

# Basic Culinary MATH

for School Nutrition Professionals



Participant's Workbook



# ***Basic Culinary Math for School Nutrition Professionals***

Participant's Workbook

**Time: 6 hours**

PROJECT COORDINATOR

Lewanda Morse, PhD

ACTING EXECUTIVE DIRECTOR

Aleshia Hall-Campbell, PhD, MPH

**Key Area(s): 2 - Operations, 3 - Administration**



2016

# Institute of Child Nutrition

## The University of Mississippi

The Institute of Child Nutrition was authorized by Congress in 1989 and established in 1990 at The University of Mississippi in Oxford and is operated in collaboration with The University of Southern Mississippi in Hattiesburg. The Institute operates under a grant agreement with the United States Department of Agriculture, Food and Nutrition Service.

### PURPOSE

The purpose of the Institute of Child Nutrition is to improve the operation of child nutrition programs through research, education and training, and information dissemination.

### MISSION

The mission of the Institute of Child Nutrition is to provide information and services that promote the continuous improvement of child nutrition programs.

### VISION

The vision of the Institute of Child Nutrition is to be the leader in providing education, research, and resources to promote excellence in child nutrition programs.

This project has been funded at least in part with Federal funds from the U.S. Department of Agriculture, Food and Nutrition Service through an agreement with the Institute of Child Nutrition at The University of Mississippi. The contents of this publication do not necessarily reflect the views or policies of the U.S. Department of Agriculture, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. government.

The University of Mississippi is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA Employer.

In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability.

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

© 2016, Institute of Child Nutrition, The University of Mississippi, School of Applied Sciences

Except as provided below, you may freely use the text and information contained in this document for non-profit or educational use with no cost to the participant for the training providing the following credit is included. These materials may not be incorporated into other websites or textbooks and may not be sold.

#### Suggested Reference Citation:

Institute of Child Nutrition. (2016). *Basic culinary math for child nutrition professionals*. University, MS: Author.

The photographs and images in this document may be owned by third parties and used by The University of Mississippi under a licensing agreement. The University cannot, therefore, grant permission to use these images.

**For more information, please contact [helpdesk@theicn.org](mailto:helpdesk@theicn.org).**

August/2016

# Table of Contents

Introduction. . . . .	1
Competencies, Knowledge Statements, Key Areas, and Professional Standards. . . . .	2
Ground Rules. . . . .	3
Lesson Objectives . . . . .	3
Lesson I . . . . .	4
Lesson II . . . . .	13
Lesson III . . . . .	17
Lesson IV . . . . .	23
Appendices . . . . .	27
<i>References.</i> . . . .	28
<i>Glossary</i> . . . . .	29
<i>Activity Answer Keys</i> . . . . .	30



## Introduction

Welcome to *Basic Culinary Math for Child Nutritional Professionals*. The goal of this training is to provide participants the opportunity to review and practice basic culinary math skills. A portion of this training will refresh the participants' knowledge of the basic math principles of addition, subtraction, multiplication, and division. The remainder of the training will focus on measuring and converting measurements, scaling recipes, and calculating food costs.

Your workbook contains information sheets, handouts, and activities to guide you through this learning process. As a result of using these math skills daily, school nutrition professionals can gain valuable information that will support strong financial management of their school nutrition programs. Consequently, real-world scenarios are provided to introduce how each of the mathematical concepts are utilized in school nutrition programs.

It is important to keep in mind that math plays a vital role in every aspect of child nutrition services; therefore, this resource focuses on the math skills needed to be successful in the various levels and specialties of child food service. Specific guidelines and rules that are unique to any one program will not be addressed, rather the focus will be on foundational skills needed to be successful, regardless of the program. As a result, some food items may be listed in unique amounts and/or units that are not common in child nutrition settings. Do not allow this to take your attention away from the focus: the math skills. An example may be skewed simply for the purpose of the example and does not come from a realistic scenario. Again, focus on the objective at hand and do not become distracted by the oddity of the problem. The design of each problem, as well as the curriculum as a whole started with the end in mind.

## Competencies & Knowledge Statements

From the *Competencies, Knowledge, and Skills of Effective School Nutrition Assistants and Technicians*, there are two competencies in the functional area of program regulation and accountability central to this training.

**Competency 4.1:** Maintains integrity and accountability of the school nutrition program (SNP) through compliance with all federal, state, and local regulations.

**Knowledge Statement:**

- Follow the collection and recording procedures approved for point of service at the school.

**Competency 4.2:** Maintains accountability of recorded documentation for compliance with federal, state, and local regulations.

**Knowledge Statement:**

- Knows the importance of completing accurate production records.
- Knows the importance of accurate record-keeping.

*Competencies, Knowledge, and Skills of Effective School Nutrition Assistants and Technicians* available on the ICN website: [www.theicn.org/ResourceOverview.aspx?ID=130](http://www.theicn.org/ResourceOverview.aspx?ID=130)

## Key Areas

2: Operations

3: Administration

## Professional Standards Learning Topics

### 2000 Operations

2100 Food Production – Employee will be able to effectively utilize food preparation principles, production records, kitchen equipment, and food crediting to prepare foods from standardized recipes, including those for special diets.

### 3000 Administration

3300 Financial Management – Employee will be able to manage procedures and records for compliance with Resource Management with efficiency and accuracy in accordance with all Federal, State, and local regulations, as well as the Administrative Review.

“Professional Standards for School Nutrition Professionals” available on the USDA website: [professionalstandards.nal.usda.gov](http://professionalstandards.nal.usda.gov)

## Ground Rules

- Be in the classroom at least five (5) minutes before scheduled starting time.
- Turn your cell phones off or to vibrate. If you must take a call or answer a text message before a scheduled break, leave the room quietly. We encourage you to keep the conversation as short as possible so you don't miss important information.
- Be respectful of everyone. Do not carry on sidebar conversations with your neighbor or others in your group. We recognize that most conversations are about the topics we are discussing, but constant talking or whispering interferes with others' ability to hear and understand information that may be extremely important to them. Please be considerate.
- Consider all ideas. Always be considerate of other people's ideas. If you disagree, do so politely.
- Clear your table of trash such as cups, napkins, or empty water bottles at the end of the training.
- Always ask for clarification if you do not understand.

