

PROPOSED RULEMAKING

STATE BOARD OF EDUCATION

[22 PA. CODE CHS. 3—6]

Academic Standards and Assessment

The State Board of Education (Board) proposes to delete Chapters 3, 5 and 6 and add a new Chapter 4 which relates to academic standards and assessment, as set forth in Annex A, under authority of the Public School Code of 1949 (24 P. S. §§ 1-101—27-2702).

Purpose

The proposed new Chapter 4 will replace existing Chapters 3 (school profiles), 5 (curriculum) and 6 (vocational education). The purpose of replacing these regulations with a single regulation focused on academic standards is to establish a single clear, concise and comprehensive regulation to govern the educational offerings of the public schools of this Commonwealth. For purposes of 1 Pa.C.S. § 1937, this chapter is a new regulation substituted for Chapters 3, 5 and 6.

Requirements of the Regulations

Proposed Chapter 4 defines the purpose of public education; delineates academic standards; defines requirements for strategic planning; describes State and local school entity responsibilities for assessment; provides requirements for instruction at primary, intermediate, middle and high school levels as well as for vocational and special education; delineates graduation requirements; establishes seals of proficiency and distinction for high school diplomas; describes profiles for school performance; and, sets forth provisions for students in other than public schools.

Affected Parties

The proposed regulations affect the students and professional employes of the public schools of this Commonwealth (including intermediate units, area vocational-technical schools, public charter and alternative schools). Provisions at § 4.71 affect nonpublic nonlicensed schools. Sections 4.71—4.74 set forth provisions relating to and affecting students in other than public schools. Nothing in proposed Chapter 4 is intended to change or go beyond the current homeschooling law.

Cost and Paperwork Estimates

Chapter 5, which this proposed regulation replaces, required students to achieve a broad array of 53 learning outcomes prior to graduation; Chapter 4 will require students to achieve standards in specific academic areas during their education. Requirements for portfolio assessment and proficiency in foreign language are eliminated. Each of these changes will yield savings to school entities by (1) focusing the curriculum; (2) eliminating training and evaluation costs associated with portfolio assessment and (3) avoiding the responsibility of hiring additional foreign language teachers. Modest savings to the Commonwealth are anticipated in removing the requirement that strategic plans be reviewed, evaluated and approved by the Department.

Costs to implement this regulation for a school entity may include curriculum development, professional development of teachers, and additional remediation efforts. It

is anticipated that costs for curriculum development beyond those routinely encountered by school entities will be more than offset by the savings.

The major portion of a new \$3 million State appropriation in the 1998-99 budget will support professional development activities to prepare educators to implement academic standards. Two other programs supported by this appropriation, urban education academies and summer institutes for teachers will also assist educators in understanding and implementing academic standards. A \$3 million dollar increase in the appropriation to support the State assessment system will cover the costs of converting the current program to meet the requirements of these proposed regulations. Costs beyond what are currently expended to identify and provide additional learning opportunities for students in the early grades should be more than offset by reduced costs for remediation in later grades.

Proposed Chapter 4 does not set forth new, additional paperwork requirements. Paperwork requirements are decreased by this proposal in that the requirement to submit local strategic plans to the Department for review and evaluation will be eliminated in Chapter 4.

Effective Date

These regulations will become effective upon final publication in the *Pennsylvania Bulletin*. State assessment under these proposed regulations will begin in the 1998-99 school year under § 4.51. Strategic plans will be developed under § 4.83 (relating to implementation schedule). Certain other sections (for example, seals of proficiency and distinction) of the regulation will require compliance 3 years from the effective date of the regulation.

Sunset Date

The effectiveness of Chapter 4 will be reviewed by the Board every 4 years, in accordance with the Board's policy and practice respecting all regulations promulgated by the Board. Thus, no sunset date is necessary.

Regulatory Review

Under section 5(a) of the Regulatory Review Act (71 P. S. § 745.5(a)), the Board submitted a copy of these proposed regulations on July 29, 1998 to the Independent Regulatory Review Commission (IRRC) and to the Chairpersons of the House and Senate Committees on Education. In addition to submitting the proposed regulations, the Board has provided IRRC and the Committees with a copy of a detailed Regulatory Analysis Form prepared by the Board in compliance with Executive Order 1996-1, "Regulatory Review and Promulgation." A copy of this material is available to the public upon request.

If the Committees have comments on the regulations, they will notify the Board within 20 days after the close of the public comment period. IRRC will submit its comments on the proposed regulations within 10 days from the closing date of the Committees' review period. The comments shall specify the regulatory review criteria which have not been met by any portion of the regulations. The Regulatory Review Act specifies detailed procedures for review, prior to final publication of the regulations, by the Board, the General Assembly and the Governor of objections raised.

Public Comments and Contact Person

Interested persons are invited to submit written comments, suggestions or objections regarding this proposal to Peter H. Garland, Executive Director of the State Board of Education, 333 Market Street, Harrisburg, PA 17126-0333 within 30 days following publication in the *Pennsylvania Bulletin*, (717) 787-3787.

Persons with disabilities needing an alternative means of providing public comment may make arrangements by calling Dr. Peter Garland at (717) 787-3787 or TDD (717) 787-7367.

Alternative formats of the proposed regulations (such as braille, large print, a cassette tape) can be made available to members of the public upon request to Dr. Garland at the telephone and TDD numbers listed above.

PETER H. GARLAND,
Executive Director

Fiscal Note: 6-265. (1) General Fund; (2) Implementing Year 1997-97 is \$1 million; (3) 1st Succeeding Year 1998-98 is \$6 million; 2nd Succeeding Year 1999-00 is \$6 million; 3rd Succeeding Year 2000-01 is \$6 million; 4th Succeeding Year 2001-02 is \$6 million; 5th Succeeding Year 2002-03 is \$6 million; (4) FY 1997-98 \$4.15 million (PA Assessment); FY 1996-97 \$4.04 million; FY 1995-96 \$4.07 million; (7) For teacher professional development . . . For PA assessment; (8) recommends adoption.

(*) The General Appropriation Act of 1998 (Act 1998-6A) made two appropriations to the Department of Education to support the implementation of these academic standards. A \$3 million appropriation was made to ensure successful integration of these standards by teachers in classrooms through teacher professional development in the Public School System and at the Academy for Urban Education and the Governor's Institutes for Teachers at the Governor's Schools for Excellence; and the appropriation for PA Assessment was increased by \$3 million to promote the evaluation of achieving these standards through academic testing.

Annex A**TITLE 22. EDUCATION****PART I. BOARD OF EDUCATION****Subpart A. MISCELLANEOUS PROVISIONS**

(Editor's Note: The Board is proposing to delete the text of 22 Pa. Code Chapters 3, 5 and 6 as they currently exist in the Pennsylvania Code, at pages 3-1—3-6, (serial pps. (229101)—(229106)), pages 5-1—5-43 (serial pps. (229107), (229108), (215559)—(215599), and pages 6-1—6-12 (234189)—(234200)).

(Editor's Note: The following chapter is new. It is being printed in regular type to enhance readability.)

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GENERAL PROVISIONS**§ 4.1. Statutory authority.**

The statutory authority in this chapter is the School Code.

§ 4.2. Purpose.

The purpose of this chapter is to establish rigorous academic standards and assessments to facilitate the improvement of student achievement and to provide parents and communities a measure by which school performance can be determined.

§ 4.3. Definitions.

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

*AVTS—Area vocational-technical school—*An area vocational-technical school, which is a public school, that provides vocational-technical education to secondary school students, out-of-school youth and adults in a geographical area comprised and operated by one or more school districts and established under sections 1840—1853 of the School Code (24 P. S. §§ 18-1840—18-1853).

*Academic standard—*What a student should know and be able to do at a specified grade level.

*Assessment—*A valid and reliable measurement of student performance on a set of academic standards in a subject area.

*Apprenticeship program—*A competency-based program that coordinates and integrates classroom instruction with a structured work-based employment experience designed for students.

Board—The State Board of Education established by sections 2601-B—2606-B of the School Code (24 P. S. §§ 26-2601-B—26-2606-B).

Cooperative vocational-technical education—A planned method of instruction developed through a signed cooperative arrangement among school representatives, students, parents and employers in the community to provide students with an opportunity to alternate in-school academic and vocational-technical instruction in entry-level paid employment in an occupational field, in which the student's total occupational work experience is planned, coordinated and supervised by the school in close cooperation with the employer.

Curriculum—A series of planned instruction that is coordinated and articulated and implemented in a manner designed to result in the achievement by all students of specific knowledge and skills and the application of this knowledge.

Department—The Department of Education of the Commonwealth.

ESOL—English to speakers of other languages.

Employment area—A geographic area where vocational-technical education program completers are most likely to be employed.

Individuals with Disabilities Education Act—20 U.S.C.A. §§ 1400—1485.

Instruction—The delivery of academic and vocational content by teachers to enable students to achieve the academic standards under § 4.12 (relating to academic standards) and additional academic standards determined in school entity strategic plans under § 4.13 (relating to strategic plans).

Intermediate unit—A regional educational service agency established under section 951—974 of the School Code (24 P. S. §§ 9-951—9-974), which provides educational services to participating school districts as part of the public school system of the Commonwealth.

Parent or guardian—A person responsible for student's care.

Planned instruction—Instruction offered by a school entity based upon a written plan which consists of at least the following elements:

(i) Objectives of the course or instructional unit to be achieved by all students.

(ii) Content, including materials and activities, and estimated instructional time to be devoted to achieving the standards. Courses or instructional units of varying lengths of time may be taught.

(iii) The relationship between the objectives of the course or instructional unit and academic standards specified under § 4.12 (relating to academic standards) and to those determined in the school entity's strategic plan under § 4.13 (relating to strategic plans), as well as the relationship between the objectives of the course or instructional unit and those of others offered by the school entity.

(iv) Procedures for measurement of the objectives of the course or instructional unit.

School Code—The Public School Code of 1949 (24 P. S. §§ 1-101—27-2702).

School entity—A school district, intermediate unit or AVTS.

Secretary—The Secretary of Education of the Commonwealth.

School organization—The organization of a school district's programs into kindergarten, primary, intermediate level, middle level and high school programs, including programs operated at AVTSs.

Tech-prep program—A combined secondary and postsecondary program which leads to an associate degree or certificate and employment by providing technical preparation in engineering technology, applied science, mechanical, industrial or practical art or trade, agriculture, health or business, including development of competence in mathematics, science and communications through a sequential course of study.

Vocational-technical education—Programs under public supervision and control which provide an organized process of learning experiences designed to develop integrated academic and occupational skills, knowledge, attitudes, work habits and leadership ability for entry into and advancement within various levels of employment in occupational areas of agriculture, business, marketing and distribution, health, home economics and trade and industry and for participation in postsecondary education and training.

§ 4.4. General policies.

(a) It is the policy of the Board that the local curriculum be designed by school entities to achieve the academic standards under § 4.12 (relating to academic standards) and additional academic standards designated in school entity strategic plans under § 4.13 (relating to strategic plans).

(b) It is the policy of the Board that local school entities have the greatest possible flexibility in curriculum planning consistent with providing quality education and in compliance with the School Code, including requirements for courses to be taught (24 P. S. §§ 15-1501 and 16-1605), subjects to be taught in the English language (24 P. S. § 15-1511), courses adapted to the age, development and needs of the pupils (24 P. S. § 15-1512), minimum school year of 180 days and minimum of 900 hours of instruction at the elementary level and 990 hours of instruction at the secondary level (24 P. S. §§ 15-1501 and 15-1504), employment of sufficient numbers of qualified professional employees (24 P. S. § 11-1106) and superintendents to enforce the curriculum requirements of State law (24 P. S. § 10-1005), and this part.

(c) Educational programs shall be provided without discrimination on the basis of race, sex, color, religion, disability, sexual orientation or national origin.

(d) School entities shall adopt policies to assure that parents or guardians have the following:

(1) Access to information about the curriculum, including academic standards to be achieved, instructional materials and assessment techniques.

(2) A process for the review of instructional materials.

(3) The right to have their children excused from specific instruction which conflicts with their religious beliefs, upon receipt by the school entity of a written request from the parents.

(4) If upon inspection of State assessments parents find the assessments in conflict with their religious belief and wish their student be excused from the assessment, the right of the parents will not be denied upon written request to the school entity superintendent.

(5) Opportunity for involvement in the strategic planning process of the district under § 4.13 (relating to strategic plans).

(6) The right to have their children excluded from research studies or surveys conducted by entities other than the school entity unless prior written consent has been obtained.

ACADEMIC STANDARDS AND PLANNING

§ 4.11. Purpose of public education.

(a) This section and §§ 4.12 and 4.13 (relating to academic standards; and strategic plans) describe the purpose of public education, the academic standards, their relationship with one another and each school entity's strategic plan.

(b) Public education prepares students for adult life by attending to their intellectual and developmental needs and challenging them to achieve at their highest level possible. In conjunction with families and other community institutions, public education prepares students to become self-directed, life-long learners and responsible, involved citizens.

(c) Together with parents, families and community institutions, public education provides opportunities for students to:

- (1) Acquire knowledge and skills.
- (2) Develop integrity.
- (3) Process information.
- (4) Think critically.
- (5) Work independently.
- (6) Collaborate with others.
- (7) Adapt to change.

(d) The academic standards describe the knowledge and skills which students will be expected to demonstrate before graduating from a public school.

(e) Achievement of high academic standards in public education is dependent upon the quality of instruction in schools and student effort supported by the involvement of family and community.

(f) Assessment in public education is designed to determine student attainment of State and local academic standards.

(g) Public schools provide instruction throughout the curriculum so that students may develop knowledge and skills in the following areas:

- (1) Reading, writing, speaking and listening.
- (2) Mathematics.
- (3) Science and technology.
- (4) Environment and ecology.
- (5) Social studies (civics and government, geography, economics and history).
- (6) Arts and humanities.
- (7) Career education and work.
- (8) Health, safety and physical education.
- (9) Family and consumer science.
- (10) World languages.

§ 4.12. Academic standards.

(a) School entities may develop, expand or improve existing academic standards in the following content

areas until the Board adopts standards under subsection (g) and rescinds the description of the corresponding content area:

(1) *Science and technology.* Study of the natural world and facts, principles, theories and laws in the areas of biology, chemistry, physics and earth sciences. Technology is the application of science to enable societal development including food production, manufacturing, building, transportation and communication. Science and technology share the use of the senses, science processes, inquiry, investigation, analysis and problem solving strategies.

(2) *Environment and ecology.* Understanding the components of ecological systems and their interrelationships with social systems and technologies. These components incorporate the disciplines of resource management, agricultural diversity, government and the impact of human actions on natural systems. This interaction leads to the study of watersheds, threatened and endangered species, pest management and the development of laws and regulations.

(3) *Social studies.*

(i) *History.* Study of the record of human experience including important events; interactions of culture, race and ideas; the nature of prejudice; change and continuity in political systems; effects of technology; importance of global-international perspectives; and the integration of geography, economics and civics studies on major developments in the history of the Commonwealth, the United States and the world.

(ii) *Geography.* Study of relationships among people, places and environments, of geographic tools and methods, characteristics of place, concept of region and physical processes.

(iii) *Civics and government.* Study of United States constitutional democracy, its values and principles, study of the Pennsylvania Constitution and government including the study of principles, operations and documents of government, rights and responsibilities of citizenship, how governments work and international relations.

(iv) *Economics.* Study of how individuals and societies choose to use resources to produce, distribute and consume goods and services. Knowledge of how economies work, economic reasoning and basic economic concepts, economic decisionmaking, economic systems, Pennsylvania and the United States economy, and international trade.

(4) *Arts and humanities.* Study of dance, theater, music, visual arts, language and literature including forms of expression, historical and cultural context, critical and aesthetic judgement, and production, performance or exhibition of work.

(5) *Career education and work.* Understanding career options in relationship to individual interests, aptitudes and skills including the relationship between changes in society, technology, government and economy and their effect on individuals and careers. Development of knowledge and skill in job-seeking and job-retaining skills and, for students completing vocational-technical programs, the skills to succeed in the occupation for which they are prepared.

(6) *Health, safety and physical education.* Study of concepts, skills and societal factors which affect personal, family and community health and safety, nutrition, physical fitness, movement concepts and strategies, safety in physical activity settings, and leadership and cooperation in physical activities.

(7) *Family and consumer science.* Understanding the role of consumers as a foundation for managing available resources to provide for personal and family needs and to provide basic knowledge of child health and child care skills.

