2025 Information Technology Core

Program CIP: 11.0101 — Computer and Information Sciences, General

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Office of Career and Technical Education
Mississippi Department of Education
Jackson, MS 39205

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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

The Information Technology curriculum was presented to the Mississippi State Board of Education on January 16, 2025. The following persons were serving on the state board at the time:

Dr. Lance Evans, State Superintendent of Education, Executive Secretary
Mr. Glen East, Chair
Mr. Matt Miller, Vice-Chair
Dr. Ronnie McGehee
Mr. Bill Jacobs
Mr. Mike Pruitt
Ms. Mary Werner
Dr. Wendi Barrett
Ms. Billye Jean Stroud
Mr. Matt Mayo
Ms. Kate Riddle, Student Representative
Mr. Crosby Parker, Student Representative

The following Mississippi Department of Education (MDE) and RCU managers and specialists assisted in the development of the information technology curriculum:

Brett Robinson, the associate state superintendent of the MDE Office of Career and Technical Education (CTE) and Workforce Development, supported the RCU and teachers throughout the development of the framework and supporting materials.
Josh Stanford, the IT program supervisor of the MDE Office of CTE, supported the RCU and teachers throughout the development of the framework and supporting materials.
Betsey Smith, the director of the RCU, supported RCU staff and teachers throughout the development of this framework and supporting materials.
Courtney McCubbins, the curriculum and assessment manager of the RCU, supported RCU staff and teachers throughout the development of this framework and supporting materials.
Kyle McDill, a project manager with the RCU, researched and co-authored this framework.
Nathan King, a project manager with the RCU, researched and co-authored this framework.

Special thanks are extended to the educators who contributed to the development and revision of this framework and supporting materials:

Justin Dorris, Pontotoc Ridge Career and Technology Center, Pontotoc
Bryan Hudson, DeSoto County CTE West, Horn Lake
Kristy Kitrell, Wayne County Career Technical Center, Waynesboro
Dustin Phillips, Jackson County Career Technical Education, Vancleave

Appreciation is expressed to the following professionals who provided guidance and insight throughout the development process:

Johnny Carrera, Director of Training and Instruction, CompTIA
Scott Davidson, Director of Product Management, CompTIA
Charline Grace, Computer Programming Instructor, EMCC (Mayhew Campus)
Cameron Kirby, Cyber-analyst, Applied Technology Group
Cindy Layman, CNT Program Director, Itawamba Community College (ICC) – Tupelo Campus
Horacio Leal, IST Department Chair, East Mississippi Community College (EMCC)
Dr. Leslie Leonard, Computer Scientist, U.S. Army Engineer Research and Development Center (ERDC)
Larry Roman, Executive IT Manager, PACCAR Engine Company, Power Train Division

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 information technology curriculum is aligned to the following standards:

National Business Education Association (NBEA)—Information Technology Standards
The National Business Education Association (NBEA) is the nation's leading professional organization devoted exclusively to serving individuals and groups engaged in instruction, administration, research, and dissemination of information for and about business. It is an outstanding resource for any teacher focused on business education and 21st-Century skills. The NBEA states: "IT is a common thread throughout every business." It also states that to maximize their employability, students need to understand intellectual property, personal privacy, and security. The NBEA encourages acting ethically, obeying the law, analyzing information, and developing service skills. Finally, the NBEA mentions that students have to be able to pragmatically solve IT problems and understanding the value and impact of IT. NBEA Business Education Library (2023).
nbea.org

International Society for Technology in Education Standards (ISTE)
Reprinted with permission from *ISTE Standards for Students* (2016). All rights reserved. Permission does not constitute an endorsement by ISTE
iste.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
Information Technology is a pathway within the Digital Technology Career Cluster designed to provide the foundation, skills, and knowledge for computer networking, applications, and support. Students will develop the skills necessary to prepare for certification exams and will learn how to develop, support, and integrate computing systems. They will acquire network-planning and -management skills and the ability to provide technical support. The program will provide hands-on experiences focused on skills related to computer system support, network setup, and system maintenance.

College, Career, and Certifications
Program competencies are designed to prepare students for IT careers by implementing the CompTIA CertMaster Tech+ Certificate of Competency and the CompTIA CertMaster Network+ Certificate of Competency in Networking which align with the National Business Education Association standards for Information Technology.

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. C or higher in English (the previous year)
2. C or higher in high school-level math (last course taken or the instructor can specify the level of math instruction needed)
3. 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

or

1. 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—Two 1-Carnegie Unit Courses

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

1. **Information Technology Core I—Course Code: 992208**
2. **Information Technology Core II—Course Code: 992209**

Course Description: Information Technology Core I
This course provides a comprehensive foundation in Information Technology (IT) by introducing IT concepts, safety procedures, digital citizenship, and career exploration. Students will examine computer hardware and study a variety of internal components while managing storage systems and peripherals. This course also focuses on maintaining software, operating systems (OSs), common computer applications, and emerging technologies such as artificial intelligence (AI) and machine learning. It introduces database concepts, including relational and non-relational databases, data structures, and data-driven decision making. Throughout this course, students engage in hands-on activities such as troubleshooting IT issues, installing hardware components, managing software, and creating basic databases. They also explore current trends in technology, including cloud computing, Internet of Things (IoT), and big data concepts which will prepare them for further study or entry-level positions in the rapidly evolving IT field.

Course Description: Information Technology Core II
This course provides students with advanced Information Technology knowledge including programming concepts, covering various programming languages, data types, and logic structures. Students will learn about interpreted and compiled languages, basic data constructs, and organizational techniques like pseudo code and flowcharts. They will also discover networking, network design, IT infrastructure components, and troubleshooting using models like OSI and TCP/IP. This course includes hands-on experiences in setting up wired and wireless networks while exploring cloud computing concepts. It ends with a deep dive into cybersecurity which introduces students to security models, encryption methods, and best practices for device and network security. Throughout these units, students will engage in practical activities such as writing simple programs, configuring networks, and implementing security measures. They'll also explore current trends like cloud computing, Internet of Things (IoT), and emerging cybersecurity threats. The final result of this course is to prepare students for the fast-paced IT work environment.

Information Technology Core I—Course Code: 992208

Unit	Unit Title	Hours
1	Orientation to Information Technology	15
2	Hardware	40
3	Software	45
4	Database	40

Total		**140**

Information Technology Core II—Course Code: 992209

Unit	Unit Title	Hours
5	Programming Concepts	50
6	Networking	45
7	Cybersecurity	45
Total		**140**

Option 2—One 2-Carnegie Unit Courses

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

Course Description: Information Technology Core
This course provides a comprehensive foundation in Information Technology (IT) by introducing IT concepts, safety procedures, digital citizenship, and career exploration. Students will examine computer hardware and study a variety of internal components while managing storage systems and peripherals. This course also focuses on maintaining software, operating systems (OSs), common computer applications, and emerging technologies such as artificial intelligence (AI) and machine learning. It introduces database concepts, including relational and non-relational databases, data structures, and data-driven decision making. Throughout this course, students engage in hands-on activities such as troubleshooting IT issues, installing hardware components, managing software, and creating basic databases. They also explore current trends in technology, including cloud computing, Internet of Things (IoT), and big data concepts. This course provides students with advanced Information Technology knowledge including programming concepts, covering various programming languages, data types, and logic structures. Students will learn about interpreted and compiled languages, basic data constructs, and organizational techniques like pseudo code and flowcharts. They will also discover networking, network design, IT infrastructure components, and troubleshooting using models like OSI and TCP/IP. This course includes hands-on experiences in setting up wired and wireless networks while exploring cloud computing concepts. It ends with a deep dive into cybersecurity which introduces students to security models, encryption methods, and best practices for device and network security. Throughout these units, students will engage in practical activities such as writing simple programs, configuring networks, and implementing security measures. They will also explore current trends like cloud computing, Internet of Things (IoT), and emerging cybersecurity threats. The final result of this course is to prepare students for the fast-paced IT work environment and for further study or entry-level positions in the rapidly evolving IT field.

