

# Chapter 1 Section 3

## Multiplication and Division of Whole Numbers

### *Multiplication of whole numbers*

**Multiplication** is the repeated addition of the same number.  
 The numbers that are multiplied are called **factors**. The answer is called the **product**.  
 The times sign “**x**” is one symbol that is used to mean multiplication.  
 The basic fact of multiplying one-digit numbers should be memorized.  
 Multiplication of larger numbers requires the repeated use of the basic multiplication facts.

### *A number multiplying by one digit*

1. Multiply  $4 \times 7$
2. Write the 8 in the ones' column and carry the 2 to the tens' column
3. The 3 in the 37 is 3 tens.
4. Multiply  $4 \times 3$  tens and carry the digit.
5. Write 14.

$$\begin{array}{r} 37 \\ \times 4 \\ \hline 8 \end{array} \qquad \begin{array}{r} 2 \\ 37 \\ \times 4 \\ \hline 148 \end{array}$$

### *A number multiplying by larger numbers*

$\begin{array}{r} 47 \\ \times 23 \\ \hline 141 \end{array}$ <p>Multiply the ones digit          The last digit is written in the ones' column</p>	$\begin{array}{r} 47 \\ \times 23 \\ \hline 141 \\ 94 \end{array}$ <p>Multiply the tens' digit          The last digit is written in the tens' column</p>	$\begin{array}{r} 47 \\ \times 23 \\ \hline 141 \\ 940 \\ \hline 1081 \end{array}$ <p>Add</p> <p style="text-align: right;"> <math>(3 * 47)</math>  <math>(20 * 47)</math>  <math>(141 + 94)</math> </p>
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### ***Properties of Multiplication***

The multiplication property of zero       $a \times 0 = 0$       or       $0 \times a = 0$

The multiplication property of one       $a \times 1 = a$       or       $1 \times a = a$

The commutative property of multiplication       $a \times b = b \times a$

The associative property of multiplication       $(a \times b) \times c = a \times (b \times c)$

***Exponents***

$4 * 4 * 4 * 4 * 4 = 4^5$

exponent

base

An exponent indicates how many times a base is multiplied by itself.  
This example is read as “Four raised to the fifth power.”

### ***Division of whole numbers***

Division may be represented by the symbol “ $\div$ ”

Ex.  $24 \div 4 = 6$

Notice that the quotient multiplied by the divisor equals the dividend.

6      x      4 =      24  
quotient      divisor      dividend

Ex.

$$\begin{array}{r} 4 \\ 6 \overline{)25} \\ \underline{24} \\ 1 \end{array}$$

In this example the divisor does not divide equally into the dividend and there is a remainder of 1.

### *Properties of Division*

If  $a \neq 0$ ,  $0/a = 0$                       Zero divided by any number other than zero is zero.

If  $a \neq 0$ ,  $a/a = 1$                       Any number other than zero divided by itself is one.

$a / 1 = a$                                   A number divided by one is the number.

$a / 0$  is undefined                      Division by zero is undefined.

### *Factors and prime factorization*

Natural number factors of a number divide that number evenly (there is no remainder).

1,2,3, and 6 are natural number factors of 6 because they divide into 6 evenly.

$$\begin{array}{r} 6 \\ 1 \overline{)6} \end{array}$$

$$\begin{array}{r} 3 \\ 2 \overline{)6} \end{array}$$

$$\begin{array}{r} 2 \\ 3 \overline{)6} \end{array}$$

$$\begin{array}{r} 1 \\ 6 \overline{)6} \end{array}$$

Notice that both the divisor and the quotient are factors of the dividend.

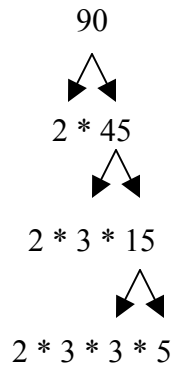
To find the factors of a number, try dividing the number by 1, 2, 3, 4, 5, ... Those numbers that divide into the number evenly are its factors. Continue this process until the factors start to repeat.

A **prime number** is a natural number greater than one that has exactly two natural number factors, 1 and the number itself. 7 is prime because its only factors are 1 and 7. If a number is not prime, it is a **composite** number. 6 is a composite number since it has factors of 2 and 3.

The prime numbers less than 50 are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47.

The **prime factorization** of a number is the expression of the number as a product of its prime factors. To find the prime factors of 90, begin with the smallest prime number as a trial divisor and continue with prime numbers as trial divisors until the final quotient is prime.



The prime factorization of 90 is  $2 * 3 * 3 * 5$