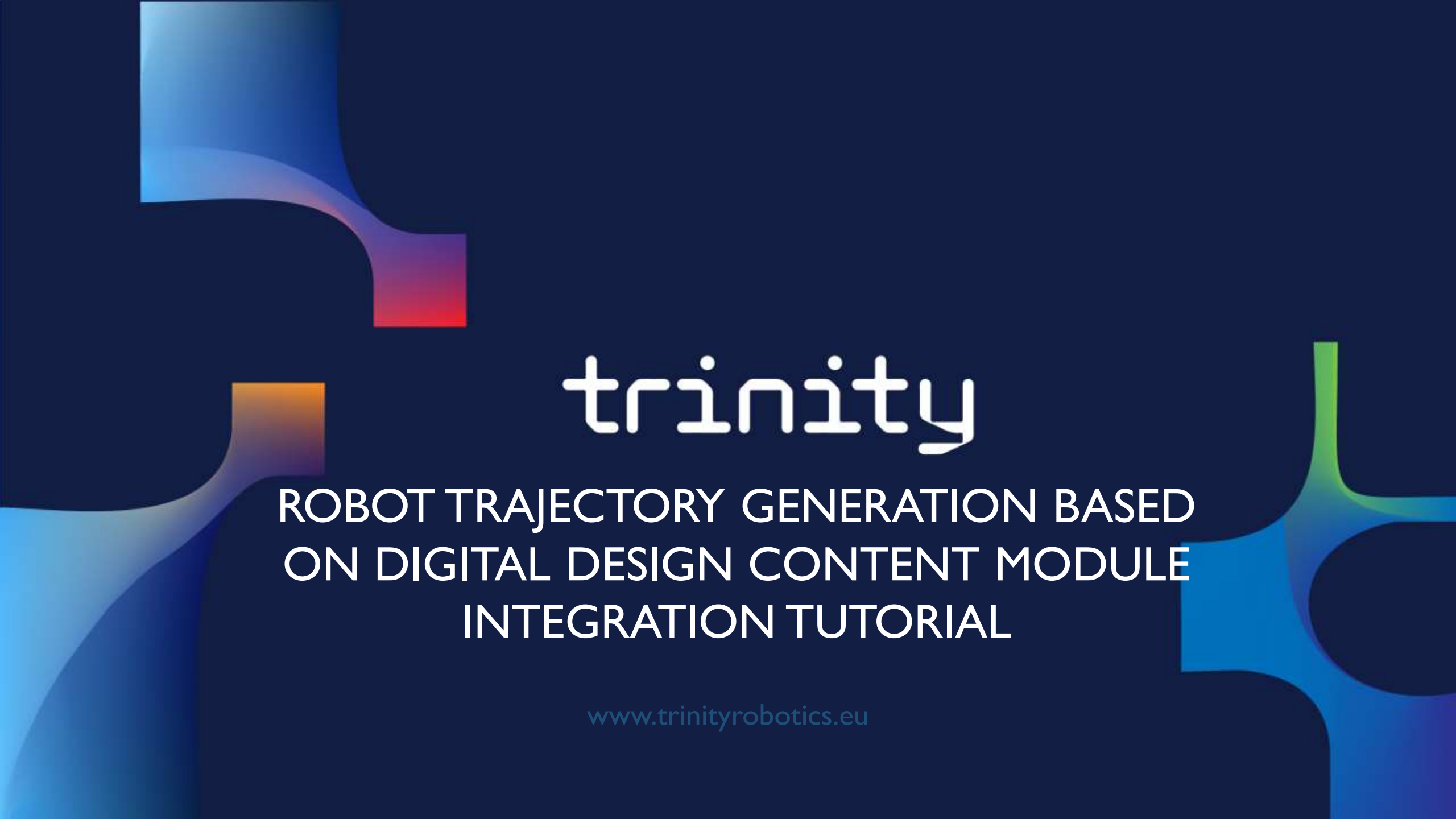




trinity

ROBOT TRAJECTORY GENERATION BASED
ON DIGITAL DESIGN CONTENT MODULE
INTEGRATION TUTORIAL

www.trinityrobotics.eu

Hardware requirements

- Workstation PC
- GPU at least NVIDIA GeForce GTX 1060 or Quadro P5000, AMD Radeon Vega 56
- Memory at least 16 Gb
- Free disk space at least 1Gb
- Steam compatible VR headset and controllers

Software requirements

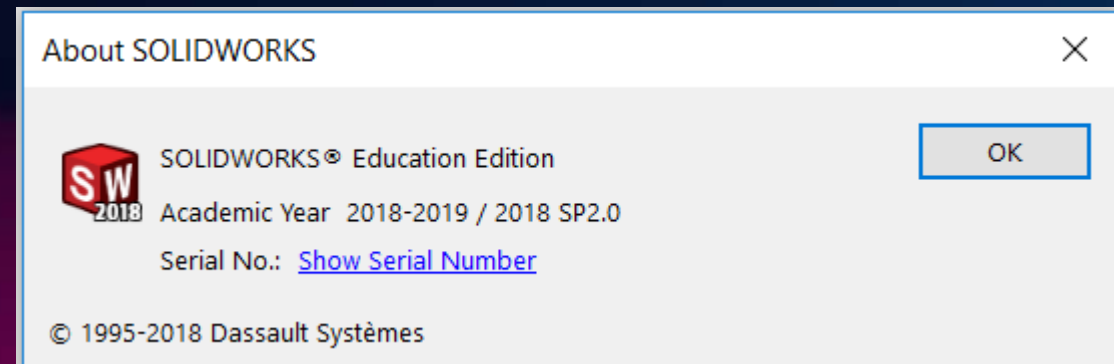
- Windows 10
- Solidworks 2019-2020
- RoboDK 5.2
- Unreal Engine 4.26

