array}{rrrr}
 & 4 & 1 & 3 \\
\times & & 2 & 1 \\
\hline
 & & 1 & 3
\end{array}
$$

step 3

$$
\begin{array}{rrrr}
 & 4 & 1 & 3 \\
\times & & 2 & 1 \\
\hline
 & 4 & 1 & 3
\end{array}
$$

step 4

$$
\begin{array}{rrrr}
 & 4 & 1 & 3 \\
\times & & 2 & 1 \\
\hline
 & 4 & 1 & 3 \\
 & & 6 & 0
\end{array}
$$

step 5

$$
\begin{array}{rrrr}
 & 4 & 1 & 3 \\
\times & & 2 & 1 \\
\hline
 & 4 & 1 & 3 \\
 & 2 & 6 & 0
\end{array}
$$

step 6

$$
\begin{array}{rrrrr}
 & & 4 & 1 & 3 \\
\times & & & 2 & 1 \\
\hline
 & & 4 & 1 & 3 \\
 & 8, & 2 & 6 & 0
\end{array}
$$

step 7

$$
\begin{array}{rrrrr}
 & & 4 & 1 & 3 \\
\times & & & 2 & 1 \\
\hline
 & & 4 & 1 & 3 \\
+ & 8, & 2 & 6 & 0 \\
\hline
 & 8, & 6 & 7 & 3
\end{array}
$$

1. How are the 2 algorithms alike? How are they different?

2. Explain or show where you see each step from the first algorithm in the second algorithm.

3. How are the final steps in the 2 algorithms alike? How are they different?

Activity 2

Use the Standard Algorithm

Use the standard algorithm to find the value of each expression.

1. 202×12

2. 122×33

3. 321×24

4. Diego finds the value of 301×24. Why doesn't Diego's answer make sense? Explain your reasoning.

$$\begin{array}{r} 301 \\ \times \quad 24 \\ \hline 1{,}204 \\ +\ 602 \\ \hline 1{,}806 \end{array}$$