Multiplication and Division of Whole Numbers: Multiplication of Whole Numbers*

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Abstract

This module is from Fundamentals of Mathematics by Denny Burzynski and Wade Ellis, Jr. This module discusses how to multiply whole numbers. By the end of the module students should be able to understand the process of multiplication, multiply whole numbers, simplify multiplications with numbers ending in zero, and use a calculator to multiply one whole number by another.

1 Section Overview

- Multiplication
- The Multiplication Process With a Single Digit Multiplier
- The Multiplication Process With a Multiple Digit Multiplier
- Multiplication With Numbers Ending in Zero
- Calculators

2 Multiplication

Multiplication is a description of repeated addition.

In the addition of

$5 + 5 + 5$

the number 5 is repeated 3 times. Therefore, we say we have three times five and describe it by writing

3×5

Thus,

$3 \times 5 = 5 + 5 + 5$

Multiplicand

In a multiplication, the repeated addend (number being added) is called the **multiplicand**. In 3×5, the 5 is the multiplicand.

Multiplier

Also, in a multiplication, the number that records the number of times the multiplicand is used is called the **multiplier**. In 3×5, the 3 is the multiplier.

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2.1 Sample Set A

Express each repeated addition as a multiplication. In each case, specify the multiplier and the multiplicand.

Example 1
$7+7+7+7+7+7$
6×7. Multiplier is 6. Multiplicand is 7.

Example 2
$18+18+18$
3×18. Multiplier is 3. Multiplicand is 18.

2.2 Practice Set A

Express each repeated addition as a multiplication. In each case, specify the multiplier and the multiplicand.

Exercise 1 *(Solution on p. 15.)*
$12+12+12+12$
_____. Multiplier is _____. Multiplicand is _____.

Exercise 2 *(Solution on p. 15.)*
$36+36+36+36+36+36+36+36$
_____. Multiplier is _____. Multiplicand is _____.

Exercise 3 *(Solution on p. 15.)*
$0+0+0+0+0$
_____. Multiplier is _____. Multiplicand is _____.

Exercise 4 *(Solution on p. 15.)*
$\underbrace{1847+1847+\ldots+1847}_{12,000 \text{ times}}$
_____. Multiplier is _____. Multiplicand is _____.

Factors
In a multiplication, the numbers being multiplied are also called **factors**.

Products
The result of a multiplication is called the **product**. In $3 \times 5 = 15$, the 3 and 5 are not only called the multiplier and multiplicand, but they are also called factors. The product is 15.

Indicators of Multiplication $\times$,$\cdot$,( )
The multiplication symbol ($\times$) is not the only symbol used to indicate multiplication. Other symbols include the dot ($\cdot$) and pairs of parentheses ( ). The expressions

3×5, $3 \cdot 5$, $3\,(5)$, $(3)\,5$, $(3)\,(5)$

all represent the same product.

3 The Multiplication Process With a Single Digit Multiplier

Since multiplication is repeated addition, we should not be surprised to notice that **carrying** can occur. Carrying occurs when we find the product of 38 and 7:

$$\begin{array}{r} {\scriptstyle 5} \\ 38 \\ \times\ \ 7 \\ \hline 266 \end{array}$$

First, we compute $7 \times 8 = 56$. Write the 6 in the ones column. Carry the 5. Then take $7 \times 3 = 21$. Add to 21 the 5 that was carried: $21 + 5 = 26$. The product is 266.

3.1 Sample Set B

Find the following products.

Example 3

$$\begin{array}{r} {\scriptstyle 1} \\ 64 \\ \times\ \ 3 \\ \hline 192 \end{array}$$

$3 \times 4 = 12$ Write the 2, carry the 1.

$3 \times 6 = 18$ Add to 18 the 1 that was carried: $18 + 1 = 19$.

The product is 192.

Example 4

$$\begin{array}{r} {\scriptstyle 13} \\ 526 \\ \times\ \ \ 5 \\ \hline 2{,}630 \end{array}$$

$5 \times 6 = 30$ Write the 0, carry the 3.

$5 \times 2 = 10$ Add to 10 the 3 that was carried: $10 + 3 = 13$. Write the 3, carry the 1.

