SECTION 4.2 USING STANDARDIZED RECIPES

A recipe is one of the most versatile and hardworking tools in the professional kitchen. The ability to read a recipe correctly and to use it as the basis of a variety of calculations is critical to a chef's success. Strong math skills and careful attention to the details of a recipe will help you to create accurate and tasty items.

Study Questions

After studying Section 4.2, you should be able to answer the following questions:

- What are the basic math calculations using numbers and fractions?
- What are the components and functions of a standardized recipe?
- How do you convert recipes to yield smaller and larger quantities based on operational needs?
- What is the difference between customary and metric measurement units?
- How do you convert between customary and metric measurements?
- Which smallware and utensils are used for measuring and portioning?
- How do you calculate amounts for a purchased (AP) and edible portion (EP)?
- How do you calculate the cost and portion cost of a standardized recipe?

Business Math

Math skills are extremely important in foodservice settings. Foodservice managers are expected to have a basic understanding of math and know how to apply mathematical principles to business situations. Math skills are also essential in the professional kitchen. Chefs and managers need to know how to

determine recipe yields, convert recipes from customary to metric measure, and change the yields of recipes.

Technology has improved efficiency and productivity in foodservice operations. Many restaurants use software for recipe and menu costing, inventory control, purchasing, and nutritional analysis. Despite this fact, it is important for students to understand how to perform these tasks by hand. What happens if the computer freezes or if a program doesn't function properly?

[what's new]

Foodservice Software

Recent advances in technology have made it easier for chefs and foodservice managers to track costs, maintain inventories, and manage recipes. Although the initial time commitment to enter data, such as ingredient costs, original recipes, and portion sizes, can be significant, the time saved later can be used for many other, more important functions, such as mentoring employees, planning new menu items, and maybe even cooking.

Today's restaurant and foodservice software can help with a variety of functions:

- Costing recipes and convert them for various yields
- Managing inventory, including the date an item was purchased, the amount of it needed for each recipe, its cost, and when it should be reordered, and even make an automated shopping list
- Determining nutritional information for each ingredient and recipe and print out individual labels for portion sales
- Maintaining sales figures by menu item, ingredient, day part, day of week, and fiscal quarter
- Calculating labor cost per recipe or per service period
- Performing a wide variety of other tasks

Having this information so easily available helps chefs and managers make smarter decisions and build stronger, more profitable organizations.

[fast fact]

Did You Know...?

Math is known as the universal language because the principles and foundations of math are the same throughout the world. For example, adding up a grocery bill uses the same mathematical process regardless of where you are in the world.

Mathematical Operators

As you may have learned in math classes, there are several operations that can be performed on numbers, and each corresponds to a familiar symbol:

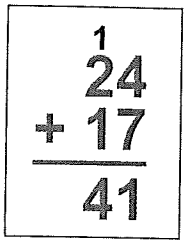
- Addition ($10 + 2 = 12$)
- Subtraction ($10 - 2 = 8$)
- Multiplication ($10 \times 2 = 20$)
- Division ($10 \div 2 = 5$)

They can also be expressed as fractions, which is the same as dividing them: ($10/2 = 10 \div 2 = 5$)

These four basic math operations are the foundation for all other mathematical functions.

Addition

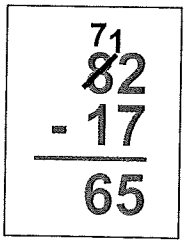
Numbers are added by lining them up in columns and then assigning each column of digits a value of 1, 10, 100, 1,000, and so on, beginning with the right-most column. In the number 372, for example, 2 is in the *ones* column, 7 is in the *tens* column, and 3 is in the *hundreds* column.



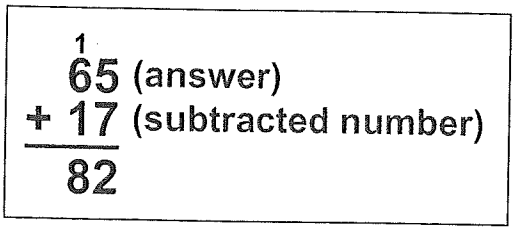
When adding a column, if the sum of a column contains two digits, then the right digit is written below the sum line, and the left digit is added to the next column as you move from right to left.