## Lesson Objectives

### Lesson I

- Apply the basic mathematical operations and their properties.
- Solve addition, subtraction, multiplication, and division problems using whole numbers, fractions, and decimals in culinary application.
- Demonstrate how to convert fractions to decimals and decimals to fractions.

### Lesson II

- Identify the standard units and tools for measuring and weighing.
- Convert measurements in a recipe to change the yield.

### Lesson III

- Determine the conversion factor to change the yield of a recipe.
- Convert a recipe from smaller to larger yield.
- Convert a recipe from larger to smaller yield.

### Lesson IV

- Calculate the unit costs of food items.
- Recognize the difference between "As Purchased" (AP) and "Edible Portion" (EP) in determining costs.
- Calculate recipe costs to determine yield costs of recipes.

## LESSON I

# REVIEW BASIC CULINARY MATH SKILLS

**Objective:** Apply the basic mathematical operations and their properties.

Our first objective is to apply basic mathematical operations and their properties. Think about an example of a basic mathematical operation that is used daily in the school nutrition program and how it is used. For example, we may use addition to add the total number of adult meals sold for the day. What are other examples of mathematical operations, and how they are used?

**List at least five ways math is used in school nutrition programs.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**Objective:** Solve addition, subtraction, multiplication, and division problems using whole numbers, fractions, and decimals in culinary application.

The next objective in the lesson is to solve addition, subtraction, multiplication, and division problems using whole numbers, fractions, and decimals in culinary application. This objective will include a review of basic math skills that are used almost daily in school nutrition programs. We will start with whole numbers. Remember, whole numbers may be any one or a combination of the following digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

## Addition of Whole Numbers

Addition is used on a daily basis. It is used to determine purchase quantities, to calculate the number of servings needed for food items, to calculate inventory, and to find the solutions for many other simple problems.

**Solve addition problems using whole numbers.**

$$\begin{array}{r} 2,146 \\ + 1,869 \\ \hline \end{array}$$

ABC Elementary School serves grades K – 6. The school does not offer choices or offer versus serve. Each morning the manager receives a count of the number of students who plan to eat the school lunch by grade. How many students should the manager plan to serve on this day?

Grades	Number
kindergarten	88
first	123
second	107
third	92
fourth	119
fifth	86
sixth	121
Total	

## Subtraction of Whole Numbers

We use subtraction for such tasks as to compare the leftover food items against the number prepared minus the number served, to determine quantities to purchase after subtracting items in inventory, and to complete production records.

**Solve subtraction problems using whole numbers.**

$$\begin{array}{r} 15,654 \\ - 8,287 \\ \hline \end{array}$$

Based on the previous school orders, Greenleaf School District needs 378 cases of sausage pizza for the next menu cycle. Records show there are 49 cases on hand in the warehouse. How many cases should be ordered?

## Multiplication of Whole Numbers

Multiplication is a basic mathematics operation that is important in school nutrition. We use multiplication to determine the total price on multiple quantities of items listed on a purchase order, to calculate the total money due from meals served in various categories, and to find the total costs of multiple servings of a menu item.

**Solve multiplication problems using whole numbers.**

$$1,232 \times 8 =$$

The manager at ABC Elementary School is ordering 29 cases of hamburger patties at a price of \$52.00 a case. What will be the total cost for the 29 cases of hamburger patties?

## Division of Whole Numbers

Division is used to calculate the cost per portion of the total recipe, to determine the average cost per meal, and to find the inventory turnover rate. Often when dividing, we end up with an answer that needs to be rounded. Just a reminder: If the number to the right of the place you are rounding is five or greater, you round up to the next number. If it is four or less, the number stays the same.

**Solve problems using division of whole numbers.**

$$1800 \div 360 =$$

The manager wants to know the cost per serving of chicken patties if the case price is \$48.00, and there are 96 servings in each case. To calculate the cost per serving, the manager divides the cost per case by the number of servings in each case. How much will each serving cost?

## Addition with Decimals

There are times when the school nutrition professional must solve a problem that contains a decimal. Basic operations with decimals are similar to whole numbers, except a decimal point is needed to express a number or part of a number that is less than one. For example 25.5 pounds means 25 whole pounds and .5 means a half pound.

*Rewrite the problem and line up the decimal points!*

---

**Solve addition problems using numbers with decimals.**

$$3.56 + 7.42 + 12.10 = \underline{\hspace{2cm}}$$

Lynn is assigned to track the actual amount of money received from three categories of meal service, and then to enter the total amount received in a revenue account. Calculate the total revenue received from the three categories:

- Adult meal sales - \$48.60
- Extra milk sales - \$16.75
- À la carte sales - \$81.93

## Subtraction with Decimals

The same principles apply to subtracting numbers with decimals as with adding decimals. The next two problems are practice problems using decimals in a subtraction problem.

*Rewrite the problem and line up the decimal points!*

---

**Solve subtraction problems using numbers with decimals.**

$$18.34 - 6.26 = \underline{\hspace{2cm}}$$

The cashier is reconciling her cash box. She started with \$12.35 in change cash. At the end of the meal, she had \$79.32 in the cash box which included the change cash. How much did the cashier collect for food sales?

## Multiplication with Decimals

Multiplication with decimals is a little different than with whole numbers. Once the multiplication process is finished, the total number of decimal places in the problem are counted and inserted in the answer. For example, when you multiply 3.45 and 10.21, the answer will have four decimal places. Then, the answer can be rounded to the nearest hundredth and any extra zeros can be dropped.

*Remember to count the decimal places and round!*

---

**Solve multiplication problems using numbers with decimals**

$$11.49 \times 0.51 = \underline{\hspace{2cm}}$$

A recipe calls for 4.5 quarts of chicken stock that costs \$0.66 a quart. Calculate the cost of the chicken stock for the recipe.

## Division with Decimals

Our final two decimal problems are division. Division with decimals is similar to division with whole numbers, except the decimals are inserted where needed.

**Solve division problems using numbers with decimals.**

$$3.35 \div 0.45 = \underline{\hspace{2cm}}$$

How many 0.25-pound servings of ready-to-cook broccoli can be obtained from 18.5 pounds of fresh, trimmed, ready-to-use broccoli florets?

