2025 Carpentry

Program CIP: 46.0201 — Carpentry

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The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land-grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances the 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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Acknowledgments

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Dr. Lance Evans, State Superintendent of Education, Executive Secretary
Mr. Glen V. East, Chair
Mr. Matt Miller, Vice-Chair
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Mr. Matt Mayo
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Standards

Standards and alignment crosswalks are referenced in the appendices. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi's CTE Carpentry curriculum is aligned to the following standards:

National Center for Construction Education and Research (NCCER) Learning Series – Carpentry Standards
The NCCER developed and published a set of industry standards that are taught nationwide by contractors, associations, construction users, and secondary and postsecondary schools called the NCCER Learning Series. When developing this set of standards, the NCCER assembled a team of subject matter experts that represented construction companies and schools across the nation. Each committee met multiple times and collected the experts' knowledge and experience to finalize the set of national industry standards.
nccer.org

College- and Career-Readiness Standards
College- and career-readiness 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-Readiness Standards (MCCRS) to provide a consistent, clear understanding of what students are expected to learn and so teachers and parents know what they need to do to help them.
mdek12.org/oae/college-and-career-readiness-standards

Framework for 21st Century Learning
In defining 21st-century learning, the Partnership for 21st Century Skills has embraced key themes and skill areas that represent the essential knowledge for the 21st century: global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; environmental literacy; learning and innovation skills; information, media, and technology skills; and life and career skills.
battelleforkids.org/networks/p21/frameworks-resources

Preface

Secondary CTE 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 applied 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. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

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; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning
: Program resources can be found at the RCU's website, 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, contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Executive Summary

Pathway Description
Carpentry is a pathway in the Construction Career Cluster. This carpentry course prepares students for professional careers in the construction industry. It teaches them how to interpret construction plans, calculate material quantities, and perform a variety of construction-related tasks like framing walls, building floor systems, and installing windows and doors. This pathway emphasizes the importance of safety procedures, effective communication, and adherence to industry standards. This ensures that students are well-equipped for either entry level carpentry employment opportunities after graduation or enrollment in a postsecondary construction program (e.g., residential carpentry, etc.). It is designed for students who wish to become proficient with basic carpentry processes. The carpentry curriculum units are aligned with the general concepts covered in the National Center for Construction Education and Research (NCCER) certification standards.

College, Career, and Certifications
NCCER Core and NCCER Carpentry Level 1

Grade Level and Class Size Recommendations
It is recommended that students enter this program as sophomores, juniors, or seniors. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students is recommended per class with only one class with the teacher at a time.

Student Prerequisites
For students to experience success in the program, the following student prerequisites are suggested:

1. Required successful completion of either Construction – 993101 or a combination of Safety and Orientation to Construction - 993102 and Introduction to Construction - 993103
2. C or higher in English (the previous year)
3. C or higher in high school-level math (last course taken or the instructor can specify the level of math instruction needed)
4. Instructor approval and Test of Adult Basic Education (TABE) reading score (eighth grade or higher)

or

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

Assessment
The latest assessment blueprint for the curriculum can be found at rcu.msstate.edu/curriculum.

Applied Academic Credit
The latest academic credit information can be found at mdek12.org/ese/approved-course-for-the-secondary-schools.

Teacher Licensure
The latest teacher licensure information can be found at
mdek12.org/oel/apply-for-an-educator-license.

Professional Learning
If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Course Outlines

Option 1—Four 1-Carnegie Unit Courses

This curriculum consists of four 1-credit courses that should be completed in the following sequence:

1. **Safety and Orientation to Construction—Course Code: 993102**
2. **Introduction to Construction—Course Code: 993103**
3. **Theory and Application of Carpentry I—Course Code: 993111**
4. **Theory and Application of Carpentry II—Course Code: 993112**

Course Description: **Safety and Orientation to Construction**
This course focuses on the NCCER Learning Series Core. It addresses work-based learning opportunities, student organizations, and leadership skills. Students will demonstrate basic safety practices within the classroom shop area and within the industrial carpentry setting. They will apply construction math, use and maintain hand and power tools, and read blueprints, all the while developing communication and employability skills.

Course Description: **Introduction to Construction**
Introduction to Construction emphasizes an overview of construction-related trades, including carpentry. It covers topics including selecting building materials and fasteners, interpreting construction plans and documentation, utilizing measurement and leveling tools. This course gives students' real-world, hands-on practice in these areas. This course should be taken only after students successfully pass the Safety and Orientation to Construction course.

Course Description: Theory and Application of Carpentry I
The Theory and Application of Carpentry I course identifies the foundational skills and knowledge required for a professional carpentry career. It covers planning site and building layouts and it also prepares students for assembling floor systems. Students will follow safety procedures and will learn the importance of following verbal and written instructions effectively in on-the-job situations all while adhering to industry standards, construction building codes, and safety protocols. This course should be taken only after students successfully pass the Introduction to Construction course.

Course Description: Theory and Application of Carpentry II
The Theory and Application of Carpentry II course incorporates advanced carpentry skills. It covers topics including calculating framing materials needed to construct wood and steel frame wall systems and it investigates materials and processes used to construct roof frames. It also covers constructing basic stair layouts and then allows students to correctly install building envelope systems. This course should be taken only after students successfully pass the Theory and Application of Carpentry I course.