Subtraction

When subtracting large numbers, a technique known as **borrowing** is often used. If a digit in one column is too large to be subtracted from the digit above it, then 10 is borrowed from the column immediately to the left.

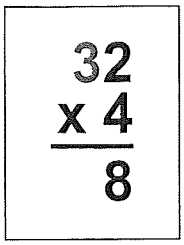


To check the work on a subtraction problem, simply add the answer to the subtracted number. The result should be the first number.



Multiplication

To multiply large numbers, the digit in the ones column of the second number is first multiplied by the digits above it, going from right to left. For example, to solve 32 × 4:

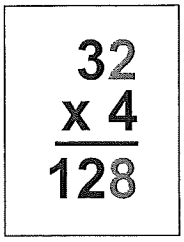


Step 1: Multiply 4 by 2

Result is 8

Step 2: Multiply 4 by 3

Result is 12



The final result is 128.

Figure 4.10 will help you review multiplication for the numbers 1 through 12.

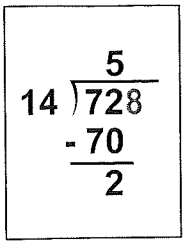
Multiplication Table

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Figure 4.10: The multiplication table.

Division

Larger numbers are divided using a combination of division and subtraction. The **dividend** is placed inside the long division sign, and the **divisor** is placed outside. For example, in the problem 728÷14, 728 is the dividend, and 14 is the divisor.



To solve 728÷14:

Step 1: Divide 14 into 72

Result is 5

14 × 5 = 70

Subtract from 72

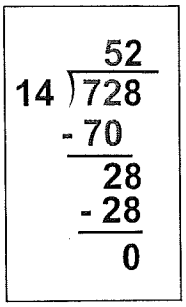
Step 2: Bring down 8

Divide 14 into 28

Result is 2

14 × 2 = 28

Subtract from 28



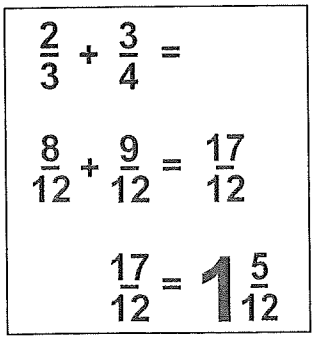
The final result is 52.

Fractions, Decimals, and Percentages

Culinary professionals need to understand the concepts of fractions, decimals, and percentages. They need to know how to use and apply these math functions in the kitchen.

Fractions

In adding and subtracting fractions, **numerators**, the upper portion of a fraction, are added and subtracted the same way as whole numbers (for example ⅓ + ⅓ = ⅔). **Denominators**, the lower portion of a fraction, are not. If the denominators to be added or subtracted are the same (called **like fractions**), the denominators remain unchanged.



If the denominators to be added or subtracted are different from each other, then the first step is to determine the **lowest common denominator**, which is the smallest number that both denominators can be divided into evenly. The next step is to multiply each numerator by the number that the corresponding denominator was multiplied by when

calculating the lowest common denominator. For example, in the next problem, both the numerator and the denominator in ⅔ are multiplied by 4, giving us the new, equivalent fraction ⁸⁄₁₂.

Fractions are often expressed as decimals. All decimals are based on one-tenth, one-hundredth, one-thousandth, etc. For example, 1.4 is 1 and 4-tenths, and 6.21 is 6 and 21-hundreths. Industry calculations are typically converted to decimals, not fractions.

Decimals

Decimals are added, subtracted, multiplied, and divided just like nondecimal numbers. When adding or subtracting decimals, the key is to line up the decimal points. Figure 4.11 shows some common fractions and their decimal equivalents.