## Fractions

Fractions are another way to express a number, part of a number, or parts of a whole. The top number in a fraction is called the numerator, and the bottom number is the denominator. Although there is no simple way to use a regular calculator when working with them, there are free apps available for mobile devices that will allow you to calculate fractions.

## Addition of Fractions

Adding fractions with a common denominator is a simple operation. Add the numerators, and place the sum over the denominator.

For example, to solve the problem,  $\frac{1}{8} + \frac{5}{8}$ , add the numerators for an answer of  $\frac{6}{8}$ . Always reduce the fraction to its lowest terms by dividing the numerator and the denominator by their greatest common factor (GCF), which is the largest number by which both the numerator and denominator can be divided. What is the GCF for  $\frac{6}{8}$ ?

**Solve addition problems with fractions.**

$$\frac{1}{5} + \frac{3}{5} = \underline{\hspace{2cm}}$$

$$\frac{1}{3} + 1\frac{1}{3} = \underline{\hspace{2cm}}$$

$$\frac{7}{8} + \frac{5}{8} = \underline{\hspace{2cm}}$$

Susan needs  $\frac{1}{3}$  cup of flour for a cheese sauce and  $\frac{2}{3}$  cup of flour for brown gravy. How much total flour will she need to record on the storeroom withdrawal sheet?  $\underline{\hspace{2cm}}$

The mixed fruit cup was a combination of  $\frac{1}{4}$  cup of mandarin oranges,  $\frac{1}{4}$  cup of blueberries, and  $\frac{1}{4}$  cup cherries. What was the total amount of fruit in the cup?  $\underline{\hspace{2cm}}$

## Subtraction of Fractions

Fractions with common denominators are subtracted by the same process as addition. Subtract the numerators, and place the answer over the common denominator. Let's consider this problem:  $\frac{8}{9} - \frac{5}{9} = \underline{\hspace{1cm}}$ . Find the answer by subtracting 5 from 8, and placing the answer over the common denominator of 9. The answer is  $\frac{3}{9}$  or  $\frac{1}{3}$ , reduced.

**Solve subtraction problems with fractions.**

*\*Be sure to reduce the fraction if possible.*

$$\frac{7}{8} - \frac{5}{8} = \underline{\hspace{2cm}}$$

$$\frac{4}{5} - \frac{1}{5} = \underline{\hspace{2cm}}$$

$$1\frac{2}{4} - \frac{1}{4} = \underline{\hspace{2cm}}$$

There was  $\frac{4}{5}$  lb of flour reserved for the morning's recipes. If the staff only used  $\frac{3}{5}$  lb of flour, how much was left?

## Addition or Subtraction of Fractions without a Common Denominator

Some fractions have uncommon denominators. There are a couple of ways to solve these problems. The first example is an addition problem.

### Example #1

$$\frac{1}{5} + \frac{2}{3} = \underline{\hspace{2cm}}$$

1. The first step is to cross-multiply the numerators and denominators.  
( $1 \times 3 = 3$ ) and ( $5 \times 2 = 10$ )
2. Next, add those two products.  $3 + 10 = 13$   
The resulting sum is the numerator for the original problem:  
 $\frac{1}{5} + \frac{2}{3} = \frac{13}{\underline{\hspace{1cm}}}$
3. Now, multiply the denominators.  $5 \times 3 = 15$   
This product is the denominator for the original problem:  
 $\frac{1}{5} + \frac{2}{3} = \frac{13}{15}$
4. The final step is to determine if the fraction can be reduced by searching for the GCF.  
Other than 0 or 1, there are no common factors, so the fraction cannot be reduced.

### Example #2

Another way to solve fraction problems that involve addition or subtraction is to find a common denominator. The least common denominator is the least common multiple of the denominators of the fractions. For example, if you want to add  $\frac{3}{8}$  and  $\frac{1}{4}$ , the number 8 is the smallest multiple of all of the denominators. By converting  $\frac{1}{4}$  to  $\frac{2}{8}$ , we can now add  $\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$ .

**Solve fraction problems without common denominators.**

$$\frac{2}{3} + \frac{3}{10} = \underline{\hspace{2cm}}$$

$$\frac{3}{4} + \frac{7}{8} = \underline{\hspace{2cm}}$$

$$\frac{1}{2} + \frac{3}{4} = \underline{\hspace{2cm}}$$

**Example #3:**

Use a similar procedure to subtract fractions.

$$\frac{2}{3} - \frac{3}{10} = \underline{\hspace{2cm}}$$

When subtracting, it is important to remember to first multiply  $2 \times 10$  and then multiply  $3 \times 3$ . The numerators to subtract are  $20 - 9$ . Multiply  $3 \times 10$  for the denominator. We can now solve the problem.

$$\frac{20 - 9}{30} = \frac{11}{30}$$

The fraction cannot be reduced.

## Multiplication with Fractions

When multiplying fractions, the numerators of each fraction are multiplied to determine the numerator of the product. Then, the denominators of each fraction are multiplied to find the denominator of the product.

For example:  $\frac{5}{6} \times \frac{4}{9} = \frac{(5 \times 4) = 20}{(6 \times 9) = 54} = \frac{20}{54} = \frac{10}{27}$

The fraction  $\frac{20}{54}$  can be reduced to  $\frac{10}{27}$ .  
The GCF is 2.

**Solve multiplication problems with fractions.**

$$\frac{2}{3} \times \frac{4}{9} = \underline{\hspace{2cm}}$$

$$\frac{6}{7} \times \frac{2}{3} = \underline{\hspace{2cm}}$$

$$\frac{5}{8} \times \frac{3}{5} = \underline{\hspace{2cm}}$$

## Division with Fractions

Division of fractions is similar to multiplication, except in division the second fraction in the equation must be inverted. This inverted fraction is known as the reciprocal. For example, if you want to solve  $\frac{3}{4} \div \frac{5}{6}$ , you must invert the second fraction so that it becomes  $\frac{6}{5}$ . Then, proceed as if you are multiplying fractions.

$$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{18}{20} = \frac{9}{10}$$

**Solve division problems with fractions.**

$$\frac{3}{8} \div \frac{3}{5} = \underline{\hspace{2cm}}$$

$$\frac{4}{5} \div \frac{1}{2} = \underline{\hspace{2cm}}$$

$$\frac{7}{12} \div \frac{5}{6} = \underline{\hspace{2cm}}$$

How many  $\frac{3}{8}$  cup servings are there in  $\frac{3}{4}$  of a cup of yogurt? =  $\underline{\hspace{2cm}}$

