

Glen Ridge Public Schools –Visual & Performing Arts Curriculum



Course Title: CAD 8

Subject: Visual and Performing Arts

Grade Level: 8

Duration: Half year

Prerequisite: None

Elective or Required: Elective

Computer Science, Engineering, and Technology Mission Statement:

Since computational thinking and problem solving are integral parts of our lives and 21st century learning, students must be actively involved in their Computer Science, Engineering, and Technology (CSET) education. The CSET curricula will emphasize thinking skills through a balance of computation, intuition, common sense, logic, design, analysis, and technology. Students will use a combination of technology and critical thinking to solve real-world problems. To achieve these goals, students will be taught a standards-based curriculum that is aligned with the New Jersey Curriculum Standards.

Course Description:

Computer Aided Drafting provides students with opportunities to discover the basic concepts of design. By the close of the semester each student will have a basic understanding of AutoCAD for producing two-dimensional, three-dimensional, and pictorial representations of mechanical objects. Architecture will be explored through the use of three-dimensional CAD software. Also, students will become aware of the role of a CAD in industry. Therefore, practical (real life) situations will be applied to the topics below. Students who wish to proceed further will enroll in CAD I where they will broaden their knowledge of CAD and its applications.

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CAD 8 TABLE OF CONTENTS

UNIT	TITLE	Timeline
1	Introduction to Computer Aided Drafting & Design	5 Weeks
2	Pictorial Drawings & Basic 3D CAD	3 Weeks
3	Orthographic Projection, Dimensioning, & Design	4 Weeks
4	Fundamentals of Architecture	8 Weeks

Course Name

CAD 8

Topic/Unit:

Introduction to Computer Aided Drafting & Design

Approximate # Of Weeks: 4-5 Weeks

Essential Questions:

- Why are drawings so important?
- Is CAD a necessary skill to become a mechanical engineer?
- How are sketches used in the engineering field?
- What makes CAD computer-aided drawing different from art drawing?
- What makes an AutoCAD drawing impressive?
- What is the future for CAD, 3D modeling, and 3D printing?
- Why is accuracy in mechanical drawing so important?
- What are the best ways to present a drawing?
- What makes a good design and bad design?
- How can AutoCAD be applied for creating technical 2D drawings?

Upon completion of this unit students will be able to:

- Draw sketches from objects to convey ideas. (8.2.8.C.5.a)
- Build a working technical vocabulary in regards to CAD and geometry terms. (M.G.A.1)
- Apply the Pythagorean theorem to determine the unknown height of a triangle. (M.G.B.7)
- Use AutoCAD as a digital tool to solve real world problems. (8.1.8.A.1)
- Compare and contrast technical designs accomplished with the application of CAD software vs. pencil drafting or sketching. (8.2.8.B.6)
- Recognize the applications of AutoCAD in the present and future work force. (9.2.8.B.4)
- Discover how CAD is used in the design and creation of a product or system. (8.2.8.A.1)
- Use AutoCAD to create two-dimensional computer representations of mechanical parts the design technical real life objects. (8.2.8.D.1)
- Apply good elements of design when creating an original drawing. (8.2.8.C.3)
- Use basic draw and modify tools in AutoCAD to design an original drawing. (8.2.8.C.8)

Interdisciplinary Standards

Math

- **M.G.A.1:** Verify experimentally the properties of rotations, reflections, and translations:

Lines are transformed to lines, and line segments to line segments of the same length.

Angles are transformed to angles of the same measure.

Parallel lines are transformed to parallel lines.

- **M.G.B.7:** Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Technology

- **8.1.8.A.1:** Demonstrate knowledge of a real world problem using digital tools.
- **8.2.8.A.1:** Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs).
- **8.2.8.B.6:** Compare and contrast the different types of intellectual property including copyrights, patents and trademarks.
- **8.2.8.C.3:** Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
- **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.
- **8.2.8.C.5.a:** Create a technical sketch of a product with materials and measurements labeled.

21st Century Life and Careers

- **9.2.8.B.4** Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally

Activities:

- Setup a CAD drawing using basic modify, and draw tools.
- Understand how the mouse functions in CAD to allow for zooming and panning in the workspace.
- Make directories and subdirectories use the school's mainframe for saving files.
- Students will brainstorm about the uses, advantages and application of today's CAD software.
- Students will complete exercises for learning AutoCAD commands.
- Students will use AutoCAD to create accurate two-dimensional representations of drawings assigned.
- Students will use basic drawing skills to design and create projects of their own using CAD.
- Students will use the Internet to research elements of good logo design.