Information Technology Core—Course Code: 992206

Unit	Unit Title	Hours
1	Orientation to Information Technology	15
2	Hardware	40
3	Software	45
4	Database	40
5	Programming Concepts	50
6	Networking	45
7	Cybersecurity	45
Total		**280**

Career Pathway Outlook

Overview

Information Technology (IT) is a science that focuses on the use of computer systems, software, and networks that process, store, transmit, and retrieve information. This course prepares students for numerous IT career paths that may require troubleshooting computer hardware and networking infrastructure. Specialized career paths could include software development, data management, cybersecurity, network administration, cloud computing, technical support, and emerging technologies like AI, machine learning, and IoT. It emphasizes hands-on troubleshooting, incorporates industry practices such as Agile Scrum, and addresses digital citizenship and safety. IT professionals may experience a wide array of workplace environments, including traditional offices, open-plan spaces, remote/hybrid work setups, freelance co-working spaces, data centers, and client sites. They may also work within Agile/Scrum collaborative environments, innovation labs, and 24/7 cybersecurity and networking operations centers. These diverse settings cater to different roles and company cultures within the IT sector, offering flexibility and collaboration to suit organizational and IT project needs.

Most careers in information technology require at least an associate degree, although careers with the highest earnings potential—computer network architects, chief information security officers (CISO), database administrators, data scientists, software developers, and postsecondary teachers, for example—usually require advanced degrees.

Needs of the Future Workforce

According to the U.S. Bureau of Labor Statistics, 440 information security analysts in the Memphis, TN – Northwest MS – Arkansas area benefit from an annual mean wage of $104,760 which is the highest employment rate in the state for this profession. Other notable employment opportunities can be found in the Northeast MS area; the Jackson, MS area; and the Gulfport-Biloxi-Pascagoula, MS area where each of those locations' employment numbers and annual mean wage are 90, $84,600; 190, $91,540; and 110, $91,090, respectively. Nationally, through 2032, there is a 32% job growth expected for information security analysts which is much faster than the average for all occupations. Cyberattacks have grown in frequency, and these analysts will be needed to create innovative solutions to prevent hackers from stealing critical information or creating problems for computer networks. Strong growth in digital health services and telehealth will also increase data security risks for healthcare providers. More of these analysts are likely to be needed to safeguard patients' personal information and data. On the other hand, the top two areas in Mississippi that employ network and computer systems administrators are the Memphis, TN – Northwest MS- Arkansas area with 90 employed and $105,820 annual wage and the Jackson, MS area with 440 employed and $82, 890 annual wage. Nationally, about 19,800 openings for network and computer systems administrators are projected each year, on average, over the decade. Demand for these professionals who maintain systems should continue, along with the nation's firms' investments in newer, faster technology and mobile networks.

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2020	Projected Jobs, 2030	Change (Number)	Change (Percent)	Average Hourly Earnings, 2024
Computer and Information Research Scientists	340	340	0	0%	$53.58
Computer and Information Systems Managers	1,140	1,250	110	9.6%	$57.75
Computer Network Support Specialists	1,130	1,190	60	5.3%	$27.83
Computer Occupations, All Other	1,150	1,150	0	0%	$40.02
Computer Programmers	880	960	80	9.1%	$33.53
Computer Systems Analysts	2,120	2,190	70	3.3%	$42.19
Computer User Support Specialists	2,440	2,590	150	6.1%	$23.36
Information Security Analysts	450	470	20	4.4%	$45.95
Network and Computer Systems Administrators	1,440	1,500	60	4.2%	$38.96
Operations Research Analysts	410	520	110	26.8%	$40.66
Computer Network Architects	370	390	20	5.4%	$45.13

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

Perkins V Requirements and Academic Infusion

The Information Technology curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in information technology-related fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses, that will further prepare them for information technology 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 Information Technology 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 information technology curriculum. SkillsUSA, Technology Student Association (TSA), and Future Business Leaders of America (FBLA) are examples of student organizations with many outlets for information technology. Student organizations provide participants and members with growth opportunities and competitive events. They also open the doors to the world of information technology 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 Information Technology 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 Information Technology curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the Information Technology curriculum that will allow and encourage collaboration with professionals currently within an information technology-related field.

Work-Based Learning

Work-based learning is an extension of understanding competencies taught in the information technology 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 information technology-related professionals. Thus, supervised collaboration and immersion into the information technology industry around the students are keys to students' success, knowledge, and skills development.

Professional Organizations

Association for Computing Machinery (ACM)
acm.org

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

Computing Technology Industry Association (CompTIA)
comptia.org

International Association of Privacy Professionals (IAPP)
iapp.org

Institute of Electrical and Electronics Engineers (IEEE)
ieee.org

Information Systems Audit and Control Association (ISACA)
isaca.org

International Society for Technology in Education (ISTE)
iste.org

Mississippi Department of Information Technology Services (ITS)
its.ms.gov

Mississippi Association of Instructional Technology Professionals (MS-AITP)
business.msstate.edu/student-organizations/association-information-technology-professionals

Mississippi Educational Computing Association (MECA)
ms-meca.org

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

Project Management Institute (PMI)
pmi.org

Society for Information Management (SIM)
simnet.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 Information Technology 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: Orientation to Information Technology

Competencies and Suggested Objectives
1. Research educational, occupational, and leadership opportunities in IT. DOK3 a. Review student rules and regulations for the local school. b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations. c. Identify and describe leadership opportunities available from CTE student organizations in the school and community. d. Preview the school's technology acceptable-use policy.
2. Identify, discuss, and apply safety procedures in the computer classroom and lab. DOK2 a. Discuss the proper classroom and personal safety procedures, including fire extinguishers, electrical, ladders, clothing, jewelry, eye protection, etc. b. Care for and correctly use computer hardware. c. Identify potential hazards when working with technology equipment. d. Explore the environmental impact related to technology. e. Develop personal safety guidelines for using technology and the internet.
3. Publish and communicate research findings on emerging IT technologies, recent trends, and IT-related issues with peers, experts, and general audiences using technology. DOK3 a. Research safety issues related to technology and internet academic standards, where applicable. b. Define and apply digital citizenship, online safety, and appropriate use best practices and its importance in IT. c. Outline computer industry-related legal considerations including software copyright issues and licensing, and internet ethics and policies. d. Review and adhere to the school's technology acceptable-use policy. e. Engage in positive, safe, legal, and ethical behavior when using technology, including social interactions online. f. Utilize online tools and electronic media to communicate effectively. g. Research, create, and present on emerging IT technologies, best practices, recent trends, and IT-related issues.
4. Define computing basics and manage file systems. DOK2 a. Identify the components of a computing system: input, processing, output, and storage. b. Demonstrate file management best practices, including creating, organizing, and managing files and folders. c. Utilize a file management system for efficient data organization and retrieval.
5. Introduce and explore common IT issues and then apply troubleshooting steps to resolve them. DOK2 a. Explore a general overview of the Open Systems Interconnection (OSI) model and how it is considered a troubleshooting sequence of methodology. b. Utilize problem-solving techniques to diagnose and fix hardware and software issues. c. Implement a systematic approach to troubleshooting and resolving IT problems. d. Discuss the role of an IT professional regarding troubleshooting technological issues.
6. Explore IT careers and communicate effectively using technology. DOK3 a. Research and present on educational, occupational, and leadership opportunities in IT.

b. Review student rules and regulations for the local school and compare them to industry standards.

