

# Unit 3: CAD and Engineering Graphics

Content Area: **Applied Technology**  
Course(s):  
Time Period: **Marking Period 1**  
Length: **25**  
Status: **Published**

## Summary

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### Introduction:

Students will become skilled at making and reading CAD engineering drawings. Students will explore conventions, used in making orthographic projection drawings. Students will use common commands, (LINE, CONSTRUCTION LINE, OFFSET) and dimension the drawings using trade appropriate units. Students will also use AutoCAD to create a drawing for a 3-d printer in the .stl format.

**Revision Date:** July, 2020

CS.9-12.ED	Engineering Design
LA.RST.11-12	Reading Science and Technical Subjects
LA.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.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible

and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

SCI.HS.ETS1.B	Developing Possible Solutions
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1	Engineering Design
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
WRK.9.2.12.CAP	Career Awareness and Planning
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.CS1	The characteristics and scope of technology.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.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 factors engineering (ergonomics).
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.12.D.CS1	Apply the design process.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
	Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most

efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.

## **Essential Questions/Enduring Understandings**

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### **Essential Questions:**

How do engineers make working drawings?

How do engineers document technical projects?

What types of drawings do engineers make?

### **Enduring Understandings:**

Engineers make orthographic drawings and they adhere to conventions

Engineers make drawings for different purposes (i.e. production, documentation, 3-D printing).

Engineers make drawings that use units that relate to trades.

## **Objectives**

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### **Students will know:**

How to start a new drawing and save it in CAD.

How units are determined and used in CAD.

How to use basic functions in CAD: line, linetype, arc, circle, rectangle, chamfer, fillet, erase, trim.

How to use dimensions in CAD.

How to affectively use dimensions and precision when describing an object.

How to evaluate tolerances in a drawing.

how to create and organize orthographic drawings

vocabulary: tolerance, units, construction line, object line, line weight, dimension line, dimension extension line, .dwg, .stl, front, top, side.

**Students will be skilled at:**

making orthographic drawings of an object

making .stl drawings of an object that can be printed on a 3-D printer

**Learning Plan**

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Preview the essential questions and connect to learning throughout the unit.

Formative assessments will be conducted throughout the process using class discussion, and practice quizzes.

Formative assessments will be conducted throughout the design process.

Teacher will provide demonstration using Smartboard of fundamental concepts of making an orthographic drawing.

Suggested activity: provide students with a 3 dimensional drawing with dimensions. Students will create orthographic drawings.

Suggested activity: provide students with a set of parts that need a chassis, i.e. 2 servo motors and an Arduino. Students will make a .stl of the mounting system and possibly print it out.

Suggested activity: Project based learning: provide students with a design problem like make a tablet holder from recycled materials. Students will make the product and orthographic drawings.

Current Events: identify trends in 3-D printers

Summative assessments will be conducted throughout to evaluate skills acquisition.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Complete unit test and/or quiz.

Complete writing prompt.

**Assessment**

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**Formative Assessment:**

participation in class discussions on 3-D printers, 3-D drawings, and arduino

accurate use of unit vocabulary

exit tickets

individual check ins with teacher that provide feedback

### **Summative Assessment:**

students will make orthographic drawings. The project will be graded using a rubric.

students will make still drawings. The project will be graded using a rubric.

Complete writing prompts: Why do engineering make orthographic drawings? What are concerns regarding size and tolerancing when making a .stl drawing?

answer the essential questions.

### **Alternate Assessment:**

Presentation on using CAD with drawing example following given parameters

### **Benchmark**

evaluation: final exam

## **Materials**

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CAD and other software programs

3-D printer and supplies

Video recording of teacher demonstration

Teacher e-board.

SmartBoard use for teacher presentation and interactive lessons

SmartBoard use for student presentations.

Model making materials, dependant on projects that used.

## **Integrated Accommodations and Modifications...**

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[Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education and those with 504s](#)

