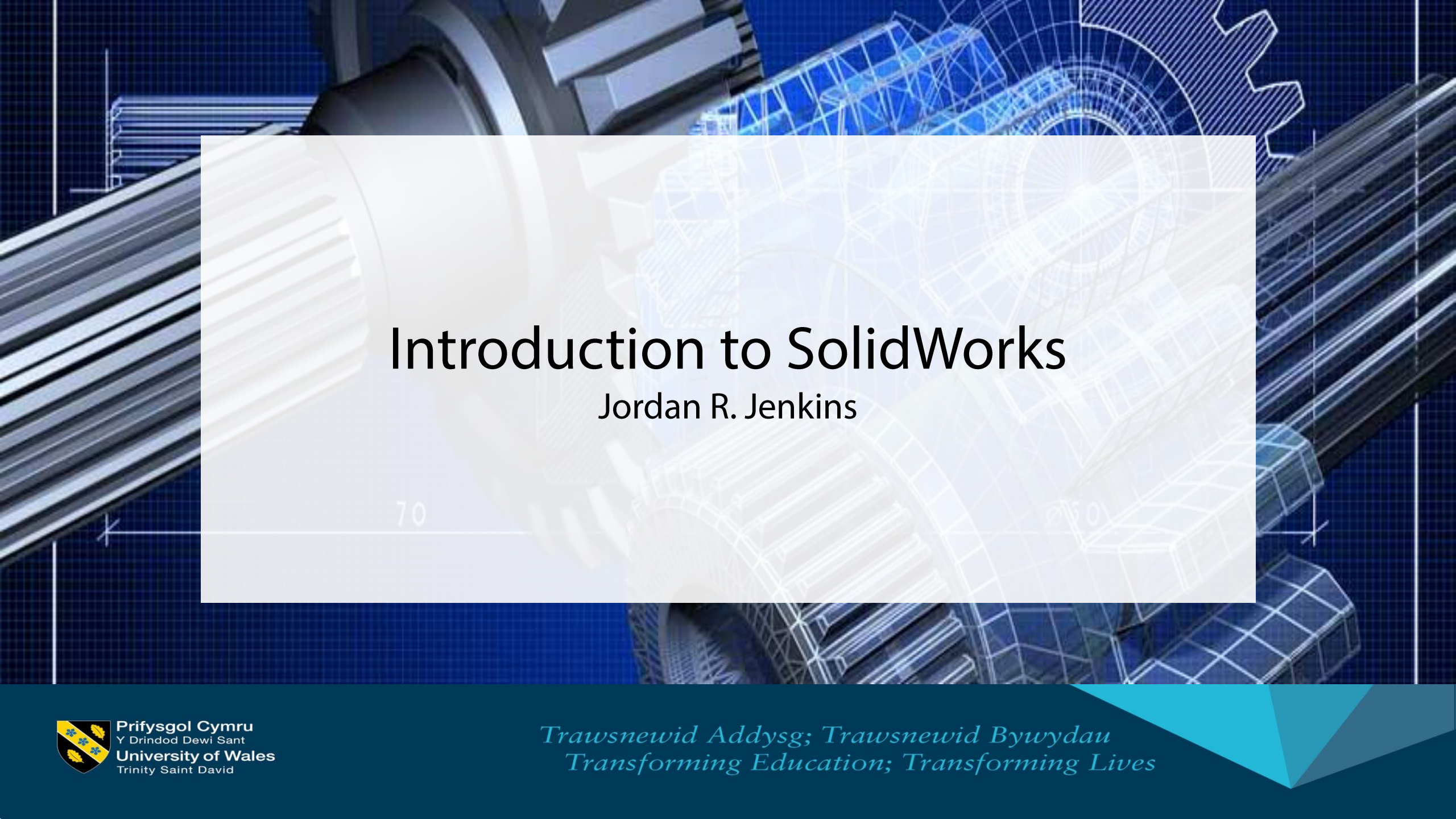




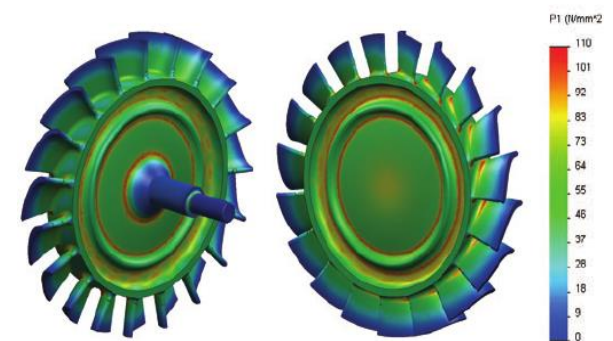
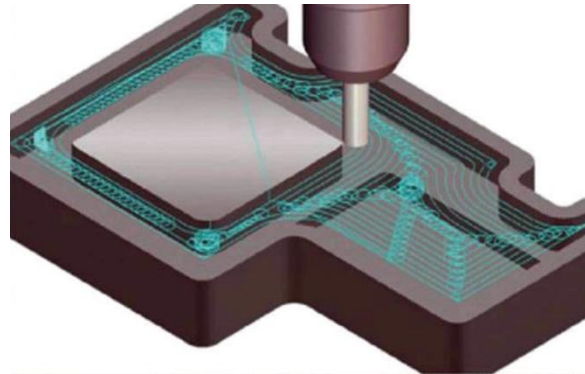
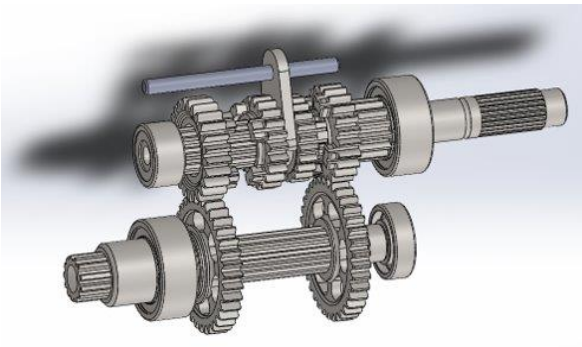
Introduction to SolidWorks