(8) *World languages.* Ability to communicate in a language other than English, including the ability to understand and interpret written and spoken language on a variety of topics and to develop knowledge and understanding of other cultures.

(b) In designing educational programs, school entities shall provide for the attainment of the academic standards under subsections (a) and (c) and additional academic standards which they describe in their strategic plans under § 4.13(c) (relating to strategic plans). Attaining the academic standards in this section requires students to demonstrate the acquisition and application of knowledge.

(c) School entities shall prepare students to attain academic standards in mathematics, reading, writing, speaking and listening as contained in Appendix A and incorporated here by reference and additional standards as may be adopted by the Board.

(d) A school entity's curriculum shall be designed to provide students with instruction needed to attain these academic standards.

(e) School entities shall apply academic standards for students in all areas described under subsections (a) and (c). The school entity assessment plan under § 4.52 (relating to school entity assessment system) shall include a description of how the academic standards will be measured by the entity and how information from the school entity assessments is used to assist students having difficulty meeting the academic standards.

(f) School entities shall assess the attainment of academic standards developed pursuant to subsections (a) and (c) and any other academic standards which they develop and describe in their strategic plans under § 4.52(c) for purposes of high school graduation and strategies for assisting students to attain them. Plans for assessment developed by school entities will take into account that academic standards in subsections (a) and (c) may be attained by students in various ways and shall be assessed by school entities in various ways. Children with disabilities may attain the academic standards by completion of their Individualized Education Programs under the Individuals with Disabilities Education Act and this part.

(g) In developing academic standards in subsection (a) content areas, the Secretary shall consult with educators, business and community leaders, and parents. Academic standards in the following content areas will be developed by the Secretary and presented to the Board no later than the following schedule:

September, 1998	Science and Technology Environment and Ecology Health, Safety and Physical Education Civics and Government
September, 1999	Arts and Humanities World Languages Family and Consumer Sciences Economics Geography
September, 2000	History Career Education and Work

(h) School entities are responsible under subsections (a), (c), (g) and § 4.13(c)(5) for assessing individual student attainment of academic standards and for assisting those students having difficulty attaining them. Upon request by a school entity, the Department will provide the entity with technical assistance in the development of academic standards and assessments that are sufficient to assure that students are making progress toward the attainment of standards required for high school graduation under subsection (f) and those identified in the strategic plan under § 4.13(c)(3).

(i) Every 3 years the Board will review the State academic standards and State assessments under this section to determine if they are appropriate, clear, specific, and challenging, and will make revisions as necessary by revising this chapter.

§ 4.13. Strategic plans.

(a) Every school entity shall develop a strategic plan once every 6 years and review that plan for revision at the midpoint according to an implementation schedule developed by the Department under § 4.83 (relating to implementation schedule). A school district plan shall incorporate appropriate components of the plan submitted under subsection (b) by an AVTS in which the district participates.

(b) Every AVTS, in conjunction with and with the approval of the majority of its participating school districts, shall develop a strategic plan once every 6 years and review that plan at the midpoint according to an implementation schedule developed by the Department under § 4.83.

(c) The strategic plan shall be based upon internal and external needs, leading to the specification of priorities for action and action plans. The requirement in subsections (a) and (b) to develop plans every 6 years and revisions every 3 years does not limit a school entity's ability to conduct a continuous strategic planning process. The plan shall include the following components in addition to others the school entity determines to include:

- (1) A mission statement.
- (2) A listing of the school entity's educational and organizational goals as they relate to student achievement.
- (3) A description of academic standards for student achievement which shall be consistent with those under § 4.12 (relating to academic standards).
- (4) The planned instruction to be offered and the instructional and assessment practices to be used in order to strive for the academic goals and attain academic standards under paragraph (3) and the high school graduation requirements under § 4.24 (relating to high school graduation requirements).

(5) An assessment plan under § 4.52 (relating to school entity assessment plan) designed to determine the degree to which students are achieving academic standards under paragraph (3) including descriptions of methods and measures used to determine achievement, how information from the assessments shall be used to assist students who have not demonstrated sufficient proficiency of the academic standards and how information from the assessments shall be made available to the public.

(6) A plan for improving students' achievement, including specific, measurable goals for student growth and plans (including those listed in this section) that are designed to attain students' achievement goals. Achieve-

ment goals shall demonstrate connection to the academic standards under § 4.12 (relating to academic standards) including, but not limited to, annual improvement goals for student scores on State and local assessments.

(7) The professional development plan under section 1205.1 of the School Code (24 P.S. § 12-1205.1) and § 49.17 (relating to continuing professional development) and the induction plan under § 49.16 (relating to approval of induction plans).

(8) A description of the school entity's organization and organizational goals and their relationship to differing student needs within the school entity's goals under paragraph (2) and the attainment of academic standards under paragraph (3).

(9) A description of the professional personnel, school library, classroom and other resources the school entity plans to devote to the attainment of academic standards.

(10) A brief description of the process used to develop the strategic plan, including a list of persons involved in its development.

(d) Strategic plans shall be developed through active participation by parents, students, school directors, teachers, school administrators, other school personnel, business and other community representatives. Teacher representatives shall be chosen by teachers, and administrative representatives shall be chosen by the administrative personnel, and school director representatives shall be chosen by the board of the school entity.

(e) Prior to its approval by the board of directors, the strategic plan and revisions of it shall be made available for public inspection in the school entity's offices and nearest public library until the next regularly scheduled board meeting or a minimum of 28 days whichever comes first. The plan shall be filed with the Department after it is recommended by the school entity superintendent of record and is approved by the school entity's board of directors. If the board of directors alters the proposed strategic plan developed under subsection (d), it shall consult with the committee which developed it in order to reach the greatest possible consensus prior to its submission and shall include any minority report which is developed.

(f) A locally approved strategic plan shall remain in effect until it is superseded by a locally approved revision or a new strategic plan developed under this section.

CURRICULUM AND INSTRUCTION

§ 4.21. Elementary education: primary and intermediate levels.

(a) The primary program shall ordinarily be completed by children who are approximately 8 years of age. School districts shall provide opportunities for individualized rates of learning and social and emotional development that reflect differing rates of development and learning styles of young children.

(b) Curriculum and instruction in the primary program shall focus on introducing young children to formal education, developing an awareness of the self in relation to others and the environment, and developing skills of communication, thinking and learning.

(c) The intermediate level program shall ordinarily be completed by children who are approximately 11 years of age.

(d) Curriculum and instruction in the intermediate level program shall continue the development of commu-

nication, thinking and learning skills and shall begin to focus on learning specific subject matter content.

(e) Planned instruction in the following areas shall be provided to every student every year in the primary program. Planned instruction may be provided as separate course or as an instructional unit within another course or other instructional activity:

(1) Language arts, integrating reading, writing, phonics, spelling, listening, speaking, literature and grammar, and information management, including library skills.

(2) Mathematics, including problem-solving and computation skills.

(3) Science and technology education, involving active learning experiences for students.

(4) Environment and ecology education, involving active learning experiences for students.

(5) Social studies (civics and government, economics, geography and history).

(6) Health, safety and physical education, includes instruction in concepts, skills and societal factors which affect personal, family and community health and safety, nutrition, physical fitness, movement concepts, motor skill development, safety in physical activity settings, and the prevention of alcohol, chemical and tobacco abuse.

(7) The arts, including active learning experiences in art, music, dance and theater.

(f) Planned instruction in the following areas shall be provided to every student every year in the intermediate level program. Planned instruction may be provided as separate course or as an instructional unit within another course or other instructional activity:

(1) Language arts, integrating reading, writing, spelling, listening, speaking, literature and grammar.

(2) Mathematics, including problem-solving and computation skills.

(3) Science and technology, including, when appropriate, instruction about agriculture and agricultural science.

(4) Environment and ecology, including when appropriate, instruction about agriculture and agricultural science.

(5) Social studies (civics and government, economics, geography and history).

(6) The arts, including art, music, dance and theater.

(7) Understanding and use of library and other information sources.

(8) Health, safety and physical education, includes instruction in concepts, skills and societal factors which affect personal, family and community health and safety, nutrition, physical fitness, movement concepts, motor skill development, safety in physical activity settings, and the prevention of alcohol, chemical and tobacco abuse.

(g) Planned instruction in the following areas shall be provided to every student at least once by the end of elementary school. Planned instruction may be provided as separate course or as an instructional unit within another course or other instructional activity. See section 1511 of the School Code (24 P.S. § 15-1511).

(1) History of the United States.

(2) History of Pennsylvania.

(3) Geography.

(4) Civics.

(h) This section does not preclude the teaching of other planned instruction designed to achieve a school district's mission, goals and academic standards.

(i) School districts shall determine the most appropriate way to operate their primary and intermediate level elementary programs to achieve the purposes under subsections (b) and (d) and the mission, goals and academic standards in their strategic plans under § 4.13 (relating to strategic plans).

(j) As of ____ (*Editor's Note:* The blank refers to a date 3 years from the effective date of adoption of this proposal.) students who have not achieved proficiency in reading and mathematics during their primary grades (K-3), as determined by the school entity, shall be afforded additional instructional opportunities through a grade-level learning plan developed by the school entity. The plan will assist the student in acquiring the knowledge and skills necessary to achieve at the proficient level. Assessments to measure proficiency shall be described in the school entity assessment system under § 4.52 (relating to school entity assessment system).

(k) As of ____ (*Editor's Note:* The blank refers to a date 3 years from the effective date of adoption of this proposal.) students who have not achieved proficiency in reading and mathematics by the end of grade 5 as determined on State assessments under § 4.51 (relating to State assessments) shall be afforded instructional opportunities to develop knowledge and skills necessary to achieve the proficient level.

§ 4.22. Middle level education.

(a) The middle level program ordinarily serves children who are approximately 11-14 years of age. School districts may modify the grouping of students based upon student needs identified in their strategic plans under § 4.13 (relating to strategic plans).

(b) Curriculum and instruction in the middle level program shall focus on mastery of academic subjects, the development of critical and creative thinking, information literacy, good health and encourage active participation in the school and community.

(c) Planned instruction in the following areas shall be provided to every student in the middle level program. Planned instruction may be provided as separate course or as an instructional unit within a course or other instructional activity:

(1) Language arts, integrating reading, writing, listening, speaking, literature and grammar.

(2) Mathematics, including mathematical reasoning, algebra and problem-solving.

(3) Science and technology, which involves active learning experiences and which may include laboratory experiments and, when appropriate, information about agriculture and agricultural science.

(4) Social studies (civics and government, economics, geography and history, including the history and cultures of the United States, Pennsylvania, and the world).

(5) Environment and ecology, including social, political and economic aspects of ecology and when appropriate, information about agriculture and agricultural sciences.

(6) Information skills, including access to traditional and electronic information sources, computer use and research.

(7) Health, safety and physical education, includes instruction in concepts, skills and societal factors which affect personal, family and community health and safety, nutrition, physical fitness, movement concepts, motor skill development, safety in physical activity settings, and the prevention of alcohol, chemical and tobacco abuse.

(8) The arts, including art, music, dance and theater.

(9) Career education, including exposure to various career options and the educational preparation necessary to achieve those options.

(10) Technology education, emphasizing practical application of academic skills and problem-solving experiences facilitated by technology.

(11) Family and consumer science, including principles of consumer behavior and basic knowledge of child health and child care skills.

(d) This section does not preclude the teaching of other planned instruction designed to achieve a school district's academic standards.

(e) School districts shall determine the most appropriate way to operate their middle level programs to achieve the purposes under subsection (b) and the academic standards in their strategic plans under § 4.13.

§ 4.23. High school education.

(a) Instruction in the high school program shall focus on the development of abilities needed to succeed in work and advanced education through a planned sequence of courses.

(b) Curriculum and instruction in the high school program shall provide all students opportunities to develop the skills of analysis, synthesis, evaluation and problem-solving, and information literacy.

(c) Planned instruction in the following areas shall be provided to every student in the high school program. Planned instruction may be provided as separate course or as an instructional unit within a course or other instructional activity:

(1) Language arts, integrating reading, writing, listening, speaking, literature and grammar.

(2) Mathematics, including problem-solving, mathematical reasoning, algebra, geometry and concepts of calculus.

(3) Science and technology, including participation in hands-on experiments and at least one laboratory science chosen from life sciences, earth and space sciences, chemical sciences, physical sciences and agricultural sciences.

(4) Social studies (civics and government, economics, geography and history including the history and cultures of the United States, Pennsylvania and the world).

(5) Environment and ecology, including scientific, social, political and economic aspects of ecology.

(6) The arts, including art, music, dance and theater.

(7) Use of applications of microcomputers and software, including word processing, database, spreadsheets and telecommunications; and information skills, including access to traditional and electronic information sources, computer use and research.

(8) Health, safety and physical education, includes instruction in concepts, skills and societal factors which affect personal, family and community health and safety, nutrition, physical fitness, movement concepts, motor

skill development, safety in physical activity settings, and the prevention of alcohol, chemical and tobacco abuse.

(9) Family and consumer science, including principles of consumer behavior and basic knowledge of child health and child care skills.

(d) The following planned instruction shall be made available to every student in the high school program:

(1) Vocational-technical education under §§ 4.3 and 4.31—4.35 (relating to definitions; and vocational education).

(2) Business education, including courses to assist students in developing business and information technology skills.

(3) World languages under § 4.25 (relating to languages).

(4) Technology education, incorporating technological problem-solving and the impacts of technology on individuals and society.

(e) College-level advanced placement courses may be offered as planned instruction in the high school curriculum.

(f) This section does not preclude the teaching of other planned instruction designed to achieve a school district's academic standards.

(g) School entities shall determine the most appropriate way to operate their high school programs to achieve the purposes under subsection (a) and the academic standards in their strategic plans under § 4.13 (relating to strategic plans).

§ 4.24. High school graduation requirements.

(a) Each school entity shall specify requirements for graduation in the strategic plan under § 4.13 (relating to strategic planning). Requirements shall include course completion and grades, completion of a culminating project, and results of State and local assessments of academic standards. To graduate students shall demonstrate proficiency in reading, writing and mathematics on State assessments administered in grade 11 or 12 or comparable local assessment under § 4.52 (relating to school entity assessment system). The purpose of the culminating project is to assure that students are able to apply, analyze, synthesize and evaluate information and communicate significant knowledge and understanding.

(b) As of ____ (*Editor's Note:* The blank refers to a date 3 years from the effective date of adoption of this proposal.) students who attain a score at the proficiency level or better on State assessments in reading, writing and mathematics administered in grade 11 or 12 shall be granted a Pennsylvania Seal of Proficiency.

(c) As of ____ (*Editor's Note:* The blank refers to a date 3 years from the effective date of adoption of this proposal.) students who attain a score at the advanced level of proficiency on State assessments in reading, writing and mathematics administered in grade 11 or 12 shall be granted a Pennsylvania Seal of Distinction.

(d) State Seals of Proficiency or Distinction shall be affixed to diplomas and noted on student transcripts.

(e) Each school entity shall describe in its strategic plan under § 4.13 how its planned instruction is designed to prepare students to meet the requirements of subsection (a).

(f) Children with disabilities who satisfactorily complete a special education program developed by an Indi-

vidualized Education Program team under the Individuals with Disabilities Education Act and this part shall be granted and issued a regular high school diploma by the school entity of residence. This subsection applies if the special education program of a child with a disability does not otherwise meet all requirements of this chapter.

§ 4.25. Languages.

(a) Every school district shall provide instruction in at least two languages in addition to English, at least one of which shall be a modern language, and at least one of which shall be offered in a minimum 4-year sequence in the secondary program (middle level and high school).

(b) World language instruction under subsection (a) may be offered beginning at any grade level, including the elementary grades.

(c) Students graduating from high school should demonstrate proficiency in a language other than English.

§ 4.26. ESOL.

Every school district shall provide a program for each student whose dominant language is not English for the purpose of facilitating the student's achievement of English proficiency and the academic standards under § 4.12 (relating to academic standards). Programs under this section shall include appropriate bilingual-bicultural or English as a second language (ESL) instruction.

§ 4.27. Physical education and athletics.

(a) Physical education shall be taught as required under §§ 4.21(e)(5) and (f)(8), 4.22(c)(7) and 4.23(c)(9) (relating to elementary education: primary and intermediate levels; middle level education; and high school education).

(b) The physical education program shall be adapted for students who are unable to participate in the regular physical education program.

(c) The physical education program shall provide co-educational instruction, except that separation by sex may be permitted in courses involving contact sports. Separation by sex may not be used to exclude students of either sex from participating in any physical education instruction.