Safety and Orientation to Construction—Course Code: 993102

Unit	Unit Title	Hours
1	Build Your Future in Construction	21
2	Basic Safety	21
3	Introduction to Construction Math	17
4	Hand Tools	12
5	Power Tools	12
6	Introduction to Construction Drawings	12
7	Communication Skills	12
8	Employability Skills	12
9	Introduction to Materials Handling	21
Total		**140**

Introduction to Construction—Course Code: 993103

Unit	Unit Title	Hours
10	Orientation to Carpentry - 27101	70
11	Building Materials and Fasteners - 27102	14
12	Construction Plans and Documents - 27113	56
Total		**140**

Theory and Application of Carpentry I—Course Code: 993111

Unit	Unit Title	Hours
13	Principles of Site and Building Layout - 27114	70
14	Floor Systems - 27105	70
Total		**140**

Theory and Application of Carpentry II—Course Code: 993112

Unit	Unit Title	Hours
15	Wall Systems - 27111	20
16	Roof Framing - 27112	50
17	Basic Stair Layout - 27110	35
18	Building Envelope Systems - 27109	35
Total		**140**

Option 2—Two 2-Carnegie Unit Courses

This curriculum consists of two 2-credit courses that should be completed in the following sequence:

1. **Construction—Course Code: 993101**
2. **Carpentry—Course Code: 993110**

Course Description: Construction
This Construction course focuses on the NCCER Learning Series Core. It addresses work-based learning opportunities, student organizations, and leadership skills. Students will demonstrate basic safety practices within the classroom shop area and within the industrial carpentry setting. They will apply construction math, use and maintain hand and power tools, and read blueprints, all the while developing communication and employability skills. This course also emphasizes an overview of construction-related trades, including carpentry. This course gives students' real-world, hands-on practice in these areas.

Course Description: Carpentry
The Carpentry course identifies the foundational skills and knowledge required for a professional carpentry career. It covers topics including selecting building materials and fasteners, interpreting construction plans and documentation, utilizing measurement and leveling tools when planning site and building layouts, and assembling floor systems. Students will follow safety procedures and will learn the importance of following verbal and written instructions effectively in on-the-job situations all while adhering to industry standards, construction building codes, and safety protocols. This course also incorporates advanced carpentry skills involving calculating framing materials needed to construct wood and steel frame wall systems. It investigates materials and processes used to construct roof frames. Students will also construct basic stair layouts and will correctly install building envelope systems.

Construction—Course Code: 993101

Unit	Unit Title	Hours
1	Build Your Future in Construction	21
2	Basic Safety	21
3	Introduction to Construction Math	17
4	Hand Tools	12
5	Power Tools	12
6	Introduction to Construction Drawings	12
7	Communication Skills	12
8	Employability Skills	12
9	Introduction to Materials Handling	21
10	Orientation to Carpentry - 27101	70
11	Building Materials and Fasteners - 27102	14
12	Construction Plans and Documents - 27113	56
Total		**280**

Carpentry—Course Code: 993110

Unit	Unit Title	Hours
13	Principles of Site and Building Layout - 27114	70
14	Floor Systems - 27105	70
15	Wall Systems - 27111	20
16	Roof Framing - 27112	50
17	Basic Stair Layout - 27110	35
18	Building Envelope Systems - 27109	35
Total		**280**

Career Pathway Outlook

Overview

By implementing the National Center for Construction Education and Research (NCCER)'s Learning Series construction skills standards into the construction-related pathways, students who successfully master the curriculum should have the skills to enter the workforce or pursue an advanced degree. These skills are based on industry-validated performance indicators. The pathway will include applied instruction designed to articulate with programs offered in Mississippi's community and junior colleges. The architecture and construction career pathway covers aspects of the construction process, including building, designing, maintaining, and managing structures. A graduate of this carpentry program can advance to become a professional carpenter, construction inspector, construction laborer, electrician, general contractor, iron/metalworker, landscape architect, plumber, sheet metal worker, and solar photovoltaic installer, among many other skilled occupations. Carpenters construct, repair, and install building frameworks and structures made from wood and other materials. Carpentry work is physically and mentally demanding, requiring many successful skills. Their work environments include a variety of simultaneously occurring construction-related activities. They work indoors and outdoors on many types of construction projects, from installing kitchen cabinets to building highways and bridges. They may work in cramped spaces and frequently alternate between lifting, standing, and kneeling. Carpenters must carefully review plans and specifications, accurately measure and cut materials, assemble and install structural elements, fixtures, and finishes while coordinating work activities and maintaining clean, safe job sites.

While on-the-job apprenticeships are available to carpenters, some carpentry-related careers may require at least an associate degree. Related careers with the highest earning potential—architects, engineers, and post-secondary teachers, for example—require advanced degrees. Students enrolled in these courses should be well prepared to pursue community college and four-year college degrees.

Needs of the Future Workforce

According to the U.S. Bureau of Labor Statistics, about 79,500 openings for carpenters are projected each year, on average, through 2032. In 2022, carpenters held about 956,300 jobs nationally. The largest employers of carpenters were as follows: self-employed workers (27%), residential building construction (23%), building finishing contractors (13%), nonresidential building construction (12%), and foundation, structure, and building exterior contractors (10%). Population growth should result in more new-home construction which is one of the largest segments employing carpenters. Construction of factories and other nonresidential buildings also is projected to result in some new jobs over the decade. In May of 2023, the Memphis, TN-Northwest Mississippi-Arkansas area experienced carpentry employment of 1,360 with an average annual wage of $49,770. Also, the Gulfport-Pascagoula-Biloxi area benefitted from 570 employed carpenters with an average annual wage of $50,630. Nationally, carpenters can expect the median pay to be $56,350 annually. Interestingly, there are 870 cabinetmakers and bench carpenters employed in northeast Mississippi, which is the highest in the state, and can expect to earn $31,520 annually. Refer to Table 1.1 for information regarding current and projected construction-related occupations.

