

Multiply 2-Digit by 2-Digit Numbers

FOCUS

Mathematics Objective Use area models and strategies to help multiply 2-digit by 2-digit numbers.

Language Objective Listen to and describe orally the standard multiplication algorithm and other strategies to multiply 2-digit by 2-digit numbers.

Essential Understanding The standard multiplication algorithm involves breaking the calculation into simpler ones using place value and properties of operations. Regrouping is used rather than showing all partial products.

COHERENCE

Look Back Previously in this topic, students multiplied 1-digit numbers using the standard multiplication algorithm.

This Lesson Students apply the standard multiplication algorithm and other strategies they have learned for multiplying two 2-digit numbers.

Look Ahead Later in the topic, students will multiply 3-digit numbers by 2-digit numbers.

Additional Connection The standard algorithm for multiplying multiple whole numbers is connected to multiplying by powers of 10.

RIGOR

Conceptual Understanding Students apply the standard multiplication algorithm, which is developed by using an area model and by comparing it to the partial products algorithm.

Procedural Skill Students extend their proficiency with multiplication as they multiply two 2-digit numbers.

Vocabulary

Review previously taught vocabulary.

Materials

none

Student Resources

 Family Engagement

Intervention System (IS)

G66 Using Arrays to Multiply Two-Digit Factors

G68 Multiplying by Two-Digit Numbers

Teacher Resources

Available at
Savvas Realize®.

 Editable Lesson Plan

 Lesson Presentation Slides

 enVision on the Go: Planning Support



Notes

Language Support

Math Phrases Use this activity as you discuss the Visual Learning page. Point out that both strategies involve *partial products*. The partial products are different for the two strategies, but when you add them up, you get the same number for the *final product*.

Ask: *What is another word for partial?*
[Sample answer: Part]

Ask: *How are partial products used to find the final product?* [Sample answer: Adding up the partial products, you will get the final product.]

Have students work with partners to brainstorm more ways to show partial products using area models.

An additional activity is available online.

- Use the activity about connecting students' experiences with Item 1.

Math Talk

Tilt or Balance?

Is the product of 73×31 less than, greater than, or equal to the product of 54×42 ?



Answer:
Less than

Number Sense Read the question and ask students to decide if the expressions are equal. If not equal, ask: *Which expression is greater than the other?* Students should use comparison symbols to help explain. Have students share their answers in pairs or small groups and then have a class discussion.

Exit Ticket

Formative Assessment

Lesson 3-5
Exit Ticket

Name _____

1. Use an algorithm or partial products to find the product. Use and draw area models as needed.

$$\begin{array}{r} 32 \\ \times 17 \\ \hline \end{array}$$

- Ⓐ 444
Ⓑ 534
Ⓒ 544
Ⓓ 624

2. Find 42×75 .

- Ⓐ 2,175
Ⓑ 2,150
Ⓒ 3,050
Ⓓ 3,150

3. A company shipped 46 boxes of dog food. Each box contains 24 cans. How many cans of dog food did the company ship?

- Ⓐ 984 cans
Ⓑ 904 cans
Ⓒ 1,004 cans
Ⓓ 1,104 cans

Have you met the lesson goals?

Math Goal

I can use area models and strategies to help multiply 2-digit by 2-digit numbers.



☐ I Can



☐ With Help



☐ Not Yet

Language Goal

I can follow the steps in the standard algorithm and other strategies to multiply 2-digit by 2-digit numbers.



☐ I Can



☐ With Help



☐ Not Yet

Teacher Answer Key

Assessment 1 of 1

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Auto-scored version online

Use the Exit Ticket results to support students as needed by reminding them that they can use different strategies to find partial products when multiplying two 2-digit numbers, such as:

- area models
- expanded algorithm
- standard multiplication algorithm

English Language Development

ELL English Language Learners (Visual Learning)

ELL English Language Learners (Practice and Problem Solving)

MLR7 Compare and Connect (Visual Learning)

Language Support (Visual Learning)

Step 1 Explore and Share

10-15 min

Explore and Share

Scout Observational Assessment

ETP Explore and Share

Formative Assessment

Purpose Investigate ways to solve a problem by multiplying two 2-digit numbers.