(d) In addition to physical education instruction under subsections (a)—(c), students of both sexes shall have equal access in interscholastic and intramural athletic programs to all of the following:

- (1) School facilities.
- (2) Coaching and instruction.
- (3) Scheduling of practice time and games.
- (4) Number of activities at each level of competition.
- (5) Equipment, supplies and services.
- (6) Funding appropriate to the sport.

(e) School districts may sponsor coeducational teams in interscholastic and intramural sports programs.

(f) Interscholastic and intramural teams playing contact sports may be separated by sex, but this subsection may not be used to exclude students of either sex from participating in a sport.

§ 4.28. Special education.

(a) Under the Individuals with Disabilities Education Act and this part, children with disabilities shall be

provided an education which enables them to be involved in and progress in the general curriculum under this chapter.

(b) Students who are gifted as defined in this part shall be provided an education that enables them to participate in acceleration or enrichment, or both, as appropriate.

(c) The educational program provided to children with disabilities shall be in accordance with their Individualized Education Programs under the Individuals with Disabilities Education Act and this part, even if the Individualized Education Program does not otherwise meet all the requirements of this chapter.

(d) Planned courses for children with disabilities shall conform to the requirements established for planned courses in § 4.3 (relating to definitions) as it relates to planned instruction.

§ 4.29. HIV/AIDS.

(a) Instruction regarding prevention of human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS) shall be given for primary, intermediate, middle school and high school education and shall follow the requirements of subsections (b) and (c).

(b) Educational materials and instruction shall be determined by the local school district and be appropriate to the age group being taught. The program of instruction shall include information about the nature of the disease, the lack of a cure, the ways the disease is transmitted and how infection can be prevented. The school district may omit instruction in the elementary grades on the transmission of the disease through sexual activity. Programs discussing transmission through sexual activity shall stress that abstinence from sexual activity is the only completely reliable means of preventing sexual transmission. Programs shall stress that avoidance of illegal drug use is the only completely reliable means of preventing transmission through shared drug paraphernalia.

(c) A school district shall excuse a pupil from HIV/AIDS instruction when the instruction conflicts with the religious beliefs or principles of the pupil or parent or guardian of the pupil and when excusal is requested in writing. Prior to the commencement of instruction, a school district shall publicize that detailed curriculum outlines and curricular materials used in conjunction with the instruction are available to parents and guardians during normal school hours or at teacher-parent conferences. Curricular materials, if practical, shall be made available by the school district for home instruction use by a parent or guardian of a student excused from the district's HIV/AIDS instruction.

VOCATIONAL-TECHNICAL EDUCATION

§ 4.31. Vocational-technical education.

(a) Vocational-technical education courses, including applied science and technology, shall be developed in the planned instruction format and shall be accessible to all high school students attending those grades in which vocational-technical education courses are offered.

(b) Vocational-technical education courses may be taught at AVTSs or other high schools.

(c) Vocational-technical education programs shall consist of a series of planned academic and vocational-technical education courses that are articulated with one another so that knowledge, skills, attitudes and behaviors are taught in a systematic manner. When appropriate,

vocational-technical education programs may also include cooperative vocational-technical education and participation in vocational student organizations to develop leadership skills and positive attitudes.

(d) Vocational-technical education courses shall include content based upon occupational analysis, clearly stated performance objectives deemed critical to successful employment and assessment of student competencies based upon performance standards. In listing planned instruction in its strategic plan under § 4.13 (relating to strategic plans), a school entity shall indicate which courses meet the requirements of this section.

(e) The record of a student enrolled in a vocational-technical education program shall include the student's educational and occupational objectives and the results of the assessment of student competencies under subsection (d).

(f) Safety education, consisting of safety practices, accident prevention, occupational health habits and environmental concerns shall be integrated into the instruction and practices in vocational-technical education programs.

(g) School districts and AVTSs administering vocational-technical education programs shall develop written policies regarding admissions. Course announcements, guidance materials and other communications shall convey the philosophy of equal access to students considering enrolling in AVTSs and shall include a description of admissions policies. The policies shall assure that when admissions to AVTSs must be limited, the admissions shall be on a nondiscriminatory basis.

§ 4.32. Standards and reports.

(a) The Secretary is responsible for the promulgation of standards appropriate for implementing this subsection. Present standards, to the extent that they are inconsistent, are superseded by this chapter.

(b) The Secretary will report annually to the Board on the status of vocational-technical education programs, including tech-prep and apprenticeship programs. Reports will include numbers and types of programs, numbers of students, post-program status of students, Statewide competency standards and assessment information.

§ 4.33. Advisory committees.

(a) A school district or AVTS administering or planning to administer vocational-technical education programs shall appoint a local advisory committee. Membership on the committee shall consist of business and industry representatives, public sector employers, agriculture, labor organizations, community organizations, postsecondary education institutions and the general public. The appointed advisory committee shall meet at least once each year and shall give advice to the board and the administration concerning the program of the school, including its general philosophy, academic and other standards, strategic plans, course offerings, support services, safety requirements and the skill needs of employers. An advisory committee may serve multiple institutions where employment areas overlap.

(b) An administrative committee, composed of chief school administrators representing participating school districts, shall be included in the organization of each AVTS. The committee shall play an integral part in the development of the AVTS strategic plan under § 4.13 (relating to strategic plans) and advise the AVTS board and the administration concerning the educational program and policies of the school.

(c) An occupational advisory committee shall be established for each vocational-technical education program or cluster of related programs offered by a school district or AVTS. The committee shall meet at least once each year to advise the board, administration and staff on curriculum, equipment, instructional materials, safety requirements, program evaluation and other related matters and to verify that the programs meet industry standards and, if appropriate, licensing board criteria and that they prepare students with occupation related competencies.

§ 4.34. Programs and equipment.

(a) A satellite vocational-technical education program may be operated by an AVTS board in conformity with a memorandum of understanding adopted with the participating school district's board of school directors.

(b) Certified guidance personnel in each secondary school and AVTS shall be assigned responsibility to provide pupils with vocational-technical guidance services.

(c) Equipment will be deemed appropriate if it is compatible, insofar as practical, to that used in occupations or households for which vocational-technical education is provided.

§ 4.35. AVTSs

(a) AVTS attendance areas shall conform to the plan of the State Board of Vocational Education. Boards of school directors may petition the State Board for Vocational Education for attendance area assignment or reassignment.

(b) The following provisions apply to the establishment of AVTSs:

(1) Where more than one district constitutes an attendance area, the appropriate intermediate unit may, and upon the request of a school district shall, call for an election by the boards of school directors within the attendance area to determine if an AVTS shall be established.

(2) A school district within the attendance area may elect to participate in the establishment of the AVTS.

(3) Where a single school district constitutes an attendance area, the board of school directors of that district may establish and operate AVTSs and be considered an AVTS board.

(c) The following provisions apply to articles of agreement for the establishment and operation of AVTSs:

(1) The boards of school directors of the school districts electing to participate in the AVTS shall enter into a written agreement setting forth rights and obligations of the participating school districts.

(2) No change may be made in the articles of agreement under paragraph (1) without the consent of each participating school district by the affirmative vote of each board of school directors.

(3) No school district may withdraw from the articles of agreement under paragraph (1) without the consent of each participating school district.

SCHEDULING AND LEARNING OPTIONS

§ 4.41. Scheduling.

(a) Kindergarten programs shall provide each kindergarten student with at least 2 1/2 hours of instruction each day for the full school term unless the school district obtains prior Department approval for an alternative kindergarten program.

(b) A school district shall obtain approval of the Department prior to scheduling 1/2-day sessions other than in kindergarten under subsection (a).

(c) A school district shall obtain approval of the Department prior to establishing a new school or changing school organization.

(d) Planned instruction offered in summer school may be designed as credit or noncredit offerings.

§ 4.42. Grade structure.

This chapter does not require educational programs to be organized in traditional grades according to students' chronological ages or academic achievement levels.

ASSESSMENT

§ 4.51. State assessment system

(a) The State assessment system shall be designed to serve the following purposes:

(1) Provide students, parents, educators and citizens with an understanding of student and school performance.

(2) Determine the degree to which school programs enable students to attain proficiency of academic standards under § 4.12 (relating to academic standards).

(3) Provide results to school entities for consideration in the development of strategic plans under § 4.13 (relating to strategic plans).

(4) Provide information to State policymakers including the General Assembly and the Board on how effective schools are in promoting and demonstrating student proficiency of academic standards.

(5) Provide information to the general public on school performance.

(b) All State assessment instruments will be standards-based and criterion referenced and include essay or open-ended response items in addition to other item formats. The proportion of type of items will vary by grade level. Neither State assessments nor academic standards under § 4.12 (relating to academic standards) may require students to hold or express particular attitudes, values or beliefs. The Department will make samples of assessment questions, instrument formats, and scoring guides available to the public after each administration of State assessments. The criteria for judging performance on State assessments are as follows:

(1) Performance on State reading assessments shall be demonstrated by students' responses to comprehension questions about age-appropriate reading passages and by their written responses to in-depth comprehension questions about the passages.

(2) Performance on State mathematics assessments shall be demonstrated by students' responses to questions about grade-appropriate content and by the quality of their responses to questions which require a written solution to a problem.

(3) Performance on State writing assessments shall be demonstrated by the quality of students' written compositions on a variety of topics and modes of writing.

(4) Levels of proficiency shall be advanced, proficient, basic and below basic. In consultation with educators, students, parents and citizens, the Department will develop and recommend to the Board for its approval specific criteria for advanced, proficient, basic and below basic levels of performance.

(c) The Department will develop or cause to be developed State assessments based on academic standards in mathematics, reading and writing under § 4.12 (relating to academic standards) and contained in Appendix A. In developing assessments, the Department will consult with educators, students, parents and citizens regarding the specific methods of assessment. To ensure that information regarding student performance is available to parents and teachers State assessments developed under this section shall include student names. Individual test results shall be used in planning instruction only by parents, teachers, administrators and guidance counselors with a need to know based upon local board policy on testing and in reporting academic progress. The Department or other Commonwealth entities are prohibited from collecting individual student test scores, and may only collect aggregate test scores by school and district.

(d) Beginning in the 1998-99 school year, the State assessments shall be administered annually and shall include assessments of the State academic standards in mathematics and reading at grades 5, 8 and 11 and in writing at grades 6, 9 and 11. The purpose of the initial year of testing is to validate assessment instruments and to provide initial information to teachers and schools to inform the redesign of curricula and instructional strategies to enable students to achieve academic standards.

(e) Students not achieving proficiency in the initial administration of State assessments in grade 11 shall be provided one additional opportunity in grade 12 to demonstrate proficiency on State assessments.

(f) Expansion of the State assessment system will be authorized by the Board through a revision of this chapter.

(g) The Department will implement provisions for security of the State assessment system, including the following provisions:

(1) Action by a professional employe or commissioned officer which is willfully designed to divulge test questions, falsify student scores or in some other fashion compromise the integrity of the State assessment system as determined by the school district shall be subject to disciplinary action under sections 1259—1267 of the School Code (24 P. S. §§ 12-1259—12-1267).

(2) Cheating by students or employes other than those covered in paragraph (1) shall be subject to disciplinary action by the school district.

(3) Cheating or breaches of assessment security shall be reported to the Secretary as soon as detected.

(h) The Secretary has the authority to establish guidelines for the administration of the State assessment system.

(i) The Secretary will report each September to the Board and the General Assembly information and pertinent data relating to the State assessment system. The Secretary will also provide each school entity information and pertinent data for the school district and its students.

(j) Children with disabilities shall be included in the State assessment system, with appropriate accommodations, when necessary. As appropriate, the Commonwealth will develop guidelines for the participation of children with disabilities in alternate assessments for those children who cannot participate in the State assessment as determined by each child's Individualized Education Program team under the Individuals with Disabilities Education Act and this part.

§ 4.52. School entity assessment system.

(a) Each school entity shall design a school district assessment system to do the following:

(1) Determine the degree to which students are achieving academic standards under §§ 4.12 and 4.13(c)(3) (relating to academic standards; and strategic plans). The school entity shall provide assistance to students not attaining proficiency in academic standards and the assistance to be provided shall be indicated in the entity's strategic plan under § 4.13.

(2) Use assessment results to improve curriculum and instructional practices, to inform instructional strategies and to develop future strategic plans under § 4.13.

(3) Provide information requested by the Department regarding the achievement of academic standards, which does not include student names, identification numbers or individually identifiable information.

(4) Provide summary information including results of school district assessments under § 4.52 (relating to school district assessment) to the general public regarding the achievement of students, which does not include student names, identification numbers or individually identifiable information.

(b) The school entity assessment system shall be implemented no later than 1 year after its strategic plan or revision is approved by the board of school directors under § 4.13.

(c) The school entity assessment system shall be described in the district's strategic plan under § 4.13(b)(5).

(d) The school entity assessment system shall be designed to include a variety of assessment strategies which may include the following:

(1) Written work by students.

(2) Scientific experiments conducted by students.

(3) Works of art or musical, theatrical or dance performances by students.

(4) Other demonstrations, performances products or projects by students related to specific academic standards.

(5) Examinations developed by teachers to assess specific academic standards.

(6) Nationally-available achievement tests.

(7) Diagnostic assessments.

(8) Evaluations of portfolios of student work related to achievement of academic standards.

(9) Other measures as appropriate, which may include standardized tests.

(f) Individual test information shall be maintained in a student's educational record in a manner consistent with the requirements of section 438 of the Family Educational Rights and Privacy Act of 1974 (20 U.S.C.A. § 1232g) and 34 CFR Part 99 (relating to family educational rights and privacy).

(g) Children with disabilities shall be included in the State assessment system, with appropriate accommodations, when necessary. As appropriate, the Commonwealth will develop guidelines for the participation of children with disabilities in alternate assessments for those children who cannot participate in the State assessment as determined by each child's Individualized Education Program team under the Individuals with Disabilities Education Act and this part.

SCHOOL PROFILES

§ 4.61. School profiles.

(a) School profiles developed by the Secretary will include the following information, in addition to other information the Secretary deems appropriate:

- (1) Results of State assessments under § 4.51 (relating to State assessment system).
- (2) Results of school entity assessments under § 4.52 (relating to school entity assessment), which may not include student names, identification numbers or individually identifiable information.
- (3) School performance improvement goals based on State assessment results under § 4.13 (relating to strategic plans).
- (4) Class size.
- (5) Information about the instructional program.
- (6) Percentages of students who graduate or who drop out and the status of graduates the year after they leave high school.
- (7) Student attendance.
- (8) Teacher attendance.
- (9) Information about fiscal support of the school, school district or AVTS.

(b) In compiling school profiles under this chapter, the Department will provide school entities interpretive information to assist in using the profiles for strategic planning under § 4.13 (relating to strategic planning).

(c) The Secretary will prescribe procedures for reporting State assessment data to schools and communities.

PROVISIONS RELATING TO OTHER THAN PUBLIC SCHOOLS

§ 4.71. Certification by principal of nonpublic non-licensed school.

Elementary or secondary nonpublic nonlicensed schools, shall, within 30 days of beginning classes, file the following notarized certificate with the Secretary.

I certify that this school is a day school for the education of children in which the following mandated programs or courses of study are taught in the English language for a minimum of 180 days of instruction or a minimum of 450 hours of instruction in the kindergarten program, a minimum of 900 hours of instruction in the elementary schools and a minimum of 990 hours of instruction in the secondary schools: Elementary school level—English, including spelling, reading and writing, arithmetic, geography, the history of the United States and Pennsylvania, science, civics, including loyalty to the State and National Government [24 P. S. § 15-1511], safety education, and the humane treatment of birds and animals, health, including physical education and physiology, music and art. Secondary school level—art, English, health, mathematics, music, physical education, science and social studies (including U. S. and Pennsylvania history [24 P. S. § 16-1605]).

Name of School _____
 Location of School _____
 Mailing Address (If Different from Above) _____
 County _____ IU# _____
 Public School District in which school is located _____

Nonpublic Principal

(Signature of Principal)

Telephone Number: Area Code () _____

NOTARIZATION:

Return to: Division of Nonpublic and
 Private School Services
 Bureau of Community and Student Services
 Department of Education
 333 Market Street
 Harrisburg, PA 17126-0333

§ 4.72. Credentials other than the high school diploma.

The requirements for a Commonwealth secondary school diploma shall be as follows:

(1) The Commonwealth secondary school diploma may be issued to an applicant who is a resident of this Commonwealth and does not possess a secondary school diploma upon presentation of evidence of full matriculation and the satisfactory completion of a minimum of 1 full year or 30 semester hours of study at an accredited institution of postsecondary education.