Pre Work

RoboDK, Unreal Engine and SolidWorks installed

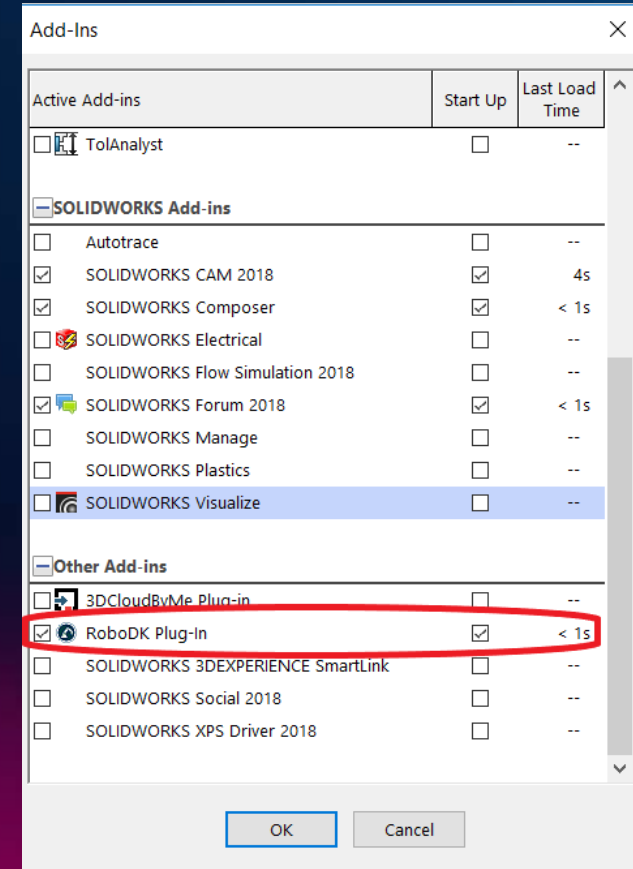
Versions used with this example RoboDK 5.1.1

Solidworks 2018 SP2.0



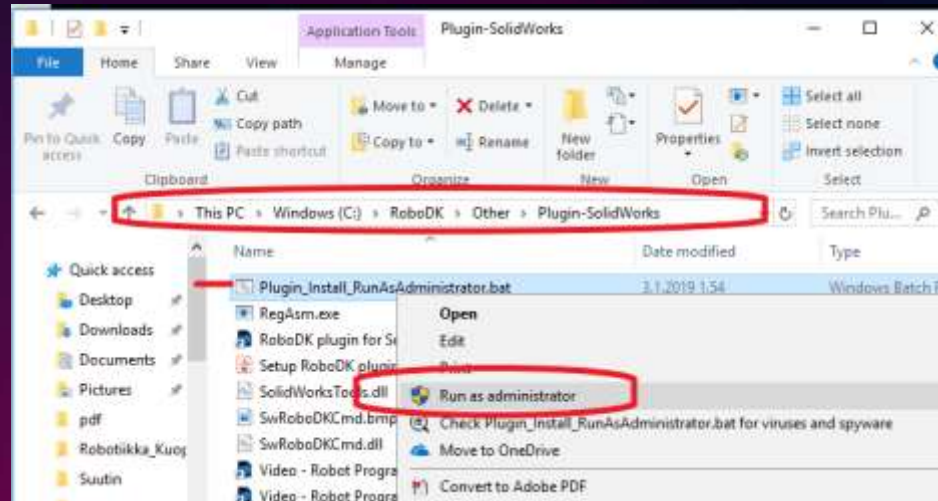
Setup SolidWorks for RoboDK

- Start Solidworks Part Modeling
- Select Tools-> Add-Ins from Top menubar
- Check these two boxes for RoboDK plugin
- Click OK

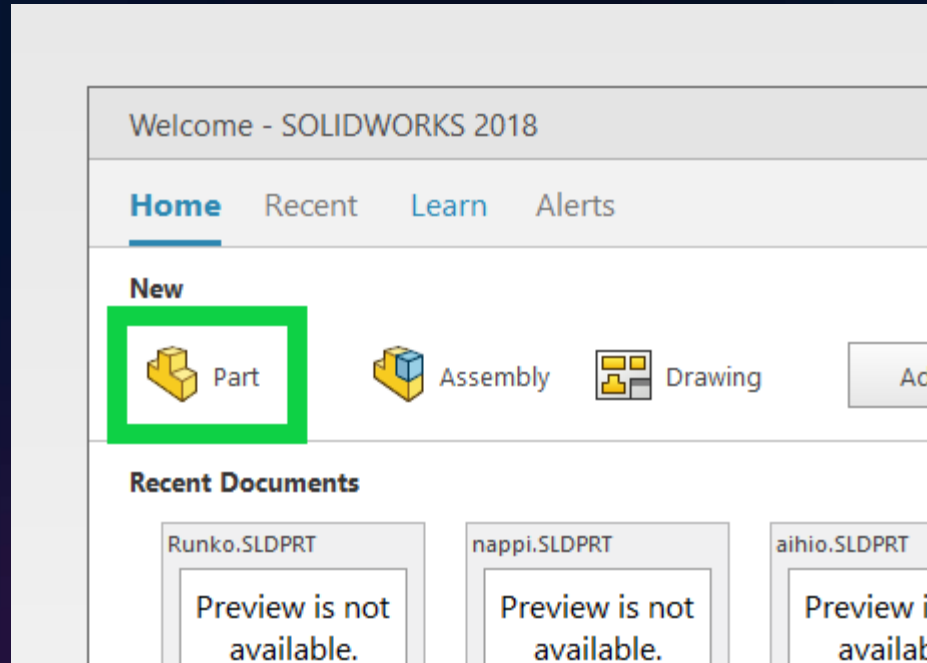


If RoboDK plugin did not exists...

