POLICY 2510
Foundations for High-Quality High School Programming Best Practices
(Grades 9-12)

Contents

Graduation Requirements

9.1.c. Graduation Requirements. The state graduation requirements total 22 credits. See the High School Programming Chart for specific credits required for graduation.

> *9.1.c.1. The CBEM have the authority to increase graduation requirements for schools in their counties. The county superintendent shall notify the WVDE of any changes in requirements beyond the state requirements.*

*Prescribed Course Credits – The required Grades 9 and 10 credit courses that are specifically prescribed per policy (Refer to WVBE Policy 2510 6.1 Grades 9 through 12 Standards-focused curriculum and graduation requirements) for all content areas across grades 9 and 10.

*Personalized Course Credit Options – The required Grades 11 and 12 courses that may be personalized by student and school staff per policy (Refer to WVBE Policy 2510 6.1 Grades 9 through 12 Standards-focused curriculum and graduation requirements) based on the student's post-secondary plans.

Arts

Subject	Graduation Requirements	Personalized Course Options
The Arts 1 credit	1 Personalized Credit An AP®, Dual Credit, or IB® Arts course may be substituted for any Arts credit.	Required to be Offered • **Four sequential courses in music (both choral and instrumental), visual art (general art and/or studio art), dance, theatre**
		Course Options • **Arts Offerings** • **Arts College Courses**
		The following CTE courses will fulfill the 1 credit Arts requirement: • **Fundamentals of Illustration (1851)** • **Fundamentals of Graphic Design (1857)** • **Illustration (1861)** • **Graphic Design Applications (1859)** • **Ornamental Metal Work (1982)** • **Digital Imaging/Multimedia I (1431)** • **Drafting Techniques (1727)** • **Floriculture (0213)** • **Digital Photography (1515)**

Guidance

It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative that students review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

Counties may choose to offer a variety of arts courses to allow students to personalize this credit requirement.

Resources

The Kennedy Center. *http://artsedge.kennedy-center.org/educators/standards.aspx*

National Coalition of Core Arts Standards (2014). *http://nationalartsstandards.org*

Computer Science

Subject	Graduation Requirements	Personalized Course Options
Computer Science		Required to be Offered • **One Course in Computer Science**
		Additional Course Options • **Computer Science in the Modern World** • **AP® Computer Science Courses** • **Information Technology (IT)** • **Information Management** • **Web Development** • **Other courses based on student need and interest** • **CTE Computer Science/IT Courses** • **County-created Computer Science/IT Courses** • **College Computer Science Courses**

Guidance

It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative that students review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

Technology is integrated throughout 9-12 classroom experiences as a tool to facilitate the learning process. Technology-infused activities should, if possible, extend the learning environment beyond the normal school day or setting and extend the development of digital citizenship skills in students.

Computer science is integrated throughout 9-12 classroom experiences as a tool to develop computational thinking, networking, data analysis, programming, and the societal impacts of computing.

All high schools must offer at least one Computer Science course. These include, *but are not limited to*:

2801	AP® Computer Science A
2805	IB Computing Studies
2806	AP® Computer Science Principles
3030	AP® Computer Science A (fourth math credit)
3161	Computer Science & Mathematics (fourth math credit)
6045	Computer Science – Introduction to Geographic Information Systems (third science credit)
2872	Computer Science in the Modern World
2811	Basic Computer
2816	Basic Programming
2821	Computer Graphics
2826	Computer Information Sciences

2831	Computer Science/Programming
2836	Computer Systems
2841	Computer Technology
2846	General Computer Applications
2851	Network Technology
2856	Object-Oriented Language
2861	Operation Systems
2866	Pascal Programming

Locally offered computer science courses

Please refer to the Course Code Manual, which is updated on a regular basis.
https://wveis.k12.wv.us/wveis2004/support.htm

Courses from these CTE pathways

IT2210	Informatics
IT2215	Computer Science
IT1640	Cisco Networking Academies
IT1680	Computer Systems Repair Technology
IT1442	Coding, App, and Game Design
MA1650	Industrial Robotics
IT1450	Information Management
IT1445	Virtual Simulation and Game Development
MA1630	Robotics

Resources

Code.org. *Computer Science Principles AP®. https://code.org/educate/curriculum/high-school*

Code.org. *Computer Science Discoveries. https://code.org/educate/curriculum/high-school*

Apple Education. Everyone Can Code, *Introduction to App Development with Swift (1 semester). App Development with Swift (2 semesters), AP Computer Science Principles with Swift. https://www.apple.com/education/teaching-code/*

College Board. *AP® Computer Science Principles.*
https://apcentral.collegeboard.org/courses/ap-computer-science-principles?course=ap-computer-science-principles

College Board. *AP® Computer Science A.*
https://apcentral.collegeboard.org/courses/ap-computer-science-a?course=ap-computer-science-a

Beauty and Joy of Computing. *Computer Science Principles AP®, https://bjc.edc.org/bjc-r/course/bjc4nyc.html*

CompuScholar. *Information Technology Courses, Python, C#, Java, AP CS A, https://www.compuscholar.com/schools/courses/overview/*

Microsoft *Make Code. https://www.microsoft.com/en-us/makecode/resources*

Microsoft *Educator Center. https://education.microsoft.com/en-us/courses*

English Language Arts (ELA)

Subject	Graduation Requirements	Personalized Course Options
English Language Arts (ELA) 4 credits	3 Prescribed Credits English 9 English 10 English 11 1 Additional Personalized Credit from Course Options An Advanced Placement (AP®), Dual Credit, or International Baccalaureate (IB®) ELA course may be substituted for any ELA credit.	Recommended College- and Career- Readiness Course Options and Courses Required to be Offered • **English 12 or Transition English Language Arts for Seniors** One credit from: • **English 12 or** • **Transition ELA for Seniors or** • **Creative Writing and Reading or** • **Technical English Language Arts**
		Additional Course Options English Language Arts College Courses • **County-created and Approved English Language Arts Courses based on student need and interest ensuring state standards for English are met.**

Guidance

It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative that students review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

6.2.c. Students who do not meet the college- and career-readiness benchmarks on the West Virginia General Summative Assessment for English language arts and/or mathematics prior to their senior year may be enrolled in a designated transition English Language Arts course and/or a designated transition mathematics course even if they already have the required number of credits in that area. Students may enroll in a higher-level course with agreement between the student, his or her parent and/or guardian, and the school to ensure the best interests and needs of each student are met.

Creative Writing and Reading

Creative Writing and Reading fulfills the fourth course credit option in English language arts for graduation. The standards for this course are located in Policy 2520.1A, West Virginia College- and Career-Readiness Standards for English Language Arts. Standards for this course emphasize analytical reading and the creation of a body of student's original work as a reflection of growth and development in the student's writing craft over time. Students engage in rigorous examination of prose, poetry, and drama through the application of multiple critical lenses. Special attention is given to studying literary structures and elements beyond the scope of foundational English language arts courses.

Technical English Language Arts

Technical English Language Arts fulfills the fourth course credit option in English language arts for graduation. The standards for this course are located in Policy 2520.1A, West Virginia College- and Career-Readiness Standards. Technical English Language Arts is designed to enhance students' communication skills through relevant, industry-specific contexts for reading, writing, speaking/listening, and language. Students engage in rigorous examination of technical and career related texts through real and simulated professional discourse experiences.

Transition English Language Arts for Seniors

Transition English Language Arts for Seniors focuses on a set of prioritized English language arts standards for students who have not met the college- and career-readiness benchmark on the SAT School Day or other nationally recognized college admissions assessments. These standards are located in Policy 2520.1A, West Virginia College- and Career-Readiness Standards for English Language Arts. Note that NCAA may not approve this course; however, counties can individually apply for NCAA approval. Students are responsible for verifying that their course selection will support their eligibility as student-athletes as defined by the NCAA. Transition English Language Arts for Seniors fulfills the fourth credit requirement in English language arts for graduation and is accepted by in-state higher education institutions.

Resources

Adlit.org. (2018). Ready for college. *http://www.adlit.org/ready_for_college/*

Southern Regional Education Board. (2013). Literacy ready: Ready for reading in all disciplines. *http://www.sreb.org/page/1683/literacy_ready.html*

Mathematics

Subject	Graduation Requirements	Personalized Course Options
Mathematics 4 credits	2 Prescribed Credits* Math I or Algebra I Math II or Geometry 2 Additional Personalized* Credits from Course Options An AP®, Dual Credit, or IB® mathematics course may be substituted for any mathematics credit.	**Recommended College and Career Readiness Course Options and Courses Required to be Offered** • **Math III STEM or Math III LA or Algebra II** • **Math IV - Trigonometry/Pre-calculus** • **Applied Statistics** • **Transition Mathematics for Seniors** Additional Course Options • **Math I Lab (when taught in conjunction with Math I)** • **Algebra I Support (when taught in conjunction with Algebra I)** • **AP® Computer Science A** • **Advanced Mathematical Modeling** • **Calculus** • **Statistics** • **Quantitative Reasoning** • **STEM Readiness Mathematics** • **Math III TR** • **Math IV TR** • **Mathematics college courses** • **Computer Science and Mathematics** • **County-created and Approved Math Courses higher than Math III or Algebra II** • **Technical Transition Math** • **Financial Algebra**

Guidance

It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative that students review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

6.2.c. Students who do not meet the college- and career-readiness benchmarks on the West Virginia General Summative Assessment for English language arts and/or mathematics prior to their senior year may be enrolled in a designated transition English language arts course and/or a designated transition mathematics course even if they already have the required number of credits in that area. Students may enroll in a higher-level course with agreement between the student, his or her parent and/or guardian, and the school to ensure the best interests and needs of each student are met.

6.4.a.3. All students will receive appropriate grades and/or credit for all work completed while attending school, regardless of the duration of their enrollment period. Students cannot receive credit for the same course twice. When a student retakes a failed course, both grades shall be transcribed.

9.1.c.4. All students complete four credits of mathematics; however, a student's enrollment in a mathematics course for each year of high school must be determined by county policy.

Guidance Concerning Institutions of Higher Education and High School Graduation Requirements

Four credits of mathematics are required for graduation. Two credits of mathematics are prescribed; students must complete either Math I and Math II or Algebra I and Geometry. Two credits of mathematics are personalized; students should carefully choose mathematics courses that best meet their individual interests and needs. Informed decisions regarding choice of personalized mathematics courses should include the student, his or her parent and/or guardian, and the school. Districts are encouraged to work with their mathematics leadership, teachers, and curriculum coordinators to design course sequences that best meet the abilities and needs of their students.

Students should check with their specific higher education institutions regarding mathematics requirements needed for admission. Undergraduate admission to WV four-year colleges and universities as well as the Promise Scholarship often requires the completion of Algebra II or Math III.

Introduction to Mathematical Applications
- **Students in grades 9-12 are eligible to take this course.**
- **Successful completion of Introduction to Mathematical Applications earns one personalized mathematics credit towards graduation.**
- **This course is a career-based mathematics course option for students who are interested in the trades.**
- **The course standards include restructuring of the Technical Transition Mathematics for Seniors standards and specific skills outlined in House Bill 3055.**
- **This is the only course that can be offered prior to Algebra I/Math I for students to earn a personalized math credit towards graduation.**

Math I Lab or Algebra I Support (The proposed Policy 2510 includes the following: "Note: Beginning with the 2024-25 freshman cohort, Math I Lab and Algebra I Support will no longer count toward a Mathematics graduation credit requirement.")
- **One mathematics credit towards high school graduation when taken in conjunction with Math I or Algebra I:**
  - » Successful completion of Math I and Math I Lab or Algebra I and Algebra I Support – two mathematics credits earned toward graduation.
  - » Successful completion of one of the two courses, Math I and Math I Lab or Algebra I and Algebra I Support – demonstrated mastery of the standards of Math I or Algebra I:
    - o County may choose to give the student credit for the actual course instead of the lab or support class since the content is identical.
- **These courses are not recognized by colleges and universities or scholarship programs like Promise Scholarship because they do not cover two distinctly different bodies of knowledge.**
- **These courses are not eligible for students to earn a mathematics credit for the lab or support class after successfully completing Math I or Algebra I.**

Math III TR and Math IV TR (The proposed Policy 2510 does not include Math III TR and Math IV TR as an option for students who successfully complete Math II. It is recommended that other possible options for students are explored for earning the two personalized mathematics credits required for graduation.)

- **Each course counts as one individual mathematics credit towards graduation.**
- **Both courses together address all the standards in Math III.**
- **Students should not take Math III TR if they do not plan on taking Math IV TR. Math III TR and Math IV TR are not available as an embedded credit option.**
- **Higher education institutions and the Promise Scholarship will not recognize Math III TR and Math IV TR as two distinct mathematics courses.**

Transition Mathematics for Seniors (please review 6.2.c. from WVBE Policy 2510)

- **This is a fourth course option only.**
- **This course contains a specific set of standards for students who have not met college- and career-readiness benchmark on SAT School Day or other nationally recognized college admissions assessment.**
- **This course prepares college-bound students for entry-level credit bearing post-secondary mathematics course.**

Technical Transition Mathematics for Seniors (The proposed Policy 2510 does not include Technical Transition Mathematics for Seniors as an option. It is recommended that other possible options for students are explored for earning a personalized mathematics credit required for graduation.)

- **This is a fourth course option only for graduation requirements.**
- **This course was created as a CTE embedded credit completer mathematics option.**
- **This course may not be recognized by higher education institutions as one of the mathematics course requirements.**

AP Computer Science A and Computer Science and Mathematics

- **These courses must be taught by a certified mathematics teacher to receive one of the personalized mathematics credits towards graduation.**

Applied Statistics

- **This course is listed as "Recommended College- and Career-Readiness Course Options and Courses Required to be Offered" in the High School Programming Mathematics section of WVBE Policy 2510.**
- **This course is designed to provide engaging everyday experiences in statistical reasoning and to support students in preparation for the SAT School Day.**

Guidance Concerning the NCAA Requirements

Students are responsible for verifying that their course selection will support their eligibility as student-athletes as defined by the NCAA. The NCAA does not recognize Algebra I Support, Math I Lab, or Transition Mathematics for Seniors as credit-bearing courses for admission. The school is responsible to determine which math courses have been approved by the NCAA.