(2) In addition to the provisions of paragraph (1), the Commonwealth secondary school diploma may be issued to an applicant who is a resident of this Commonwealth, does not possess a secondary school diploma and is not enrolled in a public, licensed private, registered accredited or licensed nonpublic secondary school upon earning a passing score as determined by the Department on the high school level tests of General Educational Development (GED). A person 18 years of age or older may qualify for GED testing upon request. A person between 16 and 18 years of age may qualify for GED testing upon the issuance of a court order or at the written request of one of the following:

- (i) An employer who requires a high school equivalency credential for job opportunities.
- (ii) An official of an accredited institution of postsecondary education which accepts applicants on the basis of GED test scores.
- (iii) A recruiting officer of a branch of the armed forces that requires a high school equivalency credential for entry of new recruits.
- (iv) The director of a State institution on behalf of residents, patients or inmates.

(3) The Department will not ordinarily issue a diploma until after the high school class of which the applicant was a member has been graduated. This restriction may be waived by the Department upon the recommendation of the school district for persons between 16 and 18 years of age who meet the higher education or GED requirements for the secondary school diploma.

§ 4.73. Correspondence schools.

An applicant 18 years of age or older shall be issued a Certificate of Preliminary Education upon presentation to the Department of evidence of the issuance of a high school diploma by an accredited private correspondence school licensed or approved by the State Board of Private Licensed Schools.

§ 4.74. Students in special situations.

(a) A foreign student without educational credentials may earn the Commonwealth secondary school diploma

by meeting the requirements under § 4.72 (relating to credentials other than the high school diploma).

(b) A graduate of a secondary school in another state which is not on an approved list of secondary schools may earn an appropriate credential by passing an examination administered by the education agency of that state or by its designee or by meeting the requirements for the Commonwealth secondary school diploma under § 4.72.

(c) Credit granted by a public school in this Commonwealth shall be accepted by all public schools and institutions in this Commonwealth upon the transfer of a student.

ENFORCEMENT AND IMPLEMENTATION

§ 4.81. Allegations of deficiencies.

(a) The Secretary will receive and investigate allegations of curriculum deficiencies from professional employees, commissioned officers, parents of students or other residents of a school district or AVTS.

(b) The Secretary will notify the school district or AVTS superintendent of allegations and may require the superintendent to submit one or more of the following:

- (1) Relevant descriptions of planned instruction.
- (2) A series of written articulated courses of instructional units.
- (3) Relevant student assessment information.
- (4) Information on staff assignments.
- (5) Other information pertinent to investigating a specific allegation.

(c) If the Secretary determines that a curriculum deficiency exists, the school district or AVTS shall be required to submit to the Secretary for approval a plan to correct the deficiency.

(d) Within 1 year of the implementation of a corrective action plan under subsection (c), the Secretary will review the actions taken to correct the deficiency. If the deficiency remains uncorrected, the Secretary will send a formal notice of deficiency to the school district or AVTS board of school directors, and the notice shall be announced at the school board meeting immediately following its receipt.

(e) If the school district or AVTS does not take appropriate actions to correct the deficiency after the notice of deficiency is announced, the Secretary will take action under State law.

§ 4.82. Exceptions.

(a) The Secretary may grant exceptions to specific provisions of this chapter when it is necessary to adapt them to the curriculum needs of individual school entities or to facilitate transition to the revised provisions of this chapter. Specific exception may be made for school districts which develop or implement academic standards that are comparable to or exceed those found in § 4.12 (relating to academic standards). Exceptions may be granted under the following conditions:

(1) The request for an exception shall be in writing and shall include relevant information supporting the need for the exception.

(2) The exception shall be valid for a limited term not to exceed 2 years.

(3) The request shall be made prior to initiating the action requiring approval and shall have the prior approval of the school entity's board of school directors.

(b) The Secretary will report annually to the Board on the status of requests for exceptions under this section.

§ 4.83. Implementation schedule.

(a) The initial strategic plans under § 4.13 (relating to strategic plans) shall be developed by a schedule to be determined by the Department. All plans addressing the requirements of this chapter shall be on file with the Department by September 30, 2001.

(b) In the school year in which a school entity submits its initial strategic plan under § 4.13, the school entity shall implement professional development, curriculum development and assessment development activities identified in the strategic plan and shall receive technical assistance from the Department.

APPENDIX A

Academic Standards for Reading, Writing, Speaking and Listening and

Academic Standards for Mathematics

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THE ACADEMIC STANDARDS

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II. INTRODUCTION

This document includes Reading, Writing, Speaking and Listening Standards:

- 1.1. Learning to Read Independently
- 1.2. Reading Critically in All Content Areas
- 1.3. Reading, Analyzing and Interpreting Literature
- 1.4. Types of Writing
- 1.5. Quality of Writing
- 1.6. Speaking and Listening
- 1.7. Characteristics and Function of the English Language
- 1.8. Research

The Reading, Writing, Speaking and Listening Standards describe what students should know and be able to do with the English Language at four grade levels (third, fifth, eighth and eleventh). The standards provide the targets for instruction and student learning essential for

success in all academic areas, not just language arts classrooms. Although the standards are not a curriculum or a prescribed series of activities, school entities will use them to develop a local school curriculum that will meet local students' needs.

The language arts—Reading, Writing, Speaking and Listening—are unique because they are processes that students use to learn and make sense of their world. Students do not read “reading”; they read about history, science, mathematics and other content areas as well as about topics for their interest and entertainment. Similarly, students do not write “writing”; they use written words to express their knowledge and ideas and to inform or entertain others.

Because of the unique nature of the language arts, all teachers in a school will use the Reading, Writing, Speaking and Listening Standards. The standards define the skills and strategies employed by effective readers and writers; therefore, all teachers will assist their students in learning them through multiple classroom situations in all the subject areas.

The Reading, Writing, Speaking and Listening standards also provide parents and community members with information about what students should know and be able to do as they progress through the educational program and at graduation. With a clearly defined target provided by the standards, parents, students, educators and community members become partners in learning success.

A glossary is included to assist the reader in understanding terminology contained in the standards.

1.1. Learning to Read Independently			
1.1.3. GRADE 3	1.1.5. GRADE 5	1.1.8. GRADE 8	1.1.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
A. Before reading identify the purposes and types of text (e.g., literary, informational).	A. Before reading establish the purpose for reading a type of text (literary, informational).	A. Before reading locate appropriate texts (literary, informational, documents) for an assigned purpose.	A. Before reading locate various texts, media and traditional resources for assigned and independent projects.
B. Preview the text formats (e.g., title, headings, chapters, and table of contents).	B. Select texts for a particular purpose using the format of the text as a guide.	B. Identify and use common organizational structures and graphic features to comprehend information.	B. Analyze the structure of informational materials explaining how authors used these to achieve their purposes.
C. During reading use knowledge of phonics, word analysis (e.g. root words, prefixes, and suffixes), syllabication, picture and context clues to decode and understand new words.	C. During reading use knowledge of phonics, syllabication, prefixes, suffixes, the dictionary or context clues to decode and understand new words. Use these words accurately in writing and speaking.	C. During reading use knowledge of root words as well as context clues and glossaries to understand specialized vocabulary in the content areas. Use these words accurately in speaking and writing.	C. During reading use knowledge of root words and words from literary works to recognize and understand the meaning of new words. Use these words accurately in speaking and writing.

1.1. Learning to Read Independently			
1.1.3. GRADE 3	1.1.5. GRADE 5	1.1.8. GRADE 8	1.1.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>D. Read text using self-monitoring comprehension strategies (e.g., predicting, revising predictions, rereading, using headings, graphics, charts, organization of text, adjusting reading rate).</p> <p>E. Acquire a reading vocabulary by identifying and correctly using words, (e.g. antonyms, synonyms, categories of words). Use a dictionary when appropriate.</p> <p>F. Understand the meaning of and use correctly new vocabulary learned in various subject areas.</p> <p>G. After reading demonstrate understanding and interpretation of both fiction and nonfiction text.</p> <ul style="list-style-type: none"> • Retell or summarize the major ideas, themes or procedures of the text. • Connect the new information or ideas in the text to known information. • Clarify ideas and understandings through rereading and discussion. • Make responsible assertions about the text by citing evidence from the text. 	<p>D. Identify the basic ideas and facts in text using strategies such as prior knowledge, illustrations and headings, and information from other sources to make predictions about text.</p> <p>E. Acquire a reading vocabulary by correctly identifying and using words related as synonyms, homophones and homographs and words related through roots, suffixes and/or prefixes. Use a dictionary or related reference.</p> <p>F. Identify, understand the meaning of and use correctly key vocabulary from various subject areas.</p> <p>G. After reading demonstrate understanding and interpretation of both fiction and nonfiction text.</p> <ul style="list-style-type: none"> • Summarize the major ideas, themes or procedures of the text. • Relate new information or ideas from the text to that learned through additional reading and media (e.g., films, audiotapes). • Clarify ideas and understandings through rereading and discussion. • Make responsible assertions about the ideas from the text by citing evidence. • Extend ideas found in the text. 	<p>D. Identify basic facts and ideas in text using strategies such as recalling genre characteristics, setting a purpose for reading or generating essential questions as aids to comprehension and clarifying understanding through rereading and discussion.</p> <p>E. Expand a reading vocabulary by identifying and correctly using idioms and words with literal and figurative meanings. Use a dictionary or related reference.</p> <p>F. Understand the meaning of and apply key vocabulary across the various subject areas.</p> <p>G. After reading demonstrate understanding and interpretation of both fiction and nonfiction text, including public documents.</p> <ul style="list-style-type: none"> • Make, and support with evidence, assertions about texts. • Compare and contrast texts using themes, settings, characters and ideas. • Make extensions to related ideas, topics or information. • Describe the context of a document. • Analyze the positions, arguments and evidence in public documents. 	<p>D. Identify, describe, evaluate and synthesize the essential ideas in text. Assess those reading strategies that were most effective in learning from a variety of texts.</p> <p>E. Establish a reading vocabulary by identifying and correctly using new words acquired through the study of their relationships to other words. Use a dictionary or related reference.</p> <p>F. Understand the meaning of and apply key vocabulary across the various subject areas.</p> <p>G. After reading demonstrate understanding and interpretation of both fiction and nonfiction text, including public documents.</p> <ul style="list-style-type: none"> • Make, and support with evidence, assertions about texts. • Compare and contrast texts using themes, settings, characters and ideas. • Make extensions to related ideas, topics or information. • Assess the validity of the document based on context. • Analyze the positions, arguments and evidence in public documents. • Evaluate the strategies of the author. • Critique public documents to identify strategies common in public discourse.

1.1. Learning to Read Independently			
1.1.3. GRADE 3	1.1.5. GRADE 5	1.1.8. GRADE 8	1.1.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>H. Demonstrate fluency and comprehension in reading.</p> <ul style="list-style-type: none"> • Read familiar materials aloud with accuracy. • Self-correct mistakes. • Use appropriate rhythm, flow, meter and pronunciation. • Read a variety of genres and types of text. • Demonstrate comprehension (Standard 1.1.3.G.). <p>(Recommend: 25 books/year)</p>	<p>H. Demonstrate fluency and comprehension in reading.</p> <ul style="list-style-type: none"> • Read familiar materials aloud with accuracy. • Self-correct mistakes. • Use appropriate rhythm, flow, meter and pronunciation. • Read a variety of genres and types of text. • Demonstrate comprehension (Standard 1.1.5.G.). <p>(Recommend: 25 books/year)</p>	<p>H. Demonstrate fluency and comprehension in reading.</p> <ul style="list-style-type: none"> • Read familiar materials aloud with accuracy. • Self-correct mistakes. • Use appropriate rhythm, flow, meter and pronunciation. • Read a variety of genres and types of text. • Demonstrate comprehension (Standard 1.1.8.G.). <p>(Recommend: 25 books/year)</p>	<p>H. Demonstrate fluency and comprehension in reading.</p> <ul style="list-style-type: none"> • Read familiar materials aloud with accuracy. • Self-correct mistakes. • Use appropriate rhythm, flow, meter and pronunciation. • Read a variety of genres and types of text. • Demonstrate comprehension (Standard 1.1.11.G.). <p>(Recommend: 25 books/year)</p>

1.2. Reading Critically in All Content Areas			
1.2.3. GRADE 3	1.2.5. GRADE 5	1.2.8. GRADE 8	1.2.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>A. Read and understand essential content of informational texts and documents in all academic areas.</p> <ul style="list-style-type: none"> • Differentiate fact from opinion within text. • Distinguish between essential and nonessential information within a text. • Make inferences from text when studying a topic (e.g., science, social studies) and draw conclusions based on text. • Analyze text organization and content to derive meaning from text using established criteria. 	<p>A. Read and understand essential content of informational texts and documents in all academic areas.</p> <ul style="list-style-type: none"> • Differentiate fact from opinion across texts. • Distinguish between essential and nonessential information across a variety of texts, identifying stereotypes and exaggeration where present. • Make inferences about similar concepts in multiple texts and draw conclusions. • Evaluate text organization and content to determine the author's purpose and effectiveness. 	<p>A. Read and understand essential content of informational texts and documents in all academic areas.</p> <ul style="list-style-type: none"> • Differentiate fact from opinion utilizing resources that go beyond traditional text to electronic media, newspapers, magazines and periodicals. • Distinguish between essential and nonessential information across texts and going beyond texts to a variety of media; identify bias and propaganda where present. • Draw inferences based on a variety of information sources. • Evaluate text organization and content to determine the author's purpose and effectiveness according to the author's theses, accuracy, and thoroughness. 	<p>A. Read and understand essential content of informational texts and documents in all academic areas.</p> <ul style="list-style-type: none"> • Differentiate fact from opinion across a variety of texts, by using complete and accurate information, coherent arguments and points of view. • Distinguish between essential and nonessential information across a variety of sources, identifying the use of proper references or authorities and propaganda techniques where present. • Use teacher and student established criteria for making decisions and drawing conclusions. • Evaluate text organization and content to determine the author's purpose and effectiveness according to the author's theses, accuracy, thoroughness, logic and reasoning.

1.2. Reading Critically in All Content Areas			
1.2.3. GRADE 3	1.2.5. GRADE 5	1.2.8. GRADE 8	1.2.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>B. Use and understand a variety of media and evaluate the quality of material produced.</p> <ul style="list-style-type: none"> • Use electronic media for research. • Identify techniques used in television and use the knowledge to distinguish between facts and misleading information. • Develop media project (e.g., script, play, audiotape) for a targeted audience. <p>C. Produce work in at least one literary genre that follows the conventions of the genre.</p>	<p>B. Use and understand a variety of media and evaluate the quality of material produced.</p> <ul style="list-style-type: none"> • Use a variety of media such as computerized card catalogues and encyclopedias for research. • Evaluate the role of media as a source of both entertainment and information. • Design and develop media project (e.g., script, play, audiotape) for a targeted audience. <p>C. Produce work in at least one literary genre that follows the conventions of the genre.</p>	<p>B. Use and understand a variety of media and evaluate the quality of material produced.</p> <ul style="list-style-type: none"> • Compare and analyze how different media offer a unique perspective on the information presented. • Analyze the techniques of particular media messages and their effect on a targeted audience. • Use, design and develop media to expand understanding (e.g., authors and works from a particular historical period). <p>C. Produce work in at least one literary genre that follows the conventions of the genre.</p>	<p>B. Use and understand a variety of media and evaluate the quality of material produced.</p> <ul style="list-style-type: none"> • Select appropriate electronic media for research and evaluate the quality of the information received. • Explain how the techniques used in electronic media modify traditional forms of discourse for different purposes. • Use, design and develop media to demonstrate understanding (e.g., a major writer or literary period or movement). <p>C. Produce work in at least one literary genre that follows the conventions of the genre.</p>

1.3. Reading, Analyzing and Interpreting Literature			
1.3.3. GRADE 3	1.3.5. GRADE 5	1.3.8. GRADE 8	1.3.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>A. Read and understand works of literature.</p> <p>B. Identify literary elements in stories describing characters, setting and plot.</p> <p>C. Identify literary devices in stories.</p> <ul style="list-style-type: none"> • Rhyme • Rhythm • Personification 	<p>A. Read and understand works of literature.</p> <p>B. Compare the use of literary elements within and among texts, including characters, setting, plot, theme, and point of view.</p> <p>C. Describe how the author uses literary devices to convey meaning.</p> <ul style="list-style-type: none"> • Sound techniques (e.g., rhyme, rhythm, meter, alliteration) • Figurative language (e.g., personification, simile, metaphor, hyperbole) 	<p>A. Read and understand works of literature.</p> <p>B. Analyze the use of literary elements by an author including characterization, setting, plot, theme, point of view, tone, and style.</p> <p>C. Analyze the effect of various literary devices.</p> <ul style="list-style-type: none"> • Sound techniques (e.g., rhyme, rhythm, meter, alliteration) • Figurative language (e.g., personification, simile, metaphor, hyperbole, illusion) 	<p>A. Read and understand works of literature.</p> <p>B. Analyze the relationships, uses and effectiveness of literary elements used by one or more authors in similar genres including characterization, setting, plot, theme, point of view, tone, and style.</p> <p>C. Analyze the effectiveness, in terms of literary quality, of the author's use of literary devices.</p> <ul style="list-style-type: none"> • Sound techniques (e.g., rhyme, rhythm, meter, alliteration) • Figurative language (e.g., personification, simile, metaphor, hyperbole, irony, satire) • Literary structures (e.g., foreshadowing, flashbacks, progressive and digressive time)

1.3. Reading, Analyzing and Interpreting Literature			
1.3.3. GRADE 3	1.3.5. GRADE 5	1.3.8. GRADE 8	1.3.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
D. Identify the structures in poetry (e.g., pattern books, predictable books and nursery rhythms).	D. Identify and respond to the effects of sound and structure in poetry (e.g., alliteration, rhyme, verse form).	D. Identify poetic forms (e.g., ballad, sonnet, couplet).	D. Analyze and evaluate in poetry the appropriateness of diction and figurative language (e.g., irony, understatement, overstatement and paradox).
E. Identify the structures in drama (e.g., dialogue, story enactment, acts and scenes).	E. Analyze drama as information source, entertainment, persuasion or transmitter of culture.	E. Analyze drama to determine the reasons for a character's actions, taking into account the situation and basic motivation of the character.	E. Analyze how a scriptwriter's use of words creates tone and mood, how choice of words advances the theme or purpose of the work.
F. Read and respond to nonfiction and fiction, including poetry and drama.	F. Read and respond to nonfiction and fiction, including poetry and drama.	F. Read and respond to nonfiction and fiction, including poetry and drama.	F. Read and respond to nonfiction and fiction, including poetry and drama.