$5 \times 5 = 25$ Add to 25 the 1 that was carried: $25 + 1 = 6$.

The product is 2,630.

Example 5

$$\begin{array}{r} {\scriptstyle 7\ \ 3} \\ 1{,}804 \\ \times\ \ \ \ \ \ 9 \\ \hline 16{,}236 \end{array}$$

$9 \times 4 = 36$ Write the 6, carry the 3.

$9 \times 0 = 0$ Add to the 0 the 3 that was carried: $0 + 3 = 3$. Write the 3.

$9 \times 8 = 72$ Write the 2, carry the 7.

$9 \times 1 = 9$ Add to the 9 the 7 that was carried: $9 + 7 = 16$.

Since there are no more multiplications to perform,write both the 1 and 6.

The product is 16,236.

3.2 Practice Set B

Find the following products.

Exercise 5 *(Solution on p. 15.)*

$$\begin{array}{r} 37 \\ \times\ \ 5 \\ \hline \end{array}$$

Exercise 6 *(Solution on p. 15.)*

$$\begin{array}{r} 78 \\ \times\ \ 8 \\ \hline \end{array}$$

Exercise 7 *(Solution on p. 15.)*

$$\begin{array}{r} 536 \\ \times \quad 7 \\ \hline \end{array}$$

Exercise 8 *(Solution on p. 15.)*

$$\begin{array}{r} 40,019 \\ \times \qquad 8 \\ \hline \end{array}$$

Exercise 9 *(Solution on p. 15.)*

$$\begin{array}{r} 301,599 \\ \times \qquad\quad 3 \\ \hline \end{array}$$

4 The Multiplication Process With a Multiple Digit Multiplier

In a multiplication in which the multiplier is composed of two or more digits, the *multiplication must take place in parts*. The process is as follows:

Part 1: First Partial Product Multiply the multiplicand by the ones digit of the multiplier. This product is called the **first partial product**.

Part 2: Second Partial Product Multiply the multiplicand by the tens digit of the multiplier. This product is called the **second partial product**. Since the tens digit is used as a factor, the second partial product is written below the first partial product so that its rightmost digit appears in the tens column.

Part 3: If necessary, continue this way finding partial products. Write each one below the previous one so that the rightmost digit appears in the column directly below the digit that was used as a factor.

Part 4: Total Product Add the partial products to obtain the **total product**.

NOTE: It may be necessary to carry when finding each partial product.

4.1 Sample Set C

Example 6
Multiply 326 by 48.

Part 1:

$$\begin{array}{r} {\scriptstyle 24} \\ 326 \\ \times\ 48 \\ \hline 2608 \end{array} \quad \longleftarrow \textbf{First partial product.}$$

Part 2:

$$\begin{array}{r} {\scriptstyle 12} \\ {\scriptstyle 24} \\ 326 \\ \times\ 48 \\ \hline 2608 \\ 1304 \end{array} \quad \longleftarrow \textbf{Second partial product.}$$

Part 3: This step is unnecessary since all of the digits in the multiplier have been used.

Part 4: Add the partial products to obtain the total product.

```
   12
   24
   326
 × 48
  2608
+1304
 15648   ⟵ Total product.
```

The product is 15,648.

Example 7
Multiply 5,369 by 842.

Part 1:

```
   11
  5369
 × 842
 10738   ⟵ First partial product.
```

Part 2:

```
   123
    11
   5369
 × 842
  10738
 21476   ⟵ Second partial product.
```

Part 3:

```
   257
   123
    11
   5369
 × 842
  10738
 21476
42952    ⟵ Third partial product.
4520698  ⟵ Total product (Part 4).
```

The product is 4,520,698.

Example 8
Multiply 1,508 by 206.

Part 1:

```
  3 4
  1508
× 206
  9048   ⟵ First partial product (in first column from the right).
```

Part 2:

```
  3 4
  1508
× 206
  9048
```

Since 0 times 1508 is 0, the partial product will not change the identity of the total product (which is obtained by addition). Go to the next partial product.

```
  1 1
  3 4
  1508
× 206
  9048
3016      ⟵ Third partial product (in third column from the right).
310648    ⟵ Total product (Part 4).
```

Part 3:

The product is 310,648

4.2 Practice Set C

Exercise 10 *(Solution on p. 15.)*

Multiply 73 by 14.

