

Student Guide

Multiplication Strategies for Larger Numbers

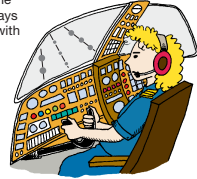
Questions 1–30 (SG pp. 284–289)

1. Answers will vary. Possible response: 324 is almost like \$3.25. $4 \times \$3.00 = \12.00 and 4 quarters adds another dollar, so it's about \$13.00, so 324×4 is almost 1300.
2. 1296 lights; methods and explanations will vary.
3. $4 \times 20 = 80$; or 4×2 tens = 8 tens
4. The 8 skinnies model 80, or 8 tens
5. $4 \times 300 = 1200$; 4×3 hundreds = 12 hundreds, or 1200
6. The 12 flats model 1200, or 12 hundreds
7. Shannon also found partial products by partitioning 324 into $300 + 20 + 4$, multiplied each of the parts by 4, and added them.
8. John and Shannon both partitioned 324 into hundreds, tens, and ones; multiplied each separately by 4; then added the partial products. Shannon showed her partitions using the area model.
9. The flats model $4 \times 300 = 1200$, the skinnies model $4 \times 20 = 80$, and the bits model $4 \times 4 = 16$.
10. **A.** $300 \times 3 = 900$
B. Yes, Grace's answer is reasonable. 3×300 is 900, so the answer should be a little more than 900.
C.* Grace knew that 3×0 tens equals 0; she could have included this partial product (0) into her calculations, but she knew it wasn't necessary. Adding 0 does not change an answer.
D. Possible response: Yes;
 $3 \times 300 = 900$
 $3 \times 6 = 18$
 $900 + 18 = 918$

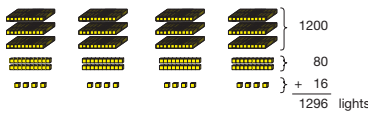
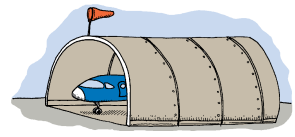
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Multiplication Strategies for Larger Numbers

1. Pilot Jones flies in and out of Busy Bee Airport. This airport has four runways. Workers are putting new lights along the runways. Each runway needs 324 lights. Estimate about how many lights will be needed for all the runways at Busy Bee Airport.
2. Use any method you wish to calculate the exact number of lights for the four runways at Busy Bee Airport. Explain your work with numbers, words, pictures, or base-ten shorthand.




Connect Methods and Strategies
 Irma found the total number of lights by modeling 4×324 using base-ten pieces. When she added her pieces, she wrote the problem on the right.

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Roberto solved the problem using the all-partials method of multiplication.



$$\begin{array}{r} 324 \\ \times 4 \\ \hline 1200 \\ 80 \\ + 16 \\ \hline 1296 \text{ lights} \end{array}$$

3. Explain where the partial product 80 came from.
4. Which of Irma's base-ten pieces model 80?
5. Explain where the partial product 1200 came from.
6. Which of Irma's base-ten pieces model 1200?

Shannon used rectangles to solve the problem.




	300	20	4	
4	$4 \times 300 = 1200$	$4 \times 20 = 80$	$4 \times 4 = 16$	

$$\begin{array}{r} 1200 \\ + 80 \\ + 16 \\ \hline 1296 \text{ lights} \end{array}$$

7. How is Shannon's method similar to Roberto's?

John used expanded form to solve the airport lights problem.



$$324 = 300 + 20 + 4$$

$$\begin{array}{r} \times 4 \\ \hline 1200 + 80 + 16 = 1296 \text{ lights} \end{array}$$

8. How is John's method similar to Shannon's?
9. How do Irma's base-ten pieces model the parts of John's method?
10. Grace computed 3×306 like this:

$$\begin{array}{r} 306 \\ \times 3 \\ \hline 918 \end{array}$$
 - A. Estimate an answer to Grace's problem.
 - B. Is Grace's answer reasonable? Why or why not?
 - C. Why are there only two partial products in this problem?
 - D. Can you solve this problem using mental math? Explain.

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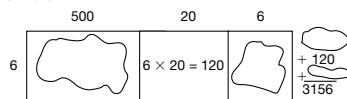
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*Answers and/or discussion are included in the lesson.

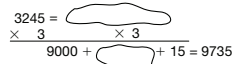
Answer Key • Lesson 7: Multiplication Strategies for Larger Numbers

11. Ming solved some multiplication problems, but then he spilled jelly on his paper. When he wiped it off, parts of his work were missing. Help Ming. Rewrite the problems and fill in the missing parts.

