Fair Lawn

Public Schools

Fair Lawn, NJ

8th Grade Dynamic Math Connections

Adopted August

2015

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Developed August 2013

The 8th grade Dynamic Mathematics Connections course has been designed for the regular math student and is aligned with the Grade 8 Common Core State Standards.

DMC 8

Fair Lawn School District

Committee Credits

Grade 8 Dynamic Math Team

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Dynamic Math 8

I. Course Synopsis

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. Throughout the course, mathematical concepts will be taught with an emphasis on enduring understandings, essential questions, real-world application, technology, and cross-curricular interaction.

II. Philosophy & Rationale

Dynamic Math Connections is an engaging program that immerses students in cross-curricular applications of mathematics and shows them how it is used in the real world. The half-year course focuses on project-based learning through the use of various technology, hands-on projects, and manipulatives. Students get to choose what they want to investigate and then analyze data from a topic that truly interests them—such as animation, video gaming and much more.

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret

components of the relationship (such as slope and y-intercept) in terms of the situation. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

CCSS.MATH.PRACTICE.MP1 - 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. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

CCSS.MATH.PRACTICE.MP2 - 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.

CCSS.MATH.PRACTICE.MP3 - 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. Elementary students can construct arguments using concrete referents such as objects,

drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

CCSS.MATH.PRACTICE.MP4 - Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. 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.

CCSS.MATH.PRACTICE.MP5 - 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 their 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. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

CCSS.MATH.PRACTICE.MP6 - 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, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

CCSS.MATH.PRACTICE.MP7 - Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. 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. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

CCSS.MATH.PRACTICE.MP8 - 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. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. 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.

III. Scope & Sequence

Unit 1: Zomes (6 Weeks):

Measuring angles using a protractor
Relative strength of geometric shapes
Sum of Interior Angles
Perimeter, Area, and Volume of regular figures
Using a computer animated design program (Zome -CAD)
Using formulas for calculations in Microsoft Excel
Congruent and similar figures
Unit and rate conversions

Unit 2: Geometer's Sketchpad (7 Weeks):

Graphing and plotting points in the coordinate plane
Identifying the four transformations
Translations, reflections, rotations, and dilations in the coordinate plane
Displaying geometric transformations with a computer animation program

Unit 3: Thermo Cup (3 Weeks):

Properties of energy (Heat Transfer)
Properties of insulators and conductors
Temperature conversions
Slope of a line
Graphing linear equations
Building a model to test
Analyzing data

Unit 4: Rubik's Cube (3 Weeks):

Constructing nets of regular solids
Surface area and volume of regular solids
Interpret mathematical algorithms
Solving a Rubik's Cube

IV. Unit Descriptions

Unit 1: Zomes

Enduring Understanding

1. Scale models are an integral part of the real-world design process.
2. Computer animated design programs are used to model real world situations.
3. The unique geometric properties of shapes and figures have different and unique uses in building and design.
4. Different angle measurements have different geometric strength when applied to a real-world design.
5. Models can be tested to ensure the presence of certain properties.

Essential Question(s)

1. How can a computer animated design program benefit the design of a tower?
2. What is the strongest geometric shape for use within a tower?
3. What is the relationship between surface area and volume?
4. How can Microsoft Excel be utilized to track a budget?
5. How can students work collaboratively to create one cost-efficient and strong tower?

Learning Objectives

Students will be able to:

1. Use manipulatives to build a stable structure.
2. Utilize Microsoft Excel to follow a specific budget by applying formulas
3. Construct a virtual display and find the inventory of the tower using a computer animated design program
4. Identify basic principles of engineering by studying the Tacoma Narrows Bridge Disaster and watching "Engineering the Impossible" by the Discovery Channel
5. Test a structure built both for height and strength.
6. Measure angles using a protractor.
7. Understand the basic geometric properties of polygons and polyhedrons, including area, surface area, and volume.