Guidance for LEAs Considering Options in High School Mathematics Course Pathways

- **Each county has chosen one of the two course pathways for mathematics progression in grades 9-10.**
  - » Option 1: Pathway known as the integrated course sequence of prescribed courses, Math I and Math II
    - o Recommended personalized credit options for this pathway only include Math III STEM, Math III LA, and Math IV
    - o Additional personalized credit options for this pathway only include Math III TR and Math IV TR
  - » Option 2: Pathway known as the traditional course sequence of prescribed courses, Algebra I and Geometry
    - o Recommended personalized credit options for this pathway only include Algebra II and Trigonometry/Pre-calculus
- **Districts need to create a team using their mathematics leadership, teachers, and curriculum coordinators to identify the gaps in standards created by completing a mathematics course on the other pathway. The team should develop and implement an instructional plan to provide students with the opportunity to master the standards not addressed in the previous course to ensure there are not significant learning gaps in understanding mathematics for students who transfer into the district.**
  - » Examples include Algebra I to Math II, Geometry to Math III, Math I to Geometry, Math II to Algebra II.
- **To ensure the student does not experience gaps in mathematics instruction, districts should consider permitting a student who transfers from one pathway to the other to finish the mathematics pathway started by the student through virtual courses.**

6.4.a.2. Any student who successfully completes a high school level course (one meeting the high school approved content standards and taught by a content-certified teacher) prior to grade 9 shall receive full credit for that course toward graduation requirements. The student's permanent record for grades 9-12 shall indicate completion of the courses. The grade for any credit-bearing course taken prior to grade 9 becomes part of the student's permanent record and is calculated in the student's grade point average (GPA).

Accelerating High School Mathematics Courses in Middle School

The West Virginia College- and Career-Readiness Standards for Mathematics in grades 6-8 are coherent, rigorous, and non-redundant, so the offering of high school coursework in middle school to students for whom it is appropriate requires careful planning to ensure that all content and practice standards are fully addressed (no omitting of critical middle school content). The K-8 content standards represent a tight progression of skills and knowledge that is inherently rigorous and designed to provide a strong foundation for success in the more advanced introductory high school mathematics course, High School Mathematics I or High School Algebra I. Districts are encouraged to work with their mathematics leadership, teachers, and curriculum coordinators to design an accelerated pathway that best meets the needs of their students. It is not a best practice to utilize courses beyond high school Mathematics I or high school Algebra I at the middle school level.

Discussions and decision-making regarding accelerating high school mathematics to the middle school should include three areas of consideration:
1. the increased rigor of the Grade 8 mathematics standards;
2. options for high school pathways that accelerate starting in Grade 9 to allow students to reach advanced mathematics courses such as calculus by Grade 12; and
3. the offering of high school mathematics, high school Algebra I for 8th graders or high school Math I for 8th graders, in middle school to students for which it is appropriate.

Students who take either of the credit-bearing Math I for 8th Graders or Algebra I for 8th Graders may not take Math I or Algebra I for credit in high school even though the course codes are different because the standards are identical.
- **If the student would happen to fail, they could then retake the course or complete the credit recovery program.**
- **If the parent/guardian would request the student take this course again in 9th grade and they have not failed it, the credit cannot count towards graduation requirements and may not be used in the calculation of the GPA unless a county policy differs.**

The selection and placement of students into accelerated opportunities must be done carefully to ensure success. It is recommended that placement decisions be made based upon a set of criteria including a readiness assessment to be reviewed by a team of stakeholders that includes teachers and instructional leadership.

Each county has chosen one of two pathways for mathematics progression in high school. The middle school option for Math 8 substitutions should follow the districts identified pathway:
- **Integrated pathway: High School Math I for 8th Graders**
- **Traditional pathway: High School Algebra I for 8th Graders**

Physical Education

Course: _____7948___   Description: <u>EXT CUR/SCLST PE</u>
Use in GPA? <u>N</u>   Graduation Requirement: <u>PE</u>

Final Grade: __

Credit: Grading Absences:
  Attempted: <u>1.000</u>   Excused: __
  Earned: <u>1.000</u>   Unexcused: __

Grade Points Earned: _____
  Compute Points? <u>N</u>
    Grade level: _

Mode: **Change**   Cancel? <u>N</u>

Fiscal Year:	*	20
Class Level:	*	11 Eleventh Grd
Term:	*	1SA ∨
Grade Title:		1FG Block1-final Grade
Course ID:		7948
Course Description:	*	EXT CUR/SCLST PE ☐ Used in GPA
Graduation Requirement:		PE Physical Education
Final Grade:		Credit attempted 1.000 Credit earned 1.000
Grading Level:	*	Regular ∨
Grade Points Earned:	*	☐ Calculate
Grading Absences:		Excused: Unexcused:

Subject	Graduation Requirements	Personalized Course Options
Physical Education (PE) 1 credit	1 Prescribed Credit PE 9-12, Integrated PE, or counties may choose to offer Extracurricular/ Interscholastic PE both graded and non-graded.	Additional Course Options • **JROTC I and II will fulfill the 1 credit PE requirement** • **Dual Credit Courses** • **Other PE courses based on student need and interest paired with the integrated online course**

Guidance

Counties will have the flexibility to allow, at their discretion, students to receive physical education credit in a variety of ways. If counties choose to offer alternate ways to deliver Physical Education (PE), then it is recommended a policy outlining allowable options be developed.

Integrated Physical Education (WVEIS 7949)

This blended learning approach combines a free abbreviated online PE course available through the West Virginia Virtual School, monitored by the PE teacher, with a physically active credit-bearing elective course (e.g. Weightlifting, Show Choir, Dance, etc.). Students will receive both the PE credit and a credit for the physically active course if the county chooses to utilize this option.

Extra-curricular/Interscholastic Physical Education Graded (WVEIS 7949)

This option allows the student to earn the high school PE credit by combining an extracurricular/interscholastic activity with the free online Integrated PE course available from the West Virginia Virtual School and administered by a local physical education teacher of record. The PE teacher will issue and transcript a grade for this course if the county chooses to utilize this option.

Extra-curricular/Interscholastic Physical Education Non-Graded (WVEIS 7948)

This option allows the student to earn the high school PE credit using an extra-curricular/interscholastic activity. The course must be transcribed as non-graded if the county chooses to utilize this option. See guidance for transcribing below.

Extra-curricular/Interscholastic Physical Education Non-Graded Transcribing Guidance

It is important to enter an N in the Compute Points option on WVEIS Green Screen. When utilizing WOW, please ensure the Used in GPA box is not checked. For a non-graded course, final grade should be left blank. See samples below.

WVEIS Green Screen View

WOW view

JROTC/P.E. Guidance

Completion of JROTC I and JROTC II will satisfy the state PE requirement. Students completing JROTC I and JROTC II will not receive a PE Credit in addition to JROTC I and JROTC II credits. This is not an embedded credit course.

Students in JROTC can still enroll in PE and receive PE credit upon successful completion of PE course requirements.

The two attached documents will assist counselors in scheduling and transcribing the JROTC and PE courses. The documents are:

- **Student Attributes for Graduation Plans**
- **Setting Up Schedule for JROTC Meeting P.E. Requirement**

Driver Education

Subject	Graduation Requirements	Personalized Course Options
Driver Education		Required to be Offered • **One Course in Driver Education**

W. Va. Code 18-6-2 requires that there shall be offered in all public secondary schools within the state, without charge to the students, an approved, comprehensive course in driver education.

*In those counties where sufficient public secondary school driver education courses are not available to meet all requests for the course, county boards of education shall, as quickly as possible, make sufficient courses available to fill those requests.

The course may be offered in summer school **in addition to** the regular instructional term.

Science

Subject	Graduation Requirements	Personalized Course Options
Science 3 credits	2 Prescribed Credits Earth and Space Science Biology	Recommended College and Career Readiness Course Options and Courses Required to be Offered • **Chemistry** • **Human Anatomy and Physiology** • **Physics** • **Physical Science**
	1 Additional Personalized Credit from Course Options An AP®, Dual Credit, or IB® Science course may be substituted for a science credit.	Additional Course Options • **Environmental Science** • **Forensics** • **Science college courses** • **Computer Science – GIS** • **County-created and Approved Science Courses** CTE Courses: • **AC Energy and Power (Courses 1-4)** • **Animal and Plant Biotechnology** • **Principles of Agriculture Science-Plan** • **Principles of Engineering** • **Human Body Systems** • **Natural Resources Management** • **Therapeutic Services (Courses I, II, and III)**

Guidance

It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative that students review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

Students are required to take a minimum of three science courses for graduation. Students planning to attend institutions of higher learning should take a minimum of four science courses.

Physical Science is recommended as the 3rd personalized science credit for students not pursuing a STEM pathway because it will give students an understanding of the third major strand of science on a high school level. Students intending to pursue a STEM pathway should be encouraged to take Chemistry as their third science course, followed by Physics their senior year, as this will give them a deeper understanding of the physical sciences and prepare them for more in-depth studies. Students need to consult their chosen post-secondary institution of higher learning to determine which courses best fit their career or continuing education plans.

The West Virginia Higher Education Policy Commission has issued the following statement, "All of the high school courses in the new Policy 2520.3C will be counted as lab sciences courses." However, each college and university may exercise its professional judgment in determining institutional admission standards. Students, their parents/guardians, and school counselors are encouraged to contact technical schools, colleges, and universities to determine admission requirements and recommendations as students develop their Personalized Education Plans and schedule high school science courses.

WVEIS codes for AP® science courses include codes for the corresponding labs. The lab codes serve as place holders for scheduling purposes only. Grades for the classwork and labs should be combined, so only one grade is given for an AP® Science class.

The College Board advises that 25 percent of the instructional time be spent in hands-on laboratory work for science courses.

The three-dimensional learning of the West Virginia science standards provides opportunities for students to actively and purposefully engage with the practices of scientists and engineers and apply the science connecting concepts to deepen their understanding of science phenomena across science disciplines.

Engineering is integrated throughout the content as students solve problems within the constraints they are given. Additionally, educators may choose to teach engineering separate from the other science topics to address computer science, robotics, or other technological process used for solving problems.

Research indicates extending the instruction beyond the classroom to the community and the environment has led to a number of positive impacts, from improving academic performance, to enhancing critical thinking skills, to developing personal growth and life-building skills including confidence, autonomy, and leadership. In addition, several studies show that environmental education increases civic engagement and positive environmental behaviors.

Resources

West Virginia Science Teachers Association. *https://wvsta.org/*

National Science Teaching Association. *http://www.nsta.org/*

Three-dimensional Learning Resources. *https://www.nsta.org/topics/three-dimensional-learning*

Next Generation Science Storylines. *https://www.nextgenstorylines.org/*

A Framework for K-12 Science Education. *https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts*

Social Studies

Subject	Graduation Requirements	Personalized Course Options
Social Studies 4 credits	**3 Prescribed Credits** 1 Credit from World Studies or an AP® Social Studies Course 1 Credit from United States (US) Studies* or US Studies Comprehensive, or AP® US History 1 Credit from Civics (includes personal finance) or AP® Government and Politics **1 Additional Personalized Credit from Course Options** *Beginning with the 2020-2021 9th grade cohort students who take US Studies must utilize Contemporary Studies as their Personalized Credit unless they are utilizing JROTC Courses I-IV. **Students who utilize AP® Government and Politics or Dual Credit Civics must be provided instruction in the personal finance standards found in Civics.	Recommended College and Career Readiness Course Options and Courses Required to be Offered • **Contemporary Studies** • **Economics** • **Geography** • **World Studies** Additional Course Options • **AP® Social Studies Courses** • **IB® Social Studies Courses** • **Financial Literacy** • **Psychology** • **Social Studies college courses** • **Dual Credit Courses** • **Sociology** • **JROTC (Courses I-IV)** • **County-created and Approved Social Studies Courses**

Guidance

It is imperative students verify high school course choices with their chosen post-secondary institution of learning. Additionally, it is imperative students review post-secondary program entrance requirements, including requirements of NCAA, Promise Scholarship, other scholarships, and admissions to specific institutions, various majors, honors programs, etc.

To best serve students, counties may choose to offer a variety of courses as the personalized social studies credit. This will provide students with flexibility, so they may choose courses that best fit their PEP and college/career goals. Please note that Policy 2520.4 allows flexibility in sequencing social studies courses. There is nothing in Policy 2510 or Policy 2520.4 that would prevent a county from doing exactly what they have been doing for social studies requirements, but it does allow flexibility for counties and students who choose to utilize it.

JROTC/Social Studies Guidance

JROTC I (WVEIS course 1065), II (WVEIS course 1066), III (WVEIS course 1080), and IV (WVEIS course 1081) will fulfill the one personalized credit. Students must pass all four JROTC courses to fulfill the one personalized social studies credit requirement.

Social Studies Assessments

W.Va. §18-2-9 requires the administration of a cumulative US history and civics test prior to high school graduation.

It is mandatory of students to take the US history exam at the end of their last US history course (AP® US History, US Comprehensive, or Contemporary Studies) and the civics exam which also meets the citizenship test requirement must be taken at the end of Civics or AP® Government and Politics prior to graduation. The Social Studies Assessment Monitoring Application allows districts to track the status of students required to take the Golden Horseshoe, US History, and Civics assessments. Superintendents, directors, and principals have access to the tracking portal by using their SSO credentials. Administrators have access to view students by their ID numbers, grade, testing year, and the status of the testing (yes, they have taken the test/no, they have not). Administrators will need to request a score report for the US History and Civics assessments if the test is being used as a classroom grade.

All students in grades 8-12 will access the assessment through Webtop using their Office 365 credentials. Depending on how scores are utilized, counties should consider testing all students on the same day.

While the Golden Horseshoe, US history, and civics (citizenship) exams are not formal summative assessments, these exams address specific topics as outlined in W.Va. Code 18-2-9. Only the classroom accommodations, as prescribed on an IEP, should be provided on these exams.

The US history and civics exams will open for a designated period of time in both the fall and spring semesters. These dates will be announced at the beginning of each school year.

If a school needs a braille test for these exams, please contact the WVDE as soon as possible.

The classroom teacher may administer the US history and civics exam to their own students. Anyone administering any of the exams, must sign the appropriate confidentiality agreement and email a scanned copy to the WVDE.

Resources

Social Studies Assessments - Frequently Asked Questions
Components of Senate Bill 636
American History and Civics Exams Confidentiality Agreement
Read Aloud Options for Social Studies Assessments

Celebrate Freedom Week

WV State Code WV State Code §18-2-9 requires county boards of education to establish a full week recognized as "Celebrate Freedom Week" during the regular school year:

(e) A full week of classes during the week selected by the county board of education shall be recognized as "Celebrate Freedom Week". The purpose of Celebrate Freedom Week is to educate students about the sacrifices made for freedom in the founding of this country and the values on which this country was founded. Celebrate Freedom Week must include appropriate instruction in each social studies class which: (1) Includes an in-depth study of the intent, meaning and importance of the Declaration of Independence, the Emancipation Proclamation and the Constitution of the United States with an emphasis on the Bill of Rights; (2) Uses the historical, political and social environments surrounding each document at the time of its initial passage or ratification; and (3) Includes the study of historical documents to firmly establish the historical background leading to the establishment of the provisions of the Constitution and Bill of Rights by the founding fathers for the purposes of safeguarding our Constitutional republic. The requirements of this subsection are applicable to all public, private, parochial, and denominational schools located within this state. Nothing in this subsection creates a standard or requirement subject to state accountability measures.