A. 6×526



B. 3245×3



C. 8×263



Practice Multiplication Methods

Solve the following problems using the all-partials method.

12. 132×3

13. 3624×2

14. 1904×4

Solve the following problems using rectangles.

15. 728×6

16. 1709×3

17. 235×4

Solve the following problems using expanded form.

18. 216×5

19. 543×3

20. 2727×2

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15.

	700	20	8	
6	$6 \times 700 =$ 4200	$6 \times 20 =$ 120	$6 \times 8 =$ 48	4200 120 + 48 ----- 4368

16.

	1000	700	9	
3	$3 \times 1000 =$ 3000	$3 \times 700 =$ 2100	$3 \times 9 =$ 27	3000 2100 + 27 ----- 5127

17.

	200	30	5	
4	$4 \times 200 =$ 800	$4 \times 30 =$ 120	$4 \times 5 =$ 20	800 120 + 20 ----- 940

18.

$$\begin{array}{r}
 216 = 200 + 10 + 6 \\
 \times 5 \qquad \qquad \times 5 \\
 \hline
 1000 + 50 + 30 = 1080
 \end{array}$$

19.

$$\begin{array}{r}
 543 = 500 + 40 + 3 \\
 \times 3 \qquad \qquad \times 3 \\
 \hline
 1500 + 120 + 9 = 1629
 \end{array}$$

20.

$$\begin{array}{r}
 2727 = 2000 + 700 + 20 + 7 \\
 \times 2 \qquad \qquad \qquad \times 2 \\
 \hline
 4000 + 1400 + 40 + 14 = 5454
 \end{array}$$

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11. A.

	500	20	6	
6	$6 \times 500 =$ 3000	$6 \times 20 = 120$	$6 \times 6 =$ 36	3000 + 120 + 36 ----- 3156

B.

$$\begin{array}{r}
 3245 = 3000 + 200 + 40 + 5 \\
 \times 3 \qquad \qquad \qquad \times 3 \\
 \hline
 9000 + 600 + 120 + 15 = 9735
 \end{array}$$

C.

$$\begin{array}{r}
 263 \\
 \times 8 \\
 \hline
 1600 \\
 480 \\
 24 \\
 \hline
 2104
 \end{array}$$

12.

$$\begin{array}{r}
 132 \\
 \times 3 \\
 \hline
 6 \\
 90 \\
 300 \\
 \hline
 396
 \end{array}$$

13.

$$\begin{array}{r}
 3624 \\
 \times 2 \\
 \hline
 6000 \\
 1200 \\
 40 \\
 8 \\
 \hline
 7248
 \end{array}$$

14.

$$\begin{array}{r}
 1904 \\
 \times 4 \\
 \hline
 16 \\
 3600 \\
 4000 \\
 \hline
 7616
 \end{array}$$

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21. Answers will vary. The compact and all-partials methods both multiply the ones, tens, and hundreds separately. The compact method does not record all the partial products, but uses little numbers as a reminder of carries.
22. Answers will vary. The compact and expanded form methods both multiply the ones, tens, and hundreds separately. Using expanded form, the top number is partitioned into its hundreds, tens, and ones before multiplying.
23. **A.** The 2 is a reminder to add 2 tens after the 7 tens are multiplied; it means 2 tens and results from multiplying $6 \times 4 = 24$.
- B.** $4 \times 70 = 280$; 280 plus the 2 tens that were carried gives 300; there are 0 tens in 300; record the 0 in the tens column.
- C.** The 3 is a reminder to add 3 hundreds after the hundreds are multiplied; it means 3 hundreds. $4 \times 70 = 280$; 280 plus the 2 tens that were carried gives 300.
- D.** $4 \times 300 = 1200$; 1200 plus the 3 hundreds that were carried gives 1500, or 1 thousand plus 5 hundred; record the 5 in the hundreds column.
- E.** $4 \times 300 = 1200$; 1200 plus the 3 hundreds that were carried gives 1500, or 1 thousand plus 5 hundred; record the 1 in the thousands column.
24. Yes. Nicholas's answer is reasonable because 1504 is between 1200 and 1600 and close to 1600.
25.
$$\begin{array}{r} 1 \\ 412 \\ \times 6 \\ \hline 2472 \end{array}$$
26.
$$\begin{array}{r} 1 \\ 5307 \\ \times 4 \\ \hline 21,228 \end{array}$$
27.
$$\begin{array}{r} 5 \ 5 \\ 356 \\ \times 9 \\ \hline 3204 \end{array}$$
28. Possible response: $5000 \times 4 = 20,000$
29. **A.** Maya put her "carry 2" above the wrong number and skipped the hundreds column. She should have placed the 2 above the 0 in the hundreds column because it was the carry from multiplying 6×40 and adding 3 tens. The 2 means 200 because $6 \times 40 = 240$, plus 30 makes 270. Then, multiplying the hundreds column yields 6×0 hundreds = 0, add 2 hundreds, $0 + 2$ hundreds = 2 hundreds, which should be recorded in the hundreds place in the answer.
- B.** 12,276

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Compact Method

Keenya said she could use the compact method to solve the airport lights problem.