Jordan R. Jenkins

Background – CAD,CAM & CAE

- Modern engineering practices are heavily reliant on computational methods.
- Competency in Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM) and Computer-Aided Engineering software has become a fundamental skills requirement for engineers of any discipline.

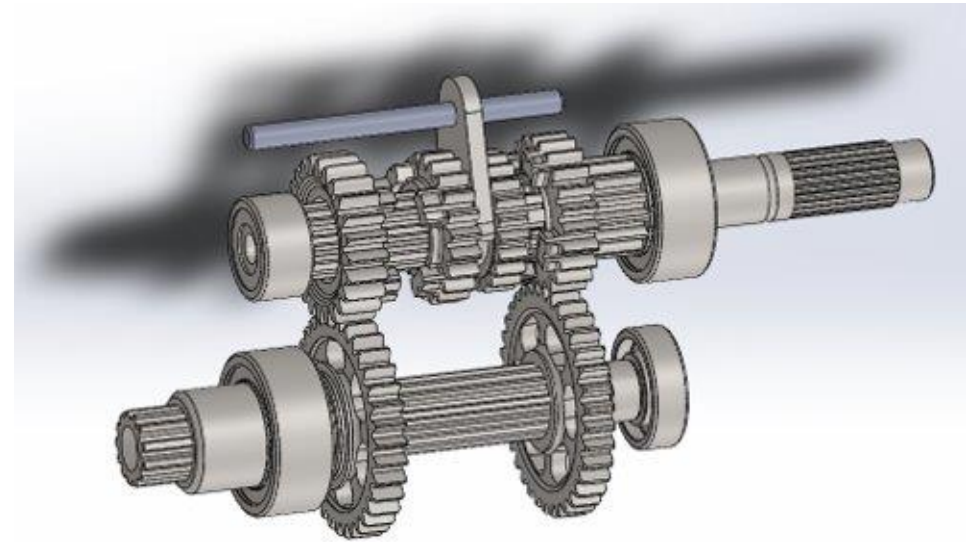
Question – Can anyone explain the differences between CAD, CAM & CAE?



What is CAD?

The use of a computer programs to design, test, analyse and optimise components. Below are some typical uses:

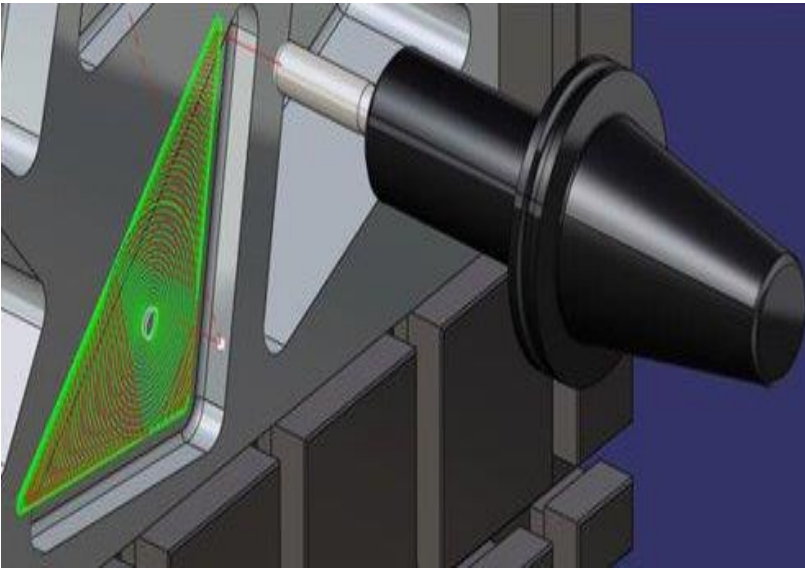
1. Component design (2D & 3D modelling)
2. Drafting (technical drawings)
3. Creating assemblies
4. Test fitting & tolerancing
5. Motion simulations
6. Design optimisation (parametric & topology)



(Gearbox Components Assembly)

What is CAM?

