POMPTON LAKES SCHOOL DISTRICT

COMPUTER AIDED DESIGN
Semester Course

COURSE OF STUDY

Submitted by
The Mathematics Department

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Unit Overview	
Content Area: Mathematical Applications for Computer Aided Design	
Unit Title: Unit 1 – Fundamentals of algebra, geometry and trigonometry for CAD applications	
Target Course/Grade Level: 11th and 12th	
Unit Summary: Students will learn the essential mathematical tools needed to successfully design simple drawings as well as complex multidimensional diagrams such as top, front and side level architectural drawings.	
Unit Rationale: Topics such as angles and ratio are instructed to students in order to give learners the tools necessary to participate in a structures learning environment.	
Student Learning Objectives	
1.) Students will be able to set up and write a ratio algebraic equation. 2.) Students will be able to solve a ratio algebraic equation. 3.) Students will be able to scale and convert to proper units. 4.) Students will be able to solve right angle trigonometry applications.	
Selected Opportunities for Connection to Mathematical Practices **1. Make sense of problems and persevere in solving them.** **2. Reason abstractly and quantitatively.** 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** **5. Use appropriate tools strategically.** **6. Attend to precision.** **7.** Look for and make use of structure**.** 8. Look for and express regularity in repeated reasoning. **All** of the content presented in this course has connections to the standards for mathematical practices. **Bold type identifies possible starting points for connections to the SLOs in this unit.**	
Code #	**Common Core State Standards**
A-SSE-3	Write expressions in equivalent forms to solve problems
A-CED-1	Create equations that describe numbers and relationships
G-SRT-1	Understand similarity in terms of similarity transformations
G-SRT-6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle leading to definitions of trigonometric for acute angles.
G-SRT-7	Explain and use the relationship between the sine and cosine of complementary angles.
G-SRT-8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G-SRT-11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.
	Common Core Anchor Standards
	English Language Arts Standards » Science & Technical Subjects » Grade 11-12

CCSS.ELA.LIT.RST-11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
CCSS.ELA.LIT.RST-11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Code #	**New Jersey Core Content Curriculum Technology Standards**
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair and human factor engineering (ergonomics).
8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
8.2.12.D.3	Determine and use the appropriate resources (CNC, 3d printers, CAD software) in the design, development and creation of a technological product or system.

Unit Essential Questions	**Unit Enduring Understandings**
• Can students recognize an appropriate angle when it is needed in a diagram? • Can students solve a simple ratio in order to properly scale a diagram?	• Convert decimals to units of measurement • Introductory dimensioning including linear measurement and angles

Unit Learning Targets

Students will ...

- be able to use a simple ratio to convert dimensions of an object or room into something that is an appropriate size for a diagram.
- be able to dimension a linear measurement.
- be able to dimension an angle measurement.
- be able to use appropriate types of numbers depending on the application.
- be able to apply algebraic and geometric principles to determine lengths and angles.

Evidence of Learning

Summative Assessment: The students will be assessed with a summative unit assessment which will be modeled after the PARCC assessment model. Diagrams will also be assessed that use the appropriate mathematical tools.

Equipment needed: Smart board, Math Worksheets, Sample Diagrams, Textbook

Teacher resources: Internet and YouTube AutoCAD lessons

Formative Assessments

- Tests and quizzes
- Discussions
- Individual practice
- Explanation of examples
- Daily homework assignments
- Notes

Lesson Plans

Lesson	**Timeframe**
Lesson 1 Discussion of ratio equations	2 days
Lesson 2 Discussion of scale	4 days
Lesson 3 Discussion of solving appropriate algebraic equations	2 days
Lesson 4 Linear Dimensioning	3 days

Lesson 5 Angle Dimensioning	3 days
Lesson 6 Creation of Geometric Shapes in AutoCAD	5 days
Lesson 7 Drawing and Dimensioning Project	5 days
Teacher Notes: 6 days allocated for formative/summative assessments which include quizzes and drawing assessments.	
Curriculum Development Resources	

Unit Overview

Content Area: Mathematics and the use of two-dimensional and three-dimensional drawing development

Unit Title: Unit 2 – Perspective and Three-Dimensional Drawings on CAD

Target Course/Grade Level: 11th and 12th

Unit Summary: Students will learn the essentials of two-dimensional and three-dimensional drawings as it pertains to geometry. Such mathematical applications will be applied when diagrams are constructed.

Unit Rationale: All types of geometric figures including circles and other shapes will be discussed and designed on the two-dimensional and three-dimensional framework.

Student Learning Objectives

1) Students will be able to draw a standard top, side, front view of a three-dimensional object.
2) Students will be able to convert between two-dimensional and three-dimensional diagrams
3) Students will be able to recognize the relevant geometric concepts when designing figures
4) Students will be able to produce engineering drawings based on 3d models and parts.
5) Create an assembly drawing using existing part drawings in order to learn how to define relationships between parts within the drawing.