To help educators select resources that address both the requirements of the bill and the West Virginia College- and Career-Readiness Standards in social studies, the Office of Teaching and Learning has prepared the following document that includes both the related CCRS by grade and a brief list of useful resources. Please note that these resources are 1) only some of the resources available and 2) provided for educators' convenience. They are not to be construed as curriculum, nor should they be considered as required in any sense.

Celebrate Freedom Week 2021-22 Resource Booklet

Resources

https://wvde.us/middle-secondary-learning/social-studies/resources/

portfolios as career awareness and planning evidence. Schools may contact the Higher Education Policy Commission (HEPC) to inquire about staff training to ensure all staff understand and are able to support ongoing, embedded use of the CFWV web-portal for career exploration and portfolio development.

Resources

WVBE Policy 2520.19 West Virginia College- and Career-Readiness Dispositions and Standards for Student Success for Grades K-12. *http://wvde.state.wv.us/policies*

WV Student Success Standards Webpage. *https://wvde.us/middle-secondary-learning/student-success/*

West Virginia School Counseling Webpage. *https://wvde.us/student-support-well-being/wv-school-counselors/*

West Virginia School Counselor Model. *22429-2021-WV-School-Counselor-Model-v3.pdf (wvde.us)*

Policy 2315: Comprehensive School Counseling Programs. *http://wvde.state.wv.us/policies/*

School Counseling One-Pager. *https://wvde.us/wp-content/uploads/2020/03/17666_SchoolCounselor-Infographic-FINAL-v4.pdf*

College for West Virginia. *www.cfwv.com*

My State My Life – West Virginia. *http://mystatemylife.com/*

WIN Career Readiness System. *https://www.wincrsystem.com/*

World Languages

Subject	Graduation Requirements	Personalized Course Options
World Languages		Recommended College- and Career-Readiness Course Options: • **Most four-year colleges and universities require the completion of at least two credits of the same world language before or during post-secondary programming. Students need to consult with their post-secondary educational institutions concerning world language requirements.**
		Required to be Offered • **Three levels of one world language** • **Students who demonstrate proficiency in two languages (English and one additional) can receive the Seal of Biliteracy.**
		Additional Course Options • **Other world languages and additional levels based on student need and interest** • **AP® World Language** • **World Language college courses**

Guidance

World languages will be offered annually. Each school is required to offer three levels of one world language in grades 9-12. Many schools offer more than one language in addition to AP® courses in languages.

Implementation of the world language should model best practices and promote positive proficiency outcomes. The College- and Career-Readiness Standards for World Languages make clear that the primary goal of all world language study must be communicative proficiency. In order to achieve this, the focus in the classroom must shift from traditional **teaching about** the language to **learning to spontaneously create** with the language. Students must have ample opportunity within and beyond the classroom setting to hear and read the language, as well as to interact and present with it.

The culture(s) of the target language should no longer be treated as isolated factoids. The language and the culture should be inseparable. Culture should be introduced daily through the language. Students should not only know about the culture but more importantly, how to behave appropriately in cultural situations.

The National Association of District Supervisors of Foreign Languages (NADSFL) and other leading experts in the field of world languages identify the following characteristics as promoting proficiency in an effective world language classroom:

- **The program cultivates globally competent students through the intentional development of learning pathways that allow students to acquire linguistic and cultural competencies.**
- **The curriculum should be standards-based and focused on developing proficiency in the target language. Thematic unit curricula provide scaffolded student learning experiences and opportunities to interact with authentic sources.**
- **The overall language competency of the learner is measured through performance-based tasks that evaluate how well students communicate in a variety of formative and summative performance tasks.**
- **The program recognizes that effective teachers are the most important factor contributing to student achievement.**
- **The classroom is student-centered, and instruction focuses on meaningful communication.**
- **The target language is the medium of instruction. The teacher uses the target language a minimum of 90% of the time.**
- **Students acquire language through authentic cultural contexts.**
- **Students use language to reinforce core content.**
- **Students experience the language for listening, speaking, reading, and writing.**
- **Students participate in learning activities which vary in length, content, and format.**
- **Students use language individually, in paired groups, in small groups, and in whole-class instruction.**
- **Language acquisition is facilitated through the teacher's use of visuals, gestures, pictures, manipulatives, and technologies.**
- **Students have the opportunity to self-assess their language competencies and cultural interactions.**

Students in the world language classroom should monitor their progress and set their own language goals through a powerful tool, Personal Learning Powered by Linguafolio®. Linguafolio® is a formative, portfolio assessment that allows students to document their learning as they move towards language proficiency. West Virginia has its own online LinguaFolio® platform which can be utilized by any student in the West Virginia public school system. Linguafolio® is available by logging on to Webtop and accessing student tools.

West Virginia Seal of Biliteracy

The West Virginia Seal of Biliteracy was adopted in 2020 and implemented during the 2021-2022 academic year. The Seal of Biliteracy is a nationally recognized award presented to high school students that demonstrate a high level of proficiency in English and at least one other language. During the junior or senior year, students can decide to confirm this proficiency through approved assessments. Students are responsible for any cost associated with testing that is not covered by the school or school system; however, there is no cost associated with having the Seal of Biliteracy on the verified transcript.

Students who attain the Seal of Biliteracy are recognized by universities and, at times are provided university credit for the Seal. In addition, having the Seal of Biliteracy can assist the student in the workforce or military.

Advanced Placement® (AP®) Credit in Social Studies and Science

Guidance

When choosing an Advanced Placement® (AP®) course to replace one of the required credits or an elective option in social studies and science, please be mindful of the following:

Social studies courses typically address periods of time or topics. It is not recommended that students take both US Studies Comprehensive and AP® US History as the two courses address the same time period and typically cover the same content.

The same perspective is not true of science courses. Some students would need to take Biology or Chemistry before they take AP® Biology or AP® Chemistry, but it is not required.

Policy 2510 states in section 6.4.a.3, students cannot receive credit for the same course twice. This is not an issue when it comes to the AP® courses as AP® Biology has a different course code than Biology.

AP® Courses with a Lab Experience

The College Board's lab requirement states that 25% of the instructional experience should take place in a laboratory setting with an emphasis on inquiry-based investigations that provide students with opportunities to apply science practices. The AP® course, including the lab experience, should make up one final grade. The two should not be separate AP® credits or AP® grades. Counties may choose to offer an additional lab time in the schedule as a second elective credit. This elective lab credit would not be weighted.

Personalized Education Plan (PEP)

Personalized Education Plan	**4 Personalized Credits** 4 credits in a CTE Program of Study 4 Credits that lead to post-secondary goals	**4 Personalized Credits** Each student's PEP will identify a career cluster and either a CTE program of study or course work for the 4 credits that will lead directly to college placement, attainment of an industry-recognized certificate or license, a workforce training program, or job placement (Appendix D). Best practices encourage students to experience the following: an AP®, IB®, dual credit, and/or Advanced Career (AC) course with corresponding examination, 2 credits in one world language, an additional science, a computer science, an online/digital learning experience, entrepreneurial experiences, and/or 4 credits (culminating in acquisition of industry-recognized CTE credential focused on career aspirations).
Electives	County Board of Education Members (CBEM) have the authority to set graduation requirements beyond the state minimum for schools in their counties. Students may typically earn up to 32 credits on a block schedule and up to 28 on a traditional schedule over their high school careers.	When choosing electives, students should consult with their chosen post-secondary educational institution and review scholarship program requirements to make sure the electives are appropriate and acceptable.

Guidance

Below are the two options for helping students to select their 4 personalized credits:
- **State approved CTE programs of study**
- **Four courses aligned to their post-secondary goals.**

Annual reviews of the PEP will include revisiting academic offerings, career plans, and review of various interests, learning styles, career and academic assessments to guide any changes to course selections. It is imperative that students verify high school course choices with their chosen post-secondary institution of learning. As part of the PEP process, students should review post-secondary program entrance requirements, including requirements of NCAA, Promise, other scholarships, and admissions to specific institutions, various majors, honors programs, etc. Students are responsible for verifying that their course selection will support their eligibility as student-athletes as defined by the NCAA.

To support PEP development, counties or schools may use the sample PEP template located on the WVDE PEP Resource Page *https://wvde.us/student-support-well-being/wv-school-counselors/academics/* to guide the development of the PEP. The PEP is developed in 8th grade for grades 9-10. High school counselors and/or teacher advisors need to work with students and parents/guardians to develop the PEP for grades 11 and 12.

Schools must use a variety of career development resources and collaborative, embedded processes to ensure all students complete various interests, learning styles, career and academic assessments to guide course selections and revisions to the PEP. Schools must identify a source and process to document these various assessments and inventories in a portfolio system that connects exploration, self-discovery and career awareness and planning activities with development and revisions to the PEP.

Career Technical Education (CTE)

Subject	Graduation Requirements	Personalized Course Options
Career and Technical Education	See section 6.3: Career and Technical Education	Required to be Offered • **One foundational course that teaches parenting skills**
		Recommendation • **Counties are encouraged to expand career exploration and offer CTE foundational courses and CTE programs of study in grades 9 and 10.**

Guidance

The Office of Technical and Adult Education recommends that state-approved CTE courses be taught for a minimum of 90 consecutive minutes a day. Schools must ensure that CTE coursework is offered in accordance with the accountability measures identified in Policy 2322, West Virginia System of Support and Accountability, focused on participation, concentration, completion, performance, work-based learning, and properly endorsed instructors.

Drug-Free Work Zone

Counties offering state-approved CTE programs of study are required to develop a random drug testing policy, which covers safety concerns for the identified programs of study below. All students enrolled in these identified programs of study will be required to participate in random drug testing.

Identified random drug testing programs of study:

- Allied Health Sciences*
- Animal Processing
- Automotive Technology
- Aviation Maintenance Technician
- Baking and Pastry
- Building Maintenance and Operations
- Career and Work Skills Training (CWST)
- Carpentry
- Collision Repair Technology
- Dental Assisting*
- Diesel Equipment Technology
- Early Childhood Classroom Assistant Teacher
- Electrical Technician
- Emergency and Firefighting Management Services
- Forest Industry
- HVAC Technician
- Industrial Equipment Maintenance
- Industrial Robotics
- JRTOC
- Machine Tool Technology
- Masonry
- Millwork and Cabinetmaking
- Pet Grooming
- Plumbing
- Power Equipment Systems
- Power, Structural and Technical Systems
- Pre-Cosmetology
- ProStart Restaurant Management
- Robotics
- Sports Medicine*
- Therapeutic Services*
- Welding

These programs of study require 100% drug testing prior to entering clinical experience.

It is strongly recommended that all students in state-approved CTE programs of study participate in random drug testing.

All students who are enrolled in a state-approved CTE program of study aspiring to achieve a county/school issued drug free certificate and/or to meet the criteria for the Governor's Workforce Credential, must pass a minimum of two drug screenings, not less than 30 days apart, offered by the school during the students' senior year.

Resources

West Virginia College- and Career-Readiness Programs of Study/Standards for Career Technical Education (2520.13). *https://apps.sos.wv.gov/adlaw/csr/readfile.aspx?DocId=55091&Format=PDF*

West Virginia Career Cluster

The West Virginia Career Cluster is comprised of two programs of study; WV5501 Career Integrated Experiential Learning (CIEL) and WV5502 Individual Work Ready Competencies (IWRC). These programs were developed with the aim of assisting students who need to complete a CTE program of study, but who are unable to meet nationally recognized cluster requirements. Students completing a West Virginia Career Cluster program of study are not considered state-approved completers for career-readiness accountability measures.

CIEL is a personalized CTE program of study that was developed to meet student needs by providing them marketable job skills and opportunities to test for multiple nationally recognized certifications.

IWRC is a state-approved CTE career pathway which provides students with a disability and a current Individualized Education Program (IEP) the opportunity to gain valuable work readiness and occupational skills as determined by the Student Assistance Team (SAT). Students must have originally been enrolled in a typical state-approved CTE program of study, where it was determined through classroom assessment measures conducted by CTE staff that the student was not on track to master ALL skill sets associated with the four state-approved sequence of courses.

CTE High School Programming Standards and Courses.

Foundational CTE course is an offering that provides an introduction to a CTE program of study.

Guidance

Policy 2520.13 identifies the requirements of CTE elective courses:

CTE High School Programming Course Standards

1. Students understand the academic content required for entry into postsecondary education and/or the workforce.
2. Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts.
3. Students understand how to make effective decisions, use career information, and manage personal career plans:
    (a) explore job qualifications, interests, aptitudes, information, and skills necessary to succeed in a career;
    (b) understand the scope of career opportunities and the requirements for education, training, and licensure within a career;
    (c) develop a career plan that is designed to reflect career interests, pathways, and postsecondary possibilities; and
    (d) explore strategies for self-promotion in the interviewing process, such as job applications, resume writing, interviewing skills and preparation of a portfolio.
4. Students utilize career-planning concepts, tools, and strategies to explore, obtain and/or develop a career.
5. Students understand the use of technological resources as they apply to career preparedness.
6. Students understand how to develop alternate solutions by integrating critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques.
7. Students demonstrate the proper behaviors associated with workplace etiquette and business processes.
8. Students understand effective leadership styles, key concepts of group dynamics, team and individual decision-making, the benefits of workforce diversity and conflict resolution.

Notes:
- EVERY student must pass ALL safety exams with a score of 100% before having access to available equipment.
- Student certifications for all state-approved programs of study can be located in the Guidance Document of Policy 2520.13.

