

Title 7: Education K-12

Part 124: Information Technology



2014 Information Technology

Mississippi Department of Education

Program CIP: 11.0101 – Computer Technology/Computer Systems Technology

Direct inquiries to

Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
662.325.2510

Program Coordinator
Office of Career and Technical Education
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
601.359.3461

Published by

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

Research and Curriculum Unit
Mississippi State University
Mississippi State, MS 39762

Betsey Smith, Curriculum Manager
Scott Kolle, Project Manager
Jolanda Harris, Educational Technologist

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

Table of Contents

Acknowledgments.....	3
Standards.....	4
Preface.....	5
Mississippi Teacher Professional Resources	6
Executive Summary	7
Course Outlines.....	9
Research Synopsis	12
Professional Organizations	16
Using This Document	17
Unit 1: Orientation to Information Technology.....	18
Unit 2: Technology and Computer Hardware Basics	20
Unit 3: Compatibility Issues	23
Unit 4: Software Installation and Functions	26
Unit 5: Security	28
Unit 6: Green Information Technology	30
Unit 7: Understanding Networking Infrastructures	32
Unit 8: Understanding Network Hardware.....	33
Unit 9: Network Protocols and Services.....	34
Unit 10: Information Technology Career Options.....	35
Student Competency Profile	37
Appendix A: Unit References.....	39
Appendix B: Industry Standards.....	41
Appendix C: 21st Century Skills	45
Appendix D: Common Core Standards	48
Appendix E: National Educational Technology Standards for Students (NETS-S).....	81

Acknowledgments

The Information Technology curriculum was presented to the Mississippi Board of Education on November 14-15, 2013. The following persons were serving on the state board at the time:

Dr. Lynn House, Interim State Superintendent of Education
Dr. O. Wayne Gann, Chair
Mr. Howell “Hal” N. Gage, Vice Chair
Ms. Kami Bumgarner
Mr. William Harold Jones
Dr. John R. Kelly
Mr. Charles McClelland
Mr. Richard Morrison
Ms. Martha “Jackie” Murphy
Mr. Simon F. Weir, II

Jean Massey, Associate Superintendent of Education for the Office of Career and Technical Education at the Mississippi Department of Education, assembled a taskforce committee to provide input throughout the development of the Information Technology *Curriculum Framework and Supporting Materials*.

LeAnn G Miller, Instructional Design Specialist for the Research and Curriculum Unit at Mississippi State University researched and authored this framework.
leann.miller@rcu.msstate.edu

Also, special thanks are extended to the teachers who contributed teaching and assessment materials that are included in the framework and supporting materials:

Brad Amacker, Petal High School, Petal, MS
Walt Littleton, Ross Collins Career and Technical Center, Meridian, MS
Bill McIlwain, Clinton Career Complex, Clinton, MS
Rickey Corker, Jackson County School District, Puckett, MS
Steve Kenedy, Tishomingo County Schools, MS
Larry Stewart, Jackson Public Schools, Jackson, MS
Davy Hammons, Smith County School District, MS
Hilda Dempsey, Greeneville, MS

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

Teresa Jones, Program Coordinator, Office of Career and Technical Education and Workforce Development, Mississippi Department of Education, Jackson, MS
tjones@mde.k12.ms.us

Standards

Standards are superscripted in each unit and are referenced in the appendices. Standards in the Information Technology *Curriculum Framework and Supporting Materials* are based on the following:

Skill Standards for Information Technology

The *Skill Standards for Information Technology* was developed by a team of IT professionals from many companies across the nation and internationally. Funding for development of the standards was provided by the National Science Foundation. In addition to industry-specific technical skills, knowledge, and abilities, the standards include foundation skills required of all workers as well as technical skills common to all jobs within a career cluster across all industries. Reprinted with permission from the National Workforce Center for Emerging Technologies. Copyright © 2003. All rights reserved. Skill standards were also developed from the Strata Information Technology Fundamentals certification objectives.

Common Core State Standards Initiative

The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy. Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved. States and territories of the United States as well as the District of Columbia that have adopted the Common Core State Standards in whole are exempt from this provision, and no attribution to the National Governors Association Center for Best Practices and Council of Chief State School Officers is required. Reprinted from <http://www.corestandards.org/>.

National Educational Technology Standards for Students

Reprinted with permission from *National Educational Technology Standards for Students: Connecting Curriculum and Technology*, Copyright 2007, International Society for Technology in Education (ISTE), 800.336.5191 (U.S. and Canada) or 541.302.3777 (International), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute an endorsement by ISTE.

21st Century Skills and Information and Communication Technologies Literacy Standards

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

Preface

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

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers.

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

Learning Management System: An online resource

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

Should you need additional instructions, please call 662.325.2510.

My PLC: An online registration for all professional-development sessions

To register for any session, teachers will need an account in the registration system, MyPLC, <https://myplc.rcu.msstate.edu>. To create an account, click on the link and navigate to the "Request a Guest ID" link. The ID should be the teacher's first initial and last name and the last four (4) digits of the social security number. Teachers should complete the entire form, which will then be sent to a secure server. Upon activation of the teacher's account, he or she will receive an e-mail with login instructions. The teacher may then browse for the available sessions and register for the desired courses.

Should you need additional instructions, please call 662.325.2510.

Executive Summary

Pathway Description

The Information Technology program is designed to provide the basic 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 experience in computer systems support and skill in network setup and maintenance.

Industry standards referenced are from the *Skill Standards for Information Technology* published by the National Workforce Center for Emerging Technologies. Program competencies are designed to prepare students for Strata IT Fundamentals certification and Microsoft Technology Associate: Networking Fundamentals certification. Additional research data used in the development of this publication were collected from a review of related literature and from surveys of local experts in business, industry, and education.

Industry Certification

Program competencies are designed to prepare students for Strata IT Fundamentals certification and Microsoft Technology Associate: Networking Fundamentals certification by integrating certification skills throughout the curriculum. Skill Standards for Information Technology is also referenced to assist in student preparation for IT careers.

Assessment

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

Student Prerequisites

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

1. C or higher in Pre-Algebra
or
2. TABE Math Computation and TABE Math Applied Score (eighth grade or higher)
or
3. Instructor Approval and TABE Reading Score (eighth grade or higher)

Applied Academic Credit

There is no academic credit at this time.

Teacher Licensure

The latest teacher licensure information can be found at

<http://www.mde.k12.ms.us/educator-licensure>

Professional Learning

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

Course Outlines

Option 1 – Four One-Carnegie-Unit Courses

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

1. **Information Technology Fundamentals I—Course Code: 992208**
2. **Information Technology Fundamentals II—Course Code: 992209**
3. **Information Technology Networking I—Course Code: 992210**
4. **Information Technology Networking II—Course Code: 992211**

Course Description: Information Technology Fundamentals I

This course covers the explanation of technology and computer hardware basics, compatibility issues and common errors associated with computer hardware.

Course Description: Information Technology Fundamentals II

This course is a continuation of topics from Information Technology Fundamentals I and addresses additional technology topics including software installation and functions, security risks and prevention, Green IT and preventative maintenance of computers.

Course Description: Information Technology Networking I

This course covers the basic concepts of networking, each network operating system, networking types, standards and how data is encoded and transmitted.

Course Description: Information Technology Networking II

This course is a continuation of topics from Information Technology Networking I and addresses additional networking topics including network protocol, services, and career options. Students should be prepared to take the Microsoft Technology Associate: Networking Fundamentals Certification exam at the end of the course.

