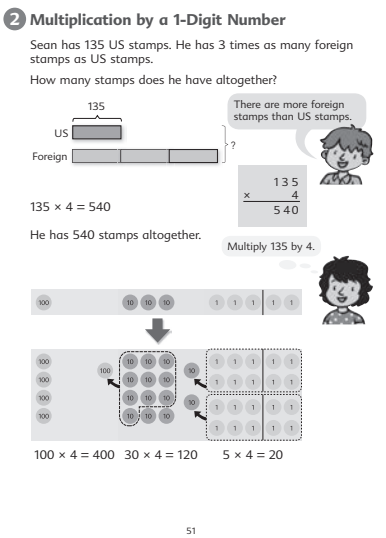
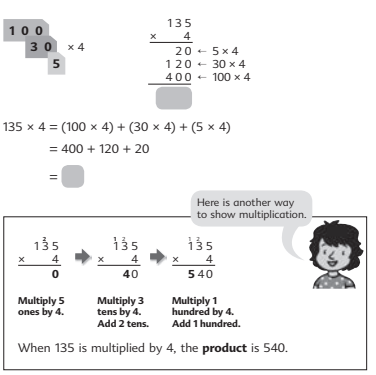
2.2a Multiplication of a 3-digit number by a 1-digit number

Objectives
- Review multiplying a 3-digit number by a 1-digit number.
- Estimate the product.

Materials
- Place-value discs (discs with 1, 10, and 100 written on them)
- Place-value chart

Common Core State Standards
4.OA.1
4.OA.2
4.OA.3
4.NBT.5

Mathematical Practices
MP1
MP2
MP4
MP7

Methods of multiplication	Textbook, pp. 51–52
• Have students refer to the example. • Read the problem with the class. Draw and discuss the comparison model as you read. Make sure that students understand how the comparison model is drawn. • Remind students that: *We can model word problems where one number is a few "times as much" as another by drawing bars containing equal-sized units. Here, there are three times as many of one kind of stamps as the other.* • Ask students what the problem is asking for. (The total number of stamps.) • Ask them the following questions: ◦ How many units do we have in total? (4) ◦ Do we know the value represented by 1 unit? (Yes, 135 stamps) ◦ How can we find 4 units? (Multiply the value of 1 unit by 4.)	
• Write the expression 135 × 4 on the board. • Go step by step through the multiplication process using place-value discs and a place-value chart as shown in the example. You can call on students to explain each step. • At the same time, show how each step is recorded in the written algorithm shown.	135 × 4 
• The number 135 is made up of 100, 30, and 5. We will multiply each of these parts by 4.	100 30 5 135 × 4

• First, we multiply the ones by 4. Ask students for the product of 5 and 4. (20) (Move the five 1-discs off the chart and quadruple them.) • Point out to students that: *Since we cannot put more than 9 ones in the ones column, we rename 20 as 2 tens.* • Replace twenty 1-discs with two 10-discs, and put the renamed tens in the tens column. • That leaves 0 ones. Explain that: *We write 0 to show that there are no ones in the final answer.* • Show this on the written algorithm by writing a little 2 above the tens place and a 0 below the line in the ones place. Point out to students that: *This reminds us that we have 2 tens from multiplying the ones by 4.* • Summarize, pointing to each digit in the algorithm as you say the equation aloud: *5 × 4 = 20*	Ones column 5 ones × 4 = 20 ones 20 ones = 2 tens **0 ones left** 100 30 5 **× 4 = 20** **2** 1 3 5 × 4 **0**
• Now, we multiply the 3 tens by 4. Point out that: *We do not include the 2 tens that came from multiplying the ones by 4 since they are not the tens of the original number, 135.* • Ask students for the product of 3 tens and 4. (12 tens) (Take the three 10-discs off the chart and quadruple them.) • Ask students the following questions: ◦ Does this add any more ones to the final answer? (No) ◦ How many tens will be in the final answer? (We have 12 tens, plus the 2 renamed tens, so we have a total of 14 tens.) ◦ Do we put them all in the tens column on the chart? (No, we need to rename ten of them as 1 hundred in the hundreds column.) • Remove ten 10-discs from the tens column and put a 100-disc in the hundreds column. • Ask students if we have any tens left to put in the tens column. (Yes, we have 4 tens left.) Explain that: *We write 4 to show that there are 4 tens in the final answer.* • Show this on the written algorithm by writing a little 1 above the hundreds place and a 4 below the line in the tens place. • Summarize, pointing to the digits: *3 tens × 4 = 12 tens* *12 tens plus 2 tens = 14 tens = 1 hundred 4 tens*	Tens column 3 tens × 4 = 12 tens 12 tens + **2 tens** = 14 tens = 10 tens + 4 tens = 1 hundred 4 tens **4 tens left** 100 30 **× 4 = 120** 5 × 4 = 20 **1** 2 1 3 5 × 4 **4** 0