Each spice pack holds  $\frac{1}{4}$  teaspoon of the chef's secret spice. If there is only  $\frac{2}{3}$  of a teaspoon of the secret spice remaining, how many spice packs can be made?  $\underline{\hspace{2cm}}$

**Objective:** Demonstrate how to convert fractions to decimals and decimals to fractions.

Ms. Jones, the school nutrition director, is concerned about the overproduction of yeast rolls in the district's elementary schools where neither offer verses serve is used nor extra rolls are sold. It is rumored some schools are making extra rolls to give additional servings to teachers. To analyze overproduction, she needs to know the percent of leftover rolls from each school daily. She requests a daily count of the number of rolls prepared and the exact meal count of lunches served with rolls. The first school sends the following information: "Rolls prepared - 120. Total meals served with a roll - 95. One roll was dropped on the floor and discarded." What percentage of rolls were leftover at this school?

**1. Convert the fraction to a decimal.**

Divide the part (the number of rolls left over) by the whole or total (total number of rolls).  
 $24 \div 120 = 0.20$

**2. Convert the decimal to a percent.**

Multiply the decimal by 100 and remove the decimal.  
 $0.20 \times 100 = 20\%$

**The school had not accounted for 20% of the rolls produced.**

There are times when the school nutrition professional may prefer to conduct an analysis that requires converting a decimal to a fraction.

- Write down 0.25 divided by 1 and then multiply both top and bottom by 100. Reduce your answer.

$$(0.25 \times 100)/(1 \times 100) = \frac{25}{100} = \frac{1}{4}$$

**Convert decimals and fractions.**

Convert  $\frac{3}{5}$  to a decimal.

Convert 0.10 to a fraction.



## LESSON II

# KITCHEN MEASURING TOOLS FOR INGREDIENTS

**Objective:** Identify the standard units and tools for measuring and weighing.

## Understanding Measurement

Measurement tools are essential for preparing and serving quality food products. In Lesson II we will identify the culinary tools used for measuring and weighing food in the preparation of standardized recipes. In addition, you will learn the standard units of measure for volume and weight and how to convert measurements in a standardized recipe to change the yield.

Understanding measurement is important in school nutrition programs. Standard measurements for portion size must be documented to meet the nutrition standard guidelines. To meet meal pattern requirements, schools must use tools that measure food items in both cups and ounces. Standardized recipes must document ingredient amounts to ensure proper preparation methods along with dietary specifications. Each tool used has its unique purpose; therefore, if employees are to ensure quality food products, they must be trained to use these tools accurately.

### Common Measurement Tools

Think about the measurement tools used in your program. Take a minute to list as many as you can in the space provided below.

---

---

---

---

---

---

---

---

---

---

## Measuring Volume and Weight

In the following table, there is a list of food items typically found in school nutrition programs (SNP) recipes. Consider the list of measurement tools created in the last activity. Then, in the second column, list the tool that will provide the most accurate measure for each food item listed. In the third column, specify whether the tool measures volume or weight.

Measuring Volume and Weight		
Food Item	Tool	Volume or Weight
1 gallon beef stock		
1 tablespoon salt		
2 lbs of chopped carrots		
3 cups of vegetable oil		
1.5 lbs butter		
2 teaspoons garlic powder		
¼ cup cornstarch		
6 lbs ground beef		
1 portion-size serving of spaghetti sauce		

### Measuring Techniques

When measuring dry ingredients, such as small amounts of sugar, spices, and leavening (baking powder, baking soda), fill the measuring cup or spoon without packing the ingredient and then level it off gently so that it is even with the top of the measuring utensil. Use a butter knife or straight edge spatula to cut across the top of the measuring cup (or spoon) parallel to the surface. This quick technique will take off any excess and keep the measurement accurate.

## Converting Measurements

**Objective:** Convert measurements in a recipe to change the yield.

Convert the amount of each ingredient below to a more accurate measurement. To help you, the Culinary Measurement Conversions chart is included. Choose a tool that results in the least number of times an ingredient will have to be measured. The first ingredient has been done for you.

Measurement Conversions			
Ingredient	Original Amount	Measurement Tool	Adjusted Amount
Example: black pepper	6 teaspoons	tablespoon	2 tablespoons
flour	12 tablespoons		
vegetable oil	2 cups		
water	4 cups		
baking powder	4 tablespoons		

Culinary Measurement Conversions		
Unit	Equivalents	
1 tablespoon	3 teaspoons	1/2 fluid ounces
1/8 cup	2 tablespoons	1 fluid ounce
1/4 cup	4 tablespoons	2 fluid ounces
1/3 cup	5 tablespoons + 1 teaspoon	2 3/4 fluid ounces
1/2 cup	8 tablespoons	4 fluid ounces
2/3 cup	10 tablespoons + 2 teaspoons	
3/4 cup	12 tablespoons	6 fluid ounces
1 cup	16 tablespoons	8 fluid ounces
1 pint	2 cups	16 fluid ounces
1 quart	2 pints	32 fluid ounces
1 gallon	4 quarts	128 fluid ounces
1 pound	16 ounces	



## LESSON III

# CONVERTING STANDARDIZED RECIPES

**Objective:** Determine the scaling factor to change the yield of a recipe.

## Scaling Factor

As we discussed in Lesson II, USDA standardized recipes list the quantities needed to produce 50 or 100 servings. While many school managers have software in their schools that will adjust recipes for them, it is important for all staff members to receive training on quantity adjustment for recipes so they understand the process. In most SNP's there are several steps used to increase or decrease the ingredients in a standardized recipe. In Lesson III you will learn to use the scaling factor method to change the yield of a standardized recipe. After we discuss the steps for conversion, you will be given an opportunity to apply the factor method to increase and decrease a standardized recipe.

First, please note the Equivalence Chart below. It includes decimal and fraction equivalents for weights in ounces. You may need to reference this information throughout the upcoming sections.