She explained how she solved 4×324 this way.

"I began by multiplying $4 \times 4 = 16$. I know that 16 is 1 ten and 6 ones."

The 1 Keenya wrote above the problem as a reminder is sometimes called a **carry**. Keenya then multiplied 4×2 tens = 8 tens, and she then added the extra ten to get 9 tens or 90.

Then Keenya multiplied 4×3 hundreds = 12 hundreds or 1200. She said, "I know that 1200 is 1 thousand and 2 hundreds."

She put the 2 in the hundreds column and the 1 in the thousands column.

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21. How is Keenya's compact method similar to Roberto's all-partials method? What is the same and what is different?

22. How is Keenya's compact method similar to John's method using expanded form? What is the same and what is different?

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23. One type of airplane can carry up to 376 passengers. How many people can 4 flights of the airplane carry?

Nicholas did this problem using the compact method.

$$\begin{array}{r} 32 \\ 376 \\ \times 4 \\ \hline 1504 \text{ passengers} \end{array}$$

A. Why did Nicholas place a 2 above the tens column? What does this 2 mean?

B. How did Nicholas get the 0 in the tens column of the answer?

C. Why did Nicholas place a 3 above the hundreds column? What does this 3 mean?

D. How did Nicholas get the 5 in the hundreds column of the answer?

E. How did Nicholas get the 1 in the thousands column of the answer?

24. Nicholas looked back at his answer and said, " 4×300 is 1200 and 4×400 is 1600. 76 is close to 100, so I know my answer will be more than 1200 and closer to 1600." Is Nicholas's answer reasonable? Why or why not?

Do the following problems using the compact method. Estimate each product to make sure your answer is reasonable.

25.
$$\begin{array}{r} 412 \\ \times 6 \\ \hline \end{array}$$

26.
$$\begin{array}{r} 5307 \\ \times 4 \\ \hline \end{array}$$

27.
$$\begin{array}{r} 356 \\ \times 9 \\ \hline \end{array}$$

28. Explain your estimation strategy for Question 26. Is your answer reasonable? Why or why not?

29. Maya multiplied 2046×6 and got 1476. She looked at her answer and said, "That can't be right. My answer is smaller than one of the numbers I was multiplying!" Here is Maya's work.

$$\begin{array}{r} 2 \ 3 \\ 2046 \\ \times 6 \\ \hline 1476 \end{array}$$

A. What did Maya do wrong?

B. What is the correct answer?

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✓ **Check-In: Question 30**

30. Your cousin has learned the compact method of multiplication but not any other paper-and-pencil methods. Write a letter to him explaining the expanded form. In your letter, make sure to do the following:
- compare the expanded form to the compact method
 - use examples of problems
 - show what computations are the same and what computations are different

Compare your class collection of multiplication strategies to those on the *Multiplication Strategies Menu for Larger Numbers* in the *Student Activity Book*. Add strategies not represented to the *My Multiplication Strategies Menu*, also in the *Student Activity Book*.



Do the following problems. First make a mental estimate of the answer. Then solve the problem. Compare your estimate with the answer.

1. There are 24 hours in a day. How many hours are there in a week?
2. North-South Airlines has two types of planes. One type of plane can carry 229 passengers and a smaller type can carry 142 passengers. Each plane flies between Minneapolis and Ft. Lauderdale five days each week. How many people can travel every week from Minneapolis to Ft. Lauderdale on North-South Airlines?
3. An airplane has a cruising speed of about 568 miles per hour. About how far can the airplane travel in 3 hours?
4. Another airplane flies at an average speed of 1336 miles per hour. How far can this aircraft travel in 3 hours?
5. **A.** The Middle City Airport has 478 flights scheduled every day. How many flights are scheduled for an entire week?
B. Explain your estimation strategy. Is your answer reasonable? Why or why not?



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30. Letters will vary. Possible response:

Dear Cousin,
I will use these examples below to help me compare the compact and expanded form methods.

