



## 2017 Culinary Arts

Program CIP: 12.0500 – Culinary Arts

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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# Standards

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Standards are superscripted in each unit and are referenced in the appendices. Standards in the Culinary Arts Curriculum Framework and Supporting Materials are based on the following:

## **National Restaurant Association Educational Foundation**

The National Restaurant Association reaches high school students in all 50 states, Guam, the Department of Defense Education Activity schools in Europe and the Pacific.

ProStart is an industry-supported program that empowers students to achieve successful careers in the restaurant and foodservice sector. Copyright 2010 National Restaurant Association Educational Foundation. All Rights reserved.

<http://www.nraef.org/Educators/Curriculum>

## **International Society for Technology in Education Standards (ISTE)**

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## **21st Century Skills and Information and Communication Technologies Literacy Standards**

In defining 21<sup>st</sup>-century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and information and communication technology (ICT) literacy.

## **College and Career-Ready Standards**

The College and Career-Ready Standards emphasize critical thinking, teamwork and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Ready Standards (MCCRS) because they provide a consistent, clear understanding of what students are expected to learn so that teachers and parents know what they need to do to help them. Reprinted from <http://www.mde.k12.ms.us/MCCRS>

# Preface

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Secondary career and technical education programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and Every Student Succeeds Act, 2015.).

# Mississippi Teacher Professional Resources

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The following are resources for Mississippi teachers.

Curriculum, Assessment, Professional Learning, and other program resources can be found at The Research and Curriculum Unit's website: <http://www.rcu.msstate.edu>

Learning Management System: An online resource

Learning Management System information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, please call 662.325.2510.



# Executive Summary

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## **Pathway Description**

Culinary Arts is a pathway for students in the human science, art, and humanities career cluster. The following description is from the current Standard Course of Study for Career–Technical Education from the Mississippi Department of Education.

The Culinary Arts pathway program includes classroom and hands-on experiences that will prepare students for employment or continuing education in the foodservice industry. This program was written to incorporate the National Restaurant Association (NRA) ProStart learning objectives. Any student who successfully completes this program and the mentoring requirements of the NRA can take the National ProStart Certificate of Achievement exam. This is a national certification program recognized throughout the foodservice industry. Each district should implement a maximum number of students dependent on the size of each lab.

## **Industry Certification**

This program was designed to articulate to postsecondary programs in Food Production, Hotel and Restaurant Management, and Culinary Arts. Industry standards are based on the NRA ProStart certification.

## **Assessment**

The latest assessment blueprint for the curriculum can be found at <http://www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx>.

## **Student Prerequisites**

In order for students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in math (last course taken, or the instructor can specify the math)
3. Instructor approval and TABE reading score (eighth grade or higher)

**or**

1. TABE reading score (eighth grade or higher)
2. Instructor approval

**or**

1. Instructor approval

## **Applied Academic Credit**

The latest academic credit information can be found at <http://www.mde.k12.ms.us/ACCRED/AAS>.

Once there, click the “Mississippi Public School Accountability Standards Year” tab. Review the appendices for graduation options and superscript information regarding specific programs receiving academic credit.

Check this site often as it is updated frequently.

**Teacher Licensure**

The latest teacher licensure information can be found at <http://www.mde.k12.ms.us/educator-licensure>.

**Professional Learning**

If you have specific questions about the content of any of training sessions provided, please contact the Research and Curriculum Unit at 662.325.2510.

# Course Outlines

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## **Option 1—Four One-Carnegie-Unit Courses**

This curriculum consists of four one-credit courses, which should be completed in the following sequence:

- 1. Orientation to Culinary Arts – Course Code: 996002**
- 2. Theory and Applications of Culinary Arts I – Course Code: 996004**
- 3. Theory and Applications of Culinary Arts II – Course Code: 996005**
- 4. Advanced Studies in Culinary Arts – Course Code: 996006**

### **Course Description: Orientation to Culinary Arts**

Orientation to Culinary Arts includes the foundation skills necessary in the foodservice industry. Content such as food safety and sanitation; equipment, safety, and security; culinary foundations and math; and an introduction to the hospitality industry are included in the course. Mastery of the competencies listed in the food safety and sanitation unit will assist in preparing students to take the National Restaurant Association’s ServSafe exam to become ServSafe Food Safety certified.

### **Course Description: Theory and Applications of Culinary Arts I**

Theory and Applications of Culinary Arts I emphasizes the real-world, hands-on practice of food preparation. Food preparation techniques included in this course include breakfast foods, dairy, and sandwiches; fruits, vegetables, salads, and garnishes; and potatoes and grains. This one-Carnegie unit course should only be taken after students successfully pass Orientation to Culinary Arts.

### **Course Description: Theory and Applications of Culinary Arts II**

Theory and Applications of Culinary Arts II emphasizes the real-world, hands-on practice of food preparation. Food preparation techniques included in this course include desserts and baked goods; meat, poultry, and seafood; and stocks, sauces, and soups. This one-Carnegie unit course should only be taken after students successfully pass Theory and Applications of Culinary Arts.

### **Course Description: Advanced Studies in Culinary Arts**

Advanced Studies in Culinary Arts is a culminating course that places emphasis on an internship experience. While they participate in the on-the-job training, students will use skills related to management and business concepts, customer communication, and customer service.

**Orientation to Culinary Arts — Course Code: 996002**

Unit	Unit Name	Hours
1	Orientation	15
2	Food Safety and Sanitation	30
3	Safety in the Workplace	30
4	Professionalism and Utilizing Standard Recipes	30
5	Equipment and Techniques	30
Total		135

**Theory and Application of Culinary Arts I — Course Code: 996004**

Unit	Unit Name	Hours
6	Stocks, Sauces, and Soups	25
7	Fruits and Vegetables	20
8	Potatoes and Grains	20
9	Serving Your Guests	25
10	Communication	15
11	Building a Successful Career in the Industry	15
12	Overview of the Foodservice and Hospitality Industry	10
13	Management Essentials	10
Total		140

**Theory and Application of Culinary Arts II — Course Code: 996005**

Unit	Unit Name	Hours
14	Introduction	15
15	Dairy Products, Breakfast Foods, and Sandwiches	35
16	Nutrition	25
17	Salads and Garnishing	32
18	Meat, Poultry, and Seafood	33
Total		140

**Advanced Studies in Culinary Arts — Course Code: 996006**

Unit	Unit Name	Hours
19	Desserts and Baked Goods	40
20	Marketing	20
21	Sustainability in the Foodservice Industry	20
22	Purchasing, Inventory and Cost Control	20
23	Global Cuisine	20
24	Other Foodservice Certifications	20
Total		140

## Option 2—Two Two-Carnegie-Unit Courses

This curriculum consists of two two-credit courses, which should be completed in the following sequence:

1. **Culinary Arts I — Course Code: 996000**
2. **Culinary Arts II — Course Code: 996001**

### Course Description: Culinary Arts I

The foundational skills necessary in the foodservice industry are included in Culinary Arts I. Content such as food safety and sanitation; equipment, safety, and security; culinary foundations and math; and an introduction to the hospitality industry are included in the course. This course also emphasizes the real-world, hands-on practice of food preparation. Food preparation techniques included in this course include breakfast foods, dairy, and sandwiches; fruits, vegetables, salads, and garnishes; and potatoes and grains. Mastery of the competencies listed in this unit will prepare the student to take the NRA’s ServSafe exam to become ServSafe Food Safety certified.

### Course Description: Culinary Arts II

Culinary Arts II emphasizes the hands-on practice of food preparation. The food preparation techniques in this course include desserts and baked goods; meat, poultry, and seafood; and stocks, sauces, and soups. This course also places emphasis on an internship experience. While they participate in on-the-job training, students will use skills related to management and business concepts, customer communication, and customer service. This course should only be taken after students successfully pass Culinary Arts I.

### Culinary Arts I —Course Code 996000

Unit	Unit Name	Hours
1	Orientation	15
2	Food Safety and Sanitation	30
3	Safety in the Workplace	30
4	Professionalism and Utilizing Standard Recipes	30
5	Equipment and Techniques	30
6	Stocks, Sauces, and Soups	25
7	Fruits and Vegetables	20
8	Potatoes and Grains	20
9	Serving Your Guests	25
10	Communication	15
11	Building a Successful Career in the Industry	15
12	Overview of the Foodservice and Hospitality Industry	10
13	Management Essentials	10
Total		275

**Culinary Arts II —Course Code: 996001**

Unit	Unit Name	Hours
14	Introduction	15
15	Dairy Products, Breakfast Foods, and Sandwiches	35
16	Nutrition	25
17	Salads and Garnishing	32
18	Meat, Poultry, and Seafood	33
19	Desserts and Baked Goods	40
20	Marketing	20
21	Sustainability in the Foodservice Industry	20
22	Purchasing and Inventory, and Cost Control	20
23	Global Cuisine	20
24	Other Foodservice Certifications	20
Total		280

# Research Synopsis

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## Introduction

Students who successfully master the curriculum should have the skills required to take the National Restaurant Association’s exam, which is based on industry-validated performance indicators. In addition, students should be prepared to take the Mississippi Culinary Arts exams through the Mississippi Department of Education and also to complete the requirements and take the certification test to become ServSafe-certified on a national level.

## Needs of the Future Workforce

Data for this synopsis were compiled from employment projections prepared by the U.S. Census Bureau, the U.S. Bureau of Labor Statistics (2010), and the Mississippi Department of Employment Security (2011).

Table 1.1: Current and Projected Occupation Report

Occupation	Employment		Projected Growth 2010-2020		Average Wage 2015	
	Current (2010)	Projected (2020)	Number	Percent	Hourly	Annual
Cooks, Restaurant	6,940	7,350	410	5.9	\$10.28	\$21,380
Cooks, Institution and Cafeteria	5,880	6,240	360	6.1	\$9.01	\$18,740
Cooks, All Other	410	450	40	9.8	\$9.95	\$20,690
Food Preparation Workers	15,320	16,300	980	6.4		
First-Line Supervisors of Food Preparation and Serving Workers	8,260	8,610	350	4.2	\$12.84	\$26,710
Combined Food Preparation and Serving Workers, Including Fast Food	9,250	10,070	820	8.9	\$8.51	\$17,710

Source: Mississippi Department of Employment Security ([www.mdes.ms.gov](http://www.mdes.ms.gov)).

## Perkins IV Requirements

The Culinary Arts curriculum meets Perkins IV requirements for high-skill, high-wage, and/or high-demand occupations by introducing students to and preparing students for occupations. It offers students a program of study, including secondary, postsecondary, and IHL courses, that will prepare them for occupations in these fields. The Culinary Arts curriculum also focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

## **Curriculum Content**

### **Summary of Standards**

The standards included in the Culinary Arts curriculum are the National Restaurant Association Educational Foundation Standards, 21st Century Skills, and the National Educational Technology Standards (NETS) for Students. Combining these standards to create this document will result in highly skilled, well-rounded students who are prepared to enter a secondary academic or career and technical program of study. They will also be prepared to compete nationally in academics because the standards are designed to prepare students for success in community colleges, institutions of higher learning, and careers.

### **Transition to Postsecondary Education**

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website: <http://www.mccb.edu/>.



## **Best Practices**

### *Innovative Instructional Technologies*

Recognizing that today's students are digital learners, the classroom should be equipped with tools that will teach them in the way they need to learn. The Culinary Arts teacher's goal should be to include teaching strategies that incorporate current technology. It is suggested that each classroom house a set of desktop student computers and one teacher laptop. To make use of the latest online communication tools, such as wikis, blogs, and podcasts, the classroom teacher is encouraged to use a learning management system, (e.g., the Culinary Arts Teacher Canvas Content Management System) that introduces students to education in an online environment and places the responsibility of learning on the student.

### *Differentiated Instruction*

Students learn in a variety of ways. Some are visual learners, needing only to read information and study it to succeed. Others are auditory learners, thriving best when information is read aloud to them. Still others are tactile learners, needing to participate actively in their learning experiences. Add the student's background, emotional health, and circumstances, and a very unique learner emerges. To combat this, the Culinary Arts curriculum is written to include several instructional methods using the Understanding by Design approach. This method of instructional design leads students to a deeper understanding of course material and provides multiple opportunities for students to succeed in different ways. Many activities are graded by rubrics that allow students to choose the type of product they will produce. By providing various teaching and assessment strategies, students with various learning styles can succeed.

### *Career and Technical Education Student Organizations*

Teachers should investigate opportunities to sponsor a student organization. There are several in Mississippi that will foster the types of learning expected from the Culinary Arts curriculum. The Family, Career, and Community Leaders of America (FCCLA) is a student organization for Culinary Arts. The FCCLA provides students with growth opportunities and competitive events. It also opens the doors to the world of Culinary Arts and scholarship opportunities.

### *Cooperative Learning*

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Culinary Arts curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Culinary Arts curriculum provides opportunities for students to work together and help each other complete complex tasks.

## **Conclusions**

Culinary Arts is one of Mississippi's most comprehensive curricula. Students who complete these programs are well-equipped for a variety of endeavors. Instructors are urged to encourage Culinary Arts students to pursue educational opportunities at community colleges and universities in Mississippi.

# Professional Organizations

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## **American Association of Family and Consumer Science - AAFCS**

400 North Columbus Street, Suite 202  
Alexandria, VA 22314  
(703) 706-4600  
<http://www.aafcs.org/>

## **American Culinary Federation**

180 Center Place Way  
St. Augustine, FL 32095  
Toll Free: (800) 624-9458  
Local: (904) 824-4468  
Fax: (904) 825-4758  
<http://www.acfchefs.org/>

## **Association for Supervision and Curriculum Development - ASCD**

1703 North Beauregard Street  
Alexandria, VA 22311-1714  
(800) 933-ASCD  
<http://www.ascd.org>

## **Association for Career and Technical Education - ACTE**

1410 King Street  
Alexandria, VA 22314  
(800) 826-9972  
<http://www.acteonline.org>

## **Family, Career, and Community Leaders of America - FCCLA**

1910 Association Drive  
Reston, VA 20191-1584  
(703) 476-4900  
<http://www.fcclainc.org/>

## **Mississippi Association for Career and Technical Education - MSACTE**

<http://www.mississippiacte.com/>

## **Mississippi Association of Family and Consumer Sciences**

<http://www.mafcs.com/index.html>

## **Mississippi Association for Supervision and Curriculum Development - MASCD**

P.O. Box 13576  
Jackson, MS 39236  
(601) 591-2210  
<http://www.mascd.com>

**Mississippi Department of Education - MDE**

Office of Vocational Education and Workforce Development

P.O. Box 771

Jackson, MS 39205

(601) 359-3940

<http://www.mde.k12.ms.us/vocational/news/>

**National Restaurant Association Educational Foundation - NRAEF**

175 West Jackson Boulevard, Suite 1500

Chicago, IL 60604-2814

(800) 765-2122

<http://www.nraef.org/>

**SkillsUSA Inc.**

14001 SkillsUSA Way

Leesburg, VA 20176-5494

(703) 777-8810

<http://www.skillsusa.org>

**DECA Inc.**

1908 Association Dr.

Reston, VA 20191

(703) 860-5000

[info@deca.org](mailto:info@deca.org)

<http://www.deca.org>

# Using This Document

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## **Suggested Time on Task**

This section indicates an estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75–80% of the time in the course.

