TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

APPLICATIONS OF MATHEMATICS / ALGEBRA III
Grade 12
Mathematics Department

2017

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Applications of Mathematics / Algebra III
Grade 12
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The Trumbull Board of Education will continue to take Affirmative Action to ensure that no persons are discriminated against in its employment.

CORE VALUES AND BELIEFS

The Trumbull High School community engages in an environment conducive to learning which believes that all students will **read and write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION

This course is designed for seniors who have completed three years of mathematics on the college-preparatory level and who would like to continue the study of mathematics in their senior year. The course includes a number of interesting topics of mathematics, topics selected to better prepare students for the next steps in their lives: college, trade school, or the workplace.

The purpose of this course is to prepare seniors for what lies ahead: SAT and ACT exams, placement tests, entrance exams, college algebra, the mathematics involved in various certifications, and survival-skill mathematics.

Topics include:

- Probability
- Statistics
- SAT and ACT preparation
- Finance
- Trigonometry
- Exponential functions
- Linear equations and systems of linear equations
- Quadratic equations: factoring, finding solutions
- Arithmetic operations with algebraic rationals
- Algebra review in preparation for College Placement tests and for SAT and ACT exams

PHILOSOPHY

Success in mathematics depends upon active involvement in a variety of interrelated experiences. When students participate in stimulating learning opportunities, they can reach their full potential.

The Trumbull Mathematics Program embraces these goals for all students.
The successful mathematician will:

- Acquire the factual knowledge necessary to solve problems
- Gain procedural proficiency in problem solving
- Demonstrate a perceptual understanding of problems posed
- Make meaningful mathematical connections to his or her world
- Solve problems utilizing a variety of strategies
- Utilize technology to improve the quality of the problem-solving process
- Communicate effectively using mathematical terminology, both independently and collaboratively
- Use sound mathematical reasoning by utilizing the power of conjecture and proof in his or her thinking
- Become a reflective thinker through continuous self-evaluation
- Become an independent, self-motivated, lifelong learner

The Trumbull Mathematics Program promotes the empowerment of students and encourages students to embrace the skills needed to become successful in the 21st century. Students expand their mathematical abilities by investigating real-world phenomena. Through such experiences, students can access the beauty and power of mathematics and truly appreciate the impact mathematics has on the world in which they live.

Developed by Trumbull K-12 Math Committee, June 2004; revised and approved April 2011

COURSE DESCRIPTION

Applications of Mathematics / Algebra III is a third-year algebra class designed to develop the eight standards of mathematical practice in students. It prepares students for college-level mathematics courses and the workplace. The course includes a brief review of algebra in preparation for the SAT and ACT exams, linear programming, probability, and statistics. During an in-depth look at college placement tests, topics such as simplifying rational equations, solving rational equations, and trigonometry are studied. In the next unit, on personal finance, students learn how to balance a checkbook, about income taxes, budgets, credit cards, loans, and interest rates.

GOALS

The Standards for Mathematical Practice describe varieties of expertise that all teachers of mathematics will develop in their students.

These practices rest on important "processes and proficiencies" that have long been valued in mathematics education.

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved.

Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and the tools' limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data.

They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.

They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, expressing numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure.

They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

METHODS OF ASSESSMENT

A student's grade will include the teacher's evaluation in the following areas:

Assignments, both in and out of class, assessed on:

- completeness, neatness, effort, accuracy, critical thinking, resourcefulness, organization

Tests & Quizzes, mainly criterion-referenced, assessed on:

- understanding of concepts, techniques, and skills
- applying concepts
- connecting concepts
- writing with correct notation & symbols
- organization

Projects & Tasks, assessed on:

- mathematical accuracy
- sophistication of response
- clarity of writing/explanation
- use of mathematical support in decision or recommendation
- adherence to other criteria detailed in assessment lists

Department Midyear and Final Exams, mainly norm-referenced, in various formats:

- standard multiple-choice (e.g., SAT)
- free response

Other Possible Grade Determinants:

- participation
- notebook
- journal
- projects

Unit 1: Review of Algebra, and SAT/ACT Preparation

Performance Standards

The TPS-created objectives are:

- The learner will utilize practice SAT and ACT exams to determine the need for review of various topics.
- The learner will become acquainted with the best use of a calculator during the SAT and ACT exams.