- Now, we multiply the hundreds by 4. Point out that: *Again, we just multiply the original 1 hundred; we do not include the 1 hundred that came from multiplying the tens by 4 since it is not in the original number, 135.*
- Ask students for the product of 1 hundred and 4. (4 hundreds) (Take the 100-disc off the chart and quadruple it.)
- Ask students how many hundreds will be in the final answer. (We have 4 hundreds, plus the 1 hundred from multiplying the tens, so we have a total of 5 hundreds.)
- We show this on the written algorithm by writing a 5 below the line in the hundreds place.
- Summarize, pointing to the digits: *1 hundred × 4 = 4 hundreds*
  4 hundreds plus 1 hundred = 5 hundreds

Hundreds column
1 hundred × 4 = 4 hundreds
4 hundreds + **1 hundred** = 5 hundreds
5 hundreds left

100 **× 4 = 400**
30 × 4 = 120
5 × 4 = 20

```
  1 2
  1 3 5
×     4
-------
  5 4 0
```

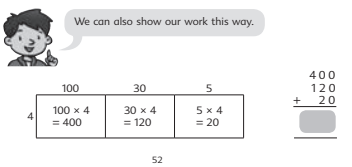
Partial products and area model — Textbook, p. 52

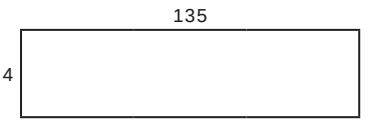
- Then show the process again by multiplying all the digits (using place-value discs) at once and showing the partial products.
- To help middle-ability students, you can show the same thing with number bonds and/or place-value strips. To solve the problem, we can break up 135 into 100, 30, and 5, and multiply the value represented by each digit in each place value by 4. The final answer is the sum of the product of the hundreds, the product of the tens, and the product of the ones.
- Lead students to see that: *135 × 4 is 135 groups of 4 which can be split into 100 groups of 4, 30 groups of 4, and 5 groups of 4.*

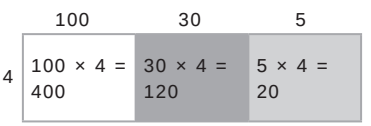
```
  1 3 5
×     4
-------
    2 0  ← 5 × 4
  1 2 0  ← 30 × 4
  4 0 0  ← 100 × 4
-------
  5 4 0
```

135 × 4 = (100 × 4) + (30 × 4)
+ (5 × 4)
= 400 + 120 + 20
= 540

- Tell students they can use a rectangle to help them keep track of their calculations.
- Draw a rectangle on the board and label the length 135 and width 4.
- Tell students that they can divide the rectangle into three parts, one for each place value.
- Draw an identical rectangle below and divide it into three columns. Lead students to see that we can split the number 135 into hundreds, tens, and ones and write 100, 30, and 5 above each column.
- Lead students to see that: *We can then show the product of each place value and 4 in each of the smaller boxes. We can then add them together to find the product of 135 and 4.*








```
  400
  120
+  20
-----
  540
```

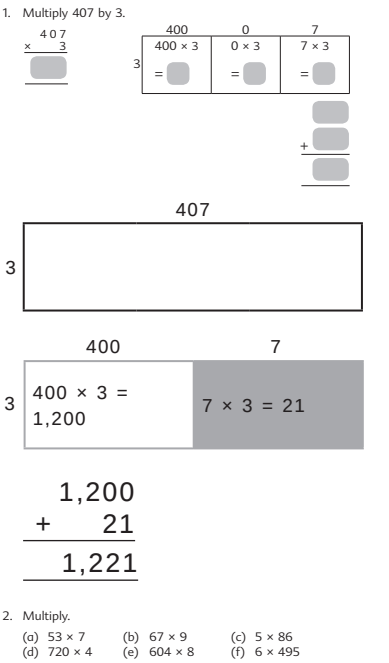
Discussion

- Have students complete Tasks 1 and 2. Then have them share the various strategies for multiplication.
- Task 1: Students should realize that since there are no tens in 407, the rectangle in the middle does not really exist. Lead students to see that:
  It is fine to split 407 into 400 and 7 only, and the rectangle should be split into 2 smaller rectangles as shown at the right instead of 3.