- RoboDK Solidworks plugin installer is here:
C:\RoboDK\Other\Plugin-SolidWorks
- Right click plugin_Install_RunAsAdministrator.bat
- Select Run as Administrator
- Close installer window
- Do steps in previous slide in order to activate plugin



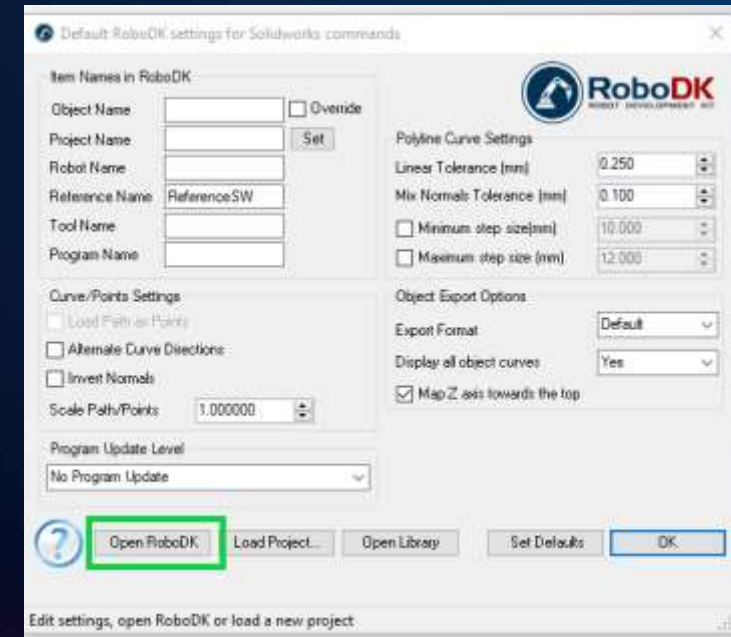
Start SolidWorks



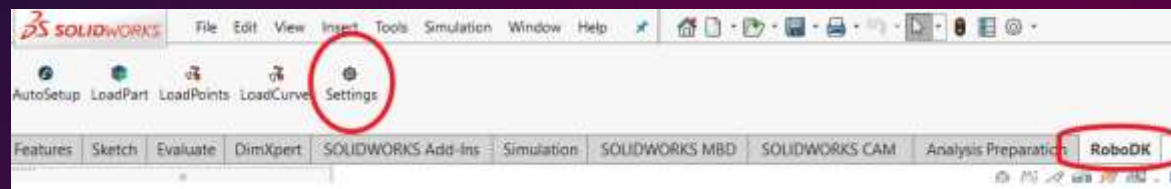
Start SolidWorks and select Part-modeler