## **Competencies and Suggested Objectives**

A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

## **Integrated Academic Topics, 21st Century Skills and Information and Communication Technology Literacy Standards, ACT College Readiness Standards, and Technology Standards for Students**

This section identifies related academic topics as required in the Subject Area Testing Program (SATP) in Algebra I, Biology I, English II, and U.S. History from 1877, which are integrated into the content of the unit. Research-based teaching strategies also incorporate ACT College Readiness standards. This section also identifies the 21st Century Skills and Information and Communication Technology Literacy skills. In addition, national technology standards for students associated with the competencies and suggested objectives for the unit are also identified.

## **References**

A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested, and the list may be modified or enhanced based on needs and abilities of students and on available resources.

# Unit 1: Orientation

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## Competencies and Suggested Objectives

1. Identify school and program policies and procedures, and compare/contrast them with industry policies and procedures. <sup>DOK 1</sup>
  - a. Discuss the school handbook and all safety procedures for classroom and building levels.
  - b. Preview local program and vocational center policies and procedures, including dress code, attendance, acceptable use of technology, academic requirements, discipline, shop/lab rules and regulations, and transportation regulations.
  - c. Describe, define, and illustrate general safety rules for working in a shop/lab, and explain how they relate to the law and public safety industry.
  - d. Give a brief overview of the course, why it is important for students to know the content of the course, and how it will be delivered.
  - e. Preview course objectives and the industry standards.
2. Identify career and leadership opportunities in the culinary industry. <sup>DOK 1, NRAEF 1-1.7</sup>
  - a. Investigate career opportunities in the culinary industry, including communication writers, food stylists, marketers, research and development, food science, sales, dietitians, food production, food processing, accounting, entrepreneurs, trainers, and grocery store and deli managers.
  - b. Investigate the occupational outlook and salaries for culinary careers according to current and future trends.
  - c. Discuss the difference between school and workplace environments.
  - d. Explore leadership opportunities available from student youth and industry organizations.
3. Explore opportunities provided by student organizations, including SkillsUSA, DECA, and FCCLA. <sup>DOK 1</sup>
  - a. Identify leadership and personal development skills.
  - b. Identify and practice effective communication concerning verbal, non-verbal, writing, and technology skills.
  - c. Work as a team to design a community service project in which the knowledge and skills learned in the course can be used to improve the lives of others.

## Unit 2: Food Safety and Sanitation

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<b>Competencies and Suggested Objectives</b>	
1. Discuss and relate the importance of food safety. <sup>DOK1, NRAEF 1-2.1</sup>	<ol style="list-style-type: none"><li>Describe a foodborne illness outbreak and associated costs.</li><li>Identify the populations at highest risk for getting a foodborne illness.</li><li>List the conditions under which bacteria can multiply rapidly, and use the letters FAT-TOM.</li><li>Give examples of temperature control for safety (TCS) foods.</li><li>Define biological, chemical, and physical contamination of food.</li><li>Identify the proper storage of chemicals.</li><li>List common food allergens, including peanuts, tree nuts, eggs, shellfish, milk, wheat, soy, and fish, as well as methods for preventing these.</li></ol>
2. Describe the importance of good personal hygiene. <sup>DOK1, NRAEF 1-2.2</sup>	<ol style="list-style-type: none"><li>Determine personal behaviors that can contaminate food.</li><li>Describe the steps to proper handwashing.</li><li>Describe appropriate work attire for the foodservice industry.</li><li>Outline ways to handle ready-to-eat food.</li><li>List the reasons why an employee would be prevented from working with food or in food operations.</li></ol>
3. Analyze the flow of food through a foodservice establishment. <sup>DOK1, NRAEF 1-2.3</sup>	<ol style="list-style-type: none"><li>Distinguish between situations in which contamination and cross-contamination can occur.</li><li>Explain how time and temperature guidelines can reduce the growth of microorganisms.</li><li>Differentiate between different types of thermometers.</li><li>Outline proper procedures for receiving, storing, preparing, cooking, holding, cooling, reheating, and serving food, including use of proper tools and equipment.</li></ol>
4. Identify the importance of a hazard analysis critical control points (HACCP) system. <sup>DOK1, NRAEF 1-2.4</sup>	<ol style="list-style-type: none"><li>List the seven major steps in an HACCP system.</li></ol>
5. Maintain a clean and sanitary kitchen. <sup>DOK1, NRAEF 1-2.5</sup>	<ol style="list-style-type: none"><li>Define the difference between clean and sanitary.</li><li>Identify the procedures for cleaning and sanitizing tools and equipment, including washing, rinsing, and sanitizing.</li><li>Define National Sanitation Foundation (NSF) and Underwriters Laboratories (UL) labels.</li><li>Describe an Integrated Pest Management (IPM) program.</li></ol>

## Unit 3: Safety in the Workplace

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<b>Competencies and Suggested Objectives</b>	
1. Analyze how vital workplace safety is to customers and employees. <small>DOK2, NRAEF 1-3.1</small>	
a. Discuss the legal responsibility of the Occupational Safety and Health Administration (OSHA) and why it is important.	
b. Describe the hazard communication standard requirements for employers.	
c. Define the material safety data sheets.	
d. Demonstrate ways to use Personal Protection Equipment (PPE) to prevent injuries.	
e. Evaluate procedures to implement emergency plans.	
2. Implement safe work habits to prevent injuries (ongoing). <small>DOK2, NRAEF 1-3.2</small>	
a. Classify the types of fires (A, B, C) and the procedures to extinguish a fire (PASS).	
b. Describe hazards that contribute to injury due to slips, trips, or falls and the procedures for cleaning up spills.	
c. Demonstrate the proper use of ladders, the proper lifting and carrying procedures to avoid injury, and the correct and safe use of knives, including handling, walking, passing, washing, and storing.	
3. Explain emergency techniques and procedures. <small>DOK1, NRAEF 1-3.3</small>	
a. Describe basic first-aid concepts and procedures for choking, cuts, burns, and strains.	

## Unit 4: Professionalism and Utilizing Standard Recipes

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<b>Competencies and Suggested Objectives</b>	
1. Identify the attributes and duties of a culinary professional. <small>DOK1, NRAEF 1-4.1</small>	
a. List the attributes of a professional culinarian, including work ethic, knowledge, skill, flavor, aroma, taste, judgment, dedication, pride, respect, personal responsibility, and education.	
b. Define the kitchen brigade and the dining room brigade systems.	
2. Apply basic mathematical calculations to basic food preparation skills. <small>DOK2, NRAEF 1-4.2</small>	
a. Given a culinary recipe, add, subtract, multiply, and divide using basic math operations.	
b. Identify the components of a standardized recipe.	
c. List the common equivalents of weights and measures, including 3 tsp = 1 tbsp, 16 tbsp = 1 c, 8 oz = 1 c, 16 oz = 1 lb, and all gallon equivalents.	
d. Convert a standardized recipe to smaller and greater quantities.	
e. Identify the difference between weight and volume.	
f. Calculate amounts for as purchased (AP) and edible portion (EP).	
g. Calculate recipe cost, including total cost and cost per serving.	
3. Identify the items included in a standardized recipe and why restaurants use them. <small>DOK1, NRAEF 1-4.4</small>	



# Unit 5: Equipment and Techniques

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<b>Competencies and Suggested Objectives</b>	
1. Demonstrate the use and maintenance of culinary equipment. <small>DOK1, NRAEF 1-5.1</small>	
a. Identify different types of knives and demonstrate basic knife cuts (e.g., mince, dice, and julienne), safety, and maintenance.	
b. Identify knives and their parts used in the foodservice industry, including boning, chef's, oyster, serrated, paring, and tourné.	
c. Identify hand tools and small equipment, including cheesecloth, tongs, colander, china cap, wire whip, zester, rubber spatula, offset spatula, skimmer, and Parisienne scoop.	
d. Identify measuring utensils used in the foodservices industry, including a balance scale, dry measuring cups, liquid measuring cups, measuring spoons, and ladle.	
e. Identify pots and pans, including boiler, double boiler, stock pot, hotel pan, sheet pan, sauté pan, and spring form pan.	
f. Identify food preparation equipment, including mixer and attachments (e.g., flat paddle, wire whip, and dough hook), mandolin, food processor, salamander, deep fat fryer, conventional oven, convection oven, and microwave oven.	
g. List kitchen equipment needed for serving and holding food, including bain-marie, chaffing dish, coffee machine, steam table, and ice machine.	
2. Define basic food-preparation techniques. <small>DOK1, NRAEF 1-5.2, NRAEF 1-5.3</small>	
a. Identify the dry-heat cooking methods.	
b. Identify the moist-heat cooking methods.	
c. Identify the combination-cooking methods.	
d. Describe the importance of a garnish.	
e. Define mise en place.	
f. Define spices and herbs.	
3. Discuss the importance of nutrition in food preparation. <small>DOK1, NRAEF 1-5.4</small>	
a. Describe a healthy diet.	
b. Differentiate between types of vegetarian diets.	
c. Interpret information on a nutrition label.	

## Unit 6: Stocks, Sauces, and Soups

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<b>Competencies and Suggested Objectives</b>	
1. Identify and prepare stocks. <small>DOK2, NRAEF 1-6.1</small>	<ol style="list-style-type: none"><li>a. Identify the four essential parts of stock and the proper ingredients for each.</li><li>b. List the ways to properly cool and degrease stock.</li><li>c. Identify the three ways to prepare bones for stock, including blanching, browning, and sweating.</li></ol>
2. Identify and prepare sauces. <small>DOK2, NRAEF 1-6.7</small>	<ol style="list-style-type: none"><li>a. Identify the grand sauces, including béchamel, espagnole, tomato, hollandaise, and veloute.</li><li>b. Identify common thickeners for sauces, including roux, slurry, and beurre manie.</li><li>c. Define liaison and tempering as it relates to making a sauce.</li><li>d. Define compound butter, coulis, au jus, and salsa.</li></ol>
3. Identify and prepare soups. <small>DOK2, NRAEF 1-6.11</small>	<ol style="list-style-type: none"><li>a. Identify and give examples of the two basic kinds of soups.</li><li>b. Define a consommé and a puree soup.</li></ol>

# Unit 7: Fruits and Vegetables

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<b>Competencies and Suggested Objectives</b>
1. Discuss the storage and preparation of fruits. <small>DOK1, NRAEF 1-9.1, NRAEF 1-9.2</small> <ol style="list-style-type: none"><li>Identify the types and market forms of fruits.</li><li>List and explain the USDA quality grades for fresh fruit.</li><li>Define enzymatic browning.</li></ol>
2. Discuss the storage and preparation of vegetables. <small>DOK1, NRAEF 9.4, NRAEF 1-9.8</small> <ol style="list-style-type: none"><li>Identify the types and market forms of vegetables.</li><li>List and explain the USDA quality grades for fresh vegetables, including hydroponic vegetables.</li></ol>

## Unit 8: Potatoes and Grains

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<b>Competencies and Suggested Objectives</b>	
1. Discuss the storage and preparation of potatoes.	DOK1, NRAEF 1-11.1, NRAEF 1-11.2
a. Outline methods to select, receive, and store potatoes.	
b. Identify and describe a russet (Idaho), chef, new potato, and sweet potato.	
c. Define latkes.	
2. Discuss the storage and preparation of legumes and grains.	DOK1, NRAEF 1-11.5, NRAEF 1-11.6
a. Outline methods to select, receive, and store legumes and grains.	
b. Define the parts of a grain.	
c. Define pilaf and risotto.	
d. Define legumes.	
3. Discuss the storage and preparation of pasta and dumplings.	DOK1, NRAEF 1-11.7, NRAEF 1-11.8, NRAEF 1-11.9
a. Outline methods to select, receive, and store pasta and dumplings.	
b. List the ingredients used to make a basic pasta and the importance of the resting stage.	
c. Define al dente.	
d. Define gnocchi and spaetzle.	

# Unit 9: Serving Your Guests

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<b>Competencies and Suggested Objectives</b>	
1. Analyze the importance of service to the culinary industry. <small>DOK2, NRAEF 1-10.1, NRAEF 1-10.2</small>	
a. Identify the characteristics of good service, including first impressions and anticipating customers' special needs.	
2. Discuss measures of a positive dining experience. <small>DOK1, NRAEF 1-10.4, NRAEF 1-10.8, NRAEF 1-10.9</small>	
a. Identify and describe greeting and taking guests' orders.	
b. Demonstrate suggestive selling techniques.	
c. Identify and describe professional alcohol service.	
d. Identify and describe processing payments.	
e. Identify and describe effective ways to get feedback on customer satisfaction.	
3. Identify service styles and setup in the foodservice industry. <small>DOK1, NRAEF 1-10.12, NRAEF 1-10.13</small>	
a. Demonstrate the similarities and differences among American, French, English, Russian, and contemporary service styles.	
b. Demonstrate setting and clearing items properly for table service.	

# Unit 10: Communication

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<b>Competencies and Suggested Objectives</b>
1. Identify positive communication skills. <small>DOK1, NRAEF 1-7.1, NRAEF 1-7.2</small> <ol style="list-style-type: none"><li>Identify effective communication skills.</li><li>Identify the barriers to effective communication.</li></ol>
2. Demonstrate positive communication skills. <small>DOK1, NRAEF 1-7.6, NRAEF 1-7.9</small> <ol style="list-style-type: none"><li>Define verbal and nonverbal communication.</li><li>Model proper and courteous telephone skills through demonstrations.</li><li>List and demonstrate effective writing skills.</li><li>Define interpersonal communication.</li></ol>

# Unit 11: Building a Successful Career in the Industry

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## Competencies and Suggested Objectives

1. Formulate a plan for an effective job search, and prepare business-related documents. <sup>DOK2,</sup>  
NRAEF 1-12.1, NRAEF 1-12.2, NRAEF 1-12.3
  - a. Create an effective one-page résumé.
  - b. Define the purpose of a portfolio.
  - c. Define the purpose of a cover letter.
  - d. Complete job, college, and scholarship application forms.
  - e. Define a resignation letter.
2. Understand issues in the culinary field. <sup>DOK1, NRAEF 1-12.18</sup>
  - a. Research employment opportunities through various outlets, such as the WIN Job Center, Monster.com, and MississippiWorks.org.