Information Technology Fundamentals I—Course Code: 992208

Unit	Unit Name	Hours
1	Introduction to Information Technology	40
2	Introduction to Computer Hardware	65
3	Compatibility Issues	20
Total		125

Information Technology Fundamentals II—Course Code: 992209

Unit	Unit Name	Hours
4	Introduction to Software	25

5	Security	35
6	Green Information Technology	50
Total		110

Information Technology Networking I—Course Code: Course Code: 992210

Unit	Unit Name	Hours
7	Network Infrastructures	60
8	Network Hardware	60
Total		120

Information Technology Networking II—Course Code: Course Code: 992211

Unit	Unit Name	Hours
9	Network Protocols and Services	70
10	Career Development	40
Total		110

Option 2 – Two Two-Carnegie-Unit Courses

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

- 1. Information Technology Associate I—Course Code: 992206**
- 2. Information Technology Associate II—Course Code: 992207**

Course Description: Information Technology Associate I

This course covers the explanation of technology and computer hardware basics, compatibility issues, common errors associated with computer hardware, software installation and functions, security risks and prevention, Green IT and preventative maintenance of computers

Course Description: Information Technology Associate II

Networking Fundamentals teaches the basic concepts of networking, each network operating system, networking types, standards and how data is encoded and transmitted. This course is designed to prepare students for the Microsoft Technology Associate: Networking Fundamentals Certification Exam.

Information Technology Associate I—Course Code: 992206

Unit	Unit Name	Hours
1	Introduction to Information Technology	40
2	Introduction to Computer Hardware	65
3	Compatibility Issues	20
4	Introduction to Software	25
5	Security	35
6	Green Information Technology	50
Total		235

Information Technology Associate II—Course Code: 992207

Unit	Unit Name	Hours
7	Network Infrastructures	60
8	Network Hardware	60
9	Network Protocols and Services	70
10	Career Development	40
Total		230

-

Research Synopsis

Introduction

The Information Technology (IT) Career Pathway will target careers at the professional and technical levels in Information Technology. Students enrolled in these courses should be better prepared to pursue degrees at the community college and 4-year-college level.

Needs of the Future Workforce

Due to a large increase in the demand for computer software, growing concerns over cyber security, and an increased dependence on computers and information technology, computer occupations are expected to grow at an average to above average rate with the Bureau of Labor Statistics (2012) projecting a 22 percent growth rate within the United States by 2020. For computer occupations that can be done remotely, however, little to no growth is expected as jobs can be outsourced to other countries for cheaper wages.

Description	Current Jobs (2010)	Projected Jobs (2020)	Change (Number)	Change (Percent)	Median Hourly Earning
Computer and Information Research Scientists	171	201	36	21	\$38
Computer and Information Systems Managers	890	999	109	12	\$34
Computer Programmers	985	939	-46	-5	\$25
Computer Systems Analyst	1,004	1,128	124	12	\$27
Network and Computer Systems Administrators	1,092	1,635	543	50	\$24
Software Developers, Applications	998	1,284	286	27	\$32
Software Developers, Systems Software	817	936	119	15	\$37

Source: State Workforce Investment Board; www.swib.ms.gov (accessed February 13, 2013).

Perkins IV Requirements

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

Curriculum Content

Summary of Standards

The standards to be included in the IT curriculum are the Common Core Standards for Mathematics and Language Arts, 21st Century Skills, and the National Educational Technology Standards (NETS) for Students. Combining these standards to create this document will result in highly skilled, well-rounded students who are prepared to enter a secondary academic or career and technical program of study. They will also be prepared to academically compete nationally as the Common Core Standards are designed to prep students for success in community colleges, Institutions of Higher Learning and careers.

Academic Credit

If academic credit is awarded, please review the Research and Curriculum Unit link at <https://www.rcu.msstate.edu/MDE/PathwaystoSuccess.aspx>.

Click “*Curriculum Enhancement List*”. Check this site often as it is updated frequently.

Academic Infusion

The IT curriculum is tied to the Common Core State standards for Language Arts and Mathematics. The curriculum provides multiple opportunities to enhance and reinforce these

academic skills. Since students will be required to communicate effectively in the classroom as well as in the workforce, there is a considerable amount of writing in this curriculum. The academic content in the IT curriculum provides several opportunities for focus on Language Arts and mathematics as it directly related to Information Technology content. Overall the Information Technology content requires students to perform calculations and utilize strategic and critical thinking skills to solve real world problems.

Transition to Postsecondary Education

The latest articulation information for Secondary to Postsecondary can be found at the Mississippi Community College Board (MCCB) website <http://www.mccb.edu/>

Best Practices

Experiential Learning (SAE)

The Experiential Learning (SAE) has long been and continues to be the backbone of every Information Technology program. The experiential learning projects can be used in a variety of situations to reinforce and compliment classroom theory and content. The experiential learning project consists of entrepreneurship, placement, research/experimentation and exploratory.

Innovative Instructional Technologies

Recognizing that today's students are digital learners, the classroom should be equipped with tools that will teach them in the way they need to learn. The IT teacher's goal should be to include teaching strategies that incorporate current technology. It is suggested that each classroom house a classroom set of desktop student computers and one teacher desktop or laptop. To make use of the latest online communication tools such as wikis, blogs, and podcasts, the classroom teacher is encouraged to use a learning management system, for example, the

Information Technology Teacher Learning Management System, that introduces students to education in an online environment and places the responsibility of learning on the student.

Career and Technical Education 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 IT curriculum. The SkillsUSA, TSA, and FBLA are a few of the student organization for IT. These organizations provide students with growth opportunities and competitive events. Student organizations also open the doors to the world of technology and scholarships opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the IT 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 IT curriculum provides opportunities for students to work together and help each other to complete complex tasks.

Conclusions

The IT curriculum is one of Mississippi's most comprehensive technology curriculums. Students that complete these programs are well equipped for a variety of endeavors. Instructors are urged to encourage IT students to pursue educational opportunities at community colleges and universities in Mississippi.

Professional Organizations

Association for Supervision and Curriculum Development - ASCD
1703 North Beauregard Street
Alexandria, VA 22311-1714
800-933-ASCD
<http://www.ascd.org>

Association for Career and Technical Education - ACTE
1410 King Street
Alexandria, VA 22314
800-826-9972
<http://www.acteonline.org>

Mississippi Association for Career and Technical Education – MSACTE
<http://www.mississippiacte.com/>

Mississippi Association for Supervision and Curriculum Development - MASCD
P.O. Box 13576
Jackson, MS 39236
601-591-2210
<http://www.mascd.com>

Mississippi Department of Education - MDE
Office of Career and Technical Education
P.O. Box 771
Jackson, MS 39205
601-359-3940
<http://www.mde.k12.ms.us/vocational/news/>

Using This Document

Suggested Time on Task

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

Competencies and Suggested Objectives

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

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

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

References

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

Unit 1: Orientation to Information Technology

Competencies and Suggested Objectives	
1.	Research educational, occupational, and leadership opportunities in information technology. ^{DOK2} <ol style="list-style-type: none">Review student rules and regulations for the local school.Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations.Identify and describe leadership opportunities available from student youth organizations in the school and community.Preview the school technology acceptable use policy.
2.	Identify, discuss, and apply safety procedures in the computer classroom and lab. ^{DOK2, SF2, SF4} <ol style="list-style-type: none">Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, and so forth.Care for and use computer hardware correctly.Handle DVDs and CDs correctly.Identify potential health hazards when working on computer equipment.
3.	Publish and communicate with peers, experts, and other audiences using technology. ^{DOK2, ND1} <ol style="list-style-type: none">Research safety issues related to telecommunications and the Internet Academic Standards, if applicable.Develop personal safety guidelines that will be used when using telecommunications and the Internet.Describe legal implications related to the computer industry to include software copyright issues, software licensing, and Internet ethics and policies.Use browsers, search engines, and e-mail.Post information to discussion boards, blogs, wikis, and social media.Use an appropriate, supervised chat room to communicate with peers, experts, and other approved audiences.Research, create, and present a presentation/project on emerging technologies, practices, trends, and issues associated with information technology.

Scenario

Safety First

Unit 1

You are a second year student in Information Technology. Your task is to mentor a first year student in Information Technology. Your assignment includes providing guidance to the student on safety and introducing him or her to new technologies. You are to create a multimedia presentation that includes a synopsis of your school's technology acceptable use policy, safety hazards when working with computer equipment. You must also research and discuss new technologies that have evolved within the last year. This multimedia presentation must be uploaded to your teachers learning management website for future use.