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2022	Projected Jobs, 2032	Change (Number)	Change (Percent)	Average Hourly Earnings, 2024
Architecture and Engineering Occupations	15,820	16,610	790	5%	$39.16
Brickmasons and Blockmasons	250	250	0	0%	$22.41
Cement Masons and Concrete Finishers	650	700	50	7.7%	$20.77
Civil Engineers	2,080	2,140	60	2.9%	$47.91
Construction and Building Inspectors	670	700	30	4.5%	$28.63
Construction and Extraction Occupations	51,130	53,810	2,680	5.2%	$23.30
Construction Laborers	12,210	12,530	320	2.6%	$17.72
Cost Estimators	1,300	1,340	40	3.1%	$32.49
Electrical and Electronics Engineering Technicians	850	870	20	2.4%	$30.25
Electrical Engineers	1,260	1,300	40	3.2%	$47.56
Electricians	5,780	6,280	500	8.7%	$27.39
First-Line Supervisors of Construction Trades and Extraction Workers	6,380	6,620	240	3.8%	$33.74
Furniture Finishers	60	60	0	0%	$15.95
Glaziers	320	340	20	6.3%	$19.37
Helpers, Construction Trades, All Other	190	200	10	5.3%	$14.56
Helpers--Carpenters	190	200	10	5.3%	$15.43
Helpers--Electricians	780	790	10	1.3%	$17.25
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	350	390	40	11.4%	$16.30
Installation, Maintenance, and Repair Occupations	55,600	58,480	2,880	5.2%	$24.18
Insulation Workers, Floor, Ceiling, and Wall	410	420	10	2.4%	$26.99
Manufactured Building and Mobile Home Installers	80	90	10	12.5%	$20.20
Millwrights	540	570	30	5.6%	$25.78

Operating Engineers and Other Construction Equipment Operators	3,430	3,590	160	4.7%	$21.78
Painters, Construction and Maintenance	2,160	2,210	50	2.3%	$19.85
Painting, Coating, and Decorating Workers	220	220	0	0%	$19.81
Paving, Surfacing, and Tamping Equipment Operators	710	740	30	4.2%	$19.17
Pipelayers	390	410	20	5.1%	$20.95
Plasterers and Stucco Masons	90	90	0	0%	$19.57
Plumbers, Pipefitters, and Steamfitters	3,050	3,300	250	8.2%	$25.61
Riggers	430	470	40	9.3%	$29.64
Roofers	620	660	40	6.5%	$19.13
Service Unit Operators, Oil, Gas, and Mining	140	190	50	35.7%	$28.98
Structural Iron and Steel Workers	640	650	10	1.6%	$22.00
Surveyors	430	440	10	2.3%	$27.52
Tile and Marble Setters	230	260	30	13%	$20.77

Source: Mississippi Department of Employment Security; mdes.ms.gov (2024).

Perkins V Requirements and Academic Infusion

The carpentry curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in carpentry fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses, that will further prepare them for architecture and construction careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Transition to Postsecondary Education

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website, mccb.edu.

Best Practices

Innovative Instructional Technologies

Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The carpentry educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunities to succeed.

CTE Student Organizations

Teachers should investigate opportunities to sponsor a student organization. There are several here in Mississippi that will foster the types of learning expected from the Carpentry curriculum. SkillsUSA and Technology Student Association (TSA) are examples of student organizations with many outlets for architecture and construction. Student organizations provide participants and members with growth opportunities and competitive events. They also open the doors to the world of carpentry-related careers and scholarship opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Carpentry 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 Carpentry curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the Carpentry curriculum that will allow and encourage collaboration with professionals currently within the carpentry field.

Work-Based Learning

Work-based learning is an extension of understanding competencies taught in the carpentry classroom. This curriculum is designed in a way that necessitates active involvement by the students in the community around them and the global environment. These real-world connections and applications link all types of students to knowledge, skills, and professional dispositions. Work-based learning should encompass ongoing and increasingly more complex involvement with local companies and carpentry professionals. Thus, supervised collaboration and immersion into the carpentry-related industry around the students are keys to students' success, knowledge, and skills development.

Professional Organizations

American Institute of Constructors (AIC)
aicnet.org

American Subcontractors Association (ASA) - Mississippi
asaofms.com

Associated Builders & Contractors (ABC) – Mississippi Chapter
abcmississippi.org

Association for Career and Technical Education (ACTE)
acteonline.org

Associated General Contractors of America (AGC) - Mississippi
msagc.com

Build Mississippi
buildmississippi.com

Construction Management Association of America (CMAA)
cmaanet.org

Home Builders Association of Mississippi (HBAM)
hbam.com

Mississippi Association for Career & Technical Education (MS ACTE)
mississippiacte.com

National Association of Home Builders (NAHB)
nahb.org

National Center for Construction Education and Research (NCCER)
nccer.org

National Institute of Building Sciences (NIBS)
nibs.org

Skills USA – Mississippi
mdek12.org/CTE/SO/SkillsUSA

SkillsUSA-National
skillsusa.org

Using This Document

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.

Teacher Resources
All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing helpdesk@rcu.msstate.edu.

Perkins V Quality Indicators and Enrichment Material
Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the carpentry program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be assessed on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

Unit 1: Build Your Future in Construction

Competencies and Suggested Objectives
1. Describe local program and center expectations, policies, and procedures. DOK1 a. Describe local program and career center policies and procedures, including dress code, attendance, academic requirements, discipline, shop/lab rules and regulations, and transportation regulations. b. Give a brief overview of the course and the carpentry industry. Explain the Construction and Carpentry Pathway, why it is important, and how it will be delivered. c. Compare and contrast local program and school policies to expectations of employers. d. Preview course objectives, program policy, and the industry standards.
2. Investigate work-based learning opportunities related to program areas. DOK1 a. Define work-based learning. b. Identify ways to pursue a career in the carpentry industry. c. Explore the opportunities available through the program areas, including: • Job shadowing • Apprenticeship programs • On-the-job training
3. Discuss the history, mission, and purpose of student organizations, including SkillsUSA. DOK1 a. Trace the history of the program area student organization. b. Identify the mission, purpose, and/or goals of the program area student organization.
4. Explore the advantages of membership in a student organization. DOK1 a. Discuss the membership process for the program area student organization. b. Explain the activities related to the local chapter and the state and national organization.
5. Discuss the organization's brand resources. DOK2 a. Identify the motto, creed, and/or pledge and discuss their meanings. b. Recognize related brand resources such as: • Emblem • Colors • Official Attire • Logos • Graphic Standards
6. Apply leadership skills to class and work-related situations and 21st Century Skills. DOK2 a. Define leadership. b. Discuss the attributes of a leader. c. Identify the roles a leader can assume.
7. Utilize teambuilding skills in class and work-related situations. DOK2 a. Define teambuilding. b. Discuss the attributes of a team. c. Identify the roles included in a team.
8. Discuss the various competitions offered through the program area student organization. DOK2

a. Describe each of the competitions and the skills needed to accomplish the tasks.
b. Perform the tasks needed to complete an assigned requirement for a competition.