1.4. Types of Writing			
1.4.3. GRADE 3	1.4.5. GRADE 5	1.4.8. GRADE 8	1.4.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
A. Write narrative pieces (e.g., stories, poems and plays). <ul style="list-style-type: none"> • Include detailed descriptions of people, places and things. • Use relevant illustrations. • Include literary elements (Standard 1.3.3.B.). 	A. Write poems, plays and multi-paragraph stories. <ul style="list-style-type: none"> • Include detailed descriptions of people, places and things. • Use relevant illustrations. • Utilize dialogue. • Apply literary conflict. • Include literary elements (Standard 1.3.5.B). • Use literary devices (Standard 1.3.5.C.). 	A. Write short stories, poems and plays. <ul style="list-style-type: none"> • Include varying organizational methods. • Use relevant illustrations. • Utilize dialogue. • Apply literary conflict. • Include literary elements (Standard 1.3.8.B.). • Use literary devices (Standard 1.3.8.C.). 	A. Write short stories, poems and plays. <ul style="list-style-type: none"> • Include varying organizational methods. • Use relevant illustrations. • Utilize dialogue. • Apply literary conflict. • Include varying characteristics (e.g., from limerick to epic, from whimsical to dramatic). • Include literary elements (Standard 1.3.11.B.). • Use literary devices (Standard 1.3.11.C.).
B. Write informational pieces (e.g., descriptions, letters, reports and instructions), using illustrations when relevant.	B. Write multi-paragraph informational pieces (e.g., essays, descriptions, letters, reports and instructions). <ul style="list-style-type: none"> • Include cause and effect. • Develop a problem and solution when appropriate to the topic. • Use relevant graphics such as maps, charts, graphs, tables, illustrations and photographs. 	B. Write multi-paragraph informational pieces (e.g., letters, descriptions, reports, instructions, essays, articles and interviews). <ul style="list-style-type: none"> • Include cause and effect. • Develop a problem and solution when appropriate to the topic. • Use relevant graphics (e.g., maps, charts, graphs, tables, illustrations and photographs). • Use primary and secondary sources. 	B. Write complex informational pieces (e.g., research papers, analyses, evaluations, and essays). <ul style="list-style-type: none"> • Include a variety of methods to develop the main idea. • Use precise language and specific detail. • Include cause and effect. • Use relevant graphics (e.g., maps, charts, graphs, tables, illustrations and photographs). • Use primary and secondary sources.

1.4. Types of Writing			
1.4.3. GRADE 3	1.4.5. GRADE 5	1.4.8. GRADE 8	1.4.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
C. Write an opinion and support it with facts.	C. Write persuasive pieces with a clearly stated position or opinion and supporting detail, citing sources when needed.	C. Write persuasive pieces. <ul style="list-style-type: none"> • Include a clearly stated position or opinion. • Include convincing, elaborated and properly cited evidence. • Develop reader interest. • Anticipate and counter reader concerns and arguments. D. Maintain a written record of activities, course work, experience, honors, and interests.	C. Write persuasive pieces. <ul style="list-style-type: none"> • Include a clearly stated position or opinion. • Include convincing, elaborated and properly cited evidence. • Develop reader interest. • Anticipate and counter reader concerns and arguments. • Include a variety of methods to advance the argument or position. D. Maintain a written record of activities, course work, experience, honors, and interests. E. Write a personal resumé.

1.5. Quality of Writing			
1.5.3. GRADE 3	1.5.5. GRADE 5	1.5.8. GRADE 8	1.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
A. Write with a sharp, distinct focus identifying topic, task and audience. B. Write using well-developed content appropriate for the topic. <ul style="list-style-type: none"> • Gather and organize information. • Write a series of related sentences or paragraphs with one central idea. • Incorporate details relevant and appropriate to the topic. 	A. Write with a sharp, distinct focus identifying topic, task and audience. B. Write using well-developed content appropriate for the topic. <ul style="list-style-type: none"> • Gather, organize and select the most effective information appropriate for the topic, task and audience. • Write paragraphs that have a topic sentence and supporting details. 	A. Write with a sharp, distinct focus. <ul style="list-style-type: none"> • Identify topic, task and audience. • Establish a single point of view. B. Write using well-developed content appropriate for the topic. <ul style="list-style-type: none"> • Gather, determine validity and reliability of and organize information. • Employ the most effective format for purpose and audience. • Write paragraphs that have details and information specific to the topic and relevant to the focus. 	A. Write with a sharp, distinct focus. <ul style="list-style-type: none"> • Identify topic, task and audience. • Establish and maintain a single point of view. B. Write using well-developed content appropriate for the topic. <ul style="list-style-type: none"> • Gather, determine validity and reliability of, analyze and organize information. • Employ the most effective format for purpose and audience. • Write fully developed paragraphs that have details and information specific to the topic and relevant to the focus.

1.5. Quality of Writing			
1.5.3. GRADE 3	1.5.5. GRADE 5	1.5.8. GRADE 8	1.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>C. Write with controlled and/or subtle organization.</p> <ul style="list-style-type: none"> • Sustain a logical order. • Include a recognizable beginning, middle and end. <p>D. Write with an awareness of the stylistic aspects of composition.</p> <ul style="list-style-type: none"> • Use sentences of differing lengths and complexities. • Use descriptive words and action verbs. <p>E. Revise writing to improve detail and order by identifying missing information and determining if ideas follow logically.</p> <p>F. Edit writing using the conventions of language.</p> <ul style="list-style-type: none"> • Spell common, frequently used words correctly. • Use capital letters correctly (first word in sentences, proper nouns, pronoun "I"). • Punctuate correctly (period, exclamation point, question mark, commas in a series). • Use nouns, pronouns, verbs, adjectives, adverbs and conjunctions properly. • Use complete sentences (simple, compound, declarative, interrogative, exclamatory and imperative). 	<p>C. Write with controlled and/or subtle organization.</p> <ul style="list-style-type: none"> • Sustain a logical order within sentences and between paragraphs using meaningful transitions. • Include an identifiable introduction, body and conclusion. <p>D. Write with an understanding of the stylistic aspects of composition.</p> <ul style="list-style-type: none"> • Use different types and lengths of sentences. • Use precise language including adjectives, adverbs, action verbs and specific details that convey the writer's meaning. • Develop and maintain a consistent voice. <p>E. Revise writing to improve organization and word choice; check the logic, order of ideas and precision of vocabulary.</p> <p>F. Edit writing using the conventions of language.</p> <ul style="list-style-type: none"> • Spell common, frequently used words correctly. • Use capital letters correctly • Punctuate correctly (period, exclamation point, question mark, commas, quotation marks, apostrophe). • Use nouns, pronouns, verbs, adjectives, adverbs, conjunctions, prepositions and interjections properly. • Use complete sentences (simple, compound, declarative, interrogative, exclamatory and imperative). 	<p>C. Write with controlled and/or subtle organization.</p> <ul style="list-style-type: none"> • Sustain a logical order within sentences and between paragraphs using meaningful transitions. • Establish topic and purpose in the introduction. • Reiterate the topic and purpose in the conclusion. <p>D. Write with an understanding of the stylistic aspects of composition.</p> <ul style="list-style-type: none"> • Use different types and lengths of sentences. • Use tone and voice through the use of precise language. <p>E. Revise writing after rethinking logic or organization and rechecking central idea, content, paragraph development, level of detail, style, tone and word choice.</p> <p>F. Edit writing using the conventions of language.</p> <ul style="list-style-type: none"> • Spell common, frequently used words correctly. • Use capital letters correctly. • Punctuate correctly (period, exclamation point, question mark, commas, quotation marks, apostrophe, colon, semicolon, parentheses). • Use nouns, pronouns, verbs, adjectives, adverbs, conjunctions prepositions and interjections properly. • Use complete sentences (simple, compound, complex, declarative, interrogative, exclamatory and imperative). 	<p>C. Write with controlled and/or subtle organization.</p> <ul style="list-style-type: none"> • Sustain a logical order throughout the piece. • Include an effective introduction and conclusion. <p>D. Write with a command of the stylistic aspects of composition.</p> <ul style="list-style-type: none"> • Use different types and lengths of sentences. • Use precise language. <p>E. Revise writing to improve style, word choice, sentence variety and subtlety of meaning after rethinking how questions of purpose, audience and genre have been addressed.</p> <p>F. Edit writing using the conventions of language.</p> <ul style="list-style-type: none"> • Spell all words correctly. • Use capital letters correctly. • Punctuate correctly (period, exclamation point, question mark, commas, quotation marks, apostrophe, colon, semicolon, parentheses, hyphen, brackets, ellipsis). • Use nouns, pronouns, verbs, adjectives, adverbs, conjunctions, prepositions and interjections properly. • Use complete sentences (simple, compound, complex, declarative, interrogative, exclamatory and imperative).

1.5. Quality of Writing			
1.5.3. GRADE 3	1.5.5. GRADE 5	1.5.8. GRADE 8	1.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
G. Present and/or defend written work for publication when appropriate.	G. Present and/or defend written work for publication when appropriate.	G. Present and/or defend written work for publication when appropriate.	G. Present and/or defend written work for publication when appropriate.

1.6. Speaking and Listening			
1.6.3. GRADE 3	1.6.5. GRADE 5	1.6.8. GRADE 8	1.6.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>A. Listen to others.</p> <ul style="list-style-type: none"> • Ask questions as an aid to understanding. • Distinguish fact from opinion. <p>B. Listen to a selection of literature (fiction and/or nonfiction).</p> <ul style="list-style-type: none"> • Relate it to similar experiences. • Predict what will happen next. • Retell a story in chronological order. • Recognize character and tone. • Identify and define new words and concepts. <p>C. Speak using skills appropriate to formal speech situations.</p> <ul style="list-style-type: none"> • Use appropriate volume. • Pronounce most words accurately. • Pace speech so that it is understandable. • Demonstrate an awareness of audience. 	<p>A. Listen to others.</p> <ul style="list-style-type: none"> • Ask pertinent questions. • Distinguish relevant information, ideas and opinions from those that are irrelevant. • Take notes when prompted. <p>B. Listen to a selection of literature (fiction and/or nonfiction).</p> <ul style="list-style-type: none"> • Relate it to what is known. • Predict the result of the story actions. • Retell actions of the story in sequence, explain the theme, and describe the characters and setting. • Identify and define new words and concepts. • Summarize the selection. <p>C. Speak using skills appropriate to formal speech situations.</p> <ul style="list-style-type: none"> • Use complete sentences. • Pronounce words correctly. • Use appropriate volume. • Pace speech so that it is understandable. • Adjust content for different audiences (e.g., fellow classmates, parents). • Speak with a purpose in mind. 	<p>A. Listen to others.</p> <ul style="list-style-type: none"> • Ask probing questions. • Analyze information, ideas and opinions to determine relevancy. • Take notes when needed. <p>B. Listen to selections of literature (fiction and/or nonfiction).</p> <ul style="list-style-type: none"> • Relate them to previous knowledge. • Predict content/events. • Summarize events and identify the significant points. • Identify and define new words and concepts. • Analyze the selections. <p>C. Speak using skills appropriate to formal speech situations.</p> <ul style="list-style-type: none"> • Use complete sentences. • Pronounce words correctly. • Adjust volume to purpose and audience. • Adjust pace to convey meaning. • Add stress (emphasis) and inflection to enhance meaning. 	<p>A. Listen to others.</p> <ul style="list-style-type: none"> • Ask clarifying questions. • Synthesize why information, ideas and opinions are relevant or irrelevant. • Take notes. <p>B. Listen to selections of literature (fiction and/or nonfiction).</p> <ul style="list-style-type: none"> • Relate them to previous knowledge. • Predict solutions to identified problems. • Summarize and reflect on what has been heard. • Identify and define new words and concepts. • Analyze and synthesize the selections relating them to other selections heard or read. <p>C. Speak using skills appropriate to formal speech situations.</p> <ul style="list-style-type: none"> • Use a variety of sentence structures to add interest to a presentation. • Pace the presentation according to audience and purpose. • Adjust stress, volume, and inflection to provide emphasis to ideas or to influence the audience.

1.6. Speaking and Listening			
1.6.3. GRADE 3	1.6.5. GRADE 5	1.6.8. GRADE 8	1.6.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>D. Contribute to discussions.</p> <ul style="list-style-type: none"> • Ask relevant questions. • Respond with appropriate information or opinions to questions asked. • Listen to and acknowledge the contributions of others. • Display appropriate turn-taking behaviors. <p>E. Participate in small and large group discussions and presentations.</p> <ul style="list-style-type: none"> • Participate in everyday conversation. • Give oral readings. • Deliver short reports (e.g., Show-and-Tell, field trip summary). • Conduct short interviews. • Give simple directions and explanations. • Report an emergency. 	<p>D. Contribute to discussions.</p> <ul style="list-style-type: none"> • Ask relevant questions. • Respond with relevant information or opinions to questions asked. • Listen to and acknowledge the contributions of others. • Adjust involvement to encourage equitable participation. • Give reasons for opinions. • Summarize, when prompted. <p>E. Participate in small and large group discussions and presentations.</p> <ul style="list-style-type: none"> • Participate in everyday conversation. • Present an oral reading. • Deliver research reports. • Conduct interviews. • Plan and participate in group presentations. • Contribute to informal debates. 	<p>D. Contribute to discussions.</p> <ul style="list-style-type: none"> • Ask relevant, probing questions. • Respond with relevant information, ideas or gives reasons in support of opinions expressed. • Listen to and acknowledge the contributions of others. • Adjust tone and involvement to encourage equitable participation. • Clarify, illustrate or expand on a response when asked. • Present support for opinions. • Paraphrase and summarize, when prompted. <p>E. Participate in small and large group discussions and presentations.</p> <ul style="list-style-type: none"> • Initiate everyday conversation. • Select a topic and present an oral reading. • Conduct interviews as part of the research process. • Organize and participate in informal debates. 	<p>D. Contribute to discussions.</p> <ul style="list-style-type: none"> • Ask relevant, clarifying questions. • Respond with relevant information or opinions to questions asked. • Listen to and acknowledge the contributions of others. • Adjust tone and involvement to encourage equitable participation. • Facilitate total group participation. • Introduce relevant, facilitating information, ideas and opinions to enrich the discussion. • Paraphrase and summarize as needed. <p>E. Participate in small and large group discussions and presentations.</p> <ul style="list-style-type: none"> • Initiate everyday conversation. • Select and present an oral reading on an assigned topic. • Conduct interviews. • Participate in a formal interview (e.g., for job, college). • Organize and participate in informal debate around a specific topic. • Use evaluation guides (National Issues Forum, Toastmasters) to evaluate group discussion (e.g., of peers, on television).

