

Introduction Computer Aided Design (Syllabus)		
Unit One: Introduction to Parametric Solid Modeling		
Essential Questions	• What is Computer Aided Design? • What is Parametric Solid Modeling? • How do you create basic 3D objects? • What is an extrusion?	
Standards	Digital Literacy and Computer Science • 9-12.CAS.c.2 Discuss the impact of computing technology on business and commerce.	
Concepts and Skills	• Explanation of what CAD programs do and how and why they are used • Examples of companies that use CAD software and examples of everyday objects that were designed in CREO. • Explanation of what extrusions are and examples of objects that are extruded • Overview of the CREO environment • Introduction to the extrude tool • Intro to “sketcher”, drawing tools, and legal sketches • Choosing a work plane and using references • Building extrudes off of each other, adding and subtracting to make progressively more complex shapes • Edit object definitions to make changes to existing parts	Science and Technology/Engineering Practices • Practice 2. Developing and Using Models

Content Objectives "I can Statements"	I can open CREO I can set my working directory I can navigate within the CREO environment (rotate, zoom in/out, scroll) I can demonstrate how to control object orientation I can create a simple sketch in "sketcher" I can use the extrude tool to make simple 3D shapes I can use the extrude tool to add and subtract material from a model I can determine whether or not something is a "legal sketch" I can edit object definitions to make changes to the existing part I can utilize sketch references I can build extrudes off of each other I can create basic 3D shapes I can edit an existing sketch or object
Assessments, vocabulary, products, practice	● Practice: Explore the program and practice drawing in sketcher and creating simple objects ● Assignment #1: Child's Cube
Text, Materials, and Resources	● Video: Play Doh Fun Factory (extrusions) ● Video: CAD Vocab
Unit Two: Creating Simple 3D Objects	
Essential Questions	● What are boolean operations? ● What is a round? ● What is a chamfer? ● What is a shell?
Standards	Digital Literacy and Computer Science ● 9-12.DTC.a.1 Use digital tools to design and develop a significant digital artifact

	Mathematics - G-GMD B.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. - G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects.	
Concepts and Skills	- Discussion about how to think about part geometry - Boolean operations - Introduction to the round tool - Introduction to the chamfer tool - Introduction to the shell tool	Science and Technology/Engineering Practices Practice 2. Developing and Using Models
Content Objectives "I can Statements"	I can accurately recreate simple shapes I can evaluate how best to create a given part I can use the round, chamfer, and shell tools I can create a more complex object (camera)	
Assessments, vocabulary, products, practice	Practice: Using the round, chamfer, and shell tools Assignment #2: Shapes Quiz: Shapes Assignment #3: Camera	
Text, Materials, and Resources	N/A	
Unit Three: Dimensioning		
Essential Questions	- What is a dimension? - How do you use dimensions to create accurate 3D models?	
Standards	Science and Technology/Engineering	

	- HS-ETS1-5(MA). Plan a prototype or design solution using orthographic projections and isometric drawings, using proper scales and proportions. Mathematics - G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects	
Concepts and Skills	- Discussion of what it means for something to be fully constrained - Explanation of weak vs strong dimensions - How to place dimensions - How to change the dimensions of a part - How to set part depth	Science and Technology/Engineering Practices Practice 2. Developing and Using Models
Content Objectives "I can Statements"	I can determine if a part is fully constrained I can dimension a line I can place a dimension between two points I can dimension an angle I can dimension a round (radius/diameter) I can edit the dimensions of a part I can control the depth of a part	
Assessments, vocabulary, products, practice	Practice: Placing dimensions and editing dimensions Assignment #4: Dimensioning Quiz: Dimensioning	
Text, Materials, and Resources	N/A	
Unit Four: Designing For 3D Printing		
Essential Questions	What is additive manufacturing? How do 3D printers work?	

Standards	Science and Technology/Engineering • HS-ETS2-1(MA). Determine the best application of manufacturing processes to create parts of desired shape, size, and finish based on available resources and safety. Digital Literacy and Computer Science • 9-12.CAS.c.2 Discuss the impact of computing technology on business and commerce • 9-12.CS.a.4 Explain and demonstrate how specialized computing devices can be used for problem solving, decision-making and creativity in all subject areas. • 9-12.CT.d.10 Use an iterative design process, including learning from making mistakes, to gain a better understanding of the problem domain. • 9-12.CT.e.1 Create models and simulations to help formulate, test, and refine hypotheses. Mathematics • G-GMD B.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. • G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects • G-MG A.3. Apply geometric methods to solve design problems	
Concepts and Skills	• Explanation of how 3D printers work • Designing for 3D printing • Angles • Bridging • Undercuts • Supports • Positioning parts on print bed • Tolerances • Exporting a Stereolithography file	Science and Technology/Engineering Practices • Practice 2. Developing and Using Models • Practice 6. Constructing Explanations and Designing Solutions
Content Objectives "I can Statements"	I can explain how a 3D printer works I can design a part for 3D printing I can export my part as a stereolithography file I can make changes to my part based on what does and doesn't work	
Assessments,	• Assignment #5: 3D Printed Pen	