Unit 2: Basic Safety

Competencies and Suggested Objectives
1. Describe, define, and illustrate general safety rules for working in a shop/lab and how they relate to construction and the carpentry industry. DOK2 a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies according to Occupational Safety and Health Administration (OSHA) standards. d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. e. Explain the need for evacuation policies and the importance of following them. f. Explain causes of accidents and the impact of accident costs. g. Compare and contrast shop/lab safety rules to industry safety rules.
2. Identify and apply safety around construction operations. DOK2 a. Use proper safety practices when constructing or working around carpentry operations. b. Explain the term "proximity work."
3. Display appropriate safety precautions to take around common job site hazards. DOK2 a. Explain the safety requirements for working in confined areas. b. Explain the different barriers and barricades and how they are used.
4. Demonstrate the appropriate use and care of personal protective equipment (PPE). DOK2 a. Identify commonly used PPE items. b. Understand proper use of PPE. c. Demonstrate appropriate care for PPE.
5. Explain fall protection, ladder, stair, and scaffold procedures and requirements. DOK2 a. Explain the use of proper fall protection. b. Inspect and safely work with various ladders, stairs, and scaffolds.
6. Explain the safety data sheet (SDS). DOK2 a. Explain the function of the SDS. b. Interpret the requirements of the SDS. c. Discuss hazardous material exposures.
7. Display appropriate safety procedures related to fires. DOK2 a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids. c. Explain the classes of fire and the types of extinguishers. d. Illustrate the proper steps to follow when using a fire extinguisher. e. Demonstrate the proper techniques for putting out a fire.
8. Explain safety in and around electrical situations. DOK2 a. Explain injuries that can result when electrical contact occurs. b. Explain safety around electrical hazards. c. Explain actions to take when an electrical shock occurs.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 3: Introduction to Construction Math

Competencies and Suggested Objectives
1. Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator. DOK3 a. Define basic angles and geometric shapes used in the manufacturing industry. • Explain angle types. • Explain geometric shapes and give an overview of their characteristics. • Discuss area and volume. b. Add, subtract, multiply, and divide whole numbers, decimals, and fractions with and without a calculator. c. Convert whole numbers to fractions and convert fractions to whole numbers. d. Convert decimals to percentages and convert percentages to decimals. e. Convert fractions to decimals. f. Convert fractions to percentages. g. Demonstrate reading a standard and metric ruler and tape measure. h. Recognize and use metric units of length, weight, volume, and temperature.

Unit 4: Hand Tools

Competencies and Suggested Objectives
1. Demonstrate the use and maintenance of hand tools. DOK2 a. Identify, visually inspect, and discuss the safe use of common hand tools used on job sites. b. Discuss rules of safety. c. Select and demonstrate the use of tools. d. Explain the procedures for maintenance.
2. Explore measurement and layout tools. DOK2

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 5: Power Tools

Competencies and Suggested Objectives
1. Demonstrate the use and maintenance of power tools. DOK2 a. Identify, visually inspect, and discuss the safe use of common power tools including electric, pneumatic, and hydraulic. b. Discuss rules of safety. c. Select and demonstrate the use of tools. d. Explain the procedures for maintenance.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 6: Introduction to Construction Drawings

Competencies and Suggested Objectives
1. Read, analyze, and understand basic components of a blueprint. DOK3 a. Recognize and identify terms, components, and symbols commonly used on blueprints. b. Relate information on drawings to actual locations on the print. c. Recognize different types of drawings. d. Interpret and use drawing dimensions and scale types.
2. Interpret symbols from a blueprint. DOK3
3. Examine various detail drawings. DOK3

Unit 7: Communication Skills

Competencies and Suggested Objectives
1. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. DOK2 a. Follow basic written and verbal instructions. b. Effectively communicate in on-the-job situations using verbal, written, or electronic communication.
2. Discuss the importance of good listening skills in on-the-job situations. DOK2 a. Apply the tips for developing good listening and speaking skills.

Unit 8: Employability Skills

Competencies and Suggested Objectives
1. Describe employment opportunities in the carpentry and construction industry. DOK2 a. Describe employment opportunities, including potential earnings, employee benefits, job availability, working conditions, educational requirements, required technology skills, and continuing education/training. b. Discuss the guidelines for developing a proper résumé. c. Demonstrate completing job applications.
2. Examine the Mississippi Department of Employment Security (MDES) website and its applications relating to employment opportunities. DOK2 a. Perform various searches through the MDES website such as: • Number of jobs available for a specific area of expertise • Hourly wage • Percent of jobs in the county • Percent of jobs in the state
3. Demonstrate appropriate interview skills. DOK2 a. Identify interview skills such as speaking, dress, professionalism, punctuality. b. Simulate a job interview.
4. Describe basic employee responsibilities and appropriate work ethics. DOK2 a. Compare and contrast employment responsibilities and expectations to local school and program policies and expectations. b. Define effective relationship skills and workplace issues including, but not limited to, sexual harassment, stress, and substance abuse. c. Demonstrate critical thinking and effective leadership skills.