Start-up

1. Click RoboDK RoboDK on top ribbon bar of SolidWorks
2. Click Settings
3. Click Open RoboDK to start RoboDK



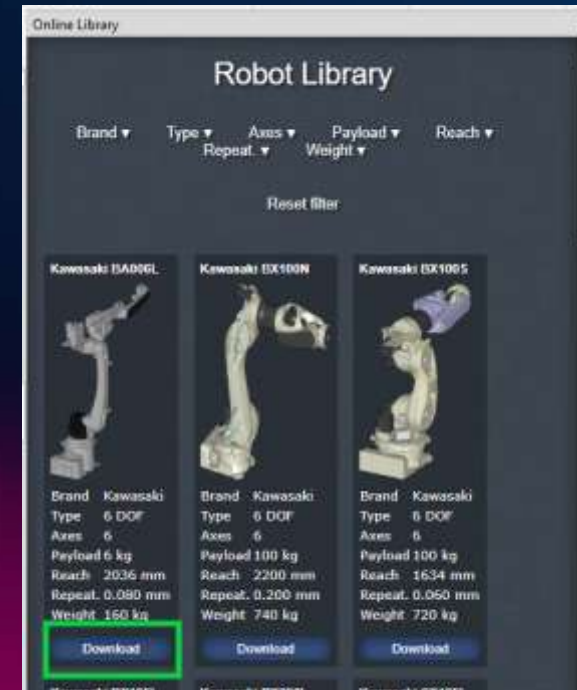
3



1, 2

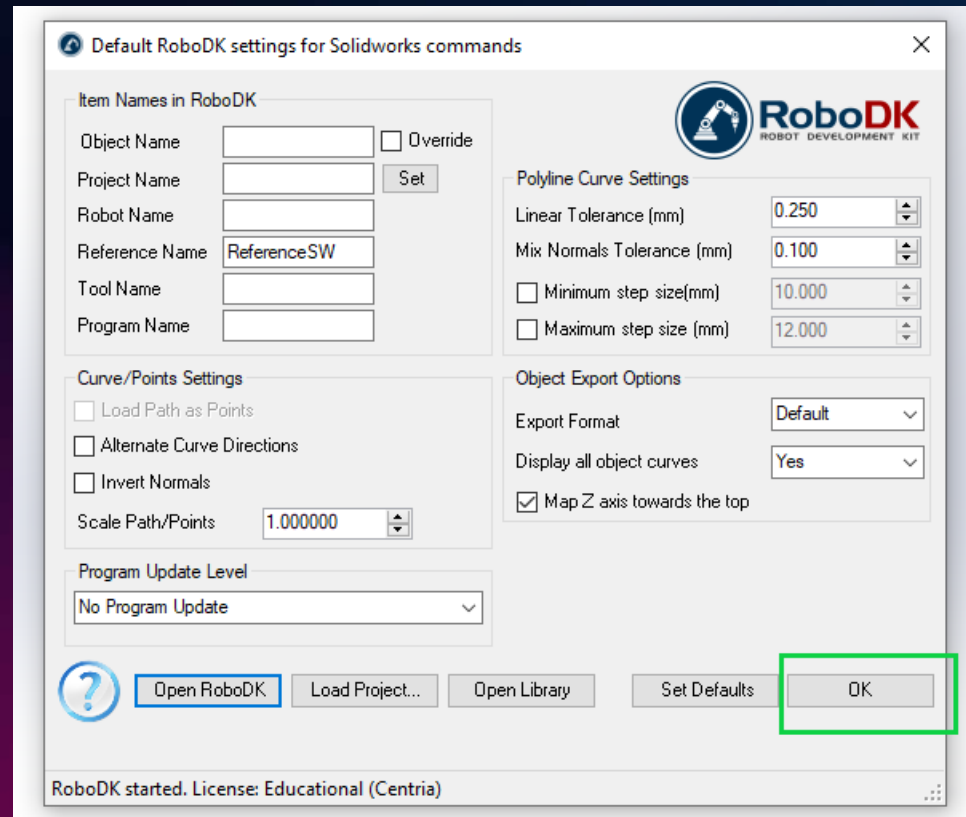
Get robot from online library

1. Click "File -> Open online library"
2. Select any robot you like. Lecturer selects "Kawasaki BA006L" robot.
3. Load the robot into your station by pressing "Download"
4. Close the online library.



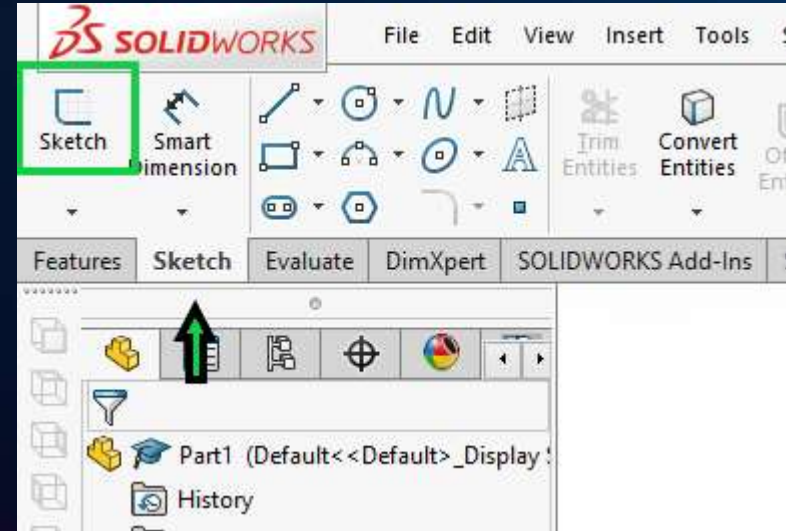
Return to Solidworks and

1. Close RoboDK settings window by clicking "ok"

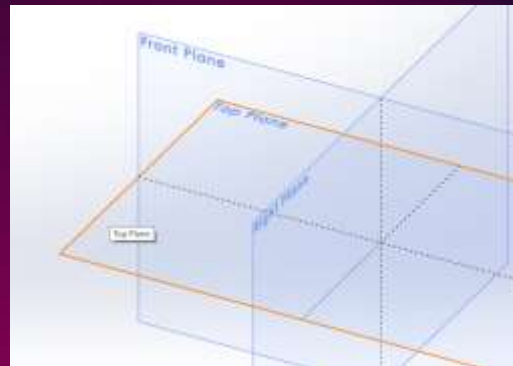


Model a pedestal for robot

1. Select "Sketch" from top ribbon bar
2. Click "Sketch"
3. Hover mouse over "Top Plane" frame
4. Left click to select "Top Plane" for sketching



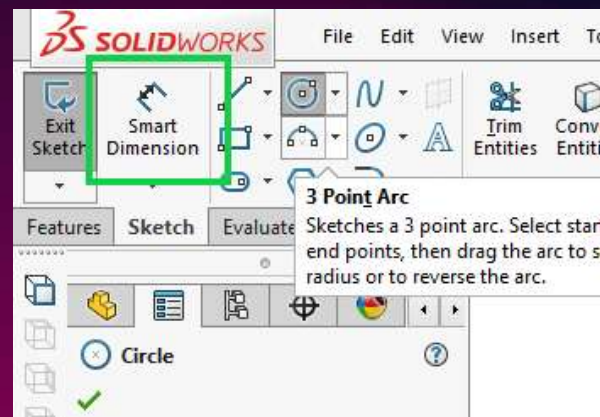
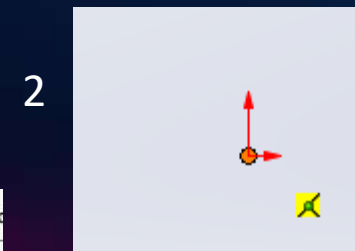
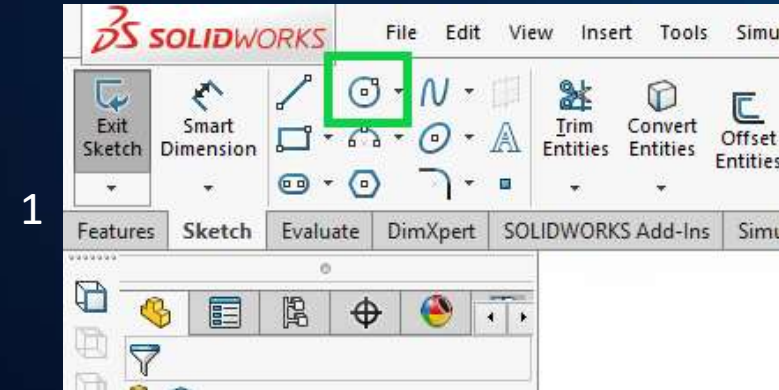
1,2