Common Core State Standards

- **8.G.A.4** Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

- **8.G.A.5** Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
- **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
    a. Tacoma Narrows Bridge Analysis
    b. Guided Activity: Familiarizing Yourself with Zomes
    c. ZomeCAD modeling laboratory activity
    d. Microsoft Excel Tower Budget
        a. G&T - Student created and manipulated (formulas, costs, etc.)
        b. (SE), 504 - Teacher created; student manipulation
    e. Zomes Tower Final Performance
    f. Zomes End of Unit Quiz (Modified formula sheet (SE), 504)
2. English Language Learners.
    a. Read written instructions.
    b. Students may be provided with note organizers / study guides to reinforce key topics.
    c. Model and provide examples
    d. Extended time on assessments when needed.
    e. Establish a non-verbal cue to redirect student when not on task.
    f. Students may use a bilingual dictionary.
    g. Pair Visual Prompts with Verbal Presentations
    h. Highlight Key Words & Formulas- this can be used as a reference sheet throughout the project.
3. Special Education/504 Students.
    a. Students may be provided with note organizers / study guides to reinforce key topics.
    b. Extended time on assessments when needed.
    c. Preferred seating to be determined by student and teacher.
    d. Provide modified assessments when necessary.
    e. Student may complete assessments in alternate setting when requested.
    f. Establish a non-verbal cue to redirect student when not on task.
    g. Maintain strong teacher / parent communication.
    h. Repetition and practice
    i. Pair Visual Prompts with Verbal Presentations

j. Provide Formulas
k. Check Use of Agenda

4. Gifted and Talented Students.
    a. Use of Higher Level Questioning Techniques
    b. Extension/Challenge Questions
    c. Project extension: Poster Presentation (Budget, model, tower)

New Jersey Core Curriculum Content Standards - Technology

- **8.1.P.A.1** Use an input device to select an item and navigate the screen
- **8.1.P.A.4** Use basic technology terms in the proper context in conversation with peers and teachers (e.g., camera, tablet, Internet, mouse, keyboard, and printer).
- **8.1.P.A.5** Demonstrate the ability to access and use resources on a computing device.
- **8.1.2.A.5** Enter information into a spreadsheet and sort the information.
- **8.2.2.C.1** Brainstorm ideas on how to solve a problem or build a product.
- **8.2.8.C.1** Explain how different teams/groups can contribute to the overall design of a product.
- **8.2.8.C.4** Identify the steps in the design process that would be used to solve a designated problem.
- **8.2.8.D.1** Design and create a product that addresses a real world problem using a design process under specific constraints.
- **8.2.8.D.3** Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
- **8.2.12.D.3** Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) technological product or system.

Career Readiness Practices

- **CRP2.** Apply appropriate academic and technical skills.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP 8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP11**. Use technology to enhance productivity.

NJCCSS 9.2 - Career Awareness, Exploration, and Preparation

- **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- **9.3.12.AC-DES.1** - Justify design solutions through the use of research documentation and analysis of data.

- **9.3.12.AC - DES.3** - Describe the requirements of the integral systems that impact the design of buildings.
- **9.3.12.AC - DES.6** - Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- **9.3.12.AC - DES.8** - Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

Unit 2: Geometer's Sketchpad

Enduring Understanding

1. Geometric transformations are applicable and present in a variety of real-world situations.
2. Different geometric transformations have unique effects on the transformed shapes.
3. After a transformation in performed, certain properties are preserved while others are changed.
4. Geometric transformations can be used to create both simple and complex animations.

Essential Question(s)

1. What are the four geometric transformations?
2. What is needed to perform each of the transformations?
3. When do transformations occur in the real world?
4. Which transformations preserve size and orientation?
5. How can you identify the transformation given the pre-image and image?
6. How can Geometer's Sketchpad be used to demonstrate the four geometric transformations?

Learning Objectives

1. Identify the transformation given the pre-image and image.
2. Define the four transformations.
3. Recall the required information to perform each transformation.
4. Manually perform transformations on graph paper.
5. Use buttons to hide/show items and create animations.
6. Construct lines, line segments, circles, polygons, and their interiors using Geometer's Sketchpad.
7. Create simple animations using merge and action buttons.
8. Create animations using transformations and presentations.
9. Animate objects using distances, angles, and ratios for dilations, rotations, and translations.
10. Utilize Geometer's Sketchpad to demonstrate the four transformations in a cohesive final animation project.