Attachments for Scenario

None

Unit 2: Technology and Computer Hardware Basics

Competencies and Suggested Objectives	
1.	Define basic IT terminology related to computer hardware and networking. ^{DOK1, SF1} a. Define terminology related to the Central Processing Unit including the following: single/dual/quad core, Intel/cell/AMD based, GHz vs. MHz, processor cache size, and bus speed. CE5,CE6,CE7 b. Define terminology related to Random Access Memory including the following: DDR, DDR2, DDR3; and DIMMs vs. SODIMMs. CE5,CE6,CE7 c. Define terminology related to hard drives including the following: RPMs; cache size; flash based vs. traditional hard drives; SATA, SCSI, and IDE; internal vs. external; and local vs. network shares ed. CE5,CE6,CE7 d. Define terminology related to networking including the following: 1. Wireless networking: 802.11 a/b/g/n, Bluetooth, RF (radio frequency), interference, WAP (wireless access point), SSID, and wireless router. 2. Ethernet technologies: CAT5 connections and cables, home plug (Ethernet over Power), broadband router, DSL and cable modems, standard vs. crossover cables, and auto-negotiating (speed and duplex). 3. Internet 4. Protocols: HTTP vs. HTTPs, FTP, SSL, POP3, SMTP, IMAP, DNS, DHCP, and TCP/IP (IPv4 address vs. IPv6 address). 5. Browser features: plug-ins, customization (text sizes, text styles, etc.), anti-phishing features, ActiveX and JAVA, cookies, and Internet cache.
2.	Demonstrate the proper use of computing devices. ^{DOK2, SF1} a. Demonstrate the proper use of monitors including adjusting monitor settings. b. Demonstrate the proper use of a desktop. c. Demonstrate the proper use of a server. d. Demonstrate the proper use of portable devices including: laptop, PDA, Smartphone, and netbook.
3.	Identify and describe the characteristics and functions of internal and external storage devices. ^{DOK1, SF1} a. Identify and describe CD/CD-RW drives. b. Identify and describe DVD/DVD-RW drives. c. Identify and describe Blu-Ray disk drives. d. Identify and describe USB storage including solid state and magnetic disk technologies. e. Identify and describe multi-card reader and writers. f. Identify and describe hard drives. g. Identify and describe mobile media devices including MP3 players and PDAs.
4.	Identify and describe the characteristics (including cables, hardware), and functions of peripheral devices. ^{DOK1, SF1} a. Identify and describe digital cameras. b. Identify and describe Web cameras. c. Identify and describe speakers. d. Identify and describe tuners. e. Identify and describe microphones.

<p>f. Identify and describe printers and scanners.</p>
<p>5. Identify and describe the characteristics and functions of input devices. ^{DOK1, SF1}</p> <ul style="list-style-type: none"> a. Identify and describe keyboards. b. Identify and describe a computer's mouse. c. Identify and describe tablet touch screens. d. Identify and describe numeric keypads. e. Identify and describe gamepads.
<p>6. Identify the risks associated with upgrading the following technologies and equipment. ^{DOK1, SF1, SF3, SF4}</p> <ul style="list-style-type: none"> a. Identify the risks associated with upgrading operating systems (open source and commercial) including the following: compatibility issues, upgrade issues, and data loss. b. Identify the risks associated with upgrading PC speed/storage capability including the following: compatibility issues, upgrade issues, bus differences, and hardware failure. c. Identify the risks associated with upgrading applications including minimum requirements and compatibility issues. d. Identify the risks associated with upgrading bandwidth including the following: VoIP, streaming, and Web delivered services. e. Identify the risks associated with automatic application and operating system updates including the following: risks of automatic updates, risks of not using automatic updates, and risks of not using manufacturer Websites
<p>7. Demonstrate the ability to set up a basic PC workstation. ^{DOK2, SF1, SF3,}</p> <ul style="list-style-type: none"> a. Demonstrate the ability to set up various connector types including the following: DVI, VGA, and HDMI; USB and PS2; FireWire; Bluetooth and wireless; serial; network connectors; PCMCIA; ExpressCard; 3.5mm audio jack; and power connectors. b. Demonstrate the ability to set up various monitor types to including CRT and LCD. c. Demonstrate the ability to set up a computer including the following: desktop, tower, laptop, and custom cases. d. Demonstrate the ability to set up various keyboards to include keyboard layout and regionalization. e. Demonstrate the ability to set up a mouse including the following: touchpad, optical, and trackball. f. Demonstrate the ability to set up various printers including the following: USB, wireless, and networked. g. Demonstrate the ability to set up PC voltage and power requirements. h. Demonstrate the ability to turn on and use the PC and peripherals

Scenario

Unit 2

Customer Service Scenario #1

You are working at the help desk and take a call from a user who cannot log onto the network. After verifying that this user is the only person affected, you ask for the user name and password and try replicating the problem. When you can successfully log on to the network with his user name and password from your help desk workstation, what causes can you rule out and why?

Customer Service Scenario #2

You are a network manager for a computer training center that allows clients to bring their own laptops to class for learning and taking notes. Clients need access to the Internet, so you have configured your network's DHCP server to issue them IP addresses automatically. What DHCP option should you modify to make sure you are not wasting addresses that were used by clients who have completed a class and no longer need them?

Customer Service Scenario #3

You manage a server that allows university students to use Telnet to make a connection then use FTP to upload their homework. Professors also pick up students' homework by telnetting to the computer and using FTP. You have decided to change the FTP port number on the server from its default number to 23, for better security. Assuming students and professors make no changes to their default workstation configurations, what will be the result of this change?

Attachments for Scenarios

No attachments for this Scenario

Unit 3: Compatibility Issues

Competencies and Suggested Objectives	
1. Identify and describe basic compatibility issues and possible solutions. <small>DOK2, SF1,SF2</small>	<ol style="list-style-type: none">a. Discuss compatibility issues involving Processor performance.b. Discuss compatibility issues involving RAM memory.c. Discuss compatibility issues involving USB (1.1, 2.0, 3.0).d. Discuss compatibility issues involving PS/2.e. Discuss compatibility issues involving Ethernet.f. Discuss compatibility issues involving Wireless networks.
2. Explain how common operational problems are often caused by hardware. <small>DOK2, SF1,SF2</small>	<ol style="list-style-type: none">a. Discuss what causes a critical error message or crash.b. Explain the causes of a System lockup (freeze).c. Discuss why an application will not start or load.d. Explain the major causes of not being able to logon to a network.e. Discuss the causes of hardware devices not functioning due to Driver/hardware compatibility.f. Explain what causes input devices not to function proper.
3. Demonstrate the ability to minimize risks. <small>DOK2, SF1,SF4</small>	<ol style="list-style-type: none">a. Identify ways to minimize risks of data loss by using various means of backup solutions.b. Identify ways to minimize risks of loss of service through use of firewalls, intrusion detections systems, honey pots, and so forth.c. Discuss the ability to minimize risks of damage to equipment by preventing Electro Static Discharge (ESD) and fire hazards.

Scenario

Compatibility Issues Involving Processor

Unit 3

You are an IT technician at a retail computer store. A customer has ordered the latest and greatest AMD processor from your company's online computer store. The customer states that he/she has researched and found that this processor is the fastest on the market today. The customer got the CPU at a discounted price and because it was discounted the customer cannot return it. The customer has brought in his desktop tower computer and states that he has a quad core Intel processor in the computer. The customer then asks you to install the AMD processor in their computer.

You are faced with explaining to the customer why this cannot be done. You are to determine the cheapest possible plan as to how the customer could use the new AMD processor with the present computer system.

You must give written documentation in paragraph form of what you would tell the customer. Give details of the cheapest possible way as to how the customer could use the new AMD CPU with the present system or give specific details if any, under what conditions would the customer not be able to use the new CPU with the present system.