Unit 2: Hardware

Competencies and Suggested Objectives
1. Identify and explore notational systems. DOK2 a. Binary b. Hexadecimal c. Decimal d. Octal
2. Identify and explore internal components and the purpose of the following computer hardware and system elements. DOK2 a. Central processing unit (CPU) b. Firmware c. Basic Input/Output System (BIOS) d. Motherboard or system board e. Power f. Types of storage (volatile vs. non-volatile) g. Expansion slots h. Cooling i. Random-access memory (RAM) and read-only memory (ROM) j. Graphics Processing Unit (GPU) k. Network Interface Card (NIC) • Onboard vs. expansion card • Wired vs. wireless l. Install and upgrade components. m. Troubleshoot common motherboard issues.
3. Install and manage storage on computer systems. DOK3 a. Classify types of storage. • Volatile vs. non-volatile b. Install storage media. • Local storage o Install a variety of storage drive types ▪ External flash drives ▪ Magnetic disks/hard disk drive (HDD) ▪ Non-volatile memory express (NVMe) ▪ Optical ▪ Solid-state drive (SSD) o RAM o ROM • Local network storage o Cloud storage service o File server o Network-attached storage (NAS) c. Create volumes and format drives. d. Perform disk maintenance. e. Troubleshoot storage.

4. Examine the basic wired and wireless peripherals, such as input, output, and combination devices, focusing on their intended purposes. DOK3
   a. Properly connect wired and wireless peripherals.
   b. Differentiate between the types of cables and connectors.
   c. Understand the uses and functions of technological peripheral devices regarding IT.
      - Computing Devices
        - E-readers
        - Gaming consoles
        - Laptops
        - Servers
        - Smartphones
        - Streaming media devices
        - Tablets
        - Workstations
      - Displays
        - Monitor
        - Projector
        - Smart TV
      - Input/Output Devices
        - External Drive
        - Keyboards
        - Mouse
        - Printer
        - Scanner
        - Speakers
        - Webcam
      - Smart Home/IoT Devices
        - Deadbolts/door locks
        - Home appliances
        - Home assistants
        - Home automation devices
        - Internet of Things (IoT)
        - Internet Protocol (IP)/security cameras
        - Security systems
        - Thermostats
        - Video doorbells
      - Wearables & AR/VR
        - Augmented reality (AR) systems
        - Virtual reality (VR) systems
        - Wearable devices
      - Medical & Industrial
        - Human Machine Interface (HMI)
        - Kiosks
        - Medical devices
        - Programmable Logic Circuits (PLC)
      - Other Peripherals

- Exercise equipment
- Vehicles
- Uninterruptible Power Supply (UPS)

d. Install and configure various types of peripherals, considering the installation method, driver requirements, and network connectivity.
   - Compare plug-n-play vs. driver installation.
   - Perform additional installation steps.
   - Explain IP-based peripherals' network integration.
   - Describe web-based peripheral configuration.

e. Identify the components and architecture of High Performance Computing (HPC) systems.

f. Troubleshoot all applicable devices.

5. Understand and configure device input/output (I/O) interfaces. DOK4

a. Identify and utilize networking tools.
   - Cable testers
   - Crimpers

b. Identify and configure wired networking interfaces:
   - Ethernet connectors (RJ45)
   - Fiber connectors (SFP)

c. Identify and configure wireless networking interfaces:
   - 802.11X
   - Bluetooth
   - Near-field communication (NFC)

d. Identify and use peripheral interfaces:
   - Bluetooth
   - Lightning
   - Radio frequency (RF)
   - Thunderbolt
   - USB (A/B/C)

e. Identify and use display ports:
   - Digital Visual Interface (DVI)
   - DisplayPort
   - High Definition Media Interface (HDMI)
   - USB-C
   - Video Graphics Array (VGA)

f. Identify and use display technology:
   - Casting
   - Mirroring

6. Design, install, and troubleshoot workstations and equipment. DOK3

a. Design a basic workstation setup.

b. Install and upgrade motherboard components.

c. Troubleshoot common motherboard and workstation issues.

d. Properly connect and troubleshoot wired and wireless peripherals.

Unit 3: Software

Competencies and Suggested Objectives
1. Compare and contrast the functions and features of commonly used computer operating systems (OSs). DOK2 a. Identify the uses, features, and types of common desktop operating systems, such as macOS, Windows, and Linux and explain how they operate as the interface between applications and hardware. b. Explore the types of operating systems and software platforms (e.g., desktop or workstation, embedded, mobile device-related, and server-related). c. Demonstrate and explain the need for task and process management. d. Install operating systems running in a virtual environment. e. Identify the uses and features of common mobile operating systems. f. Identify the basic features of an operating system. g. Demonstrate the uses of an operating system. h. Explain and utilize other system software such as: BIOS, CMOS, and firmware. i. Utilize device management tools. j. Explore access control
2. Identify and utilize common software applications and then describe the purpose of each application. DOK2 a. Demonstrate the proper uses of productivity software, such as office suites, applications, email, and desktop publishing (e.g., Microsoft Office, Google Workspace, etc.). • Create effective presentations. • Manage data with spreadsheets. • Design visual diagrams. • Produce documents with word processing. b. Explain and operate collaboration software, such as online workspaces, cloud storage, screen sharing, videoconferencing software, instant messaging (IM) clients, VoIP, and email. c. Manipulate utility software, such as antimalware, diagnostic software, device drivers, and file compression utilities. d. Identify and use system applications and utilities: • Drivers • Processes • Services e. Assess the need for and uses of instant messaging software and remote support software. f. Examine specialized software, such as computer-aided design (CAD), graphic design, gaming, multimedia, virtualization, and industrial software. g. Identify common file types, including document, audio, image, video, executables, and compression formats. h. Configure and manage browser-based features and artificial intelligence. • Accessibility • Appearance

- Browser add-ons/extensions (add, remove, and enable/disable)
- Cache clearing
- Configure browser-based settings
- Default search engine
- Identify and use web-browsing and remote support software.
- Organizing features (e.g., bookmarks, etc.)
- Password Management
- Pop-up blockers
- Private browsing
- Profile synchronization

3. Demonstrate software management best practices. DOK3
   a. Install/uninstall OS features, applications, and drivers.
   b. Install updates and patches for OS, drivers, applications, and security software.
   c. Identify and explain filesystem characteristics:
      - Compression
      - Encryption
      - Types and extensions
   d. Identify the proper versions of software that are compatible with various platforms.
   e. Define various licensing procedures, such as product keys, site licenses, multiuser licenses, and freeware.
   f. Perform backup operations.
   g. Configure local and network printing.
4. Demonstrate file management best practices. DOK3
   a. Manage files, folders, and directories in the Windows files system.
   b. Manage file and New Technology File System (NTFS) permissions.
   c. Naming restrictions
   d. Describe and use interfaces:
      - File attributes and properties
      - Graphical user interface (GUI)
      - Use console/command line and utilities
   e. Create a virtual machine.
5. Identify and utilize artificial intelligence applications to enhance productivity and workflow. DOK2
   a. AI chatbots for customer support, information retrieval, and automating responses
   b. AI assistants for scheduling, reminders, and managing tasks
   c. Generative AI for creating code, generating content, and automating repetitive tasks
   d. AI predictions and suggestions for data analysis, decision-making, and optimizing processes.
6. Research and identify emerging technologies and their potential impact on various industries. DOK4
   a. Analyze the implications of new technologies on existing software and systems.
   b. Discuss the benefits and challenges of adopting emerging technologies.
   c. Experiment with and evaluate emerging technologies through hands-on projects or case studies.

d. Present findings on how emerging technologies can be integrated into current workflows and processes.