# Unit 12: Overview of the Foodservice and Hospitality Industry

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## Competencies and Suggested Objectives

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| <p>1. Research the history of the foodservice industry. <small>DOK1, NRAEF 1-1.3, NRAEF 1-1.4, NRAEF 1-1.5, NRAEF 1-1.7</small></p> <ul style="list-style-type: none"><li>a. List the segments of the restaurant industry, including commercial and noncommercial.</li><li>b. Describe the significant culinary contributions of Escoffier, Boulanger, and Catherine de Medici.</li><li>c. Identify influential entrepreneurs and restaurants in the foodservice industry, including Julia Child, Boulanger, Fred Harvey, the Delmonico Brothers, Walter Scott, Roy Allen and Frank Wright, White Castle, McDonald's, and Pizza Hut.</li></ul> |
| <p>2. Investigate career opportunities in the foodservice industry. <small>DOK 1, NRAEF 1-1.2</small></p> <ul style="list-style-type: none"><li>a. Categorize the types of businesses that make up the tourism industry, including caterers, stadiums, retailers, convention centers, theme parks, schools and universities, and shopping.</li><li>b. Identify the difference between front-of-the-house and back-of-the-house jobs.</li></ul>   |



# Unit 13: Management Essentials

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<b>Competencies and Suggested Objectives</b>	
1. Analyze the importance of working together in the culinary industry. <sup>DOK1, NRAEF 1-8.1</sup>	
a. Explain how stereotypes and prejudices can negatively affect how people work together.	
b. Explain how diversity can have a positive effect in the workplace and how diversity can be promoted.	
c. Define harassment in the workplace.	
2. Identify the attributes of a successful leader in the culinary industry. <sup>DOK1, NRAEF 1-8.9</sup>	
a. Define ethics and business ethics.	
b. Define characteristics of good leadership.	
c. Explore organizational goals and why they should be Specific, Measurable, Achievable, Relevant, Time bound (SMART).	
3. Analyze the importance of interviewing and orientation to the culinary industry. <sup>DOK1, NRAEF 1-8.21, NRAEF 1-8.22</sup>	
a. Discuss job descriptions.	
b. Differentiate between exempt and nonexempt employees.	
c. Describe labor laws as they apply to lawful hiring practices.	
d. Discuss legal and illegal questions during an interview.	
4. Analyze skills related to training and evaluation. <sup>DOK1, NRAEF 1-8.26, NRAEF 1-8.27</sup>	
a. Analyze the benefits of cross-training, effective group training, and on-the-job training.	
b. Define a Point of Sale (POS) system.	

## Unit 14: Introduction

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<b>Competencies and Suggested Objectives</b>
1. Discuss the policies and procedures of the local school and of working in local business and industries.
2. Investigate career opportunities, and research local careers in the food industry. <sup>DOK1, NRAEF 1-8.7</sup>
3. Identify leadership skills needed in the foodservice industry. <sup>DOK1, NRAEF 1-8.9</sup>

# Unit 15: Dairy Products, Breakfast Foods, and Sandwiches

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## Competencies and Suggested Objectives

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| <p>1. Demonstrate preparation and handling of dairy products and eggs. <small>DOK1, NRAEF 2-1.1, NRAEF 2-1.2, NRAEF 2-1.3</small></p> <ul style="list-style-type: none"><li>a. Explain how to keep milk products safe and sanitary.</li><li>b. Define homogenization and pasteurization.</li><li>c. Identify the role of fat in milk products, including flavor, body, and mouth feel.</li><li>d. Define lactose intolerance.</li><li>e. Define cream.</li><li>f. Differentiate between butter, butter substitutes, and margarine.</li><li>g. Define ripened and unripened cheese.</li><li>h. Identify the grades and sizes of eggs and the parts of an egg.</li><li>i. Define quiche, hard-cooked egg, poached egg, shirred egg, soufflé, and omelet.</li></ul> |
| <p>2. Identify breakfast foods and drinks. <small>DOK1, NRAEF 2-1.6, NRAEF 2-1.7, NRAEF 2-1.8</small></p> <ul style="list-style-type: none"><li>a. Differentiate between pancakes and crepes.</li><li>b. Identify the most common breakfast meats, including ham, sausage, and bacon.</li><li>c. Identify the brewing and holding temperatures for preparing coffee and tea.</li></ul>   |
| <p>3. Identify the two categories of sandwiches. <small>DOK1, NRAEF 2-1.10, NRAEF 2-1.11, NRAEF 2-1.12</small></p> <ul style="list-style-type: none"><li>a. List the three parts of a sandwich: bread, spread, and filling.</li><li>b. Define kinds of sandwiches, including open-faced, hor d'oeuvres, grilled, deep fried, multi-decker, tea sandwiches, and wraps.</li></ul>  |

# Unit 16: Nutrition

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## Competencies and Suggested Objectives

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| <p>1. Discuss the components of a healthy diet. <small>DOK1, NRAEF 2-2.1, NRAEF 2-2.3, NRAEF 2-2.4</small></p> <ul style="list-style-type: none"><li>a. Define phytochemicals and fiber and the role they play in the function of the body.</li><li>b. Identify the two types of carbohydrates and food sources of each.</li><li>c. Identify and discuss the role of nutrients, including carbohydrates, lipids, proteins, vitamins, minerals, and water.</li><li>d. Define cholesterol and food sources.</li><li>e. Define protein and food sources.</li><li>f. Identify the three major vegetarian diets (i.e., vegan, lacto-vegetarian, and lacto-ovo vegetarian).</li><li>g. List the fat-soluble vitamins (A, D, E, and K) and water-soluble vitamins (B and C) and the function of water and minerals in the body.</li><li>h. Define food additives and the role they play in food.</li></ul> |
| <p>2. Describe components of a nutritious menu. <small>DOK1, NRAEF 2-2.15, NRAEF 2-2.16</small></p> <ul style="list-style-type: none"><li>a. Identify ways to modify a recipe to make it more healthy and nutritious (e.g., reducing fat, salt, or refined sugar).</li><li>b. Define the criteria for food to be called organic (i.e., no pesticides and no growth hormones).</li></ul>   |

# Unit 17: Salads and Garnishing

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## Competencies and Suggested Objectives

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| 1. Evaluate various types of salads. <small>DOK1, NRAEF 2-4.1, NRAEF 2-4.2, NRAEF 2-4.3</small> <ol style="list-style-type: none"><li>Identify the four parts of a salad (base, body, dressing, and garnish) and their roles.</li><li>List and define the five types of salads, including green, bound, vegetable, fruit, and combination.</li><li>List the five ways a salad can be offered on a menu, including starter, accompaniment, main course, intermezzo, and dessert.</li><li>Describe how to appropriately clean and store salad ingredients.</li></ol> |
| 2. Identify salad dressings. <small>DOK1, NRAEF 2-4.8, NRAEF 2-4.9, NRAEF 2-4.10</small> <ol style="list-style-type: none"><li>Define vinaigrette, suspension, emulsifier, and mayonnaise-based dressings.</li><li>Define guacamole, salsa, and hummus.</li></ol>  |
| 3. Identify appropriate garnishing techniques. <small>DOK1, NRAEF 2-4.13, NRAEF 2-4.14, NRAEF 2-4.15</small> <ol style="list-style-type: none"><li>Describe the importance of a garnish and how it is used.</li><li>Define napping and dollop.</li><li>List common ingredients used to garnish soups and desserts (e.g., carrots, tomato, lemon, or chocolate).</li></ol>  |

# Unit 18: Meat, Poultry, and Seafood

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<b>Competencies and Suggested Objectives</b>	
1. Identify quality meat products. <small>DOK1, NRAEF 2-6.1, NRAEF 2-6.2, NRAEF 2-6.3</small>	<ol style="list-style-type: none"><li>a. Outline the federal inspection and grading systems for meat, including prime, choice, and select.</li><li>b. Define meats, including beef, veal, lamb, and pork.</li><li>c. Define primal cuts, retail cuts, ageing, and fabrication (e.g., butterflying).</li><li>d. Define offal and game meat, marbling, marinating, and dry rubs.</li><li>e. Identify the factors that go into purchasing and receiving meat, including color, texture, odor, packaging, and freezer burn.</li></ol>
2. Identify a quality poultry product. <small>DOK1, NRAEF 2-6.6, NRAEF 2-6.7, NRAEF 2-6.8</small>	<ol style="list-style-type: none"><li>a. Outline the federal inspection and grading systems for poultry.</li><li>b. Define poultry, including chicken, turkey, duck, goose/guinea, pigeon, and dove.</li><li>c. Define á point, truss, and opaque.</li><li>d. Outline the forms of poultry (e.g., white and dark meat) and the guidelines for purchasing, fabricating, and storing poultry.</li></ol>
3. Identify a quality seafood product. <small>DOK1, NRAEF 2-6.13, NRAEF 2-6.14, NRAEF 2-6.15</small>	<ol style="list-style-type: none"><li>a. List the grading factors for seafood, including appearance, blemishes, color, dehydration, flavor, odor, texture, and uniformity.</li><li>b. Differentiate between the two categories of seafood (i.e., fin fish and shellfish).</li><li>c. Define the difference between flat fish and round fish.</li><li>d. Define shellfish, crustaceans, mollusks, and cephalopods.</li><li>e. Outline the forms of fin fish, including whole, drawn, dressed, fillet, butterfly fillet, and steak.</li><li>f. List the characteristics required to accept fresh fin fish, including color, texture, odor, eyes, and packaging.</li><li>g. List the characteristics required to accept shellfish (e.g., condition, smell, and shells) or reject shellfish (e.g., condition, odor, texture, shells, and freezer burn).</li><li>h. Identify the purpose of the shellfish identification tag and the temperature at which live shellfish can be received.</li><li>i. Define bouillabaisse.</li></ol>
4. Identify charcuterie and garde manger. <small>DOK1, NRAEF 2-6.19, NRAEF 2-6.20</small>	<ol style="list-style-type: none"><li>a. Define charcuterie and garde manger.</li></ol>

# Unit 19: Desserts and Baked Goods

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<b>Competencies and Suggested Objectives</b>	
1. Describe bakeshop basics. <small>DOK1, NRAEF 2-8.1, NRAEF 2-8.6</small>	<ol style="list-style-type: none"><li>List the components required to create a baked product, including strengtheners, fats/shortenings, sweeteners, flavorings, leaveners, thickeners, liquids, and additives.</li><li>Describe the four most common types of leaveners, including baking soda, baking powder, yeast, and physical leaveners.</li><li>Define baking formula (vs. recipe).</li></ol>
2. Describe working with yeast breads. <small>DOK1, NRAEF 2-8.7</small>	<ol style="list-style-type: none"><li>Outline the types of yeast bread dough (e.g., lean and rich).</li><li>Define proofing and kneading.</li></ol>
3. Describe the characteristics of quick breads and cake batters. <small>DOK1, NRAEF 2-8.8</small>	<ol style="list-style-type: none"><li>Define quick breads and cake batters.</li><li>Outline the three basic purposes for icing, including improving and keeping quality, flavor and richness, and appearance.</li><li>Identify steamed puddings and soufflés.</li></ol>
4. Describe the methods of making pies and cookies. <small>DOK1, NRAEF 2-8.11, NRAEF 2-8.12</small>	<ol style="list-style-type: none"><li>Describe the 3-2-1 method and baking blind.</li><li>Identify the most common types of cookies, including bagged, bar, dropped, icebox, molded, rolled, and sheet.</li></ol>
5. Describe characteristics of working with chocolate. <small>DOK1, NRAEF 2-8.15</small>	<ol style="list-style-type: none"><li>Define tempering and bloom.</li></ol>
6. Describe specialty desserts. <small>DOK1, NRAEF 2-8.18</small>	<ol style="list-style-type: none"><li>Define torte and coulis.</li></ol>

# Unit 20: Marketing

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## Competencies and Suggested Objectives

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| 1. Identify marketing principles. <small>DOK1, NRAEF 2-7.1, NRAEF 2-7.2, NRAEF 2-7.5</small> <ol style="list-style-type: none"><li>Define marketing.</li><li>Define target market and how they relate to the foodservice industry.</li><li>Define Strength, Weaknesses, Opportunities, and Threats (SWOT) analysis.</li></ol>   |
| 2. Identify marketing segments. <small>DOK1, NRAEF 2-7.8</small> <ol style="list-style-type: none"><li>Outline the basic types of research methods used to gather marketing information.</li><li>Define types of market segmentation, including demographic, geographic, product usage, and lifestyle segmentation.</li></ol>   |
| 3. Utilize the menu as a marketing tool. <small>DOK1, NRAEF 2-7.13, NRAEF 2-7.14, NRAEF 2-7.15</small> <ol style="list-style-type: none"><li>Define á la carte, du jour, cyclical, limited, fixed, California, prix fixe, and table d'hôte.</li><li>List the most common order of food items on a menu, including appetizers, soups, salads, sandwiches, entrees, vegetables, desserts, and beverages.</li><li>Define food cost percentage method to determine a menu price (item food cost ÷ food cost % = menu price).</li><li>List the four categories of menu items, including star, plow horse, puzzle, and dog.</li></ol> |



## Unit 21: Sustainability in the Foodservice Industry

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<b>Competencies and Suggested Objectives</b>	
1. Describe sustainability and water conservation in the foodservice industry. NRAEF 2-9.2	DOK1, NRAEF 2-9.1,
a. Define sustainability and conservation.	
2. Describe energy conservation.	DOK1, NRAEF 2-9.4, NRAEF 2-9.5, NRAEF 2-9.6
a. Define renewable and nonrenewable energy sources.	
3. Describe waste management in the foodservice industry. NRAEF 2-9.10	DOK1, NRAEF 2-9.8, NRAEF 2-9.9, NRAEF 2-
a. Define recycle, compost, reduce, and reuse.	