Introduce WHOLE CLASS

Ask: Have you ever made a plan to reach a long-term goal? How long do you think it took to reach your goal?

Monitor, Select, and Sequence SMALL GROUP

Observe students at work.

- **How do students use place value to multiply?** They might break up each factor into tens and ones and multiply to find partial products.

Look for solutions that use partial products to help them multiply. If students notice that the partial products do not give the final product, ask: *Once you have partial products, what should you do to find the final product?*

Select solutions for students to present. For 12×16 , show solutions that did not use the expanded algorithm (Victor) before solutions that did (Sarah).

Early Finishers

Say: Estimate the product of 29 and 21 and then find the exact product. [Estimate: $30 \times 20 = 600$; product: 609]

Connect WHOLE CLASS

Connect Solution Strategies Discuss students' work.

Connect Victor's use of partial products using place values with Sarah's use of an algorithm. Both Victor and Sarah understood that they needed to add all of the partial products to find the final product.

Connect to the Visual Learning During the Visual Learning, connect to student work in Explore and Share. Be sure students understand that they can multiply two 2-digit numbers by breaking the calculation into simpler ones using place value and properties of operations.

Name _____

Multiply 2-Digit by 2-Digit Numbers

Let's Build

I can ... use area models and strategies to help multiply 2-digit by 2-digit numbers.

Lesson
3-5

Explore and Share

Jada sets a goal to reach a personal best time in a race. In order to do that, it is recommended that she runs 75 miles each month for 3 months before race day. In the first week, she plans to run 16 miles. If she continues to do this for 12 weeks before the race, do you think she'll reach her goal?



Sample Student Work

Victor's Work

Victor drew an area model to break up the factor 16 into 10 and 6. He found the partial products and added them together.

$$\begin{array}{r} 10 \quad 6 \\ 12 \overline{) 120 \quad 72} \\ 120 + 72 = 192 \text{ miles} \end{array}$$

Jada will run 192 miles before the race.
 $3 \times 75 = 225$. So, Jada will not reach her goal.

Sarah's Work

Sarah used the expanded algorithm by evaluating 6×2 , 6×10 , 10×2 , and 10×10 to get the partial products 12, 60, 20, and 100, and then added them together.

$$\begin{array}{r} 12 \\ \times 16 \\ \hline 12 \\ 60 \\ 20 \\ + 100 \\ \hline 192 \end{array} \quad \text{No, she won't reach her goal.}$$

Visual Learning Animation

Essential Question

How Do You Multiply 2-Digit Numbers by 2-Digit Numbers?

Visual Learning

A A ferry carried 37 cars per trip on the weekend. If the ferry made 11 trips on Saturday and 13 trips on Sunday, how many cars did it carry on the weekend?

You can add to find that 24 trips were made on Saturday and Sunday. So the ferry carried 37×24 cars on the weekend.

B One way

Use the area model to find the **partial products** for 24×37 .

$$\begin{array}{r} 37 \\ \times 24 \\ \hline 148 \\ 740 \\ \hline 888 \end{array}$$

$4 \times 37 = 148$
 $20 \times 37 = 740$

The ferry carried 888 cars on the weekend.

C Another way

Use the **standard algorithm**.

Step 1: Multiply by the **ones**.
Step 2: Multiply by the **tens**.

$$\begin{array}{r} 1 \\ 2 \\ 37 \\ \times 24 \\ \hline 148 \\ + 740 \\ \hline 888 \end{array}$$

Step 1: 148 (4×37)
Step 2: $+ 740$ (20×37)

The ferry carried 888 cars.

Talk About Math Ideas What are ways you can estimate to check the reasonableness of the answer?

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ELL English Language Learners Reading

Display: "simpler." Explain that *simpler* means something that is easier or clearer than something else.

