onshape®

INTRO TO CAD

UNIT 1: WELCOME TO ONSHAPE

Lesson 2 Teacher Guide

ptc education

1.2 Why CAD?

Teacher Guide

Learning Objectives

In this lesson, your students will learn:

- Why should we use CAD?
- The three datum planes used in Onshape views.
- How to explore objects in CAD.
- What it means to view something normal to a plane.
- How to quickly move to different views in Onshape using the View cube.
- How to take measurements in Onshape.
- The difference between a part studio and an assembly in Onshape.

Standards

- HS-ETS1-1 Engineering Design
- CCSS.MATH.PRACTICE.MP4
- CCSS.MATH.CONTENT.HSG.GMD.B.4

Introduction

For the rest of Unit 1, students will imagine themselves in the role of design engineer at a bike company.

During Lesson 1.2, students are introduced to a bike model that is partially complete. Students will be guided through viewing the model and navigating the tabs of the document. Viewing objects in Onshape is a skill that takes a little practice. To help students move around the model, we will introduce the View Cube and how it relates to the three datum planes in Onshape.

Our goal is to build 3D models that can eventually be built in real life, like a bike! We use a computer to do this complex work quickly, find design problems, and save material during the prototype phases. However, viewing 3D objects on a 2D plane can be tough. Your computer monitor can't let you hold what you're making - yet! So, we must learn how to view and rotate 3D objects on the 2D screen.

Designers often need to change perspective to view objects from the top, right, or front to build parts that properly fit together. We call a view that is straight on at 90 degrees, *normal*. In fact, it's so helpful that we even have a shortcut key to quickly snap an object to view it normal to a selected side (the N key).

Let's get started!

NOTE: Onshape is updated regularly and you may find some discrepancies between the instructional content and the Onshape interface. If you find areas in need of updating in the curriculum, please let us know!

Terms and Vocabulary

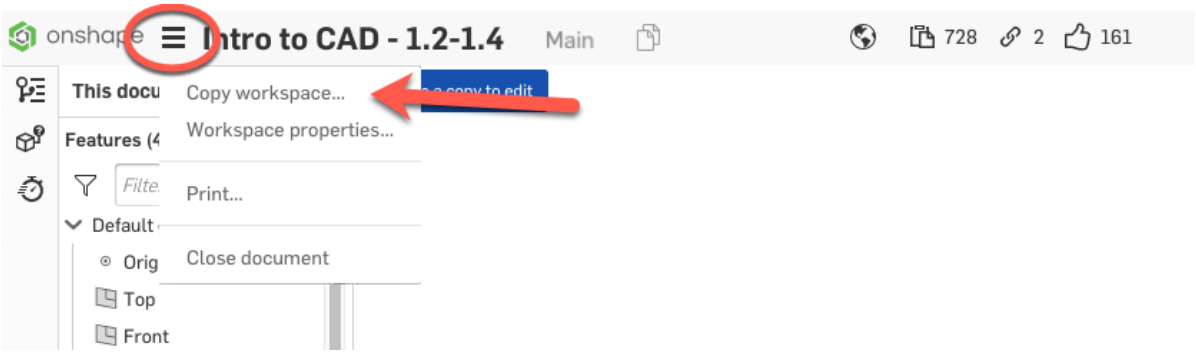
Onshape Glossary

- **Assembly** - A collection of instances of parts, sketches, surfaces, or subassemblies that define both position and movement.
- **Mate** - An Onshape feature used to position instances in an assembly and define movement.
- **Normal** - Perpendicular to a given object.
- **Onshape Document** - A collection of design data organized into Onshape tabs.
- **Part Studio** - A tab inside of an Onshape document containing the parametric definition of one or more solid bodies.
- **Plane** - A flat, two-dimensional surface that extends infinitely far.
- **View Cube** - The cube in the top right corner of the graphics area when you open a document.

Preparation

Share the Student Guide with your students. If you have an LMS, we suggest using the Student Guide to create an assignment.

The link to the Onshape document is provided in the Student Guide. This is a public document. Students will need to make a copy of the workspace and add their own name to the end of the document name. It will look like this.



Guiding Questions

- Why should we use CAD?
- What are the views typically used in CAD?

Teaching Guide

Slide 1 - Title Slide

Slide 2 - Warm Up

This warm-up is a pre-assessment to see what your students know about CAD and why it's used. Students that have some familiarity with CAD are welcome to bring up their own experiences and where it has been used for them.

The purpose of CAD: Help students see that CAD is used not only to just create nice looking models, but specifically to solve big problems and communicate ideas in the clearest manner possible.

The third question is meant to help students see that anything can be modeled in CAD. This is a huge advantage when the models are complex as it allows the engineer to solve a lot of problems along the way because of CAD's exactness. It's also helpful if you are planning on manufacturing large quantities of an item. Machines meant for quick manufacturing will require a file generated from a CAD model to create the repeatability desired in large manufacturing processes.

Slide 3 - Guiding Questions

- Why should we use CAD?
- What are the views typically used in CAD?

Slide 4 - Lesson 1.2 Open the Onshape Assignment

Students will need to make a copy of the document provided, Intro to CAD - 1.2-1.4.

Because they are new to opening and navigating documents, students may need some support. Once they have copied the workspace, this document is now in their own Onshape account. It can be shared with the teacher using the share button.

Students should start with the **Lesson 1.2-1.4** tab at the bottom left of their screen. We recommend opening both the lesson and part studios in two browser windows. You can do this by right-clicking on a part studio or assembly tab and selecting **Open in new browser tab**. If students have access to dual monitors, this can be especially helpful.

The lesson will start with students navigating around the bike model and learning about the different views in Onshape. Understanding how to navigate a model and identify different views is an important part of learning CAD.

Students will also gain familiarity with the layout of Onshape, e.g. What are the different kinds of tabs within an Onshape document and what do they do?

Slide 5 - How to Take a Screenshot

Slide is hidden. But, we left it here should you want to use it.

Slide 6 - Exit Ticket

When finished, students should return to the Student Guide to submit their Exit Ticket for the assignment.

Teacher Tips

- **Remember the tabs**: Students may need a reminder about how to navigate between tabs in the document.

- **Model is lost:** If students lose their object in the window because they have zoomed way out or panned it off the screen, simply click on the View Cube or use shortcut key **F** to fit in the window.
- **Orthographic orientation:** When looking at the Top view, the Front plane is on the bottom.

Assessment

Exit Ticket #1	2 pts	
Exit Ticket #2	2 pts	
Exit Ticket #3	2 pts	
Exit Ticket #4	4 pts	
Total	**10 pts**	**/10**

Exit Ticket

1) Use the View Cube to match the picture below. What view is this? TOP, RIGHT, FRONT?

This is the RIGHT *view*. Students will often want to say this is the left side of the bike. That is because they can picture themselves on the bike and from that perspective it is the left. However, in CAD we are viewing objects from the outside. Imagine looking at the bike from the FRONT then, from the same vantage point, this view is of the RIGHT side of the bike.

2) Step 4 asked you what camera and render options were used to produce the image below. What did you decide?

This view was produced using “Shaded without edges” and “Turn perspective on.”

3) Step 9 asked you to measure the Parallel Axis Distance between the two holes in the Dog Bone Link. What did you find?

   3.346”

4) What is the difference between a part studio and an assembly?

   Part studios are used to define solid bodies. Basically, this is where we build parts. Assemblies are used to define the relationships between parts and their movement relative to one another.