If it is decided that the customer cannot use the new CPU, explain how the customer might regain some or all his money?

Attachments for compatibility issues involving processor scenario

Compatibility issues involving processors worksheet. (see Learning management website)

Compatibility Issues iInvolving RAM Memory.

You are an IT technician at a retail computer store. A customer wants to add more memory to their present computer. The customer wants to add the fastest and maximum amount of memory to their computer. The customer states that all the documentation that came with their computer has been misplaced. The customer has looked inside the computer and found that the mother board in the computer is a GIGABYTE GA-Z77X-UD3H Intel 7 Series Motherboard (any modern mother board and memory may be substituted here) and it has one stick of 8 GB of DDR3 1066MHz memory. The customer states that the operating system is a 64 bit system.

The customer wants to know how much memory can be added, if the fastest memory can be installed, and what the memory will cost. After finding the mother board's documentation on line, you are faced with giving two proposals to the customer.

In the first proposal to minimize the cost, you are to determine how much memory could be added with the present stick of memory and find the cost of this memory from your company's online computer store.

The second proposal is without using the present stick of memory, determine how much of the fastest memory could be added and find the cost of this memory from your company's online computer store.

You must give written documentation in paragraph form of each proposal. Give documented proof that supports each of the proposals.

Attachments for compatibility issues involving RAM memory scenario

Compatibility issues involving RAM memory worksheet. (see learning management website)

Unit 4: Software Installation and Functions

Competencies and Suggested Objectives	
1. Conduct basic software installation, removal and/or upgrading. ^{DOK3, SF1,SF3}	
a. Discuss the basic installation/upgrade procedures which include a clean installation, minimum PC requirements, Administrative Rights, and configurations of Firewalls.	
b. Discuss how to configure the Operating System's settings, and set up User accounts and PC settings such as screen resolutions and power settings.	
c. Discuss the importance of software documentation which includes different types of Licensing agreements and registering Software.	
d. Discuss the purpose of Digital Rights Management as it relates to the IT industry.	
e. Discuss how to perform a software removal (clean un-installation).	
f. Discuss how to perform a software re-installation (clean installation).	
2. Identify issues related to folder and file management. ^{DOK3, SF1,SF3}	
a. Demonstrate how to Create, delete, rename, and move folders.	
b. Demonstrate how to Create, delete, rename, move, and print files.	
c. Discuss the importance of following back-up guidelines and procedures.	
3. Explain the function and purpose of software tools. ^{DOK3, SF1,SF3}	
a. Discuss the use of performance and error correction tools to include the System Information tool, Task Manager tool, Windows Action Center, and the System Configuration tool.	
b. Discuss the importance of the Activity or event logging.	
c. Discuss the use of back-up tools.	
d. Discuss the purpose of the disk clean-up tools.	
e. Discuss the purpose of file compression tools.	

Scenario

Unit 4

Installation/Upgrade Procedures Scenario

You are an IT technician at a retail computer store. A customer has brought you their computer and wants you to put windows 8 on their computer. They have Windows 7 as the current operating system and because they are not sure if they will like Win 8, they request that you leave Windows 7 on their computer and put Win 8 on it at the same time. You are faced with setting up a dual booting system of Win 7 and Win 8 on the customer computer.

Attachments for installation/upgrade procedures Scenario

Basic installation/upgrade procedures worksheet (see Learning management website)

The Function and Purpose of Software Tools Scenario

You are an IT technician at a retail computer store. A customer has brought you their computer with a Windows 7 operating system. The customer states that they have been told by a techie friend that computers slow down when cluttered with unused programs and unused files scatter all over the computer's hard drive. The customer wants you to clean up their computer's hard drive. You are faced with removing any malware, spyware, and so forth, and, if need be, help protect the computer from viruses and uninstall any program no longer used or that was accidentally installed on the hard drive while downloading from the Internet. Your store has a policy that you can only use Windows software tools to clean up this computer and make it faster.

Attachments for the function and purpose of software tools Scenario

Software tools work sheet. (see Learning management website)

Unit 5: Security

Competencies and Suggested Objectives	
1. Identify, describe, and discuss the basic security risk associated with both desktop and wireless laptop computers connected through hardwired or wireless networks. Discussion should include, but not be limited to Social Engineering, Viruses, Worms, Trojan Horses, Unauthorized access, File and Folder sharing, Identity theft. ^{DOK2, ND5, ND7, SF4}	
a. Discuss the dangers of security risk and the problems they pose for protecting data.	
b. Describe the methods of delivery of malicious code associated with, Viruses, Worms, and Trojans.	
c. Describe the methods employed in Social Engineering including face to face human interaction and online activities.	
d. Discuss methods used to improperly access computer systems including a discussion of Hackers, Malware, Spyware, Adware, and Phishing.	
e. Explain and discuss the consequences of a successful attempt of Identity Fraud.	
f. Discuss the risk associated with file permissions and access to sensitive data on a network server or personal computer.	
g. Discuss the inherent vulnerability risk that come with new operating systems and the need to be vigilant in doing security updates and loading service packs.	
h. Discuss the security risk associated with open or unsecured networks.	
i. Discuss the security risk associated with mis-configuration issues, lost or stolen backups or sensitive files, cookies, pop ups linked to malware, and keyloggers.	
2. Identify and discuss prevention methods used to ensure the security of a computer and/or network. ^{DOK2, ND5, ND7, SF4}	
a. Discuss the different spyware, antivirus and anti-spam software available to computer users, including freeware and products available in the market	
b. Discuss methods of protection available to users built into their operating systems. Topics are to include: Firewalls, file encryption, security certificates Id(SSL), and password complexity and usage.	
c. Have students research and report on the risk involved in not providing a secure environment for data at the client and server levels	
d. Discuss the risk involved and prevention methods associated with unsecure wireless access points. Topics should include but not be limited to, the unethical use of signal, war driving, encryption (WPA and WEP)	
3. Identify and discuss access control methods available for computers. ^{DOK2, ND5, ND6, ND7}	
a. Discuss and demonstrate the proper creation and use of passwords and user IDs incorporating password complexity recommendations, one time passwords and locks.	
b. Demonstrate an access control method using a screensaver password.	
c. Discuss the use of smartcards, and biometrics for securing access to systems.	
4. Discuss and perform exercises that are used to resolve security issues. ^{DOK2, ND7} Install, configure and run software designed to protect the security of a computer and/or network.	
a. Discuss the protocol and the reason for elevating resolved or unresolved security threats that have been identified on a computer or network.	
b. Establish the appropriate protocol and methods (virus scans, service packs, application	

and O.S. updates) for providing the most secure computer environment possible.

Scenario

Unit 5

Security Installation and verification

Students will install antivirus and adware software found as freeware on the internet. Students will need to insure that the software is compatible with the operating system being used. Student will run scans for any virus or other forms of malware. If malicious software is found they will quarantine the virus or delete it if instructed to do so by their teacher. Depending on the operating system students should be instructed to check in msconfig and in the control panel for suspicious applications that may reside there.

Attachments for Scenario

<http://www.lavasoft.com>

<http://www.safer-networking.org>

http://www.malwarebytes.org/products/malwarebytes_free

Unit 6: Green Information Technology

Competencies and Suggested Objectives

1. Identify environmentally sound techniques to preserve power and dispose of materials. DOK2, SF1,SF5
 - a. Students will demonstrate power-saving techniques in both personal computers and laptops. Students will be able to set the power-saving settings for different environments and the appropriate measure of each power level.
 - b. Students will identify hazardous materials found in personal computers and laptops and learn of the proper way to handle each one. They will learn of proper battery disposal using EPA (Environmental Protection Agency) procedures.
 - c. Students will learn of the dangers of CRT monitors and the proper disposal with EPA standards of CRT monitors, flat-panel monitors, and computers.
 - d. Students will be able to demonstrate proper toner and ink jet cartridge recycling and learn of the proper way to clean spills of each according to EPA standards.
2. Identify green techniques, equipment and procedures. DOK2, SF1,SF5
 - a. Students will be able to identify procedures to ensure energy conservation in their office space and server rooms and how proper spacing can contribute to energy efficiency.
 - b. Students will learn of procedures to conserve hardware usage in computers and networking by consolidating hardware such as hard drives, processors, and servers through virtualization and how cloud computing and VoIP can reduce energy costs.
 - c. Students will examine Energy Star standards for monitors.
Students will learn how to reduce paper consumption through techniques such as dual sided printing.
3. Identify preventative maintenance products, techniques, and how to use them. DOK2, SF1,SF5
 - a. Students will learn of proper chemicals to clean equipment and the proper disposal of such chemicals.
 - b. Students will learn how proper cleaning of equipment can reduce energy consumption and reduce costs of hardware replacement.
 - c. Students will examine proper cooling of computers and keeping their environment from dust and particle contamination.
 - d. Students will be able to identify proper power consumption features such as use of UPS, surge protectors, and proper wiring for both electrical and data.