3,4

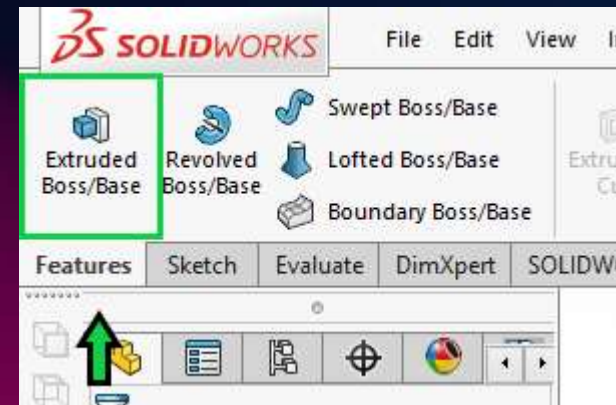
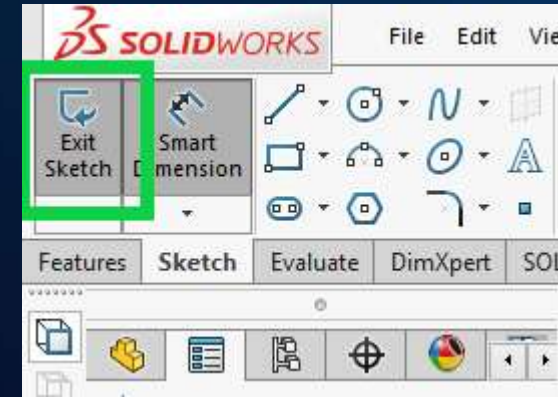
Model a pedestal for robot...

5. Select circle tool from sketch ribbon
6. Left click on "origo" point
7. Draw a circle
8. Select "Smart Dimension"
9. Set 600mm as diameter



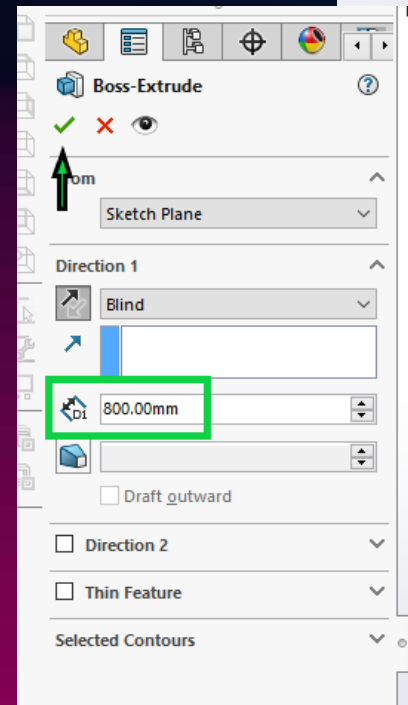
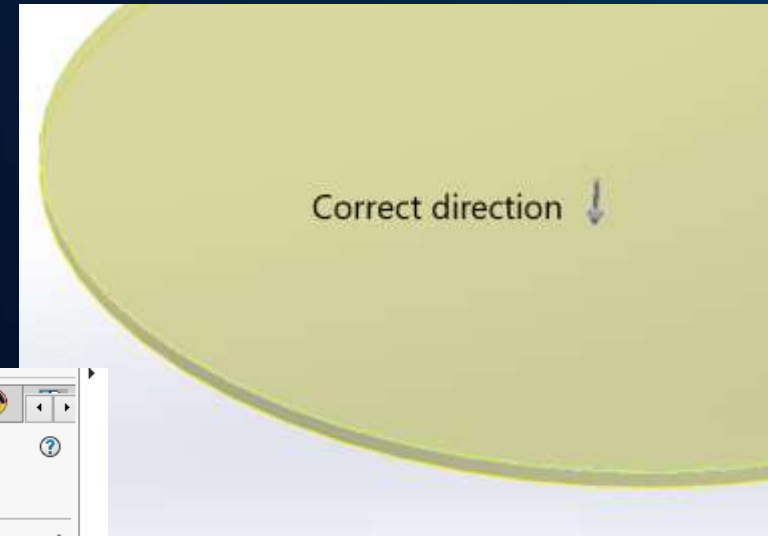
Model a pedestal for robot...