Compact	Expanded Form
$\begin{array}{r} 2 \\ 34 \\ \times 5 \\ \hline 170 \end{array}$	$\begin{array}{r} 34 = 30 + 4 \\ \times 5 \\ \hline 150 + 20 = 170 \end{array}$

- In both strategies you break apart 34 into tens and ones and multiply.
- In the expanded form you write down each partial product and then add the partial products to find the product.
- In the compact method you carry the tens and add as you go. The little 2 stands for 2 tens you need to add to 150, the product of 5×30 .

Student Guide

Homework

Questions 1–23 (SG pp. 289–290)

1. Possible estimate: Think of money—24 is close to 25¢. Seven times 25¢ is \$1.75.
168 hours; $7 \times 24 = 168$ hours
2. Possible estimate: $250 + 150 = 400$,
 $400 \times 5 = 2000$.
1855 people; $229 + 142 = 371$ passengers;
 $371 \times 5 = 1855$ passengers
3. Possible estimate: About 1650 miles;
 $3 \times 500 = 1500$
 $3 \times 50 = +150$
1650 miles
 $3 \times 568 = 1674$ miles
4. Possible estimate: $3 \times 1200 = 3600$;
 $3 \times 1500 = 4500$; between 3600 and 4500 miles.
4008 miles; $3 \times 1336 = 4008$ miles
5. **A.** 3346 flights
B. Possible strategy: $7 \times 500 = 3500$; It is reasonable because 3346 is a little less.

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Answer Key • Lesson 7: Multiplication Strategies for Larger Numbers

For Questions 6–20, methods will vary. Students should use each of the methods on the *Multiplication Strategies Menu for Larger Numbers* at least once.

- | | | |
|------------|------------|-------------|
| 6. 270 | 7. 256 | 8. 15,245 |
| 9. 2526 | 10. 9360 | 11. 43,278 |
| 12. 92,040 | 13. 9024 | 14. 255,000 |
| 15. 27,624 | 16. 21,168 | 17. 3800 |
| 18. 9400 | 19. 4700 | 20. 24,800 |
21. Methods will vary.
22. Possible strategy: $6 \times 400 = 2400$ and $6 \times 25 = 150$. $2400 + 150 = 2550$. So 6×421 is a little less than 2550.
23. Possible strategy:
 $(3 \times 3000) + (3 \times 8) = 9000 + 24 = 9024$

Student Activity Book

Smart Multiplication

Questions 1–6 (SAB p. 237)

- $5 \times 600 = 3000$, so the boys' answer of 355 is way too low. They didn't carry the tens and hundreds; 3085
- $2000 \times 7 = 14,000$ and their answer of 1715 is not close; they partitioned 2045 incorrectly and multiplied 7×200 instead of 2000; 14,315.
- $6 \times 700 = 4200$, so the answer should be at least 4200. They forgot the 7 in 748 means 700 and 4 means 40; 4488.
- $4 \times 400 = 1600$, but to get the exact answer they should have subtracted 4, because $4 \times 1 = 4$; 1596.
- $3 \times 500 = 1500$, so 264 is way too low; when they multiplied 3×500 they should have gotten 1500; 1614.
- * $7 \times 158 = (7 \times 100) + (7 \times 50) + (7 \times 8) = 700 + 350 + 56$, but they added incorrectly; 1106.

Practice Problems

Use each of the methods on the *Multiplication Strategies Menu for Larger Numbers* in the *Student Activity Book* at least once. Estimate to be sure your answers are reasonable.

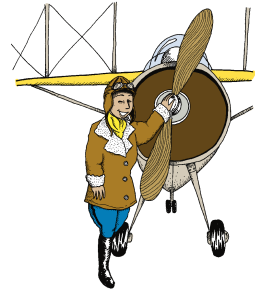
- | | | |
|----------------------|---------------------|----------------------|
| 6. 6×45 | 7. 8×32 | 8. 5×3049 |
| 9. 6×421 | 10. 30×312 | 11. 6×7213 |
| 12. 40×2301 | 13. 3×3008 | 14. 60×4250 |
| 15. 8×3453 | 16. 7×3024 | 17. 38×100 |
| 18. 94×100 | 19. 100×47 | 20. 124×200 |

- Show how to solve Questions 11 and 16 using different methods than the ones you used the first time.
- Explain your estimation strategy for Question 9.
- Explain a mental math strategy for solving Question 13.

Did You Know?

Mrs. Dewey's classroom, Room 204, is in Bessie Coleman School. Bessie Coleman was the world's first African American female aviator.