STEAM Activities:

- Logo Duplication: Students will use AutoCAD to duplicate a basic professional logo by copying and pasting a logo in to AutoCAD. They will use the poly line tool to trace the logo and the poly edit and spline tool to modify the shape of their objects. They will use the gradient and hatch tool to fill in the logo with color and texture.
- Logo Design: The students will design an original logo that represents them or their interests using AutoCAD. The logo will appear in their personalized title block.
- Keychain Design: Students will use 3D CAD to extrude an original logo for a 3D printed key chain. They will apply the design process, use a scale and caliper to create a real life size object.

Enrichment Activities:

- Single View CAD Drawings: Students will recreate single view drawings from the drafting textbook. Each drawing will build skills of using the draw and modify tool bars.
- Maze: Students will design a maze that uses the grid, snap command and line tool. Students can also use Trim, Extend and offset to create the maze.
- Snowflake: Students will use the Polar Array tool to create a snowflake. They will use the Gradient tool to fill in the snowflake with color.

Methods of Assessments/Evaluation:

- Quizzes on measuring, dividing and using polar coordinates.
- Questions of the day. (Commands, careers & computer operations)
- Peer evaluation of drawings.
- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and demeanor of their drawings.
- Students will complete assigned drawing by the determined due date.
- Students will keep a digital portfolio of their drawings.
- Students will make all necessary revisions for final flawless drawing to include in their digital portfolios.

Resources:

- Digital handouts of 2D drawings references
- Textbooks: *Mechanical Drawing*, & *Basic Technical Drawing*
- Computers with AutoCAD and Sketch Up installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Calipers

Online Resources:

- Mr. D'n'T: <http://www.mr-d-n-t.co.uk/>
- Technology Student: <http://www.technologystudent.com/>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3604>

Course Name

CAD 8

Topic/Unit:

Pictorial Drawings & Basic 3D CAD

Approximate # Of Weeks: 2-3 Weeks

Essential Questions:

- Why are pictorial views so important in the engineering world?
- How are pictorial drawings be used during the design process?
- How can one be so sure in choosing the right pictorial for a job?
- Why is accuracy 3D modeling important?
- What role does tolerance play when designing a 3D object in CAD for a 3D printed model in real life?
- How can AutoCAD allow the use to construct these pictorial drawings with ease?
- How can one take a 2-D drawing and create a 3-D object?
- How does the phrase “A picture is worth a thousand words” apply to CAD?

Upon completion of this unit students will be able to:

- Prepare hand-drawn pictorial sketches using regular and isometric grid paper (8.2.8.C.5.a)
- Draw 3D solid models to design a proposal for a given problem. (8.2.8.C.8)
- Evaluate an existing three-dimensional design and identify methods for how that product has been improved to meet current demands. (8.2.8.A.1)
- Design a prototype to solve a real world problem for a STEM based challenge. (8.2.8.D.3)
- Collect data form a design challenge, and then analyze methods for improving the design to create an optimal solution. (MS-ETS1-4)

Interdisciplinary Standards

Science: Engineering Design

- **MS-ETS1-3:** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Technology

- **8.2.8.A.1:** Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs).

- **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.
- **8.2.8.C.5.a:** Create a technical sketch of a product with materials and measurements labeled.
- **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.

Activities – include 21st Century Technologies:

- Identify different methods for developing axonometric drawings.
- Draw objects using isometric drawing methods.
- Draw objects using oblique drawing methods.
- Draw three-dimensional objects using 3-D operations.
- Students will complete exercises for the construction of pictorial and oblique drawings.
- Drawings should allow students to become familiar with the process of creating 2D drawing and projecting into a 3D representation.

STEAM Activities:

- Part design: Students can re-create a small part or ornament using precision measurement tools (calipers) to be printed using the dimension printer.
- Balloon Car: Students will engineer and design a balloon-powered car in 3D CAD. The parts will be 3D printed and raced for speed and alignment. Students will collect data and evaluate performance to suggest methods of improving their design.

Enrichment Activities:

- Technical drawing of oblique and isometric mechanical parts from a drafting textbook. Each drawing will build skills of using the draw and modify tool bars.
- Drawings should allow students to become familiar with using the command line, and tool bars.
- Oblique Name Plate: Students should use rulers to create an oblique representation of their name or initials, and then use CAD to recreate their nameplate. Students should use polar tracking set at 45 degrees to control the projection angle.
- Introduction to 3D Drawings: Parts in this unit can be generated in 3D by using the pres/pull in CAD or Sketch Up.

Methods of Assessments/Evaluation:

- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and layout of their drawings.
- Practical drawing quizzes.

- Peer evaluation of drawings.
- Students will complete self-assessments prior to submitting drawings.