Emerging Display " 24×37 ." Show 24 written as $20 + 4$. Say: *Breaking one factor apart makes the problem simpler.* Ask students to read and complete the sentence stems "One _____ problem is 4 multiplied by 37. The other _____ problem is 20 multiplied by 37."

Expanding Display " 24×37 ." Ask students to read the expression. Break the problem into two simpler problems: 4×37 and 20×37 . Ask: *Why are the two problems simpler than the first problem?* [4×37 and 20×37 are easier to calculate than 24×37 .]

Bridging Display " 24×37 ." Ask students to read the expression. Have student pairs decide what two simpler problems they could solve to perform the calculation. Ask the pairs to explain why breaking the problem into two problems makes it simpler to solve.

ETP Visual Learning

Classroom Conversation

A Make Sense and Persevere Ask: Why can you add the number of trips on Saturday and the number of trips on Sunday, and then multiply by the number of cars per trip? [According to the Distributive Property of Multiplication, $(11 \times 37) + (13 \times 37) = (11 + 13) \times 37$.] How many trips did the ferry make on the weekend? [24 trips]

B Ask: Why are there 4 partial products? [Both the 24 and the 37 are broken into tens and ones.]

C Ask: When you multiply the ones in 37×4 , will you need to regroup? [You will need to regroup 28 ones as 2 tens 8 ones.] Ask: Why is the second partial product 740 and not 74? [Because the second partial product is 20×37 , not 2 times 37.]

Prevent Misconceptions Watch for students who have trouble regrouping using the standard multiplication algorithm. For example, be sure students understand that in Step 1, they regroup 2 tens to add to the partial product, and in Step 2, they regroup 1 hundred to the add to the partial product.

MLR7 Compare and Connect

Ask: How are the steps for the standard multiplication algorithm similar to using an area model to find partial products? [Both strategies multiply by the ones and then tens, and add partial products to find the final product.]

ETP Talk About Math Ideas

Have students engage in a think-pair-share to explore different ways they might estimate the product to check the reasonableness of the answer. Listen for conversations about how they might round factors to the nearest tens place or model the problem to estimate the answer.

ETP Revisit the Essential Question

Different strategies and algorithms can be used to multiply two 2-digit numbers. These are used to find and add partial products by multiplying the ones, multiplying the tens, and more, and regrouping as needed. These steps do not change as the values of the factors increase or decrease.

Step 3 Practice and Problem Solving

15-20 min

Interactive Practice

Adaptive Practice

You may opt to have students complete automatically scored practice items online.

Name _____

Guided Practice

Do You Understand?

1. Critique Reasoning Janet said that the standard algorithm is just a shortcut for partial products. Do you agree? Explain.

Sample answer: Yes. When you multiply by the 1s in the standard algorithm, you're finding the first two partial products and adding them together.

Do You Know How?

2. Use an algorithm or partial products to find the product. Estimate to check if your answer is reasonable.

$$\begin{array}{r} 41 \\ \times 23 \\ \hline 123 \\ + 820 \\ \hline 943 \end{array}$$

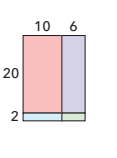
Check students' estimates.

Practice and Problem Solving

For 3-10, use an algorithm or partial products to find the product. Use and draw area models as needed.

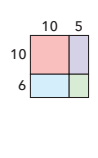
3.

$$\begin{array}{r} 16 \\ \times 22 \\ \hline 32 \\ + 320 \\ \hline 352 \end{array}$$



4.

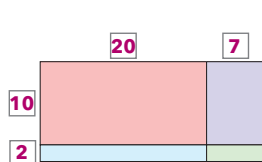
$$\begin{array}{r} 15 \\ \times 16 \\ \hline 90 \\ + 150 \\ \hline 240 \end{array}$$



Use estimation to check if your answers are reasonable.