The use of a computer programs to plan, control or manage manufacturing machines, equipment and processes, for example:



Machine Toolpath Planning

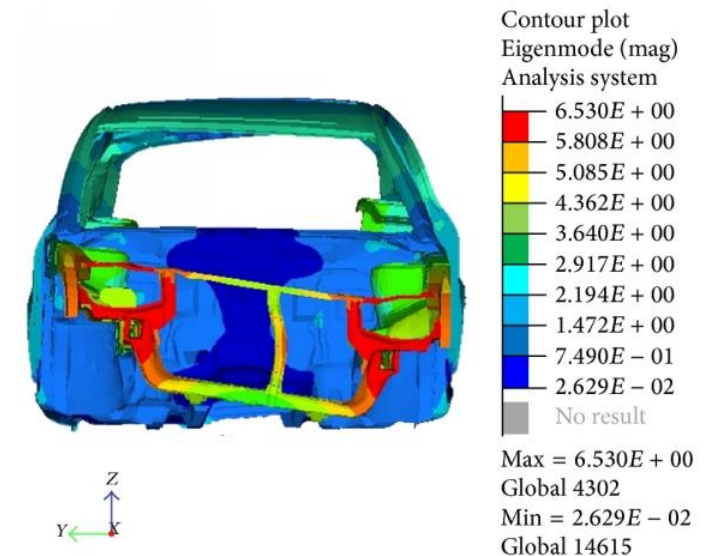
1. Computer Numerical Control for precision machining processes.
2. Tool path generation from 3D models
3. Robot path programming
4. Process optimisation for reduced scrap, tool wear, machining time and costs.
5. improved quality - highly repeatable programs with less deviation than manual processes.

What is CAE?

The use of a computer programs to test, analyse and optimise the performance of components under different loading conditions

1. Structural dynamics - Forces, stresses, deformation & fatigue etc.
2. Fluid Flow dynamics – Aero / hydrodynamic studies.
3. Thermal analysis
4. Topology optimisation (increased stiffness & reduced Mass).

Note: most CAE tools rely on Finite Element Methods



FE Analysis of Vehicle Body

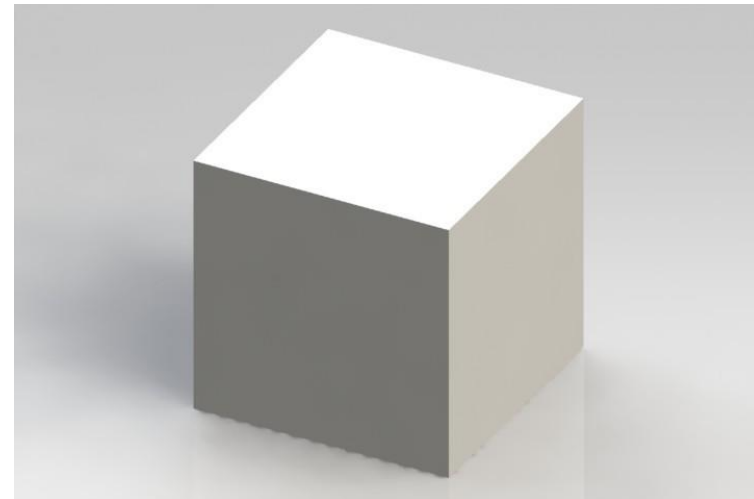
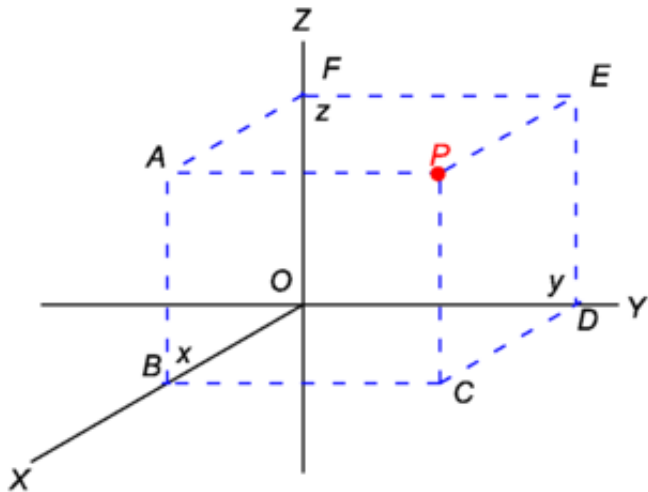
What is SolidWorks?



- SolidWorks is primarily a solid modelling computer-aided design program (but also has CAM & CAE capabilities).
- It's a widely used & recognised in academia and industry (one of the most popular packages).
- We will be focusing CAD applications in this module, but you will use CAM/CAE later on in your studies.

