

Introduction – Autodesk Inventor 2026 for Designing and Rendering FTC Robots

Autodesk Inventor is a **computer-aided design (CAD)** software used in mechanical engineering for creating, simulating, and documenting 3D models. **The Autodesk Inventor 2026** version offers an advanced set of tools for parametric modeling, assembly creation, mechanical simulations, and realistic product rendering. The software is widely used in fields such as robotics, automotive industry, aerospace engineering, and prototype development.

In robotics competitions such as **FIRST Tech Challenge (FTC)**, Autodesk Inventor is used for the virtual design of robots before their physical construction. Through CAD, teams can create 3D models of robot components, assemble mechanisms, and verify dimensions and available space. This allows teams to identify and solve design problems before manufacturing the real parts, saving both time and resources.

The program enables the detailed design of mechanical parts (wheels, arms, supports, transmissions), the creation of complete robot assemblies, and the simulation of their movements. Additionally, **Autodesk Inventor** includes rendering functions that allow the generation of realistic images of the robot, which are useful for technical presentations, documentation, or team promotional materials.

By using **Autodesk Inventor 2026** in the design of FTC robots, students develop important skills in engineering and technical design, learning how to transform a conceptual idea into a precise digital model that can later be built in reality.



AUTODESK Inventor



1. Steps to Download Autodesk Inventor 2026

1. Go to the official Autodesk website.
2. Create or log into your **Autodesk Account**.
3. Navigate to **Products → Inventor**.
4. Select **Autodesk Inventor 2026**.
5. Choose:
 - Operating system version
 - Language
6. Click **Download Installer**.
7. Run the downloaded setup file.
8. Follow installation instructions.
9. Sign in with your Autodesk account when prompted.

2. System Requirements (Minimum vs Recommended)

Minimum Requirements

- Operating System:
Windows 10 64-bit or newer
- Processor:
64-bit CPU, 2.5 GHz or higher
- Memory (RAM):
16 GB RAM
- Graphics Card:
Basic DirectX 11 compatible GPU
- Storage:
At least 40 GB free disk space

Recommended Requirements (Better Performance)

- Operating System:
Windows 11 64-bit
- Processor:
Multi-core processor (3.0 GHz or higher)
- Memory (RAM):
32 GB RAM



- Graphics Card:
Dedicated GPU with at least 4–8 GB VRAM
- Storage:
SSD storage recommended

3. Important Notes

- Always install latest graphics drivers.
- Use SSD for faster loading and rendering.
- Close background programs while using Inventor.

4. Common Installation Problems

- Installation fails → Check internet connection
- Program crashes → Update GPU drivers
- Slow performance → Increase RAM or use SSD

2. Autodesk Inventor 2026 Program Interface

The interface of **Autodesk Inventor 2026** is designed to facilitate the design and management of 3D models in an efficient and organized way. It is structured into several main areas that allow the user to create, modify, and analyze designed parts or assemblies. The program is developed by **Autodesk** and is frequently used in mechanical engineering and robotics design.

One of the main components of the interface is the **Ribbon** (main toolbar). It is located at the top of the window and contains all the tools needed for modeling, editing, and analysis. The tools are organized into tabs such as **3D Model**, **Sketch**, **Assemble**, **Inspect**, and **Render**, each providing specific functions for different stages of the design process.

On the left side of the screen is the **Model Browser**. This displays the structure of the project, including sketches, features, and assembly components. The Browser allows quick selection of model elements and their modification when necessary.

The central area of the interface represents the **Workspace**, where 2D and 3D models are created and viewed. In this area, the user can draw sketches, build parts, and analyze assemblies. Models can be rotated, zoomed in, or zoomed out to observe details from different perspectives.



At the top, there is the **Quick Access Toolbar**, which contains frequently used commands such as saving the project, opening files, or undoing the last actions. This toolbar provides fast access to the essential functions of the program.

Another important element of the interface is the **ViewCube** and the **Navigation Bar**, located on the right side of the workspace. These tools help orient the model in 3D space, allowing quick changes of perspective (front, top, side, or isometric).

At the bottom of the window is the **Status Bar**, which provides information about current operations, cursor coordinates, and other useful details during the design process.