Common Core State Standards

- **8.G.A.1** Verify experimentally the properties of rotations, reflections, and translations:
    a. Lines are taken to lines, and line segments to line segments of the same length.
    b. Angles are taken to angles of the same measure.
    c. Parallel lines are taken to parallel lines.
- **8.G.A.2** Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- **8.G.A.3** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- **8.G.A.4** Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
    a. Geometer's Sketchpad Guided Activities 1-8
    b. Geometer's Sketchpad Final Animation
    c. Transformation Activities 1-3 (Extension for G&T)
    d. Final Animation Help (Extension for G&T)
    e. Geometer's Sketchpad illustrated practice (SE), 504
    f. Using Tangrams to model transformations (SE), 504
2. English Language Learners.
    a. Read written instructions.
    b. Students may be provided with note organizers / study guides to reinforce key topics.
    c. Model and provide examples
    d. Extended time on assessments when needed.
    e. Establish a non-verbal cue to redirect student when not on task.
    f. Students may use a bilingual dictionary.
    g. Pair Visual Prompts with Verbal Presentations
    h. Highlight Key Words & Formulas- this can be used as a reference sheet throughout the project.
3. Special Education/504 Students.
    a. Students may be provided with note organizers / study guides to reinforce key topics.
    b. Extended time on assessments when needed.

c. Preferred seating to be determined by student and teacher.
d. Provide modified assessments when necessary.
e. Student may complete assessments in alternate setting when requested.
f. Establish a non-verbal cue to redirect student when not on task.
g. Maintain strong teacher / parent communication.
h. Repetition and practice
i. Pair Visual Prompts with Verbal Presentations
j. Provide Formulas
k. Check Use of Agenda

4. Gifted and Talented Students.
    a. Use of Higher Level Questioning Techniques
    b. Extension/Challenge Questions

New Jersey Core Curriculum Content Standards - Technology

- **8.2.8.C.1** - Explain how different teams/ groups can contribute to the overall design of a project
- **8.2.8.C.4** - Identify the steps in the design process that would be used to solve a designated problem
- **8.2.8.D.3** Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

Career Readiness Practices

- **CRP2.** Apply appropriate academic and technical skills.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP 8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP11**. Use technology to enhance productivity.

NJCCSS 9.2 - Career Awareness, Exploration, and Preparation

- **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- **9.3.12.AR.6** - Evaluate technological advancements and tools that are essential to occupations within the arts, A/V technology and communications career cluster.
- **9.3.12.AR-AV.4** - Design an audio, video and/or film production.
- **9.3.12.AR-VIS.3** - Analyze and create two and three dimensional visual art forms using various media.

Unit 3: Thermo-Cup

Enduring Understanding

1. Materials have unique properties that make them ideal for certain tasks and poor for others.
2. Certain materials have properties that maintain the heat of an object.
3. A linear trend on a graph shows a correlation between two variables, either positive, negative, or none.
4. Different units of measurement are used to represent the same temperature.
5. Different countries use different systems of measurement.

Essential Question(s)

1. What is an insulator?
2. Which materials make good insulators?
3. Where are insulators used in everyday life?
4. How do you convert temperatures between Celsius and Fahrenheit
5. Why are multiple forms of a line (point slope and slope-intercept) both used?

Learning Objectives

1. Complete the EasyTemp Lab using temperature probes, Hand Dynamometers, TI-Nspire calculators, and related computer software.
2. Record data into a document for further analysis and comparison.
3. Brainstorm ideas and construct an insulated cup (thermos).
4. Generate a list of insulators and conductors
5. Test their ThermoCup for percent of heat lost to determine the best design
6. Analyze the results of the class through graphing.

Common Core State Standards

- **8.EE.B.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
- **8.EE.B.6** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.
- **8.EE.C.7** Solve linear equations in one variable.
- **8.F.A.1** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- **8.F.A.2** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a

linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

- **8.F.B.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- **8.F.B.5** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
    a. Easy Temp Laboratory Activity (TI-nspire)
    b. Plastic vs. Styrofoam vs. Lid Experiment
    c. ThermoCup Group project
        a. Project outline allows for individualized project ideas/designs.
        b. Diagram of materials used can be created using different mediums (e.g. Geometer's Sketchpad, Microsoft Word, Paint, etc.)
    d. Grip Test/Analysis
    e. Solving Linear Equations
    f. Solving Systems of Equations
        a. Graphing
        b. Elimination
        c. Substitution
    g. Slope-Intercept Form
2. English Language Learners.
    a. Read written instructions.
    b. Students may be provided with note organizers / study guides to reinforce key topics.
    c. Model and provide examples
    d. Extended time on assessments when needed.
    e. Establish a non-verbal cue to redirect student when not on task.
    f. Students may use a bilingual dictionary.
    g. Pair Visual Prompts with Verbal Presentations
    h. Highlight Key Words & Formulas- this can be used as a reference sheet throughout the project.