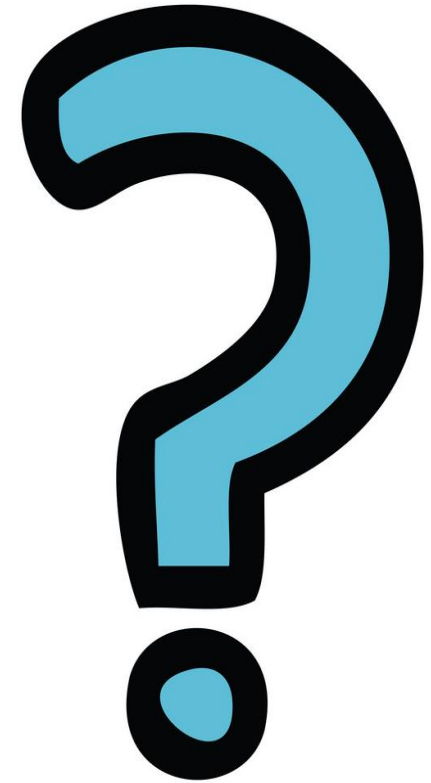
Geometric Modelling - How does it work?

- At a very high level, SolidWorks (any CAD Software) creates a model as a series of 3-dimensional coordinates in space.
- The software can then use these coordinates to display a 2D or 3D visual representation of the model.



Question – Significance of CAD

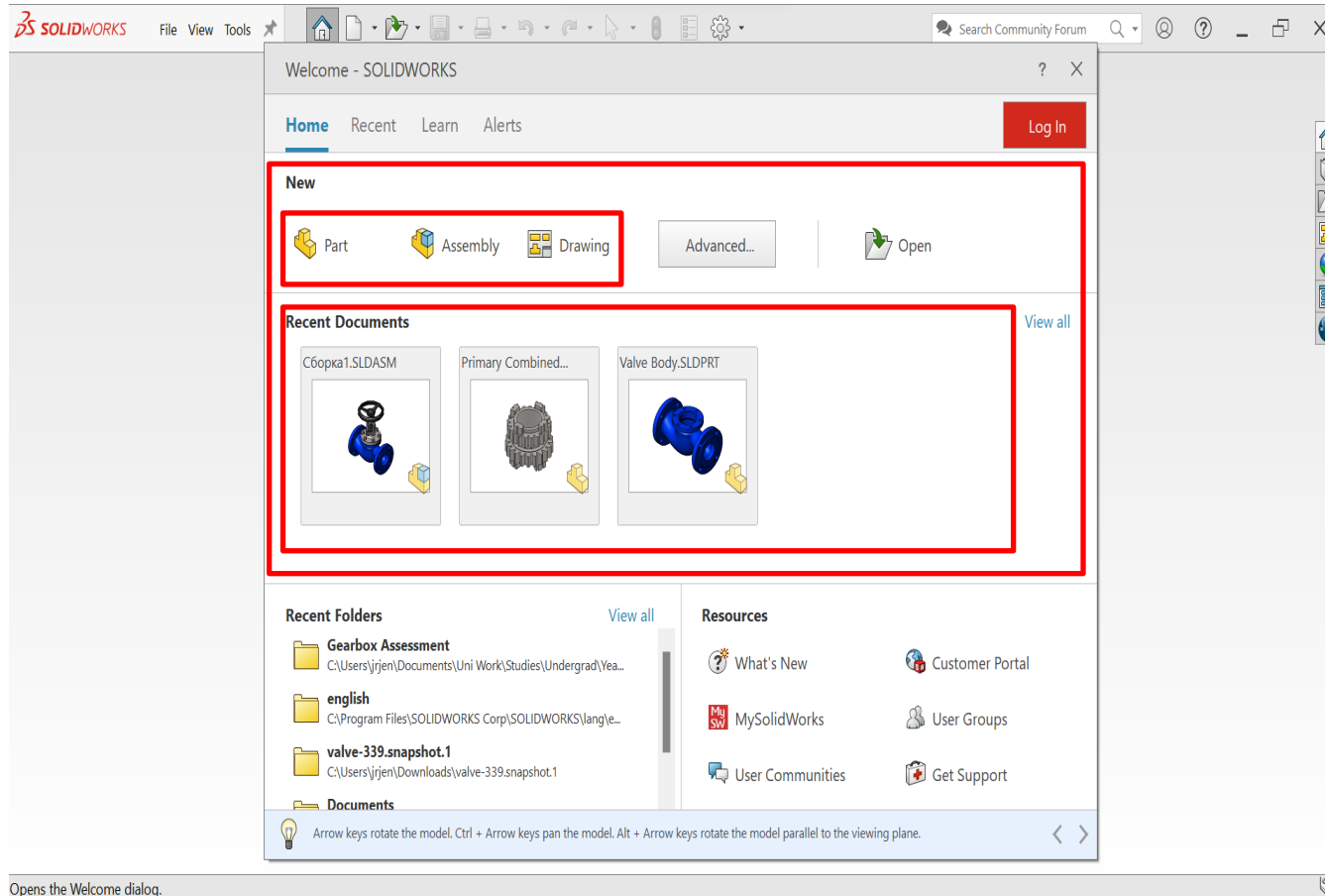
Why do you think Computer-Aided Design has become so significant?
What factors do you think drove the development / adoption of CAD in industry?