Selected Opportunities for Connection to Mathematical Practices

1. **Make sense of problems and persevere in solving them.***
2. **Reason abstractly and quantitatively.**
3. Construct viable arguments and critique the reasoning of others.
4. **Model with mathematics.***
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
7. Look for and make use of structure**.**
8. Look for and express regularity in repeated reasoning.

All of the content presented in this course has connections to the standards for mathematical practices.
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8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
8.2.12.D.3	Determine and use the appropriate resources (CNC, 3d printers, CAD software) in the design, development and creation of a technological product or system.

Unit Learning Targets

Students will ...

- be able to design two-dimensional and three-dimensional diagrams that will entail numerous teacher and student selected designs.

Evidence of Learning

Summative Assessment:

This model assessment will include performance task. The students engineering drawings will be assessed for correctness, accuracy and technological requirements.

Formative Assessments

- Individual practice
- Project Tasks
- Notes
- Performance tasks

Lesson Plans

Lesson	Timeframe
Lesson 1 Students will create given perspective drawings	3 days
Lesson 2 Students will design their own perspective drawings	3 days
Lesson 3 Students will create given 3-dimensional drawings	5 days
Lesson 4 Students will design their own 3-dimensional drawings	10 days
Lesson 5 Students will create a given assembly drawing	5 days
Lesson 6 Students will create their own assembly drawing	10 days

Teacher Notes:

Assembly drawing will be a capstone project for the unit

Curriculum Development Resources

Unit Overview
Content Area: Mathematics and its use in engineering and architectural development
Unit Title: Unit 3 – Reverse Engineering
Target Course/Grade Level: 11th and 12th
Unit Summary: Students will develop their mechanical skills through exploration of how things are created and assembled. Students will correctly draw each piece of the object. The procedure to draw such objects will be to correctly draw and dimension a three view drawing in order to make the transition to architectural development.
Unit Rationale: Three-dimensional view drawings will be examined in detail
Student Learning Objectives
1) students will be able to convert decimals to inches 2) students will be able to create three view drawings from objects 3) students will be able to apply proper scale and dimensioning 4) students will be able to reverse engineer a physical object and create a suite of drawings of the physical object. The students will be able to take apart an object, measure physical dimensions and create a complete of engineering drawings.
Selected Opportunities for Connection to Mathematical Practices **1. Make sense of problems and persevere in solving them.*** **2. Reason abstractly and quantitatively.** 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.*** **5. Use appropriate tools strategically.** **6. Attend to precision.** **7.** Look for and make use of structure**.** 8. Look for and express regularity in repeated reasoning. All of the content presented in this course has connections to the standards for mathematical practices. **Bold type identifies possible starting points for connections to the SLOs in this unit.**

Code #	**Common Core State Standards**
M-1	Modeling links classroom mathematics to everyday life, work and decision-making.
G-GMD-4	Identify the shapes of two-dimensional cross-sections of three-dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional objects.
Code #	**New Jersey Core Content Curriculum Technology Standards**
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair and human factor engineering (ergonomics).
8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints, addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.

8.2.12.D.4	Assess the impacts of emerging technologies on developing countries.
8.2.12.D.3	Determine and use the appropriate resources (CNC, 3d printers, CAD software) in the design, development and creation of a technological product or system.
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
8.2.12.C.6	Research an existing product, reverse engineer, and redesign it to improve form and function.

Unit Essential Questions	**Unit Enduring Understandings**
• Can students convert objects to three view engineering drawings? • Can students scale all relevant objects correctly? • Can students persevere in completing a detailed long-term project involving multiple tasks?	• Proper Measurement and Tool Selection • Three-Dimensional Representation • Reverse Engineering

Unit Learning Targets

Students will ...

- correctly measure, draw, dimension and label three view drawings from three-dimensional objects

Evidence of Learning

Summative Assessment: The students will be assessed with a summative unit assessment which will require the student to create a full set of part drawings, material list and assembly drawings.

Formative Assessments

- Teacher review of progress towards final summative assessment

Lesson Plans

Lesson	Timeframe
Lesson 1 Three view drawing	12 days
Lesson 2 Dimensioning	5 days
Lesson 3 Reverse engineering	10 days

Teacher Notes:

Provide multiple part projects for reverse engineering project

Curriculum Development Resources

Considerations for classified students:

Classroom Instruction:

- All instruction for classified students will be guided by the students' Individualized Education Plan (IEP).
- Regular education teachers will be responsible for differentiating instruction for classified students based on the instructional modifications listed in the IEP.
- In the case of General Education - Supported Instruction (GE-SI) Classes, the special education teacher will be responsible for support in modifying the curriculum for the students, informing the class room teacher of the modifications, and directing instructional aide(s) to provide support accordingly.
- Grading will be done collaboratively by the regular and special education teachers.

Modifications:

- Modifications include but are not limited to:
  Extra time for assignments, modified classwork/homework assignments based on disability, preferential seating, study guides, copies of class notes, assistive technology and rewording/repeating or clarifying directions.