The following courses are high school elective offerings and are considered non-occupational:

0133	Agricultural Cooperative Education
0146	Leadership Development
0201	Grounds Maintenance
0234	Agricultural Experience Program 2
0700	Exploring Health Professions
0710	Employment in Health Occupations
0720	ECG/Phlebotomy
0725	Understanding Human Behavior
0730	Health Science Clinical Behavior
0736	Medical Assistant Administrative Procedures II
0739	Nutrition and Wellness
0742	Dental Assistant Clinical Practice
0745	Dental Assisting Clinical Mentoring
0747	Dental Specialties
0749	Supervised Dental Clinical Experience
0929	Learning for the Independence, Family, and Employment
0950	Nutrition and Foods Foundation
0954	Foundational Food Preparation[1]
0972	Discover Your Future[1]
0973	Practical Know How[1]
1016	Food Service Management Practices
1017	Culinary Nutrition and the Menu
1018	Baking and Pastry Applications
1032	Principles of Investigation
1055	Public Safety and Wellness
1062	JROTC V
1063	JROTC VI
1064	JROTC Internship
1116	Event Production Operations
1212	Event and Project Planning and Management
1221	Leisure Behavior
1222	Introduction to Recreation and Leisure
1441	Keyboarding
1472	Principles of Entrepreneurship

1518	Fundamentals of Media Writing
1519	Information Graphics
1601	Basic Control Circuits
1602	Air Conditioning Applications
1063	Domestic Refrigeration
1604	Fossil Fuel Heating Systems
1607	Heating Systems
1608	Commercial Air Conditioning
1609	Ductwork Fabrication
1661	Blueprint Reading
1672	Detailing and Interior Parts
1673	Mechanical and Electrical Components
1674	Refinishing Techniques
1676	Custom Finishing Processes
1692	PC Essential Hardware
1706	Imaging for the Web
1718	Introduction to Computer Aided Drafting
1722	Piping Systems
1723	Civil Drafting
1726	Structural Steel Drafting
1728	Advanced Computer Aided Drafting
1742	Diesel Equipment Electrical Systems
1743	Diesel Engine Tune Up and Troubleshooting
1749	Diesel Truck Chassis Concepts
1763	Fundamentals of Electricity
1803	Basic Plumbing and Electricity
1805	Fundamentals of Facilities Maintenance
1820	Applications in Commercial Construction
1821	Concrete Finishing
1822	Blueprint Reading for Construction
1823	Finishing Carpentry
1824	Framing Practices and Applications
1828	Building and Constructive Applications
1829	Masonry and Plumbing
1853	Fundamentals of Computer Graphics
1854	Computer Graphics
1855	Fundamentals of Desktop Publishing
1856	Desktop Publishing/Page Layout
1901	Engine Machining

1902	Machine Tool Technology
1904	Integrated Machine Processes
1906	Machining Processes and Applications
1908	CNC Machining
1911	Block and Rock Laying
1913	Bricklaying
1914	Bricklaying Applications
1916	Decorative Masonry Work
1917	Foundation and Footings
1970	Power Equipment Systems Applications
1972	Recreational Applications
1973	Compact Diesels
1974	Generators
1982	Ornamental Metalwork
1983	Blueprint Reading and Metallurgy
1987	Gas Metal Arc Welding
1989	Gas Tungsten Arc Welding
2004	Agriculture Blueprint/CAD
2006	Agriculture Intro to Oxy-Acetylene/Arc Welding
2124	Cabinet Construction
2145	Smoldering and Flaring Copper Pipe
2146	Gas Piping
2148	Drains, Waste, and Vent Systems
2149	Plumbing Fixtures
2202	Fire Science Technology
2207	Telecommunicator
2208	Auto Extrication
2209	Drive/Pump Operator
2436	Fundamentals of Engineering[1]

[1]This is a CTE foundational offering.

Resources

Educator Portal. *https://wvde.state.wv.us/forms/cte/guidance/*

Community Readiness

Community Readiness	Students with disabilities may earn 4 credits in Community Readiness Training recommended through an IEP Team as a personalized concentration.

Guidance

Students with disabilities may earn four (4) Community Readiness credits in addition to the eighteen (18) prescribed credits as outlined in Policy 2510: Assuring Quality of Education: Regulations for Education Programs. These personalized programs of study are recommended through an Individualized Education Program (IEP) Team for some students, typically those with the most significant cognitive disabilities, and are created by each district to provide guidance in the development of employment, training/education, and independent living skills. The four courses have an increasing focus on employment opportunities and the skills needed to be successful in those settings, including options for training and/or further education. The courses also address independent living skills and community integration to support students as they become responsible and productive citizens.

Social and Emotional Advisory System for Student Success

Social and Emotional Advisory System for Student Success	**Required** Through a Comprehensive School Counseling System, high schools will implement a continuous advisory system that provides students with meaningful supportive relationships and maximizes each student's personalized learning experience. The advisory system will be evidence-and standards-based to systemically address Policy 2520.19 and include development of each student's Personalized Education Plan (PEP), career portfolio, social emotional learning, and the teaching of other skills that enhance school success, and build competent, engaged citizens.

All West Virginia high schools are required to implement a Social and Emotional Advisory System for Student Success which provides students with meaningful supportive relationships and maximizes each student's personalized learning experience. An adult advocate, advisor, or mentor will work to support student's learning, goal setting, career planning, and personal growth. The advisory system will be evidence- and standards-based to systemically address the W. Va. 126CSR44U, WVBE Policy 2520.19, West Virginia College- and Career-Readiness Dispositions, and Standards for Student Success for Grades K-12 (Policy 2520.19), career portfolios, and the teaching of other skills that enhance school success and build competent global citizens.

Guidance

Comprehensive School Counseling Program

WVBE Policy 2315 requires a comprehensive school counseling program (CSCP) to be in place in every WV school and outlines program requirements. Schools are required to develop/revise a CSCP plan annually to ensure continuous improvement and address current student needs. The CSCP is an integral part of the total school program and is aligned with the school's mission, vision, and strategic plan. The CSCP provides universal prevention for all students, targeted interventions for at-risk students, and intensive interventions for the most at-risk students. Tools to develop and deliver a CSCP may be found on the School Counseling webpage.

The West Virginia College- and Career-Readiness Dispositions and Standards for Student Success (WVCCRDSSS) represent the foundational standards for school counseling programs in WV. The WVCCRDSSS are to be collaboratively delivered, involving all staff and engaging community professional, when appropriate. As per WVBE Policy 2315 school leadership teams, in conjunction with the school counselor, will design a systemic process for embedding the WVCCRDSSS into courses, co-curricular activities, and extra-curricular activities. Additional implementation tools are available on the Student Success and the School Counselor webpages.

All West Virginia schools are required to systemically address the WVCCRDSSS found in Policy 2520.19 through a Social and Emotional Advisory System for Student Success. The Social and Emotional Advisory System should be evidence- and standards-based. Schools may utilize the resources found

on the School Counseling and Student Success webpages to design a comprehensive curriculum that addresses the standards and the identified student needs in each school. Evidence-based best practices encourage students to remain with the same advisor throughout high school to ensure each student has a meaningful and supportive relationship. This continuity promotes school connectedness, personalization of each student's learning experience, and PEP development. School counselors will work collaboratively with other school staff to assist students with academic and postsecondary planning that leads to seamless transitions to the chosen postsecondary options identified on each student's PEP. Standards-based advisories should meet consistently for at least 30 minutes per session.

Career Education Integration

Career exploration, development, preparation, and decision making will be a structured, ongoing embedded process that is multi-faceted occurring continuously throughout grades 9-12 for all students. Career education/development should not be taught as a single class that limits career awareness activities to one grading period. Schools should use a variety of methods (course integration, online exploratory, community professionals, career days, etc.) and multiple resources to expose students to career opportunities where all staff assist students to explore the 16 career clusters during the instructional day. To facilitate structured, on-going experiences for career exploration and post-secondary planning it is recommended that schools utilize free WV specific resources that are aligned with the 16 career clusters such as the WVDE Student Success, School Counselor, and CTE webpages, College for West Virginia (CFWV), WIN Career Readiness System, My State My Life, Pathways WV, and WV Strategic Compass. To request Social and Emotional Advisory System and Strategic Compass support contact the WVDE. Schools may contact the Higher Education Policy Commission (HEPC) to inquire about staff training to ensure all staff understand and are able to support ongoing, embedded student use of the CFWV portal for career exploration and portfolio development.

School counselors and/or teacher advisors will use each student's career awareness activities to develop the PEP. School counselors and/or teacher advisors will assist students and their parents/guardians to utilize their various interests, learning styles, and career and academic assessments to guide educational planning and career choices. Career exploration activities will be documented in each student's personalized career portfolio that is transportable throughout the student's middle and high school career. Refer to Policy 2510, High School Programming chart to assure alignment with career development requirements.

Portfolio

Counties or schools will identify portfolio components, the source and the process for development, and maintenance of cumulative career portfolios for all students in each school in grades 6-12. Portfolios can be electronic, hardcopy, or both. It is recommended that schools select a portfolio system that is portable and remains with the student through his or her educational career. College for West Virginia (CFWV) provides a free online portfolio development system for West Virginia students that includes grade-level benchmarks for developing and maintaining the career portfolio. This system allows counselors and teacher advisors to guide and monitor portfolio development. Portfolios should remain with students and can be accessed at home or in any West Virginia school should the student transfer. Career and Technical Education (CTE) students may use their required concentration

Resources

Boix-Mansilla, V. & Jackson, A. (2011). Educating for global competence: Preparing our youth to engage the world. Retrieved from *http://asiasociety.org/files/book-globalcompetence.pdf*

Can-Do statements (n.d.). *https://ncssfl.org/linguafolio2020/2017-can-do-statements/*

Classroom Activities Collection (n.d.). *http://teach.nflc.umd.edu/startalk/classroom-activities*

Couet, R., Duncan, G. W., Eddy, J., Met, M., Smith, M. J., Still, M., & Tollefson, A. Starting with the end in mind: Planning and evaluating highly successful foreign language programs. (n.d.). Retrieved from *http://assets.pearsonschool.com/asset_mgr/current/201136/EndinMind_Bro_32201_1.pdf*

Jensen, J. & Sandrock, P. (2007). The essentials of world languages, grades K-12: effective curriculum, instruction, and assessment. ASCD.

Personal Learning Powered by Linguafolio® (n.d.) *https://ncssfl.org/linguafolio2020/*

Teacher Effectiveness for Language Learning. (n.d.) Retrieved from *http://www.tellproject.com*

Embedded Credit

Appendix A:

Embedded Credit Policy	CBEM are encouraged to establish policy which permits a student who masters the approved content standards for a credit-bearing high school course that are embedded within a second course to receive credit for both courses. If these embedded credit courses are used to meet graduation requirements, the county policy and alignment documentation must be reviewed by the WVDE and approved by the WVBE.

Guidance

Please see embedded credit policy template found at the State Board Policy webpage, *http://wvde. state.wv.us/policies/*.

All embedded credit policies must include the following provison: Students will receive high quality instruction that will allow them to work toward mastery on 100% of the content standards and objectives for all embedded credit courses approved by the county and submitted for approval to the WVBE

CTE Embedded Credit Courses

- **Transcribing Embedded Credit Courses – CTE completers in WVDE approved embedded programs of study may receive embedded credit for Transition English Language Arts, Transition Math and in some cases Advanced Mathematical Modeling. Students enrolled and successfully complete an embedded credit program of study will be awarded the credit for transition ELA and or Math during their senior year.**
- **Correctly coding embedded credit courses – When two teachers are collaborating to deliver the embedded credit, it is very important that courses be properly entered into WVEIS to ensure the course is properly documented on transcripts in such a way that it will be recognized by a two- or four-year college/university.**
    - » *Transition English Language Arts for Seniors* – WVEIS Code 4013C
        - o Note that NCAA may not approve this course; however, counties can individually apply for NCAA approval. Students are responsible for verifying that their course selection will support their eligibility as student-athletes as defined by the NCAA.
    - » *Transition Math for Seniors* – WVEIS Code 3052C
        - o Students are responsible for verifying that their course selection will support their eligibility as student-athletes as defined by the NCAA. The NCAA does not recognize Algebra I Support, Math I Lab, or Transition Mathematics for Seniors as credit-bearing courses for admission. The school is responsible to determine which math courses have been approved by the NCAA.
    - » *Technical Transition Mathematics* – WVEIS Code 3069C
    - » *Advanced Mathematical Modeling* – WVEIS Code 3025C
- **Awarding Grades – Credit will be awarded at the end of a particular course or multiple courses where the credit is embedded. Students must receive an actual letter grade they cannot receive a pass or fail.**

Resources

State Approved Career Clusters, Pathways, Embedded Credit, and/or Fulfillment of Credit Requirement

Documents. *Embedded-Credit-08.2020.pdf (wvde.us)*

Dual Credit

Appendix A:

Dual Credit Policy	CBEM shall adopt a policy (W. Va. Code §18B-1-1) that allows students to earn credit for completion of college courses and other advanced courses outside the school setting. Dual credit policies and revisions must be reviewed by the WVDE and approved by the WVBE by June 1 annually. If dual credit courses are used to meet graduation requirements, the alignment documentation must be reviewed by the WVDE. Counties must annually update dual credit course offerings and any new alignment documentation with the WVDE Office of Middle and Secondary Learning.

Guidance

In order for students to use dual credit courses in place of graduation requirements, the county dual credit policy must be submitted to the WVDE for approval. A policy template can be found at the State Board Policy webpage, *http://wvde.state.wv.us/policies/*.

Beginning July 1, 2022, counties will annually upload and/or update Dual Credit course offerings by using the following link: *https://wveis.k12.wv.us/dual-credit-courses*.

West Virginia Virtual School

Guidance

It is recommended that all students complete an online learning experience during grades 9-12. This recommendation can be met through the West Virginia Virtual School (WVVS). The WVVS helps bridge the barriers of time, distance and inequities for all West Virginia students by providing access to online courses aligned to current state standards. All courses are reviewed by a committee of West Virginia teachers who ensure West Virginia standards are met. Online teachers with the WVVS have West Virginia certification in the content area. Courses through the WVVS assure consistent, high-quality education for the students of West Virginia.

Registration is automated through the master schedule. To be placed in a virtual course, school administration will need to assign the student to the correct four-digit WVEIS course code followed by a V in the fifth position. For honors level, H will need to be placed in the sixth position. Students have 10 calendar days to begin a course. Students who remain in a course beyond 14 calendar days are committed to completing the course. Any student removed after day 14 must receive a WF. If a county is using the WV Learns platform and curriculum but providing their own teacher, a Q should be used in the fifth position instead of a V.

County Boards of Education shall provide their own instructor for courses containing more than 25 students unless it is a world language course. If a school does not have a certified teacher for the course due to staffing loss such as death, retirement or FMLA, special arrangements can be made by contacting the WVVS office.

Credit recovery courses are also offered through the WVVS. A complete list of courses available can be found at *http://virtualschool.k12.wv.us/vschool/courses/crcatalog.cfm*. Credit recovery courses through the WVVS are signified in WVEIS by placing a "W" in the fifth position. Credit recovery courses are used when a student has previously failed a course. If the student has not taken the course, the student should be registered for original credit courses.

The virtual course grade will be available to the school facilitator/mentor. The facilitator/mentor ensures student grades for WV Virtual School courses are entered in the WVEIS data system. No changes can be made to the online course grade by local school personnel.

County Virtual Instruction Programs (§18-5F-1-6)

As per W. Va. Code §18-5F-1 et seq., a CBEM or a multi-county consortium may create a virtual instruction program for one or more schools serving any composition of grades Kindergarten through 12 by adopting a policy creating the program. When there is a multi-county consortium, CBEM in the consortium shall adopt a policy creating the virtual instruction program.