1.6. Speaking and Listening			
1.6.3. GRADE 3	1.6.5. GRADE 5	1.6.8. GRADE 8	1.6.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>F. Use media for learning purposes.</p> <ul style="list-style-type: none"> • Explain the importance of television, radio, film, and Internet in the lives of people. • Explain how advertising sells products. • Show or explain what was learned (e.g., audiotape, computer download). 	<p>F. Use media for learning purposes.</p> <ul style="list-style-type: none"> • Compare information received on television with that received on radio or in newspapers. • Access information on the Internet. • Discuss the reliability of information received on Internet sources. • Explain how film can represent either accurate versions or fictional versions of the same event. • Explain the role of advertisers in the media. • Use a variety of images and sound to create an effective presentation on a topic. 	<p>F. Use media for learning purposes.</p> <ul style="list-style-type: none"> • Describe how the media provides information that is sometimes accurate, sometimes biased based on a point of view or by the opinion or beliefs of the presenter. • Analyze the role of advertising in the media. • Create a multi-media (e.g., film, music, computer-graphic, verbal) presentation for display or transmission. 	<p>F. Use media for learning purposes.</p> <ul style="list-style-type: none"> • Use various forms of media to elicit information to make a student presentation, complete class assignments and projects. • Evaluate the role of media in focusing attention and forming opinions. • Create a multi-media (e.g., film, music, computer-graphic, verbal) presentation for display or transmission that demonstrates an understanding of a specific topic or issue or teaches others about it.

1.7. Characteristics and Functions of the English Language			
1.7.3. GRADE 3	1.7.5. GRADE 5	1.7.8. GRADE 8	1.7.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>A. Identify words from other languages that are commonly used English words.</p> <p>B. Identify variations in the dialogues of literary characters and relate them to differences in occupation or geographical location.</p>	<p>A. Identify words from other languages that are commonly used English words. Use a dictionary to find the meaning and origin of these words.</p> <p>B. Identify differences in formal and informal speech (e.g., dialect, slang and jargon).</p> <p>C. Identify word meanings that have changed over time (e.g., cool mouse).</p>	<p>A. Describe the origins and meanings of common, learned and foreign words used frequently in English language (e.g., carte blanche, faux pas).</p> <p>B. Analyze the role and place of standard American English in speech, writing, and literature.</p> <p>C. Identify new words that have been added to the English language over time.</p>	<p>A. Describe the influence of historical events on the English language.</p> <p>B. Analyze when differences in language are a source of negative or positive stereotypes among groups.</p> <p>C. Explain and evaluate the role and influence of the English language within and across countries.</p>

1.8. Research			
1.8.3. GRADE 3	1.8.5. GRADE 5	1.8.8. GRADE 8	1.8.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>			
<p>A. Select a topic for research.</p> <p>B. Locate information using appropriate sources and strategies.</p> <ul style="list-style-type: none"> Locate resources for a particular task (e.g., newspapers, dictionary). Select sources (e.g., dictionaries, encyclopedias, interviews to write a family history, observations and electronic media). Use table of contents, key words, and guide words. Use traditional and electronic search tools. <p>C. Organize and present the main ideas from the research.</p> <ul style="list-style-type: none"> Take notes from sources using a structured format. Summarize, orally or in writing, the main ideas. 	<p>A. Select and refine a topic for research.</p> <p>B. Locate information using appropriate sources and strategies.</p> <ul style="list-style-type: none"> Evaluate the usefulness and qualities of the sources. Select appropriate sources (e.g., dictionaries, encyclopedias, other reference materials, interviews, observations, and computer databases). Use table of contents, indices, key words, cross-references and appendices. Use traditional and electronic search tools. <p>C. Organize and present the main ideas from the research.</p> <ul style="list-style-type: none"> Take notes from sources using a structured format. Present the topic using relevant information. Credit sources using a structured format (e.g., author, title). 	<p>A. Select and refine a topic for research.</p> <p>B. Locate information using appropriate sources and strategies.</p> <ul style="list-style-type: none"> Determine valid resources for researching the topic, including primary and secondary sources. Evaluate the importance and quality of the sources. Select essential sources (e.g., dictionaries, encyclopedias, other reference materials, interviews, observations, and computer databases). Use table of contents, indices, key words, cross-references and appendices. Use traditional and electronic search tools. <p>C. Organize, summarize and present the main ideas from the research.</p> <ul style="list-style-type: none"> Identify the steps necessary to carry out a research project. Take relevant notes from sources. Develop a thesis statement based on the research. Give precise, formal credit for others' ideas, images or information using a standard method of documentation. Use formatting techniques to create an understandable presentation for the designated audience. 	<p>A. Select and refine a topic for research.</p> <p>B. Locate information using appropriate sources and strategies.</p> <ul style="list-style-type: none"> Determine valid resources for researching the topic, including primary and secondary sources. Evaluate the importance and quality of the sources. Select sources appropriate to the breadth and depth of the research (e.g., dictionaries, thesauruses, other reference materials, interviews, observations, and computer databases). Use table of contents, indices, key words, cross references, and appendices. Use traditional and electronic search tools. <p>C. Organize, summarize, and present the main ideas from the research.</p> <ul style="list-style-type: none"> Take notes relevant to the research topic. Develop a thesis statement based on the research. Anticipate readers' problems or misunderstandings. Give precise, formal credit for others' ideas, images or information using a standard method of documentation. Use formatting techniques (e.g., headings, graphics) to aid reader understanding.

III. GLOSSARY

- Alliteration:** The repetition of initial consonant sounds in neighboring words.
- Allusion:** A reference in literature to a familiar person, place or event.
- Analysis:** The process or result of identifying the parts of a whole and their relationships to one another.
- Antonym:** A word that is the opposite of another word.
- Characterization:** The method an author uses to reveal his characters and their various personalities.
- Compare:** A literary technique of placing together characters, situations or ideas to show common or differing features.
- Context clues:** Information from the reading that identifies a word or group of words.

Conventions of Language:	Mechanics, usage, and sentence completeness.
Evaluation:	Examine and judge carefully.
Figurative language:	Language that cannot be taken literally since it was written to create a special effect or feeling.
Fluency:	The clear, easy, written or spoken expression of ideas. Freedom from word-identification problems that might hinder comprehension in silent reading or the expression of ideas in oral reading.
Focus:	The center of interest or attention.
Genre:	A category used to classify literary works, usually by form, technique or content. Example: prose, poetry.
Graphic organizer:	A diagram or pictorial device that shows relationships.
Homophone:	A word that is pronounced the same, but that has different meaning. Example: hair/hare, scale (fish)/scale (musical).
Hyperbole:	An exaggeration or overstatement. Example: <i>I was so embarrassed I could have died.</i>
Idiomatic language:	An expression peculiar to itself grammatically or that cannot be understood if taken literally. Example: <i>Let's get on the ball.</i>
Irony:	Using a word or phrase to mean the exact opposite of its literal or usual meaning.
Literary conflict:	The struggle that grows out of the interplay of the two opposing forces in a plot.
Literary elements:	The essential techniques used in literature, such as characterization, setting, plot, and theme.
Literary devices:	Tools used by the author to enliven and provide voice to the writing, such as dialogue and alliteration.
Literary structures:	The author's method of organizing text, such as foreshadowing and flashbacks.
Metaphor:	Comparing of two unlike things in which no words of comparison (<i>like</i> or <i>as</i>) are used. Example: <i>That new kid in class is really a squirrel.</i>
Meter:	The repetition of stressed and unstressed syllables in a line of poetry.
Narrative:	A story, actual or fictional, expressed orally or in writing.
Paraphrase:	A restatement of a text or passage in other words, often to clarify meaning or show understanding.
Pattern book:	A book with a predictable plot structure and often written with predictable text; also known as predictable book.
Personification:	An object or abstract idea is given human qualities or human form. Example: <i>Flowers danced about the lawn.</i>
Phonics:	The relationship between letters and sounds fundamental in beginning reading.
Point of View:	The way in which an author reveals characters, events and ideas in telling a story; the vantage point from which the story is told.
Public document:	Documents that focus on civic issues or matters of public policy at the community level and beyond.
Reading critically:	Reading in which a questioning attitude, logical analysis and inference are used to judge the worth of text; evaluating relevancy and adequacy of what is read; the judgement of validity, or worth of what is read, based on sound criteria.
Reading rate:	The speed at which a person reads, usually silently.
Research:	A systematic inquiry into a subject or problem in order to discover, verify or revise relevant facts or principles having to do with that subject or problem.
Satire:	A literary tone used to ridicule or make fun of human vice or weakness.
Self-monitor:	Knowing when what one is reading or writing is making sense and adjusting strategies for comprehension.
Semantics:	The study of meaning in language.
Simile:	A comparison of two unlike things in which a word of comparison (<i>like</i> or <i>as</i>) is used. Example: <i>She eats like a bird.</i>
Sources:	
Primary:	Text and/or artifacts, which tell or show a first-hand account of an event; original works used when researching.
Secondary:	Text and/or artifacts used when researching which are derived from something original.
Subject area:	An organized body of knowledge; a discipline; a content area.

Style:	How an author writes; an author's use of language, its effects and appropriateness to the author's intent and theme.
Synonym:	One or two words in a language that have highly similar meanings. Example: sorrow, grief, sadness.
Syntax:	The pattern or structure of word order in sentences, clauses and phrases.
Theme:	A topic of discussion or writing; a major idea broad enough to cover the entire scope of a literary work.
Thesis:	The basic argument advanced by a speaker or writer who then attempts to prove it; the subject or major argument of a speech or composition.
Tone:	The attitude of the author toward the audience and characters, such as serious or humorous.
Voice:	The fluency, rhythm and liveliness in writing that makes it unique to the writer. Writing without voice is mechanical and flat.

Academic Standards for Mathematics

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V. INTRODUCTION

This document includes Mathematics Standards:

- 2.1. Numbers, Number Systems and Number Relationships
- 2.2. Computation and Estimation
- 2.3. Measurement and Estimation
- 2.4. Mathematical Reasoning and Connections
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- 2.7. Probability and Predictions
- 2.8. Algebra and Functions
- 2.9. Geometry
- 2.10. Trigonometry
- 2.11. Concepts of Calculus

The Mathematics Standards describe what students should know and be able to do at four grade levels (third, fifth, eighth and eleventh). They reflect the increasing complexity and sophistication that students are expected to achieve as they progress through school.

This document avoids repetition of learned skills, making an obvious progression across grade levels less explicit. Teachers shall expect that students know and can apply the concepts and skills expressed at the preceding level. Consequently, previous learning is reinforced but not retaught.

Students who achieve these mathematical standards will be able to communicate mathematically. Although it is an interesting and enjoyable study for its own sake, mathematics is most appropriately used as a tool to help organize and understand information from other academic disciplines. Because our capacity to deal with all things mathematical is changing rapidly, students must be able to bring the most modern and effective means of technology to bear on their learning of mathematical concepts and skills.

A glossary is included to assist the reader in understanding terminology contained in the standards.

2.1. Numbers, Number Systems and Number Relationships			
2.1.3. GRADE 3	2.1.5. GRADE 5	2.1.8. GRADE 8	2.1.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Count using whole numbers (to 10,000) and by 2's, 3's, 5's, 10's, 25's and 100's.</p> <p>B. Use whole numbers and fractions to represent quantities.</p> <p>C. Represent equivalent forms of the same number through the use of concrete objects, drawings, word names, and symbols.</p> <p>D. Use drawings, diagrams, or models to show the concept of fraction as part of a whole.</p> <p>E. Count, compare and make change using a collection of coins and one-dollar bills.</p> <p>F. Apply number patterns (even and odd) and compare values of numbers on the hundred board.</p> <p>G. Use concrete objects to count, order, and group.</p> <p>H. Demonstrate understanding of one-to-one correspondence.</p> <p>I. Apply place-value concepts and numeration to counting, ordering, and grouping.</p> <p>J. Estimate, approximate, round, or use exact numbers as appropriate.</p> <p>K. Describe the inverse relationship between addition and subtraction.</p> <p>L. Demonstrate knowledge of basic facts in four basic operations.</p>	<p>A. Use expanded notation to represent whole numbers or decimals.</p> <p>B. Apply number theory concepts to rename a number quantity.</p> <p>C. Demonstrate that mathematical operations can represent a variety of problem situations.</p> <p>D. Use models to represent fractions and decimals.</p> <p>E. Explain the concepts of prime and composite numbers.</p> <p>F. Use simple concepts of negative numbers such as on a number line, in counting, and temperature.</p> <p>G. Develop and apply number theory concepts (e.g., primes, factors, multiples, and composites) to represent numbers in various ways.</p>	<p>A. Represent and use numbers in equivalent forms (integers, fractions, decimals, percents, exponents, scientific notation and square roots).</p> <p>B. Simplify numerical expressions involving exponents, scientific notation and using order of operations.</p> <p>C. Distinguish between and order rational and irrational numbers.</p> <p>D. Apply ratio and proportion to mathematical problem situations involving distance, rate, time, and similar triangles.</p> <p>E. Simplify and expand algebraic expressions using exponential forms.</p> <p>F. Use the number line model to demonstrate integers and their applications.</p> <p>G. Use the inverse relationships between addition, subtraction, multiplication, division, and exponentiation and root extraction to determine unknown quantities in equations.</p>	<p>A. Use operations such as opposite, reciprocal, absolute value, raising to a power, finding roots and logarithms.</p>

2.2. Computation and Estimation			
2.2.3. GRADE 3	2.2.5. GRADE 5	2.2.8. GRADE 8	2.2.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Apply addition and subtraction situations using concrete objects.</p> <p>B. Solve single and double digit addition and subtraction problems with regrouping in vertical form.</p> <p>C. Demonstrate concept of multiplication as repeated addition and arrays.</p> <p>D. Demonstrate concept of division as repeated subtraction and as sharing.</p> <p>E. Use estimation skills to arrive at conclusions.</p> <p>F. Determine the reasonableness of calculated answers.</p> <p>G. Explain addition and subtraction algorithms with regrouping.</p>	<p>A. Create and solve word problems involving addition, subtraction, multiplication and division of whole numbers.</p> <p>B. Develop and apply algorithms to solve word problems that involve addition, subtraction, and/or multiplication with decimals with and without regrouping, fractions and mixed numbers, that include like and unlike denominators.</p> <p>C. Demonstrate the ability to round numbers.</p> <p>D. Determine through estimations the reasonableness of answers to problems involving addition, subtraction, multiplication and division of whole numbers.</p> <p>E. Demonstrate skills for using fraction calculators to verify conjectures, confirm computations, and explore complex problem solving situations.</p> <p>F. Apply estimation strategies to a variety of problems including time and money.</p> <p>G. Explain multiplication and division algorithms.</p> <p>H. Select a method for computation and explain why it is appropriate.</p>	<p>A. Complete calculations by applying the order of operations.</p> <p>B. Add, subtract, multiply and divide different kinds and forms of rational numbers including integers, decimal fractions, percents and proper and improper fractions.</p> <p>C. Solve word problems using ratio and proportion.</p> <p>D. Estimate the value of irrational numbers.</p> <p>E. Estimate amount of tips and discounts using ratios, proportions and percents.</p> <p>F. Determine appropriateness of overestimating or underestimating in computation.</p> <p>G. Identify the difference between exact value and approximations and determine which is appropriate for a given situation.</p> <p>H. Check the reasonableness of an answer.</p>	<p>A. Develop and use computation concepts, operations and procedures on real numbers in problem solving situations.</p> <p>B. Use estimation to solve problems for which exact answer is not needed.</p> <p>C. Construct and apply mathematical models, including lines and curves of best fit, to estimate values of related quantities.</p> <p>D. Describe and explain the amount of error that may exist in a computation using estimates.</p> <p>E. Recognize that the degree of precision needed in calculating a number depends on how the results will be used and the instruments used to generate the measure.</p> <p>F. Demonstrate skills for using computer spreadsheets and scientific and graphing calculators.</p>