vocabulary, products, practice		
Text, Materials, and Resources	● Video: What is 3D printing ● Presentation: The ABCs of 3D Printing ● Video: YHT Video	
Unit Five: Advanced Tools (Revolves, Mirrors, Patterns, Blend, Sweep)		
Essential Questions	● How can you reuse elements of your model to save time and effort? ● How do you create more advanced models? ● What is a revolve ● What is a pattern? ● What is a mirror? ● What is a sweep? ● What is a blend? ● What is a centerline? ● What is a cross section?	
Standards	Digital Literacy and Computer Science ● 9-12.DTC.a.1 Use digital tools to design and develop a significant digital artifact Mathematics ● G-GMD B.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. ● G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects.	
Concepts and Skills	● Reusing sketches ● Introduction to the revolve tool ● Mirroring a 2D sketch ● Mirroring a 3D part ● Circular Patterns ● Linear patterns ● Sweeping along a line	Science and Technology/Engineering Practices ● Practice 2. Developing and Using Models

	• Sweeping along an edge • Cross sections • Blends	
Content Objectives "I can Statements"	I can reuse a sketch in another extrusion or document I can use the revolve tool I can mirror a 2D drawing in sketcher I can mirror a 3D part I can pattern around a circle I can create a linear pattern I can use the sweep tool along a line or along an edge I can use the blend tool to create a part from a series of cross section	
Assessments, vocabulary, products, practice	• Practice: Using mirroring 2D drawings, and 3D objects. Practice using the revolve tool, patterning in a circle, and patterning in a line or grid. Practice sweeping along a line or an edge, and using the blend tool. • Assignment #6: Vehicle	
Text, Materials, and Resources	N/A	
Unit Six: Orthographic Drawings		
Essential Questions	• What is an Orthographic Projection? • How do you create an accurate 3D model from an engineering drawing (blueprints)?	
Standards	Digital Literacy and Computer Science • 9-12.DTC.a.1 Use digital tools to design and develop a significant digital artifact • 9-12.CT.d.10 Use an iterative design process, including learning from making mistakes, to gain a better understanding of the problem domain. • 9-12.CT.e.1 Create models and simulations to help formulate, test, and refine hypotheses. Mathematics	

	• G-GMD B.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. • G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects. • G-MG A.3. Apply geometric methods to solve design problems.	
Concepts and Skills	• Discussion of what an orthographic is and how they work • Creating 3-view drawings from 3D objects • Creating 3D objects from 2D drawings • Creating dimensionally accurate parts from 3-view drawings	Science and Technology/Engineering Practices • Practice 2. Developing and Using Models
Content Objectives "I can Statements"	I can create a 3-view drawing of a 3D object I can create a 3D model from a 3-view drawing I can use the dimension on a 3-view drawing to accurately dimension my 3D model	
Assessments, vocabulary, products, practice	• Worksheets 3D to 2D on paper • Worksheets 2D to 3D on paper • Worksheet: 2D to 3D in CREO • Quiz: Orthographics	
Text, Materials, and Resources	• Presentation: What is an Orthographic Projection?	
Unit Seven: Assemblies		
Essential Questions	• What is an assembly? • How can you reuse elements of your model to save time and effort? • How do you assemble individual parts to create complete objects?	
Standards	Science and Technology/Engineering	

	• HS-ETS1-5(MA). Plan a prototype or design solution using orthographic projections and isometric drawings, using proper scales and proportions. Digital Literacy and Computer Science • 9-12.DTC.a.1 Use digital tools to design and develop a significant digital artifact • 9-12.CT.d.10 Use an iterative design process, including learning from making mistakes, to gain a better understanding of the problem domain. • 9-12.CT.e.1 Create models and simulations to help formulate, test, and refine hypotheses. Mathematics • G-GMD B.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. • G-MG A.1. Use geometric shapes, their measures, and their properties to describe objects • G-MG A.3. Apply geometric methods to solve design problems	
Concepts and Skills	• Discussion of what an assembly is and why we use them • Inserting parts into an assembly • Discussion of the different types of constraints (coincident, normal, distance, angle offset) • Adding and deleting constraints • Making sure your part is fully constrained • Demonstration of what happens when you make changes to the original parts • How to scale a part • How to save time by using the pattern tool in an assembly and assembling assemblies	Science and Technology/Engineering Practices Practice 2. Developing and Using Models
Content Objectives "I can Statements"	I can bring a part into an assembly and secure it in space I can add parts to my assembly I can add constraints (coincident, distance, normal, angle offset) to my assembled parts I can confirm that my parts are "fully constrained" I can make changes to the original part files I can scale a part	

	I can assemble an assembly into an assembly I can pattern inside an assembly
Assessments, vocabulary, products, practice	• Worksheet: Assemblies • Activity: Build with Legos • Assignment #7: Environment
Text, Materials, and Resources	Library of CREO models of LEGO parts