Unit 9: Introduction to Materials Handling

Competencies and Suggested Objectives
1. Safely handle and store materials. DOK2 a. Define a load. b. Establish a pre-task plan prior to moving a load. c. Use proper materials-handling techniques. d. Recognize hazards and follow safety procedures required for materials handling.
2. Choose appropriate materials-handling equipment for the task. DOK2 a. Motorized b. Non-Motorized

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 10: Orientation to Carpentry - 27101

Competencies and Suggested Objectives
1. Review local program and career center policies and procedures. DOK1 a. Review local program and career center policies and school handbook procedures including dress code, attendance, acceptable use of technology policy, academic requirements, discipline, and transportation regulations. b. Give a brief overview of the course, and explain to students what General Carpentry is, why it is important for students to know the content of the course, and how it will be delivered. c. Review course objectives, program expectations, and industry standards.
2. Reinforce shop/lab rules and safety procedures. DOK2 a. Review Unit 5 of the Construction Core curriculum when discussing basic safety, which is associated with module 00101 or complete OSHA 10 training. ***Note:*** *This objective will be reinforced throughout the year. This unit must consist of at least 10 classroom hours regarding safety.*
3. Explore employment opportunities and employment responsibilities. DOK2 a. Research employment opportunities and include potential earnings, employee benefits, job availability, work environment, and educational requirements. b. Research basic employee responsibilities and appropriate work ethics. c. Update your resume and/or employment portfolio.
4. Review the advantages of membership in a student organization. DOK2 a. Discuss the membership process for the program area's student organization. b. Explain the activities related to the local chapter and the state and national organizations.
5. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. DOK 2 a. Follow basic written and verbal instructions. b. Effectively communicate in workplace situations.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file and the must be kept on file for the recommended time period.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.
Note: This unit is includes a reinforced review of the material covered in the Construction Core curriculum under Unit 5: Basic Safety and Option A – Unit 11: Introduction to Carpentry.

Unit 11: Building Materials and Fasteners - 27102

Competencies and Suggested Objectives
1. Select correct building materials, fasteners, and adhesives. DOK3 a. Identify and state the use of various building materials, types of softwoods and hardwoods, and the safety precautions associated with each. b. Identify the different grades and markings of wood building materials and types of engineered lumber. c. * - Calculate the quantities of building materials using industry-standard methods. d. * - Identify fasteners, anchors, and adhesives used in construction work and explain their uses.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.
Note: * - indicates Shop Time/Performance Task

Unit 12: Construction Plans and Documents - 27113

Competencies and Suggested Objectives
1. Identify the drawings included in construction plans and how to interpret them. DOK3 a. Explain what each drawing in a set of plans is used for. b. Recognize line types, symbols, and related abbreviations. c. Clarify the various approaches used in dimensioning construction drawings. d. * - Read and interpret construction plan drawings and schedules.
2. Explain the uses of written specifications. DOK2 a. Outline the structure and organization of specifications. b. Emphasize the significance of adhering to construction building codes. c. * - Understand and clarify written specifications.

Note: * - indicates Shop Time/Performance Task

Unit 13: Principles of Site and Building Layout - 27114

Competencies and Suggested Objectives
1. Summarize how site and building layouts utilize construction drawings. DOK3 a. Investigate and categorize site and building layout tasks. b. Distinguish the uses of construction drawing types with regard to building site layouts.
2. Identify right triangle computations and basic construction math ideas regarding site layouts. DOK2 a. Describe how site and building layouts utilize the Pythagorean Theorem and the 3-4-5 rule.
3. Examine how site and building layouts utilize measurement and leveling tools. DOK2 a. Identify measurement tools and how they are used. b. Explain leveling tool applications. c. * - Determine elevations and angles with the use of leveling tools (e.g., water level, builder's level, laser level, or transit level). d. Identify and explore instruments and equipment regarding site layouts. e. Describe site layout instruments and equipment. f. * - Show how measurement and leveling tools are used.
4. Verify that corners are square, set up building lines, and measure horizontal and vertical distances. DOK2 a. Determine the procedure for measuring both horizontal and vertical distances. b. Provide a summary of the steps for setting up building lines with batter boards and ensuring that corner boards are square. c. * - Utilize either the 3-4-5 rule or the Pythagorean Theorem to confirm that intersecting walls are at right angles.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: * - indicates Shop Time/Performance Task

Unit 14: Floor Systems - 27105

Competencies and Suggested Objectives
1. Outline the specifications and construction drawings that indicate the necessary floor system requirements. DOK2 a. Paraphrase how specifications and architectural drawings contribute to floor construction.
2. Recognize and differentiate categories of floor framing systems. DOK2 a. List and explain the varieties of wood-frame flooring systems.
3. Determine the components of a floor system and calculate the necessary quantities of materials. DOK3 a. Explain the function of a sill plate and its significance to floor framing. b. Identify and characterize various types of girders and supports. c. Explore types of floor joists. d. Determine the functions of a subfloor and underlayment. e. * - Calculate the quantity of materials required for floor structure. f. Calculate the required material quantity for framing a floor assembly based on a set of plans.
4. Explain the process of building a platform floor assembly. DOK3 a. Outline the procedure for constructing a floor assembly. b. * - Arrange and build a floor assembly incorporating a rough opening and subfloor material.