Unit 4: Database

Competencies and Suggested Objectives
1. Understand informative and valuable database concepts. DOK2 a. Explain database design and purpose. b. Identify data and information as assets (e.g., critical vs. non-critical data). c. Explain data-driven business decisions. • Understand data capture and collection. • Explore data correlation. • Identify meaningful reporting. d. Describe data monetization and data analytics e. Explore big data concepts: • Define and characterize big data (volume, velocity, and variety). • Explore the importance and applications of big data in business and technology. • Explain techniques for analyzing and deriving insights from big data.
2. Explore objects of a relational database. DOK2 a. Identify differences between relational and nonrelational databases. b. Create database tables with different types of relationships. c. Create reports to analyze data.
3. Explore the general idea of a database and its significance. DOK2 a. Identify and describe database uses: • Create databases. • Import and input data. • Perform queries. • Generate reports. b. Compare flat file and database • Analyze the ability to handle multiple concurrent users. • Assess scalability. • Evaluate speed. • Examine the variety of data supported. c. Understand database records and storage: • Explain data persistence. d. Compare data availability (cloud vs. local, online vs. offline).
4. Analyze structural aspects of a database. DOK3 a. Compare different types of data structures: • Differentiate between structured, semi-structured, and non-structured data. b. Identify and describe the components of relational databases. • Define and explain the schema. • Describe tables and their functions. • Explain rows/records and fields/columns. • Identify and apply constraints in databases. o Understand the role and significance of primary keys. o Understand the role and significance of foreign keys. c. Identify and describe non-relational databases:

- Explain key/value databases and their applications.
- Discuss document databases and their uses.

5. Back up and troubleshoot databases. DOK4
   a. Back up data.
      - Show how to back up files appropriately.
      - Properly manage system backups.
      - Demonstrate how to restore data from a backup.
   b. Manage backup locations.
      - Locally stored
        - Use flash drive
        - Utilize external hard drives
        - Operate secure digital (SD) cards
      - Cloud storage

Unit 5: Programming Concepts

Competencies and Suggested Objectives
1. Understand programming languages and their categorical placements. DOK2 a. Identify and describe interpreted programming languages: • Explain the use and characteristics of scripting languages. • Explain the use and characteristics of markup languages. b. Identify and describe compiled programming languages: • Discuss the features and applications of Python. • Discuss the features and applications of C++. • Discuss the features and applications of C#. • Discuss the features and applications of .NET. c. Identify and describe query languages and assembly languages: • Explain the purpose and use of query languages. • Explain the purpose and use of assembly languages. d. Provide a general overview of Agile Scrum: • Define Agile Scrum and its importance in software development. • Explain the key roles in an Agile Scrum team (e.g., Product Owner, Scrum Master, Development Team). • Describe the main components of the Agile Scrum process (e.g., sprints, backlogs, stand-up meetings, reviews).
2. Understand features of basic data type constructs. DOK2 a. Identify and describe the characteristics and uses of basic data types: • Char: Define and explain the use of character data types. • Strings: Describe the structure and application of string data types. • Numbers: Differentiate between and describe the uses of numeric data types: o Integers: Explain the properties and applications of integer data types. o Floats: Explain the properties and applications of floating-point data types. • Boolean: Define and explain the use of Boolean data types in logical operations.
3. Determine the reasoning for programming constructs. DOK3 a. Explain the purpose and use of identifiers: • Differentiate between variables and constants and describe their roles in programming. b. Describe the structure and use of arrays: • Explain how arrays are used to store and manage collections of data. c. Discuss the function and application of functions: • Define functions and explain their use in modular programming and code reuse. d. Explain the concept and use of objects in programming: • Define objects and describe their importance in object-oriented programming. • Explain properties and their role in defining object characteristics. • Describe attributes and how they define object states. • Explain methods and their use in defining object behaviors.
4. Understand logic concepts and organizational programming. DOK3

a. Explain organizational techniques in programming:
    - Describe the use and purpose of pseudo code concepts in planning and designing algorithms.
    - Explain object-oriented methods and their role in structuring and organizing code.
    - Discuss the importance of comments and documentation in maintaining and understanding code.
    - Explain flow chart concepts and their use in visualizing program sequences.
b. Describe and apply logic concepts in programming:
    - Explain branching and its use in decision-making processes within a program.
    - Describe looping and its role in repeating actions or iterating over data sets.

Unit 6: Networking

Competencies and Suggested Objectives

1. Develop skills to design, deploy, and administer networks. DOK2
   a. Identify basic network connectivity concepts.
   b. Differentiate between network architecture and topologies.
   c. Identify network fundamental infrastructure components.
      - Understand the basics of network communication.
      - Recognize network identifiers.
        - IP addresses
        - Media access control (MAC) addresses
        - Ports
      - Explain how notational systems (e.g., binary, hexadecimal, decimal, and octal) connect to network identifiers.
      - Understand basic network services and the networking protocols that support them.
        - Secure web browsing
        - File transfer
        - Email
      - Identify networking devices.
        - Modem
        - Router
        - Switch
        - Access point
        - Firewall
      - Understand networking models.
        - Client/server
        - Peer-to-peer
      - Local area network (LAN)
      - Wide area network (WAN)
   d. Identify varying formats of internet services.
      - Cable
      - Digital subscriber line (DSL)
      - Fiber optic
      - Wireless (e.g., cellular and radio frequency [RF])
      - Satellite
2. Design and develop network infrastructure. DOK2
   a. Compare and contrast network cabling solutions, including but not limited to:
      - Coaxial
      - Twisted Pair (e.g., Cat5e, Cat6)
      - Fiber Optic
   b. Set up a basic wired network.
   c. Compare and contrast components of and setup up a basic wireless network.
      - 802.11n/ac/ax

- Speed considerations
- Interference and attenuation factors
- Older vs. newer standards
- Band options (e.g., 2.4 GHz, 5 GHz, and 6 GHz)

d. Manage mobile and Bluetooth devices.
e. Identify components of and construct ethernet/internet cables.
- Straight-through cables
- Follow either the T568A or the T568B wiring standard.
- Crossover cables
- One end follows the T568A wiring standard, and the other end follows the T568B wiring standard.

f. Identify network devices that support Auto Medium Dependent Interface Crossover (Auto-MDIX) and describe the use cases for this wiring technology.

3. Explore and discuss internet technologies. DOK1
   a. Configure browsers for optimal use.
   b. Enable and use a proxy server.
   c. Describe the Internet of Things (IoT) and evaluate common IoT devices.
   d. Describe various internet communications technologies.

4. Troubleshoot various networking issues using the Open Systems Interconnection (OSI) model and the Transmission Control Protocol/Internet Protocol (TCP/IP) model. DOK4
   a. Demonstrate how to utilize the TCP/IP model.
   b. Demonstrate how to utilize the OSI model.