Essential Questions

- What are the current structures of the SAT and ACT exams?
- What are the current scoring methods for the exams?
- What are the differences between calculator and no-calculator questions?
- What are the mathematics topics covered in the exams?
- What are systems of linear equations and inequalities?
- What are quadratic functions, and how are they solved and graphed?
- What are possible applications of quadratic functions?
- What are the characteristics of a logarithmic function?
- What are the characteristics of an exponential function?

Content (Scope and Sequence)

Complete a review of algebra topics covered in prior courses

Complete SAT and ACT online practice tests

Complete SAT and ACT study guides and review material as necessary

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, Reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Performance-based assessment

Teacher-created quizzes and tests

Time Allocation

Approximately 10 weeks

Unit 2: Probability

Performance Standards

The Performance Standards align with the Connecticut Core Standards for Mathematics. For this unit, the Standards are below grade level.

7.SP Statistics and Probability

Investigate chance processes and develop, use, and evaluate probability models.

5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*
7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
    a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
    b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*
8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
    a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
    b. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

Essential Questions

- How does the science of probability relate to real-world applications (e.g., automobile insurance, baseball)?
- What is the difference between the expectancy and the probability of an event's occurring?

Content (Scope and Sequence)

Learn vocabulary of probability, including *outcomes*, *sample space*, *event*, *independent events*, *dependent events*, *Fundamental Counting Principle*

Determine sample space

Solve problems with independent and dependent events, permutations, and combinations

Find odds of single and multiple events

Find probability of mutually inclusive and exclusive events

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, Reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Activity involving rolling dice and determining sample space and various probabilities

Performance-based assessment

Teacher-created quizzes and tests

Time Allocation

Approximately 5 weeks

Unit 3: Statistics

Performance Standards

The Performance Standards align with the Connecticut Core Standards for Mathematics.

S-ID Interpreting Categorical and Quantitative Data

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

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Summarize, represent, and interpret data on two categorical and quantitative variables

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

Essential Questions

- How can I measure central tendency to represent a set of data?
- How can I measure variation for a set of data?
- How can I determine whether a set of data appears to be normally distributed or skewed?
- How can I solve problems involving normally-distributed data?

Content (Scope and Sequence)

Create charts and graphs from a data set

Interpret charts and graphs

Calculate relative frequency, finding measures of central tendency and variation of the data

Use normally-distributed data to answer real-world application

Develop strategy for collecting data and organizing results

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, Reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Survey project

Teacher-created quizzes and tests

Time Allocation

Approximately 5 weeks

Midyear Review & Midyear Exam

Time Allocation

Approximately 1 week

Unit 4: Operations with Rational Algebraic Expressions

Performance Standards

The Performance Standards align with the Connecticut Core Standards for Mathematics.

A-APR Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials

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

Understand the relationship between zeros and factors of polynomials

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

Rewrite rational expressions

6. Rewrite simple rational expressions in different forms; write $^{a(x)} / b(x)$ in the form $q(x) + {}^{r(x)} / b(x)$, where $a(x)$, $b(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, [and factoring].
7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Essential Questions

- Can a rational expression be factored?
- What is the simplified form of a rational expression?
- What is a Least Common Multiple?

Content (Scope and Sequence)

Simplify rational expressions using multiplication, division, addition, subtraction, and factoring

Solve rational equations

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, Reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Teacher-created quizzes and tests

Time Allocation

Approximately 4 weeks

Unit 5: Fundamentals of Trigonometry

Performance Standards

The Performance Standards align with the Connecticut Core Standards for Mathematics.