Exercise 11 *(Solution on p. 15.)*

Multiply 86 by 52.

Exercise 12 *(Solution on p. 15.)*

Multiply 419 by 85.

Exercise 13 *(Solution on p. 15.)*

Multiply 2,376 by 613.

Exercise 14 *(Solution on p. 15.)*

Multiply 8,107 by 304.

Exercise 15 *(Solution on p. 15.)*

Multiply 66,260 by 1,008.

Exercise 16 *(Solution on p. 15.)*

Multiply 209 by 501.

Exercise 17 *(Solution on p. 15.)*

Multiply 24 by 10.

Exercise 18 *(Solution on p. 15.)*

Multiply 3,809 by 1,000.

Exercise 19 *(Solution on p. 15.)*

Multiply 813 by 10,000.

5 Multiplications With Numbers Ending in Zero

Often, when performing a multiplication, one or both of the factors will end in zeros. Such multiplications can be done quickly by aligning the numbers so that the rightmost nonzero digits are in the same column.

5.1 Sample Set D

Perform the multiplication $(49,000)(1,200)$.

$$(49{,}000)(1{,}200) = \begin{array}{r} 49000 \\ \times\ \ 1200 \\ \hline \end{array}$$

Since 9 and 2 are the rightmost nonzero digits, put them in the same column.

$$\begin{array}{r} 49000 \\ \times 1200 \\ \hline \end{array}$$

Draw (perhaps mentally) a vertical line to separate the zeros from the nonzeros.

$$\begin{array}{r|l} 49 & 000 \\ \times 12 & 00 \\ \hline \end{array}$$

Multiply the numbers to the left of the vertical line as usual, then attach to the right end of this product the total number of zeros.

$$\begin{array}{r|l} 49 & 000 \\ \times\ 12 & 00 \\ \hline 98 & \\ 49 & \\ \hline 588 & 00000 \end{array}$$

Attach these 5 zeros to 588.

The product is 58,800,000

5.2 Practice Set D

Exercise 20 *(Solution on p. 15.)*
Multiply 1,800 by 90.

Exercise 21 *(Solution on p. 15.)*
Multiply 420,000 by 300.

Exercise 22 *(Solution on p. 15.)*
Multiply 20,500,000 by 140,000.

6 Calculators

Most multiplications are performed using a calculator.

6.1 Sample Set E

Example 9
Multiply 75,891 by 263.

		Display Reads
Type	75891	75891
Press	×	75891
Type	263	263
Press	=	19959333

Table 1

The product is 19,959,333.

Example 10
Multiply 4,510,000,000,000 by 1,700.

		Display Reads
Type	451	451
Press	×	451
Type	17	17
Press	=	7667

Table 2

The display now reads 7667. We'll have to add the zeros ourselves. There are a total of 12 zeros. Attaching 12 zeros to 7667, we get 7,667,000,000,000,000.

The product is 7,667,000,000,000,000.

Example 11
Multiply 57,847,298 by 38,976.

		Display Reads
Type	57847298	57847298
Press	×	57847298
Type	38976	38976
Press	=	2.2546563 12

Table 3

The display now reads 2.2546563 12. What kind of number is this? This is an example of a whole number written in **scientific notation**. We'll study this concept when we get to decimal numbers.

6.2 Practice Set E

Use a calculator to perform each multiplication.

Exercise 23 *(Solution on p. 15.)*
52×27

Exercise 24 *(Solution on p. 15.)*
$1,448 \times 6,155$

Exercise 25 *(Solution on p. 15.)*
$8,940,000 \times 205,000$

7 Exercises

For the following problems, perform the multiplications. You may check each product with a calculator.