EQUIVALENCY CHART		
Weight	Decimal Equivalent	Fraction Equivalent
1 oz	0.0625 lb	$\frac{1}{16}$
2 oz	0.125 lb	$\frac{1}{8}$
3 oz	0.1875 lb	$\frac{3}{16}$
4 oz	0.25 lb	$\frac{1}{4}$
5 oz	0.312 lb	$\frac{5}{16}$
6 oz	0.375 lb	$\frac{3}{8}$
7 oz	0.437 lb	$\frac{7}{16}$
8 oz	0.5 lb	$\frac{1}{2}$

EQUIVALENCY CHART		
Weight	Decimal Equivalent	Fraction Equivalent
9 oz	0.562 lb	$\frac{9}{16}$
10 oz	0.625 lb	$\frac{5}{8}$
11 oz	0.687 lb	$\frac{11}{16}$
12 oz	0.75 lb	$\frac{3}{4}$
13 oz	0.812 lb	$\frac{13}{16}$
14 oz	0.875 lb	$\frac{7}{8}$
15 oz	0.937 lb	$\frac{15}{16}$
16 oz	1 lb	1

## Increasing a Recipe Yield

The school nutrition program manager in School A forecasts the staff will serve 225 students a menu item that has ground beef as one of its ingredients. The standardized recipe yield is for 100 servings. In order to determine how much ground beef it will take to prepare a recipe that yields 225 servings, the staff must first determine the scaling factor.

The factor is determined by dividing the number of servings needed by the number of servings listed in the original recipe. For example, if you plan to prepare 225 servings and the recipe yield is 100, divide 225 by 100 to get a factor of 2.25.

$$\text{Increase: } \frac{\text{number of servings needed}}{\text{original number of servings}} = \frac{225}{100} = 2.25 \text{ scaling factor}$$

## Converting to a Common Unit of Measurement

Before multiplying by the scaling factor, any ingredients that have mixed units need to be converted to a common unit. Sometimes, the Weight Equivalence chart may help you determine if one ingredient will be easier to convert than the other.

**Number of Servings Needed: 225      Recipe Yield: 100      Amount to Adjust: 5 lbs 8 oz**

In this example, since we know 16 ounces equals 1 pound that means 8 ounces is equal to  $\frac{1}{2}$  pound (0.5 lb). Therefore, it is easier to convert the entire amount to pounds.

$$5 \text{ lbs } 8 \text{ oz} = 5 \text{ lbs} + 0.5 \text{ lbs} = 5.5 \text{ lbs}$$

Now we can determine the amount of ground beef needed for 225 servings by using 5.5 pounds as the measure for 100 servings.

- Multiply 5.5 (total pounds) by 2.25 (factor) = 12.375 pounds
- Then, to convert back to the mixed units, multiply 0.375 lbs by 16 (oz in a lb) = 6 oz  
Adjusted Amount for 225 servings = **12 lbs 6 oz**

If the original amount of ground beef had not easily converted to pounds, we would have converted it to ounces before multiplying by the scaling factor.

- Multiply 5 pounds x 16 (number of ounces in a pound) = **80 ounces**
- Add this amount to the 8 ounces you originally had = **88 ounces**

$$5 \text{ lbs } 8 \text{ oz} = \mathbf{88 \text{ ounces}}$$

Now we can determine the amount of ground beef needed for 225 servings by using 88 ounces as the measure for 100 servings.

- Multiply 88 (total ounces) by 2.25 (factor) = 198 ounces, the scaled amount
- Then, to convert back to the mixed units, divide 198 oz by 16 (oz in a lb) = 12.375 lbs
- Multiply 0.375 lbs by 16 (oz in a lb) = 6

$$\text{Adjusted Amount for 225 servings ounces: } \mathbf{12 \text{ lbs } 6 \text{ oz}}$$

### Decreasing a Recipe Yield Using a Scaling Factor

The school nutrition program manager at School B forecasts they will serve 80 students for lunch. They are serving a menu item that has ground beef as one of its ingredients. The standardized recipe yield is for 100 servings. What is the conversion factor?

$$\text{Decrease: } \frac{\text{number of servings needed}}{\text{original number of servings}} = \frac{80}{100} = 0.80 \text{ scaling factor}$$

### Recipe Conversion

Assume a recipe with a yield of 100 specifies 16 pounds 4 ounces of ground beef. You need 80 servings, so convert the yield to 80. Convert both weight units to ounces.

### Special Situations in Recipe Adjustment

#### Adjustments resulting in fractions of a measure

There are special situations that require decisions to be made when scaling a recipe. Some recipe adjustment calculations will result in a fraction or decimal that is not easy to convert or measure. For example, if there are 2 ounces of bell pepper in an original recipe that yields 100 servings and the scaling factor is 2.4, the adjusted amount of bell pepper is 4.8 ounces. If your scale cannot weigh to the accuracy of 0.8 ounces, round up to the next nearest measurable amount. In this example, the decimal 0.8 can be increased to 1 ounce, so the adjusted amount would be 5 ounces.

### Increasing or Decreasing Seasonings

Increasing or decreasing spices or seasonings may require a different proportion from other ingredients. Be careful when adjusting seasonings. *Culinary Techniques for Healthy School Meals* published by ICN offers this recommendation: In general, double the spices and herbs in a recipe when increasing from 50 to 100 servings. Increase the spice or herb by 25% for each additional 100 servings.

### Adjusting Eggs

In some cases, it may be difficult to adjust eggs using the factor method, so the manager and staff will need to make the final decision. If the recipe adjustment results in  $1\frac{2}{3}$  eggs, rounding up to 2 eggs is usually the best option.

**Objective:** Convert a standardized recipe from a smaller to a larger yield.

## Using a Scaling Factor to Increase a Recipe Yield

Adjust the ingredients to make 100 servings. Work with your table team or a learning partner to find the scaling factor and fill in the blanks in the following table. Notice some of the work has already been done for you.

SUNSHINE SALAD Recipe Yield Increase to 100 Servings					
Ingredient	For 50 Servings	Quantities Converted	Scaling Factor	Calculated Amount	For 100 Servings
Lettuce, romaine	1 lb 3 oz			38 oz	2 lbs 6 oz
Lettuce, green leaf	1 lb	16 oz		32 oz	
Carrots, shredded	7 oz	7 oz		14 oz	
Mandarin oranges, canned, drained	1 qt 1 cup				2 ½ qts
Orange juice	4 ¼ cups	4.25 cups			
Sugar, light brown, packed	⅓ cup	⅓ cup			
Vanilla extract	½ tsp	½ tsp			

**Objective:** Convert a standardized recipe from a larger to a smaller yield.

## Using the Factor Method to Decrease a Recipe Yield

Adjust the ingredients to make 75 servings. Work with your table team or a learning partner to find the scaling factor and fill in the blanks in the following table.. Notice some of the work has already been done for you.