2.3. Measurement and Estimation			
2.3.3. GRADE 3	2.3.5. GRADE 5	2.3.8. GRADE 8	2.3.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Compare measurable characteristics of different objects on the same dimensions (time, temperature, area, length, weight, capacity, perimeter).</p> <p>B. Determine the measurement of objects with non-standard and standard (e.g., US customary and metric) units.</p> <p>C. Determine and compare elapsed times.</p> <p>D. Tell time (analog and digital) to the minute.</p> <p>E. Determine appropriate unit of measure.</p> <p>F. Use concrete objects to determine area and perimeter.</p> <p>G. Estimate and verify measurements.</p> <p>H. Demonstrate that a single object has different attributes that can be measured in different ways (e.g. length, mass/weight, time, area, temperature, capacity and perimeter).</p>	<p>A. Select and use appropriate instruments and units for measuring quantities such as perimeter, volume, area, weight, time, and temperature.</p> <p>B. Select and use standard tools to measure the size of figures with specified accuracy, including length, width, perimeter, and area.</p> <p>C. Estimate, refine, and verify specified measurements of objects.</p> <p>D. Convert linear measurements within the same system.</p> <p>E. Add and subtract measurements.</p>	<p>A. Develop formulas and procedures for determining measurements (e.g. area, volume, distance, etc.).</p> <p>B. Solve rate problems (e.g. rate x time = distance, principal x interest rate = interest, etc.).</p> <p>C. Measure angles in degrees and determine relations of angles.</p> <p>D. Estimate, use, and describe measures of distance, rate, perimeter, area, volume, capacity, weight, mass and angles.</p> <p>E. Describe how a change in linear dimension of an object affects its perimeter, area, and volume.</p> <p>F. Use scale measurements to interpret maps or drawings.</p> <p>G. Create and use scale models.</p>	<p>A. Select and use appropriate units and tools to measure to the degree of accuracy required in particular measurement situations.</p> <p>B. Measure and compare angles in degrees and radians.</p> <p>C. Determine relationships between linear, square and cubic measures and describe how changes in one of the measures of the figure affect the others.</p> <p>D. Demonstrate ability to produce measures with specified levels of precision.</p>

2.4. Mathematical Reasoning and Connections			
2.4.3. GRADE 3	2.4.5. GRADE 5	2.4.8. GRADE 8	2.4.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Make, check, and verify predictions about the quantity, size and shape of objects and groups of objects.</p> <p>B. Use measurements to determine the geography of the school building.</p>	<p>A. Compare quantities and magnitudes of numbers.</p> <p>B. Use models, number facts, properties and relationships to check and verify predictions and explain reasoning.</p>	<p>A. Make conjectures based on logical reasoning and test conjectures by using counter-examples.</p> <p>B. Combine numeric relationships to arrive at a conclusion.</p>	<p>A. Use direct proofs, indirect proofs, or proof by contradiction to validate conjectures.</p> <p>B. Construct valid arguments from stated facts.</p>

2.4. Mathematical Reasoning and Connections			
2.4.3. GRADE 3	2.4.5. GRADE 5	2.4.8. GRADE 8	2.4.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
	<p>C. Draw inductive and deductive conclusions within mathematical contexts.</p> <p>D. Distinguish between relevant and irrelevant information in a mathematical problem.</p> <p>E. Interpret statements made with precise language of logic (i.e. all, every, none, some, or, many).</p> <p>F. Use statistics to quantify issues in social studies.</p>	<p>C. Use if . . . then statements to construct simple valid arguments.</p> <p>D. Construct, use, and explain algorithmic procedures for computing and estimating with whole numbers, fractions, decimals and integers.</p> <p>E. Distinguish between inductive and deductive reasoning.</p> <p>F. Use measurements and statistics in family and consumer science.</p>	<p>C. Determine the validity of an argument.</p> <p>D. Use truth tables to reveal the logic of mathematical statements.</p> <p>E. Demonstrate mathematical solutions to problems in the physical sciences.</p>

2.5. Mathematical Problem Solving and Communication			
2.5.3. GRADE 3	2.5.5. GRADE 5	2.5.8. GRADE 8	2.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Use appropriate problem solving strategies such as guess and check and working backwards.</p> <p>B. Determine when sufficient information is present to solve a problem and explain how to solve a problem.</p> <p>C. Select and use an appropriate method, materials and strategy to solve problems, including mental mathematics, paper and pencil, and concrete objects.</p>	<p>A. Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense and explain how the problem was solved.</p> <p>B. Use appropriate mathematical terms, vocabulary, language symbols and graphs to clearly and logically explain solutions to problems.</p> <p>C. Show ideas in a variety of ways, including words, numbers, symbols, pictures, charts, graphs, tables, diagrams and models.</p> <p>D. Connect, extend, and generalize problem solutions to other concepts, problems and circumstances in mathematics.</p>	<p>A. Invent, select, use, and justify the appropriate methods, materials and strategies used to solve problems.</p> <p>B. Verify and interpret results using precise mathematical language, notation, and representations, including numerical tables and equations, simple algebraic equations and formulas, charts, graphs and diagrams.</p> <p>C. Justify strategies and defend approaches used and conclusions reached.</p> <p>D. Determine pertinent information in problem situations, and whether any further information is needed for solution.</p>	<p>A. Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems.</p> <p>B. Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas and results.</p> <p>C. Present mathematical procedures and results clearly, systematically, succinctly and correctly.</p> <p>D. Conclude a solution process with a summary of results and evaluate the degree to which the results obtained represent an acceptable response to the initial problem and why the reasoning is valid.</p>

2.5. Mathematical Problem Solving and Communication			
2.5.3. GRADE 3	2.5.5. GRADE 5	2.5.8. GRADE 8	2.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
	<p>E. Select, use, and justify the methods, materials and strategies used to solve problems.</p> <p>F. Use appropriate problem solving strategies such as solving a simpler problem or drawing a picture or diagram.</p>		

2.6. Statistics and Data Analysis			
2.6.3. GRADE 3	2.6.5. GRADE 5	2.6.8. GRADE 8	2.6.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Gather, organize and display data using pictures, tallies, charts, bar graphs, and pictographs.</p> <p>B. Formulate and answer questions based on data shown on graphs.</p> <p>C. Predict the likely number of times a condition will occur based on the analyzed data.</p> <p>D. Form and justify an opinion on whether a given statement is reasonable based on a comparison to data.</p>	<p>A. Organize and display data using pictures, tallies, tables, charts, bar graphs, and circle graphs.</p> <p>B. Describe data sets using mean, median, mode and range.</p> <p>C. Sort data using Venn diagrams.</p> <p>D. Predict the likely number of times a condition will occur based on the analyzed data.</p> <p>E. Construct and defend simple conclusions based on data.</p>	<p>A. Compare and contrast different plots of data using values of mean, median, mode, quartiles and range.</p> <p>B. Explain effects on reliability of sampling procedures and of missing or incorrect information.</p> <p>C. Fit a line to the scatter plot of two quantities and describe any correlation of the variables.</p> <p>D. Design and carry out a random sampling procedure.</p> <p>E. Analyze and display data in stem-and-leaf and box-and-whisker plots.</p> <p>F. Use scientific and graphing calculators and computer spreadsheets to organize and analyze data.</p> <p>G. Determine the validity of the sampling method described in studies published in local or national newspapers.</p>	<p>A. Design and conduct an experiment using random sampling, describe the data as an example of a distribution using statistical measures of center and spread, and organize and represent the results with graphs. (Use standard deviation, variance and t-tests).</p> <p>B. Use appropriate technology to organize and analyze data taken from the local community.</p> <p>C. Determine regression equation of best fit (e.g., linear, quadratic, and exponential).</p> <p>D. Make predictions using interpolation, extrapolation, regression, and estimation, using technology.</p> <p>E. Determine the validity of the sampling method described in a given study.</p> <p>F. Determine the degree of dependence of two quantities specified by a two-way table.</p> <p>G. Describe questions of experimental design, use of control groups, treatment groups, cluster sampling and reliability.</p> <p>H. Use sampling techniques to draw inferences about large populations.</p>

2.6. Statistics and Data Analysis			
2.6.3. GRADE 3	2.6.5. GRADE 5	2.6.8. GRADE 8	2.6.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
			I. Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.

2.7. Probability and Predictions			
2.7.3. GRADE 3	2.7.5. GRADE 5	2.7.8. GRADE 8	2.7.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
A. Predict and measure the likelihood of events and recognize that the results of an experiment may not match predicted outcomes. B. Design a fair and an unfair spinner. C. List or graph the possible results of an experiment. D. Analyze data using the concepts of largest, smallest, most often, least often and middle.	A. Perform simulations with concrete devices (dice, spinner, etc.) to predict the chance of an event occurring. B. Determine the fairness of the design of a spinner. C. Express probabilities as fractions and decimals. D. Compare predictions based on theoretical probability and experimental results. E. Calculate the probability of a simple event. F. Determine patterns generated as a result of an experiment. G. Determine the probability of an event involving "and", "or" or "not". H. Predict and determine why some outcomes are certain, more likely, less likely, equally likely or impossible. I. Find all possible combinations and arrangements involving a limited number of variables. J. Make a tree diagram and list the elements in the sample space.	A. Determine the number of combinations and permutations for an event. B. Present the results of an experiment using visual representations (tables, charts, and graphs). C. Analyze predictions such as election polls. D. Compare and contrast results from observations and mathematical models. E. Make valid inferences, predictions and arguments based on probability.	A. Compare odds and probability. B. Apply probability and statistics to perform an experiment involving a sample and generalize its results to the entire population. C. Draw a conclusion regarding the validity of a probability or statistical argument and justify conclusion. D. Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations. E. Solve problems involving independent simple and compound events.

2.8. Algebra and Functions			
2.8.3. GRADE 3	2.8.5. GRADE 5	2.8.8. GRADE 8	2.8.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Recognize, describe, extend, create and replicate a variety of patterns including attribute, activity, number and geometric patterns.</p> <p>B. Use concrete objects and trial and error to solve number sentences and check if solutions are sensible and accurate.</p> <p>C. Substitute a missing addend in a number sentence.</p> <p>D. Create a story to match a given combination of symbols and numbers.</p> <p>E. Use concrete objects and symbols to model the concepts of variables, expressions, equations, and inequalities.</p> <p>F. Explain the meaning of solutions and symbols.</p> <p>G. Gather information and display it in the form of a table or a chart.</p> <p>H. Describe and interpret the data shown in tables and charts.</p> <p>I. Demonstrate simple function rules.</p>	<p>A. Recognize, reproduce, extend, create and describe patterns, sequences and relationships verbally, numerically, symbolically and graphically, using a variety of materials.</p> <p>B. Connect patterns to geometric relations and basic number skills.</p> <p>C. Form rules based on patterns (e.g., an equation that relates pairs in a sequence).</p> <p>D. Use concrete objects and combinations of symbols and numbers to create expressions that model mathematical situations.</p> <p>E. Explain the use of combinations of symbols and numbers in expressions, equations, and inequalities.</p> <p>F. Describe a realistic situation using information given in equations, inequalities, tables or graphs.</p> <p>G. Select and use appropriate strategies, including concrete materials, to solve number sentences and explain the method of solution.</p> <p>H. Locate and identify points on a coordinate system.</p> <p>I. Generate functions from tables of data and relate data to corresponding graphs and functions.</p>	<p>A. Apply simple algebraic patterns to basic number theory and to spatial relations.</p> <p>B. Discover, describe, and generalize patterns, including linear, exponential and simple quadratic relationships.</p> <p>C. Create and interpret expressions, equations, or inequalities that model problem situations.</p> <p>D. Use concrete objects to model algebraic concepts.</p> <p>E. Select and use a strategy to solve an equation or inequality, explain the solution and check the solution for accuracy.</p> <p>F. Solve and graph equations and inequalities using scientific and graphing calculators and computer spreadsheets.</p> <p>G. Represent relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules.</p> <p>H. Graph a linear function from a rule or table.</p> <p>I. Generate a table or graph from a function and use graphing calculators and computer spreadsheets to graph and analyze functions.</p>	<p>A. Analyze a given set of data for the existence of a pattern and represent the pattern algebraically and graphically.</p> <p>B. Give examples of patterns that occur in data from other disciplines.</p> <p>C. Use patterns, sequences and series to solve routine and non-routine problems.</p> <p>D. Formulate expressions, equations, inequalities, systems of equations, systems of inequalities, and matrices to model routine and non-routine problem situations.</p> <p>E. Use equations to represent curves such as lines, circles, ellipses, parabolas and hyperbolas.</p> <p>F. Identify whether systems of equations and inequalities are consistent or inconsistent.</p> <p>G. Analyze and explain systems of equations, systems of inequalities and matrices.</p> <p>H. Select and use an appropriate strategy to solve systems of equations and inequalities using graphing calculators, symbol manipulators, spreadsheets, and other software.</p> <p>I. Use matrices to organize and manipulate data, including matrix addition, subtraction, multiplication, and scalar multiplication.</p>

2.8. Algebra and Functions			
2.8.3. GRADE 3	2.8.5. GRADE 5	2.8.8. GRADE 8	2.8.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
J. Analyze simple functions and relationships and locate points on a simple grid.		J. Show that an equality relationship between two quantities remains the same as long as the same change is made to both quantities; and explain how a change in one quantity determines another quantity in a functional relationship.	<p>J. Demonstrate the connection between algebraic equations and inequalities and the geometry of relations in the coordinate plane.</p> <p>K. Select, justify, and apply an appropriate technique to graph a linear function in two variables, including slope-intercept, x- and y-intercepts, graphing by transformations, and the use of a graphing calculator.</p> <p>L. Write the equation of a line when given the graph of the line, two points on the line, or the slope of the line and a point on the line.</p> <p>M. Given a set of data points, write an equation for a line of best fit.</p> <p>N. Solve linear, quadratic, and exponential equations both symbolically and graphically.</p> <p>O. Determine the domain and range of a relation, given a graph or set of ordered pairs.</p> <p>P. Analyze a relation to determine whether a direct or inverse variation exists and represent it algebraically and graphically.</p> <p>Q. Represent functional relationships in tables, charts, and graphs.</p> <p>R. Create and interpret functional models.</p> <p>S. Analyze properties and relationships of functions (linear, polynomial, rational, trigonometric, exponential, and logarithmic).</p> <p>T. Analyze and categorize functions by their characteristics.</p>

2.9. Geometry			
2.9.3 GRADE 3	2.9.5. GRADE 5	2.9.8 GRADE 8	2.9.11 GRADE 11
<i>Pennsylvania's public school shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Name and label geometric shapes in two and three dimensions (circle/sphere, square/cube, triangle/pyramid, rectangle/prism)</p> <p>B. Build geometric shapes using concrete objects (manipulatives).</p> <p>C. Draw two and three dimensional geometric shapes and construct rectangles, squares and triangles on the geoboard and on graph paper satisfying specific criteria.</p> <p>D. Find and describe geometric figures in real life.</p> <p>E. Identify and draw lines of symmetry in geometric figures.</p> <p>F. Identify symmetry in nature.</p> <p>G. Fold paper to demonstrate the reflections about a line.</p> <p>H. Show relationships between and among figures using reflections.</p> <p>I. Predict how shapes can be changed by combining or dividing them.</p>	<p>A. Give formal definitions of geometric figures.</p> <p>B. Classify and compare triangles and quadrilaterals according to sides or angles.</p> <p>C. Identify and measure circles, their diameters and radii.</p> <p>D. Describe in words how geometric shapes are constructed.</p> <p>E. Construct two and three dimensional shapes and figures using manipulatives, geoboards and computer software.</p> <p>F. Find familiar solids in the environment and describe them.</p> <p>G. Create an original tessellation.</p> <p>H. Describe the relationship between the perimeter and area of triangles, quadrilaterals and circles.</p> <p>I. Represent and use the concepts of line, point, and plane.</p>	<p>A. Construct figures incorporating perpendicular and parallel lines, the perpendicular bisector of a line segment and an angle bisector using computer software.</p> <p>B. Draw, label, measure and list the properties of complementary, supplementary, and vertical angles.</p> <p>C. Classify familiar polygons as regular or irregular up to a decagon.</p> <p>D. Identify, name, draw and list all properties of squares, cubes, pyramids, parallelograms, quadrilaterals, trapezoids, polygons, rectangles, rhombi, circles, spheres, triangles, prisms, and cylinders.</p> <p>E. Construct parallel lines, draw a transversal, measure and compare angles formed such as alternate interior and exterior angles.</p> <p>F. Distinguish between similar and congruent polygons.</p> <p>G. Approximate the value of π (pi) through experimentation.</p> <p>H. Use simple geometric figures such as triangles and squares to create, through rotation, transformational figures in three dimensions.</p> <p>I. Generate transformations using computer software.</p>	<p>A. Construct geometric figures using dynamic geometry tool (Geometer's Sketchpad, Cabri Geometre, etc.)</p> <p>B. Prove two triangles or two polygons are congruent or similar using algebraic and coordinate as well as deductive proofs.</p> <p>C. Identify and prove the properties of quadrilaterals involving opposite sides and angles, consecutive sides and angles, and diagonals using deductive proofs.</p> <p>D. Identify corresponding parts in congruent triangles to solve problems.</p> <p>E. Solve problems involving inscribed and circumscribed polygons.</p> <p>F. Use the properties of angles, arcs, chords, tangents, and secants to solve problems involving circles.</p> <p>G. Solve problems using analytic geometry.</p> <p>H. Construct a geometric figure and its image using various transformations.</p> <p>I. Model situations geometrically to formulate and solve problems.</p>