Exercise 26 *(Solution on p. 16.)*

$$\begin{array}{r} 8 \\ \underline{\times 3} \end{array}$$

Exercise 27

$$\begin{array}{r} 3 \\ \underline{\times 5} \end{array}$$

Exercise 28 *(Solution on p. 16.)*

$$\begin{array}{r} 8 \\ \underline{\times 6} \end{array}$$

Exercise 29

$$\begin{array}{r} 5 \\ \underline{\times 7} \end{array}$$

Exercise 30 *(Solution on p. 16.)*

6×1

Exercise 31

4×5

Exercise 32 *(Solution on p. 16.)*

75×3

Exercise 33

35×5

Exercise 34 *(Solution on p. 16.)*

$$\begin{array}{r} 45 \\ \underline{\times\ \ 6} \end{array}$$

Exercise 35

$$\begin{array}{r} 31 \\ \underline{\times\ \ 7} \end{array}$$

Exercise 36 *(Solution on p. 16.)*

$$\begin{array}{r} 97 \\ \underline{\times\ \ 6} \end{array}$$

Exercise 37

$$\begin{array}{r} 75 \\ \underline{\times 57} \end{array}$$

Exercise 38 *(Solution on p. 16.)*

$$\begin{array}{r} 64 \\ \underline{\times 15} \end{array}$$

Exercise 39

$$\begin{array}{r} 73 \\ \underline{\times 15} \end{array}$$

Exercise 40 *(Solution on p. 16.)*

$$\begin{array}{r} 81 \\ \underline{\times 95} \end{array}$$

Exercise 41

$$\begin{array}{r} 31 \\ \underline{\times 33} \end{array}$$

Exercise 42 *(Solution on p. 16.)*

57×64

Exercise 43

76×42

Exercise 44 *(Solution on p. 16.)*

894×52

Exercise 45

684×38

Exercise 46 *(Solution on p. 16.)*

$$\begin{array}{r} 115 \\ \underline{\times\ \ 22} \end{array}$$

Exercise 47

$$\begin{array}{r} 706 \\ \underline{\times\ \ 81} \end{array}$$

Exercise 48 *(Solution on p. 16.)*

$$\begin{array}{r} 328 \\ \underline{\times\ \ 21} \end{array}$$

Exercise 49

$$\begin{array}{r} 550 \\ \underline{\times\ \ 94} \end{array}$$

Exercise 50 *(Solution on p. 16.)*

930×26

Exercise 51

318×63

Exercise 52 *(Solution on p. 16.)*

$$\begin{array}{r} 582 \\ \underline{\times 127} \end{array}$$

Exercise 53

$$\begin{array}{r} 247 \\ \underline{\times 116} \end{array}$$

Exercise 54 *(Solution on p. 16.)*

$$\begin{array}{r} 305 \\ \underline{\times 225} \end{array}$$

Exercise 55

$$\begin{array}{r} 782 \\ \underline{\times 547} \end{array}$$

Exercise 56 *(Solution on p. 16.)*

$$\begin{array}{r} 771 \\ \underline{\times 663} \end{array}$$

Exercise 57

$$\begin{array}{r} 638 \\ \underline{\times 516} \end{array}$$

Exercise 58 *(Solution on p. 16.)*

1,905 × 710

Exercise 59

5,757 × 5,010

Exercise 60 *(Solution on p. 16.)*

$$\begin{array}{r} 3,106 \\ \underline{\times 1,752} \end{array}$$

Exercise 61

$$\begin{array}{r} 9,300 \\ \underline{\times 1,130} \end{array}$$

Exercise 62 *(Solution on p. 16.)*

$$\begin{array}{r} 7,057 \\ \underline{\times 5,229} \end{array}$$

Exercise 63

$$\begin{array}{r} 8,051 \\ \underline{\times 5,580} \end{array}$$

Exercise 64 *(Solution on p. 16.)*

$$\begin{array}{r} 5,804 \\ \underline{\times 4,300} \end{array}$$

Exercise 65

$$\begin{array}{r} 357 \\ \underline{\times 16} \end{array}$$

Exercise 66 *(Solution on p. 16.)*

$$\begin{array}{r} 724 \\ \underline{\times \quad 0} \end{array}$$

Exercise 67

$$\begin{array}{r} 2,649 \\ \underline{\times \quad 41} \end{array}$$

Exercise 68 *(Solution on p. 16.)*

$$\begin{array}{r} 5,173 \\ \underline{\times \quad 8} \end{array}$$

Exercise 69

$$\begin{array}{r} 1,999 \\ \times \quad 0 \\ \hline \end{array}$$

Exercise 70 *(Solution on p. 16.)*

$$\begin{array}{r} 1,666 \\ \times \quad 0 \\ \hline \end{array}$$

Exercise 71