Answers:

1. 1,221; 1,200; 0; 21
   1,200
   21
   1,221
2. (a) 371 (b) 603 (c) 430
   (d) 2,880 (e) 4,832 (f) 2,970

Textbook, p. 53



Estimation

- Write 658 × 7 on the board.
- Ask students to estimate the product. Have them round 658 to the nearest hundred and multiply by 7.
- Then ask students to find the exact answer.
- Point out that:
  The final answer, 4,606, is reasonable when compared to the estimate, 4,900.

658 × 7

658 ≈ 700

658 × 7
↓
700 × 7 = 4,900
658 × 7 = 4,606

- Write the equation 973 × 6 = 5,838 on the board.
- Ask students to check for reasonableness of the answer by using estimation.
- Have students round 973 to the nearest hundred and multiply by 6.
- Ask if 5,838 is a reasonable answer. (Yes)

973 × 6 = 5,838

973 ≈ 1,000

973 × 6
↓
1,000 × 6 = 6,000

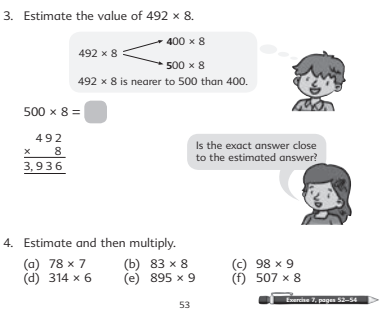
Discussion

- Discuss Task 3 with the class. Lead students to see that:
  Although 492 lies between 400 and 500, 492 is much closer to 500 than to 400. Hence, 500 × 8 would give a closer estimated answer than 400 × 8.

Answers:

3. 4,000
4. (a) 80 × 7 = 560; 546
   (b) 80 × 8 = 640; 664
   (c) 100 × 9 = 900; 882
   (d) 300 × 6 = 1,800; 1,884
   (e) 900 × 9 = 8,100; 8,055
   (f) 500 × 8 = 4,000; 4,056

Textbook, p. 53



EXERCISE 7

1. Estimate and then multiply.

(a) 82 × 6 → 80 × 6 = **480**

$$\begin{array}{r} 82 \\ \times\ \ 6 \\ \hline \mathbf{492} \end{array}$$

(b) 79 × 7 → **80** × 7 = **560**

$$\begin{array}{r} 79 \\ \times\ \ 7 \\ \hline \mathbf{553} \end{array}$$

(c) 83 × 8 → **80** × 8 = **640**

$$\begin{array}{r} 83 \\ \times\ \ 8 \\ \hline \mathbf{664} \end{array}$$

(d) 96 × 9 → **100** × 9 = **900**

$$\begin{array}{r} 96 \\ \times\ \ 9 \\ \hline \mathbf{864} \end{array}$$

2. Estimate and then multiply.

(a) 213 × 5 → 200 × 5 = **1,000**

$$\begin{array}{r} 213 \\ \times\ \ 5 \\ \hline \mathbf{1{,}065} \end{array}$$

(b) 497 × 4 → **500** × 4 = **2,000**

$$\begin{array}{r} 497 \\ \times\ \ 4 \\ \hline \mathbf{1{,}988} \end{array}$$

(c) 706 × 8 → **700** × 8 = **5,600**

$$\begin{array}{r} 706 \\ \times\ \ 8 \\ \hline \mathbf{5{,}648} \end{array}$$

(d) 898 × 7 → **900** × 7 = **6,300**

$$\begin{array}{r} 898 \\ \times\ \ 7 \\ \hline \mathbf{6{,}286} \end{array}$$

3. Multiply.

$$\begin{array}{r} 34 \\ \times\ \ 4 \\ \hline \mathbf{136} \end{array}$$

$$\begin{array}{r} 47 \\ \times\ \ 5 \\ \hline \mathbf{235} \end{array}$$

$$\begin{array}{r} 228 \\ \times\ \ 3 \\ \hline \mathbf{684} \end{array}$$

$$\begin{array}{r} 219 \\ \times\ \ 6 \\ \hline \mathbf{1{,}314} \end{array}$$

$$\begin{array}{r} 285 \\ \times\ \ 9 \\ \hline \mathbf{2{,}565} \end{array}$$

$$\begin{array}{r} 357 \\ \times\ \ 7 \\ \hline \mathbf{2{,}499} \end{array}$$

$$\begin{array}{r} 356 \\ \times\ \ 8 \\ \hline \mathbf{2{,}848} \end{array}$$

$$\begin{array}{r} 489 \\ \times\ \ 9 \\ \hline \mathbf{4{,}401} \end{array}$$