Note: * - indicates Shop Time/Performance Task

Unit 15: Wall Systems - 27111

Competencies and Suggested Objectives
1. List the elements of a wall system and explain the process of calculating the necessary framing materials. DOK3 a. Outline the elements of a wall system. b. Describe the process of estimating the quantities and materials needed for framing walls. c. * - Compute the estimated materials needed for wall framing.
2. Describe the process of marking and framing walls. DOK3 a. Provide a comprehensive explanation of the process involved in constructing wood frame walls. b. Provide a comprehensive explanation of the process involved in constructing steel frame walls. c. * - Arrange a wood frame wall incorporating plates, corner assemblies, door and window openings, partition Ts, bracing, and fireblocking.
3. Provide a concise overview of the process involved in constructing and raising wall systems. DOK3 a. Outline the process for putting together a wall. b. Demonstrate the four steps required to raise a wall. c. * - Construct and raise a wooden frame wall encompassing top and bottom plates, corner assemblies, openings for doors and windows, partition Ts, bracing, and fireblocking. d. * - Properly install the sheathing on a wall.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: * - indicates Shop Time/Performance Task

Unit 16: Roof Framing - 27112

Competencies and Suggested Objectives
1. Recognize and mount ceiling frame elements. DOK3 a. Explain the process of arranging, cutting, and setting up ceiling joists. b. Describe how to calculate and compute the required number of ceiling joists for a structure. c. * - Demonstrate ceiling joist lay out. d. * - Calculate the quantity of ceiling joists needed for the construction of the building.
2. Recognize and categorize the various types and components of residential roofs. DOK2
3. Explain and demonstrate the techniques of laying out and cutting common rafters. DOK3
4. Provide a detailed explanation on the process of constructing and sheathing a gable roof. DOK3 a. Explain the process of constructing a gable roof and its ends. b. Outline the process for attaching sheathing to the roof. c. Determine the quantity of rafters, ridgeboard, and sheathing required for material takeoff. d. * - Cut and install gable roof rafters, frame a gable end wall, and demonstrate how to sheath a gable roof with an opening.
5. Acknowledge the utilization of trusses in fundamental roof construction. DOK2 a. Discuss trusses and describe their installation process. b. Use trusses to erect a gable roof.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: * - indicates Shop Time/Performance Task

Unit 17: Basic Stair Layout - 27110

Competencies and Suggested Objectives
1. Recognize the essential elements of a stairway and the corresponding requirements associated with them. DOK2 a. Define essential stairway terminology and construction specifications. b. Expound on the various types of stairways.
2. Explain how to calculate the overall height, quantity, and dimension of risers and treads required for a staircase. DOK3 a. Explain how to calculate the total rise, tread count, dimensions of risers, and the count and dimensions of treads required for a staircase. b. Explain the process of determining the dimensions for stairwell openings. c. * - Calculate the rise and run for a stairway, determine the height and number of risers, and determine the depth and number of treads.
3. Explain the details regarding the procedures for constructing stairs. DOK3 a. Describe the process for laying out, cutting, and constructing stringers and concrete forms. b. * - Demonstrate how to lay out and cut a stringer.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: * - indicates Shop Time/Performance Task

Unit 18: Building Envelope Systems - 27109

Competencies and Suggested Objectives
1. Explain the function and elements of building envelope systems. DOK3 a. Discover methods to reduce air and moisture infiltration in structures.
2. Explain the varieties of windows and their installation specifications. DOK4 a. Recognize different window types, their uses, and the steps involved in their installation. b. * - Prepare a rough opening and ensure the correct installation of a window.
3. Provide an overview of the various types of doors including their specific applications and requirements for installation. DOK4 a. Differentiate between residential and non-residential doors and outline the installation procedures for each type. b. * - Prepare a rough opening and ensure the correct installation of a door.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: * - indicates Shop Time/Performance Task

Student Competency Profile

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.

Unit 1: Build Your Future in Construction		
	1.	Describe local program and center expectations, policies, and procedures.
	2.	Investigate work-based learning opportunities related to program areas.
	3.	Discuss the history, mission, and purpose of student organizations, including SkillsUSA.
	4.	Explore the advantages of membership in a student organization.
	5.	Discuss the organization's brand resources.
	6.	Apply leadership skills to class and work-related situations and 21st Century Skills.
	7.	Utilize teambuilding skills in class and work-related situations.
	8.	Discuss the various competitions offered through the program area student organization.
Unit 2: Basic Safety		
	1.	Describe, define, and illustrate general safety rules for working in a shop/lab and how they relate to construction and the carpentry industry.
	2.	Identify and apply safety around construction operations.
	3.	Display appropriate safety precautions to take around common jobsite hazards.
	4.	Demonstrate the appropriate use and care of personal protective equipment (PPE).
	5.	Explain fall protection, ladder, stair, and scaffold procedures and requirements.
	6.	Explain the safety data sheet (SDS).
	7.	Display appropriate safety procedures related to fires.
	8.	Explain safety in and around electrical situations.
Unit 3: Introduction to Construction Math		
	1.	Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator.
Unit 4: Hand Tools		
	1.	Demonstrate the use and maintenance of hand tools.
	2.	Explore measurement and layout tools.

Unit 5: Power Tools		
	1.	Demonstrate the use and maintenance of power tools.
Unit 6: Introduction to Construction Drawings		
	1.	Read, analyze, and understand basic components of a blueprint.
	2.	Interpret symbols from a blueprint.
	3.	Examine various detail drawings.
Unit 7: Communication Skills		
	1.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
	2.	Discuss the importance of good listening skills in on-the-job situations.
Unit 8: Employability Skills		
	1.	Describe employment opportunities in the carpentry and construction industry.
	2.	Examine the Mississippi Department of Employment Security (MDES) website and its applications relating to employment opportunities.
	3.	Demonstrate appropriate interview skills.
	4.	Describe basic employee responsibilities and appropriate work ethics.
Unit 9: Introduction to Materials Handling		
	1.	Safely handle and store materials.
	2.	Choose appropriate materials-handling equipment for the task.
Unit 10: Orientation to Carpentry - 27101		
	1.	Review local program and career center policies and procedures.
	2.	Reinforce shop/lab rules and safety procedures.
	3.	Explore employment opportunities and employment responsibilities.
	4.	Review the advantages of membership in a student organization.
	5.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
Unit 11: Building Materials and Fasteners - 27102		
	1.	Select correct building materials, fasteners, and adhesives.
Unit 12: Construction Plans and Documents - 27113		
	1.	Identify the drawings included in construction plans and how to interpret them.
	2.	Explain the uses of written specifications.
Unit 13: Principles of Site and Building Layout - 27114		
	1.	Summarize how site and building layouts utilize construction drawings.
	2.	Identify right triangle computations and basic construction math ideas regarding site layouts.
	3.	Examine how site and building layouts utilize measurement tools and leveling tools.