Scenario

Unit 6

Responsible recycling and practical computer maintenance

Students will organize a computer recycling day at their school once a semester. They will contact the local computer recycling agency in accordance with the Environmental Protection Agency (EPA) standards to set up a date and place in the IT lab/classroom for both the school and community.

Students will compile a Materials Safety Data Sheet (SDS) for their shop to observe and be aware of any hazardous chemicals and procedures for their handling.

Students will create a PowerPoint and give demonstrations of common preventative maintenance procedures such as hard drive defragmentation, setting up automatic updates, disk cleanup, and be responsible for scheduling such tasks on their computer in the lab/classroom and other labs in the building and school if permitted.

Attachments for Scenario

Resources:

https://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_co de=CO

<http://www.epa.gov/epawaste/conserves/materials/ecycling/index.htm>

<http://www.microsoft.com/athome/setup/maintenance.aspx#fbid=ICcq6NS9FNt>

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

Unit 7: Understanding Networking Infrastructures

Competencies and Suggested Objectives	
1. Differentiate between the concepts of Internet, intranet, and extranet. ^{DOK2, NDI}	
a. Research and define Internet, intranet, and extranet.	
b. Compare and contrast the identifying factors Internet, intranet, and extranet.	
2. Classify networks based on size. ^{DOK2, NDI}	
a. Investigate the characteristics of the different types of networks such as Local Area Network (LAN), and Wide Area Network (WAN).	
b. Discuss the variance of bandwidth based on network size.	
3. Examine wireless networking. ^{DOK2, NDI}	
a. Identify the devices on a wireless network including Network Interface Card (NIC), Ethernet hub, wireless access point (WAP), wireless bridge, and so forth.	
b. Identify the devices on a wireless network including Network Interface Card (NIC).	
4. Examine network topologies and access methods. ^{DOK2, NDI, ND3}	
a. Compare and contrast the two types of network topologies: physical and logical.	
b. Recognize Ethernet as the most common local area networking standard for wired networks.	
c. Discover how networks share information through interconnection.	
d. Recognize the roles of protocols in networks.	
e. Outline the parameters of peer-to-peer and client/server networking.	

Scenario

Unit 7

No scenario for this unit.

Unit 8: Understanding Network Hardware

Competencies and Suggested Objectives	
1. Examine network hardware to include layers 1, 2, and 3 devices.	DOK2, ND1, ND2
a. Identify and define hubs, bridges, and switches as layers 1 and 2 network hardware devices.	
b. Identify and define routers, firewalls, and layer 3 switches as layer 3 network hardware devices.	
2. Recognize network media types.	DOK2, ND1, ND2
a. Investigate the characteristics of Twisted Pair cabling in networks.	
b. Investigate the characteristics of coaxial cabling in networks.	
c. Investigate the characteristics of fiber optic cabling in networks.	
d. Investigate the characteristics of wireless networks.	

Scenario

Unit 8

No scenario for this unit

Unit 9: Network Protocols and Services

Competencies and Suggested Objectives	
1. Understand Network Models. <small>DOK2, NDI, ND2, ND3, ND4</small>	<ol style="list-style-type: none">Examine the OSI Model, and explain the functions of each of the seven layers.Compare the TCP/IP Model to the OSI Model.Explain how data moves on the network utilizing packets and frames.
2. Describe Internet protocol. <small>DOK2, ND2, ND3,</small>	<ol style="list-style-type: none">Use number systems to include binary, decimal, and hexadecimal.Explain IPv4 addressing, to include address classes, NAT, APIPA, and CIDR.Calculate subnets for IPv4 networks.Explain IPv6 addressing, to include provisions for backwards compatibility, short notation, and reserved addresses.Calculate subnets for IPv6 networks.
3. Describe network services. <small>DOK2, NDI, ND3, ND5, ND6</small>	<ol style="list-style-type: none">Explain name resolution to include WINS and DNS.Describe network services to include DHCP, IPSec, and Remote Access.Identify common TCP/IP subprotocols including ICMP, Telnet and FTP, including the port numbers associated with each.

Scenario

Unit 9

Creating CIDR Subnets

You are the Network Administrator for a school district. The IT Director tasks you to set up six computer labs at a new middle school that will open in the fall. Each computer lab will have 28 student PCs, one teacher PC, and one networked printer. The director has assigned one Class C range of IP addresses to be used for the six labs.

Create a subnetting scheme that will create six subnets that can accommodate the thirty required hosts per lab.

Attachments for Scenario

Unit 9.pdf (see learning management website)

Unit 10: Information Technology Career Options

Competencies and Suggested Objectives	
1.	Investigate and demonstrate career development skills. ^{DOK3} <ol style="list-style-type: none">Investigate career opportunities and emerging technologies in information technology.Locate resources for a job opening in an IT career field.Prepare, in an acceptable format, a cover letter, a resume, and a follow-up letter using word processing software.Demonstrate appropriate job interview skills, including completing a job application.
2.	Use appropriate communication skills and professional behavior when communicating with clients and co-workers. ^{DOK3} <ol style="list-style-type: none">Practice appropriate communication skills including speaking clearly and concisely, using tact and discretion, avoiding jargon, asking pertinent questions, and exercising listening skills.Practice appropriate professional behavior including maintaining a positive attitude and tone of voice, avoiding arguments or defensiveness, and respecting clients' privacy and property.
3.	Research opportunities related to information technology, and participate in field experiences or simulations. ^{DOK3} <ol style="list-style-type: none">Investigate educational opportunities related to information technology.Describe national standards and certification/licensing procedures related to information technology.Describe the role of trade organizations, associations, and unions related to information technology.Participate in a school-to-careers activity (shadowing, mentoring, simulations, career fair, etc.).Visit an industry/computer center, and analyze the hardware/ software usage and needs, the educational training for personnel, the tasks performed by personnel, and the future outlook for those jobs.

Scenario

Unit 10

Communication Skills

You are a PC support technician that takes calls for your online computer store. A very angry customer calls to tell you that they have left numerous phone messages and you have not answered any of them. The customer has the option to leave a message or hold for the next available support technician. The company's policy is to take phone calls as they come in and then answer messages when there are no callers on the line. The customer is not aware that you receive about 20 phone messages daily and you are trying hard to keep up with your work load. Finally the customer gets you on the line, what do you say?

Employability Skills

You are a job applicant looking to be employed with a local computer retail store. They are looking to hire a full time PC technician to work in their store as a salesperson some of the time and as repair person some of the time. You wish to apply for this job. You are to prepare the following: a resume, cover letter, and a follow up letter. Documents are to be prepared in an acceptable format, free of grammatical and typographical errors, and must include all components for a complete document.