# Unit 22: Purchasing, Inventory, and Cost Control

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## Competencies and Suggested Objectives

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| <p>1. Examine the purchasing process. <small>DOK1, NRAEF 2-5.1, NRAEF 2-5.2, NRAEF 2-5.3, NRAEF 2-5.6</small></p> <ul style="list-style-type: none"><li>a. List the channels of distribution in purchasing (i.e., primary, intermediary, and retailer).</li><li>b. Explain the relationship between primary and intermediary sources and retailers.</li><li>c. Explain the importance of dealing with ethical suppliers, including approved suppliers, kickbacks, and the bid and quote processes.</li><li>d. Define product specifications, make-or-buy analysis, purchase orders, credit memos, and requisitions.</li><li>e. Define perishable products, inventory, staples, pilfering, and par stock.</li><li>f. Identify factors that affect food costs when purchasing, including seasonal, quantities, form, local, and as-needed.</li></ul> |
| <p>2. Control food costs. <small>DOK2, NRAEF 2-3.13, NRAEF 2-3.15, NRAEF 2-3.16</small></p> <ul style="list-style-type: none"><li>a. List the types of costs in food service, including food, beverage, labor, and overhead.</li><li>b. Define revenue and invoices.</li><li>c. Determine food-cost percentage (total food cost ÷ sales = food cost %).</li><li>d. Calculate Edible-portion (EP) and As-purchased (AP) portion amounts.</li><li>e. Explain how portion control directly affects food costs, and give examples of portion control devices (e.g., scoops, ladles, and portion scales).</li><li>f. Calculate how to increase or decrease a recipe's yield.</li><li>g. Calculate a menu price using the food cost percentage method.</li></ul>   |
| <p>3. Control labor costs. <small>DOK2, NRAEF 2-3.20, NRAEF 2-3.21</small></p> <ul style="list-style-type: none"><li>a. List the factors that affect labor costs, including business volume, employee turnover, quality standards, and operational standards.</li><li>b. Define master and crew schedule.</li></ul>  |

# Unit 23: Global Cuisine

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<b>Competencies and Suggested Objectives</b>	
1. Describe the cuisines of North America. <small>DOK1, NRAEF 2-10.1, NRAEF 2-10.2, NRAEF 2-10.3, NRAEF 2-10.4</small>	
a. Define New England boiled dinners, clam chowder, bisque, the trinity, gumbo, jambalaya, Creole, Cajun, masa, and fusion cuisine.	
2. Explore the cultural influences and flavor profiles of global areas, including South America, Central America, Europe, the Mediterranean, the Middle East, and Asia. <small>DOK1, NRAEF 2-10.7, NRAEF 2-10.9, NRAEF 2-11.1, NRAEF 2-11.5, NRAEF 2-11.8, NRAEF 2-11.10</small>	

## Unit 24: Other Foodservice Certifications

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<b>Competencies and Suggested Objectives</b>
1. Explore foodservice certifications, including ServSafe Food Handler, ServSafe Employee, ServSafe Manager, and ProStart COA.
2. Explore food safety. <ol style="list-style-type: none"><li>List the factors that affect the safety of food.</li><li>List the factors of contamination of food.</li><li>Identify how time and temperature affect the safety of food.</li></ol>
3. Identify characteristics of good personal hygiene. <ol style="list-style-type: none"><li>List the steps in proper handwashing.</li><li>Know how and when to properly use gloves.</li></ol>
4. Explore facility sanitation and identify pest management. <ol style="list-style-type: none"><li>List the components of an IPM program.</li><li>Identify how cleaning and sanitizing are different.</li></ol>

# Student Competency Profile

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**Student's Name:** \_\_\_\_\_

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

<b>Unit 1: Orientation</b>		
	1.	Identify school and program policies and procedures, and compare/contrast them with industry policies and procedures.
	2.	Identify career and leadership opportunities in the culinary industry.
	3.	Explore opportunities provided by student organization, including SkillsUSA, DECA, and FCCLA.
<b>Unit 2: Food Safety and Sanitation</b>		
	1.	Discuss and relate the importance of food safety.
	2.	Describe the importance of good personal hygiene.
	3.	Analyze the flow of food through a foodservice establishment.
	4.	Identify the importance of a hazard analysis critical control points (HACCP) system.
	5.	Maintain a clean and sanitary kitchen.
<b>Unit 3: Safety in the Workplace</b>		
	1.	Analyze how vital workplace safety is to customers and employees.
	2.	Implement safe work habits to prevent injuries (ongoing).
	3.	Explain emergency techniques and procedures.
<b>Unit 4: Professionalism and Utilizing Standard Recipes</b>		
	1.	Identify the attributes and duties of a culinary professional.
	2.	Apply basic mathematical calculations to basic food preparation skills.
	3.	Identify the items included in a standardized recipe and why restaurants use them.
<b>Unit 5: Equipment and Techniques</b>		
	1.	Demonstrate the use and maintenance of culinary equipment.
	2.	Define basic food preparation techniques.
	3.	Discuss the importance of nutrition in food preparation.

<b>Unit 6: Stocks, Sauces, and Soups</b>		
	1.	Identify and prepare stocks.
	2.	Identify and prepare sauces.
	3.	Identify and prepare soups.
<b>Unit 7: Fruits and Vegetables</b>		
	1.	Discuss the storage and preparation of fruits.
	2.	Discuss the storage and preparation of vegetables.
<b>Unit 8: Potatoes and Grains</b>		
	1.	Discuss the storage and preparation of potatoes.
	2.	Discuss the storage and preparation of legumes and grains.
	3.	Discuss the storage and preparation of pasta and dumplings.
<b>Unit 9: Serving Your Guests</b>		
	1.	Analyze the importance of service to the culinary industry.
	2.	Discuss measures of a positive dining experience.
	3.	Identify service styles and setup in the foodservice industry.
<b>Unit 10: Communication</b>		
	1.	Identify positive communication skills.
	2.	Demonstrate positive communication skills.
<b>Unit 11: Building a Successful Career in the Industry</b>		
	1.	Formulate a plan for an effective job search, and prepare business-related documents.
	2.	Understand issues in the culinary field.
<b>Unit 12: Overview of the Foodservice and Hospitality Industry</b>		
	1.	Research the history of the foodservice industry.
	2.	Investigate career opportunities in the foodservice industry.
<b>Unit 13: Management Essentials</b>		
	1.	Analyze the importance of working together in the culinary industry.
	2.	Identify the attributes of a successful leader in the culinary industry.
	3.	Analyze the importance of interviewing and orientation to the culinary industry.
	4.	Analyze skills related to training and evaluation.
<b>Unit 14: Introduction</b>		
	1.	Discuss the policies and procedures of the local school and of working in local business and industries.
	2.	Investigate career opportunities, and research local careers in the food industry.

	3.	Identify leadership skills needed in the foodservice industry.
<b>Unit 15: Dairy Products, Breakfast Foods, and Sandwiches</b>		
	1.	Demonstrate preparation and handling of dairy products and eggs.
	2.	Identify breakfast foods and drinks.
	3.	Identify the two categories of sandwiches.
<b>Unit 16: Nutrition</b>		
	1.	Discuss the components of a healthy diet.
	2.	Describe components of a nutritious menu.
<b>Unit 17: Salads and Garnishing</b>		
	1.	Evaluate various types of salads.
	2.	Identify salad dressings.
	3.	Identify appropriate garnishing techniques.
<b>Unit 18: Meat, Poultry, and Seafood</b>		
	1.	Identify quality meat products.
	2.	Identify a quality poultry product.
	3.	Identify a quality seafood product.
	4.	Identify charcuterie and garde manger.
<b>Unit 19: Desserts and Baked Goods</b>		
	1.	Describe bakeshop basics.
	2.	Describe working with yeast breads.
	3.	Describe the characteristics of quick breads and cake batters.
	4.	Describe the methods of making pies and cookies.
	5.	Describe characteristics of working with chocolate.
	6.	Describe specialty desserts.
<b>Unit 20: Marketing</b>		
	1.	Identify marketing principles.
	2.	Identify marketing segments.
	3.	Utilize the menu as a marketing tool.
<b>Unit 21: Sustainability in the Foodservice Industry</b>		
	1.	Describe sustainability and water conservation in the foodservice industry.
	2.	Describe energy conservation.
	3.	Describe waste management in the foodservice industry.

<b>Unit 22: Purchasing, Inventory, and Cost Control</b>		
	1.	Examine the purchasing process.
	2.	Control food costs.
	3.	Control labor costs.
<b>Unit 23: Global Cuisine</b>		
	1.	Describe the cuisines of North America.
	2.	Explore the cultural influences and flavor profiles of global areas, including South America, Central America, Europe, the Mediterranean, the Middle East, and Asia.
<b>Unit 24: Other Foodservice Certifications</b>		
	1.	Explore foodservice certifications, including ServSafe Food Handler, ServSafe Employee, ServSafe Manager, and ProStart COA.
	2.	Explore food safety.
	3.	Identify characteristics of good personal hygiene.
	4.	Explore facility sanitation and identify pest management.



# Appendix A: Unit References

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All of the Culinary Arts units use the same resources for each unit. You will find suggested resources listed below.

National Restaurant Association. (2011). *Foundations of restaurant management & culinary arts: Level one* (11th ed.). Boston, MA: Prentice Hall.

National Restaurant Association. (2011). *Foundations of restaurant management & culinary arts: Level two* (11th ed.). Boston, MA: Prentice Hall.

# Appendix B: Industry Standards

## Foundations of Restaurant Management & Culinary Arts

### Standards from the Foundations of Restaurant Management & Culinary Arts - Level One

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13
1-1	X											X	
1-2		X											
1-3			X										
1-4				X									
1-5					X								
1-6						X							
1-7										X			
1-8													X
1-9							X						
1-10									X				
1-11								X					
1-12											X		

### Standards from the Foundations of Restaurant Management & Culinary Arts - Level Two

	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18	Unit 19	Unit 20	Unit 21	Unit 22	Unit 23	Unit 24
2-1		X									
2-2			X								
2-3									X		
2-4				X							
2-5									X		
2-6					X						
2-7							X				
2-8						X					
2-9								X			
2-10										X	
2-11										X	

## **Standards from the Foundations of Restaurant Management & Culinary Arts - Level One**

- 1-1.1 Identify the two segments of the restaurant and foodservice industry, and give examples of businesses in each of them.
- 1-1.2 Categorize the types of businesses that make up the travel and tourism industry.
- 1-1.3 Outline the growth of the hospitality industry throughout the history of the world, emphasizing growth in the United States.
- 1-1.4 List chefs who have made significant culinary contributions, and note their major accomplishments.
- 1-1.5 List entrepreneurs who have influenced foodservice in the United States.
- 1-1.6 Identify foodservice opportunities provided by the travel and tourism industry.
- 1-1.7 Identify career opportunities offered by the travel and tourism industry.
- 1-1.8 Identify the two major categories of jobs in the restaurant and foodservice industry.
- 1-1.9 Name reasons why people travel.
- 1-1.10 Describe the differences between leisure and business travelers.
- 1-1.11 Identify national organizations that rate commercial lodging and foodservice establishments, and list factors used in making their rating judgments.
- 1-1.12 List and describe the characteristic types of lodging operations.
- 1-1.13 List and describe activities associated with front-desk operations.
  
- 1-2.1 Define what a foodborne-illness outbreak is, and list the costs associated with one
- 1-2.2 Recognize risks associated with high-risk populations.
- 1-2.3 Identify factors that affect the growth of pathogens (FAT TOM).
- 1-2.4 Identify characteristics of TCS food and list examples.
- 1-2.5 Identify methods for preventing biological contamination.
- 1-2.6 List guidelines for storing chemicals safely.
- 1-2.7 Recognize the need for food defense systems.
- 1-2.8 Identify the most common allergens and methods for preventing allergic reactions.
- 1-2.9 Identify government agencies that regulate the restaurant and foodservice industry.
- 1-2.10 List personal behaviors that can contaminate food.
- 1-2.11 List the steps to proper handwashing, and identify when hands should be washed.
- 1-2.12 Identify proper personal cleanliness practices and appropriate work attire.
- 1-2.13 Identify ways to handle ready-to-eat food safely.
- 1-2.14 Identify when foodhandlers should be prevented from working around food or from working in the operation.
- 1-2.15 Identify ways to prevent cross-contamination.
- 1-2.16 Identify ways to prevent time-temperature abuse.
- 1-2.17 List different temperature-measuring devices and their uses.
- 1-2.18 Identify characteristics of an approved food source.
- 1-2.19 Identify criteria for accepting or rejecting food during receiving.
- 1-2.20 Outline proper procedures for storing food.
- 1-2.21 Identify the minimum internal temperature requirements for cooking various TCS food.
- 1-2.22 Outline proper procedures for holding, cooling, and reheating TCS food.
- 1-2.23 Identify ways to handle food ready for service.
- 1-2.24 Outline proper procedures for preparing and serving food for off-site service.
- 1-2.25 List the HACCP principles and explain their importance to food safety.
- 1-2.26 Explain the difference between cleaning and sanitizing.

- 1-2.27 Outline proper procedures for cleaning and sanitizing tools and equipment.
- 1-2.28 Identify factors that affect the effectiveness of sanitizers.
- 1-2.29 List the elements of a master cleaning schedule.
- 1-2.30 Identify organizations that certify that equipment meets sanitation standards.
- 1-2.31 Outline proper procedures for managing pests.
  
- 1-1-3.1 State who is legally responsible for providing a safe environment and ensuring safe practices.
- 1-3.2 Define the role of Occupational Safety and Health Administration regulations.
- 1-3.3 State the Hazard Communication Standard requirements for employers.
- 1-3.4 List the requirements for storing hazardous chemicals in an operation.
- 1-3.5 Explain the importance of general safety audits and safety training.
- 1-3.6 Explain the importance of completing accident reports.
- 1-3.7 Describe the purpose of an emergency plan.
- 1-3.8 List ways to use protective clothing and equipment to prevent injuries.
- 1-3.9 Identify electrical hazards that contribute to accidental fires.
- 1-3.10 Classify different types of fires and fire extinguishers.
- 1-3.11 Identify the cleaning frequency for equipment as a way to prevent fires.
- 1-3.12 Outline the actions to take in the event of a fire at a restaurant or foodservice operation.
- 1-3.13 Identify procedures for preventing slips, trips, and fall in a foodservice operation.
- 1-3.14 Outline the procedure for cleaning up spills on floors.
- 1-3.15 Demonstrate how to use ladders safely.
- 1-3.16 Demonstrate proper lifting and carrying procedures to avoid injury.
- 1-3.17 Demonstrate correct and safe use of knives.
- 1-3.18 Outline basic first aid concepts and procedures.
- 1-3.19 Recognize the importance of locking doors.
  
- 1-4.1 Define professionalism, and explain what it means to culinary professionals.
- 1-4.2 List the stations and positions in the kitchen brigade and the dining brigade.
- 1-4.3 Perform basic math calculations using numbers or fractions.
- 1-4.4 Identify the components and functions of a standardized recipe.
- 1-4.5 Convert recipes to yield smaller and larger quantities based on operational needs.
- 1-4.6 Explain the difference between customary and metric measurement units, and convert units between the two systems.
- 1-4.7 Demonstrate measuring and portioning using the appropriate small wares and utensils.
- 1-4.8 Given a problem, calculate as purchased (AP) and edible portion (EP) amounts.
- 1-4.9 Calculate the total cost and portion costs of a standardized recipe.
  