When Bessie's brother returned to America after World War I, he told Bessie that French women could fly airplanes. At that time, Bessie worked as a manicurist in a Chicago barber shop. Hearing this news, Bessie decided she too could learn to fly. She went to school in Chicago to learn French. Then she went to France. In 1921 she earned her pilot's license from the Federation Aeronautique Internationale. When she returned to Chicago, she became an air circus performer. A street and a library in Chicago are named after Bessie Coleman.



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Smart Multiplication

Joe and Moe Smart worked on their homework together. They did not estimate to make sure their answers made sense.

Estimate to see if Joe and Moe's answers are reasonable. Check their work and discuss their mistakes with your partner. Then solve each problem correctly using the strategy or method Joe and Moe used for that problem.

$$\begin{array}{r} 617 \\ \times 5 \\ \hline 355 \end{array}$$

$$2. \quad 2045 = 200 + 40 + 5$$

$\times 7$	$\times 7$
$1400 + 280 + 35 = 1715$	

$$\begin{array}{r} 748 \\ \times 6 \\ \hline 48 \\ 24 \\ \hline 42 \\ 114 \end{array}$$

$$4. \quad 399 \times 4$$

$4 \times 400 = 1600$,
 minus 1 makes 1599.



$$5. \quad 538 = 500 + 30 + 8$$

$\times 3$	$\times 3$
$150 + 90 + 24 = 264$	

$$6. \quad \begin{array}{r} 158 \\ \times 7 \\ \hline 56 \\ 350 \\ \hline 700 \\ 1016 \end{array}$$

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*Answers and/or discussion are included in the lesson.

Name _____ Date _____

Making Connections in Multiplication

Use the *Multiplication Strategies Menu for Larger Numbers* to help you solve the following problems.

- Michael did a research project about traffic. He counted 278 cars passing through a busy intersection during one hour. He estimated that less than 1500 cars would pass through during that same hour from Monday through Friday. Explain how Michael reached his estimate. What “friendly” numbers did he use and how did he get them?
- Jerome solved the problem below using the compact method.

$$\begin{array}{r} 34 \\ \times 6 \\ \hline 2088 \end{array}$$
 - Why did Jerome place a 4 above the tens column? What does this 4 mean?
 - How did Jerome get the 8 in the tens column of the answer?
 - Jerome placed a 2 above which column? _____
Why?
What does this 2 mean?
 - How did Jerome get the 2 in the thousands column of the answer?

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Name _____ Date _____

- Lee Yah solved 259×3 using expanded form as shown below. Use Lee Yah’s work to show how to solve the same problem using rectangles.

$$\begin{array}{r} 259 = 200 + 50 + 9 \\ \times 3 \\ \hline 600 + 150 + 27 = 777 \end{array}$$
- Show how to solve the problem below using a mental math strategy and a paper-and-pencil method.

$$\begin{array}{r} 151 \\ \times 4 \\ \hline \end{array}$$

Making Connections in Multiplication Feedback Box	Expectation	Check In	Comments
Use place value and mathematical properties to multiply. [Q# 1–4]	E3		
Show connections between models and strategies for multiplication. [Q# 3–4]	E4		
Estimate products. [Q# 1–4]	E6		
Multiply larger numbers using mental math strategies and paper-and-pencil methods (e.g., expanded form, all-partials, compact). [Q# 1–4]	E7		

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Teacher Guide

Making Connections in Multiplication

Questions 1–4 (TG pp. 1–2)

- Michael rounded 278 up to 300 and multiplied by 5. $300 \times 5 = 1500$.
- The 4 is a reminder to add 4 tens after multiplying the tens; it means 4 tens and results from multiplying $6 \times 8 = 48$.
 - He multiplied 6×40 and got 240; then he added 4 tens and got 280; he recorded the 8 in the tens place in the answer.
 - The hundreds column, because he multiplied $6 \times 40 = 240$ and added 4 tens from multiplying the ones to equal 280; the 2 means 2 hundreds
 - $6 \times 300 = 1800$; he added the 2 hundred from multiplying the tens and he got 2000; he recorded the 2 in the thousands place in the answer.

3.

200	50	9	
$3 \times 200 = 600$	$3 \times 50 = 150$	$3 \times 9 = 27$	$\begin{array}{r} 600 \\ 150 \\ 27 \\ \hline 777 \end{array}$

604. Strategies and methods will vary. Possible mental math strategy is thinking about money: 4 dollars, 4 fifty cents and 4 pennies; $400 + 200 + 4 = 604$.