TUNA SALAD Recipe Yield Decrease to 75 Servings					
Ingredient	For 100 Servings	Quantities Converted	Scaling Factor	Calculated Amount	For 75 Servings
canned chunk-style tuna	16 lbs 4 oz	260 oz		195 oz	
fresh onion, chopped	2 lbs 8 oz	40 oz			1 lb 14 oz
fresh celery	4 lbs	4 lbs			
dill pickle relish	2 cups	2 cups			
hard-cooked eggs	16 eggs	16 eggs			
low-fat mayonnaise	5 lbs 3 oz			62.25 oz	3 lbs 14 oz



## LESSON IV

# CALCULATING FOOD COST

**Objective:** Calculate the unit cost of food items.

In Lesson IV you will learn how to calculate the unit cost of food items, the difference between “As Purchased” (AP) and “Edible Portion” (EP), and why these terms are important when determining food costs. You will also have the opportunity to calculate the cost of a recipe to determine per-meal cost.

## Calculating Unit Cost

Units are food products that can often be divided into smaller portions. These products are usually sold in cases. Calculating the unit cost is necessary in order to determine the portion cost. For example, if several whole pizzas are sold as a case, one pizza represents a unit. The pizza unit is further divided into portions.

- **Unit Cost** = Case Cost ÷ Number of Units
- **Portion Cost** = Unit Cost ÷ Number of portions

### Determine Unit and Portion Costs.

The school nutrition director orders pre-prepared lasagna at a cost of \$91.20 per case. Each case contains 4 pans of lasagna. The manager determines there are 24 servings in each pan.

1. What is the cost per unit for a pan of lasagna?
2. What is the cost per portion for a serving of the pre-prepared lasagna?

## Calculating Weight/Volume Unit and Portion Costs

If the SNP is serving an item that is measured in ounces or cups, the unit cost will need to be calculated as weight or volume. For example, if the school receives a case that contains several bags of food product, the cost of each bag is the unit price. The portion cost is determined by the number of servings in each bag according to the weight or volume required for a serving.

### Determine unit and portion cost using weight.

The SNP director wants to know the food cost per serving for a ¼ cup of baked fries. The cost for a case is \$21.00. Each case contains 6 bags of oven-ready fries that weigh 5 pounds. According to the product label, each 5 pound bag contains 70 servings measured by ¼ cup.

1. Determine the cost of each bag (unit).
2. Determine the cost per ¼ cup portion or serving.

**Objective:** Recognize the difference between the “As Purchased” (AP) form and the “Edible Portion” (EP) form in determining food costs.

## “As Purchased” and “Edible Portion”

Many food products are delivered in what is called the “As Purchased” (AP) form that needs some preparation before they are ready to be served in the “Edible Portion” (EP) form. The AP amount refers to the food products as they were ordered and received; the EP amount refers to the amount of the food that is available to serve after it is trimmed and/or prepared.

### Food Buying Guide Tools

The *Food Buying Guide for Child Nutrition Programs*, published by the USDA, provides information on the edible yield percentages of various foods. It helps menu planners determine the amount to purchase. Not only can it save the menu planner time, it can increase accuracy since manual calculations often lead to errors. The *Food Buying Guide* can be found on the USDA Food and Nutrition Service website.

[usda.gov/tn/food-buying-guide-school-meal-programs](https://usda.gov/tn/food-buying-guide-school-meal-programs)

There is also a *Food Buying Guide Calculator* provided by the Institute of Child Nutrition that can save valuable time for the staff member determining how much product to purchase. There are individual calculators for each of the food groups outlined in the *Food Buying Guide* that can save valuable time when determining how much product to purchase. The *Calculator* is available on the Institute of Child Nutrition’s website.

[fbg.theicn.org](http://fbg.theicn.org)

### Using the Food Buying Guide

Below is an example of selected information provided in the *Food Buying Guide*. Three products are listed along with the description and yield. The *Food Buying Guide* provides other descriptions of the food such as AP, purchase unit, servings per purchase unit, serving size per meal contribution, and how much to purchase for 100 servings.

Selected Food Products from the <i>Food Buying Guide</i>		
Product	Description	Yield
ground beef, fresh/frozen raw	No more than 26% fat	1 lb AP = 0.72 cooked, drained lean meat
chicken breast, fresh/frozen raw	Portion without backs; with skin	1 lb AP = 0.64 lb. cooked, boned chicken meat with skin
pork sausage, Italian-style, fresh/frozen raw	No more than 35% fat (3% water maximum)	1 lb AP = 0.62 cooked, drained Italian-style sausage

## Determine Amount to Purchase Using Food Buying Guide

The menu planner wants to purchase enough ground beef (AP) to serve 2 ounces (EP) to 100 students. The following steps are necessary to determine the amount of ground beef to purchase.

1. Determine the total number of ounces needed by multiplying ounces per student times the number of students.  
 $100 \text{ students} \times 2 \text{ ounces} = 200 \text{ ounces EP}$
2. Divide the number of ounces needed by the yield percentage.  
 $200 \div 0.72 = 277.78 \text{ ounces AP}$
3. Convert to pounds.  
 $277.78 \text{ ounces} \div 16 \text{ ounces} = 17.36 \text{ (rounded to 17.50)}$

The menu planner will need 17.5 pounds of ground beef to serve 2 ounces EP to 100 students.

## Calculate the Amount of AP Product to Purchase.

The menu planner plans to purchase enough Italian-style pork sausage to 2 ounces (EP) to 200 students. Using the information provided in the food product table in the workbook, calculate the amount of AP Italian-style pork sausage the menu planner should order.

1. What is the total number of ounces needed per student?
2. How many ounces will the menu planner need to have on hand based on the yield percentage?
3. How many pounds of Italian-style pork sausage must be purchased to yield the desired EP?