Through the organization of these elements, the **Autodesk Inventor 2026** interface allows users to efficiently design complex parts and assemblies, making it an essential tool in robotics design for competitions such as **FIRST Tech Challenge**.

3. Sketches - User Manual in Autodesk Inventor 2025

In **Autodesk Inventor 2025**, sketches (**Sketch**) represent the foundation of 3D modeling. Every part begins with a **2D drawing** created on a work plane, which is later transformed into a **three-dimensional model** through operations such as **Extrude** or **Revolve**. In the sketch environment, various tools are available for drawing geometric elements and controlling their dimensions.

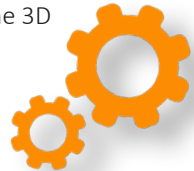
1. Sketch Working Environment

In **Autodesk Inventor 2025**, the sketch environment appears when the user selects **Start 2D Sketch** in a **Part** file. After selecting a plane (**XY, XZ, or YZ**), the interface changes and displays the tools specific to sketch creation.

In this environment, several important areas can be observed:

- **Ribbon (toolbar)** – contains all the commands used for creating and editing sketches
- **Model Browser** – displays the structure of the part and the created sketches
- **Workspace (graphics area)** – the space where the drawing is created
- **ViewCube and Navigation Bar** – help orient the model in the 3D space

These elements allow the user to quickly create and modify the geometry of the sketch.



2. Creating a Sketch

In **Autodesk Inventor 2025**, to create a new sketch, follow these steps:

1. Open a new **Part (.ipt)** file.
2. Click **Start 2D Sketch**.
3. Select one of the work planes (**XY, XZ, or YZ**).
4. Start drawing using the tools from the **Sketch** tab.

After selecting the plane, the program activates the **sketch environment** and allows the user to begin drawing.

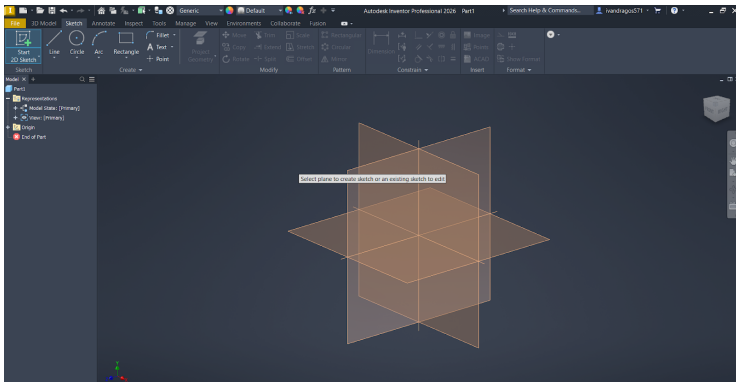


Photo of a workplane

3. Main Sketch Tools

In the **Sketch** tab of **Autodesk Inventor 2025**, there are several tools used to draw basic shapes:

1. **Line** – creates straight lines
2. **Circle** – creates circles
3. **Arc** – creates arcs
4. **Rectangle** – creates rectangles
5. **Point** – creates reference points
6. **Fillet** – rounds the corners of a shape

These tools are used to build the basic geometry of the part, which will later become a **3D model**.



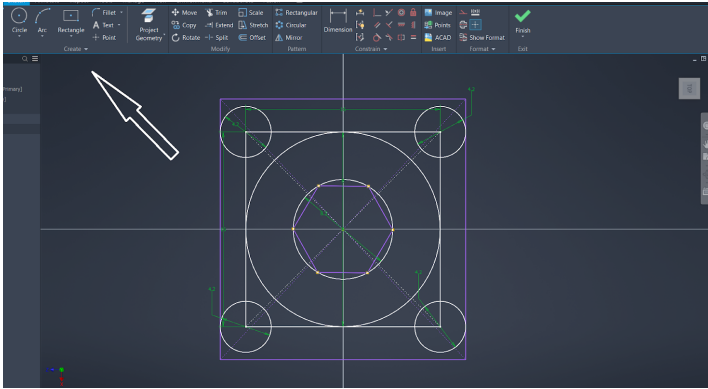


Photo of a sketch

4. Geometric Constraints

In Autodesk Inventor 2025, geometric constraints are used to ensure that a sketch is technically correct. These constraints define the relationships between the drawn elements.