- 1-5.1 Identify the equipment needed for receiving and storing food and supplies.
- 1-5.2 Identify the equipment needed for pre-preparation.
- 1-5.3 List the different types of knives used in the foodservice kitchen and give examples of their uses.
- 1-5.4 Identify basic types of pots and pans and their common uses.
- 1-5.5 List the different types of preparation equipment used in the foodservice kitchen and give examples of their uses.
- 1-5.6 Identify the kitchen equipment needed for holding and serving food and beverages.

- 1-5.7 Apply effective mise en place through practice.
- 1-5.8 Explain how to care for knives properly.
- 1-5.9 Demonstrate the proper use of knives.
- 1-5.10 Explain the difference between seasoning and flavoring.
- 1-5.11 Describe and demonstration basic pre-preparation techniques.
- 1-5.12 List and explain how the three types of cooking work.
- 1-5.13 Describe dry-heat cooking methods and list the foods to which they are suited.
- 1-5.14 Describe moist-heat cooking methods and list the foods to which they are suited.
- 1-5.15 Describe combination-heat cooking methods and list the foods to which they are suited.
- 1-5.16 Identify ways to determine if a food is done cooking.
- 1-5.17 List guidelines for plating or storing food that has finished cooking.
- 1-5.18 Describe a healthy diet.
- 1-5.19 Use the Dietary Guidelines for Americans and MyPyramid to plan meals.
- 1-5.20 Interpret information on a nutrition label.
- 1-5.21 Define obesity and explain how it can be prevented.
  
- 1-6.1 Identify the four essential parts of stock and the proper ingredients for each.
- 1-6.2 List and explain the various types of stock and their ingredients.
- 1-6.3 Demonstrate three methods for preparing bones for stock.
- 1-6.4 Prepare the ingredients for and cook several kinds of stocks.
- 1-6.5 Explain how and why to degrease stock.
- 1-6.6 List the ways to cool stock properly.
- 1-6.7 Identify the grand sauces and describe other sauces made from them.
- 1-6.8 List the proper ingredients for sauces.
- 1-6.9 Prepare several kinds of sauces.
- 1-6.10 Match sauces to appropriate food.
- 1-6.11 Identify the two basic kinds of soups and give examples of each.
- 1-6.12 Explain the preparation of the basic ingredients for broth, consommé, purée, clear, and cream soups.
- 1-6.13 Prepare several kinds of soups.
  
- 1-7.1 Describe the communication process.
- 1-7.2 Identify obstacles to effective communication and explain how to prevent them.
- 1-7.3 Explain how personal characteristics can affect communication.
- 1-7.4 List and demonstrate effective listening skills.
- 1-7.5 List and demonstrate effective speaking skills.
- 1-7.6 Identify and use business-appropriate telephone skills.
- 1-7.7 List and demonstrate effective writing skills.
- 1-7.8 Define organizational communication and give examples of when it might be used.
- 1-7.9 Describe interpersonal communication.
- 1-7.10 List ways to build relationships through interpersonal communication.
  
- 1-8.1 State the difference between school and workplace environments.
- 1-8.2 Explain how stereotypes and prejudices can negatively affect working together.
- 1-8.3 Identify the benefits of diversity to a workplace.
- 1-8.4 List ways to promote diversity in the workplace.

- 1-8.5 Describe what a harassment-free environment and mutually respectful workplace is.
- 1-8.6 List guidelines for handling harassment claims.
- 1-8.7 Explain the concept of teamwork.
- 1-8.8 Describe ethics, and explain their importance to the restaurant and foodservice industry.
- 1-8.9 Identify the behaviors of a leader.
- 1-8.10 Identify common expectations that employees have about managers.
- 1-8.11 Define motivation, and explain a leader's responsibility to motivate employees.
- 1-8.12 Define organizational goal, and explain why this type of goal should be SMART.
- 1-8.13 Explain the purpose of vision statements and mission statements.
- 1-8.14 Identify how employees' roles and jobs impact a mission and goals.
- 1-8.15 List the steps for solving a problem and explain how each step contributes to finding a solution.
- 1-8.16 Explain the importance of individual development to your restaurant or foodservice career.
- 1-8.17 Explain what is included in a job description and explain the importance of these documents to a business.
- 1-8.18 Identify the difference between exempt and non-exempt employees.
- 1-8.19 Explain a manager's responsibility for maintaining labor law knowledge.
- 1-8.20 Identify discriminatory language and practices in the hiring process.
- 1-8.21 Identify methods for ensuring a fair and consistent hiring process.
- 1-8.22 Describe the typical phases of onboarding and explain its importance to a business.
- 1-8.23 Explain what employees can expect during orientation.
- 1-8.24 List items that employees receive during orientation.
- 1-8.25 Identify the typical topics addressed in orientation sessions and employee manuals.
- 1-8.26 Identify the benefits of training.
- 1-8.27 List skills that a trainer should have.
- 1-8.28 Identify the key points of effective employee training.
- 1-8.29 List the benefits of cross-training.
- 1-8.30 Summarize and discuss effective group training and on-the-job training.
- 1-8.31 Describe the employee evaluation process.
  
- 1-9.1 Identify and describe different types of fruit.
- 1-9.2 List and explain the USDA quality grades for produce.
- 1-9.3 List factors that affect produce purchasing decisions.
- 1-9.4 Identify procedures for storing fruit.
- 1-9.5 Explain how to prevent enzymatic browning of fruit.
- 1-9.6 Match and cook fruit to appropriate methods.
- 1-9.7 Identify and describe different types of vegetables.
- 1-9.8 Describe hydroponic farming.
- 1-9.9 Identify procedures for storing vegetables.
- 1-9.10 Match and cook vegetables to appropriate methods.
- 1-9.11 List ways to hold vegetables that maintain their quality.
  
- 1-10.1 Explain the importance of customer service to the restaurant and foodservice industry.
- 1-10.2 List the reasons for making a good first impression and give examples of how to make one.

- 1-10.3 Describe the types of customers that may have special needs.
- 1-10.4 Identify ways to identify customer needs.
- 1-10.5 Outline the process for receiving and recording reservations and special requests.
- 1-10.6 Outline the process for taking orders at the table, beginning with the greeting.
- 1-10.7 Define suggestive selling, and give examples of how to do it.
- 1-10.8 Identify basic guidelines for serving alcohol to guests.
- 1-10.9 List methods for processing payment.
- 1-10.10 List ways to obtain feedback from guests and determine their satisfaction.
- 1-10.11 Explain how customer complaints should be resolved.
- 1-10.12 Describe the four traditional styles of service: American, French, English, and Russian.
- 1-10.13 Identify contemporary styles of service.
- 1-10.14 Demonstrate setting and clearing items properly.
- 1-10.15 Describe traditional service staff roles, and list the duties and responsibilities of each.
- 1-10.16 Identify various server tools and the correct way to stock a service station.
  
- 1-11.1 Identify and describe different types of potatoes.
- 1-11.2 Outline methods to select, receive, and store potatoes.
- 1-11.3 Using a variety of recipes and cooking methods, prepare potatoes.
- 1-11.4 Identify and describe different types of grains and legumes.
- 1-11.5 Using a variety of recipes and cooking methods, prepare grains and legumes.
- 1-11.6 Outline methods to select, receive, and store grains.
- 1-11.7 Identify and describe different types of pasta.
- 1-11.8 Using a variety of recipes and cooking methods, prepare pasta.
- 1-11.9 Describe and prepare dumplings.
  
- 1-12.1 Identify skills needed by foodservice professionals.
- 1-12.2 Outline a plan for an effective job search.
- 1-12.3 Write a resume that lists your experience, skills, and achievements.
- 1-12.4 Write an effective cover letter.
- 1-12.5 Compile the best examples of your work into a portfolio.
- 1-12.6 Read and complete a job application form.
- 1-12.7 Outline the steps to choosing a college or trade school and identify resources for answering those questions.
- 1-12.8 Read and complete college and scholarship application forms.
- 1-12.9 List ways to find and apply for scholarships.
- 1-12.10 List the steps to an effective job interview.
- 1-12.11 Identify the differences between closed- and open-ended questions in interviews.
- 1-12.12 Explain the follow-up steps for a job interview.
- 1-12.13 List factors for maintaining health and wellness throughout a restaurant or foodservice career.
- 1-12.14 Describe the relationship between time and stress.
- 1-12.15 List ways to manage time and stress.
- 1-12.16 Outline the steps to resigning a job
- 1-12.17 Explain the importance of professional development and list ways to achieve it.
- 1-12.18 Identify career opportunities in the restaurant and foodservice industry.
- 1-12.19 Identify career opportunities in the lodging industry.



- 1-12.20 Identify career opportunities in the travel industry.
- 1-12.21 Identify career opportunities in the tourism industry.

## **Foundations of Restaurant Management & Culinary Arts - Level Two**

- 2-1.1 List the characteristics of milk and identify ways to keep it safe.
- 2-1.2 Identify the different forms of cream and their fat contents.
- 2-1.3 Differentiate between butter and butter substitutes and recognize the characteristics of each.
- 2-1.4 Identify the different types of cheese and give examples of each.
- 2-1.5 List the characteristics of eggs and identify ways to keep them safe.
- 2-1.6 Prepare and serve eggs using a variety of cooking methods.
- 2-1.7 Prepare pancakes, crêpes, waffles, and French toast.
- 2-1.8 Prepare ham, hash, grits, cold cereals, oatmeal, and sausage.
- 2-1.9 Prepare coffee, tea, and cocoa.
- 2-1.10 Give examples of different types of sandwiches, including simple hot, open-faced, hors d'oeuvres, grilled, deep-fried, and simple cold.
- 2-1.11 Explain the roles of the three components of a sandwich: bread, spread, and filling
- 2-1.12 Prepare common sandwich spreads and fillings.
- 2-1.13 List the necessary tools and equipment to make sandwiches at a sandwich station.
- 2-1.14 Demonstrate preparation of several types of sandwiches.
  
- 2-2.1 Explain why nutrition is important to the foodservice industry.
- 2-2.2 List the six basic types of nutrients found in food.
- 2-2.3 Describe how phytochemicals and fiber function in the body.
- 2-2.4 Name the types of carbohydrates and fats and describe their function in the body.
- 2-2.5 Identify food sources of carbohydrates and fats.
- 2-2.6 Describe cholesterol and identify its food sources.
- 2-2.7 Describe the makeup of proteins and their function in the body.
- 2-2.8 Identify food sources of proteins.
- 2-2.9 Describe the three major vegetarian diets.
- 2-2.10 List the functions of vitamins, minerals, and water in the body.
- 2-2.11 Identify food sources of vitamins, minerals, and water.
- 2-2.12 Explain what food additives are and how they function in food.
- 2-2.13 Explain the role of digestion in nutrition and health.
- 2-2.14 List and describe techniques for food preparation that preserve nutrients.
- 2-2.15 Suggest ways to make menus and recipes more healthful.
- 2-2.16 Suggest healthful substitutes for high-fat items.
- 2-2.17 List and define recent developments in food production that may affect nutrition.
  
- 2-3.1 Identify the types of costs incurred by a foodservice business and give examples of each.
- 2-3.2 Explain the purposes of a budget.
- 2-3.3 Explain the purpose of a profit-and-loss report.
- 2-3.4 Identify methods for analyzing profit-and-loss reports.
- 2-3.5 Explain the purpose of invoices in a foodservice business.
- 2-3.6 Identify tools to help control costs.



- 2-3.7 Define and calculate food cost and food cost percentage.
- 2-3.8 Given a problem, calculate as purchased (AP) and edible portion (EP) amounts.
- 2-3.9 Calculate the total cost and portion costs of a standardized recipe.
- 2-3.10 Develop a recipe cost card for a standardized recipe.
- 2-3.11 Explain the importance of portion control to food cost.
- 2-3.12 Give examples of portion-control devices used in foodservice operations.
- 2-3.13 List the steps in the process to control food costs.
- 2-3.14 Forecast sales by analyzing and evaluating sales histories, popularity indices, and production sheets.
- 2-3.15 Calculate a recipe's yield and the number of portions it will produce.
- 2-3.16 Use a conversion factor to calculate a new yield for an existing recipe.
- 2-3.17 Explain the importance of standards for controlling production volume.
- 2-3.18 List and describe standard procedures used for controlling production volume.
- 2-3.19 List and explain the various methods for menu pricing.
- 2-3.20 Explain the importance of standard labor costs to a business's success.
- 2-3.21 List factors that affect labor costs.
- 2-3.22 Describe the relationship between sales volume and labor costs.
- 2-3.23 Explain the difference between a master schedule and a crew schedule.
- 2-3.24 Describe the components and factors to consider when developing labor schedules.
- 2-3.25 List and describe purchasing, receiving, and storage procedures that help to preserve quality and control costs.
- 2-3.26 List ways to evaluate a finished product for quality.
- 2-3.27 Describe the process for identifying quality problems in the kitchen.
- 2-3.28 Determine the dollar value of inventory.
- 2-3.29 List and explain the various methods of inventory pricing.
  
- 2-4.1 Identify and describe the various ingredients used to make salads.
- 2-4.2 List the four parts of a salad and explain the role of each.
- 2-4.3 Identify various types of salad and explain how to prepare them.
- 2-4.4 Explain the roles of salads on the menu.
- 2-4.5 Design attractive salads.
- 2-4.6 Identify proper procedures for cleaning salad greens.
- 2-4.7 Identify proper procedures for storing salads.
- 2-4.8 Differentiate among various oils and vinegars.
- 2-4.9 Prepare vinaigrettes and other emulsions.
- 2-4.10 Match dressings to salad ingredients.
- 2-4.11 Give examples of ingredients used to make dips.
- 2-4.12 Prepare several dips.
- 2-4.13 Give examples of garnishes.
- 2-4.14 Describe and prepare ingredients commonly used as garnishes.
- 2-4.15 Garnish various items, including plates, desserts, and soups.
  
- 2-5.1 Define the terms purchasing, selection, and procurement.
- 2-5.2 Outline the objectives of the purchasing function in a foodservice operation.
- 2-5.3 Explain the relationship between primary and intermediary sources and retailers.

- 2-5.4 Explain the differences between formal and informal buying and the formal bidding process.
- 2-5.5 List the types of goods and service that a foodservice operation might buy.
- 2-5.6 Describe the buyer's role in a foodservice operation and explain the importance of ethical behavior to a buyer.
- 2-5.7 List the factors that help to determine an operation's quality standards.
- 2-5.8 Identify ways to communicate quality standards and give examples of standards a foodservice operation might use.
- 2-5.9 Describe buyer considerations when conducting a make-or-buy analysis.
- 2-5.10 Outline the process for procuring products and services.
- 2-5.11 Identify production records used to calculate buying needs.
- 2-5.12 Write purchase orders for items to be purchased.
- 2-5.13 List ways to verify that supplier services meet an operation's needs.
- 2-5.14 List factors that affect food prices.
- 2-5.15 List proper procedures for receiving deliveries.
- 2-5.16 List proper procedures for storing food and supplies.
- 2-5.17 Describe perpetual inventory and physical inventory systems.
- 2-5.18 Explain the difference between perishable and nonperishable food items.
  