Common fractions and their decimal equivalents

$\frac{1}{8} = 0.125$	$\frac{5}{8} = 0.625$
$\frac{1}{6} = 0.1667$	$\frac{2}{3} = 0.6667$
$\frac{1}{4} = 0.25$	$\frac{3}{4} = 0.75$
$\frac{3}{8} = 0.375$	$\frac{5}{6} = 0.8333$
$\frac{1}{2} = 0.50$	

Figure 4.11: Common fractions and their decimal equivalents.

When multiplying decimals, determine where to place the decimal point after calculating the final total answer. To do this, count the total number of digits to the right of all decimal points in the numbers that are being multiplied together and then place the decimal point in the final answer by counting that many places from the right. For example, there are a total of four digits to the right of the decimal points in 8.46 and 4.23. Therefore, the decimal point goes four places from the right in the answer, 35.7858.

8.46	8.46	8.46
+ 4.23	- 4.23	x 4.23
12.69	4.23	2538
		16920
		338400
		35.7858

To convert a decimal to a percentage, move the decimal point two places to the right and add a percent (%) sign. If necessary, add a zero on the back to get the second decimal place. For example, .123 = 12.3%.

$$4.23\overline{)8.46} = 2.00$$

When dividing decimals, simply bring the decimal point up directly above the long division sign.

When calculators or computers do the math, numbers often have more digits to the right of the decimal point than are practical or useful. In these cases, numbers are rounded to the nearest tenth, hundredth, or thousandth. Numbers are sometimes rounded to the nearest whole number in order to eliminate the decimal point.

In business math rounding, if the next digit to the right is less than 5, then the number is usually rounded down (5.12 is rounded to 5.1). If the number to the right is 5 or above, then the number is rounded up (both 5.15 and 5.19 are rounded to 5.2). The number 5.192635 can be rounded to the nearest thousandth (5.193), hundredth (5.19), tenth (5.2), or whole number (5.).

Percentages

Percentages are a particularly important mathematical operation in foodservice operations. Managers and employees often express numbers as **percents**, or parts per 100. When working with a fraction that should be a percent, the first step is to convert the fraction into a decimal. For example, to express ½ as a decimal, the numerator (1) is divided by the denominator (2) for an answer of 0.5. Then add a zero (0) in the hundreds place (0.50), and the two digits to the right of the decimal point are expressed as 50 percent, or 50%.

$$\begin{array}{r} 60 \\ \times\ 0.20 \\ \hline 00 \\ 1200 \\ \hline 12.00 \end{array}$$

To determine a certain percent of a given number, the percent is first expressed as a decimal and then multiplied. For instance, to find 20 percent of 60, multiply 60 by 0.20.

In other words, 20 percent of 60 is 12.

It is also possible to determine that one number is a percent of another number. For instance, if 60 customers out of a total of 300 are ordering the house special, the percentage of customers ordering the special is found by dividing the portion (60) by the total (300). Remember that dividing is the same as making a fraction. The total will be the denominator of the fraction: $^{60}/_{300}$. The portion is the numerator, or the part that gives the number. When the numerator is smaller than the denominator, the answer will always be a decimal.

$$\frac{60}{300} = 0.20 = 20\%$$

Therefore, 60 is 20 percent of 300. Twenty percent of the customers are ordering the special.

[on the job]

Do the Math

Let's assume that you work at a restaurant. Your restaurant is having a special; 15 percent off of the entire check. If the check total is $75, what will the check total be after the discount?

Math influences every decision that a manager makes in a foodservice operation. It is the foundation of the kitchen and the back office.

U.S. and Metric Measurement Systems

The most commonly used system of measurement in the United States is based on customary units. Some examples of these customary units are ounces, teaspoons, tablespoons, cups, pints, and gallons. Most American recipes are written using this customary system. Often they are abbreviated, as shown in parenthesis in Table 4.4, which lists customary units used in recipes.

