

# Unit 4: Inventor Procedures and Processes

Content Area: **Industrial Technology**  
Course(s): **Auto CAD I**  
Time Period: **1 marking period**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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In this unit, Students will be learning the processes and procedures using AutoDesk Inventor, a 3D processing and design program. This unit focuses on not just simple 2D drawings, but full 3D rendering, and utilizing the tools available to modify their designs. Students will be shown all the different tools to manipulate perspectives, and understand design in a 3D dimensional space, as well as transfer 2D design concepts into 3D. The train project focuses on highlighting each of the tools, through the construction of parts of the train. The character project is a fun challenge project used to apply what they have learned through the construction of the train, in order to make something of their own. Through this unit, 3D printers are also explored, solidifying an understanding of a true real world application of the program.

## Transfer

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Students will be able to independently use their learning to

- Complete real world tasks typically asked of architects and engineers
- Work as a drafter for any design firm without any college experience
- Utilize design principles normally used by engineerings and architects
- Apply critical thinking skills for any task, especially ones focused on utilizing design aspects
- Understanding principles of building, building codes of different states, and how those codes affect design choices
- Research materials when selecting for building
- Be able to model and print 3D parts using a modern software solution used by inventors and engineers alike

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For more information, read the following article by Grant Wiggins.

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## **Meaning**

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## **Understandings**

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Students will understand

- The similarities and differences of design in 2D and 3D
- How to produce 3D objects from concept drawings in a 2D space
- How to utilize previous knowledge of drawings and sketches to remake them in a 3D space
- How to disassemble real world objects in order to recreate them in a modeling space
- Labeling objects in a 3D space and how to properly display these labels in the software
- Concepts for troubleshooting issues when designing within a program

## **Essential Questions**

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Students will keep considering

- What applications could I use 3D modeling for?
- How accurate do I have to be when modeling in a 3D space
- How do I go about changing or adjusting an object I render?
- Are there jobs in companies that utilize this kind of design and software?
- If I wanted a career in this, what routes can I take?
- What does the design process look like when compared to 2D modeling and design?

## **Application of Knowledge and Skill**

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## **Students will know...**

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Students will know

- How to render a 3D model using inventor software
- How to translate a 2D laid out model in order a 3D model using inventor
- How to import AutoCAD drawings into inventor to generate 3D models
- The tools that can be utilized in Inventor in order to modify and adjust a model properly
- How to annotate, label, and transfer models into a printable medium
- How to animate 3D models to create demonstrations of behavior for a particular invention

## **Students will be skilled at...**

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Students will be skilled at

- Creating new concepts, inventions and objects using Inventor software
- Generating accurate models in 3D using 2D drawings
- Following vague instructions for construction of a consistent model
- Design accurate pieces based on researched images
- Animation processes for 3D models

## **Academic Vocabulary**

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Inventor

Sketch

Model

Extrude

Filet

Chamfer

Hole

Loft

Revolve

Shell

Annotation

Animation

Scheduling

Ball and Socket Joint

Assembly

Generating

## **Learning Goal 1 - Basic Principles of Inventor**

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SWBAT Sketch and model objects and design concepts in AutoDesk Inventor

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.8.1.12.A.2   | Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.      |
| TECH.8.1.12.F.CS2 | Plan and manage activities to develop a solution or complete a project.   |
| TECH.8.1.12.F.CS4 | Use multiple processes and diverse perspectives to explore alternative solutions.   |
| TECH.8.2.12.A.CS2 | The core concepts of technology.  |
| 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.C.CS1 | The attributes of design.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Target 1 - Sketching and Extrusions**

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SWBAT Sketch and extrude objects in inventor based on instructor specifications

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|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Target 2 - Fillet and Chamfer**

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## SWBAT Filet and Chamfer objects in Inventor based on instructor specifications

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 3 - Hole**

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#### SWBAT Use the hole tool to place assorted holes into objects in Inventor based on instructor specifications

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 4 - Loft**

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#### SWBAT Use the loft tool to create more obscure objects in Inventor based on instructor specifications