- 2-2-6.1 Outline the federal grading systems for meat.
- 2-6.2 Describe the various kinds of meat.
- 2-6.3 Identify the proper purchasing and storing procedures for meat.
- 2-6.4 List factors that affect purchasing decisions for meat.
- 2-6.5 Outline basic techniques for cooking meat.
- 2-6.6 Match various cooking methods with different forms of meat.
- 2-6.7 Outline the federal grading systems for poultry.
- 2-6.8 Describe the various kinds of poultry.
- 2-6.9 Identify the proper purchasing and storing procedures for poultry.
- 2-6.10 List factors that affect purchasing decisions for poultry.
- 2-6.11 Outline basic techniques for cooking poultry.
- 2-6.12 Match various cooking methods with different forms of poultry.
- 2-6.13 Outline the federal grading systems for seafood.
- 2-6.14 Describe the various kinds of seafood.
- 2-6.15 Identify the proper purchasing and storing procedures for seafood.
- 2-6.16 List factors that affect purchasing decisions for seafood.
- 2-6.17 Outline basic techniques for cooking seafood.
- 2-6.18 Match various cooking methods with different forms of seafood.
- 2-6.19 Identify and describe different types of charcuterie.
- 2-6.20 Explain garde manger and how it relates to charcuterie.
  
- 2-7.1 Define marketing, and list the steps in the marketing process.
- 2-7.2 Explain the role that marketing plays in determining products and services.
- 2-7.3 List factors that affect a market environment.
- 2-7.4 Define target market, and explain why it is important to a business.
- 2-7.5 Identify the parts of a SWOT analysis.
- 2-7.6 List ways to attract and keep customers.

- 2-7.7 List reasons why promotions are important.
- 2-7.8 Identify the steps in developing a promotion mix and a promotion plan.
- 2-7.9 Explain the importance of training to promotions.
- 2-7.10 Recognize different types of sales promotions.
- 2-7.11 List the benefits of public relations.
- 2-7.12 Identify opportunities for public relations.
- 2-7.13 Explain the importance of the menu to a foodservice operation.
- 2-7.14 Describe à la carte, table d'hôte, California, limited, du jour, and cycle menus.
- 2-7.15 Organize the information on a menu.
- 2-7.16 Explain principles of menu layout and design.
- 2-7.17 Identify ways to test new menu items.
- 2-7.18 Explain the purposes of a menu sales mix analysis.
- 2-7.19 Define profitability and target margin.
- 2-7.20 Classify menu items according to their popularity.
- 2-7.21 List and compare basic pricing methods.
  
- 2-8.1 Identify and use common ingredients in baking.
- 2-8.2 Calculate ingredient weights using baker's percentages.
- 2-8.3 Convert baking recipes to a new yield.
- 2-8.4 Differentiate between lean doughs, rich doughs, sponge doughs, and sourdoughs, and give examples.
- 2-8.5 Mix yeast dough using the straight-mix method.
- 2-8.6 Proof bake shop items.
- 2-8.7 Prepare yeast breads.
- 2-8.8 Prepare different types of quick breads and cake batters.
- 2-8.9 Identify the functions of icings and determine which are best suited for different baked goods.
- 2-8.10 Describe and prepare steamed puddings and dessert soufflés.
- 2-8.11 Prepare pie dough using the 3-2-1 method.
- 2-8.12 Describe the procedure for baking blind.
- 2-8.13 Describe roll-in dough, phyllo dough, and pâte à choux.
- 2-8.14 Prepare cookies using various makeup methods.
- 2-8.15 Explain how chocolate is made, including chocolate liquor, cocoa butter, and cocoa powder.
- 2-8.16 Demonstrate how to store chocolate properly.
- 2-8.17 Explain how chocolate is tempered.
- 2-8.18 Explain how crème anglaise, pastry creams, and Bavarian creams are made, and how they are used in desserts.
- 2-8.19 List the characteristics of ice cream and give examples of other frozen desserts.
- 2-8.20 List the steps for preparing poached fruits and tortes.
- 2-8.21 List guidelines for plating and presenting desserts.
  
- 2-9.1 Define the terms sustainability and conservation.
- 2-9.2 Explain why water conservation is important.
- 2-9.3 List ways in which a restaurant or foodservice operation can improve the efficiency of its water usage.

- 2-9.4 Explain the differences between renewable and nonrenewable energy sources.
- 2-9.5 Explain why using energy efficiently is important.
- 2-9.6 List ways in which a restaurant or foodservice operation can improve the efficiency of its energy usage.
- 2-9.7 List ways in which a restaurant or foodservice operation can build or make structural improvements to its facility in a sustainable way.
- 2-9.8 Identify ways to reduce the total amount of waste in a restaurant or foodservice operation.
- 2-9.9 List items that a restaurant or foodservice operation can reuse.
- 2-9.10 List items that a restaurant or foodservice operation can recycle.
- 2-9.11 Define the term local sourcing.
- 2-9.12 Identify the steps a restaurant or foodservice operation should take to purchase and then promote the use of sustainable food products.
- 2-9.13 Identify the issues surrounding the global production of seafood, coffee, animals, and organic food.
  
- 2-10.1 Identify the major influences, ingredients, flavors, and cooking techniques of Northeastern American cuisine.
- 2-10.2 Identify the major influences, ingredients, flavors, and cooking techniques of Midwestern American cuisine.
- 2-10.3 Identify the major influences, ingredients, flavors, and cooking techniques of Southern American cuisine.
- 2-10.4 Identify the major influences, ingredients, flavors, and cooking techniques of Southwestern American cuisine.
- 2-10.5 Identify the major influences, ingredients, flavors, and cooking techniques of Pacific Coast/Rim cuisine.
- 2-10.6 Identify the major influences, ingredients, flavors, and cooking techniques of Mexican cuisine.
- 2-10.7 Identify the major influences, ingredients, flavors, and cooking techniques of Central American cuisine.
- 2-10.8 Identify the major influences, ingredients, flavors, and cooking techniques of Caribbean cuisine.
- 2-10.9 Identify the major influences, ingredients, flavors, and cooking techniques of Brazilian cuisine.
- 2-10.10 Identify the major influences, ingredients, flavors, and cooking techniques of Bolivian cuisine.
  
- 2-11.1 Identify the major influences, ingredients, flavors, and cooking techniques of French cuisine.
- 2-11.2 Identify the major influences, ingredients, flavors, and cooking techniques of Italian cuisine.
- 2-11.3 Identify the major influences, ingredients, flavors, and cooking techniques of Spanish cuisine.
- 2-11.4 Identify the major influences, ingredients, flavors, and cooking techniques of Moroccan cuisine.

- 2-11.5 Identify the major influences, ingredients, flavors, and cooking techniques of Greek cuisine.
- 2-11.6 Identify the major influences, ingredients, flavors, and cooking techniques of Tunisian cuisine.
- 2-11.7 Identify the major influences, ingredients, flavors, and cooking techniques of Egyptian cuisine.
- 2-11.8 Identify the major influences, ingredients, flavors, and cooking techniques of Iranian cuisine.
- 2-11.9 Identify the major influences, ingredients, flavors, and cooking techniques of Saudi Arabian cuisine.
- 2-11.10 Identify the major influences, ingredients, flavors, and cooking techniques of Chinese cuisine.
- 2-11.11 Identify the major influences, ingredients, flavors, and cooking techniques of Japanese cuisine.
- 2-11.12 Identify the major influences, ingredients, flavors, and cooking techniques of Indian cuisine.

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# Appendix C: 21st Century Skills<sup>1</sup>

21 <sup>st</sup> Century Crosswalk for 2017 Secondary Culinary Arts												
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12
21 <sup>st</sup> Century Standards												
CS1	X								X			X
CS2											X	X
CS3											X	X
CS4	X	X							X			
CS5												
CS6					X	X	X	X				
CS7			X									
CS8				X					X	X	X	
CS9												
CS11											X	
CS12				X								
CS13				X								
CS14				X					X			
CS15				X								
CS16	X			X								
	Unit 13	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18	Unit 19	Unit 20	Unit 21	Unit 22	Unit 23	Unit 24
CS1											X	
CS2	X							X			X	
CS3											X	
CS4				X								
CS5									X			
CS6			X		X	X	X					
CS7	X							X				
CS8								X				
CS13	X											
CS15	X									X		
CS16	X	X										

## CSS1-21st Century Themes

### CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Understanding other nations and cultures, including the use of non-English languages

### CS2 Financial, Economic, Business, and Entrepreneurial Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy in society
- Using entrepreneurial skills to enhance workplace productivity and career options

### CS3 Civic Literacy

- Participating effectively in civic life through knowing how to stay informed and understanding governmental processes

<sup>1</sup> 21st century skills. (n.d.). Washington, DC: Partnership for 21st Century Skills.

2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

**CS4 Health Literacy**

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

**CS5 Environmental Literacy**

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems.
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.).
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions.
4. Take individual and collective action toward addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues).

**CSS2-Learning and Innovation Skills**

**CS6 Creativity and Innovation**

1. Think Creatively
2. Work Creatively with Others
3. Implement Innovations

**CS7 Critical Thinking and Problem Solving**

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

**CS8 Communication and Collaboration**

1. Communicate Clearly
2. Collaborate with Others

**CSS3-Information, Media and Technology Skills**

**CS9 Information Literacy**

1. Access and Evaluate Information
2. Use and Manage Information

**CS10 Media Literacy**

1. Analyze Media
2. Create Media Products

**CS11 ICT Literacy**

1. Apply Technology Effectively

**CSS4-Life and Career Skills**

**CS12 Flexibility and Adaptability**

1. Adapt to change
2. Be Flexible

**CS13 Initiative and Self-Direction**

1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

**CS14 Social and Cross-Cultural Skills**

1. Interact Effectively with others
2. Work Effectively in Diverse Teams

**CS15 Productivity and Accountability**

1. Manage Projects
2. Produce Results

**CS16 Leadership and Responsibility**

1. Guide and Lead Others
2. Be Responsible to Others



# Appendix D: College and Career Ready Standards

English Standards													
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	
W.9.2										X	X		
W.9.3										X	X		
SL.9.1										X			
SL.9.4										X			

## College and Career Ready English I

### Reading Literature Key Ideas and Details

RL.9.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

RL.9.2 Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

RL.9.3 Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.

### Craft and Structure

RL.9.4 Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).

RL.9.5 Analyze how an author’s choices concerning how to structure a text, order events within it (e.g., parallel plots), and manipulate time (e.g., pacing, flashbacks) create such effects as mystery, tension, or surprise.

RL.9.6 Analyze a particular point of view or cultural experience reflected in a work of literature from outside the United States, drawing on a wide reading of world literature.

### Integration of Knowledge and Ideas

RL.9.7 Analyze the representation of a subject or a key scene in two different artistic mediums, including what is emphasized or absent in each treatment (e.g., Auden’s “Musée des Beaux Arts” and Breughel’s Landscape with the Fall of Icarus).

RL.9.8 Not applicable to literature.

## College and Career Ready English I

RL.9.9 Analyze how an author draws on and transforms source material in a specific work (e.g., how Shakespeare treats a theme or topic from Ovid or the Bible or how a later author draws on a play by Shakespeare).

### Range of Reading and Level of Text Complexity

RL.9.10 By the end of grade 9, read and comprehend literature, including stories, dramas, and poems, in the grades 9-10 text complexity band proficiently, with scaffolding as needed at the high end of the range.

## College and Career Ready English I

### Reading Informational Text Key Ideas and Details

RI.9.3 Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.

### Craft and Structure

RI.9.5 Analyze in detail how an author’s ideas or claims are developed and refined by particular sentences, paragraphs, or larger portions of a text (e.g., a section or chapter).

RI.9.6 Determine an author’s point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose.

### Integration of Knowledge and Ideas

RI.9.7 Analyze various accounts of a subject told in different mediums (e.g., a person’s life story in both print and multimedia), determining which details are emphasized in each account.

RI.9.8 Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.

RI.9.9 Analyze seminal U.S. documents of historical and literary significance (e.g., Washington’s Farewell Address, the Gettysburg Address, Roosevelt’s Four Freedoms speech, King’s “Letter from Birmingham Jail”), including how they address related themes and concepts.

### College and Career Ready English I

#### Writing Text Types and Purposes

W.9.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

W.9.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.

W.9.1b Develop claim(s) and counterclaims fairly, supplying evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience’s knowledge level and concerns.

W.9.1c Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

W.9.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.9.1e Provide a concluding statement or section that follows from and supports the argument presented.

W.9.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

W.9.2a Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

W.9.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.

W.9.2c Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

### College and Career Ready English I

W.9.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.9.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

W.9.3 Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

W.9.3a Engage and orient the reader by setting out a problem, situation, or observation, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.

W.9.3b Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.

W.9.3c Use a variety of techniques to sequence events so that they build on one another to create a coherent whole.

- W.9.3d Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
- W.9.3e Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

#### Production and Distribution of Writing

- W.9.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
- W.9.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 9–10.)
- W.9.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.

#### Research to Build and Present Knowledge

- W.9.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

#### College and Career Ready English I

- W.9.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
- W.9.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- W.9.9a Apply grades 9–10 Reading standards to literature (e.g., “Analyze how an author draws on and transforms source material in a specific work [e.g., how Shakespeare treats a theme or topic from Ovid or the Bible or how a later author draws on a play by Shakespeare]”).
- W.9.9b Apply grades 9–10 Reading standards to literary nonfiction (e.g., “Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning”).

#### Range of Writing

- W.9.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audience.

#### College and Career Ready English I

- SL.9.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.
- SL.9.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- SL.9.1b Work with peers to set rules for collegial discussions and decision making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
- SL.9.1c Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
- SL.9.1d Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

SL.9.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

SL.9.3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

### Presentation of Knowledge and Ideas

SL.9.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

### College and Career Ready English I

SL.9.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.9.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)

### College and Career Ready English I

#### Language

#### Conventions of Standard English

L.9.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

L.9.1a Use parallel structure.\*

L.9.1b Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations.

L.9.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

L.9.2a Use a semicolon (and perhaps a conjunctive adverb) to link two or more closely related independent clauses.

L.9.2b Use a colon to introduce a list or quotation.

L.9.2c Spell correctly

#### Knowledge of Language

L.9.3 Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening

L.9.3a Write and edit work so that it conforms to the guidelines in a style manual (e.g., MLA Handbook, Turabian's Manual for Writers) appropriate for the discipline and writing type.