Examples of constraints:

- **Horizontal** – the line becomes horizontal
- **Vertical** – the line becomes vertical
- **Parallel** – two lines become parallel
- **Perpendicular** – two lines become perpendicular
- **Coincident** – two elements meet at the same point
- **Equal** – two elements have the same dimension

By using these constraints, the sketch becomes **parametric**, meaning that its shape automatically adjusts when the dimensions are modified.

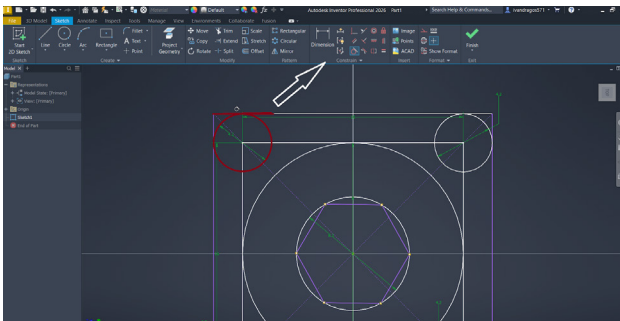


Photo of a constraint



5. Dimensions

After creating the geometry, dimensions are added using the **General Dimension** tool in **Autodesk Inventor 2025**. To use this function more quickly, the shortcut key “**D**” can also be used.

Dimensions control:

- the **length of lines**
- the **diameter of circles**
- the **distance between elements**
- the **angles between lines**

When all constraints and dimensions are applied, the sketch becomes **Fully Constrained**, which means that the geometry is completely defined and stable.

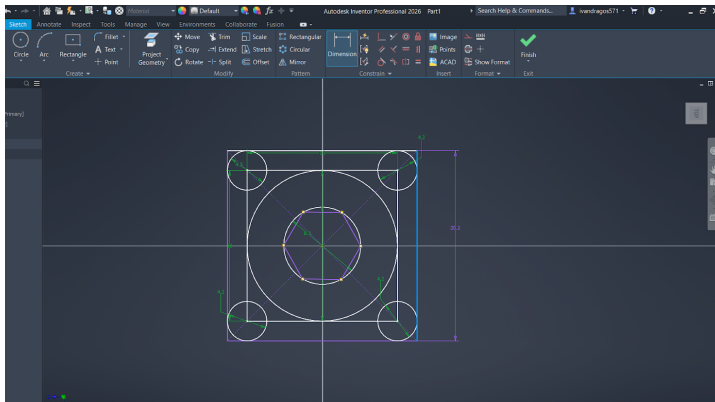


Photo of driven dimensions

6. Sketch Completion

After finishing the drawing, press **Finish Sketch**. The sketch can then be used for 3D operations such as:

- **Extrude** – transforms the sketch into a solid volume
- **Revolve** – creates a shape by rotating the sketch around an axis
- **Sweep** – creates a shape along a path

These operations allow the transformation of a sketch into a 3D part used in mechanical design or robot design.

As before, where there was a specific key for the dimension function (the **D** key), here too the **D** key can be used.