Resources:

- Digital handouts of pictorial drawings references
- Textbooks: *Mechanical Drawing*, & *Basic Technical Drawing*
- Computers with AutoCAD, Inventor and Sketch Up installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Calipers

Online Resources:

- Mr. D'n'T: <http://www.mr-d-n-t.co.uk/>
- Technology Student: <http://www.technologystudent.com/>
- 8th grade Technology & CAD: <http://www.troyareasd.org/Page/4081>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3604>

Course Name

CAD 8

Topic/Unit:

Orthographic Projection, Dimensioning and Design

Approximate # Of Weeks: 4 Weeks

Essential Questions:

- How do orthographic drawings convey ideas more efficiently than a single view drawing?
- Is it important to have more than one view in a drawing?
- How does one decide to make the best possible projection for an object?
- How does dimensioning affect an engineering drawing?
- What is the difference between decimals versus fractions?
- Why is it important to know the do's and don'ts of dimensioning standard?
- Why is it necessary to use proper dimensioning, line types and layout?
- How do dimensions help you interpret a drawing?
- What problems would arise from inaccurate or a lack of dimensions?

Upon completion of this unit students will be able to:

- Explain the importance of each part in a system. (8.2.8.A.2)
- Determine the correct method of dimensioning. (8.2.8.C.5.a)
- Evaluate a current technology and improve the aesthetics and ergonomics of the design. (8.2.8.C.3)
- Create orthographic drawings from tangible and mechanical parts. (8.2.8.C.5.a)
- Use 3D modeling to improve an existing technology to meet the demands of an individual. (8.2.8.B.5)
- Create advertising that uses Orthographic representations to truthfully convey a product to a consumer. (9.1.8.E.8)
- Describe how advertisements are used to distort facts about products. (9.1.8.E.3)
- Create a description and presentation of a new product. (W.8.4.)
- Measure parts and apply the dimensions to a drawing to develop an accurate part. (MS-ETS1-4)

Interdisciplinary Standards

English

- **W.8.4:** Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience.

Science: Engineering Design

- **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Technology

- **8.2.8.A.2:** Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.
- **8.2.8.C.3:** Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
- **8.2.8.C.5.a:** Create a technical sketch of a product with materials and measurements labeled.
- **8.2.8.B.5:** Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries and societies.

21st Century Life and Careers

- **9.1.8.E.8:** Recognize the techniques and effects of deceptive advertising.
- **9.1.8.E.3:** Compare and contrast product facts versus advertising claims.

Activities:

- Students will create a series of orthographic drawings containing one, two and three views with dimensioning.
- Students will complete exercises on the dimensioning process.
- Students will design and create and improve projects of their own. By drawing common objects (i.e. smart phone or other technical objects).
- Students will create a series of CAD drawings with dimensions using a three-dimensional modeling program.

STEAM Activities:

- **Draw it:** Students will use calipers to measure and draw a current technology such as a cell phone or other hand-held technology.
- **Technology accessory:** Students will design a new accessory for an existing technology (example: cell phone case). They will export and print the design and test it to determine the tolerance and accuracy of the accessory.
- **Advertisement:** Students will create an advertisement of their new design that will include dimensions of orthographic views and a written description of the product.

Enrichment Activities:

- **Multi-View CAD Drawings:** Students will recreate multi-view drawings from a drafting textbook to include in their digital portfolio. Each drawing will be dimensioned using proper dimensioning rules.
- Students will draw sketches and use a three-dimensional CAD program to extrude sketches in 3D.
- Drawings will familiarize students with the creation of basic 3D Drawings

should use layers for centerlines, hidden lines, extension lines and dimensioning.

- Drawings should allow students to become familiar with producing an orthographic layout.
- Drawings should allow students to become familiar with dimensioning.
- Students will learn how to modify dimensions to change 3D objects..
- Cell Phone: Students will create an orthographic projection of their cell phone and dimension it properly.

Methods of Assessments/Evaluation:

- Assessment rubrics to ensure drawings meet the requirements specified.
- Students will be assessed on the accuracy and layout of their drawings.
- Drawings will be assessed for proper dimensioning.
- Orthographic projection quiz: Missing view quiz.
- Practical quiz on layout and dimensioning.
- Discussion on the importance of good dimensioning practices.
- Peer evaluation of drawings with dimensions.