#### Vocabulary Acquisition and Use

L.9.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, choosing flexibly from a range of strategies.

L.9.4a Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.

L.9.4b Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., analyze, analysis, analytical; advocate, advocacy).

### College and Career Ready English I

L.9.4c Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, or its etymology.

L.9.4d Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

L.9.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

- L.9.5a Interpret figures of speech (e.g., euphemism, oxymoron) in context and analyze their role in the text.
- L.9.5b Analyze nuances in the meaning of words with similar denotations.
- L.9.6 Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

## College and Career Ready English II

### Range of Reading and Level of Text Complexity

RL.10.10 By the end of grade 10, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 9-10 text complexity band independently and proficiently.

## Grades 9-10: Literacy in History/SS

### Reading in History/Social Studies Key Ideas and Details

- RH.9-10.1 Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
- RH.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.
- RH.9-10.3 Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.

### Craft and Structure

- RH.9-10.4 Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
- RH.9-10.5 Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
- RH.9-10.6 Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.

### Integration of Knowledge and Ideas

- RH.9-10.7 Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.
- RH.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claims.
- RH.9-10.9 Compare and contrast treatments of the same topic in several primary and secondary sources.

### Range of Reading and Level of Text Complexity

RH.9-10.10 By the end of grade 10, read and comprehend history/social studies texts in the grades 9–10 text complexity band independently and proficiently.

## Grades 9-10: Literacy in Science and Technical Subjects

### Reading in Science and Technical Subjects Key Ideas and Details

- RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

### Craft and Structure

- RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
- RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
- RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

### Integration of Knowledge and Ideas

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts

### Range of Reading and Level of Text Complexity

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

## Grades 9-10: Writing in History/SS, Science, and Technical Subjects

### Writing Text Types and Purposes

WHST.9-10.1 Write arguments focused on discipline-specific content.

WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.

WHST.9-10.1c Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

## Grades 9-10

### Writing in History/SS, Science, and Technical Subjects

WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

WHST.9-10.3 Not Applicable

### Production and Distribution of Writing

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.



WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  
WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

#### Research to Build and Present Knowledge

WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Grades 9-10

Writing in History/SS, Science, and Technical Subjects

#### Range of Writing

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

English III

#### Reading Literature Key Ideas and Details

RL.11.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RL.11.2 Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.

RL.11.3 Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

#### Craft and Structure

RL.11.4 Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)

RL.11.5 Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.

RL.11.6 Analyze a case in which grasping a point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

#### Integration of Knowledge and Ideas

RL.11.7 Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

RL.11.8 Not applicable to literature.

RL.11.9 Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.

### Range of Reading and Level of Text Complexity

RI.11.10 By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.

### English III

#### Reading Informational Text Key Ideas and Details

RI.11.3 Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.

#### Craft and Structure

RI.11.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RI.11.5 Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.

RI.11.6 Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness or beauty of the text.

#### Integration of Knowledge and Ideas

RI.11.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

RI.11.8 Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., The Federalist, presidential addresses).

RI.11.9 Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including Them Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.

### Range of Reading and Level of Text Complexity

RI.11.10 By the end of grade 11, read and comprehend literary nonfiction in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.

### English III

#### Writing

W.11.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

W.11.1a Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.

W.11.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.

W.11.1c Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

W.11.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11.1e Provide a concluding statement or section that follows from and supports the argument presented.

W.11.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.



W.11.2a Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

### English III

W.11.2b Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

W.11.2c Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

W.11.2d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

W.11.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

W.11.3 Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

W.11.3a Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.

W.11.3b Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.

W.11.3c Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).

W.11.3d Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.

W.11.3e Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

### Production and Distribution of Writing

W.11.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

### English III

W.11.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12.)

W.11.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

### Research to Build and Present Knowledge

W.11.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.11.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

W.11.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

W.11.9a Apply grades 11–12 Reading standards to literature (e.g., “Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics”).

W.11.9b Apply grades 11–12 Reading standards to literary nonfiction (e.g., “Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., The Federalist, presidential addresses]”).

### Range of Writing

W.11.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

## English III

### Speaking and Listening

#### Comprehension and Collaboration

SL.11.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

SL.11.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

SL.11.1b Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed.

SL.11.1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

SL.11.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

SL.11.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

SL.11.3 Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

#### Presentation of Knowledge and Ideas

SL.11.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

## English III

SL.11.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.11.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 for specific expectations.)

## English III

### Language

#### Conventions of Standard English

L.11.1a Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.

L.11.1b Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster’s Dictionary of English Usage, Garner’s Modern American Usage) as needed.

L.11.2a Observe hyphenation conventions.

L.11.3a Vary syntax for effect, consulting references (e.g., Tufte’s Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.

### Vocabulary Acquisition and Use

L.11.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.

L.11.4b Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).

### English IV

#### Range of Reading and Level of Text Complexity

RL.12.10 By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11–CCR text complexity band independently and proficiently.

### Grades 11-12: Literacy in History/SS

#### Reading in History/Social Studies Key Ideas and Details

RH.11-12.1 Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

RH.11-12.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.

RH.11-12.3 Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain. Craft and Structure

RH.11-12.4 Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RH.11-12.5 Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.

RH.11-12.6 Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence. Integration of Knowledge and Ideas

Rh.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

RH.11-12.8 Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.

RH.11-12.9 Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources. Range of Reading and Level of Text Complexity

RH.11-12.10 By the end of grade 12, read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.

### Grades 11-12: Literacy in Science and Technical Subjects

#### Reading in Science and Technical Subjects Key Ideas and Details

RST. 11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

#### Craft and Structure

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

#### Range of Reading and Level of Text Complexity

RST.11-12.10 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

#### Grades 11-12: Writing I History/SS, Science and Technical Subjects

##### Writing

##### Text Types and Purposes

WHST.11-12.1a Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

WHST.11-12.1c Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

WHST.11-12.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

#### Grades 11-12: Writing I History/SS, Science and Technical Subjects

WHST.11-12.2d Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

#### Production and Distribution of Writing

WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

# Appendix D: College and Career Ready Standards

Mathematics Standards												
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12
N-Q.1				X								
N-Q.2				X								
N-Q.3				X								
A-SSE.1				X								
A-SSE.2				X								
F-BF.1				X								

  

Mathematics Standards												
	Unit 13	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18	Unit 19	Unit 20	Unit 21	Unit 22	Unit 23	Unit 24
N-Q.1								X		X		
N-Q.2								X		X		
N-Q.3								X		X		
A-SSE.1								X		X		
A-SSE.2								X		X		

## Number and Quantity

### Reason quantitatively and use units to solve problems

N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.\*

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*

N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.\*

## Algebra

### Analyze and solve linear equations and pairs of simultaneous linear equations

8.EE.8 Analyze and solve pairs of simultaneous linear equations.

- Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example,  $3x + 2y = 5$  and  $3x + 2y = 6$  have no solution because  $3x + 2y$  cannot simultaneously be 5 and 6.
- Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

### Interpret the structure of expressions

A-SSE.1 Interpret expressions that represent a quantity in terms of its context.\*

- Interpret parts of an expression, such as terms, factors, and coefficients.
- Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*

c. Use the properties of exponents to transform expressions for exponential functions. For example the expression  $1.15t$  can be rewritten as  $[1.151/12]^{12t} \approx 1.01212t$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

#### Creating equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.\*

A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.\*

A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .\*

#### Solve equations and inequalities in one variable

A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

#### Solve systems of equations

A-REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

#### Represent and solve equations and inequalities graphically

A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11 Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

A-REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

### Functions

#### Define, evaluate, and compare functions

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. 1

8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

8.F.3 Interpret the equation  $y = mx + b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function  $A = s^2$  giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

#### Use functions to model relationships between quantities

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.



8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

#### Understand the concept of a function and use function notation

F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

#### Interpret functions that arise in applications in terms of the context

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\* Analyze functions using different representations Supporting

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\* a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

#### Build a function that models a relationship between two quantities

F-BF.1 Write a function that describes a relationship between two quantities.\* a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.\*

#### Construct and compare linear, quadratic, and exponential models and solve problems

F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.\*

a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).\*

F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.\* Interpret expressions for functions in terms of the situation they model Supporting

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.\*

## Geometry

### Understand and apply the Pythagorean Theorem

8.G.6 Explain a proof of the Pythagorean Theorem and its converse.

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

### Experiment with transformations in the plane

G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

G-CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

G-CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

G-CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

### Understand congruence in terms of rigid motions

G-CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

### Prove geometric theorems

G-CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

## Statistics and Probability

### Investigate patterns of association in bivariate data

8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.



8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Summarize, represent, and interpret data on a single count or measurement variable

- S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).\*
- S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.\*
- S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).\*

Summarize, represent, and interpret data on two categorical and quantitative variables

- S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.\*
- S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*
  - a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
  - c. Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

- S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.\*
- S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.\*
- S-ID.9 Distinguish between correlation and causation.\*

Algebra I

Number and Quantity

Use properties of rational and irrational numbers

- N-RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Reason quantitatively and use units to solve problems

- N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.\*
- N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*
- N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.\*

Algebra

Interpret the structure of expressions

- A-SSE.1 Interpret expressions that represent a quantity in terms of its context.\*
  - a. Interpret parts of an expression, such as terms, factors, and coefficients.
  - b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .
- A-SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$  thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

### Write expressions in equivalent forms to solve problems

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*

- Factor a quadratic expression to reveal the zeros of the function it defines.
- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- Use the properties of exponents to transform expressions for exponential functions. For example the expression  $1.15t$  can be rewritten as  $[1.151/12] 12t \approx 1.01212t$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

## Algebra I

### Perform arithmetic operations on polynomials

A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

### Understand the relationship between zeros and factors of polynomials

A-APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

### Create equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.\*

A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.\*

A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .\*

### Understand solving equations as a process of reasoning and explain the reasoning

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

### Solve equations and inequalities in one variable

A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4 Solve quadratic equations in one variable.

- Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

## Algebra I

### Solve systems of equations

A-REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

### Represent and solve equations and inequalities graphically

A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11 Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

A-REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

## Functions

### Understand the concept of a function and use function notation

F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$

### Interpret functions that arise in applications in terms of the context

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

## Algebra I

### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. B

### Build a function that models a relationship between two quantities

F-BF.1 Write a function that describes a relationship between two quantities.\*

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

### Build new functions from existing functions

F-BF.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them

### Construct and compare linear, quadratic, and exponential models and solve problems

F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.\*  
a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.  
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.  
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.  
F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).\*  
F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.\*

## Algebra I

### Interpret expressions for functions in terms of the situation they model

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.\*

## Statistics and Probability \*

### Summarize, represent, and interpret data on a single count or measurement variable

S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).\*  
S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.\*  
S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).\*

### Summarize, represent, and interpret data on two categorical and quantitative variables

S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.\*  
S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*  
a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.  
b. Informally assess the fit of a function by plotting and analyzing residuals.  
c. Fit a linear function for a scatter plot that suggests a linear association.

### Interpret linear models

S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.\*  
S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.\*  
S-ID.9 Distinguish between correlation and causation.\*

## Geometry Course

### Geometry

### Experiment with transformations in the plane

G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

G-CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

G-CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

G-CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

#### Understand congruence in terms of rigid motions

G-CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

#### Prove geometric theorems

G-CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

### Geometry Course

#### Make geometric constructions

G-CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G-CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

#### Understand similarity in terms of similarity transformations

G-SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor:

a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

### Prove theorems involving similarity

G-SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

G-SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Define trigonometric ratios and solve problems involving right triangles

G-SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G-SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.

G-SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.\*

### Understand and apply theorems about circles

G-C.1 Prove that all circles are similar

G-C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

G-C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

### Find arc lengths and areas of sectors of circles

G-C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

### Translate between the geometric description and the equation for a conic section A

G-GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

### Use coordinates to prove simple geometric theorems algebraically

G-GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, \sqrt{3})$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .

G-GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

G-GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

G-GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.\*

### Explain volume formulas and use them to solve problems

G-GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

G-GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.\*

### Visualize relationships between two-dimensional and three-dimensional objects

G-GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

### Apply geometric concepts in modeling situations

G-MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).\*



G-MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).\*

G-MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).\*

## Algebra II

### Number and Quantity

#### Extend the properties of exponents to rational exponents

N-RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $[5^{1/3}]^3 = 5(1/3)^3$  to hold, so  $[5^{1/3}]^3$  must equal 5.

N-RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

#### Reason quantitatively and use units to solve problems

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*

#### Perform arithmetic operations with complex numbers

N-CN.1 Know there is a complex number  $i$  such that  $i^2 = -1$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

N-CN.2 Use the relation  $i^2 = -1$  and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

#### Use complex numbers in polynomial identities and equations

N-CN.7 Solve quadratic equations with real coefficients that have complex solutions.

## Algebra

### Interpret the structure of expressions

A-SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2 - y^2)(x^2 + y^2)$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

### Write expressions in equivalent forms to solve problems

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\* c. Use the properties of exponents to transform expressions for exponential functions. For example the expression  $1.15t$  can be rewritten as  $[1.151/12]^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

## Algebra II

A-SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.\*

### Understand the relationship between zeros and factors of polynomials

A-APR.2 Know and apply the Remainder Theorem: For a polynomial  $p(x)$  and a number  $a$ , the remainder on division by  $x - a$  is  $p(a)$ , so  $p(a) = 0$  if and only if  $(x - a)$  is a factor of  $p(x)$ .

A-APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

### Use polynomial identities to solve problems

A-APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity  $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$  can be used to generate Pythagorean triples.

### Rewrite rational expressions

A-APR.6 Rewrite simple rational expressions in different forms; write  $a(x)/b(x)$  in the form  $q(x) + r(x)/b(x)$ , where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

### Create equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

### Understand solving equations as a process of reasoning and explain the reasoning

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

### Solve equations and inequalities in one variable

A-REI.4 Solve quadratic equations in one variable. b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

## Algebra II

### Solve systems of equations

A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .

### Represent and solve equations and inequalities graphically

A-REI.11 Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

## Functions

### Understand the concept of a function and use function notation

F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

### Interpret functions that arise in applications in terms of the context

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.



## Algebra II

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth and decay.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

### Build a function that models a relationship between two quantities

F-BF.1 Write a function that describes a relationship between two quantities.\*

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.\*

### Build new functions from existing functions

F-BF.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.4 Find inverse functions. a. Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ .

### Construct and compare linear, quadratic, and exponential models and solve problems

F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).\*

F-LE.4 For exponential models, express as a logarithm the solution to  $abct = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology.\*

### Interpret expressions for functions in terms of the situation they model

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.\*

## Algebra II

### Extend the domain of trigonometric functions using the unit circle

F-TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

### Model periodic phenomena with trigonometric functions

F-TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.\*

### Prove and apply trigonometric identities

F-TF.8 Prove the Pythagorean identity  $\sin^2(\theta) + \cos^2(\theta) = 1$  and use it to find  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$ , given  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$  and the quadrant of the angle.