10. Click "Exit Scketch"
11. Select "Features" from ribbon bar
12. Click "Extruded Boss/Base"



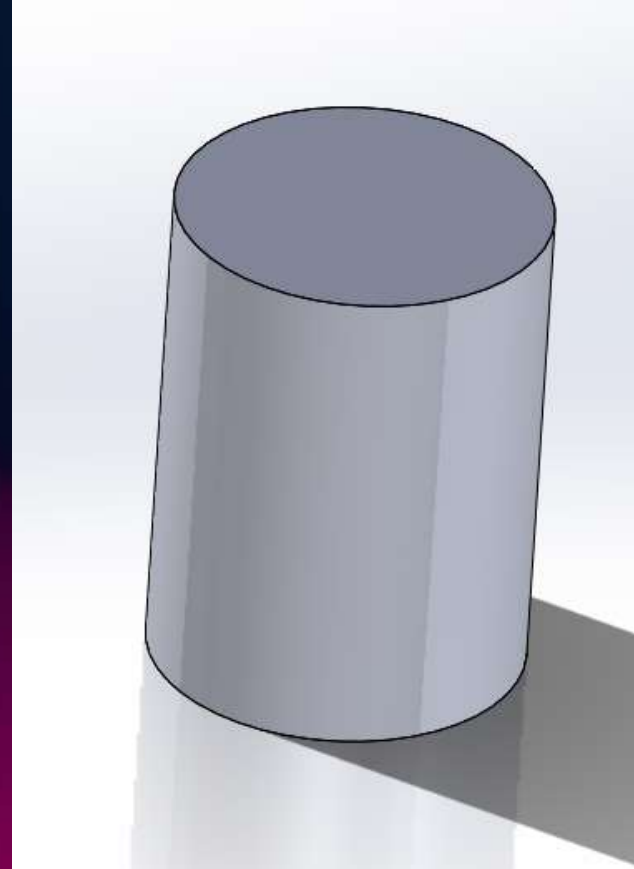
Model a pedestal for robot

1. Click on "Direction" so that feature will be extruded downwards
2. Set 800mm as length of extrusion
3. Click "Ok"



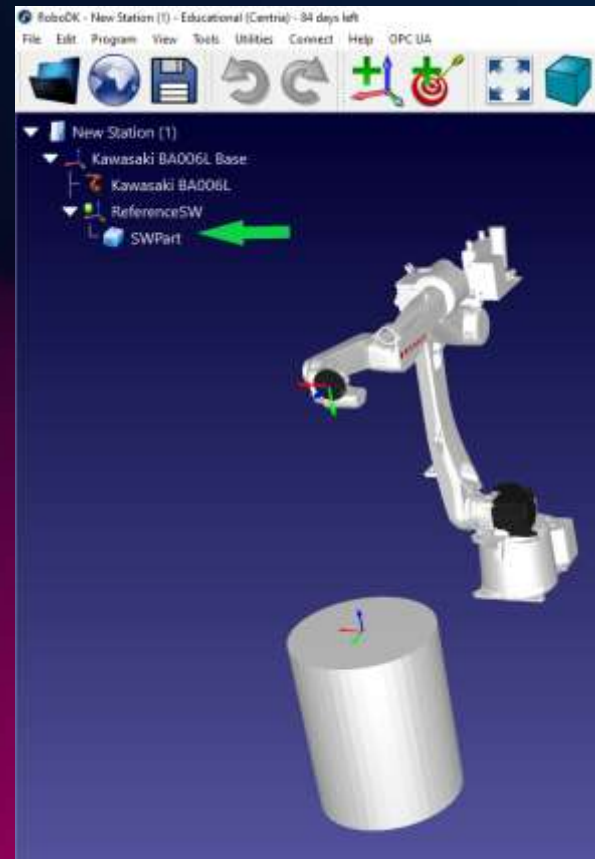
Check pedestal

Check that your pedestal model looks like this?



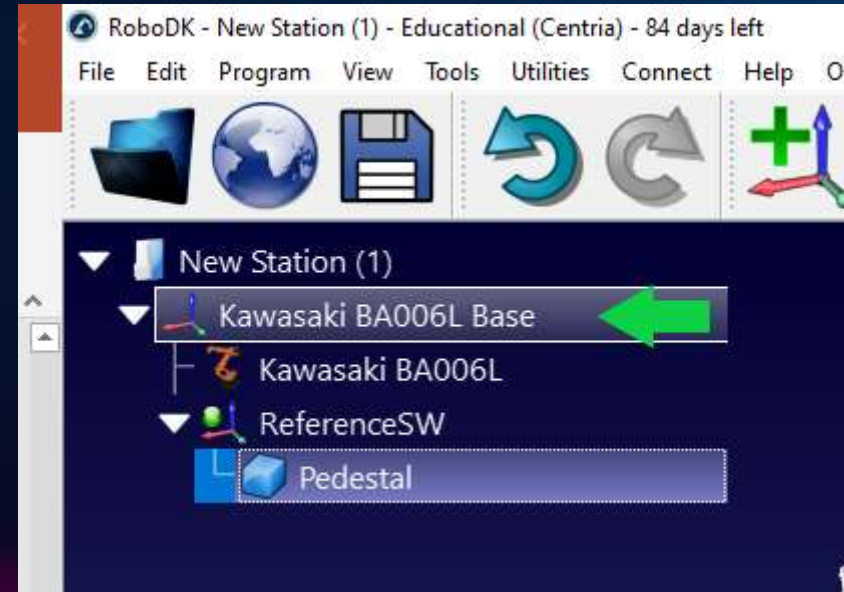
Load pedestal to RoboDK

1. Click RoboDK on top ribbon bar
2. Click "Load Part"
3. Activate RoboDK window
4. Pedestal should appear in RoboDK as SWPart