F-TF <u>Trigonometric Functions</u>

Extend the domain of trigonometric functions using the unit circle

1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
3. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$, and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x ,where x is any real number.
5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
7. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

Essential Questions

- How do the angles in a right triangle relate to the sides of that triangle?
- How can trigonometry help solve real-world problems?

Content (Scope and Sequence)

Review trigonometric functions

Use trigonometric functions to solve right-triangle problems: finding sides using angles, and finding angles using sides

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning, Finding trigonometric values by appropriately using calculator instead of using a trigonometric table, Converting between degrees and radians

Technology Competency Standards

4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Teacher-created quizzes and tests

Time Allocation

Approximately 4 weeks

Unit 6: Placement Test Preparation

Performance Standards

This particular unit does not align with the Connecticut Core Standards for Mathematics.

Essential Questions

- How do I prepare for the college placement test that does not allow me to use a calculator?

Content (Scope and Sequence)

Complete practice tests and review material as necessary

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Teacher-created quizzes and tests

Time Allocation

Approximately 2 weeks

Unit 7: Personal Finance

Performance Standards

The Performance Standards align with the Connecticut Core Standards for Mathematics.

F-LE   Linear, Quadratic, and Exponential Models

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

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
   b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
   c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Essential Questions

- How do I balance a checkbook?
- How do I calculate payments for a loan?
- How do I create a budget?
- How do I calculate state, federal, and FICA taxes?

Content (Scope and Sequence)

Calculate simple, compounded, and continuously compounded interest

Calculate monthly payments on various loans, including automobile loans, credit cards, and student loans

Understand how to calculate payroll deductions

Prepare an individualized budget

Instructional/Teaching Strategies

Helping students set objectives, Providing feedback, reinforcing effort and providing recognition, Offering targeted homework and practice, Questioning-and-answering, Modeling, Providing guided and independent practice, Cooperative learning

Assured Experiences (Projects)

Student-led discussion, class participation, classwork, and homework

Budget project

Teacher-created quizzes and tests

Time Allocation

Approximately 5 weeks

Final Review & Final Exam

Time Allocation

Approximately 1 week

COURSE CREDIT

One credit in mathematics

One class period daily for a full year

Level: College Preparatory

PREREQUISITES

Completion of Algebra II with a C+ or better.

TEXT

Algebra 2, Glencoe/McGraw Hill, 2003

SUPPLEMENTARY MATERIALS/RESOURCES/TECHNOLOGY

Graphing calculators

Teacher-prepared worksheets

Practice masters

Study guides

Enrichment

5-minute checks (may be used as quizzes)

SAT/ACT study guides

math.glencoe.com (for computer assistance for study or homework help)

CURRENT REFERENCES

Common Core State Standards - Mathematics

http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

ASSURED STUDENT PERFORMANCE RUBRICS

- Trumbull High School School-Wide Writing Rubric
- Trumbull High School School-Wide Problem-Solving Rubric
- Trumbull High School School-Wide Independent Learning and Thinking Rubric