## Costing Recipes

The cost of food used in producing a meal is an essential piece of financial information needed when making financial management decisions about the SNP. One way to determine the cost of a meal is to determine the yield cost of a recipe. There are three pieces of information that are important to determining yield cost of recipes:

1. Recipe yield
2. Amount of each ingredient needed for preparing the recipe
3. Unit price of each item in the recipe

## Calculate Portion Cost of Single Ingredient

The recipe calls for 10 ounces of pasta for 50 servings of salad, and the purchase price for 1 lb of pasta is \$8.00. What is the cost of the pasta for the recipe?

- Since the pasta is priced by the pound but the pasta is in ounces, first, convert the cost to a price per ounce.  
 $\$8 \text{ per pound} \div 16 \text{ ounces} = \$0.50 \text{ per ounce}$
- Next, multiply the cost per ounce by the number of ounces required by the recipe.  
 $\$0.50 \text{ per ounce} \times 10 \text{ ounces called for in recipe} = \textbf{\$5.00 cost of pasta in the recipe}$

To determine the cost for each serving since the recipe yield is 50, it only requires one additional step.

- Divide the cost of the pasta in the recipe by the number of servings.  
 $\$5.00 \text{ recipe cost} \div 50 \text{ (servings)} = \textbf{\$0.10 per serving for pasta}$

**Objective:** Calculate recipe costs to determine yield costs of recipes.

To simplify the process when calculating the cost for an entire recipe, first determine the cost of each ingredient. Then, add the cost of all ingredients, and divide the total cost of the recipe by the yield for the as-served cost.

## Calculate Recipe Costs

Calculate both the recipe cost and portion cost for the menu item Powerhouse Chili in the following table. If you need a memory jog about conversions, refer back to Lesson II.

POWERHOUSE CHILI Recipe Yield: 100 servings			
Ingredient	Amount (100 servings)	Unit Cost	Total Cost
Fresh onions, diced	6 lbs	\$0.95/lb	
Fresh garlic, minced	8 oz	\$6.20/lb	
Low-sodium vegetable stock	12 ½ cups	\$3.88/qt	
Canned low-sodium black beans drained, rinsed	12 lbs	\$1.28/lb	
Fresh red bell peppers, diced ½"	2 lbs 8 oz	\$1.25/lb	
Canned low-sodium diced tomatoes	11 lbs 12 oz	\$1.38/lb	
Canned low-sodium tomato sauce	3 ½ qts	\$2.70/qt	
Chili powder	4 oz	\$9.53/lb	
Total Recipe Cost:			
As-Served Portion Cost:			

## Appendices

References . . . . .	.28
Glossary . . . . .	.29
Activity Answer Keys . . . . .	30

## References

- Dopson, L. R. & Hayes, D. K. (2011). *Food and beverage cost control*. Hoboken, NJ: John Wiley & Sons.
- Gilchrist, J. (Ed.). (2009). *Kitchen math everyday math skills*. Northwest Territories Literacy Council. Retrieved from [www.nwt.literacy.ca](http://www.nwt.literacy.ca)
- Institute of Child Nutrition. (2006). *Competencies, knowledge, and skills of effective school nutrition assistants and technicians*. University, MS: Author.
- Institute of Child Nutrition. (2009). *Culinary techniques for healthy school meals: Seasonings* (p. 13-14). Retrieved from [www.theicn.org/documentlibraryfiles/PDF/20100210102351.pdf](http://www.theicn.org/documentlibraryfiles/PDF/20100210102351.pdf)
- Jones, T. (2008). *Culinary calculations: Simplified math for culinary professionals*. Hoboken, NJ: John Wiley & Sons.
- McGreal, M. & Padilla, L. J. (2014). *Culinary math principles and applications*. Orland Park, IL: American Technical Publishers.
- Smith, J. A. (2010). "Kitchen math and measuring: How it all adds up." *Learning seed*. Retrieved from [www.learningseed.com/catalog/kitchen-math-and-measuring](http://www.learningseed.com/catalog/kitchen-math-and-measuring)
- Strianese, A. J. & Strianese, P.P. (2012). *Math principles for food service occupations*. Clifton Park, NY: Thomson Delmar Learning.
- United States Department of Agriculture, Food and Nutrition Services. (2014). *Food buying guide for child nutrition programs*. Retrieved from [www.fns.usda.gov/tn/foodbuying-guide-child-nutrition-programs](http://www.fns.usda.gov/tn/foodbuying-guide-child-nutrition-programs)

## Glossary of Key Terms

**as purchased (AP) amount:** the food item as it is purchased from the supplier

**as-served cost:** the cost of a menu item served to the customer

**decimal number:** a number that uses a decimal point followed by a digit or digits to represent a value that is smaller than one

**denominator:** the bottom number in a fraction that represents the number of parts into which the whole is divided

**dividend:** a number to be divided by another number

**divisor:** a number that divides into another number

**edible portion (EP):** the amount of a food product that remains after it has been trimmed

**factor:** the numbers multiplied together to get another number

**fraction:** two quantities shown as a numerator over a denominator that represents the parts of whole

**greatest common factor (GCF):** the largest number that is a common divisor of a given set of numbers; also called greatest common divisor (GCD)

**ingredient:** one or more parts of a recipe

**least common multiple (LCM):** the smallest positive number that is a multiple of two or more numbers; also called least common denominator (LCD)

**measurement tool(s):** a device for measuring a physical quantity

**mixed number:** a whole number greater than zero and a proper fraction

**multiple:** a number that can be divided by another number without a remainder

**numerator:** the top number in a fraction that represents the parts of the whole

**percent:** the parts per 100; represented by the symbol “%”

**portion:** the amount of food item or beverage served to an individual person

**product:** the answer to a multiplication problem

**proper fraction:** a fraction whose numerator is less than the denominator

**quotient:** the answer to a division problem

**reciprocal:** a fraction that results from switching the numerator and denominator in an existing fraction

**rounding:** reducing the places in a number to gain a specific level of accuracy

**scaling factor:** the number used to multiply all of a recipe's ingredients in order to adjust the yield of the recipe

**standardized recipe:** a recipe that has been tried, adapted, and retried several times for use by a specific school nutrition operation

**yield:** the total amount of food or beverage made from a standardized recipe

**yield percentage (YP):** the percentage found when dividing the edible-portion (EP) amount by the as-purchased (AP) amount