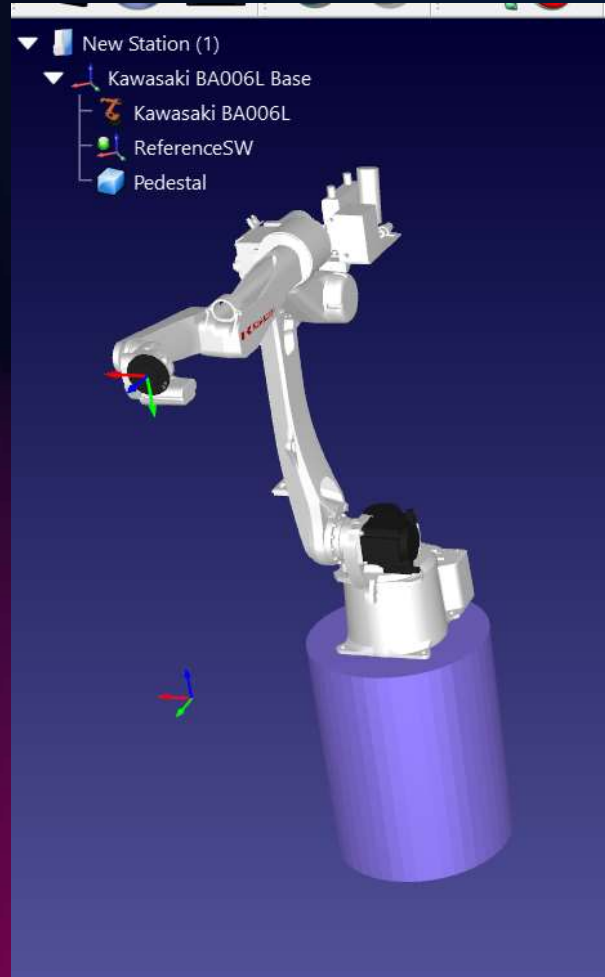


Load pedestal to RoboDK

1. Rename "SWPart" to "Pedestal"
2. Select "Pedestal" with left mouse button
3. Drag and drop "Pedestal" over "Kawasaki BA006L Base"
4. Change color of pedestal

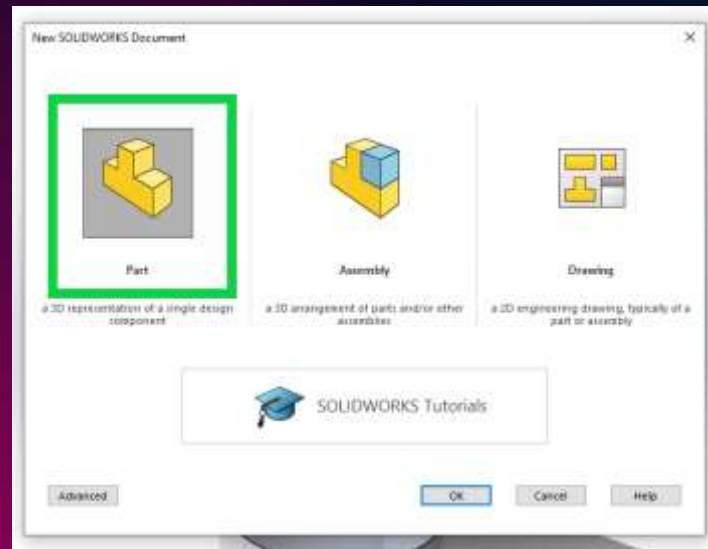
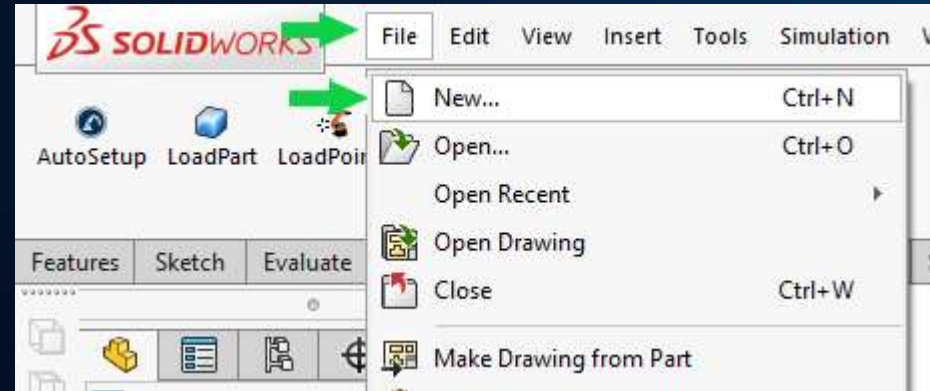


Check that view matches this



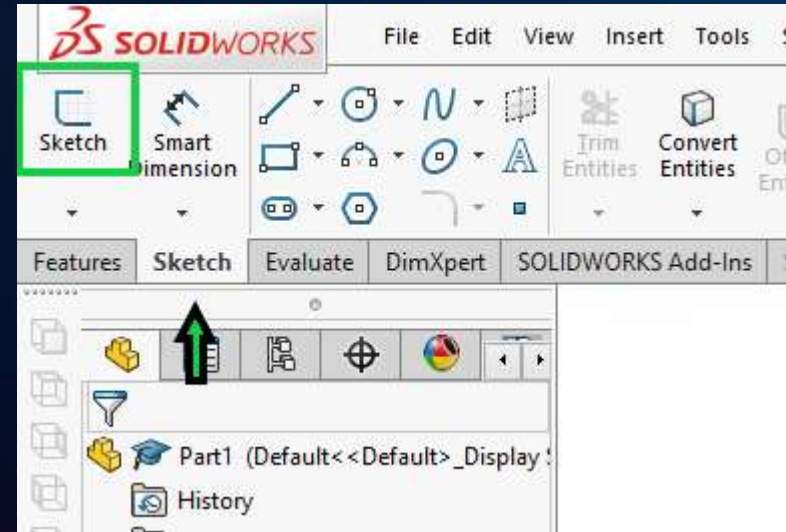
Model a table

1. Activate Solidworks Window
2. Click "File" from top bar
3. Click "New"
4. Double-click "Part"

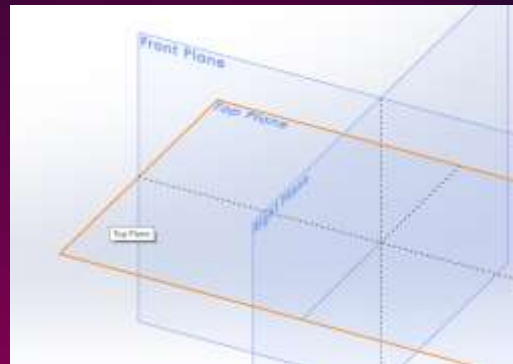


Model a table

1. Select "Sketch" from top ribbon bar
2. Click "Sketch"
3. Hover mouse over "Top Plane" frame
4. Left click to select "Top Plane" for sketching