5. Define and describe the uses of cloud computing. DOK2
   a. Understand virtualization vs cloud-based technological tools.
- Virtualization
- Hypervisor
- Guest operating system (OS)
- Cloud concepts
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)
- Software as a Service (SaaS)
- Deployment models
- On premises
- Cloud
- Hybrid

Unit 7: Cybersecurity

Competencies and Suggested Objectives

1. Explore the structure of security models that can be used when preventing cyber threats. DOK2
    a. Explore cybersecurity breaches and how they relate to confidentiality, integrity, and availability (CIA).
        - Privacy
        - Cookie consent
        - Email
        - File sharing
        - Government regulations (e.g., General Data Protection Regulations [GDPR])
        - Instant messaging
        - Metadata
        - Personally identifiable information (PII)
        - Social networking sites
    b. Understand authentication, authorization, accounting, and non-repudiation concepts.
        - Authentication
            - Single factor
            - Multifactor
            - Single sign-on
        - Authorization
            - Permissions
                - Administrator vs. user accounts
                - Least privilege model
        - Accounting
            - Logs
            - Location tracking
            - Web browser history
    c. Identify and describe Endpoint Detection and Response (EDR) in terms of a cybersecurity approach.
    d. Explore protection as the main purpose of cybersecurity.
    e. Identify and discuss Zero Trust security models as a method of safeguarding systems, networks, and data from unauthorized access, misuse and attacks.
2. Develop a plan for keeping technological devices secure. DOK3
    a. Understand security awareness.
        - Social engineering
            - Explore various types of phishing (e.g., spear phishing, whaling, etc.)
        - Malicious or compromised content
        - Intrusion detection
        - Define and give descriptive, researched examples for any of these types of honeypot cyberattacks.
            - Client
            - Cloud

    - Database
    - Decoy
    - Email/Spam
    - Low/High-Interaction
    - Malware
    - Mobile
    - Production
    - Pure
    - Research
    - Spam
    - Spider
    - Sticky
    - Supervisory Control and Data Acquisition (SCADA)
    - Virtual
    - Watering Hole

b. Secure mobile and workstation devices
    - Authentication
    - Anti-malware
    - Firewall
    - Patching/updating
    - Physical device security
        - Cable locks
        - USB locks
        - Cameras
        - Door locks

c. Implement device use best practices.
    - Licensing and piracy
        - Open source vs. proprietary
        - Compare subscription, one-time purchase, and perpetual
        - Product keys and serial numbers
    - Software sources
        - Researching and validating legitimate sources
        - Original equipment manufacturer (OEM) websites vs. third-party websites
        - Application stores
    - Removal of software
        - Unwanted
        - Unnecessary
        - Malicious
    - Software piracy

d. Compare and contrast operational technology (OT) and information technology (IT).
    - Security and critical infrastructure

e. Implement safe browsing practices.
    - Valid and invalid certificates

f. Understand privacy considerations.
    - Social networking sites
    - Email

- File sharing
- Instant messaging
- AI

g. Explore physical safeguards for device protection against physical threats that maintain availability to critical systems and data and ensure their operational resilience.
    - Disaster recovery and business continuity
    - Environmental controls
    - Fire suppression systems
    - Physical access controls
    - Uninterruptible power supply (UPS)

h. Analyze the unique cybersecurity challenges related to operational technology (OT) and information technology (IT).
    - Explore critical infrastructure (e.g., power grids, water treatment facilities, transportation networks, and healthcare systems, etc).

3. Investigate and discuss safety standards regarding password security. DOK2
    a. Password length
    b. Password complexity
    c. Password history
    d. Password expiration
    e. Password reuse across sites
    f. Password managers
    g. Password privacy
    h. Password reset process
    i. Changing default usernames and passwords
    j. Enabling passwords
    k. Define and explore password hashes

4. Explore the reasoning and necessity for various levels of encryption. DOK2
    a. Compare and contrast plain text and cipher text.
    b. Cryptography
        - Define hashing.
        - Define and explore rainbow tables.
    c. Data at rest
        - File level
        - Disk level
        - Mobile device
    d. Data in transit
        - Email
        - HyperText Transfer Protocol Secure (HTTPS)
        - Virtual Private Network (VPN)
        - The Onion Router (TOR)
        - Dark Web
        - Mobile application
    e. Compare and contrast asymmetric and symmetric encryption.
    f. Explore blockchains and cryptocurrency.

g. Compare and contrast private keys and public keys in terms of cryptography and how they relate to enabling secure communication and data protection. h. Explain symmetric vs asymmetric encryption.
5. Develop a reasonable argument for security setting configurations regarding wireless networks. DOK3 a. Changing the service set identifier (SSID) b. Changing the default password c. Compare and contrast encrypted and unencrypted wireless networks. • Open • Pre-shared key • Wireless Protected Access (WPA) • Wireless Protected Access 2 (WPA2) • Wireless Protected Access 3 (WPA3)
6. Troubleshoot a comprehensive array of cybersecurity issues and implement solutions. DOK3

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: Orientation to Information Technology		
	1.	Research educational, occupational, and leadership opportunities in IT.
	2.	Identify, discuss, and apply safety procedures in the computer classroom and lab.
	3.	Publish and communicate research findings on emerging IT technologies, recent trends, and IT-related issues with peers, experts, and general audiences using technology.
	4.	Define computing basics and manage file systems.
	5.	Introduce and explore common IT issues and then apply troubleshooting steps to resolve them.
	6.	Explore IT careers and communicate effectively using technology.
Unit 2: Hardware		
	1.	Identify and explore notational systems.
	2.	Identify and explore internal components and the purpose of the following computer hardware and system elements.
	3.	Install and manage storage on computer systems.
	4.	Examine the basic wired and wireless peripherals, such as input, output, and combination devices, focusing on their intended purposes.
	5.	Understand and configure device input/output (I/O) interfaces.
	6.	Design, install, and troubleshoot workstations and equipment.
Unit 3: Software		
	1.	Compare and contrast the functions and features of commonly used computer operating systems (OSs).
	2.	Identify and utilize common software applications and then describe the purpose of each application.
	3.	Demonstrate software management best practices.
	4.	Demonstrate file management best practices.
	5.	Identify and utilize artificial intelligence applications to enhance productivity and workflow.
	6.	Research and identify emerging technologies and their potential impact on various industries.

Unit 4: Database		
	1.	Understand informative and valuable database concepts.
	2.	Explore objects of a relational database.
	3.	Explore the general idea of a database and its significance.
	4.	Analyze structural aspects of a database.
	5.	Back up and troubleshoot databases.
Unit 5: Programming Concepts		
	1.	Understand programming languages and their categorical placements.
	2.	Understand features of basic data type constructs.
	3.	Determine the reasoning for programming constructs.
	4.	Understand logic concepts and organizational programming.
Unit 6: Networking		
	1.	Develop skills to design, deploy, and administer networks.
	2.	Design and develop network infrastructure.
	3.	Explore and discuss internet technologies.
	4.	Troubleshoot various networking issues using the Open Systems Interconnection (OSI) model and the Transmission Control Protocol/Internet Protocol (TCP/IP) model.
	5.	Define and describe the uses of cloud computing.
Unit 7: Cybersecurity		
	1.	Explore the structure of security models that can be used when preventing cyber threats.
	2.	Develop a plan for keeping technological devices secure.
	3.	Investigate and discuss safety standards regarding keeping passwords secure.
	4.	Explore the reasoning and necessity for various levels of encryption.
	5.	Develop a reasonable argument for security setting configurations regarding wireless networks.
	6.	Troubleshoot a comprehensive array of cybersecurity issues and implement solutions.

Appendix A: International Society for Technology in Education (ISTE) Standards

	Units	1	2	3	4	5	6	7
Standards								
T1		X	X	X	X	X	X	X
T2		X		X				X
T3		X		X	X			X
T4			X			X	X	
T5			X		X	X	X	X
T6		X						
T7		X		X				

International Society for Technology in Education (ISTE)

T1 Empowered Learner

Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.

1. Articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.
2. Build networks and customize their learning environments in ways that support the learning process.
3. Use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
4. Understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

T2 Digital Citizen

Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical.

1. Cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.
2. Engage in positive, safe, legal, and ethical behavior when using technology, including social interactions online or when using networked devices.
3. Demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.
4. Manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.

T3 Knowledge Constructor

Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.

1. Plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.

2. Evaluate the accuracy, perspective, credibility, and relevance of information, media, data, or other resources.
3. Curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
4. Build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

T4 Innovative Designer

Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

a. Know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts, or solving authentic problems.
b. Select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
c. Develop, test and refine prototypes as part of a cyclical design process.
d. Exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

T5 Computational Thinker

Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

a. Formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions.
b. Collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
c. Break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.
d. Understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

T6 Creative Communicator

Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals.

a. Choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
b. Create original works or responsibly repurpose or remix digital resources into new creations.
c. Communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
d. Publish or present content that customizes the message and medium for their intended audiences.

T7 Global Collaborator

Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

a. Use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.
b. Use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.
c. Contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.
d. Explore local and global issues and use collaborative technologies to work with others to investigate solutions.

Appendix B: National Business Education Association (NBEA) – National Standards for Business Education – Information Technology (IT)

	Units	1	2	3	4	5	6	7
Standards								
IS		X	X		X		X	X
IL		X		X	X	X		
DC		X		X				X
DAC		X	X	X			X	
OS			X	X			X	X
IT		X	X	X				
A				X	X	X		
DM				X				
WDD								
DMS					X	X		
PMA						X		
PAD						X		
DNI			X				X	X
PA								
SRM							X	X
EST								
BF					X			
C		X						

National Business Education Association (NBEA)
National Standards for Business Education (2023) - Information Technology (IT)

IS Impact on Society

Assess the impact of information technology in a diverse global society.

Level 1 Performance Expectations

1. Use technology to achieve academic success and lifelong learning
2. Identify uses of information technology in the home, school, workplace, and globally diverse society
3. Explain how information technologies meet human needs and affect quality of life
4. Describe how information technology impacts government, work, family, school, and other cultures
5. Identify the impact of information technologies on the environment and society—both positive and negative
6. Identify the risks of information technology to personal health, safety, and privacy

Level 2 Performance Expectations

7. Describe the impact of technology on the knowledge and skills needed for success in the workplace
8. Describe how information technology affects worker-management relationships (e.g., outsourcing, communications, and cloud computing)
9. Identify and evaluate how information technology developments change the way users do their work
10. Describe how information technology creates greater interdependence among workers, organizations, and nations

11. Explain how information technology has impacted worker productivity and teamwork
12. Analyze the potential societal effect of widespread reliance on information technology
13. Analyze how human ingenuity and technology satisfy specific human needs
14. Evaluate the cause and effect of technological solutions on society

Level 3–4 Performance Expectations

15. Analyze how developments in information technology affect the supply/demand characteristics of the job market
16. Illustrate how information technology changes organizational structures
17. Examine how information technology changes the breadth and level of worker responsibilities
18. Evaluate how information technology transforms business processes and relationships
19. Assess how information technology changes the manner in which training is offered and implemented
20. Identify emerging trends in information technology and predict influences on business, industry, and the global economy
21. Analyze and compare society's influence on information technology and information technology's influence on our diverse, global society

IL Information Literacy

Gather, evaluate, synthesize, use, cite, and disseminate information from technology sources.

Level 1 Performance Expectations

1. Use information technology resources to retrieve information
2. Evaluate the credibility, reliability, and bias of information sources
3. Interpret information for use in decision making
4. Cite information sources appropriately
5. Use search procedures appropriate to type of information, nature of source, and nature of query
6. Discuss and follow copyright rules, trademarks, intellectual property, creative commons, and regulations (e.g., images, music, video, software)
7. Explain plagiarism and its consequences

Level 2 Performance Expectations

8. Evaluate the accuracy, relevance, and comprehensiveness of retrieved information
9. Draw conclusions and make generalizations based on information gathered
10. Access, exchange, organize, and synthesize information
11. Analyze the effectiveness of information resources to support collaborative tasks, research, publications, communications, and increased productivity

Level 3–4 Performance Expectations

12. Synthesize information from data sources to formulate decisions across the curriculum
13. Analyze and use mathematical and/or statistical methods to manipulate data into useful information
14. Present analyzed information in a meaningful format

DC Digital Citizenship

Demonstrate respectful, responsible, inclusive, and ethical behavior in a digital world.

Level 1-2 Performance Expectations

1. Identify and explore basic privacy issues associated with technology
2. Explore the risks and dangers of sharing personal information in a digital world (e.g., digital footprint, cyberbullying, cyberstalking, identity theft)
3. Explore the possibilities and perils of digital communications
4. Discuss and apply Internet safety practices
5. Identify how social media is used to learn across the curriculum
6. Explore how technology can be used to address bias and create more inclusive communities
7. Discuss basic issues related to responsible use of technology and describe personal or legal consequences of inappropriate use
8. Demonstrate respectful and responsible use and creation of media and technology
9. Demonstrate the appropriate and legal use of intellectual property
10. Demonstrate legal, inclusive, and ethical behaviors when using information technologies
11. Identify aspects of global connectivity and its implications
12. Demonstrate appropriate etiquette when using information technologies
13. Discuss the process of safely buying and selling online
14. Review acceptable use policies for legal and ethical use of information

Level 3–4 Performance Expectations

15. Recognize the importance of one's digital footprint and manage it professionally
16. Recognize responsible use of digital commerce
17. Recognize how information technology contributes to lifelong learning
18. Implement organizational policies and procedures dealing with legal, ethical, and inclusive issues
19. Compare and contrast various types of license agreements (e.g., open source, creative commons, multiple license agreements, single-user installation, site license)
20. Read, interpret, and adhere to software license agreements and legal mandates
21. Analyze legal and ethical dilemmas within the framework of current laws and legislation (e.g., virus development, hacking, threats, phishing)

DAC Devices and Components

Describe current and emerging devices and components; configure, install, and upgrade equipment; diagnose problems; and repair hardware.

Level 1 Performance Expectations

1. Identify devices appropriate for specific tasks
2. Identify the components of devices
3. Connect needed external components
4. Evaluate the capabilities and limitations of devices for user needs
5. Explain the purpose, operation, and care of devices and components
6. Identify examples of emerging technologies
7. Identify storage options

Level 2 Performance Expectations

8. Describe interrelationships between device components and supportive applications

9. Troubleshoot and diagnose applications and devices using appropriate resources (e.g., help desks, online help, manuals, technical support specialists)
10. Evaluate devices and features to make sound consumer decisions
11. Compare and contrast various storage devices (e.g., local, removable, remote, cloud)
12. Remove, upgrade, store, and install computer hardware and supportive applications

Level 3-4 Performance Expectations

13. Troubleshoot and repair computer hardware and resolve related application problems
14. Obtain hardware certification(s) needed for a chosen career path
15. Evaluate and recommend devices to solve specific problems
16. Analyze cost-benefit and life cycle of devices
17. Evaluate device vendors, warranties, and purchasing options

OS Operating Systems

Identify, evaluate, select, install, use, upgrade, and customize operating systems. Diagnose and solve problems with various types of operating system utilities.