Students enrolled in a county's virtual instruction program are subject to the same state assessment requirements as other students in the district. Students who participate in county virtual instruction programs have the same rights as students in the brick and mortar classrooms in terms of school academic and sporting events.

Students enrolled in a county's virtual instruction program are included in the net enrollment of the district in which the student resides and used for the purpose of calculating and receiving state aid. These funds can be used to support the county virtual instructional program. Virtual courses in a county virtual instruction program should include a R in the fifth position.

West Virginia State Code (§18-5F-1-6) was not meant to replace the WVVS but to allow counties to have the flexibility to allow students to take all or some of their classes virtually. It was also passed in hopes that many of the students currently being home schooled would reenroll in public school. Districts may use courses through WVVS for their online program, write their own courses, or write a policy enabling the county to contract with one or more third-party course provider. Counties are required to review all online courses through an outside course provider to ensure each course masters the content standards for the subject/grade level.

West Virginia eLearning for Educators

Teacher Professional Learning

Online teacher professional learning courses specific to grades 9-12 teaching and learning have been developed for high school educators. Course descriptions and course schedule information may be accessed from *https://wvde.state.wv.us/elearning/*. Successfully completed coursework may be applied to teacher re-certification and/or salary advancement.

Applicants may use WVDE WVLearns eLearning courses approved by the WVDE to meet the renewal requirements for a Professional Certificate. Applicants will submit certificates of completion in lieu of a college/university transcript at the time of renewal application.

If an individual intends to apply WVLearns course hours toward salary reclassification, then the hours must be represented on a college/university transcript. Information regarding college/university registration and associated costs will be provided the day the course begins.

Instructional Resources

Per §18-2A-10. Providing Instructional Resources to Students
    (i) Each county board shall furnish free of charge the necessary instructional resources to students attending the public schools in that county. A county board choosing to furnish electronic instructional resources to its students and teachers shall provide reasonable access to these resources and the necessary computer equipment to students for completing assignments that require using the resources and equipment. All instructional resources furnished as provided in this section shall be the property of the county board and loaned to students and teachers on terms as each board prescribes.

Per W. Va. Code §18-2A-10, County Board of Education Members (CBEM) are required to create an Instructional Resource Policy.
    (j) Every county board shall adopt a policy regarding the adoption of instructional resources which shall include, at a minimum, the following:
        (1) The process for reviewing instructional resources to ensure the resources meet the non-negotiable requirements established by the state board and cover no less than eighty percent of the required content and skills for a subject as approved by the state board: Provided, That a county board may rely on an instructional material review completed by the state department of education to fulfill this requirement;
        (2) The composition, duties and responsibilities of the county's instructional resource review committee;
        (3) The process for recommending instructional resources that are proposed for adoption;
        (4) At a properly noticed meeting, the county board shall determine by a majority vote of all members elected which instructional resources shall be required in the schools under its control; and
        (5) The county board shall provide an annual report of the instructional resources adopted to the state board of education.

Guidance

The county board of education members shall adopt a policy regarding the adoption of instructional resources (W. Va. Code §18-2A-10). A policy template can be found at the State Board Policy webpage, *http://wvde.state.wv.us/policies*.

The county board of education will review, select, and approve instructional resources each year, based on six-year adoption cycle. All content must comply with the Americans with Disabilities Act of 1990, amended Section 508 of the Rehabilitation Act of 1973, and the Web Content Accessibility Guidelines (WCAG) 2.0.

The county board of education will report the instructional resources selected for each adoption cycle to WVDE using the online tool by June of each year. *http://wvde.state.wv.us/materials*.

Resources

West Virginia Code §18-2A: Adoption of Textbooks, Instructional Materials and Learning Technologies. *http://code.wvlegislature.gov/18-2A/*

West Virginia Board of Education Policy 2445.40. *http://wvde.state.wv.us/policies*

West Virginia Instructional Resource site. *http://wvde.state.wv.us/materials*

West Virginia Board of Education Content Standards Revision Cycle and Adoption Schedule. *https://wvde.us/wp-content/uploads/2020/02/WVBE-ContentStandardsRevisionCycle-REV-2.pdf*

Americans with Disabilities Act of 1990. *https://www.eeoc.gov/eeoc/history/35th/1990s/ada.html*

Section 508 of the Rehabilitation Act of 1973. *https://www.section508.gov/manage/laws-and-policies*

Web Content Accessibility Guidelines (WCAG) 2.0. *https://www.w3.org/WAI/standards-guidelines/wcag/*

Integration of Additional Standards

West Virginia's College- and Career-Readiness Standards for Technology and Computer Science

Guidance

All educators are required to implement the West Virginia's College- and Career-Readiness Standards (WVCCRS) for Technology and Computer Science (Policy 2520.14). WVCCRS for Technology and Computer Science promote proficiency in foundational technology skills, digital literacy, digital citizenship, and computer science. College- and career-readiness is supported in technology and computer science as students acquire and develop their abilities to engage and thrive in a connected, digital world.

High school students focus on academic, career, social and emotional development, and global citizenship. Acquisition of the knowledge, skills, and dispositions described in WVCCRDSSS help students achieve school success and prepare to successfully transition to their post-secondary choices; whether it is direct placement in entry-level jobs, credit-bearing academic college course, industry-recognized certificate, license, or workforce training programs. These standards will be delivered within the programmatic level in a sequence designed by the school leadership team. The school leadership and a team of teachers will determine how these standards are to be covered within the designed sequence.

West Virginia College- and Career-Readiness Dispositions and Standards for Student Success

Guidance

All schools are required to systemically address the WVCCRDSSS found in Policy 2520.19 through a Social and Emotional Advisory System for Student Success. High School Level Programming (Grades 9-12) focuses on academic, career, social and emotional development, and global citizenship. Acquisition of the knowledge, skills, and dispositions described in WVCCRDSSS help students achieve school success and prepare to successfully transition to their post-secondary choices; whether it is direct placement in entry-level jobs, credit-bearing academic college course, industry-recognized certificate, license, or workforce training programs. These standards will be delivered within the programmatic level in a sequence designed by the school leadership team. School leadership teams, in conjunction with the school counselor, should evaluate the existing integration of the WVCCRDSSS within all content areas, and devise a plan to ensure all students have the ability to master the standards.

Resources

WVBE Policy 2520.19 West Virginia College- and Career-Readiness Dispositions and Standards for Student Success for Grades K-12. *http://wvde.state.wv.us/policies*

West Virginia Student Success Standards Webpage. *https://wvde.us/middle-secondary-learning/student-success/*

West Virginia School Counselor Model. *22429-2021-WV-School-Counselor-Model-v3.pdf (wvde.us)*

APPENDIX – Mathematics Standards

- **Applied Statistics**
- **Financial Algebra/Mathematics**
- **Quantitative Reasoning**
- **Statistics; Probability and Statistics**
- **Technical Transition Mathematics**
- **Data Science**

Mathematics – Applied Statistics

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Applied Statistics provides authentic experiences in statistics designed to strengthen students' application of the statistical method. Students will conduct statistical simulations to model everyday situations in an increasingly data-rich world. Students in this course will select appropriate graphical and numerical methods to explore data, design and implement a plan to collect and analyze data, and use probability to evaluate outcomes and make decisions. Students will build on their work with linear, quadratic, and exponential functions and extend their repertoire of functions to include polynomial, radical, and rational functions. Students will use multiple representations, technology, applications and modeling in problem-solving contexts. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Exploring Data	Designing Studies
• **Represent data visually and calculate statistical measures that describe the data set. (e.g., Construct and interpret a histogram for a student created data set.)**	• **Design a plan to collect data using an appropriate sampling method to solve a problem. (e.g., Design and conduct an experiment to determine the effect of a treatment.)**
Functions and Modeling	**Probability and Informed Decisions**
• **Explore expressions, functions, and models to highlight key features that provide insight into their structure, properties, and form. (e.g., Model situations using mathematics to provide an optimal solution.)**	• **Make inferences and justify conclusions from data and analyze decisions and strategies using probability concepts. (e.g., Compare experimental and theoretical probabilities to make informed decisions.)**

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Applied Statistics:

Exploring Data	
Select appropriate graphical and numerical methods to explore data.	Standards 1-7
Designing Studies	
Design and implement a plan to collect and analyze data.	Standards 8-12
Functions and Modeling	
Explore expressions, functions, and models to describe numbers or relationships.	Standards 13-21
Probability and Informed Decisions	
Use probability to evaluate outcomes and make decisions.	Standards 22-29

Exploring Data

Cluster	Select appropriate graphical and numerical methods to explore data.
M.ASHS.1	Generate appropriate ways to display various types of data. Instructional Note: Build on data displays introduced in prior courses.
M.ASHS.2	Calculate appropriate measures of center, variability, and position for data. Instructional note: Include comparisons of mean vs. median, standard deviation vs. IQR.
M.ASHS.3	Use graphical displays and summary statistics to make conclusions. Informally develop the concept of statistical significance; a result that is unlikely to have occurred by chance alone. Instructional Note: Focus on statistics as a way of dealing with, not eliminating, inherent randomness.
M.ASHS.4	Represent data in two variables to model relationships between quantities. Instructional Note: Students will use multiple representations with appropriate labels and scales.
M.ASHS.5	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities. Instructional Note: Focus on form, strength, direction, and departures from a model based on data and context.
M.ASHS.6	Compare characteristics of two data sets each represented in different ways (algebraically, graphically, numerically, and verbally). Instructional Note: Focus on applications and how key features relate to characteristics of a situation and select an appropriate model.
M.ASHS.7	Use appropriate measures of center and spread to describe a distribution. Instructional Note: Emphasize that only some data are well described by a normal distribution.

Cluster	Design and implement a plan to collect and analyze data.
M.ASHS.8	Develop a process for making inferences about population parameters based on a random sample through data collection and analysis.
M.ASHS.9	Evaluate the results from a given data-generating process to determine consistency between theoretical and experimental probabilities. Instructional Note: Include the Law of Large Numbers.
M.ASHS.10	Recognize the purposes of and differences among sample surveys, experiments, and observational studies. Explain the importance of randomization in each method. Instructional Note: Emphasize that the way in which data is collected determines the scope and nature of the conclusions.
M.ASHS.11	Use data from a sample survey to estimate a population mean or proportion. Instructional Note: Develop the connection between sample size and margin of error.
M.ASHS.12	Design and conduct an experiment to compare two treatments. Instructional Note: Include randomization, replication, blocking, and control in the design.

Functions and Modeling

Cluster	Explore expressions, functions, and models to describe numbers or relationships.
M.ASHS.13	Create equations and inequalities in one variable and use them to solve problems. Instructional Note: Include equations arising from linear and quadratic functions, simple rational and exponential functions.
M.ASHS.14	Develop the concept of a complex number i such that $i^2 = -1$. Understand that every complex number can be written in the form $a + bi$ with a and b real.
M.ASHS.15	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
M.ASHS.16	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. Instructional Note: Extend to polynomial and rational expressions.
M.ASHS.17	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.
M.ASHS.18	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. Instructional Note: This standard requires the general division algorithm for polynomials.
M.ASHS.19	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Instructional Note: Extend to simple rational and radical equations.

M.ASHS.20	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g., solve for and Margin of Error = for .) Instructional Note: While functions will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Algebra I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line. This example applies to earlier instances of this standard, not to the current course.
M.ASHS.21	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. Include intercepts, intervals where the function is increasing, decreasing, positive, negative, relative extrema, symmetries, and end behavior. Instructional Note: Emphasize the selection of a model function based on the behavior of data in context.

Probability and Informed Decisions

Cluster	Use probability to evaluate outcomes and make decisions.
M.ASHS.22	Connect sampling variability and margin of error to generate and interpret plausible parameter values. Instructional Note: The concept of statistical significance is developed informally through simulation as meaning a result that is unlikely to have occurred by chance alone. Focus on statistics as a way of dealing with, not eliminating, inherent randomness.
M.ASHS.23	Interpret results from a randomized experiment comparing two treatments. Use simulations to decide if experimental results are significant. Instructional Note: Develop informally the comparison of an observed result and an established probability value (for example $p \leq 0.05$).
M.ASHS.24	Evaluate claims based on data reports. Instructional Note: Data reports can be gathered from media.
M.ASHS.25	Use probability rules to make fair decisions. Instructional Note: Extend and apply probability rules introduced in prior courses to more complex probability models that involve decisions. Include examples that yield both false positive and false negative results.
M.ASHS.26	Use two-way tables, tree diagrams, Venn diagrams, or 10 x 10 grids to model probabilities.
M.ASHS.27	Justify a decision using probability rules (e.g., product testing, medical testing, weather forecasting, marketing, or sports coaching decisions). Instructional Note: Extend and apply probability rules introduced in prior courses to more complex probability models that involve decisions. Include examples that yield both false positive and false negative results.
M.ASHS.28	Perform appropriate calculations for given outcomes and decisions based on expected values for non-normal distributions. Instructional Note: Focus on uniform, discrete, continuous (geometric areas), or games of chance.

M.ASHS.29	Given data from a normal distribution, use the mean and standard deviation to estimate population percentages. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. Recognize that there are data sets for which such a procedure is not appropriate. Instructional Note: While students may have heard of the normal distribution, it is unlikely that they will have prior experience using it to make specific estimates. Build on students' understanding of data distributions to help them see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities).

Mathematics – Financial Algebra/Mathematics

All West Virginia teachers are responsible for classroom instruction that integrates content standards and objectives and mathematical habits of mind. Students in this course will focus on financial applications designed to deepen and extend understanding of mathematics. Students in Financial Algebra/Mathematics will communicate effectively, using accurate mathematical language in a financial context. Students will interpret and analyze various functions, graphs and data in order to make responsible and wise financial decisions in the context of their personal lives regarding banking services, automobile purchases and maintenance decisions, income tax and employee benefits, and business decisions. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed through opportunities for exploration and investigation of mathematical content and financial literacy topics:

Mathematical Language in a Financial Context	The Algebra of Finance
• Demonstrate reasoning skills in developing, explaining, and justifying sound financial decisions. • Communicate effectively, using accurate mathematical language in a financial context.	• Apply algebraic skills and concepts to make responsible and wise financial decisions in the context of their personal lives regarding banking services, consumer credit, automobile purchases and maintenance decisions, income tax and employee benefits, and business decisions.
Financial Modeling with Functions	**Modeling with Data**
• Interpret and analyze various functions, graphs, and data to make responsible and wise financial decisions in the context of their personal lives regarding banking services, consumer credit, automobile purchases and maintenance decisions, income tax and employee benefits, and business decisions.	• Create, interpret, and evaluate financial models to make responsible and wise financial decisions in the context of their personal lives regarding banking services, consumer credit, automobile purchases and maintenance decisions, income tax and employee benefits, and business decisions.