The Need for CAD

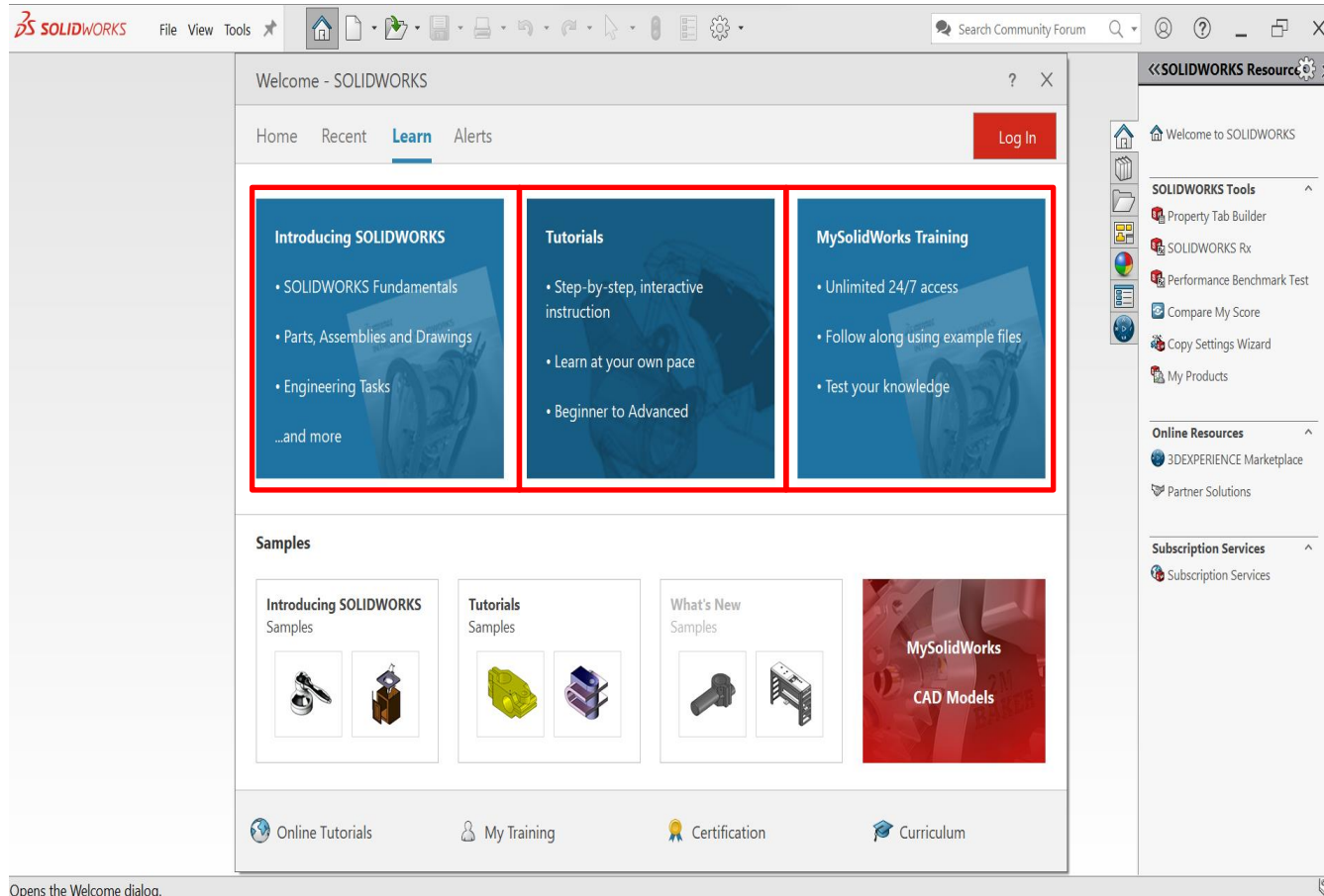
- To decrease lead times and time to market for new products (avoiding iterative design).
- Digitisation – Ease of modifying and sharing models.
- Respond to modern consumerism – shorter product life cycle.
- Global competition – need to release new products, with enhanced features, at a lower cost.
- Mass customisation – customer specific design changes to satisfy diverse requirements (flexibility/versatility in design).
- Increasing consumer awareness of product quality (right first time products).

Introduction to SolidWorks UI



- First screen presented on opening SolidWorks
- The centre Section is the Quick Access Menu
- From here you can create new parts, assemblies and drawings by clicking the icons
- Your 5 most recent files will also show here.