	4.	Verify that corners are square, set up building lines, and measure horizontal and vertical distances.
Unit 14: Floor Systems - 27105		
	1.	Outline the specifications and construction drawings that indicate the necessary floor system requirements.
	2.	Recognize and differentiate categories of floor framing systems.
	3.	Determine the components of a floor system and calculate the necessary quantities of materials.
	4.	Explain the process of building a platform floor assembly.
Unit 15: Wall Systems - 27111		
	1.	List the elements of a wall system and explain the process of calculating the necessary framing materials.
	2.	Describe the process of marking and framing walls.
	3.	Provide a concise overview of the process involved in constructing and raising wall systems.
Unit 16: Roof Framing - 27112		
	1.	Recognize and mount ceiling frame elements.
	2.	Recognize and categorize the various types and components of residential roofs.
	3.	Explain and demonstrate the techniques of laying out and cutting common rafters.
	4.	Provide a detailed explanation on the process of constructing and sheathing a gable roof.
	5.	Acknowledge the utilization of trusses in fundamental roof construction.
Unit 17: Basic Stair Layout - 27110		
	1.	Recognize the essential elements of a stairway and the corresponding requirements associated with them.
	2.	Explain how to calculate the overall height, quantity, and dimension of risers and treads required for a staircase.
	3.	Explain the details regarding the procedures for constructing stairs.
Unit 18: Building Envelope Systems - 27109		
	1.	Explain the function and elements of building envelope systems.
	2.	Explain the varieties of windows and their installation specifications.
	3.	Provide an overview of the various types of doors including their specific applications and requirements for installation.

Appendix A: National Center for Construction Education and Research (NCCER) - National Craft Assessment and Certification Program – Level Test Specifications – Carpentry – Level I Standards

	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Standards																			
Core																			
BFC		X							X										
BSM			X		X	X			X	X									
ICM				X	X														
IHT					X														
IPT						X													
BLU							X												
COM								X											
EMP									X										
IMH										X									
Carpentry Level 1																			
BMF											X	X							
CPD											X		X						
PSL											X			X					
FS											X				X				
WS											X					X			
RF											X						X		
BSL											X							X	
BES											X								X

National Center for Construction Education and Research (NCCER) - National Craft Assessment and Certification Program - Level Test Specifications – Core and Carpentry Level I

NCCER Core

1. BFC – Build Your Future in Construction (00100)
2. BSM - Basic Safety (00101)
3. ICM - Introduction to Construction Math (00102)
4. IHT - Introduction to Hand Tools (00103)
5. IPT - Introduction to Power Tools (00104)
6. BLU - Introduction to Construction Drawings (00105)
7. COM - Basic Communication Skills (00107)
8. EMP - Basic Employability Skills (00108)
9. IMH - Introduction to Materials Handling (00109)

Carpentry Level 1

10. BMF Building Materials and Fasteners (27102)
11. CPD Construction Plans and Documents (27113)
12. PSL Principles of Site and Building Layout (27114)
13. FS Floor Systems (27105)
14. WS Wall Systems (27111)
15. RF Roof Framing (27112)
16. BSL Basic Stair Layout (27110)

17. BES Building Envelope Systems (27109)

Appendix B: College and Career Ready Standards – Mathematics (8th Grade, Algebra I, and Geometry)

	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mathematics Standards																			
8th Grade																			
8.NS.1			X		X														
8.NS.2			X	X	X														
8.EE.1			X	X	X														
8.EE.4			X		X														
8.EE.5				X	X														
8.EE.6				X	X														
8.EE.7			X			X	X	X	X	X									
8.EE.8				X	X														
8.F.2					X														
8.F.3				X	X				X										
8.F.5					X														
8.G.1		X	X	X	X	X	X	X	X	X	X								
8.G.2		X		X	X	X	X	X	X	X									
8.G.3		X		X	X	X	X	X	X	X									
8.G.4		X		X	X	X	X	X	X	X									
8.G.5		X	X	X	X	X	X	X	X	X				X					
8.G.6					X														
8.G.7			X	X	X	X	X	X	X	X				X			X	X	
8.G.8					X									X					
8.G.9			X	X	X	X	X	X	X	X									
8.SP.1		X		X															
8.SP.2		X																	
8.SP.3		X																	
8.SP.4		X																	
Algebra I																			
N-RN.3					X														
N-Q.1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-Q.2			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-Q.3			X			X	X	X	X		X	X	X	X	X	X	X	X	X
A-SSE.1				X															
A-SSE.2				X	X														
A-SSE.3				X	X														
A-APR.1					X														
A-APR.3				X	X														
A-CED.1					X	X	X	X	X			X			X		X	X	X
A-CED.2				X	X														
A-CED.3				X															
A-CED.4				X															
A-REI.1				X	X														
A-REI.3				X	X														
A-REI.4				X	X														
A-REI.5				X	X														
A-REI.6				X															
A-REI.10				X									X	X					
A-REI.11				X															
A-REI.12				X	X														
F-IF.1			X	X	X	X	X	X	X	X				X			X		
F-IF.2			X	X	X	X	X	X	X	X							X		
F-IF.3			X	X	X	X	X	X	X	X									
F-IF.4				X									X		X	X		X	
F-IF.5			X	X	X	X	X	X	X	X									
F-IF.6			X	X	X	X	X	X	X	X									
F-IF.7			X	X	X	X	X	X	X	X									
F-IF.8			X	X	X	X	X	X	X	X									
F-IF.9				X		X													