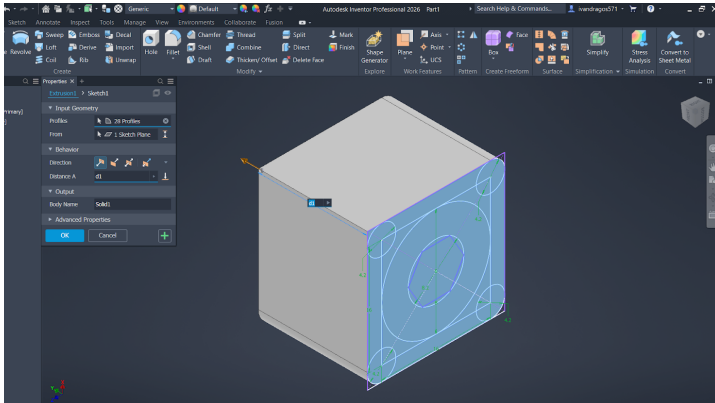


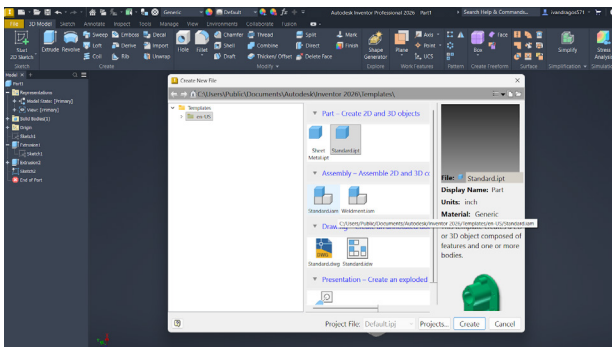
Photo of extruded sketch

4. Autodesk Inventor 2026 – Assembly Guide

An assembly file brings multiple parts together to build a complete product. The assembly environment allows positioning, constraining, and connecting components.

1. Creating an Assembly File

1. Open **Autodesk Inventor 2026**
2. Click **New** → **Standard.iam** (Assembly)
3. Save the file with a meaningful name

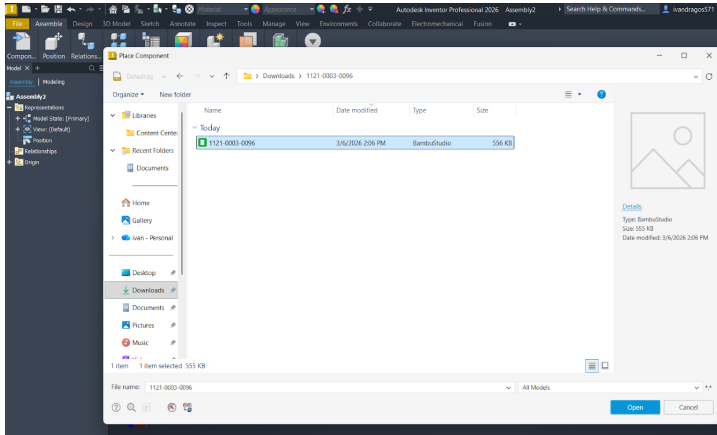


Selection menu

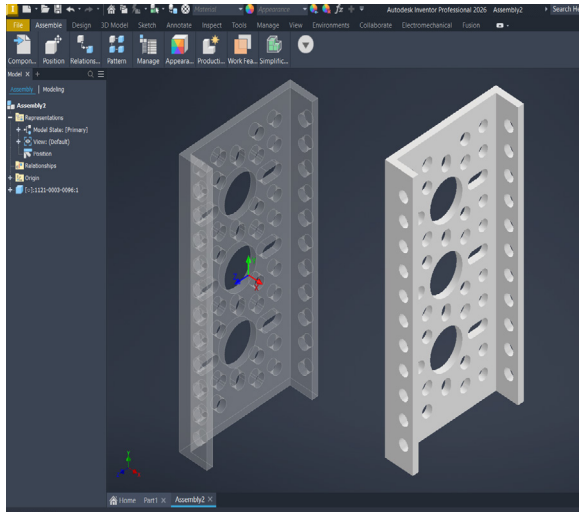


2. Placing Components

1. In the Assembly environment, click **Place**
2. Select part files (**.ipt**)
3. Place the parts in the workspace
 - Click once to place
 - Press **ESC** to stop placing parts



How to add components



Multiply them



3. Assembly Browser

The left panel shows:

- All parts
- Subassemblies
- Constraint editing and visibility options

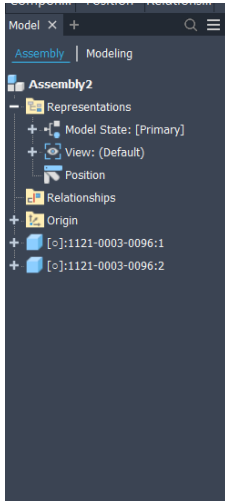


Photo of the assembly browser

4. Constraining Parts

Parts are fixed using **constraints**:

- **Mate** – surfaces touch each other
- **Flush** – surfaces are aligned
- **Angle** – sets angle between elements
- **Insert** – for cylindrical parts (for example, screw into a hole)