Resources:

- Digital handouts of pictorial drawings references
- Textbooks: *Mechanical Drawing*, & *Basic Technical Drawing*
- Computers with AutoCAD, Inventor and Sketch Up installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers
- Calipers

Online Resources:

- Mr. D'n'T: <http://www.mr-d-n-t.co.uk/>
- Technology Student: <http://www.technologystudent.com/>
- Instructables:
<http://www.instructables.com/id/How-to-create-your-own-3D-Printed-iPhone-Case-from/>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3604>

Course Name

CAD 8

Topic/Unit:

Fundamentals of Architecture

Approximate # Of Weeks: 8 Weeks

Essential Questions:

- Is architecture design or art?
- Is design just as important as construction?
- What standards are necessary for architecture?
- How does interior design influence furniture design and placement?
- How can sketching skills improve an architect's design?
- How can one make the best possible architectural drawing?
- Has free and low cost home architecture software had an impacted on the way residential structures are designed and furnished?
- What identifies a good design as it relates to residential architecture?
- What is the work triangle in a kitchen?
- How does the work triangle affect the layout of appliances and workspace in the kitchen?

Upon completion of this unit students will be able to:

- Produce architectural drawings utilizing appropriate Computer Aided Drafting and Design software and free 3D modeling software. (9.3.12.AC.2)
- Draw and design furniture for a residential home. (8.2.8.D.1)
- Design and draw basic residential homes using 3D modeling software. (8.2.8.C.5.a)
- Design and organize basic exterior spaces around homes and public shared spaces such as parks, play grounds and fields. (8.2.8.C.3)
- Design and organize interior shared spaces for clients' needs. (8.2.8.C.3)
- Renovate interior spaces for clients' needs. (9.3.12.AC.3)
- Design and draw commercial buildings such as towers and stadiums. (8.2.8.C.8)
- Work with a team to complete designs for public and private communal spaces such as playgrounds/parks, amusement parks and zoos. (8.2.8.C.1)

Interdisciplinary Standards

Technology

- **8.2.8.C.1:** Explain how different teams/groups can contribute to the overall design of a product.
- **8.2.8.C.3:** Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.

- **8.2.8.C.5.a:** Create a technical sketch of a product with materials and measurements labeled.
- **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.
- **8.2.8.D.1:** Design and create a product that addresses a real world problem using a design process under specific constraints.

Career and Technical Education

- **9.3.12.AC.2:** Use architecture and construction skills to create and manage a project.
- **9.3.12.AC.3:** Comply with regulations and applicable codes to establish and manage a legal and safe workplace.

Activities:

- Students will complete exercises for developing design skills in architecture.
- Students will create and import object into floor plans to design interior spaces.
- Students will create exterior spaces with proper components.
- Students will design and renovate spaces based on client requirements.

STEAM activities:

- Furniture design: Students will use Sketch Up to create original designed furniture for the interior space of their house. 3D modeled furniture must be ergonomic and aesthetically pleasing to meet a common design theme in the house.
- Playground Equipment: Students will use Sketch Up to create original designed playground equipment for the park project. 3D models must follow the common themes of the playground and must be functional.

Enrichment Activities:

- Room Floor plan: Students will design floor plans for dining rooms, bedrooms, living rooms, kitchens and bathrooms.
- Plot Plan: Students will create a plot plan for a basic residential home.
- Sketch Up: Students will utilize Sketch Up to complete client based required projects these include:
 - Basic residential home with exterior components
 - Kitchen design following the rules for the work triangle
 - Interior furniture design. (Desk, Book Shelf, Dresser or other).
 - Classroom using arrays for the desks
 - Coffee Shop: renovate the class room into a coffee shop
 - Playground with originally designed equipment.
 - Stadiums with sports fields
 - Towers using arrays for the windows.

- o Amusement Park, Zoo with a partner
- o Lake house floor plan and 3D exterior view

Methods of Assessments/Evaluation:

- Performance-based assessment on good design as it relates to residential architecture
- Assessment on the creation of detailed drawings in the following areas:
 1. Floor Plans
 2. Design and layout
 3. Exterior planning.
 4. Kitchen Plans incorporating the work triangle
 - 5.

Resources:

- Digital handouts of drawing procedures and requirements for each drawing.
- Textbooks: *Architecture Residential Drafting and Design*
- Computers with AutoCAD, and Sketch Up installed
- Plotter/Printers
- 3D printer
- Projector and screen
- Calculator
- Rulers

Online Resources

- Google Sketch Up: <http://www.sketchup.com/>
- 3D warehouse: <https://3dwarehouse.sketchup.com/?hl=en>
- House Plans: <https://www.houseplans.com/>
- Mr. Shohen's page: <http://www.glenridge.org/Page/3604>
- SCAD furniture design: <https://www.scad.edu/academics/programs/furniture-design/student-work>
- Tech note: <http://www.tcea.org/blog/free-3d-software/>
- StageDTstudios: <https://sagedtstudios.com/8th-grade/>