## Activity Answer Keys

### Lesson I

1. Solve problems adding whole numbers.
  - 4,015
  - 736
2. Solve problems subtracting whole numbers.
  - 7,367
  - 329 cases to order
3. Solve problems using multiplication of whole numbers.
  - 9,856
  - \$1,508
4. Solve problems using division of whole numbers.
  - 5
  - Each serving costs \$0.50.
5. Solve addition problems using numbers with decimals.
  - 23.08
  - \$147.28
6. Solve subtraction problems using numbers with decimals.
  - 12.08
  - \$66.97
7. Solve multiplication problems using numbers with decimals.
  - 5.8599 or 5.86
  - \$2.97
8. Solve division problems using numbers with decimals.
  - 7.4444 or 7.44
  - $18.5 \div 0.25 = 74$

9. Solve addition problems with fractions.

- $\frac{4}{5}$
- $1\frac{2}{3}$
- $1\frac{1}{2}$
- $\frac{3}{3} = 1$  cup
- $\frac{3}{4}$  cup

10. Solve subtraction problems with fractions.

- $\frac{2}{8} = \frac{1}{4}$
- $\frac{3}{5}$
- $1\frac{3}{4}$
- $\frac{1}{5}$

11. Solve fraction problems without a common denominator.

- $\frac{29}{30}$
- $1\frac{5}{8}$
- $1\frac{1}{4}$

12. Solve multiplication problems with fractions.

- $\frac{8}{27}$
- $\frac{4}{7}$
- $\frac{3}{8}$

13. Solve division problems with fractions.

- $\frac{15}{24} = \frac{5}{8}$
- $1\frac{3}{5}$
- $\frac{7}{10}$
- $\frac{24}{12} = 2$  servings
- $2\frac{2}{3}$

14. Convert decimals and fractions.

- 0.60
- $\frac{10}{100} = \frac{1}{10}$

## Lesson II

### 1. Measuring Volume and Weight

Measuring Volume and Weight		
Food Item	Tool	Volume or Weight
1 gallon beef stock	liquid measuring cup	volume
1 tablespoon salt	nested measuring spoons	volume
2 lbs of chopped carrots	scale	weight
3 cups of vegetable oil	liquid measuring cup	volume
1.5 lbs butter	scale	weight
2 teaspoons garlic powder	nested measuring spoons	volume
¼ cup cornstarch	nested measuring cups for dry ingredients	volume
6 lbs ground beef	scale	weight
1 portion-size serving of spaghetti sauce	ladle	volume

### 2. Measurement Conversion

Measurement Conversions			
Ingredient	Amount	Measurement Tool	Adjusted
<i>Example: black pepper</i>	6 teaspoons	<i>tablespoon</i>	<i>2 tablespoons</i>
flour	12 tablespoons	dry measuring cup	$\frac{3}{4}$ cup
vegetable oil	2 cups	liquid measuring cup	16 fluid ounces
water	4 cups	liquid measuring cup	1 quart
baking powder	4 tablespoons	dry measuring cup	$\frac{1}{4}$ cup

## Lesson III

### 1. Recipe Conversion

- 13 pounds of ground beef

### 2. Using the Factor Method to Increase a Recipe Yield

SUNSHINE SALAD Recipe Yield Increase to 100 Servings					
Ingredient	For 50 Servings	Quantities Converted	Scaling Factor	Calculated Amount	For 100 Servings
Lettuce, romaine	1 lb 3 oz	19 oz	2	38 oz	2 lbs 6 oz
Lettuce, green leaf	1 lb	16 oz		32 oz	2 lbs
Carrots, shredded	7 oz	7 oz		14 oz	0.88 lbs
Mandarin oranges, canned, drained	1 qt 1 cup	5 cups		10 cups	2 ½ qts
Orange juice	4 ¼ cups	4.25 cups		8.5 cups	8 ½ cups
Sugar, light brown, packed	⅓ cup	⅓ cup		⅔ cup	⅔ cup
Vanilla extract	½ tsp	½ tsp		1 tsp	1 tsp

### 3. Using the Factor Method to Decrease a Recipe Yield

TUNA SALAD Recipe Yield Decrease to 75 Servings					
Ingredient	For 100 Servings	Quantities Converted	Scaling Factor	Calculated Amount	For 75 Servings
canned chunk-style tuna	16 lbs 4 oz	260 oz	0.75	195 oz	12 lbs 3 oz
fresh onion, chopped	2 lbs 8 oz	40 oz		30 oz	1 lbs 14 oz
fresh celery	4 lbs	4 lbs		3 lbs	3 lbs
dill pickle relish	2 cups	2 cups		1.5 cups	1 ½ cups
hard-cooked eggs	16 eggs	16 eggs		12 eggs	12 eggs
low-fat mayonnaise	5 lbs 3 oz	83 oz		62.25 oz	3 lbs 14 oz

## Lesson IV

1. **Determine unit and portion costs.**
  - \$22.80
  - \$0.95
2. **Determine unit and portion cost using weight.**
  - \$3.50 per bag
  - \$0.05 per portion/serving
3. **Calculate amount of AP product to purchase.**
  - 40.32 rounded to 40.5 pounds
4. **Calculate Recipe Costs**

POWERHOUSE CHILI Recipe Yield: 100 servings			
Ingredient	Amount (100 servings)	Unit Cost	Total Cost
Fresh onions, diced	6 lbs	\$0.95/lb	\$5.70
Fresh garlic, minced	8 oz	\$6.20/lb	\$3.10
Low-sodium vegetable stock	12 ½ cups	\$3.88/qt	\$12.13
Canned low-sodium black beans drained, rinsed	12 lbs	\$1.28/lb	\$15.36
Fresh red bell peppers, diced ½"	2 lbs 8 oz	\$1.25/lb	\$3.13
Canned low-sodium diced tomatoes	11 lbs 12 oz	\$1.38/lb	\$16.22
Canned low-sodium tomato sauce	3 ½ qts	\$2.70/qt	\$9.45
Chili powder	4 oz	\$9.53/lb	\$2.38
Total Recipe Cost:			\$67.47
As-Served Portion Cost:			\$0.67





**800-321-3054**  
[www.theicn.org](http://www.theicn.org)

©2016 The Institute of Child Nutrition  
The University of Mississippi