Attachments for Scenario

No attachments for this Scenario

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 information technology.
	2.	Identify, discuss, and apply safety procedures in the computer classroom and lab.
	3.	Publish and communicate with peers, experts, and other audiences using technology.
Unit 2: Technology and Computer Hardware Basics		
	1.	Define basic IT terminology related to computer hardware and networking.
	2.	Demonstrate the proper use of computing devices.
	3.	Identify and describe the characteristics and functions of internal and external storage devices.
	4.	Identify and describe the characteristics (including cables, hardware), and functions of peripheral devices.
	5.	Identify and describe the characteristics and functions of input devices.
	6.	Identify the risks associated with upgrading the following technologies and equipment.
	7.	Demonstrate the ability to set up a basic PC workstation.
Unit 3: Compatibility Issues		
	1.	Identify and describe basic compatibility issues and possible solutions.
	2.	Explain how common operational problems are often caused by hardware.
	3.	Demonstrate the ability to minimize risks.
Unit 4: Software Installation and Functions		
	1.	Conduct basic software installation, removal and/or upgrading.
	2.	Identify issues related to folder and file management.
	3.	Explain the function and purpose of software tools.
Unit 5: Security		
	1.	Identify, describe, and discuss the basic security risk associated with both desktop and wireless laptop computers connected through hardwired or wireless networks. Discussion should include, but not be limited to Social Engineering, Viruses,

		Worms, Trojan Horses, Unauthorized access, File and Folder sharing, Identity theft.
	2.	Identify and discuss prevention methods used to ensure the security of a computer and/or network.
	3.	Identify and discuss access control methods available for computers.
	4.	Discuss and perform exercises that are used to resolve security issues. ^{DOK2, ND7} Install, configure and run software designed to protect the security of a computer and/or network.
Unit 6: Green Information Technology		
	1.	Identify environmentally sound techniques to preserve power and dispose of materials.
	2.	Identify green techniques, equipment and procedures.
	3.	Identify preventative maintenance products, techniques, and how to use them.
Unit 7: Understanding Networking Infrastructures		
	1.	Differentiate between the concepts of Internet, intranet, and extranet.
	2.	Classify networks based on size.
	3.	Examine wireless networking.
	4.	Examine network topologies and access methods.
Unit 8: Understanding Network Hardware		
	1.	Examine network hardware to include layers 1, 2, and 3 devices.
	2.	Recognize network media types.
Unit 9: Network Protocols and Services		
	1.	Understand Network Models.
	2.	Describe Internet protocol.
	3.	Describe network services.
Unit 10: Information Technology Career Options		
	1.	Investigate and demonstrate career development skills.
	2.	Use appropriate communication skills and professional behavior when communicating with clients and co-workers.
	3.	Research opportunities related to information technology, and participate in field experiences or simulations.

Appendix A: Unit References

Units 1-5

Andrews, J. (2006). *A+ guide to managing and maintaining your PC, comprehensive* (6th ed.).

Boston, MA: Thomson Course Technology.

Anthony, S. (n.d.). How to dual-boot Windows 8 and Windows 7 | ExtremeTech. *Latest*

Technology News / Tech Blog / ExtremeTech. Retrieved May 10, 2013, from

<http://www.extremetech.com/computing/143380-how-to-dual-boot-windows-8-and-windows-7>

CompTIA Strata™ Fundamentals of IT Technology Examination Objectives from

<http://www.certipoint.com/portal/common/documentlibrary/US-Strata-Objectives.pdf> ,

Darril Gibson (2012), *CompTIA Strata IT Fundamentals Quick Reference*, Indianapolis, In:

Pearson Education, Inc.

Scott Jernigan (2011), *CompTIA Strata IT Fundamentals All-in-one Exam Guide* (Exam FCO-

U41), United States : McGraw-Hill Osborne Media

SkillsUSA. (n.d.). Retrieved September 8, 2008, from <http://www.skillsusa.org/>

Units 6-10

Bailey, L. J. (2006). *Working* (4th ed.). Mason, OH: Thomson.

Burrow, J., Kleindl, B. A., & Everard, K. E. (2008). *Business principles and management* (12th

ed.). Mason, Ohio: Thomson Learning.

Company. (n.d.). Jobs & Job Search Advice, Employment & Careers | Careerbuilder.com. Jobs

& Job Search Advice, Employment & Careers | Careerbuilder.com. Retrieved May 10,

2013, from <http://www.careerbuilder.com>

- Complete Guide to Ethics Management: An Ethics Toolkit for Managers. (n.d.).Free Management Library (SM). Retrieved May 10, 2013, from <http://managementhelp.org/businessethics/ethics-guide.htm#anchor35028>
- Dean, T. (2010). *Network+ guide to networks*. Cambridge, MA: Course Technology, Cengage Learning.
- Gambrel, B. (2011). *Networking fundamentals exam 98-366 : Microsoft official academic course*. Hoboken (N.J.): Wiley.
- Hill, R. B. (2000). *The work ethic site*. Retrieved from the University of Georgia's Department of Workforce Education, Leadership, and Social Foundations: <http://www.coe.uga.edu/workethic/index.html>
- Lowe, D. (2010). *Networking for dummies*(9th ed.). New York, NY: Wiley Pub..
- National Association of State Directors of Career Technical Education Consortium: Career Clusters® : Career Clusters® Resources : Student Interest Survey. (n.d.). *CTE - Career Technical Education / CTE Online*. Retrieved May 10, 2013, from <http://www.careertech.org/career-clusters/ccresources/interest-survey.html>
- Palmer, M. (2013). *Hands-on networking fundamentals* (2nd ed.). Boston, MA: Course Technology/Cengage Learning.

Appendix B: Industry Standards

INFORMATION TECHNOLOGY PATHWAY CONTENT STANDARDS AND PERFORMANCE ELEMENTS

Crosswalk for Information Technology											
	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
NWCET											
ND1 Perform Analysis		X						X	X	X	
ND2 Design Network									X	X	
ND3 Configure & Deploy Network								X		X	
ND4 Perform Testing										X	
ND5 Manage Network						X				X	
ND6 Maintain Network and Manage Growth						X				X	
ND7 Perform Security Administration						X					

NATIONAL WORKFORCE CENTER FOR EMERGING TECHNOLOGIES SKILL STANDARDS FOR INFORMATION TECHNOLOGY NETWORK DESIGN AND ADMINISTRATION

ND1 Perform Analysis

- Gather data to identify customer requirements.
- Identify, interpret, and evaluate system network and security requirements.
- Define scope of work.
- Review network architecture, topology, interdependencies, and constraints.
- Research technical alternatives and analyze technical options.
- Develop a project plan.

ND2 Design Network

- Participate in design reviews.
- Prepare an integration plan for new processes, protocols, and equipment.
- Recommend selection of architecture, topology, hardware, and software.
- Prepare capacity and throughput plan.
- Specify servers and supporting hardware.
- Specify wired and wireless facilities.
- Integrate network components.

ND3 Configure and Deploy Network

- Plan and document system configuration.
- Implement new system configuration.
- Perform workstation configuration and software loading.
- Support, track, and document change implementation.
- Implement deployment.
- Manage contract personnel.
- Install hardware.

- Perform network fault management.

ND4 Perform Testing

- Define and document test specifications.
- Develop test plan and procedures.
- Schedule and perform testing.
- Document, interpret, and report test results.
- Perform final tests, and gain customer acceptance.
- Perform functional verifications and system audits.

ND5 Manage Network

- Set up and maintain user accounts.
- Coordinate, communicate, and document changes.
- Manage inventory.
- Analyze system performance to baseline.
- Monitor and report component and connectivity problems.
- Make recommendations for system optimization, improvement, and security.
- Generate and present reports.
- Monitor capacity to ensure required service levels.
- Manage and implement contingency and emergency recovery plans.

ND6 Maintain Network and Manage Growth

- Develop maintenance and upgrade plans.
- Coordinate maintenance for the computer, Web server, and telecommunications networks.
- Apply maintenance upgrades, security enhancements, and process changes.
- Perform system backups, and restore data.
- Troubleshoot and maintain client, server, and network systems.
- Develop growth and capacity plans, and make recommendations.
- Implement growth plans and long-range solutions.