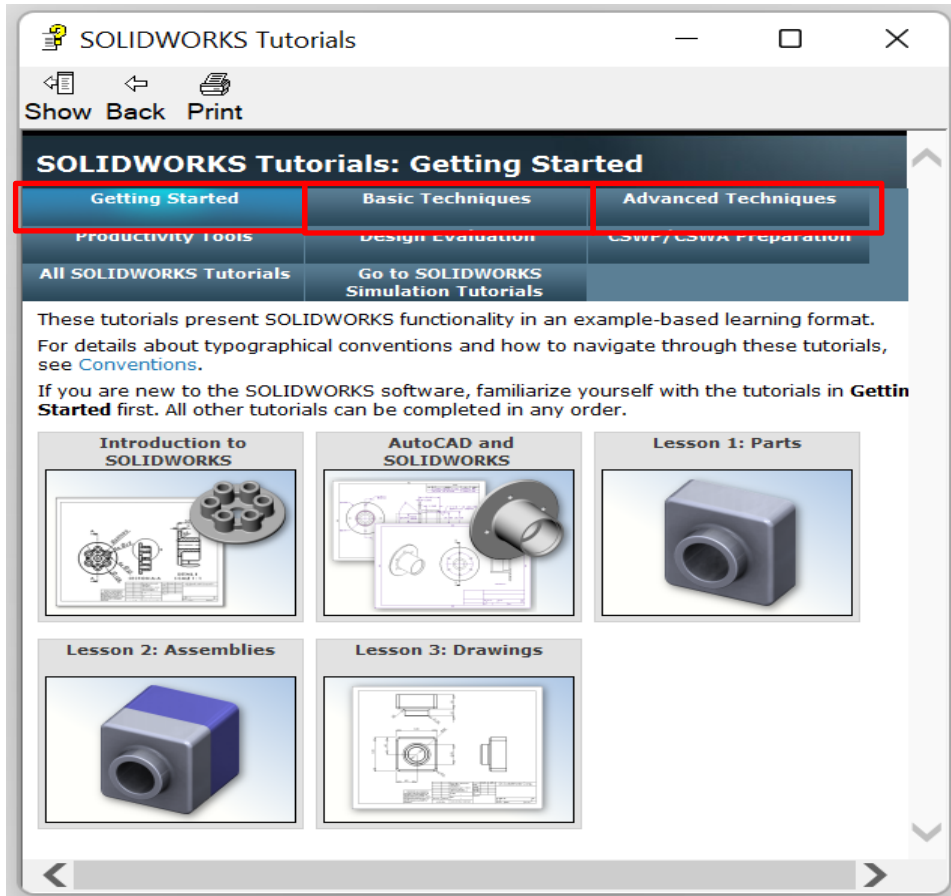
Introduction to SolidWorks UI



Opens the Welcome dialog.

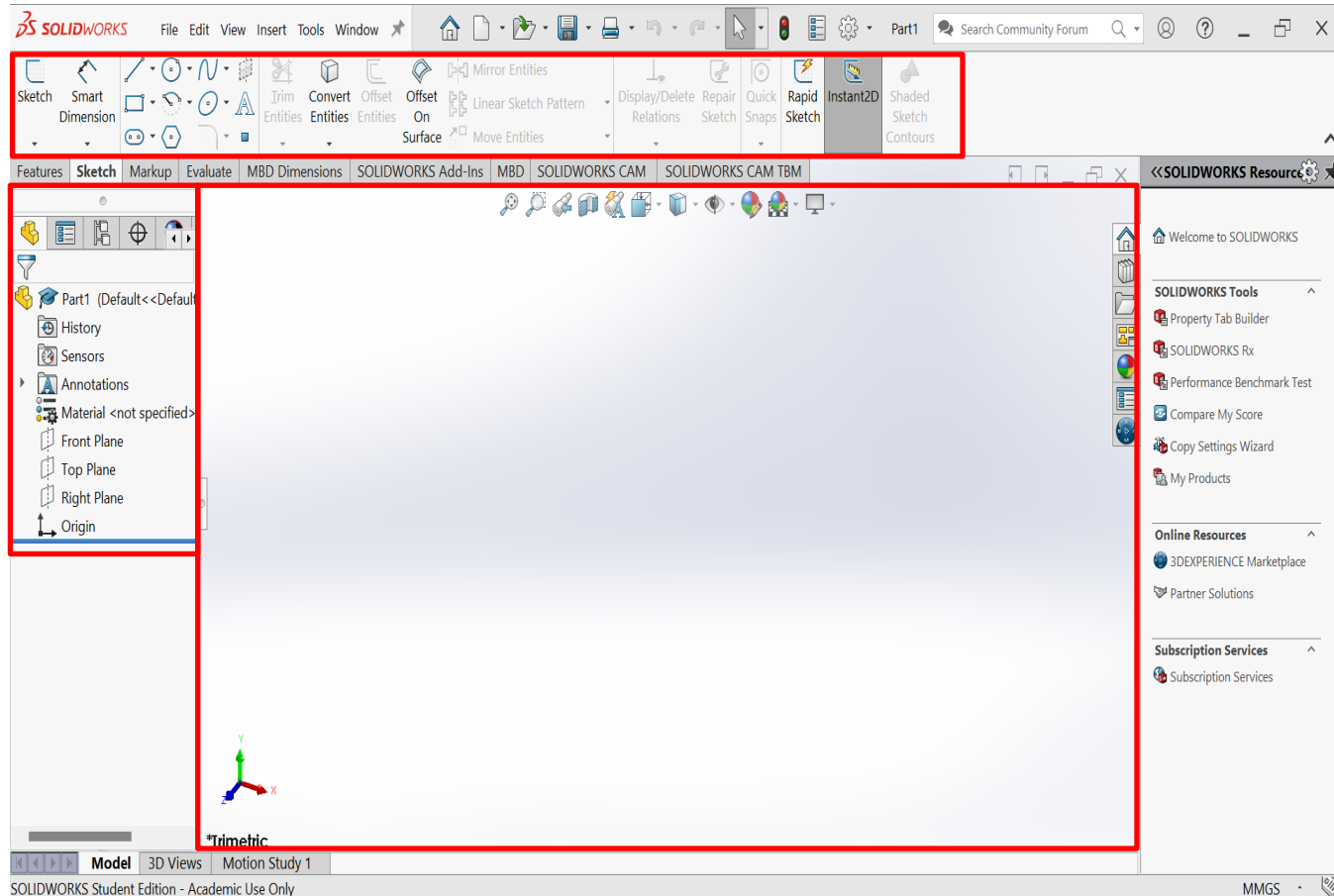
- Clicking on the 'Learn' tab gives you access to tutorials & documentation
- The screen will now look like this.
- The tutorials are a great way to utilise your individual learning hours!
- There is also some useful documentation found here
- Lots of web-based resources / training found here