$$\begin{array}{r} 51,730 \\ \times \quad 142 \\ \hline \end{array}$$

Exercise 72 *(Solution on p. 16.)*

$$\begin{array}{r} 387 \\ \times 190 \\ \hline \end{array}$$

Exercise 73

$$\begin{array}{r} 3,400 \\ \times \quad 70 \\ \hline \end{array}$$

Exercise 74 *(Solution on p. 16.)*

$$\begin{array}{r} 460,000 \\ \times \quad 14,000 \\ \hline \end{array}$$

Exercise 75

$$\begin{array}{r} 558,000,000 \\ \times \quad 81,000 \\ \hline \end{array}$$

Exercise 76 *(Solution on p. 17.)*

$$\begin{array}{r} 37,000 \\ \times \quad 120 \\ \hline \end{array}$$

Exercise 77

$$\begin{array}{r} 498,000 \\ \times \quad 0 \\ \hline \end{array}$$

Exercise 78 *(Solution on p. 17.)*

$$\begin{array}{r} 4,585,000 \\ \times \quad 140 \\ \hline \end{array}$$

Exercise 79

$$\begin{array}{r} 30,700,000 \\ \times \quad 180 \\ \hline \end{array}$$

Exercise 80 *(Solution on p. 17.)*

$$\begin{array}{r} 8,000 \\ \times \quad 10 \\ \hline \end{array}$$

Exercise 81

Suppose a theater holds 426 people. If the theater charges \$4 per ticket and sells every seat, how much money would they take in?

Exercise 82 ***(Solution on p. 17.)***

In an English class, a student is expected to read 12 novels during the semester and prepare a report on each one of them. If there are 32 students in the class, how many reports will be prepared?

Exercise 83

In a mathematics class, a final exam consists of 65 problems. If this exam is given to 28 people, how many problems must the instructor grade?

Exercise 84 ***(Solution on p. 17.)***

A business law instructor gives a 45 problem exam to two of her classes. If each class has 37 people in it, how many problems will the instructor have to grade?

Exercise 85

An algebra instructor gives an exam that consists of 43 problems to four of his classes. If the classes have 25, 28, 31, and 35 students in them, how many problems will the instructor have to grade?

Exercise 86 ***(Solution on p. 17.)***

In statistics, the term "standard deviation" refers to a number that is calculated from certain data. If the data indicate that one standard deviation is 38 units, how many units is three standard deviations?

Exercise 87

Soft drinks come in cases of 24 cans. If a supermarket sells 857 cases during one week, how many individual cans were sold?

Exercise 88 ***(Solution on p. 17.)***

There are 60 seconds in 1 minute and 60 minutes in 1 hour. How many seconds are there in 1 hour?

Exercise 89

There are 60 seconds in 1 minute, 60 minutes in one hour, 24 hours in one day, and 365 days in one year. How many seconds are there in 1 year?

Exercise 90 ***(Solution on p. 17.)***

Light travels 186,000 miles in one second. How many miles does light travel in one year? (*Hint:* Can you use the result of the previous problem?)

Exercise 91

An elementary school cafeteria sells 328 lunches every day. Each lunch costs $1. How much money does the cafeteria bring in in 2 weeks?

Exercise 92 ***(Solution on p. 17.)***

A computer company is selling stock for $23 a share. If 87 people each buy 55 shares, how much money would be brought in?

7.1 Exercises for Review

Exercise 93

(here[1]) In the number 421,998, how may ten thousands are there?

Exercise 94 ***(Solution on p. 17.)***

(here[2]) Round 448,062,187 to the nearest hundred thousand.

Exercise 95

(here[3]) Find the sum. 22,451 + 18,976.