ND7 Perform Security Administration

- Gather and document security requirements.
- Design and document security plan.
- Implement and enforce system and user security requirements.
- Maintain, improve, and enhance security in response to industry developments and user experience.
- Detect, monitor, and report security problems.
- Contribute to and develop recommendations for long-range security plans.

**STRATA INFORMATION TECHNOLOGY
CONTENT STANDARDS**

Crosswalk for Information Technology											
	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Strata IT Fundamentals											
SF1 Technology and Computer Hardware Basics			X	X	X	X	X	X	X	X	
SF2 Compatibility Issues and Common Errors				X							
SF3 Software Installation and Functions			X		X						
SF4 Security			X			X		X			
SF5 Green IT and Preventative Maintenance							X				X

Strata Information Technology Fundamental Standards

SF1 Technology and Computer Hardware Basics

- Identify basic IT vocabulary
- Demonstrate proper use of devices
- Explain the characteristics and functions of internal and external storage devices
- Explain the characteristics and functions of peripheral devices
- Explain the characteristics and functions of core input devices
- Identify the risks associated with upgrading technologies and equipment
- Demonstrate the ability to set up a basic PC workstation

SF2 Compatibility Issues and Common Errors

- Identify basic compatibility issues
- Recognize common operational problems caused by hardware
- Demonstrate the ability to minimize risks

SF3 Software Installation and Functions

- Conduct basic software installation, removal and/or upgrading.
- Identify issues related to folder and file management
- Explain the function and purpose of software tools

SF4 Security

- Recognize basic security risks and procedures to prevent them
- Recognize security breaches and ways to resolve them

SF5 Green IT and Preventative Maintenance

- Identify environmentally sound techniques to preserve power and dispose of materials
- Identify green techniques, equipment and procedures
- Identify preventative maintenance products, techniques, and how to use them.

Appendix C: 21st Century Skills¹

21 st Century Crosswalk for Information Technology											
	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
21 st Century Standards											
CS1											X
CS2											X
CS3											X
CS4											
CS5						X					
CS6											X
CS7		X									X
CS8		X									X
CS9		X	X	X	X	X	X	X	X	X	X
CS10			X	X	X	X	X	X	X	X	X
CS11		X	X	X	X	X	X	X	X	X	X
CS12			X	X	X	X	X	X	X	X	X
CS13		X	X	X	X	X	X	X	X	X	X
CS14											X
CS15											X
CS16		X									X

CSS1-21st Century Themes

CS1 Global Awareness

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

CS2 Financial, Economic, Business, and Entrepreneurial Literacy

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

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions

¹ *21st century skills*. (n.d.). Washington, DC: Partnership for 21st Century Skills.

4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

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

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

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

CS7 Critical Thinking and Problem Solving

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

CS8 Communication and Collaboration

1. Communicate Clearly
2. Collaborate with Others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

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

CS10 Media Literacy

1. Analyze Media
2. Create Media Products

CS11 ICT Literacy

1. Apply Technology Effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be Flexible

CS13 Initiative and Self-Direction

1. Manage Goals and Time
2. Work Independently

3. Be Self-directed Learners
- CS14 Social and Cross-Cultural Skills**
1. Interact Effectively with others
 2. Work Effectively in Diverse Teams
- CS15 Productivity and Accountability**
1. Manage Projects
 2. Produce Results
- CS16 Leadership and Responsibility**
1. Guide and Lead Others
 2. Be Responsible to Others

Appendix D: Common Core Standards

Common Core Crosswalk for English/Language Arts (11-12)											
	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Common Core Standards											
RL.11.1.											
RL.11.2.											
RL.11.3.											
RL.11.4.											
RL.11.5.											
RL.11.6.											
RL.11.7.											
RL.11.8.											
RL.11.9.											
RL.11.10.											
RI.11.1.		X	X	X	X	X	X	X	X	X	X
RI.11.2.		X	X	X	X	X	X	X	X	X	X
RI.11.3.		X	X	X	X	X	X	X	X	X	X
RI.11.4.		X	X	X	X	X	X	X	X	X	X
RI.11.5.											
RI.11.6.											
RI.11.7.		X	X	X	X	X	X	X	X	X	X
RI.11.8.		X	X	X	X	X	X	X	X	X	X
RI.11.9.											
RI.11.10.		X	X	X	X	X	X	X	X	X	X
W.11.1.		X				X					X
W.11.2.		X									X
W.11.3.											
W.11.4.											
W.11.5.											
W.11.6.											
W.11.7.		X									X
W.11.8.											
W.11.9.											
W.11.10.											
SL.11.1.		X				X					X
SL.11.2.											
SL.11.3.											
SL.11.4.		X									X
SL.11.5.		X	X	X	X	X	X	X	X	X	X
SL.11.6.											
L.11.1.		X	X	X	X	X	X	X	X	X	X
L.11.2.		X	X	X	X	X	X	X	X	X	X
L.11.3.											
L.11.4.											
L.11.5.											
L.11.6.											
RH.11.1.											
RH.11.2.											
RH.11.3.											
RH.11.4.											
RH.11.5.											
RH.11.6.											
RH.11.7.											
RH.11.8.											
RH.11.9.											
RH.11.10.											
RST.11.1.											
RST.11.2.											
RST.11.3.											

RST.11.4.											
RST.11.5.											
RST.11.6.											
RST.11.7.		X	X	X	X	X	X	X	X	X	X
RST.11.8.		X	X	X	X	X	X	X	X	X	X
RST.11.9.											
RST.11.10.											
WHST.11.1.											
WHST.11.2.		X									X
WHST.11.3.											
WHST.11.4.											
WHST.11.5.											
WHST.11.6.											
WHST.11.7.		X									
WHST.11.8.		X									
WHST.11.9.		X									
WHST.11.10.		X									

Reading Standards for Literature (11-12)

College and Career Readiness Anchor Standards for *Reading Literature*

Key Ideas and Details

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

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

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

Craft and Structure

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

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

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

Integration of Knowledge and Ideas

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

RL.11.8. (Not applicable to literature)

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

Range of Reading and Level of Text Complexity

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

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

Reading Standards for Informational Text (11-12)

College and Career Readiness Anchor Standards for *Informational Text*

Key Ideas and Details

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

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

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

Craft and Structure

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

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

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

Integration of Knowledge and Ideas

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

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

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

Range of Reading and Level of Text Complexity

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

By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11–CCR text complexity band independently and proficiently.

College and Career Readiness Anchor Standards for *Writing*

Text Types and Purposes

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

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

b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both

in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.

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

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

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

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

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

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

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

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

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

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

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

- a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.
- b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters
- c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).
- d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
- e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

Production and Distribution of Writing

- W.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
- W.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12 on page 54.)
- W.11.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

- W.11.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- W.11.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
- W.11.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

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

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

Range of Writing

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

College and Career Readiness Anchor Standards for *Speaking and Listening*

Comprehension and Collaboration

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

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

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

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

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

SL.11.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and

solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

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

Presentation of Knowledge and Ideas

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

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

SL.11.6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)

College and Career Readiness Anchor Standards for *Language*

Conventions of Standard English

L.11.1. Demonstrate command of the conventions of Standard English grammar and usage when writing or speaking.

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

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

L.11.2. Demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing.

a. Observe hyphenation conventions.

b. Spell correctly.

Knowledge of Language

L.11.3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

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

Vocabulary Acquisition and Use

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

- a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word’s position or function in a sentence) as a clue to the meaning of a word or phrase.
- b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).
- c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.
- d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

L.11.5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

- a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.
- b. Analyze nuances in the meaning of words with similar denotations.

L.11.6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Reading Standards for Literacy in History/Social Studies (11-12)

Key Ideas and Details

RH.11.1 Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

RH.11.2. determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas

RH.11.3. evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain

Craft and Structure

RH.11.4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RH.11.5. Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.

RH.11.6. Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.

Integration of Knowledge and Ideas

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

RH.11.8. Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.

RH.11.9. Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

Range of Reading and Level of Text Complexity

RH.11.10. By the end of grade 12 read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.

