

SECTION I

**BASIC
MATHEMATICS**
for the
**FOODSERVICE
INDUSTRY**

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Basic Mathematics *with* Whole Numbers

“The foundation is built before the house is constructed.”

—TERRI JONES

Having basic mathematical knowledge is critical to a successful career in the culinary and foodservice industry. Basic mathematics includes addition, subtraction, multiplication, and division with whole numbers. This chapter reviews these concepts.



LEARNING OBJECTIVES

1. To review basic mathematical operations and their properties
2. To review addition, subtraction, multiplication, and division using whole numbers in typical foodservice situations



Whole Numbers

The system used, the Hindu–Arabic numeration system, is a decimal place-value system. This system is based on the number 10 and uses symbols called **digits** or **integers**. The digits or integers are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Whole numbers may consist of one or more digits.



Place Value

Each place a digit occupies in a number has a value called a **place value**. Each place value increases from right to left, and each increase is 10 times the value of the place to the right. The place values are arranged in **periods**, or groups of three. The first period is called **ones**, the second is called **thousands**, the third is called **millions**, and so on. Within each period is a **ones** place, a **tens** place, and a **hundreds** place. Commas are used to set off groups of three-digit numbers.

1	One
100	One Hundred
1,000	One Thousand
1,000,000	One Million
1,000,000,000	One Billion



Numbers Written as Words

Numbers can be written as words. We work from left to right, writing the numbers in each group, followed by the group name. Additional rules apply to this method:

1. The name of the *ones* group is not written.
2. The word *and* is not used.
3. The numbers from 21 to 99, except 30, 40, 50, and so forth, use a hyphen when they are written.
4. A period containing all zeros is skipped.

The number 2,342 is written as:
Two thousand, three hundred, forty-two.



Addition

Addition is the combining of two or more groups of the same kind to arrive at a **sum**. The symbol for addition is the “plus” sign, or “+.” Addition has three properties:

1. *Commutative property*. Numbers can be added in any order:
 $1 + 2 = 3$ or $2 + 1 = 3$



2. *Associative property.* Numbers can be grouped in any order:

$$(4 + 5) + 6 = 15 \text{ or } 4 + (5 + 6) = 15$$

3. *Zero identity property.* Adding zero to any number results in the same number:

$$7 + 0 = 7 \text{ or } 0 + 7 = 7$$

ADDITION EXAMPLE

Addition is used to total a guest check. Three guests place an order from an à la carte menu. The guest-check items are added to arrive at a sum or the total amount of money the guests owe for their meals.

À LA CARTE MENU

ITEM A \$3

ITEM B \$4

ITEM C \$5

ITEM D \$6

ITEM E \$7

Items B, D, and E are ordered. The food server adds the guest check:

Item B + Item D + Item E = Guest-check sum

$$\$4 + \$6 + \$7 = \$17, \text{ or } \$4$$

$$\$6$$

$$+ \$7$$

$$\hline \$17$$

The guest-check sum is \$17.

Addition is used daily in foodservice operations to add guest counts, guest checks, purchase quantities, labor costs, recipe costs, and sales revenue.



Subtraction

Subtraction is the deducting, or taking away, of one number from another to arrive at the **difference**. The symbol for subtraction is the “minus” sign, or “-.” Subtraction is the opposite of addition. It does *not* have the following properties:

1. *Commutative property.* Subtraction is not commutative:

$$2 - 1 = 1, \text{ but } 1 - 2 \text{ does not equal } 1.$$

2. *Associative property.* Subtraction is not associative:

$$5 - (4 - 3) = 4, \text{ but } (5 - 4) - 3 \text{ does not equal } 4.$$



3. *Zero identity property.* Subtraction does not have zero identity.

$6 - 0 = 6$, but $0 - 6$ does not equal 6.

SUBTRACTION EXAMPLE

Item E was not to the guest's liking. The food server subtracts the cost of Item E from the guest check.