Introduction to SolidWorks UI



- We will be doing some of these tutorials during the lectures, but there are many more than we can cover!
- For the time being, you should be focusing on the 'Getting Started' Section.
- We will be moving to 'Basic Techniques' in the coming sessions.
- If you are already familiar with SolidWorks, feel free to jump ahead and try some of the more advanced tutorials.

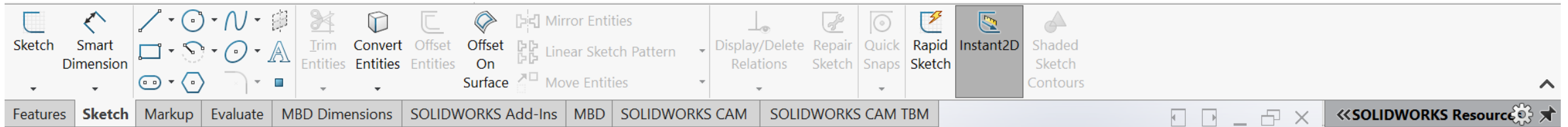
Introduction to SolidWorks UI



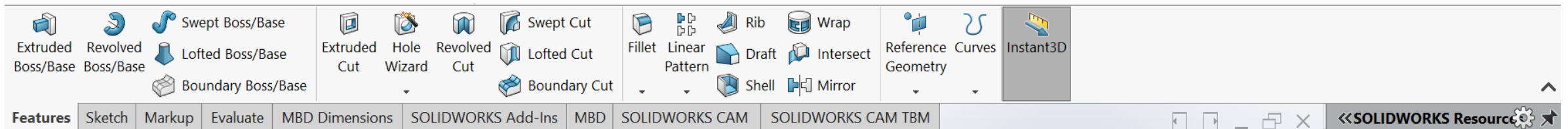
- When you select 'Part' in the Quick Access menu, the screen will change to look like this.
- This view contains 3 main sections:
 1. The Function Toolbars
 2. Feature Manager Design Tree
 3. Modelling Window

Introduction to SolidWorks UI

The function toolbars along the top of the screen are split into different tabs for different types of modelling activity.



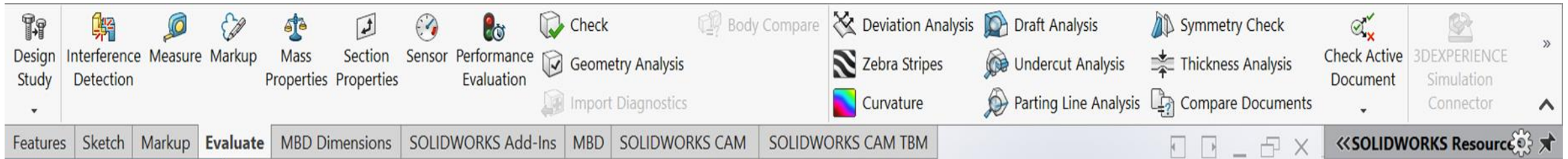
The Sketch tab is where you will find all the sketching tools. Sketching is where you work in 2D to create the that you will then turn into 3D shapes.



The Features tab has all the tools for working in 3D.