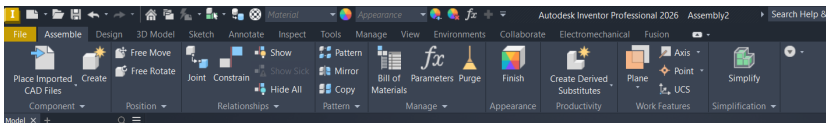


Photo of the toolbar



How to apply:

1. Click **Constrain**
2. Select two faces or edges
3. Choose constraint type
4. Click **OK**

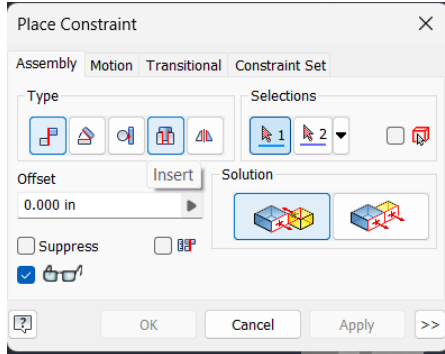


Photo of the constraint menu

5. Joints (Modern Alternative)

- **Rigid** – fully locks movement
- **Revolute** – allows rotation
- **Slider** – linear movement
- **Cylindrical** – combined rotation and translation
- **Ball** – spherical movement

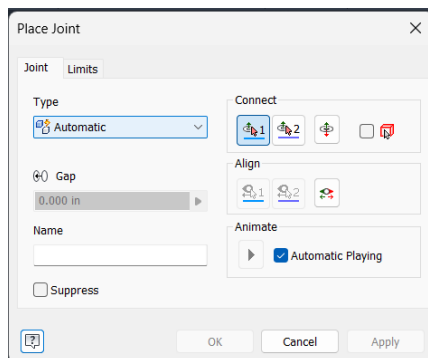


Photo of joint menu



6. Grounding a Base Part

- Right click the part → **Ground**
- Usually only one base part is grounded.

7. Moving Components

- **Free Move** – move parts manually
- **Rotate** – rotate around an axis
Useful before applying final constraints.

8. Pattern and Assembly Features

- **Pattern** – duplicate parts in circular or rectangular patterns
- **Hole / Cut** – create machining features across components

9. Interference Detection

1. Go to **Inspect** tab
2. Click **Interference**
3. The software checks for overlapping parts

10. Keyboard Shortcuts

- **C** – Constrain
- **P** – Place Component
- **R** – Repeat command
- **Mouse wheel** – Zoom
- **Shift + Middle mouse** – Rotate view

11. Recommended Workflow

1. Create assembly file
2. Place base component
3. Ground base component
4. Add remaining parts
5. Apply constraints
6. Check interference
7. Save project



5. Rendering in Autodesk Inventor 2026

Rendering is used to create realistic images of 3D models using lighting, materials, and environment settings.

1. Open Rendering Environment

1. Finish modeling and assembly
2. Go to **Environments Tab**
3. Click **Render**

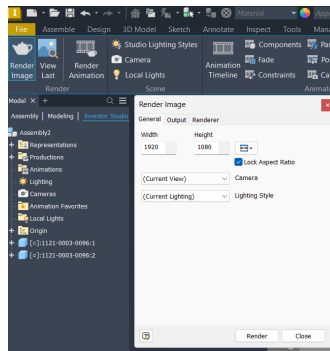
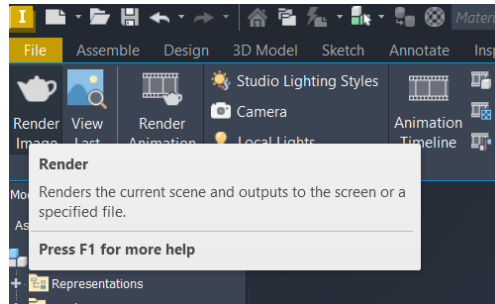
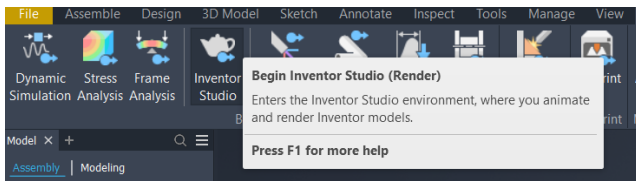


Photo of render menu



2. Apply Materials

1. Open **Materials Browser**
2. Choose material type:
 - Metal
 - Plastic
 - Glass
 - Wood

Drag and drop material onto model parts.