2.9. Geometry			
2.9.3 GRADE 3	2.9.5. GRADE 5	2.9.8 GRADE 8	2.9.11 GRADE 11
<i>Pennsylvania's public school shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
	<p>J. Define the basic properties of squares, pyramids, parallelograms, quadrilaterals, trapezoids, polygons, rectangles, rhombi, circles, triangles, cubes, prisms, spheres, and cylinders.</p> <p>K. Analyze simple transformations of geometric figures and rotations of line segments.</p> <p>L. Identify properties of geometric figures (i.e., parallel, perpendicular, similar, congruent, symmetrical).</p>	<p>J. Analyze geometric patterns, such as tessellations and sequences of shapes, and develop descriptions of the patterns.</p> <p>K. Analyze objects to determine if they illustrate tessellations, symmetry, congruence, similarity, and scale.</p>	<p>J. Analyze figures in terms of the kinds of symmetries they have.</p>

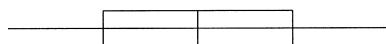
2.10. Trigonometry			
2.10.3 GRADE 3	2.10.5. GRADE 5	2.10.8 GRADE 8	2.10.11 GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to . . .</i>			
<p>A. Identify right angles in the environment.</p> <p>B. Model right angles and right triangles using concrete objects.</p>	<p>A. Identify and compare parts of right triangle including right angles, acute angles, hypotenuse, and legs.</p> <p>B. Create right triangles on a geoboard.</p>	<p>A. Compute measures of sides and angles using proportions, the Pythagorean Theorem, and right triangle relationships.</p> <p>B. Solve problems requiring indirect measurement for lengths of sides of triangles.</p>	<p>A. Use graphing calculators to display periodic and circular functions; describe properties of the graphs.</p> <p>B. Identify, create, and solve practical problems involving right triangles using the trigonometric functions and the Pythagorean Theorem.</p>

2.11. Concepts of Calculus			
2.11.3 GRADE 3	2.11.5. GRADE 5	2.11.8 GRADE 8	2.11.11 GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire to the knowledge and skills to . . .</i>			
<p>A. Identify whole number quantities and measurements from least to most and greatest value.</p> <p>B. Identify least and greatest values represented in bar graphs and pictographs.</p> <p>C. Categorize rates of change as faster and slower.</p> <p>D. Continue a pattern of numbers or objects that could be extended infinitely.</p>	<p>A. Make comparisons of numbers such as more, less, same, least, most, greater than and less than.</p> <p>B. Identify least and greatest values represented in bar and circle graphs.</p> <p>C. Identify maximum and minimum.</p> <p>D. Describe the relationship between rates of change and time.</p>	<p>A. Analyze graphs of related quantities for minimum and maximum values and justify.</p> <p>B. Describe concept of unit rates, ratios, and slope in context of rate of change.</p> <p>C. Continue a pattern of numbers or objects that could be extended infinitely.</p>	<p>A. Determine maximum and minimum values of a function over a specified interval.</p> <p>B. Interpret maximum and minimum values in problem situations.</p> <p>C. Graph and interpret rates of growth/decay.</p> <p>D. Determine sums of finite sequences of numbers and infinite geometric series.</p>

2.11. Concepts of Calculus			
2.11.3 GRADE 3	2.11.5. GRADE 5	2.11.8 GRADE 8	2.11.11 GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire to the knowledge and skills to . . .</i>			
	E. Estimate areas and volumes as the sums of areas of tiles and volumes of cubes. F. Describe the relationship between the size of the unit of measurement and the estimate of the areas and volumes.		E. Estimate areas under curves using sequences of areas.

VI. GLOSSARY

- Absolute value:** A number's distance from zero on a number line. The absolute value of 2 is equal to the absolute value of -2.
- Algorithm:** A method of performing an arithmetic operation.
- Analog time:** Time displayed on a timepiece having hour and minute hands.
- Array:** Arrangement of a series of items according to the values of the items, e.g., largest to smallest.
- Box-and-whisker plot:** A graphic method for showing a summary of data using median, quartiles and extremes of data.



- Capacity:** The volume of a container given in units of liquid measure.
- Combination:** A subset of the elements in a given set, without regard to the order in which those elements are arranged.
- Composite number:** Any positive integer exactly divisible by one or more positive integers other than itself and 1.
- Congruent:** Having the same shape and the same size.
- Conjecture:** A statement believed to be true but not proved.
- Coordinate system:** A method of locating points in the plane or in space by means of numbers. A point in the plane is located by its distances from both a horizontal and a vertical line called the axes. The horizontal line is called the x-axis. The vertical line is called the y-axis. The pairs of numbers are called ordered pairs. The first number, called the x-coordinate, designates the distance along the horizontal axis. The second number, called the y-coordinate, designates the distance along the vertical axis. The point at which the two axes intersect has the coordinates (0,0) and is called the origin.
- Correlation:** A measure of the mutual relationship between two variables.
- Customary system:** A system of weights and measures frequently used in the United States. The basic unit of weight is the pound; the basic unit of capacity is the quart.
- Deductive reasoning:** The process of reasoning from statements accepted as true to reach a conclusion.
- Direct variation:** When two variables are so related that their ratio remains constant, one of them is said to vary directly as the other.
- Domain:** The set of all possible replacements for the placeholder in an open sentence.
- Equation:** A statement of equality between two mathematical expressions. (e.g., $X + 5 = Y - 2$).
- Equivalent forms:** Different forms of numbers that name the same number; (e.g., fraction, decimal, percent as 1/2, .5, 50%).
- Exponential function:** A function whose general equation is $y = a X b^x$ or $y = a X b^{kx}$, where a, b, and k stand for constants.
- Exponent:** A numeral used to tell how many times a number or variable is used as a factor. (e.g., a^2 , 2^n , y^x).
- Expression:** A mathematical phrase that can include operations, numerals, and variables. In algebraic terms: $2l + 3x$; in numeric terms: $13.4 - 4.7$.
- Factor:** The numbers or variables multiplied in a multiplication expression.

Factorial:	The expression $n!$ (n factorial) is the product of all the numbers from 1 to n for any positive integer n .
Function:	A relation in which each value of an independent variable takes on a unique value of the dependent value.
Geoboard:	A board with pegs aligned in grid fashion which permits rubber bands to be wrapped around pegs to form geometric figures.
Graphing calculator:	A calculator that will store and draw the graph of several functions at once.
Independent events:	Events such that the outcome of the first event has no effect on the probabilities of the outcome of the second event. (e.g., two tosses of the same coin are independent events).
Inductive reasoning:	Forming generalizations from particular observations in a common occurrence.
Inequality:	A mathematical sentence that contains a symbol; such as $>$, $<$, \geq , \leq , or \neq and in which the terms on either side of the symbol are unequal. (e.g., $x < y$, $7 > 3$, $n \geq 4$).
Infinite:	Has no end or goes on forever.
Integer:	A number that is a positive whole number, a negative whole number, or zero.
Inverse:	A new conditional formed by negating both the antecedent and the consequent of a conditional.
Inverse operations:	Operations that undo each other (e.g., addition and subtraction are inverse operations, multiplication and division are inverse operations).
Inverse variation:	When the ratio of one variable to the reciprocal of the other is constant, one of them is said to vary inversely as the other.
Irrational number:	A number that cannot be written as a simple fraction. It is an infinite and non-repeating decimal.
Limit:	A number to which the terms of a sequence get closer so that beyond a certain term all terms are as close as desired to that number.
Line of best fit:	The line that fits a set of data points with the smallest value for the sum of the squares of the errors (vertical distances) from the data points to the line. Also called the regression line.
Linear function:	A function whose general equation is $y = mx + b$, where m and b stand for constants, and $m \neq 0$.
Linear measurement:	Measurement in a straight line.
Logarithm:	The exponent indicating the power to which a fixed number, the base, must be raised to produce a given number. For example, if $n^x = a$, the logarithm of a , with n as the base, is x ; symbolically, $\log_n a = x$. If the base is 10, the log of 100 is 2 or 10^2 .
Manipulatives:	Materials that allow students to explore mathematics concepts in a concrete mode.
Mathematical induction:	A formal method of proving that a statement about a positive integer n is true for all positive integers n , by: 1) proving that the statement is true for the first integer, then 2) proving that if the statement is true for n , it must be true for $(n-1)$.
Mathematical model:	A representation in the mathematical world of some phenomenon in the real world. It frequently consists of a function or relation specifying how two variables are related.
Matrix:	A rectangular array of numbers representing such things as the coefficients in a system of equations arranged in rows and columns.
Maximum:	The greatest number in a set of data.
Mean:	The mean of a set of numbers is the sum of the set of numbers divided by n , the number of numbers in the set.
Median:	The number that lies in the middle when a set of numbers is arranged in order. If there are two middle values, the median is the mean of these values.
Metric system:	A system of measurement used throughout the world based on factors of 10. It includes measures of length, weight, and capacity.
Minimum:	The least number in a set of data.
Missing addend:	A member of an addition number sentence in which that term is missing. (e.g., $5 + \underline{\quad} = 8$).
Mode:	The number(s) which occurs most often in a set of numbers. (e.g., in the set 1, 2, 3, 3, 5, 8; the mode is 3).
Multiple:	A number which is the product of a given integer and another integer. (e.g., 6 and 9 are multiples of 3).
Normal curve:	A graph describing the normal distribution in which more scores are found in the center and fewer scores are found at the extremes.

One-to-one Correspondence:	When one and only one element of a second set is assigned to an element of a first set, all elements of the second set are assigned, and every element of the first set has an assignment, the mapping is called one-to-one. (e.g., in the set Bill Clinton, George Bush, Ronald Reagan, Jimmy Carter, Hillary Clinton, Barbara Bush, Nancy Reagan, and Rosalynn Carter, there is a one-to-one correspondence between the pairs.)
Open sentence:	A statement that contains at least one unknown. It becomes true or false when a quantity is substituted for the unknown. (e.g., $x + 5 = 9$, $y - 2 = 7$).
Order of operations:	Rules for evaluating an expression: work first within parentheses; then calculate all powers, from left to right; then do multiplications or divisions, from left to right; then do additions and subtractions, from left to right.
Patterns:	Regularities in situations such as those in nature, events, shapes, designs and sets of numbers (for example, spirals on pineapples, geometric designs in quilts, the number sequence 3, 6, 9, 12, . . .).
Permutation:	An arrangement of a given number of objects from a given set.
Perpendicular lines:	Two lines which intersect to form right angles. (e.g., \perp , \lrcorner , \ulcorner).
Plotting points:	Locating points by means of coordinates, or a curve by plotted points, and to represent an equation by means of a curve so constructed.
Polygon:	A union of segments connected end to end, such that each segment intersects exactly two others at its endpoints.



Powers:	A number expressed using an exponent. The number 5^3 is read five to the third power or five cubed.
Prime:	An integer greater than one whose only positive factors are 1 and itself. (1, 2, 3, 5, 7, 11, 13, 17, and 19 are prime numbers)
Probability:	A number from 0 to 1 that indicates how likely something is to happen.
Problem solving:	Finding ways to reach a goal when no routine path is apparent.
Proof by contradiction:	A proof in which, if s is to be proven, one reasons from not s until a contradiction is deduced; from this it is concluded that not s is false, which means that s is true.
Proportion:	An equation of the form $a/b = c/d$ which states that the two ratios are equivalent.
Quadrilateral:	A four-sided polygon.
Quartiles:	The three values that divide an ordered set into four subsets of approximately equal size. The second quartile is the median.
Radian:	A unit of angular measure equal to $1/(2\pi)$ of a complete revolution.
Range (1):	The difference between the greatest number and the least number in a set of data.
Range (2):	The set of output values for a function.
Rate of change:	The limit of the ratio of an increment of the function value at the point to that of the independent variable as the increment of the variable approaches zero.
Ratio:	A comparison of two numbers by division.
Rational numbers:	Any number that can be written in the form a/b where a is any interger and b is any integer except zero.
Real numbers:	The set consisting of all rational numbers and all irrational numbers.
Reasonableness:	Quality of a solution such that it is not extreme or excessive.
Reciprocal:	The fractional number that results from dividing one by the number.
Rectangular prism:	A three-dimensional figure whose sides are all rectangles, a box.
Reflection:	A tranformation that produces the mirror image of a geometric figure.
Regression:	The line that represents the least deviation from the points in a scatter plot of data.
Regular polygon:	A polygon in which all sides have the same measure and all angles have the same measure.
Relation:	A set of ordered pairs.
Reliability:	The extent to which a measuring procedure yields the same results on repeated trials.
Repeated addition:	A model for multiplication. (e.g., $2 + 2 + 2 = 3 \times 2$).
Rotation:	A transformation that maps every point in the plane to its image by rotating the plane around a fixed point.

Scientific calculator:	A calculator which represents very large or very small numbers in scientific notation and with the powering, factorial, square root, negative, and reciprocal keys.
Scientific notation:	A way of writing a number of terms of an integer power of 10 multiplied by a number greater than or equal to 1 and less than 10.
Sequence:	A set of ordered quantities. (e.g., positive integers).
Series:	The indicated sum of the terms of a sequence.
Similarity:	Having the same shape but not necessarily the same size.
Simple event:	An event whose probability can be obtained from consideration of a single occurrence. (e.g., the tossing of a coin is a simple event).
Simulation:	Modeling a real event without actually observing the event.
Slope:	The slope of a line is the ratio of the change in y to the corresponding change in x . The constant m in the linear function equation. Rise/run.
Standard deviation:	The square root of the variance.
Stem-and-leaf plot:	A frequency distribution made by arranging data. (e.g., student scores on a test were 98, 96, 85, 93, 83, 87, 85, 87, 93, 75, 77, and 83. This data is displayed in a stem-and-leaf plot below.
	$\begin{array}{r l} 9 & 8, 6, 3, 3 \\ 8 & 7, 7, 5, 5, 3, 3 \\ 7 & 7, 5 \end{array}$
Systems of equations:	Two or more equations that are conditions imposed simultaneously on all the variables, but may or may not have common solutions. (e.g., $x + y = 2$, and $3x + 2y = 5$).
Symmetry:	A line of symmetry separates a figure into two congruent halves, each of which is a reflection of the other, (e.g., \emptyset , the line through the center of the circle divides it into congruent halves).
t-test:	A statistical test done to test the difference of means of two samples.
Tessellations:	A repetitive pattern of polygons that covers an area with no holes and no overlaps, like floor tiles.
Transformations:	An operation on a geometric figure by which each point gives rise to a unique image.
Translations:	A transformation that moves a geometric figure by sliding each of the points the same distance in the same direction.
Tree diagram:	A diagram used to show the total number of possible outcomes in a probability experiment.
Trigonometric functions:	A function (sine, cosine, tangent, cotangent, secant, cosecant) whose independent variable is an angle measure, usually in degrees or radians.
Valid argument:	An argument with the property no matter what statements are substituted in the premises, the truth value of the form is true. If the premises are true, then the conclusion is true.
Variable:	A symbol used to stand for any one of a given set of numbers or other objects. (e.g., in the equation $y = x + 5$, y and x are variables).
Variance:	In a data set, the sum of the squared deviations divided by one less than the number of elements in the set (sample variance s^2) or by the number of elements in the set (population variance σ^2).
Vector:	A quantity that has both magnitude and direction. (e.g., physical quantities such as velocity and force).
Venn diagram:	A display that pictures unions and intersections of sets.
Volume:	The amount of space enclosed in a space (3-dimensional) figure, measured in cubic units.
Y-intercept:	The y -intercept of a line is the y -coordinate of the point at which the graph of an equation crosses the y -axis.
π :	pi, the ratio of the circumference of a circle to its diameter: about 3.1415926535.

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