Table 4.4: Customary (U.S.) Units of Measure

Volume	Weight	Temperature	Length
teaspoon (tsp) tablespoon (tbsp) cup (cup) fluid ounce (fl oz) pint (pt) quart (qt) gallon (gal)	ounce (oz) pound (lb)	degrees Fahrenheit (°F)	inches (in)

Cooking and baking require exact weighing and measuring of ingredients to ensure consistent quality and minimal waste. It's important to understand that the same amount can be expressed in different ways by using different units of measure. This is called an *equivalent*. For example, 4 tbsp of flour is equivalent to $^1/_4$ cup of flour. Table 4.5 shows the customary units of measure commonly used in the United States and their equivalence to each other.

Table 4.5: Units of Measure (U.S): Equivalencies

Weight 1 pound = 16 ounces					
Volume					
16 cups	= 1 gallon	= 128 fluid ounces	= 4 quarts	= 256 tablespoons	= 768 teaspoons
1 quart	= 32 fluid ounces	= 2 pints	= 4 cups	= 64 tablespoons	=192 teaspoons
1 pint	=16 fluid ounces	= 2 cups	= 32 tablespoons		= 96 teaspoons
1 cup	= 8 fluid ounces	= 16 tablespoons	= 48 teaspoons		
1 fluid ounce	= 2 tablespoons				
1 tablespoon	= 3 teaspoons				
Length 1 foot = 12 inches					

[fast fact]

Did You Know...?

The metric system was created approximately 200 years ago by a group of French scientists. It was created so that there would be a standard system for accurate and consistent measurement.

Metric units were defined in a way different from traditional units of measure. The Earth itself was selected as the measuring stick. For example, the meter was defined to be one ten-millionth of the distance from the equator to the north pole. It didn't turn out quite like this, because the scientific methods of the time were not quite up to the task of measuring these quantities precisely, but the actual metric units come very close to the design.

The metric system is the standard system used in many other parts of the world. It is also used by scientists and health professionals. **Metric units** are based on multiples of 10 and include milliliters, liters, milligrams, grams, and kilograms. For example, just as there are 100 pennies in one dollar, there are 100 milligrams in one gram. Often they are abbreviated, as shown in the parenthesis below. Table 4.6 on the following page lists the most common metric units used in recipes.

Table 4.6: Metric Units of Measure

Volume	Temperature	Weight	Length
milliliter (ml) liter (l)	degrees Celsius (°C) (or centigrade)	milligram (mg) gram (g) kilogram (kg)	millimeter (mm) centimeter (cm) meter (m)

It is important to be very familiar with both systems of measurement. As long as the correct measuring equipment is available, it's not necessary to convert measurements from one system to the other. If a recipe is written using metric units, use metric measuring tools. It is helpful, however, to understand some common equivalencies. For example, 4 tablespoons of flour is equivalent to ¼ cup of flour, or about 60 milliliters. Table 4.7 lists some common equivalents between customary and metric units of measure.

Table 4.7: Equivalent Measure

Volume			Weight		
Customary Measure	**Customary Equivalent**	**Metric Equivalent**	**Customary Measure**	**Customary Equivalent**	**Metric Equivalent**
1 tsp		5 ml	1 oz		28 g
1 tbsp	3 tsp	15 ml	1 lb	16 oz	450 g
1 fl oz	2 tbsp	30 ml	2 lb	32 oz	900 g
¼ cup	4 tbsp	60 ml			0.9 kg
⅓ cup	5 ⅓ tbsp	80 ml	2.2 lb		1 kg
½ cup		120 ml			
⅔ cup		160 ml	**Temperature**		
¾ cup		180 ml	**Customary Measure**	**Customary Equivalent**	**Metric Equivalent**
1 cup	8 fl oz 16 tbsp	240 ml 0.24 l	0°F		-17.8°C
1 pt	2 cup 16 fl oz	470 ml 0.47 l	32°F	(freezing point)	0°C
1 qt	2 pt 4 cup 32 fl oz	950 ml 0.95 l	212°F	(boiling point)	100°C
1 gal	4 qt	3.8 l			