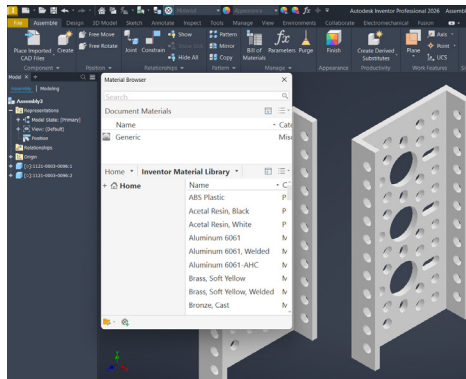


Photo of material selection panel

3. Set Lighting

Good lighting improves realism.

Options:

- Studio lighting for professional product rendering
- Environment lighting for natural light simulation
- Point or directional lights for manual control

Adjust intensity and shadow position.

4. Set Camera View

- Use **Perspective View** for realistic rendering
- Adjust zoom and angle before rendering
- Choose an angle that highlights important details.



5. Rendering Settings

Click **Render Image** and adjust:

- Resolution (HD, Full HD)
- Quality (Draft, High, Production)
- Background style

Higher quality requires more processing time.

6. Start Rendering

Click **Render**, wait for processing, then save the image.

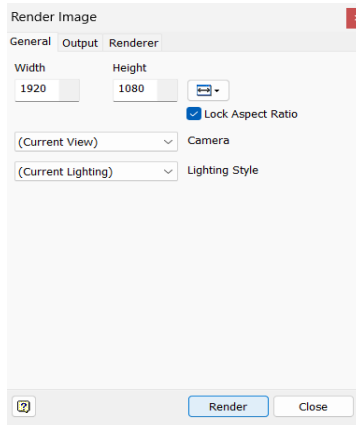


Photo of the rendering window

Tips for Better Renders

- Use realistic materials
- Add shadows
- Use environment backgrounds
- Avoid too many strong lights

6. Sketch Problems and Tips

Common Problems

- Sketch is not fully constrained
 - Geometry moves when you try to modify dimensions
 - Extrude command fails
 - Lines are overlapping or open profiles exist



Tips

- Always fully constrain sketches before modeling
- Check sketch status (fully constrained vs under constrained)
- Use:
 - **D** → Dimension tool
 - **C** → Constraint tool
- Use **Project Geometry** when referencing existing edges
- Keep sketches simple and clean

2. 3D Modeling Problems and Tips

Common Problems

- Extrude or revolve fails
- Sweep or loft operations fail
- Self-intersecting geometry

Tips

- Make sure profiles are closed
- Use construction lines for reference only
- Check sketch plane before modeling
- Build models step-by-step, not in one feature

3. Assembly Problems and Tips

Common Problems

- Parts are floating randomly
- Constraints conflict
- Mechanisms do not move properly
- Too many constraints slow performance

Tips

- Always:
 - Place base component first
 - Right click → **Ground**
 - Add parts one by one
- Use constraints wisely:
 - Mate
 - Flush
 - Angle
 - Insert



- Use **Interference Detection** to check collisions
- Do not mix joints and constraints randomly

4. Rendering Problems and Tips

Common Problems

- Render looks flat
- Materials look unrealistic
- Poor lighting and shadows
- Rendering takes too long

Tips

- Use realistic materials
- Apply HDRI or studio lighting
- Use **Current View**
- Reduce rendering quality while testing
- Add only 1–2 main light sources

5. Performance Tips

- Suppress unused components
- Turn off shadows while designing
- Save frequently
- Work in stages (Sketch → Model → Assembly → Render)

6. Pro Workflow

1. Create and fully constrain sketch
2. Create 3D model features
3. Build assembly with grounded base
4. Apply constraints carefully
5. Check interference
6. Apply materials
7. Set lighting
8. Render final image



Impressions