Numbering of Standards

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Applied Statistics:

Mathematical Language in a Financial Context	
Communicate reasoning and decisions.	Standards 1-3
Algebra/Mathematics of Finance	
Use algebraic reasoning and techniques.	Standards 4-11
Financial Modeling with Functions	
Construct, graph, use, and interpret functions.	Standards 12-27
Financial Modeling with Data	
Represent, summarize, and evaluate data.	Standards 28-37

Mathematical Language in a Financial Context

Cluster	Communicate reasoning and decisions.
M.FAM.1	Demonstrate reasoning skills in developing, explaining, and justifying sound mathematical decision making. (e.g., Demonstrate reasoning skills in creating and presenting a budget of monthly expenses based on a career pathway income, and analyze the soundness of the mathematical reasoning of others; determine outlook for a chosen career pathway and use the average salary to determine if the desired cost of living can be met.)
M.FAM.2	Communicate with and about mathematics in a financial context.
M.FAM.3	Communicate with and about mathematics in writing and orally, both independently and collaboratively, by preparing financial plans (e.g., Plan for an emergency savings fund that will last three to six months in the case of loss of income; determine the total percentage of income paid to taxes or the percentage of total salary that a benefits package represents).

Algebra/Mathematics of Finance

Cluster	Use algebraic reasoning and techniques.
M.FAM.4	Interpret parts of an expression or equation, such as terms, factors, and coefficients, in a variety of financial models including those found in stock markets, automobile financing and in banking contexts.
M.FAM.5	Create and solve linear equations and inequalities in one variable and use them to solve problems in financial applications that may include, but are not limited to stock markets, automobile ownership, business modeling, or employment. (e.g., Calculate wages by hourly rates or pay periods to make decisions about pay in a real world context.)

M.FAM.6	Create equations in two or more variables to represent relationships between quantities in a financial context; graph equations on coordinate axes with labels and scales. Financial contexts may include, but are not limited to stock markets, automobile ownership, business modeling employment, banking, consumer debt, and independent living decisions regarding taxes or planning for retirement. (e.g., Create a linear expense equation based on fixed and variable expenses and graph choosing an appropriate scale and origin for the graph.)
M.FAM.7	Represent constraints in financial applications by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. (e.g., Create a system of equations based on the expenses incurred and monthly payment when choosing home ownership versus rental; find the percentage of total salary that a benefits package represents; calculate taxes owed based on a given income and tax table and determine total percentage of income paid to taxes; calculate the gross pay and net pay using the FICA percentage (7.65%), retirement contribution, and worker's compensation insurance (employer match).)
M.FAM.8	Rearrange formulas for financial applications to highlight a quantity of interest, using the same reasoning as in solving equations. Know difference between growth and decay functions. (e.g., Solve the literal equation for exponential depreciation to find a depreciation rate and the literal equation for continuous interest to find the interest rate; apply the formula for average daily balance, (average daily balance*APR*days in billing cycle)/365, using literal equations with varying APRs and billing cycles)).
M.FAM.9	Solve systems of linear equations exactly and approximately (e.g., with graphs) in making financial decisions, focusing on pairs of linear equations in two variables. (e.g., Create and solve a system of equations based on the expenses incurred and monthly payment when choosing home ownership versus rental.)
M.FAM.10	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 that model financial situations. (e.g., Combine the polynomials that model income and expense to create a profit model.)
M.FAM.11	Solve quadratic equations in one variable in a financial context that may include, but are not limited to, business modeling or employment decisions. (e.g., Given a quadratic equation that models a profit function, determine the break-even points; apply braking distance/stopping distance formulas to solve problems related to driving and safety data.)

Cluster	Construct, graph, use, and interpret functions.
M.FAM.12	Use functions to model financial situations. 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)*. (e.g., Develop and communicate the appropriateness of representing a commission salary using a linear versus a piecewise function; use linear and polynomial functions to evaluate and communicate quantities as required by Internal Revenue Service and Social Security Administration regulations and to determine when and why the models may be discontinuous.)
M.FAM.13	Use function notation in financial applications, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a financial context. (e.g., In making decisions regarding retirement income, apply the formula $A(t) = Pe^{rt}$ to determine future value.)
M.FAM.14	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Use this relationship in analyzing financial situations. (e.g., Compare the linear function modeling simple interest with the exponential function modeling compound interest.)
M.FAM.15	For a function that models a relationship between two quantities in financial contexts, 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. (e.g., Write, graph, and interpret the revenue (quadratic) function in comparison to the expense (linear) function using key features of the functions; reason quantitatively to compare subsidized and unsubsidized loans, as well as other forms of financial aid available to college students; calculate mortgage payments, reasoning and making decisions about the length of the loan and a fixed versus adjustable rate mortgage.)
M.FAM.16	Interpret the parameters in a linear or exponential function in terms of a context. (e.g., Investigate and compare, using technology and regression, historical data to determine if automobile depreciation follows a linear or exponential model.)
M.FAM.17	Construct linear and exponential functions modeling financial contexts, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). (e.g., Utilize linear and exponential functions to compare simple with compound interest.)
M.FAM.18	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. Data may address, but is not limited to automobile financing, investing in the stock market, business, employment, banking, consumer credit, taxes, and retirement planning.
M.FAM.19	Calculate and interpret the average rate of change of a function modeling a financial context (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (e.g., Examine depreciation trends.)

M.FAM.20	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (e.g., Graph the linear, quadratic, or exponential curve that models the demand versus supply functions and find the equilibrium point with and without technology.)
M.FAM.21	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). (e.g., Utilize linear and exponential functions to compare simple with compound interest; calculate and compare using both the loan payment formula and payment schedules in table format, the monthly cost of purchasing an automobile, and discuss the feasibility of that payment in relation to monthly budget; compare two functions showing interest accrued when paying the minimum monthly payment over time compared to paying a larger monthly payment, and identify and compare the average rate of change between given time periods.)
M.FAM.22	Graph linear and quadratic functions and show intercepts, maxima, and minima. (e.g., In the model of a profit function, determine the break-even points, the maximum possible loss, and the maximum profit.)
M.FAM.23	Write a function that describes a relationship between two quantities in a financial context. (e.g., Calculate the costs associated with purchasing a vehicle, including leasing, purchasing with cash, or with a loan.)
M.FAM.24	Identify the effect on functions that model financial situations 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. (e.g., Identify the impact of a change in a constraint in a function that models retirement planning, business income and expenses, or employment benefits.)
M.FAM.25	Graph square root, cube root, and piecewise-defined functions that model financial situations, including step functions and absolute value functions. (e.g., Develop and communicate the appropriateness of representing a commission salary using a linear versus a piecewise function; analyze graphs of functions that model profit.)
M.FAM.26	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model financial situations, and translate between the two forms. (e.g., Create recursive and explicit models of sequences related to retirement planning; amortization schedules for a loan; comparing subsidized and unsubsidized loans, reasoning and making decisions about the length of the loan and a fixed versus adjustable rate mortgage.)
M.FAM.27	Apply exponential formulas to solve for future and present value of investments by hand or with graphing technology. (e.g., PV=FV*(1/(1+r)^n) and A(t) = Pe^{rt})

Financial Modeling with Data

Cluster	Represent, summarize, and evaluate data.
M.FAM.28	Represent data with plots on the real number line (dot plots, histograms, and box plots). Data may address, but is not limited to automobile financing, investing in the stock market, business, employment, banking, consumer credit, taxes, and retirement planning.
M.FAM.29	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit regression lines to scatterplots and make predictions based on lines of best fit. Find and interpret correlation coefficients of regression equations in financial situations. (e.g., Use scatter plots to show correlation between two funds, two stocks or even a stock and the general market or in business situations to forecast sales or to compare revenue to the number of units sold.)
M.FAM.30	Create a data display modeling financial situations. This may include, but is not limited to modeling the different savings options for a given investment at local banking establishments; calculating and comparing the monthly cost of purchasing an automobile using both the loan payment formula and payment schedules in table format; creating an amortization schedule through the use of spreadsheet technology and the formula tool for a loan given principle, term, monthly payment, and interest rate; creating representations of pay schedules using a variety of modeling technologies, and making decisions in a financial context based on those representations.
M.FAM.31	Summarize categorical data in various forms (e.g., two-way frequency tables, circle graphs, segmented bar charts). Interpret relative frequencies in the context of the data in making financial decisions.
M.FAM.32	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). Data sets may address, but are not limited to automobile financing, investing in the stock market, business, employment, banking, consumer credit, taxes, and retirement planning.
M.FAM.33	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.(e.g., Use units appropriately as a way to understand multi-step problems in relationship to understanding credit card fees and finance charges; compute distance, rate and time to solve problems to analyze driving and safety data, using single and multiple unit conversion; use and compare researched reaction times and vehicle velocity, as well as accepted equations to solve problems with braking distances.)
M.FAM.34	Use financial models from automobile financing, investing in the stock market, business, employment, banking, consumer credit, taxes, and retirement planning to solve problems.
M.FAM.35	Evaluate reports based on data. Data may address, but is not limited to, planning for retirement or stock markets.
M.FAM.36	Use probability and expected value to analyze financial situations. (e.g., Model and compare automobile insurance policies.)
M.FAM.37	Evaluate the impact of taxes on business ownership including property tax, sales tax, social security, retirement, and disability benefits. Evaluate the impact of taxes on personal finance decisions.

Mathematics – Quantitative Reasoning

This course was created in conjunction with the West Virginia Higher Education Policy Commission (HEPC) and is intended to be a dual credit course.

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Quantitative Reasoning prepares students to reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information. Students will compare, analyze, and synthesize of multiple forms or sources of quantitative information. Students will use appropriate mathematical and statistical language in oral, written, and graphical forms; read and interpret authentic texts such as advertisements, consumer information, government forms, and newspaper articles containing quantitative information, including graphical displays of quantitative information. Students will develop an answer to an open-ended question requiring analysis and synthesis of multiple calculations, data summaries, and/or models. Students will draw conclusions or make decisions in quantitatively based situations that are dependent upon multiple factors and analyze how different situations would affect the decisions. Students will be able to critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information. Students will evaluate the validity and possible biases in arguments presented in authentic contexts based on multiple sources of quantitative information (e.g., advertising, internet postings, consumer information, political arguments). Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Logical Reasoning	Number Sense
• **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**	• **Create and analyze mathematical models to make decisions related to earning, investing, spending and borrowing money.**

Descriptive Statistics	Probability
• **Make decisions based on understanding, analysis and critique of reported statistical information and summaries.** • **Use basic rules of counting and probability to analyze and evaluate risk and return in the context of everyday situations.** • **Interpret categorical and quantitative date, make inferences and justify conclusions.** • **Create and analyze mathematical models to make decisions related to earning, investing, spending and borrowing money.**	• **Make conclusions based on understanding, analysis and critique of probabilities. (e.g., Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.)** • **Develop a probability distribution. (e.g., 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.)**

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Quantitative Reasoning:

Logical Reasoning	
Math as a language.	Standards 1-2
Tools for problem solving.	Standard 3
Algebraic Modeling and Number Sense	
Understand ratio concepts and use ratio reasoning to solve problems.	Standard 4
Work with integer exponents, scientific notation, and radicals.	Standards 5-7
Reason quantitatively and use units to solve problems.	Standard 8
Represent and solve equations and inequalities graphically.	Standard 9
Explain volume formulas and use them to solve problems.	Standard 10
Understand financial models.	Standards 11-13
Reason quantitatively and use units to solve problems.	Standards 14-15
Create equations that describe numbers or relationships.	Standards 16-17
Construct and compare linear, quadratic, and exponential models and solve problems.	Standard 18
Build a function that models a relationship between two quantities.	Standard 19
Interpret linear models.	Standard 20
Descriptive Statistics	
Summarize, represent, and interpret data on two categorical and quantitative variables.	Standard 21
Summarize, represent, and interpret data on a single count or measurement variable.	Standards 22-24
Conduct statistical analysis.	Standard 25
Communicate statistical information.	Standards 26-27
Probability	
Analyze information using probability and counting.	Standards 28-29
Use probability to evaluate outcomes of decisions.	Standard 30
Manage uncertainty.	Standard 31
Understand independence and conditional probability and use them to interpret data.	Standards 32-36
Use the rules of probability to compute probabilities of compound events in a uniform probability model.	Standards 37-40
Use probability to evaluate outcomes of decisions.	Standards 41-42

Logical Reasoning

Cluster	Math as a language
M.QR.1	Demonstrate reasoning skills in developing, explaining, and justifying sound mathematical arguments and analyze the soundness of mathematical arguments of others.
M.QR.2	Communicate with and about mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.

Cluster	Tools for problem solving
M.QR.3	Gather data, conduct investigations and apply mathematical concepts and models to solve problems in mathematics and other disciplines.

Algebraic Modeling and Number Sense

Cluster	Understand ratio concepts and use ratio reasoning to solve problems.
M.QR.4	Use ratio and rate reasoning to solve real-world and mathematical problems. a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. (e.g., If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?) c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Cluster	Work with integer exponents, scientific notation, and radicals.
M.QR.5	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
M.QR.6	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. (e.g., Use millimeters per year for seafloor spreading.) Interpret scientific notation that has been generated by technology.
M.QR.7	Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Cluster	Reason quantitatively and use units to solve problems.
M.QR.8	Define appropriate quantities for the purpose of descriptive modeling.

Cluster	Represent and solve equations and inequalities graphically.
M.QR.9	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).

Cluster	Explain volume formulas and use them to solve problems.
M.QR.10	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Cluster	Understand financial models.
M.QR.11	Determine, represent and analyze mathematical models for loan amortization and the effects of different payments and/or finance terms (e.g., Auto, Mortgage, and/or Credit Card).
M.QR.12	Determine, represent and analyze mathematical models for investments involving simple and compound interest with and without additional deposits. (e.g., Savings accounts, bonds, and/or certificates of deposit.)
M.QR.13	Research and analyze taxes including payroll, sales, personal property, real estate and income tax returns.

Cluster	Reason quantitatively and use units to solve problems.
M.QR.14	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.
M.QR.15	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Cluster	Create equations that describe numbers or relationships.
M.QR.16	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.
M.QR.17	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Cluster	Construct and compare linear, quadratic, and exponential models and solve problems.
M.QR.18	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).

Cluster	Build a function that models a relationship between two quantities.
M.QR.19	Write a function that describes a relationship between two quantities. a. 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. b. 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.

Cluster	Interpret linear models.
M.QR.20	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Descriptive Statistics

Cluster	Summarize, represent, and interpret data on two categorical and quantitative variables.
M.QR.21	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.