F-BF.1				X		X													
F-BF.3						X													
F-LE.1			X	X	X	X	X	X	X	X									
F-LE.2			X	X	X	X	X	X	X	X									
F-LE.5			X	X	X	X	X	X	X	X									
S-ID.1		X	X	X							X	X				X			
S-ID.2			X	X							X								
S-ID.3			X	X							X								
S-ID.5			X	X															
S-ID.6			X	X															
S-ID.7			X	X															
S-ID.8			X	X															
S-ID.9			X	X															
Geometry																			
G-CO.1				X				X	X				X	X		X			
G-CO.2				X				X											
G-CO.3				X				X											
G-CO.4				X															
G-CO.5				X															
G-CO.6		X		X															
G-CO.7				X															
G-CO.8				X				X	X										
G-CO.9		X		X			X	X	X										
G-CO.10		X		X	X		X	X	X										
G-CO.11		X				X	X	X	X										
G-CO.12				X	X	X	X	X	X	X			X	X	X	X	X	X	X
G-CO.13							X	X	X										
G-SRT.1				X		X	X	X	X										
G-SRT.2						X	X	X	X										
G-SRT.3								X	X										
G-SRT.4				X	X	X	X	X	X										
G-SRT.5					X			X	X									X	
G-SRT.6							X	X	X					X					
G-SRT.7							X	X	X										
G-SRT.8								X	X				X	X	X	X	X	X	X
G-C.2							X	X	X					X					
G-C.3							X	X	X										
G-C.5							X	X	X										
G-GPE.1				X		X	X	X	X	X									
G-GPE.4				X		X	X	X	X										
G-GPE.5				X		X	X	X	X					X			X	X	
G-GPE.6				X				X	X										
G-GPE.7				X	X				X										
G-GMD.1				X		X			X										
G-GMD.3						X			X										
G-GMD.4				X		X	X	X	X	X									
G-MG.1			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
G-MG.2				X															
G-MG.3			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

2016 Mississippi College- and Career- Readiness Standards for Mathematics: Grade 8

NS The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers.

1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.
2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., rr^2). For example, by truncating the

decimal expansion of ✓2, show that ✓2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

EE Expressions and Equations

Work with radicals and integer exponents.

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that ✓2 is irrational.
3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.
4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Understand the connections between proportional relationships, lines, and linear equations.

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

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

7. Solve linear equations in one variable.
   a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
   b. Solve linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms.
8. Analyze and solve pairs of simultaneous linear equations.
   a. 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.
   b. 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.

c. 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.

F Functions

Define, evaluate, and compare functions.

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.
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.
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.

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.
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.

G Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

1. Verify experimentally the properties of rotations, reflections, and translations.
   a. Lines are taken to lines, and line segments to line segments of the same length.
   b. Angles are taken to angles of the same measure.
   c. Parallel lines are taken to parallel lines.
2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

Understand and apply the Pythagorean Theorem

6. Explain a proof of the Pythagorean Theorem and its converse.
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. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

SP Statistics and Probability

Investigate patterns of association in bivariate data

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.
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.
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.
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?

Number and Quantity

RN The Real Number System

Use properties of rational and irrational numbers

3. Explain why:
   a. the sum or product of two rational numbers is rational.
   b. the sum of a rational number and an irrational number is irrational; and
   c. the product of a nonzero rational number and an irrational number is irrational.

Q Quantities

Reason quantitatively and use units to solve problems.

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.
2. Define appropriate quantities for the purpose of descriptive modeling. [Refer to the Quantities section of the High School Number and Quantity Conceptual Category in the previous pages of this document.]
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra

SSE Seeing Structure in Expressions

Interpret the structure of expressions

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.
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.

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.
   c. Use the properties of exponents to transform expressions for exponential functions.

APR Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials

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

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 (limit to 1st- and 2nd- degree polynomials).

CED Creating Equations

Create equations that describe numbers or relationships

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.
2. Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [Note this standard appears in future courses with a slight variation in the standard language.]
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.
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.

REI Reasoning with Equations and Inequalities

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

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

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

Solve systems of equations

5. Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system.
6. Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.

Represent and solve equations and inequalities graphically

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).
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, quadratic, absolute value, and exponential functions.

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

IF Interpreting Functions

Understand the concept of a function and use function notation

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).
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
3. Recognize that sequences are functions whose domain is a subset of the integers.

Interpret functions that arise in applications in terms of the context

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.
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.
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

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 functions (linear and quadratic) and show intercepts, maxima, and minima.
   b. Graph square root and piecewise-defined functions, including absolute value functions.
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.
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.

BF Building Functions

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities.
    a. Determine an explicit expression or steps for calculation from a context.

Build new functions from existing functions

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.

LE Linear, Quadratic, and Exponential Models

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

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.
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).

Interpret expressions for functions in terms of the situation they model

5. Interpret the parameters in a linear or exponential function in terms of a context.

Statistics and Probability

ID Interpreting Categorical and Quantitative Data

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

1. Represent and analyze data with plots on the real number line (dot plots, histograms, and box plots).
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.
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

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.
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

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

2016 Mississippi College- and Career- Readiness Standards for Mathematics: High School - Geometry

Geometry

CO Congruence

Experiment with transformations in the plane

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.
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).
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
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

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.
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.
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

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.
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.

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.

Make geometric constructions

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

SRT Similarity, Right Triangles, and Trigonometry

Understand similarity in terms of similarity transformations

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

Prove theorems involving similarity

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.
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

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.
7. Explain and use the relationship between the sine and cosine of complementary angles.
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

C Circles

Understand and apply theorems about circles

1. Prove that all circles are similar.

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.
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

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.

GPE Expressing Geometric Properties with Equations

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

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

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, ✓3) lies on the circle centered at the origin and containing the point (0, 2).
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).
6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

GMD Geometric Measurement and Dimension

Explain volume formulas and use them to solve problems

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.
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Visualize relationships between two-dimensional and three-dimensional objects

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.

MG Modeling with Geometry

Apply geometric concepts in modeling situations

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

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).