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 5 - Revolve**

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#### SWBAT Use the revolve tool to create sphere and cylindrical based objects in Inventor based on instructor specifications

|                 |   |
|-----------------|---|
| TECH.8.1.12.A   | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled. |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Target 6 - Shell**

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SWBAT Use the shelling tool to hollow out objects in Inventor based on instructor specifications

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Target 7 - Annotation of Objects**

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SWBAT Lay out in a printable format, objects generated in inventor in order to send to a client

SWBAT Annotate and dimension generated objects in Inventor

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Learning Goal 2 - Inventor Train Understanding Assessment**

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SWBAT Construct, Assemble, and Animate a toy train to demonstrate understanding of Inventor mechanics

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.8.1.12.A.CS1 | Understand and use technology systems.  |
| TECH.8.1.12.A.CS2 | Select and use applications effectively and productively.   |
| TECH.8.1.12.F.CS2 | Plan and manage activities to develop a solution or complete a project.   |
| TECH.8.1.12.F.CS4 | Use multiple processes and diverse perspectives to explore alternative solutions.   |
| TECH.8.2.12.A.CS2 | The core concepts of technology.  |
| 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.C.CS1 | The attributes of design.                  |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems. |

### **Target 1 - Train Introduction, Goals, and Scheduling**

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SWBAT Understand the needs and expectations of the train project as presented by the client

SWBAT Follow a detailed schedule for train construction, meeting all benchmarks along the way

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 2 - Train Body, Cow Catcher, and Engine Wheels**

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SWBAT Complete the Train Body within the schedule time frame

SWBAT Complete the Cow Catcher within the schedule time frame

SWBAT Complete the Engine Wheels within the schedule time frame

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 3 - Link Arm, Link Pins, Peg, and Smoke Stack**

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SWBAT Utilize extrusions, and holes in order to complete the Link Arms within the schedule time frame

SWBAT Utilize angles and revolve in order to complete the Link Pins within the schedule time frame

SWBAT Utilize angles and revolve in order to complete the Wheel Pegs within the schedule time frame

SWBAT Utilize revolve and shell in order to complete the Smoke Stack within the schedule time frame

|               |  |
|---------------|--|
| TECH.8.1.12.A | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations. |
|---------------|--|

|                   |   |
|-------------------|---|
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 4 - Train Track, and Assembly Process**

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SWBAT Utilize revolve, angles, and extrusions, in order to complete the Train Track within the schedule time frame

SWBAT Utilize assembly processes, such as constraints and joints, in order to complete the Train Assembly within the schedule time frame

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 5 - Animations**

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SWBAT Animate the train track motion

SWBAT Animate the wheels of the train to turn with the train track motion

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 6 - Task / Performance of Understanding and Assessment**

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SWBAT Sketch, Construct, Assemble, and Animate Train Cars to demonstrate understanding of Inventor processes

|                 |   |
|-----------------|---|
| TECH.8.1.12.A   | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5 | Create scaled engineering drawings of products both manually and digitally with materials   |



and measurements labeled.

TECH.8.2.12.D.CS3

Assess the impact of products and systems.

### **Learning Goal 3 - Character Project Understanding Assessment**

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SWBAT Sketch, Construct, Assemble, and Animate a fully designed and scaled action figure / doll character in Inventor based on instructor specification

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.8.1.12.A.2   | Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.      |
| TECH.8.1.12.A.CS1 | Understand and use technology systems.  |
| TECH.8.1.12.F.CS2 | Plan and manage activities to develop a solution or complete a project.   |
| TECH.8.1.12.F.CS4 | Use multiple processes and diverse perspectives to explore alternative solutions.   |
| TECH.8.2.12.A.CS2 | The core concepts of technology.  |
| 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.C.CS1 | The attributes of design.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 1 - Character Project Introduction, Goals, and Scheduling**

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SWBAT Understand the needs and expectations of the character project as presented by the client

SWBAT Follow a detailed schedule for figure construction, meeting all benchmarks along the way

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 2 - Decision Process of Character Selection**