Cluster	Summarize, represent, and interpret data on a single count or measurement variable.
M.QR.22	Represent data with plots on the real number line (dot plots, histograms, and box plots).
M.QR.23	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.
M.QR.24	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Cluster	Conduct statistical analysis
M.QR.25	Create data displays for given data sets to investigate, compare, and estimate center, shape, spread and unusual features.
Cluster	Communicate statistical information
M.QR.26	Report results of statistical studies to a particular audience, including selecting an appropriate presentation format, creating graphical data displays and interpreting results in terms of the question studied.
M.QR.27	Communicate statistical results in both oral and written formats using appropriate statistical and nontechnical language.

Probability

Cluster	Analyze information using probability and counting
M.QR.28	Use the Fundamental Counting Principle, Permutations and Combinations to determine all possible outcomes for an event; determine probability and odds of a simple event; explain the significance of the Law of Large Numbers.
M.QR.29	Determine and interpret conditional probabilities and probabilities of compound events by constructing and analyzing representations, including tree diagrams, Venn diagrams, two-way frequency tables and area models, to make decisions in problem situations.

Cluster	Use probability to evaluate outcomes of decisions.
M.QR.30	Use probabilities to make and justify decisions about risks in everyday life.

Cluster	Manage uncertainty
M.QR.31	Calculate expected value to analyze mathematical fairness, payoff and risk.

Cluster	Understand independence and conditional probability and use them to interpret data.
M.QR.32	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").
M.QR.33	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.
M.QR.34	Recognize the conditional probability of A given B as P(A 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.
M.QR.35	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. Instructional Note: Build on work with two-way tables from Algebra I to develop understanding of conditional probability and independence.
M.QR.36	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.

Cluster	Use the rules of probability to compute probabilities of compound events in a uniform probability model.
M.QR.37	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.
M.QR.38	Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
M.QR.39	Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
M.QR.40	Use permutations and combinations to compute probabilities of compound events and solve problems.

Cluster	Use probability to evaluate outcomes of decisions.
M.QR.41	Use probabilities to make fair decisions (e.g., drawing by lots and/or using a random number generator).
M.QR.42	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, and/or pulling a hockey goalie at the end of a game).

Mathematics – Statistics; Probability and Statistics

The Statistics course and the Probability and Statistics course are options for a one-credit year-long course or for a half-credit semester course.

The Statistics course is designed to be a full-year course that addresses all standards, including those identified by (+) sign, and that supplements the one-semester course with additional modeling experiences.

The Probability and Statistics course is designed to be a one-semester course and does not include the (+) standards.

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Knowledge of topics related to probability and statistics is critical to decision-making and to the analysis of data. The Statistics and the Probability and Statistics courses provide an opportunity to address the fundamental ideas and most commonly used techniques to organize and make sense of data. These courses build on knowledge of probability, randomness, and variability to provide students with an understanding of experimental design, estimation, hypothesis testing, and effective communication of experimental results. Using concepts of probability and statistics, students predict the likelihood of an event occurring, organize and evaluate data, and identify the significance of statements. Students investigate types of probability, determine probability and odds using multiple counting principles and distributions and apply the concepts to real-world problems. Statistical information collected and analyzed by students is used to investigate ways of collecting, displaying, and analyzing data. Students differentiate, make predictions about and support the analysis of individual performance, characteristics of samples. They analyze and justify using statistical concepts to test validity of a hypothesis and of correlation as applied in real-world situations. Students identify a real life situation that involves statistical concepts, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present their findings using predictive and analytic tools in a clear and concise manner. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Descriptive Statistics	Probability
• Given a two-way table of relative frequencies that summarizes survey data relates a person's highest level of education and their role model, determine if a person whose highest level of education is a bachelor's degree is more likely to have a family member than a stranger as a role model.	• A cereal company is putting a prize in each box of cereal. The company is offering four different and evenly distributed prizes. How many boxes should one expect to need to buy to get all four prizes?
Probability Distributions	**Correlation and Regression**
• The heights of five women are measured to be 63 inches, 68 inches, 56 inches, 64 and 67 inches. Determine the expected value of the height of a randomly chosen woman.	• A random sample of beef hotdogs was taken and the amount of sodium (in mg) and calories were measured. Use the provided information to determine and use the regression equation to determine to find the amount of sodium in a beef hotdog that has 170 calories and in a beef hotdog that has 120 calories. Which of the calculated sodium levels is closer to the true sodium level? Why?
Confidence Intervals	**Hypothesis Testing with One Variable**
• Alyssa has over 500 songs saved on her phone. She wants to estimate the proportion of songs by a female artist. After taking a simple random sample of 50 songs, she finds that 20 of the sampled songs are by a female artist. Determine a 99% confidence interval for the proportion of songs on her phone that are by a female artist.	• Ellen has a pair of dogs and she noticed that they seem to breed more male puppies than female puppies. In the next litter of 12 puppies, there were 9 male puppies. Test the hypothesis that each puppy has an equal chance of 50% of being either male or female versus the alternative that the chance of a male puppy is greater. Look at the results of 1000 simulations, each simulating 12 puppies with a 50% chance of being male or female. According to the simulations, what is the probability of having 9 male puppies or more out of 12? If the observed outcome has a probability less than 1% under the tested hypotheses, reject the hypothesis. What should be concluded regarding the hypothesis?
Statistical Inference	
• A researcher wants to know if the children from three schools have equal mean IQ scores. Each school enrolls 1000 students. But there is neither the time of funding to test all 3000 students. Based on a simple random survey of 10 students from each school, perform and analyze an ANOVA test.	

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Mathematics:

Descriptive Statistics	
Summarize, represent, and interpret data on single count or measurement variable.	Standards 1-8
Probability	
Understand independence and conditional probability and use them to interpret data.	Standards 9-17
Probability Distributions	
Calculate expected values and use them to solve problems.	Standards 18-25
Correlation and Regression	
Interpret linear models.	Standards 26-29
Confidence Intervals	
Determine and interpret confidence intervals.	Standards 30-35
Hypothesis Testing with One Variable	
Use hypothesis testing in making and interpreting decisions.	Standards 36-44
Statistical Inference	
Determine and use correlation.	Standards 45-48
Use linear regression to predict and interpret.	Standards 49-53
Use statistical tests to determine a relationship.	Standards 54-59

Descriptive Statistics

Cluster	Summarize, represent, and interpret data on single count or measurement variable.
M.PS.1	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
M.PS.2	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.
M.PS.3	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
M.PS.4	Evaluate reports based on data. Write a function that describes a relationship between two quantities.
M.PS.5	Represent data with plots on the real number line (dots plots, histograms, and box plots).
M.PS.6	Use statistics appropriate to the shape of the data distributions to compare center and spread of two or more different data sets. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

M.PS.7	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.
M.PS.8	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.

Probability

Cluster	Understand independence and conditional probability and use them to interpret data.
M.PS.9	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").
M.PS.10	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.
M.PS.11	Recognize the conditional probability of A given B as P(A 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. Instructional Note: Build on work with two-way tables from previous courses to develop understanding of conditional probability and independence.
M.PS.12	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. Instructional Note: Build on work with two-way tables from previous courses to develop understanding of conditional probability and independence.
M.PS.13	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.
M.PS.14	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.
M.PS.15	Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
M.PS.16	Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
M.PS.17	Use permutations and combinations to compute probabilities of compound events and solve problems.

Probability Distributions

Cluster	Calculate expected values and use them to solve problems.
M.PS.18	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.
M.PS.19	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
M.PS.20	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated: find the expected value.
M.PS.21	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically to find the expected value.
M.PS.22	Weight the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values (e.g., find the expected payoff for a game of chance).
M.PS.24	Evaluate and compare strategies on the basis of expected values.
M.PS.25	Analyze decisions and strategies using probability concepts.

Correlation and Regression

Cluster	Interpret linear models.
M.PS.26	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. Instructional Note: Focus should be on situations for which linear models are appropriate. c. Fit a linear function for scatter plots that suggest a linear association. Instructional Note: Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.
M.PS.27	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Instructional Note: Build on students' work with linear relationships in previous courses and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.
M.PS.28	Compute (using technology) and interpret the correlation coefficient of a linear fit. Instructional Note: Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.

M.PS.29	Distinguish between correlation and causation. Instructional Note: The important distinction between a statistical relationship and a cause-and-effect relationship is the focus.

Confidence Intervals

Cluster	Determine and interpret confidence intervals.
M.PS.30 (+)	Find the point estimate and margin of error in a given scenario.
M.PS.31 (+)	Construct and interpret confidence intervals for the population mean.
M.PS.32 (+)	Determine minimum sample size requirements when estimating mean, μ (population proportion).
M.PS.33 (+)	Interpret the t-distribution and use t-distribution table in real life scenarios.
M.PS.34 (+)	Construct confidence intervals when the sample size, n, is less than 30, population is normally distributed, and standard deviation, σ, is unknown.
M.PS.35 (+)	Interpret the chi-square distribution and use chi-square distribution table. Use the chi-square distribution to construct a confidence interval for the variance and standard deviation.

Hypothesis Testing with One Variable

Cluster	Use hypothesis testing in making and interpreting decisions.
M.PS.36 (+)	Interpret a hypothesis test; state a null hypothesis and an alternative hypothesis.
M.PS.37 (+)	Identify Type I and Type II errors and interpret the level of significance.
M.PS.38 (+)	Use one-tailed and two-tailed statistical tests to find p-value.
M.PS.39 (+)	Make and interpret decisions on comparing two hypotheses based on results of a statistical test. Write a claim for a hypothesis test.
M.PS.40 (+)	Find p values and test for mean and use in a z-test.
M.PS.41 (+)	Find critical values and rejection regions in a normal distribution. Use rejection regions for a z-test.
M.PS.42 (+)	Find critical values in a t-distribution and us the t-test to test a mean.
M.PS.43 (+)	Use the z-test to tests a population proportion, p.
M.PS.44 (+)	Find critical values for chi squared test. Use the chi squared test to test a variance or a standard deviation.

Statistical Inference

Cluster	Determine and use correlation.
M.PS.45 (+)	Find a correlation coefficient.
M.PS.46 (+)	Test a population correlation coefficient using a table.
M.PS.47 (+)	Perform a hypothesis test for a population correlation coefficient.
M.PS.48 (+)	Distinguish between correlation and causation.

Cluster	Use linear regression to predict and interpret.
M.PS.49 (+)	Find the equation of a regression line; predict y-values using a regression line.
M.PS.50 (+)	Interpret the types of variation about a regression line.
M.PS.51 (+)	Find and interpret the coefficient of determination.
M.PS.52 (+)	Find and interpret the standard error of estimate for a regression line; construct and interpret a prediction interval for y.
M.PS.53 (+)	Use technology to find a multiple regression equation, the standard error of estimate, and the coefficient of determination.

Cluster	Use statistical tests to determine a relationship.
M.PS.54 (+)	Use a contingency table to find expected frequencies.
M.PS.55 (+)	Use the chi-squared distribution to test whether a frequency distribution fits a claimed distribution and to test whether two variables are independent.
M.PS.56 (+)	Interpret the F-distribution and use an F-table to find critical values.
M.PS.57 (+)	Perform a two-sample F-test to compare two variances.
M.PS.58 (+)	Perform a two-sample F-test to compare two variances. Interpret the F-distribution and use an F-table to find critical values.
M.PS.59 (+)	Use one-way analysis of variance to test claims involving three or more means. Introduce two-way analysis of variance. Perform and analyze an ANOVA test.

Mathematics – Technical Transition Mathematics for Seniors

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Students Technical Transition Mathematics for Seniors will solidify their quantitative literacy by enhancing numeracy and problem-solving skills as they investigate and use fundamental concepts of algebra, geometry, introductory trigonometry, and statistical analysis. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Number and Quantity:	Algebra: Seeing Structure in Expressions
• Develop an understanding of basic operations, equivalent representations, and properties of the real number system.	• Create equations or inequalities that model physical situations.
Functions: Interpreting Functions	**Geometry/Trigonometry**
• Develop knowledge and understanding of the concept of functions as they use, analyze, represent, and interpret functions and their applications.	• Solve application problems by calculating area or surface area in two-dimensional object or volume in three-dimensional objects. • Understand and apply the Pythagorean Theorem for solving real-world problems. (e.g., checking accuracy on gate construction, conduit bending).
Modeling	**Statistics - Interpreting Categorical & Quantitative Data**
• Create and use two- and three-dimensional representations of authentic situations in problem solving. • Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	• Analyze and interpret tables, charts and graphs. (e.g., interpret a body mass index (BMI) chart). • Distinguish between correlation and causation.
Finance Mathematics	
• Determine, represent and analyze mathematical models for personal finance.	

Numbering of Standards

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Technical Transition Mathematics for Seniors:

Number and Quantity

Math as a language	Standards 1-3
Math and Measurement	Standards 4-6
The Real Number System	Standards 7-8

Algebra: Seeing Structure in Expressions

Understand the connections between proportional relationship, lines, and linear equations.	Standards 9-10
Create equations that describe numbers or relationships.	Standards 11-14
Solve systems of equations. Standards 15-16	

Functions: Interpreting Functions

Understand the concept of a function and use function notation.	Standard 17
Analyze functions using different representations.	Standards 18-20
Build a function that models a relationship between two quantities.	Standards 21-22

Geometry/Trigonometry

Visualize relationships between two dimensional and three-dimensional objects and apply geometric concepts in modeling situations.	Standards 23-26
Use geometric theorems and formulas to solve problems.	Standards 27-31
Define trigonometric ratios and solve problems involving right triangles.	Standards 32-33

Modeling

Concrete geometric representation (physical modeling).	Standards 34-35
Summarize, represent, and interpret data on two quantitative variables.	Standards 36-39

Statistics - Interpreting Categorical & Quantitative Data

Conduct statistical analysis.	Standards 40-43
Summarize, represent, and interpret data on a single count or measurement variable.	Standards 44-48

Finance Mathematics

Understand financial models.	Standards 49-50
Personal use of finance.	Standards 51-52

Number and Quantity

Cluster	Math as a language
M.TTMS.1	Demonstrate reasoning skills in developing, explaining and justifying sound mathematical arguments and analyze the soundness of mathematical arguments of others.
M.TTMS.2	Communicate with and about mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.

M.TTMS.3	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.

Cluster	Math and Measurement
M.TTMS.4	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
M.TTMS.5	Solve real-life problems requiring conversion of units using dimensional analysis for measurements in English and metric systems. Solve problems involving multiple units of measurement. (e.g., converting between currencies, calculating dosages of medicine, trip planning from miles to kilometers.)
M.TTMS.6	Distinguish between proportional and non-proportional situations, apply proportional reasoning when appropriate, solve for an unknown quantity in proportional situations; apply scale factors to perform indirect measurements. (e.g., maps, blueprints, concentrations, dosages, and densities).