In-class Assessments

- All assessments are to be in line with students' IEPs. In-class support teachers should modify tests for classified students. Tests may be given in the regular education classroom or completed with the inclusion teacher in another location with additional time. Students may be tested separately according to the IEP.
- Assessment grades may be modified based on a student's disability and in accordance with their IEP.

Considerations for English Language Learners (ELLs):

CLASSROOM INSTRUCTION:

- Instruction for ESL students will be guided by their WIDA English Language Proficiency level. Teachers should receive this level from the ESL teacher assigned to the building.
- General education teachers will be responsible for differentiating instruction for ELLs with the assistance of the ESL teacher that promotes language, literacy and content learning.
- Sheltered Instruction Observation Protocol (SIOP)
  http://siop.pearson.com/about-siop/
  The following 8 components provide all teachers with lesson planning and instructional strategies that support language and learning goals for all students. This approach to teaching aligns with preparing students with college and career ready skills.
  The SIOP Model components:
  1. Lesson Preparation

2. Building Background
3. Comprehensible Input
4. Strategies
5. Interaction
6. Practice and Application
7. Lesson Delivery
8. Review and Assessment

- In the case of Content-Based ESL (CBE), the ESL teacher and the general education teacher will be responsible for identifying language objectives and additional instructional strategies that improve proficiency in English and academic success of ELLs. Instructional strategies and the necessary scaffolds to promote student learning will be shared with the general education teacher for daily lessons that are aligned to District Curricula, CCSS, and WIDA Standards. The general Education teacher and ESL teacher will be co-teachers for a pre-determined amount of classroom instruction.
- Grading will be done collaboratively by the regular and ESL teachers.

MODIFICATIONS: The following are possible modifications but are not limited to this list.

- Direct instruction, small group or pullout, about the contrasting letter sound correspondences, syllabication patterns and morphology in English supported with connections to their native language, native language text and/or resources, graphic organizers, visuals, sentence starters/ sentence frames, cloze activities, modeling, working with a partner, timeline and phrase wall and adapted text (in English) or specific sections of the original text, highlighted/bold-faced words within text.
- Draw pictures instead of writing/speaking.
- Match drawings with new vocabulary that might correspond.
- Work in small group or pairs with their English Only (EOs) peers for authentic content language talk and grade level modeling.
- Write simple sentences instead of complex sentences that demonstrates an understanding of academic language particular to specific content.
- Match simple sentences with new vocabulary that might apply to edit sentences.
- Have students provide examples/explanations of main idea in simple sentences. Revisions show an attempt to improve Language Control by embedding academic content vocabulary and Linguistic Complexity by expanding and varying sentence structures and using correct punctuation.

- Draw pictures instead of writing/speaking about seasonal changes. Match drawings with new vocabulary (adjective word wall, content word walls) that might correspond.
- Provide multiple opportunities for authentic speech acts to practice language skills and develop English fluency.
- Total Physical Response (TPR) to model critical thinking skills like analyze and synthesize.
- Study Guides

IN CLASS ASSESSMENTS:

- All formative and summative assessments will include modifications that support student's English Proficiency level. ESL teachers will collaborate with regular education teachers to provide appropriate differentiation for assessing ELLs.

Considerations for At Risk Students:

- At Risk students are identified by the I&RS committee in each school. The committee woks to understand the reasons behind the student's low performance level in school and to create and implement a plan that is carried out by a variety of staff members in the building.
- Teachers with At Risk students are notified by the I&RS committee and provided with a copy of the plan and a timeframe for assessing the growth of the student. There are academic as well as behavioral goals that are listed for the students with recommended strategies unique to each individual.
- Classroom teachers are to follow the plan using instructional strategies that will help the student improve his/her performance while applying appropriate behavioral strategies consistent with the needs of the student.
- Teachers will report student progress to the I&RS committee within the specified timeframe for the plan.

Classroom instruction:

- Teachers will use differentiated instruction for At Risk students as they do for all students in their class. The strategies would be guided by the I&RS plan and be consistent with the student's ability and learning modality.

Modifications:

- Clarify all assignments and place specific timeframes for completion. Provide student with opportunity for one on one time for clarification.
- Set clear expectations for all assignments, in and outside of class. Keep expectations within the framework of the I&RS plan.

- Use positive reinforcement for all successes. Hold student to defined consequences for not completing work.
- Provide time outside the normal class time for completion of work. Not completing assignments is unacceptable, all assignments will be completed.

In Class Assessments:

- At Risk students should receive any modifications listed in the I&RS plan. If necessary, students should be provided with extended time to complete assessments.

Considerations for Gifted Students:

- Teachers will use differentiated instruction for Gifted Students as they do for all students in their class.
- Assignments and assessments can be planned and implemented with input from the student.
- Gifted students will be provided with the opportunity to demonstrate their knowledge through a variety of platforms.
- Teachers will have the latitude to provide assignments with the individual student's ability in mind.