Level 1-2 Performance Expectations

1. Navigate the basic operating system
2. Manage local and cloud-based files and folders
3. Describe various operating systems, platforms, and utilities (e.g., Android, iPhone system, Chrome, opensource)
4. Describe features of operating systems that can be personalized
5. Differentiate between operating systems and applications

Level 3–4 Performance Expectations

6. Compare and contrast the functions, features, and limitations of different operating systems and utilities (e.g., open-source, mobile, and proprietary operating systems)
7. Select operating systems and utilities appropriate for specific hardware, software, and tasks
8. Install and customize operating systems and utilities
9. Diagnose and repair installation and operational problems of operating systems
10. Identify and use appropriate help resources (e.g., help desks, online help, and manuals) to install, configure, upgrade, diagnose, and repair operating systems and utilities
11. Maintain operating system security
12. Troubleshoot and repair network operating system connectivity
13. Describe the use and benefit of operating systems running in a virtual environment
14. Install operating systems running in a virtual environment
15. Obtain operating system certification(s) needed for a chosen career path

IT Input Technologies

Use various input technologies to enter and manipulate information appropriately.

Level 1 Performance Expectations

1. Develop and practice proper input techniques (e.g., keyboarding; voice recognition; facial recognition; handwriting recognition; virtual keypad; virtual

reality; augmented reality; mixed reality; and the use of a multi-touch screen, mouse/pad, or stylus)
2. Identify appropriate input technology for various tasks
3. Describe ergonomic issues related to input technologies

Level 2–4 Performance Expectations

4. Select appropriate input technology to optimize performance
5. Apply a variety of input technologies to maximize productivity
6. Use a variety of input technologies to optimize academic and workplace performance
7. Create media using a variety of input technologies

A Applications

Identify, evaluate, select, install, use, upgrade, troubleshoot, and customize applications.

Level 1 Performance Expectations

1. Identify and use applications appropriate for specific tasks to improve academic achievement across the curriculum
2. Use collaborative application tools to support learning
3. Produce projects that include a variety of media (e.g., images, text, video, web-based tools, and audio)
4. Explore web-based communication applications (e.g., social media, image sharing, video chat, instant messaging)
5. Identify help features and reference materials to learn applications and solve problems

Level 2 Performance Expectations

6. Use help features and reference materials to learn applications
7. Evaluate and select the appropriate applications to productively complete tasks
8. Identify application installation options (local, webbased, software as a service [SaaS])
9. Identify and use resources to solve problems using application software
10. Compare and contrast application features
11. Install, upgrade, and customize applications

Level 3-4 Performance Expectations

12. Evaluate providers, licensing, and purchasing options
13. Use the collaborative features of applications to accomplish organizational tasks
14. Apply advanced features of applications for productivity
15. Evaluate the effectiveness of applications to solve specific problems
16. Diagnose and solve problems resulting from an application's installation and use
17. Compare and contrast locally-installed, web-based, mobile app-based, and cloud-based, installations of software applications
18. Use applications to analyze data for making good business decisions
19. Obtain software industry certification(s) needed for a chosen career path
20. Demonstrate the transferability of skills between applications
21. Diagnose and solve application problems
22. Select and integrate productivity software products appropriate for various computer and cloud platforms

23. Identify, evaluate, and select software specific to an organizational function and/or industry
24. Analyze cost benefit and life cycle of applications
25. Create training materials for applications

DM Digital Media

Use, analyze, and create digital media.

Level 1-2 Performance Expectations

1. Explore current and emerging digital media
2. Select and apply digital media appropriate for specific tasks
3. Create digital media to enhance academic achievement across the curriculum
4. Identify and select appropriate delivery methods and tools for digital media projects
5. Explore the impact of digital media on society
6. Troubleshoot digital media applications
7. Create digital media projects collaboratively
8. Use elements of digital and visual literacy appropriately

Level 3-4 Performance Expectations

9. Interpret, analyze, and determine meaning for digital media production
10. Create an original high-end, professional quality media production
11. Analyze the societal impacts of digital media
12. Analyze and select appropriate digital media formats and properties (e.g., plug-ins, codecs, compression)
13. Analyze digital media delivery tools and their effect on business functions
14. Evaluate and configure digital media delivery system solutions (e.g., streaming media servers, custom authored media, open media-sharing solutions, podcast, vodcast, screen share)
15. Select and integrate digital media appropriate for various platforms
16. Obtain digital media industry certification(s)

WDD Web Development and Design

Design, develop, test, implement, update, and evaluate web solutions.

Level 1-2 Performance Expectations

1. Identify and utilize various types of resources for web development
2. Identify and apply appropriate design concepts
3. Design and create web pages
4. Design and create websites incorporating digital media
5. Publish websites on local and cloud-based web development platforms

Level 3-4 Performance Expectations

6. Identify client and target audience needs
7. Create content that is readable, accessible, searchable, and sticky
8. Explain and use various Internet protocols
9. Research and apply accessibility guidelines and laws affecting website design
10. Assess website content in terms of organizational policies, inclusive practices, and federal and state laws
11. Research and analyze hosting and domain name solutions
12. Compare and contrast the features of web development applications and web content management systems

13. Use digital media optimized for website integration
14. Install and configure web development applications and plug-ins
15. Design, develop, and deliver advanced web content and applications using authoring tools
16. Build dynamic web elements utilizing scripting, coding, applications using authoring tools
17. Create a comprehensive website using industry design standards
18. Test, implement, and evaluate the website
19. Analyze web server solutions and platforms
20. Plan, set up, and configure a web server
21. Design e-commerce solutions
22. Troubleshoot advanced server and site dilemmas
23. Analyze work flow and project management procedures relevant to web design
24. Build responsive websites to support all platforms (e.g., computer, mobile, tablet)
25. Develop organizational policy for website content and access
26. Connect web servers to application servers for interoperability
27. Obtain web development and design industry certification(s)

DMS Database Management Systems

Use, plan, develop, and maintain database management systems.

Level 1 Performance Expectations

1. Retrieve and use information from a database
2. Define basic database terminology

Level 2 Performance Expectations

3. Identify the appropriate type of database for a particular situation
4. Identify the variety of data types that are stored in database management systems
5. Create, modify, and extract data from databases for decision making
6. Describe search strategies and use them to solve common information problems
7. Organize and present the results of data retrieval through reports

Level 3 Performance Expectations

8. Identify the concepts and terminology for enterprise-level databases
9. Plan, develop, and implement an enterprise-level database management system
10. Utilize the application development tools from various vendors to interact with a developed enterprise-level database management system
11. Analyze, assess, and troubleshoot enterprise-level database management systems
12. Deploy database development tools to create solutions for reaching organizational goals
13. Obtain database management industry certification(s)

Level 4 Performance Expectations

14. Develop retention schedules that adhere to organizational policies and governmental laws
15. Use data mining techniques to extract useful information
16. Explain the options for converting legacy records to electronic database management systems

PMA Project Management and Systems Analysis

Analyze and design projects and information systems using appropriate management and development tools.

Level 1–2 Performance Expectations

1. Define project management principles
2. Use project management to complete projects across the curriculum
3. Build timelines for projects
4. Apply project management concepts for collaborative works projects
5. Identify the different project management methodologies

Level 3-4 Performance Expectations

6. Identify and explain the steps in the systems development life cycle
7. Identify and describe various structured analysis and design tools
8. Use project management to manage information systems development projects
9. Analyze a current system using structured systems analysis tools
10. Define system requirements using structured systems analysis tools
11. Incorporate appropriate user interface design principles
12. Identify and apply appropriate application development tools
13. Develop a conversion plan
14. Develop design specifications for record types, output, and data stores
15. Create appropriate documentation for information systems
16. Develop a testing plan
17. Develop a training plan
18. Obtain project management industry certification

PAD Programming and Application Development

Design, develop, test, and implement programs and applications.