Cluster	The Real Number System
M.TTMS.7	Perform operations using positive and negative numbers, fractions, absolute value, decimals, percentages, and scientific notation. (e.g., given the cost of a project, determine what percentage of the budget went for salaries, percent of increase/decrease)
M.TTMS.8	Solve real-world problems in a variety of contexts by representing quantities in equivalent forms (fractions, decimals, and percentages) to investigate and describe quantitative relationships. Compare the size of numbers in different forms arising in authentic real-world contexts, such as growth expressed as a fraction versus as a percentage. Interpret the meaning of numbers in different forms, such as scientific notation and the meaning of a fraction or percentage greater than 100 and its validity in a given context. Recognize incorrect or deceptive uses of fractions, decimals, or percentages.

Algebra – Seeing Structure in Expressions

Cluster	Understand the connections between proportional relationship, lines, and linear equations.
M.TTMS.9	Graph proportional relationships, interpreting the unit rates as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed. (e.g., Labor cost per time, material cost per job).
M.TTMS.10	Solve application problems using direct and inverse variation equations. (e.g., determine the mechanical advantage of gears, Ohm's Law)

Cluster	Create equations that describe numbers or relationships.
M.TTMS.11	Analyze real-world problem situations and use variables to construct and solve equations involving one or more unknown or variable quantities to answer questions about the situations, such as creating spreadsheet formulas to calculate prices based on percentage mark-up or solving formulas for specified values. Demonstrate understanding of the meaning of a solution. Identify when there is insufficient information given to solve a problem.
M.TTMS.12	Analyze real-world problem situations and use variables to construct and solve equations and inequalities in one variable. Include equations arising from linear functions and simple rational and exponential functions. (e.g., using spreadsheet functions, determine sale price of items)
M.TTMS.13	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (e.g., profit vs. number of units, cost vs. number of units, resistance vs. current)
M.TTMS.14	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g., Rearrange Ohm's law $V = IR$ to highlight resistance R)

Cluster	Solve systems of equations.
M.TTMS.15	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (e.g., child care facility – sq. footage to number of children; solving electrical current in a circuit with multiple paths, Break-Even point)
M.TTMS.16	Explain why the x-coordinates of the points where the graphs of the equation $y = f(x)$ and $y = g(x)$ intersect are the solution of the equation $f(x) = g(x)$; find the solution approximately (e.g., using technology to graph the functions, make tables of values or find successive approximations).

Functions – Interpreting Functions

Cluster	Understand the concept of a function and use function notation.
M.TTMS.17	Understand 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 $y = f(x)$.

Cluster	Analyze functions using different representations.
M.TTMS.18	Interpret the parameters in a linear function in terms of a context.
M.TTMS.19	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line, give examples of functions that are not linear.
M.TTMS.20	Describe qualitatively the functional relationship between two quantities by analyzing a graph.

Cluster	Build a function that models a relationship between two quantities.
M.TTMS.21	Represent application problems as linear equations. Write a function that describes a relationship between two quantities. (e.g., level of education versus pay; rate of speed versus fuel consumption; caloric intake versus expenditure)
M.TTMS.22	Recognize 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). Instructional Note: Focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.

Geometry/Trigonometry

Cluster	Visualize relationships between two dimensional and three-dimensional objects and apply geometric concepts in modeling situations.
M.TTMS.23	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
M.TTMS.24	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
M.TTMS.25	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot, airflow per cubic foot).
M.TTMS.26	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with topographic grid systems based on ratios).

Cluster	Use geometric theorems and formulas to solve problems.
M.TTMS.27	Use theorems about triangles to solve real-world application problems. 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.
M.TTMS.28	Understand and apply the Pythagorean Theorem for solving real-world problems. (e.g., checking accuracy on gate construction, conduit bending)
M.TTMS.29	Solve application problems by calculating area and surface area for two dimensional objects. (e.g., calculate the cost of heating a building based on square footage).
M.TTMS.30	Solve application problems by calculating volume for three dimensional objects using formulas for cylinders, pyramids, prisms, cones, and spheres. (e.g., compute amount of cement needed for a sidewalk, amount of water in a fire hose, amount of air in ductwork)
M.TTMS.31	Solve application problems by calculating circumference, area, radius, diameter, area of sector, arc length of a circle with appropriate unit labels. (e.g., develop a circular watering system)

Cluster	Define trigonometric ratios and solve problems involving right triangles.
M.TTMS.32	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. (e.g., angles of depression/elevation, conduit bending)
M.TTMS.33	Identify and apply special right triangle relationships, 30-60-90 and 45-45-90. (e.g., isometric drawing in drafting, conduit bending)

Modeling

Cluster	Concrete geometric representation (physical modeling)
M.TTMS.34	Create and use two- and three-dimensional representations of authentic situations using paper techniques or dynamic geometric environments for computer-aided design and other applications.
M.TTMS.35	Gather data, conduct investigations and apply mathematical concepts and models to solve problems in mathematics and other disciplines.

Cluster	Summarize, represent, and interpret data on two quantitative variables.
M.TTMS.36	Collect numerical bivariate data; represent data on two quantitative variables on a scatter plot; determine whether or not a relationship exists; if so, describe how the variables are related and select a function to model the data, justify the selection and use the model to make predictions.
M.TTMS.37	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
M.TTMS.38	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.
M.TTMS.39	Compute (using technology) and interpret the correlation coefficient of a linear fit. Identify positive and negative correlations. (e.g., vehicle depreciation)

Statistics – Interpreting Categorical & Quantitative Data

Cluster	Conduct statistical analysis.
M.TTMS.40	Identify the population of interest, select an appropriate sampling technique and collect data.
M.TTMS.41	Identify the variables to be used in a study.
M.TTMS.42	Determine possible sources of statistical bias in a study and how such bias may affect the ability to generalize the results.
M.TTMS.43	Determine possible sources of variability of data, both those that can be controlled and those that cannot be controlled.

Cluster	Summarize, represent, and interpret data on a single count or measurement variable.
M.TTMS.44	Represent data with plots on the real number line (dot plots, histograms, and box plots).
M.TTMS.45	Analyze and interpret tables, charts and graphs. (e.g., interpret a body mass index (BMI) chart)
M.TTMS.46	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.
M.TTMS.47	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
M.TTMS.48	Distinguish between correlation and causation.

Finance Mathematics

Cluster	Understanding financial models
M.TTMS.49	Determine, represent and analyze mathematical models for loan amortization and the effects of different payments and/or finance terms (e.g., Business Loans, Auto, Mortgage, and/or Credit Card).
M.TTMS.50	Determine, represent and analyze mathematical models for investments involving simple and compound interest with and without additional deposits. (e.g., Savings accounts, bonds, and/or certificates of deposit.)

Cluster	Personal use of finance
M.TTMS.51	Research, develop and analyze personal budgets based on given parameters (e.g., Fixed and discretionary expenses, insurance, gross vs. net pay, types of income, wage, salary, commission, career choice, geographic region, retirement and/or investment planning, etc.).
M.TTMS.52	Research and analyze taxes including payroll, sales, personal property, real estate and income tax returns.

Mathematics – Data Science

All West Virginia teachers are responsible for classroom instruction that integrates content standards and objectives and mathematical habits of mind. Data Science provides students an opportunity to integrate mathematics, statistics, and computer science to analyze and interact with data. Data Science is an interdisciplinary field where mathematical principles and scientific methods are applied to datasets using technology and computing skills to solve problems. It relies heavily on the mathematical and statistical reasoning that is developed during prior courses and contextualizes those concepts with computational solutions. Students will engage with data through cycles of exploration, visualization, analysis, communication, and application. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progression of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Explore Data	Visualize Data
• **Develop questions that can be answered by exploring multivariable data sets.** • **Explore implications of complex data sets, collection methods, and privacy concerns.**	• **Use technology to generate a visualization appropriate to the data set to explore the data and generate questions.**
Analyze Data	**Communicate Using Data**
• **Choose appropriate statistics, understanding how algorithms can be used to calculate these values.** • **Use the shape of distributions to determine probabilities of situations leading to decision-making.** • **Fit multiple regression models; compare the strength of each model; and use the appropriate regression model to make predictions.**	• **Represent findings to a particular audience using the relevant interdisciplinary language of mathematics and data science.**
	Application of Data Science
	• **Utilize a coding language to store, analyze, and model with data.** • **Describe the application of artificial intelligence, machine learning, and natural language processing to data science.** • **Complete a capstone project using techniques learned throughout the course.**

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Data Science:

Explore Data	
Ask and develop questions; collect data; and consider ethics and bias.	Standards 1-5
Research issues, access multivariable data, and clean data.	Standards 6-9
Visualize Data	
Display data.	Standards 10-15
Analyze Data	
Choose appropriate statistical values.	Standards 16-17
Fit bivariate data to functions using regression.	Standards 18-20
Understand the use of algorithms in statistical tests.	Standards 21-22
Understand probability in relation to decision-making.	Standards 23-24
Communicate Using Data	
Compare distributions.	Standards 25-26
Evaluate claims.	Standards 27-28
Report conclusions in multiple formats.	Standard 29
Applications of Data Science	
Understand security and ethics.	Standards 30-31
Explore artificial intelligence.	Standards 32-35
Utilize a coding language.	Standards 36-41
Apply data science to a capstone project.	Standard 42

Explore Data

Cluster	Ask and develop questions; collect data; and consider ethics and bias.
M.DSHS.1	Describe techniques for locating and collecting small- and large-scale data sets.
M.DSHS.2	Recognize a question that can be explored or answered using data science, including statistical questions.
M.DSHS.3	Use technology to informally describe the shape, variability, and center of a distribution of data.
M.DSHS.4	Determine possible sources of statistical bias in a study and how such bias may affect the ability to generalize the results and evaluate a variety of resources used to collect data for accuracy, perspective, credibility, relevance, and privacy concerns.
M.DSHS.5	Understand that random sampling tends to produce representative samples that support valid inferences and generalizations about a population.

Cluster	Research issues, access multivariable data, and clean data.
M.DSHS.6	Explore and understand real-world issues and problems using multivariable data sets to hypothesize solutions.
M.DSHS.7	Access data from a variety of sources and apply mathematical concepts and models to solve problems in mathematics and other disciplines.
M.DSHS.8	Using programming techniques and spreadsheet capabilities, clean, store, analyze, and model with data sets.
M.DSHS.9	Compare techniques (e.g., sorting, statistics, searching) for analyzing multivariable data sets.

Visualize Data

Cluster	Display data.
M.DSHS.10	Use appropriate tools to represent data visually.
M.DSHS.11	Use appropriate tools and multiple representations to represent and model relationships of quantitative multivariable data consisting of at least four variables.
M.DSHS.12	Describe visual patterns in quantitative data such as clustering, outliers, positive or negative association, linear association, and nonlinear association (e.g., determine form, strength, and direction).
M.DSHS.13	Visualize categorical data using appropriate models such as mosaic plots, stacked bar graphs, etc. Recognize possible associations and data trends.
M.DSHS.14	Use methods of geospatial analysis to graphically or spatially represent natural phenomena.
M.DSHS.15	Understand the use of simulation to compare probabilities from a model to observed frequencies; explain possible sources of discrepancy.

Analyze Data

Cluster	Display data.
M.DSHS.16	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.
M.DSHS.17	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Cluster	Fit bivariate data to functions using regression.
M.DSHS.18	Use technology to create a regression for data that suggests a linear association. Compute the correlation coefficient, coefficient of determination, and residual plot, and interpret the results in the context of the problem.
M.DSHS.19	Fit a function to the data that does not suggest a linear association; use algebraic re-expression of the function to fit the data to solve problems in the context of the situation.
M.DSHS.20	Interpret key features such as intercepts, rate of change, and turning points of models in the context of the data.

Cluster	Understand the use of algorithms in statistical tests.
M.DSHS.21	Examine existing algorithms and describe connections to algebraic and statistical functions, sets, and logic.
M.DSHS.22	Develop algorithms in order to solve mathematical problems.

Cluster	Understand probability in relation to decision-making.
M.DSHS.23	Use the concepts of independent events and conditional probabilities to calculate and interpret outcomes of chance events to make data-informed decisions. Recognize and explain the concepts of conditional probability and independence to multiple audiences and contexts.
M.DSHS.24	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages, using the area beneath the curve to make estimations of frequencies. Instructional Note: Emphasize that only some data are well described by a normal distribution.

Communicate Using Data

Cluster	Compare distributions.
M.DSHS.25	Assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability (e.g., The mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability on either team; on a dot plot, the separation between the two distributions of heights is noticeable).
M.DSHS.26	Analyze and communicate the benefits and limitations of data visualization tools to solve a real-world problem.

Cluster	Evaluate claims.
M.DSHS.27	Distinguish between correlation and causation. Instructional Note: The important distinction between a statistical relationship and a cause-and-effect relationship is the focus.
M.DSHS.28	Evaluate claims based on data reports gathered from a variety of sources such as the media, scientific journals, census data, etc.

Cluster	**Report conclusions in multiple formats.**
M.DSHS.29	Report results using an appropriate format (digital presentation, verbal, textual, etc.) and to a particular audience using the relevant language of mathematics and data science. Use data displays and interpret results in terms of the question studied.

Application of Data Science

Cluster	**Understand security and ethics.**
M.DSHS.30	Explore various legal and ethical standards for data ownership and the implications of the standards to the study and application of data science.
M.DSHS.31	Describe and understand how data is collected from both individuals and groups of individuals, shared, and used.

Cluster	**Explore artificial intelligence.**
M.DSHS.32	Know and identify examples of real-world or societal machine learning applications.
M.DSHS.33	Describe basic machine learning concepts such as training a model and evaluating model performance.
M.DSHS.34	Know and identify examples of natural language processing and its connection to mathematics and probability.
M.DSHS.35	Review ethical issues and the impact of machine learning and natural language processing.

Cluster	**Utilize a coding language.**
M.DSHS.36	Evaluate the appropriateness of programming languages and applications as they relate to data science.
M.DSHS.37	Select a programming language to explore, display, and analyze data.
M.DSHS.38	Identify types of information that can be stored as variables, classify variables, and utilize variables in programs that store data in appropriate ways (e.g., Booleans, characters, integers, floating points, strings).
M.DSHS.39	Interpret relational and logical expressions of level-appropriate complexity using comparison and Boolean operators.
M.DSHS.40	Create programming solutions by reusing existing code to perform analysis or retrieve data (e.g., libraries, APIs, publicly shared code).
M.DSHS.41	Write code or functions that can programmatically manipulate data sets (e.g., slice, merge, subset, sort, fit, summarize, analyze).

Cluster	**Apply data science to a capstone project.**
M.DSHS.42	Choose a problem or issue of interest. Throughout the program of study, research and use existing data set(s) to explore, visualize, analyze, and communicate findings to tell a data story.

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