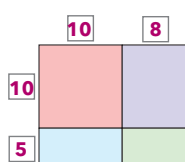
5.

$$\begin{array}{r} 27 \\ \times 12 \\ \hline 324 \end{array}$$



6.

$$\begin{array}{r} 18 \\ \times 15 \\ \hline 270 \end{array}$$



7. $53 \times 17 = 901$

8. $81 \times 46 = 3,726$

9. $15 \times 16 = 240$

10. $17 \times 21 = 357$

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11. Make Sense and Persevere

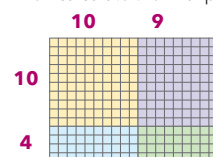
The *Queen Mary 2*'s height above water is about the same as a 14-story building. What is the *Queen Mary 2*'s height above water?

168 feet

Each story is 12 feet tall.



12. Model with Math Label each part of the model and write the multiplication expression it represents. Find the partial products. Then calculate the final product.



14 x 19; 10 x 10 = 100;
10 x 9 = 90; 4 x 10 = 40;
4 x 9 = 36;
100 + 90 + 40 + 36 = 266

13. Higher Order Thinking An elevator can carry 15 adults or 20 children at one time. During the course of a day, the elevator carries a full passenger load 52 times. If all the passengers were children, how many more people would the elevator carry than if all the passengers were adults? Explain your answer.

260 more people;
Sample explanation:
20 x 52 = 1,040;
15 x 52 = 780;
1,040 - 780 = 260

Assessment Practice

14. Eleven years ago, Melissa planted a tree in her back yard. She has taken a photo of the tree every week so she can see how it grows as time passes. How many photos of the tree does Melissa now have?

- A 63 photos
- B 302 photos
- C 572 photos**
- D 631 photos

There are 52 weeks in one year.

15. Mr. Morris bought sketchpads for 24 of his students. Each pad contained 50 sheets. How many sheets of paper were in all the pads?

- A 1,000 sheets
- B 1,200 sheets**
- C 1,400 sheets
- D 1,600 sheets

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Guided Practice

Formative Assessment

Error Intervention Item 1

If students don't see the connection between the standard algorithm and partial products, then have them look at the solutions from the problem on the Visual Learning. Ask: **What does the 2 above the 3 represent?** [two tens or 20] Ask: **Where do you see this 20 in the partial products?** [It is the 2 in the number 28.]

Item 1 Critique Reasoning Make sure students know what Janet is comparing in order to know how to critique the logic of Janet's statement.

Practice and Problem Solving

ELL English Language Learners

Item 13 Higher Order Thinking Help students by describing two different strategies that can be used to solve this problem. [One strategy is to multiply 20 and 15 each by 52 and find the difference between the products. The second strategy is to subtract 15 from 20 and multiply the difference by 52.]

ETP Quick Check

Formative Assessment

Check marks indicate items for prescribing differentiation. Item 14: 1 point. Items 7 and 11: up to 2 points. The online Quick Check is auto scored and auto prescribes differentiation.

Step 4 Assess and Differentiate



15-30 min

Differentiation Library

- Additional Differentiation Library resources are described at the start of this topic.
- Differentiation resources that support diverse learning styles are online and in the Differentiation Library Teacher's Guide.

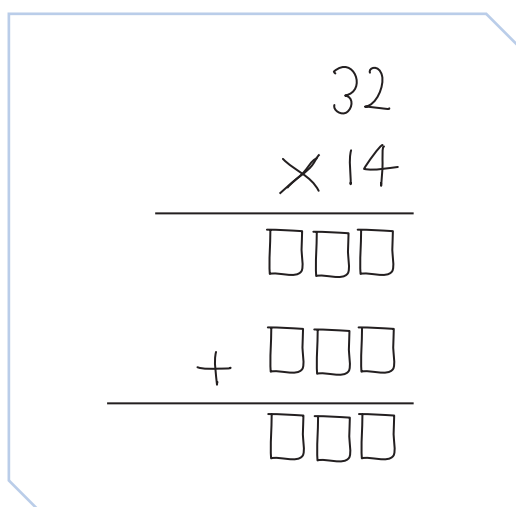
0-3 points: Intervention Activity or Reteach to Build Understanding Activity

4-5 points: Enrichment Activity

In addition, **English Language Learners** may benefit from the Build Mathematical Literacy Activity.