Guest-check sum – Item E = Revised guest-check sum

$$\begin{array}{r} \$17 - \$7 = \$10, \quad \text{or } \$17 \\ \quad \quad \quad - \$7 \\ \hline \quad \quad \quad \$10 \end{array}$$

The revised guest-check sum is \$10.

Subtraction is also used daily in foodservice operations. Daily inventory usage is subtracted from beginning inventory levels to determine purchase requirements. Subtraction is used to take away costs from sales, to determine profit for individual menu items, and to calculate gross profit and total profit or loss for a foodservice operation.



Multiplication

Multiplication is the adding of a number to itself a certain number of times to arrive at a **product**. It abbreviates the process of repeated addition. The symbol for multiplication is the "times" sign, or " $\times$." Multiplication has the following properties:

1. *Commutative property.* Numbers can be multiplied in any order:
 $1 \times 2 = 2$ or $2 \times 1 = 2$
2. *Associative property.* Numbers can be grouped in any manner:
 $(3 \times 4) \times 5 = 60$ or $3 \times (4 \times 5) = 60$
3. *Zero property.* The product of a number and zero is zero:
 $7 \times 0 = 0$ or $0 \times 7 = 0$
4. *Multiplicative identity property.* Multiplying any number by 1 results in the same number:
 $8 \times 1 = 8$ or $1 \times 8 = 8$
5. *Distributive property.* Multiplying a sum or a difference by a factor is equivalent to multiplying each term of the sum or difference by the factor:
 $2 \times (3 + 4) = 2 \times 7 = 14$ or $2 \times (3 + 4) = (2 \times 3) + (2 \times 4) = 6 + 8 = 14$
 $4 \times (3 - 2) = 4 \times 1 = 4$ or $4 \times (3 - 2) = (4 \times 3) - (4 \times 2) = 12 - 8 = 4$

**QUICK TIP:**

Appendix I contains a Math Facts Multiplication Grid. Use it to review your multiplication facts.

MULTIPLICATION EXAMPLE

TJ's Hotel offers three banquet menus. A guest would like the total cost of each menu to serve 50 people. Multiplying the cost per menu times the number of guests will determine the total cost for each banquet menu.

BANQUET MENU CHOICES**MENU I: \$32****MENU II: \$42****MENU III: \$52**

$$\begin{array}{rcl} \text{Menu I: } 50 \times \$32 = \$1,600, & \text{or} & \begin{array}{r} \$32 \\ \times 50 \\ \hline \$1,600 \end{array} \end{array}$$

$$\begin{array}{rcl} \text{Menu II: } 50 \times \$42 = \$2,100, & \text{or} & \begin{array}{r} \$42 \\ \times 50 \\ \hline \$2,100 \end{array} \end{array}$$

$$\begin{array}{rcl} \text{Menu III: } 50 \times \$52 = \$2,600, & \text{or} & \begin{array}{r} \$52 \\ \times 50 \\ \hline \$2,600 \end{array} \end{array}$$

The total cost to serve 50 guests: Menu I \$1,600.00, Menu II \$2,100.00, and Menu III \$2,600.00

Multiplication is used daily in foodservice operations to determine the total price of multiple quantities of items on a purchase order, the total cost of more than one of the same menu items, or anytime repeated addition will yield the correct answer.

**Division**

Division is the process of determining how many times one number is contained within another number. It is the opposite of multiplication. The **divisor** (**b**) is divided into the **dividend** (**a**). The answer is called the **quotient**. There are four symbols to represent division:

$$\frac{a}{b} \quad \frac{a}{b} \quad a \overline{)b} \quad a \div b$$



Division does *not* have the following:

1. *Commutative property.* Division is not commutative:
 $12 \div 6 = 2$, but $6 \div 12$ does not equal 2
2. *Associative property.* Division is not associative.
 $(12 \div 6) \div 2 = 2 \div 2 = 1$, but $12 \div (6 \div 2) = 12 \div 3 = 4$
3. *Zero division rules:*
 - a. Zero divided by a nonzero number equals 0:
 $0 \div 3 = 0$
 - b. Any number divided by zero is undefined:
 $3 \div 0 = \text{Undefined}$
 - c. Zero divided by zero is indeterminate:
 $0 \div 0 = \text{Indeterminate}$
4. *Divisibility identity property.* Any number divided by 1 results in the same number:
 $4 \div 1 = 4$

DIVISION EXAMPLE

The guest interested in holding the banquet for 50 people would like to spend a total of \$2,000. What would the menu price be if 50 (divisor) guests were served for \$2,000 (dividend)? The cost per person, or menu price, is determined by dividing 50 people into the \$2,000. The menu price is \$40.00.

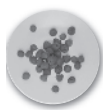
$$\begin{array}{l}
 \$2,000 / 50 = \$40 \\
 \frac{\$2,000}{50} = \$40 \\
 \begin{array}{r}
 40 \\
 50 \overline{) 2,000} \\
 \hline
 \end{array} \\
 \$2,000 \div 50 = \$40
 \end{array}$$

Division is used daily in foodservice operations to determine the cost per portion from the total cost of a recipe, the average cost per guest, the average guest check, and inventory turnover rate.



Conclusion

The basic mathematical operations of addition, subtraction, multiplication, and division are used daily in the professional kitchen and foodservice business office. A solid understanding of these operations is critical for a successful career in the foodservice industry.



Basic Mathematics with Whole Numbers: REVIEW PROBLEMS

Addition

1. $32 + 56 =$

2. $267 + 389 =$

3. $539 + 884 =$

4. $1,117 + 206 =$

5. $2,064 + 1,896 =$

6.
$$\begin{array}{r} 1,245 \\ + 2,456 \\ \hline \end{array}$$

7.
$$\begin{array}{r} 2,654 \\ + 800 \\ \hline \end{array}$$

8.
$$\begin{array}{r} 10,538 \\ + 12,662 \\ \hline \end{array}$$

9.
$$\begin{array}{r} 124,368 \\ + 189,960 \\ \hline \end{array}$$

10.
$$\begin{array}{r} 1,650,324 \\ + 2,895,421 \\ \hline \end{array}$$

Subtraction

1. $67 - 23 =$

2. $54 - 33 =$

3. $123 - 98 =$

4. $1,064 - 889 =$

5. $2,657 - 1,559 =$

6.
$$\begin{array}{r} 654 \\ - 550 \\ \hline \end{array}$$

7.
$$\begin{array}{r} 1,112 \\ - 678 \\ \hline \end{array}$$

8.
$$\begin{array}{r} 15,693 \\ - 9,872 \\ \hline \end{array}$$

9.
$$\begin{array}{r} 259,654 \\ - 112,399 \\ \hline \end{array}$$

10.
$$\begin{array}{r} 5,678,321 \\ - 2,889,450 \\ \hline \end{array}$$

Multiplication

1. $10 \times 2 =$

2. $45 \times 4 =$

3. $105 \times 6 =$

4. $1,234 \times 5 =$

5. $2,500 \times 8 =$



$$\begin{array}{r} 6. \quad 65 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 300 \\ \times 40 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 80 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 2,500 \\ \times 60 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 250 \\ \times 4 \\ \hline \end{array}$$

Division

$$1. \quad 20/5 =$$

$$7. \quad 22 \overline{)22,000}$$

$$2. \quad 60 \div 12 =$$

$$8. \quad \frac{2,004}{12} =$$

$$3. \quad 10 \overline{)900}$$

$$9. \quad 10,000/250 =$$

$$4. \quad \frac{90}{45} =$$

$$10. \quad 25,000 \div 25 =$$

$$5. \quad 250/5 =$$

$$11. \quad 15 \overline{)600}$$

$$6. \quad 1,200 \div 300 =$$

$$12. \quad \frac{800}{40} =$$