SCHOOL-WIDE RUBRICS

Rubric 2: Write Effectively

Category/ Weight	Exemplary 4 Student work:	Goal 3 Student work:	Working Toward Goal 2 Student work:	Needs Support 1-0 Student work:
Purpose X_______	• Establishes and maintains a clear purpose • Demonstrates an insightful understanding of audience and task	• Establishes and maintains a purpose • Demonstrates an accurate awareness of audience and task	• Establishes a purpose • Demonstrates an awareness of audience and task	• Does not establish a clear purpose • Demonstrates limited/no awareness of audience and task
Organization X_______	• Reflects sophisticated organization throughout • Demonstrates logical progression of ideas • Maintains a clear focus • Utilizes effective transitions	• Reflects organization throughout • Demonstrates logical progression of ideas • Maintains a focus • Utilizes transitions	• Reflects some organization throughout • Demonstrates logical progression of ideas at times • Maintains a vague focus • May utilize some ineffective transitions	• Reflects little/no organization • Lacks logical progression of ideas • Maintains little/no focus • Utilizes ineffective or no transitions
Content X_______	• Is accurate, explicit, and vivid • Exhibits ideas that are highly developed and enhanced by specific details and examples	• Is accurate and relevant • Exhibits ideas that are developed and supported by details and examples	• May contain some inaccuracies • Exhibits ideas that are partially supported by details and examples	• Is inaccurate and unclear • Exhibits limited/no ideas supported by specific details and examples
Use of Language X_______	• Demonstrates excellent use of language • Demonstrates a highly effective use of standard writing that enhances communication • Contains few or no errors. Errors do not detract from meaning	• Demonstrates competent use of language • Demonstrates effective use of standard writing conventions • Contains few errors. Most errors do not detract from meaning	• Demonstrates use of language • Demonstrates use of standard writing conventions • Contains errors that detract from meaning	• Demonstrates limited competency in use of language • Demonstrates limited use of standard writing conventions • Contains errors that make it difficult to determine meaning

Rubric 3: Problem Solving through Critical Thinking

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Understanding X_______	• Student demonstrates clear understanding of the problem and the complexities of the task.	• Student demonstrates sufficient understanding of the problem and most of the complexities of the task.	• Student demonstrates some understanding of the problem but requires assistance to complete the task.	• Student demonstrates limited or no understanding of the fundamental problem after assistance with the task.
Research X_______	• Student gathers compelling information from multiple sources including digital, print, and interpersonal.	• Student gathers sufficient information from multiple sources including digital, print, and interpersonal.	• Student gathers some information from few sources including digital, print, and interpersonal.	• Student gathers limited or no information.
Reasoning and Strategies X_______	• Student demonstrates strong critical thinking skills to develop a comprehensive plan integrating multiple strategies.	• Student demonstrates sufficient critical thinking skills to develop a cohesive plan integrating strategies.	• Student demonstrates some critical thinking skills to develop a plan integrating some strategies	• Student demonstrates limited or no critical thinking skills and no plan.
Final Product and/or Presentation X_______	• Solution shows deep understanding of the problem and its components. • Solution shows extensive use of 21st-century technology skills.	• Solution shows sufficient understanding of the problem and its components. • Solution shows sufficient use of 21st-century technology skills.	• Solution shows some understanding of the problem and its components. • Solution shows some use of 21st-century technology skills.	• Solution shows limited or no understanding of the problem and its components. • Solution shows limited or no use of 21st-century technology skills.

Rubric 5: Independent Learners And Thinkers

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Proposal X_______	• Student demonstrates a strong sense of initiative by generating compelling questions, creating uniquely original projects/work.	• Student demonstrates initiative by generating appropriate questions, creating original projects/work.	• Student demonstrates some initiative by generating questions, creating appropriate projects/work.	• Student demonstrates limited or no initiative by generating few questions and creating projects/work.
Independent Research & Development X_______	• Student is analytical, insightful, and works independently to reach a solution.	• Student is analytical, and works productively to reach a solution.	• Student reaches a solution with direction.	• Student is unable to reach a solution without consistent assistance.
Presentation of Finished Product X_______	• Presentation shows compelling evidence of an independent learner and thinker. • Solution shows deep understanding of the problem and its components. • Solution shows extensive and appropriate application of 21st-century skills.	• Presentation shows clear evidence of an independent learner and thinker. • Solution shows adequate understanding of the problem and its components. • Solution shows adequate application of 21st-century skills.	• Presentation shows some evidence of an independent learner and thinker. • Solution shows some understanding of the problem and its components. • Solution shows some application of 21st-century skills.	• Presentation shows limited or no evidence of an independent learner and thinker. • Solution shows limited or no understanding of the problem. • Solution shows limited or no application of 21st-century skills.