[1] "Addition and Subtraction of Whole Numbers: Whole Numbers" <http://cnx.org/content/m34795/latest/>
[2] "Addition and Subtraction of Whole Numbers: Rounding Whole Numbers" <http://cnx.org/content/m34780/latest/>
[3] "Addition and Subtraction of Whole Numbers: Addition of Whole Numbers" <http://cnx.org/content/m34786/latest/>

Exercise 96 ***(Solution on p. 17.)***

(here[4]) Subtract 2,289 from 3,001.

Exercise 97

(here[5]) Specify which property of addition justifies the fact that (a first whole number + a second whole number) = (the second whole number + the first whole number)

[4] "Addition and Subtraction of Whole Numbers: Subtraction of Whole Numbers" <http://cnx.org/content/m34784/latest/>

[5] "Addition and Subtraction of Whole Numbers: Properties of Addition" <http://cnx.org/content/m34802/latest/>

Solutions to Exercises in this Module

Solution to Exercise (p. 2)
4×12. Multiplier is 4. Multiplicand is 12.
Solution to Exercise (p. 2)
8×36. Multiplier is 8. Multiplicand is 36.
Solution to Exercise (p. 2)
5×0. Multiplier is 5. Multiplicand is 0.
Solution to Exercise (p. 2)
$12,000 \times 1,847$. Multiplier is 12,000. Multiplicand is 1,847.
Solution to Exercise (p. 3)
185
Solution to Exercise (p. 3)
624
Solution to Exercise (p. 4)
3,752
Solution to Exercise (p. 4)
320,152
Solution to Exercise (p. 4)
904,797
Solution to Exercise (p. 6)
1,022
Solution to Exercise (p. 6)
4,472
Solution to Exercise (p. 6)
35,615
Solution to Exercise (p. 6)
1,456,488
Solution to Exercise (p. 6)
2,464,528
Solution to Exercise (p. 6)
66,790,080
Solution to Exercise (p. 6)
104,709
Solution to Exercise (p. 6)
240
Solution to Exercise (p. 6)
3,809,000
Solution to Exercise (p. 6)
8,130,000
Solution to Exercise (p. 7)
162,000
Solution to Exercise (p. 7)
126,000,000
Solution to Exercise (p. 7)
2,870,000,000,000
Solution to Exercise (p. 8)
1,404
Solution to Exercise (p. 8)
8,912,440

Solution to Exercise (p. 8)
1,832,700,000,000
Solution to Exercise (p. 9)
24
Solution to Exercise (p. 9)
48
Solution to Exercise (p. 9)
6
Solution to Exercise (p. 9)
225
Solution to Exercise (p. 9)
270
Solution to Exercise (p. 9)
582
Solution to Exercise (p. 9)
960
Solution to Exercise (p. 9)
7,695
Solution to Exercise (p. 10)
3,648
Solution to Exercise (p. 10)
46,488
Solution to Exercise (p. 10)
2,530
Solution to Exercise (p. 10)
6,888
Solution to Exercise (p. 10)
24,180
Solution to Exercise (p. 10)
73,914
Solution to Exercise (p. 10)
68,625
Solution to Exercise (p. 11)
511,173
Solution to Exercise (p. 11)
1,352,550
Solution to Exercise (p. 11)
5,441,712
Solution to Exercise (p. 11)
36,901,053
Solution to Exercise (p. 11)
24,957,200
Solution to Exercise (p. 11)
0
Solution to Exercise (p. 11)
41,384
Solution to Exercise (p. 12)
0
Solution to Exercise (p. 12)
73,530

Solution to Exercise (p. 12)
6,440,000,000
Solution to Exercise (p. 12)
4,440,000
Solution to Exercise (p. 12)
641,900,000
Solution to Exercise (p. 12)
80,000
Solution to Exercise (p. 13)
384 reports
Solution to Exercise (p. 13)
3,330 problems
Solution to Exercise (p. 13)
114 units
Solution to Exercise (p. 13)
3,600 seconds
Solution to Exercise (p. 13)
5,865,696,000,000 miles per year
Solution to Exercise (p. 13)
$110,055
Solution to Exercise (p. 13)
448,100,000
Solution to Exercise (p. 14)
712