## Geometry

### Translate between the geometric description and the equation for a conic section

G-GPE.2 Derive the equation of a parabola given a focus and directrix.

## Statistics and Probability

### Summarize, represent, and interpret data on a single count or measurement variable

S-ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.\*

### Summarize, represent, and interpret data on two categorical and quantitative variables

S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*

a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

## Algebra II

### Understand and evaluate random processes underlying statistical experiments

S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.\*

S-IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?\*

### Make inferences and justify conclusions from sample surveys, experiments, and observational studies

S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.\*

S-IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.\*

S-IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.\*

S-IC.6 Evaluate reports based on data.\*

### Understand independence and conditional probability and use them to interpret data

S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).\*

S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.\*

S-CP.3 Understand the conditional probability of A given B as  $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.\*

S-CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.\*

S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.\*

Use the rules of probability to compute probabilities of compound events in a uniform probability model

S-CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.\*

S-CP.7 Apply the Addition Rule,  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.\*

Integrated Mathematics

Number and Quantity

Reason quantitatively and use units to solve problems

N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.\*

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*

N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.\*

Algebra

Interpret the structure of expressions

A-SSE.1 Interpret expressions that represent a quantity in terms of its context.\*

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret  $P(1+r)^n$  as the product of P and a factor not depending on P.

Write expressions in equivalent forms to solve problems

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*

c. Use the properties of exponents to transform expressions for exponential functions. For example the expression  $1.15t$  can be rewritten as  $[1.151/12]^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

Create equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.\*

A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.\*

A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance R.\*

Integrated Mathematics I

Solve equations and inequalities in one variable

A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Solve systems of equations

A-REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

### Represent and solve equations and inequalities graphically

A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11 Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

A-REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

## Functions

### Understand the concept of a function and use function notation

F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n+1) = f(n) + f(n-1)$  for  $n \geq 1$ .

### Interpret functions that arise in applications in terms of the context

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

## Integrated Mathematics I

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

### Build a function that models a relationship between two quantities

F-BF.1 Write a function that describes a relationship between two quantities.\* a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.\*

### Construct and compare linear, quadratic, and exponential models and solve problems

F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.\*

- a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).\*

F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.\*

### Interpret expressions for functions in terms of the situation they model

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.\*

## Integrated Mathematics I

### Geometry

#### Experiment with transformations in the plane

G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

G-CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

G-CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

G-CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

#### Understand congruence in terms of rigid motions

G-CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

#### Prove geometric theorems

G-CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

Integrated Mathematics I  
Statistics and Probability

Summarize, represent, and interpret data on a single count or measurement variable

- S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).\*
- S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.\*
- S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).\*

Summarize, represent, and interpret data on two categorical and quantitative variables

- S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.\*
- S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*
  - a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
  - c. Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

- S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.\*
- S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.\*
- S-ID.9 Distinguish between correlation and causation.\*

Integrated Mathematics I  
Number and Quantity

Extend the properties of exponents to rational exponents

- N-RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $[5^{1/3}]^3 = 5(1/3)^3$  to hold, so  $[5^{1/3}]^3$  must equal 5.
- N-RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Use properties of rational and irrational numbers

- N-RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Reason quantitatively and use units to solve problems

- N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*

Perform arithmetic operations with complex numbers

- N-CN.1 Know there is a complex number  $i$  such that  $i^2 = -1$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.
- N-CN.2 Use the relation  $i^2 = -1$  and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations

- N-CN.7 Solve quadratic equations with real coefficients that have complex solutions.



## Algebra

### Interpret the structure of expressions

A-SSE.1 Interpret expressions that represent a quantity in terms of its context.\* b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .

## Integrated Mathematics II

A-SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

### Write expressions in equivalent forms to solve problems

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*

a. Factor a quadratic expression to reveal the zeros of the function it defines.

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

### Perform arithmetic operations on polynomials

A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

### Create equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.\*

A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .\*

### Understand solving equations as a process of reasoning and explain the reasoning M

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

### Solve equations and inequalities in one variable

A-REI.4 Solve quadratic equations in one variable.

a. Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.

b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

### Solve systems of equations

A-REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .

## Functions

### Interpret functions that arise in applications in terms of the context M

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

#### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth and decay.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

### Integrated Mathematics II

#### Build a function that models a relationship between two quantities

F-BF.1 Write a function that describes a relationship between two quantities.\*

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

#### Build new functions from existing functions

F-BF.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

### Geometry

#### Understand similarity in terms of similarity transformations

G-SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor:

a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

#### Prove theorems using similarity

G-SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.



G-SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles

G-SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G-SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.

Integrated Mathematics II

G-SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.\*

Explain volume formulas and use them to solve problems

G-GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

G-GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.\*

Statistics and Probability\*

Summarize, represent, and interpret data on two categorical and quantitative variables

S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*

a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

b. Informally assess the fit of a function by plotting and analyzing residuals.

Understand independence and conditional probability and use them to interpret data

S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).\*

S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.\*

S-CP.3 Understand the conditional probability of A given B as  $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.\*

S-CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.\*

S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Integrated Mathematics II

Use the rules of probability to compute probabilities of compound events in a uniform probability model

S-CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.\*

S-CP.7 Apply the Addition Rule,  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.\*

## Integrated Mathematics III

### Number and Quantity

#### Reason quantitatively and use units to solve problems

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.\*

### Algebra

#### Interpret the structure of expressions

A-SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .

#### Write expressions in equivalent forms to solve problems

A-SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.\*

#### Understand the relationship between zeros and factors of polynomials

A-APR.2 Know and apply the Remainder Theorem: For a polynomial  $p(x)$  and a number  $a$ , the remainder on division by  $x - a$  is  $p(a)$ , so  $p(a) = 0$  if and only if  $(x - a)$  is a factor of  $p(x)$ .

A-APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

#### Use polynomial identities to solve problems

A-APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity  $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$  can be used to generate Pythagorean triples.

#### Rewrite rational expressions

A-APR.6 Rewrite simple rational expressions in different forms; write  $a(x)/b(x)$  in the form  $q(x) + r(x)/b(x)$ , where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

## Integrated Mathematics III

### Create equations that describe numbers or relationships

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.\*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.\*

### Understand solving equations as a process of reasoning and explain the reasoning

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

### Represent and solve equations and inequalities graphically

A-REI.11 Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

### Interpret functions that arise in applications in terms of the context

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\* c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

### Build new functions from existing functions

F-BF.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.4 Find inverse functions. a. Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ .

### Construct and compare linear, quadratic, and exponential models and solve problems

F-LE.4 For exponential models, express as a logarithm the solution to  $abct = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology.\*

### Extend the domain of trigonometric functions using the unit circle

F-TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

### Model periodic phenomena with trigonometric functions

F-TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.\*

### Prove and apply trigonometric identities

F-TF.8 Prove the Pythagorean identity  $\sin^2(\theta) + \cos^2(\theta) = 1$  and use it to find  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$ , given  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$  and the quadrant of the angle.

## Integrated Mathematics III

### Geometry

#### Make geometric constructions

G-CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G-CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

### Understand and apply theorems about circles

G-C.1 Prove that all circles are similar.

G-C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

G-C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

### Find arc lengths and areas of sectors of circles

G-C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

### Translate between the geometric description and the equation for a conic section

G-GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

G-GPE.2 Derive the equation of a parabola given a focus and directrix.

### Use coordinates to prove simple geometric theorems algebraically

G-GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, \sqrt{3})$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .

G-GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

### Integrated Mathematics III

G-GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

G-GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.\*

### Visualize relationships between two-dimensional and three-dimensional objects

G-GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

### Apply geometric concepts in modeling situations

G-MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).\*

G-MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).\*

G-MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with topographic grid systems based on ratios).\*

### Statistics and Probability\*

#### Summarize, represent, and interpret data on a single count or measurement variable S

S-ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.\*

Summarize, represent, and interpret data on two categorical and quantitative variables

S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.\*

a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

b. Informally assess the fit of a function by plotting and analyzing residuals.

Understand and evaluate random processes underlying statistical experiments

S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Integrated Mathematics III

S-IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?\*

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.\*

S-IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.\*

S-IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.\*

S-IC.6 Evaluate reports based on data.\*

Advanced Mathematics Plus

Number and Quantity

Perform arithmetic operations with complex numbers

N-CN.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Represent complex numbers and their operations on the complex plane

N-CN.4 Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.

N-CN.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example,  $(-1 + \sqrt{3}i)^3 = 8$  because  $(-1 + \sqrt{3}i)$  has modulus 2 and argument  $120^\circ$ .

N-CN.6 Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Use complex numbers in polynomial identities and equations

N-CN.8 Extend polynomial identities to the complex numbers. For example, rewrite  $x^2 + 4$  as  $(x + 2i)(x - 2i)$ .

N-CN.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials

Represent and model with vector quantities

N-VM.1 Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g.,  $v$ ,  $|v|$ ,  $\|v\|$ ,  $v$ ).

N-VM.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

N-VM.3 Solve problems involving velocity and other quantities that can be represented by vectors.

## Advanced Mathematics Plus

### Perform operations on vectors

N-VM.4 Add and subtract vectors.

- Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
- Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
- Understand vector subtraction  $v - w$  as  $v + (-w)$ , where  $-w$  is the additive inverse of  $w$ , with the same magnitude as  $w$  and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

N-VM.5 Multiply a vector by a scalar.

- Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as  $c(v_x, v_y) = (cv_x, cv_y)$ .
- Compute the magnitude of a scalar multiple  $cv$  using  $\|cv\| = |c|v$ . Compute the direction of  $cv$  knowing that when  $|c| > 0$ , the direction of  $cv$  is either along  $v$  (for  $c > 0$ ) or against  $v$  (for  $c < 0$ ).

### Perform operations on matrices and use matrices in applications

N-VM.6 Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

N-VM.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

N-VM.8 Add, subtract, and multiply matrices of appropriate dimensions.

N-VM.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

N-VM.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

N-VM.11 Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.

N-VM.12 Work with  $2 \times 2$  matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

## Algebra

### Use polynomial identities to solve problems

A-APR.5 Know and apply the Binomial Theorem for the expansion of  $(x + y)^n$  in powers of  $x$  and  $y$  for a positive integer  $n$ , where  $x$  and  $y$  are any numbers, with coefficients determined for example by Pascal's Triangle.

## Advanced Mathematics Plus

### Rewrite rational expressions

A-APR.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

### Solve systems of equations

A-REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension  $3 \times 3$  or greater).

## Functions

### Analyze functions using different representations

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.



Build a function that models a relationship between two quantities

- F-BF.1 Write a function that describes a relationship between two quantities. \*
- c. Compose functions. For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.

Build new functions from existing functions

- F-BF.4 Find inverse functions.
- b. Verify by composition that one function is the inverse of another.
- c. Read values of an inverse function from a graph or a table, given that the function has an inverse.
- d. Produce an invertible function from a non-invertible function by restricting the domain.
- F-BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Advanced Mathematics Plus

Extend the domain of trigonometric functions using the unit circle

- F-TF.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for  $\pi/3$ ,  $\pi/4$  and  $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for  $\pi-x$ ,  $\pi+x$ , and  $2\pi-x$  in terms of their values for  $x$ , where  $x$  is any real number.
- F-TF.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model periodic phenomena with trigonometric functions

- F-TF.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
- F-TF.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. \*

Prove and apply trigonometric identities

- F-TF.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

Apply trigonometry to general triangles

- G-SRT.9 Derive the formula  $A = \frac{1}{2} ab \sin(C)$  for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- G-SRT.10 Prove the Laws of Sines and Cosines and use them to solve problems.
- G-SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Understand and apply theorems about circles

- G-C.4 Construct a tangent line from a point outside a given circle to the circle.

Translate between the geometric description and the equation for a conic section

Advanced Mathematics Plus

- G-GPE.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Explain volume formulas and use them to solve problems

- G-GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Statistics and Probability\*

Use the rules of probability to compute probabilities of compound events in a uniform probability model

- S-CP.8 Apply the general Multiplication Rule in a uniform probability model,  $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$ , and interpret the answer in terms of the model.\*

S-CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.\*

Calculate expected values and use them to solve problems

S-MD.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.\*

S-MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.\*

S-MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.\*

S-MD.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?\*

Advanced Mathematics Plus

Use probability to evaluate outcomes of decisions

S-MD.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. \*

a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.

b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.\*

S-MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).\*

S-MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).\*



## Appendix E: International Society for Technology in Education Standards (ISTE)

ISTE Crosswalk for 2017 Secondary Culinary Arts													
	Course	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12
<b>ISTE Standards</b>													
T1										X		X	
T2		X	X	X		X				X	X		
T3												X	
T4					X	X	X	X	X				
T5													X
		Unit 13	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18	Unit 19	Unit 20	Unit 21	Unit 22	Unit 23	Unit 24
T1									X	X			
T2			X						X	X			
T3									X	X			
T4		X		X	X	X	X	X			X	X	X

- T1** Creativity and Innovation
- T2** Communication and Collaboration
- T3** Research and Information Fluency
- T4** Critical Thinking, Problem Solving, and Decision Making
- T5** Digital Citizenship
- T6** Technology Operations and Concepts

- T1** Creativity and Innovation  
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:
- a. Apply existing knowledge to generate new ideas, products, or processes.
  - b. Create original works as a means of personal or group expression.
  - c. Use models and simulations to explore complex systems and issues.
  - d. Identify trends and forecast possibilities.
- T2** Communication and Collaboration  
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:
- a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
  - b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.

- c. Develop cultural understanding and global awareness by engaging with learners of other cultures.
- d. Contribute to project teams to produce original works or solve problems.

**T3** Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students do the following:

- a. Plan strategies to guide inquiry.
- b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
- d. Process data and report results.

**T4** Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Students do the following:

- a. Identify and define authentic problems and significant questions for investigation.
- b. Plan and manage activities to develop a solution or complete a project.
- c. Collect and analyze data to identify solutions and/or make informed decisions.
- d. Use multiple processes and diverse perspectives to explore alternative solutions.

**T5** Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:

- a. Advocate and practice safe, legal, and responsible use of information and technology.
- b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
- c. Demonstrate personal responsibility for lifelong learning.
- d. Exhibit leadership for digital citizenship.

**T6** Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:

- a. Understand and use technology systems.
- b. Select and use applications effectively and productively.
- c. Troubleshoot systems and applications.
- d. Transfer current knowledge to learning of new technologies.

Source: *MS Code §37-1-3, 37-31-103 (Adopted 07/2016)*