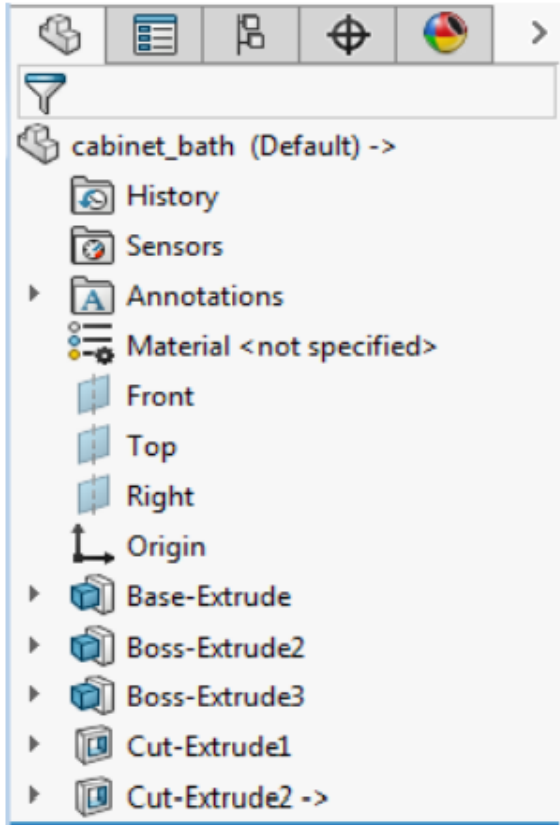
Introduction to SolidWorks UI

The Evaluate tab also has some useful tools, the main one being the Measure function. This is very handy when working in 3D, you can accurately measure the distances between multiple points on the model.



Do not worry about all of the other tabs for now. These tabs contain more advanced features, we won't be covering these this year, but you will be covering them later in your studies!

Introduction to SolidWorks UI



- The design tree is where you find the full history of all the features and tools that you have used in creating the part.
- It Displays the structure of the part, assembly, or drawing.
- Select an item from the design tree to edit the underlying sketch, edit the feature, and suppress and un-suppress the feature or component, for example.
- The feature tree runs chronologically, so the last feature you used will be last displayed on the list.

Introduction to SolidWorks UI



- The model view window is where SolidWorks will display the view of the part, assembly or drawing you are working on.
- There not many functions or buttons available in this window, but some can be found at the top.
- These functions are used to control the view / alter the appearance of the model, including zoom, cross-section views, annotation viewer, view orientation, display style, show/hide etc.

Introduction to SolidWorks UI

The mouse buttons operate in the following ways:

Left click

- Selects menu items, entities in the graphics area, and objects in the Feature Manager design tree.

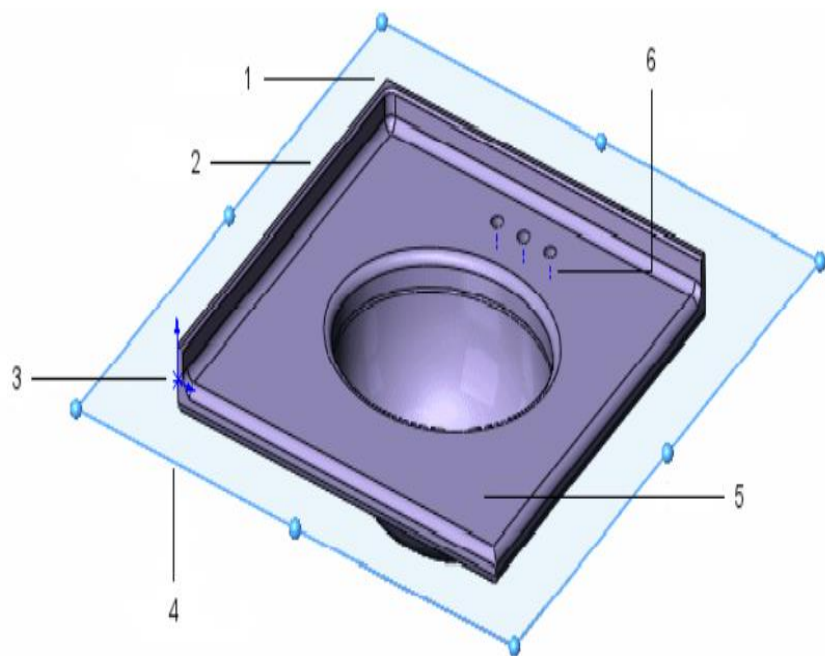
Right Click

- Displays the context-sensitive shortcut menus.

Scroll Wheel

- Middle Rotates, pans, and zooms a part or an assembly, and pans in a drawing.

Introduction to SolidWorks UI



Keyword	Definition
1.Vertex	Point at which two or more lines or edges intersect. You can select vertices for sketching and dimensioning, for example.
2.Edge	Location where two or more faces intersect and are joined together. You can select edges for sketching and dimensioning, for example.
3.Origin	Appears as two blue arrows and represents the (0,0,0) coordinate of the model. When a sketch is active, a sketch origin appears in red and represents the (0,0,0) coordinate of the sketch. You can add dimensions and relations to a model origin, but not to a sketch origin.
4.Plane	Flat construction geometry. You can use planes for adding a 2D sketch, section view of a model, or a neutral plane in a draft feature, for example.
5.Face	Boundaries that help define the shape of a model or a surface. A face is a selectable area (planar or nonplanar) of a model or surface. For example, a rectangular solid has six faces.
6.Axis	Straight line used to create model geometry, features, or patterns. You can create an axis in different ways, including intersecting two planes. The SOLIDWORKS application creates temporary axes implicitly for every conical or cylindrical face in a model.

Introduction to SolidWorks UI

- This has been a very basic introduction to the SolidWorks User Interface.
- There are many more tools, features and functions available than have been presented here.
- With packages such as this, there really is no substitute for time spent practicing / exploring the software.
- You should now complete the 'getting started' tutorial to familiarise yourself with the software.