3. Special Education/504 Students.
    a. Students may be provided with note organizers / study guides to reinforce key topics.
    b. Extended time on assessments when needed.
    c. Preferred seating to be determined by student and teacher.
    d. Provide modified assessments when necessary.
    e. Student may complete assessments in alternate setting when requested.
    f. Establish a non-verbal cue to redirect student when not on task.
    g. Maintain strong teacher / parent communication.
    h. Repetition and practice
    i. Pair Visual Prompts with Verbal Presentations
    j. Provide Formulas
    k. Check Use of Agenda
4. Gifted and Talented Students.
    a. Use of Higher Level Questioning Techniques
    b. Extension/Challenge Questions

<u>New Jersey Core Curriculum Content Standards - Technology</u>

- **8.1.8.A.4** Graph and calculate data within a spreadsheet and present a summary of the results
- **8.1.5.F.1** Apply digital tools to collect, organize, and analyze data that support a scientific finding.
- **8.2.8.C.4** Identify the steps in the design process that would be used to solve a designated problem.
- **8.2.8.D.1** Design and create a product that addresses a real world problem using a design process under specific constraints.

<u>Career Readiness Practices</u>

- **CRP2.** Apply appropriate academic and technical skills.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP 8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP11**. Use technology to enhance productivity.

<u>NJCCSS 9.2 - Career Awareness, Exploration, and Preparation</u>

- **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- **9.3.HU-CSM.2** - Communicate produce or equipment features that meet the needs of clients and consumers.
- **9.3.HU-CSM.8** - Apply business procedures and utilize equipment and facilities to produce satisfying client outcomes.

Unit 4: Rubik's Cube

Enduring Understanding

1. A net is a two dimensional shape that can be folded to form a three dimensional figure.
2. A net is made up of the same shapes as the faces of its three dimensional equivalent.
3. A three dimensional figure can be identified by its net.
4. Prisms and pyramids are unique figures with specific properties.
5. An algorithm is a step-by-step process used to solve a problem.
6. Algorithms are used in real world situations to complete tasks and solve problems.

Essential Question(s)

1. What is a net?
2. How are volume and surface area calculated?
3. What are volume and surface area?
4. How do I solve a Rubik's Cube?
5. What is an algorithm?

Learning Objectives

1. Calculate the volume of regular polyhedrons.
2. Recall the differences between prisms and pyramids.
3. Calculate the surface area of regular polyhedrons.
4. Understand the process of finding surface area given a net.
5. Create a three-dimensional figure provided a net.
6. Deconstruct a rectangular prism into a net.
7. Attempt to solve a Rubik's Cube using given step-by-step algorithms.
8. Explain the history, process, and significance of the Rubik's Cube.

Common Core State Standards

- **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
- **7.G.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
   a. Constructing nets
   b. Cereal box activity
   c. Surface area of 3-D shapes
   d. Volume of 3-D shapes (worksheet)
   e. Solving a Rubik's Cube
      a. G&T -
      b. SE, 504 - students will continue to use a guide throughout the project
2. English Language Learners.
   a. Read written instructions.
   b. Students may be provided with note organizers / study guides to reinforce key topics.
   c. Model and provide examples
   d. Extended time on assessments when needed.
   e. Establish a non-verbal cue to redirect student when not on task.
   f. Students may use a bilingual dictionary.
   g. Pair Visual Prompts with Verbal Presentations
   h. Highlight Key Words & Formulas- this can be used as a reference sheet throughout the project.
3. Special Education/504 Students.
   a. Students may be provided with note organizers / study guides to reinforce key topics.
   b. Extended time on assessments when needed.
   c. Preferred seating to be determined by student and teacher.
   d. Provide modified assessments when necessary.
   e. Student may complete assessments in alternate setting when requested.
   f. Establish a non-verbal cue to redirect student when not on task.
   g. Maintain strong teacher / parent communication.
   h. Repetition and practice
   i. Pair Visual Prompts with Verbal Presentations
   j. Provide Formulas
   k. Check Use of Agenda
   l. Students will continue to use a guide throughout the project
   m. Making mosaics: students who cannot solve the cube can design single sides
4. Gifted and Talented Students.
   a. Use of Higher Level Questioning Techniques

b. Extension/Challenge Questions
c. Students will learn algorithms and apply on their own

New Jersey Core Curriculum Content Standards - Technology

- **8.2.8.D.1** Design and create a product that addresses a real world problem using a design process under specific constraints.
- **8.2.8.C.8** Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.