Intervention Activity

Materials Place-value charts (or Teaching Tool 30), optional, Paper



- Have students create a 2-digit by 2-digit multiplication problem. Ask them to draw squares under their problem to represent each digit in the partial and final products. Then have them make an answer key on a separate sheet of paper.
- Have students discuss the strategies they used to decide how many squares were needed in the partial products and the final product.
- Have students exchange and solve each other's problems. Students should check their work using the answer keys.

Video Tutorial Available at Savvas Realize®

Students can access this video anytime to reinforce lesson content.

Another Look Video

Additional Practice

Printable or autoscored at Savvas Realize®

Name _____

Multiply 2-Digit by 2-Digit Numbers

3-5

Another Look!

There are 24 cars in the Speedy Cup Series. Each car has 13 workers in the pit area. How many pit-area workers are at the race?

Use Partial Products

$$\begin{array}{r} 24 \\ \times 13 \\ \hline 12 \quad (3 \times 4) \\ 60 \quad (3 \times 20) \\ 40 \quad (10 \times 4) \\ + 200 \quad (10 \times 20) \\ \hline 312 \end{array}$$

Use the Standard Algorithm

$$\begin{array}{r} 24 \\ \times 13 \\ \hline 72 \\ + 240 \\ \hline 312 \end{array}$$

There are 312 pit-area workers at the race.

For 1-6, use the standard algorithm or partial products to find the product. Draw area models as needed.

- $\begin{array}{r} 18 \\ \times 26 \\ \hline 108 \\ 360 \\ \hline 468 \end{array}$
- $\begin{array}{r} 17 \\ \times 25 \\ \hline 85 \\ 340 \\ \hline 425 \end{array}$
- $\begin{array}{r} 88 \\ \times 32 \\ \hline 2,816 \end{array}$
- $\begin{array}{r} 53 \\ \times 48 \\ \hline 2,544 \end{array}$
- $\begin{array}{r} 18 \\ \times 77 \\ \hline 1,386 \end{array}$
- $\begin{array}{r} 67 \\ \times 27 \\ \hline 1,809 \end{array}$

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7. Rob purchased a rug for his apartment. The rug is 72 inches by 96 inches. Calculate the area of the rug in square inches.
- 6,912 square inches**

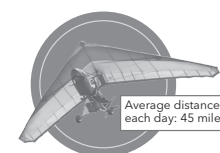
8. **Critique Reasoning** Corina found $62 \times 22 = 1,042$. Is Corina's answer reasonable? Explain.
- No; Sample answer: When both of Corina's factors are rounded down, her answer is still low; $60 \times 20 = 1,200$.**

Make Sense and Persevere For 9 and 10, use the table shown.

9. How much do 21 bushels of sweet corn weigh?
- 735 pounds**
10. How much do 18 bushels of asparagus and 7 bushels of carrots weigh in all?
- 782 pounds**

Vegetable	Weight of 1 Bushel
Asparagus	24 pounds
Beets	52 pounds
Carrots	50 pounds
Sweet corn	35 pounds

11. **Higher Order Thinking** An ultralight airplane tracked monarch butterflies migrating to Mexico during the month of September and the first 15 days of October. There are 30 days in September. How many more miles did the ultralight travel in September? Explain.
- 675 more miles; Sample explanation: The airplane flew 15 more days in Sept. than in Oct.; $15 \times 45 = 675$.**



Assessment Practice

12. Maria has 92 flower arrangements. Each arrangement has 48 blue flowers and 50 yellow flowers. Which of the following expressions shows how to find the total number of flowers?
- Ⓐ $90 + 50 + 50$
 Ⓑ 92×10
 Ⓒ $92 \times (48 + 50)$
 Ⓓ $90 \times (50 \times 48)$
13. Mr. Jenkins bought 28 markers for each of his 32 students. How many markers did he buy in all?
- Ⓐ 196
 Ⓑ 496
 Ⓒ 896
 Ⓓ 12,096