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SWBAT Select a character to construct that meets the specifications laid out by the instructor

|                 |  |
|-----------------|--|
| TECH.8.1.12.A   | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations. |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled. |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 3 - Ball and Socket Joint Creation**

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SWBAT Generate a ball and socket joint model to allow for animation of the selected character project

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 4 - Character Part Generation**

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SWBAT Generate all parts of their selected character within the scheduled time frame

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 5 - Character Assembly**

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SWBAT Assemble all the parts together to form one figure utilizing learned assembly processes within the scheduled time frame

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

### **Target 6 - Character Animations**

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SWBAT Animate the generated figure for motions specified and approved by the instructor

|                   |   |
|-------------------|---|
| TECH.8.1.12.A     | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.  |
| 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.C.5   | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.   |
| TECH.8.2.12.D.CS3 | Assess the impact of products and systems.  |

## **Summative Assessment**

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- Performance Task
- Test/Quiz
- Benchmark Exam Drawing
- Challenge Drawing of Marking Period

## **21st Century Life and Careers**

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|                 |   |
|-----------------|---|
| CRP.K-12.CRP2   | Apply appropriate academic and technical skills.  |
| CRP.K-12.CRP4   | Communicate clearly and effectively and with reason.  |
| CRP.K-12.CRP6   | Demonstrate creativity and innovation.  |
| CRP.K-12.CRP8   | Utilize critical thinking to make sense of problems and persevere in solving them.  |
| CAEP.9.2.12.C   | Career Preparation  |
| CAEP.9.2.12.C.1 | Review career goals and determine steps necessary for attainment.   |
| CAEP.9.2.12.C.3 | Identify transferable career skills and design alternate career plans.  |
| CAEP.9.2.12.C.5 | Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures. |
| CAEP.9.2.12.C.9 | Analyze the correlation between personal and financial behavior and employability.  |

## **Formative Assessment and Performance Opportunities**

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- Academic Games
- Classroom Discussions
- Classwork
- Closures
- Do Nows / Warm Ups
- Group Work

- Homework
- Student / Teacher Discussions
- Think-Pair-Share
- After School and Lunch Opportunities

## **Accommodations/Modifications**

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- For the character project, alternative character selection requirements and options can be used for students
- Train Project Tutorials contain English and Alternative Language Subtitles for students needing additional assistance beyond the demonstration
- Students will be provided additional 1 on 1 time with the instructor if needed
- Project Time Frame Negotiations and Performance Evaluation for Unfinished Work, given communication with the instructor on issues
- If Vision issues with computer screens, can adjust size of text font and icons to fit the needs of the students
- If ESL, Language adjustments can be implemented into AutoCAD
- If ESL, Alternative Notes can be provided
- Preferential Seating will be provided for the sake of demonstrations, note taking, and general physical and behavioral accommodations
- 504 Accommodations
- Additional Challenging / Enrichment Tasks
- Grouping
- IEPs
- Drawing of the Month
- Scaffolding Questions
- General Use of Technology Accommodations (Adjusted to meet needs of student in accordance to 504/IEP)

## **Unit Resources**

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- AutoDesk Design Handbook
- General AutoCAD Practice Websites - <https://www.investintech.com/resources/blog/archives/5947-free-online-autocad-tutorials-courses.html>
- Khan Academy
- Youtube Tutorials - [https://www.youtube.com/channel/UC0bEfqT1FZudcnyegNvtu1A?view\\_as=subscriber](https://www.youtube.com/channel/UC0bEfqT1FZudcnyegNvtu1A?view_as=subscriber)

## Interdisciplinary Connections

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|-------------------------|--|
| LA.RH.9-10.3            | Analyze in detail a series of events described in a text; draw connections between the events, to determine whether earlier events caused later ones or simply preceded them.  |
| LA.RH.9-10.7            | Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text, to analyze information presented via different mediums.   |
| LA.WHST.9-10.6          | Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.  |
| 9-12.HS-ETS1-1.1        | Asking Questions and Defining Problems   |
| 9-12.HS-ETS1-4.5        | Using Mathematics and Computational Thinking   |
| 9-12.HS-ETS1-4.ETS1.B.1 | 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. |