Career Readiness Practices

- **CRP2.** Apply appropriate academic and technical skills.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP 8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP11**. Use technology to enhance productivity.

NJCCSS 9.2 - Career Awareness, Exploration, and Preparation

- **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- **9.3.HU-CSM.2** - Communicate produce or equipment features that meet the needs of clients and consumers.
- **9.3.HU-CSM.8** - Apply business procedures and utilize equipment and facilities to produce satisfying client outcomes.

V. Course Materials

Include the course textbook citation, including the year it was adopted by the Fair Lawn Board of Education. Include any additional materials which are used during the course.

Unit 1: Zomes

Protractors
Calculators
Zomes
Rulers
Laptops
ZomeCAD Program
Microsoft Excel
TNB PowerPoint
TNB Worksheet
Zomes Familiarity WS
Properties of Polygons WS
Measuring Polyhedrons WS
Plastic 3-D Solids
Textbooks (to test towers)
Zomes Smart Notebook file (Notes, DO NOWS)
Zomes Quiz, formula sheet

Unit 2: Geometer's Sketchpad

GSP Smart Notebook file (Notes, DO NOWS)
Laptops
Geometer's Sketchpad Program
GSP Activities 1-8
Translations WS
Rotations WS
Reflections WS
Transformation Activities 1-3
GSP Activities Checklist
GSP Final Animation Rubric
Audience Participation Log
GSP Final Animation Extra Help

Unit 3: Thermo-Cup

Classroom set of TI-nspire CX calcuators
Easy Temp Probes
Vernier Temperature Probes
Household Supplies (students can bring in)
Water
Electric Kettle
Hand Dynamometer (Grip Test)
TinkerPlots (or Microsoft Excel, Google Form)
LoggerPro Program
Laptops
ThermoCup Smart Notebook file (notes, DO NOWs)
Plastic cups
Easy Temp Lab Handouts
Slope-intercept WS
Point-slope WS
Vernier Docking Station

Unit 4: Rubik's Cube

Classroom Set of Rubik's Cubes
Rubik's cube Introduction WS
Rubik's Cube Smart Notebook file (notes, DO NOWs)
Nets WS
Large Graph paper
Colored Pencils/crayons
Rulers
Rubik's Cube Solution Guides
Cereal Boxes (students can bring in)
Volume of Rectangular Prisms WS
Surface Area of Rectangular Prism WS
Scissors

VI. Assessments

Unit 1: Zomes

- Physical tower model (built using zomes pieces) tested for strength
- Microsoft Excel budget spreadsheet
- Computer animated design model (created in Zome-CAD)
- Extended constructed response questions
- TenMarks assignments
    - Area and volume of regular figures
    - Similar figures

Unit 2: Geometer's Sketchpad

- Transformation worksheets and activities
- Extended constructed response questions
- TenMarks assignments
    - Identifying the four transformations
    - Transformations in the coordinate plane
- Final animation project (created on the Geometer's Sketchpad program)

Unit 3: Thermo-Cup

- Temperature conversion quiz
- Cup plan and diagram (created electronically)
- Slope and linear equations worksheets
- Constructed Thermo-Cup
- Thermo-Cup data analysis

Unit 4: Rubik's Cube

- Creating a figure from a net
- Volume of 3-D shapes worksheet
- Parrot worksheet - Volume and area

VII. Cross Curricular Aspects

Unit 1: Zomes

- Science/engineering
  - Building a physical model to withstand outside forces
- Literacy
  - Tower design written proposal
- Social Studies
  - Examining the Tacoma Narrows Bridge disaster

Unit 2: Geometer's Sketchpad

- Art
  - Creating an animation

Unit 3: Thermo-Cup

- Science
  - Temperature conversions
  - Heat transfer
  - Properties of insulators and conductors
- Engineering
  - Construction of thermos from raw materials
- Art
  - Constructing a diagram of your Thermo-Cup

Unit 4: Rubik's Cube

- Social Studies
  - History and background of the Rubik's cube and its inventor
- Art
  - Constructing mosaics
- Engineering
  - Exploring the construction and inner workings of the Rubik's Cube's gears