Level 1-2 Performance Expectations

1. Identify and define programming terminology
2. Demonstrate the ability to code using programming tools

Level 3–4 Performance Expectations

3. Identify and explain programming structures
4. Differentiate between source and object code
5. Choose the appropriate language or application development tool for specific tasks
6. Use scripting languages in application development
7. Apply design principles to programming tasks
8. Develop both procedural and object-oriented programs
9. Select and incorporate appropriate compiler
10. Code common tasks using application development tools
11. Code a program solution in more than one programming language
12. Test, debug, and document code
13. Maintain and modify existing code
14. Develop programs and applications for a variety of platforms
15. Explore the integration of artificial intelligence (AI) in application development
16. Design 3D, augmented reality, and gaming environments in relationship to the development of applications
17. Explore immersive and visualization techniques
18. Obtain programming industry certification(s)

DNI Data and Networking Infrastructures

Develop the skills to design, deploy, and administer networks and telecommunications systems.

Level 1–2 Performance Expectations

1. Identify basic network connectivity concepts
2. Apply basic networking terminology to a network environment
3. Explore and explain the benefits of cloud computing
4. Identify and use basic networking resources
5. Recognize the impact of the convergence of communication technologies on networks
6. Configure basic networking devices and security

Level 3 Performance Expectations

7. Identify network connectivity hardware and related software
8. Identify network architecture and topologies
9. Identify and distinguish network protocols, standards, and theoretical models in actual implementations
10. Identify network hardware infrastructure components including networking media and connection hardware and software
11. Design and develop network infrastructure
12. Explore distributed cloud infrastructures
13. Install and configure network servers, routers, clients, and related hardware and software
14. Monitor and manage computer networks
15. Apply virtualization technologies to servers, networks, storage, and related infrastructure
16. Configure and manage network operating systems in multi-vendor environments
17. Implement hardware and software security solutions
18. Monitor and fortify network security
19. Develop enterprise networking solutions
20. Obtain cloud storage, data management, telecommunications or networking industry certification(s)

Level 4 Performance Expectations

21. Implement a distributed storage solution
22. Develop networking strategic plans
23. Develop policies, protocols, and procedures for maintaining enterprise networks

PA Information Technology Planning and Acquisition

Plan the selection and acquisition of information technologies.

Level 1-2 Performance Expectations

1. Identify personal technology needs and budget
2. Identify and research reliable sources of information about information technologies
3. Select appropriate information technologies

Level 3-4 Performance Expectations

4. Identify and analyze user needs within an organization
5. Research and identify information technology solutions to meet organizational needs

6. Compare, contrast, and identify potential solutions to meet the needs for an organization
7. Analyze, compare, and contrast total costs of ownership for information technology solutions and the return on investment (ROI)
8. Explore sustainability strategies relative to information technology planning, acquisition, and disposal
9. Develop request for proposals for information systems
10. Evaluate bid specifications received from vendors
11. Identify the importance of inventory management and system life cycles on decision making
12. Develop and present a project plan for identifying, evaluating, selecting, purchasing, installing, and supporting an information system

SRM Security and Risk Management

Design and implement security and risk management policies and procedures for information technology.

Level 1–2 Performance Expectations

1. Identify and discuss privacy issues and vulnerabilities relative to the individual and within an organization
2. Implement organizational policies and procedures for security, privacy, and risk management
3. Discuss the risks of data loss and methods of prevention
4. Apply ergonomic techniques to information technology tasks to avoid injury
5. Identify and demonstrate best practices at home and while working (e.g., computers, mobile phones, televisions, tablets)
6. Demonstrate cybersecurity best practices at home and while working with computers, mobile phones, televisions, tablets or other related devices.

Level 3 Performance Expectations

7. Analyze security, privacy, and risk management issues
8. Identify potential risks to enterprise systems from physical or cyber threats
9. Implement configuration management strategies
10. Implement procedures used to recover information from failures and security breaches
11. Implement controls to prevent loss of integrity of data and other information resources

Level 4 Performance Expectations

12. Identify risks to personnel, facilities, data, communications systems, and applications
13. Identify and select controls for personnel, facilities, data, communications systems, and applications appropriate to specific risks
14. Explore the integration of artificial intelligence (AI) in security systems
15. Develop mechanisms to protect an enterprise system from physical and cyber threats
16. Design and implement a security plan for information systems
17. Develop and implement data retention, records management, and destruction schedules

18. Develop and implement disaster prevention and recovery policies and procedures (e.g., Continuity of Operations Plan [COOP])

EST End-User Support and Training

Develop the technical and interpersonal skills and knowledge to train and support a diverse user community.

Level 1-2 Performance Expectations

1. Work in a team to solve problems and share knowledge
2. Tutor and support others in information technology skills
3. Develop technical reading skills
4. Develop technical writing, digital communication, and presentation skills to work effectively with global cultures and diverse individuals
5. Develop critical thinking skills to locate resources to solve problems
6. Develop interpersonal skills
7. Use information technologies to facilitate learning
8. Explore online learning opportunities

Level 3 Performance Expectations

9. Demonstrate an inclusive, customer-oriented, service quality approach with users
10. Use a logical and structured approach to isolate, identify, and resolve problems
11. Identify, evaluate, and use resources for problem identification and resolution
12. Explore help-desk resources (e.g., software, videos, support specialists)
13. Develop help-desk procedures
14. Develop traditional and computer-mediated training materials for users
15. Obtain industry certification in one or more information technology areas
16. Explain the need for lifelong learning and professional growth
17. Design a job aid to teach a "how-to"

Level 4 Performance Expectations

18. Train end users to recognize and solve typical information technology problems
19. Identify, evaluate, and select training resources to meet user needs
20. Select appropriate training delivery methods
21. Create learning materials to facilitate user training
22. Plan and create resources to promote lifelong learning
23. Plan, design, deliver, and evaluate traditional and computer-mediated user training solutions

BF Information Technology and Business Functions

Describe the information technology components of business functions and explain their interrelationships.

Level 3-4 Performance Expectations

1. Identify and examine information systems and their impact on the enterprise (e.g., Enterprise Resource Planning [ERP] systems)
2. Identify and explain the major components of marketing and sales information technologies and their interrelationships
3. Identify and explain the major components of accounting and finance information technologies and their interrelationships
4. Identify and explain the major components of manufacturing and logistics information technologies and their interrelationships

5. Identify and explain the major components of research and development information technologies and their interrelationships
6. Identify and explain the major components of human resource management information technologies and their interrelationships

C Information Technology Careers

Explore career opportunities in information technology.

Level 1-2 Performance Expectations

1. Identify information technologies commonly used in all careers
2. Discuss the impact of information technology on all careers
3. Identify common tasks performed in information technology careers
4. Identify and explore career opportunities in information technology (e.g., LinkedIn, Indeed, etc.)

Level 3-4 Performance Expectations

5. Describe best practices for posting a resume and professional information on job search websites
6. Examine education, experience, skills, and personal requirements for careers in information technology
7. Describe the impact of technological change on information technology positions and the resulting need for lifelong learning
8. Experience an information technology career (e.g., job shadowing, community service, apprenticeship, internship, entry-level job, virtual career exploration)
9. Identify the benefits of industry certifications and higher education for various information technology careers

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

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

F-IF.3								
F-IF.4								
F-IF.5								
F-IF.6								
F-IF.7								
F-IF.8								
F-IF.9								
F-BF.1								
F-BF.3								
F-LE.1								
F-LE.2								
F-LE.5								
S-ID.1								
S-ID.2								
S-ID.3								
S-ID.5					X			
S-ID.6					X			
S-ID.7								
S-ID.8								
S-ID.9								

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?

2016 Mississippi College- and Career- Readiness Standards for Mathematics: High School—Algebra I

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.