Reading Standards for Literacy in Science and Technical Subjects (11-12)

Key Ideas and Details

RST.11.1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11.2. determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

RST.11.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11.5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11.6. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas

RST.11.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

RST.11.10. By the end of grade 12 read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes

WHST.11.1. Write arguments focused on discipline-specific content.

- a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.
- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.

- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

WHST.11.3. (Not applicable as a separate requirement)

Production and Distribution of Writing

WHST.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

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

Research to Build and Present Knowledge

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

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

WHST.11.9. Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

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

Common Core Crosswalk for Mathematics (11-12)

	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Common Core Standards											
N-RN.1.											
N-RN.2.											
N-RN.3.											
N-Q.1.										X	
N-Q.2.					X			X		X	
N-Q.3.											
N-CN.1.											
N-CN.2.											
N-CN.3.											
N-CN.4.											
N-CN.5.											
N-CN.6.											
N-CN.7.											
N-CN.8.											
N-CN.9.											
N-VM.1.											
N-VM.2.											
N-VM.3.											
N-VM.4.											
N-VM.5.											
N-VM.6.											
N-VM.7.											
N-VM.8.											
N-VM.9.											
N-VM.10.											
N-VM.11.											
N-VM.12.											
A-SSE.1.					X				X	X	
A-SSE.2.											
A-SSE.3.											
A-SSE.4.											
A-APR.1.											
A-APR.2.											
A-APR.3.											
A-APR.4.											
A-APR.5.											
A-APR.6.											
A-APR.7.											
A-CED.1.											
A-CED.2.											
A-CED.3.											
A-CED.4.										X	
A-REI.1.											
A-REI.2.											
A-REI.3.											
A-REI.4.											
A-REI.5.											
A-REI.6.											
A-REI.7.											
A-REI.8.											
A-REI.9.											
A-REI.10.											
A-REI.11.											
A-REI.12.											
F-IF.1.											
F-IF.2.											
F-IF.3.											

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

G-MG.2.												
G-MG.3.												
S-ID.1.												
S-ID.2.												
S-ID.3.												
S-ID.4.												
S-ID.5.												
S-ID.6.												
S-ID.7.												
S-ID.8.												
S-ID.9.												
S-IC.1.												
S-IC.2.												
S-IC.3.												
S-IC.4.												
S-IC.5.												
S-IC.6.			X							X		X
S-CP.1.												
S-CP.2.												
S-CP.3.												
S-CP.4.												
S-CP.5.												
S-CP.6.												
S-CP.7.												
S-CP.8.												
S-CP.9.												
S-MD.1.												
S-MD.2.												
S-MD.3.												
S-MD.4.												
S-MD.5.												
S-MD.6.												
S-MD.7.												

Mathematics (High School)

Number and Quantity

The Real Number System

N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

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

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

Quantities

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

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

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

The Complex Number System

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

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

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

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

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

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

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

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

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

Vector and Matrix Quantities

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

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

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

N-VM.4. (+) Add and subtract vectors

N-VM.4.a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

N-VM.4.b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

N-VM.4.c. Understand vector subtraction $v - w$ as $v + (-w)$, where $-w$ is the additive inverse of w , with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

N-VM.5. (+) Multiply a vector by a scalar.

N-VM.5.a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.

N-VM.5.b. Compute the magnitude of a scalar multiple cv using $\|cv\| = |c|v$. Compute the direction of cv knowing that when $|c|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$).

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

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

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

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

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

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

N-VM.12. (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

Seeing Structure in Expressions

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

A-SSE.1.a. Interpret parts of an expression, such as terms, factors, and coefficients.

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

A-SSE.2. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

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

A-SSE.3.a. Factor a quadratic expression to reveal the zeros of the function it defines.

A-SSE.3.b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A-SSE.3.c. Use the properties of exponents to transform expressions for exponential functions.

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

Arithmetic with Polynomials and Rational Expressions

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

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

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

A-APR.4. Prove polynomial identities and use them to describe numerical relationships.

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

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

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

Creating Equations

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

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

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

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

Reasoning with Equations and Inequalities

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

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

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

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

A-REI.4.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.

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

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

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

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

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

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

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

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

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

system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Interpreting Functions

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

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

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

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

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

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

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

F-IF.7.a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.7.b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.7.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-IF.7.d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

F-IF.7.e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

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

F-IF.8.a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F-IF.8.b. Use the properties of exponents to interpret expressions for exponential functions.

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

Building Functions

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

F-BF.1.a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.1.b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

F-BF.1.c. (+) Compose functions. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.

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

F-BF.3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph

using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.4. Find inverse functions.

F-BF.4.a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.

F-BF.4.b. (+) Verify by composition that one function is the inverse of another.

F-BF.4.c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

F-BF.4.d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Linear, Quadratic, and Exponential Models

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

F-LE.1.a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F-LE.1.b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F-LE.1.c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another

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

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

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

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

Trigonometric Functions

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

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

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

F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

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

F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

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

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

Geometry

Congruence

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

G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and

give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

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

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

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

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

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

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

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

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

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

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

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

Similarity, Right Triangles, and Trigonometry

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

G-SRT.1.a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

G-SRT.1.b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

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

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

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

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

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

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

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

G-SRT.9. (+) Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

G-SRT.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles

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

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

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

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

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

Expressing Geometric Properties with Equations

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

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

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

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

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

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

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

Geometric Measurement and Dimension

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

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

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

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

Modeling with Geometry

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

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

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

Statistics and Probability

Interpreting Categorical and Quantitative Data

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

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate.

Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

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

S-ID.6.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.

S-ID.6.b. Informally assess the fit of a function by plotting and analyzing residuals.

S-ID.6.c. Fit a linear function for a scatter plot that suggests a linear association.

S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9. Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions

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

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

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

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

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

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

Conditional Probability and the Rules of Probability

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

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

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

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

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

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

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

S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Using Probability to Make Decisions

S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?

S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

S-MD.5.a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.

S-MD.5.b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Appendix E: National Educational Technology Standards for Students (NETS-S)

NETS Crosswalk for Information Technology											
	Course	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
NETS Standards											
T1		X	X	X	X	X	X	X	X	X	X
T2		X	X	X	X	X	X	X	X	X	X
T3		X	X	X	X	X	X	X	X	X	X
T4		X	X	X	X	X	X	X	X	X	X
T5		X	X	X	X	X	X	X	X	X	X
T6		X	X	X	X	X	X	X	X	X	X

- T1** Creativity and Innovation
- T2** Communication and Collaboration
- T3** Research and Information Fluency
- T4** Critical Thinking, Problem Solving, and Decision Making
- T5** Digital Citizenship
- T6** Technology Operations and Concepts

T1 Creativity and Innovation
 Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:

- a. Apply existing knowledge to generate new ideas, products, or processes.
- b. Create original works as a means of personal or group expression.
- c. Use models and simulations to explore complex systems and issues.
- d. Identify trends and forecast possibilities.

T2 Communication and Collaboration
 Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:

- a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
- b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- c. Develop cultural understanding and global awareness by engaging with learners of other cultures.
- d. Contribute to project teams to produce original works or solve problems.

T3 Research and Information Fluency
 Students apply digital tools to gather, evaluate, and use information. Students do the following:

- a. Plan strategies to guide inquiry.
- b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
- d. Process data and report results.

T4 Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Students do the following:

- a. Identify and define authentic problems and significant questions for investigation.
- b. Plan and manage activities to develop a solution or complete a project.
- c. Collect and analyze data to identify solutions and/or make informed decisions.
- d. Use multiple processes and diverse perspectives to explore alternative solutions.

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:

- a. Advocate and practice safe, legal, and responsible use of information and technology.
- b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
- c. Demonstrate personal responsibility for lifelong learning.
- d. Exhibit leadership for digital citizenship.

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:

- a. Understand and use technology systems.
- b. Select and use applications effectively and productively.
- c. Troubleshoot systems and applications.
- d. Transfer current knowledge to learning of new technologies.