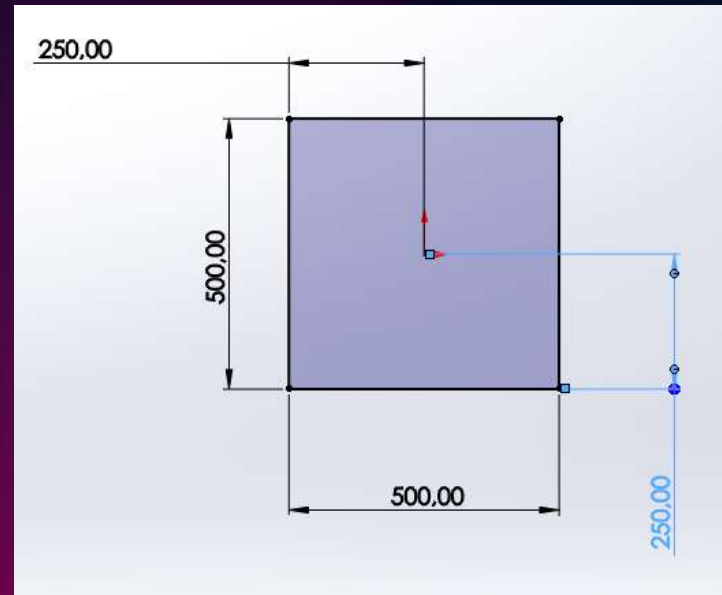
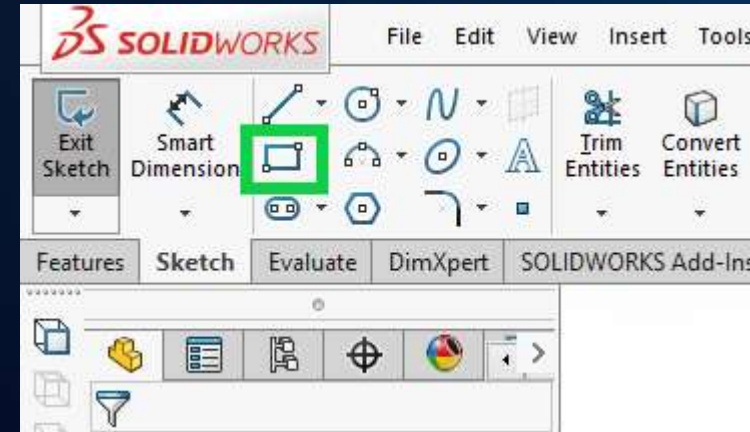
1,2



3,4

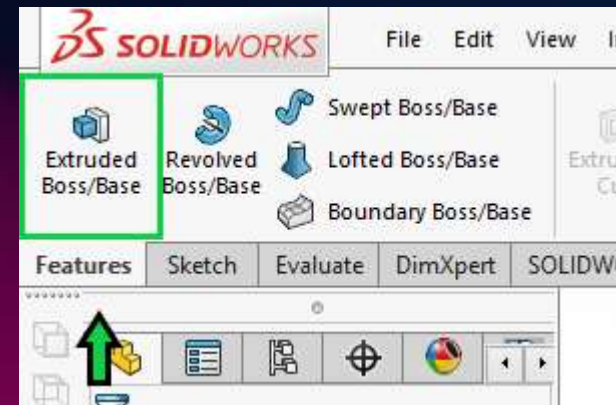
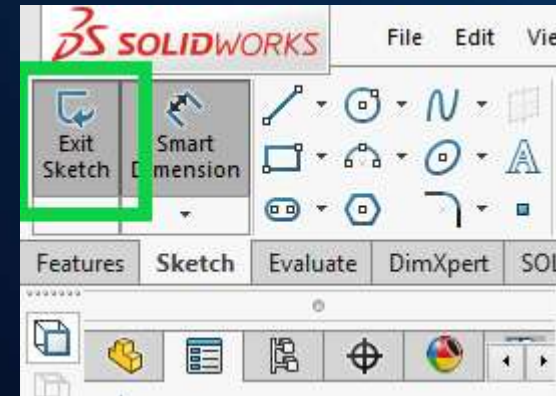
Model a table

1. Select "Rectangle" tool from menu
2. Draw a rectangle and dimension it as appears in picture below



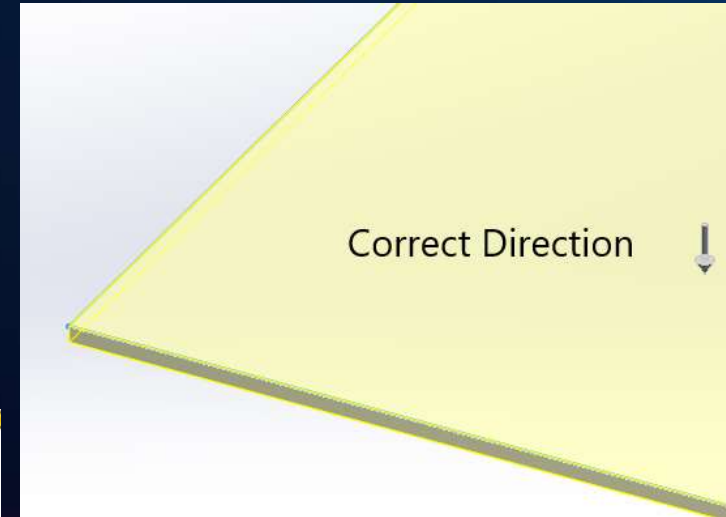
Model a table

10. Click "Exit Scketch"
11. Select "Features" from ribbon bar
12. Click "Extruded Boss/Base"



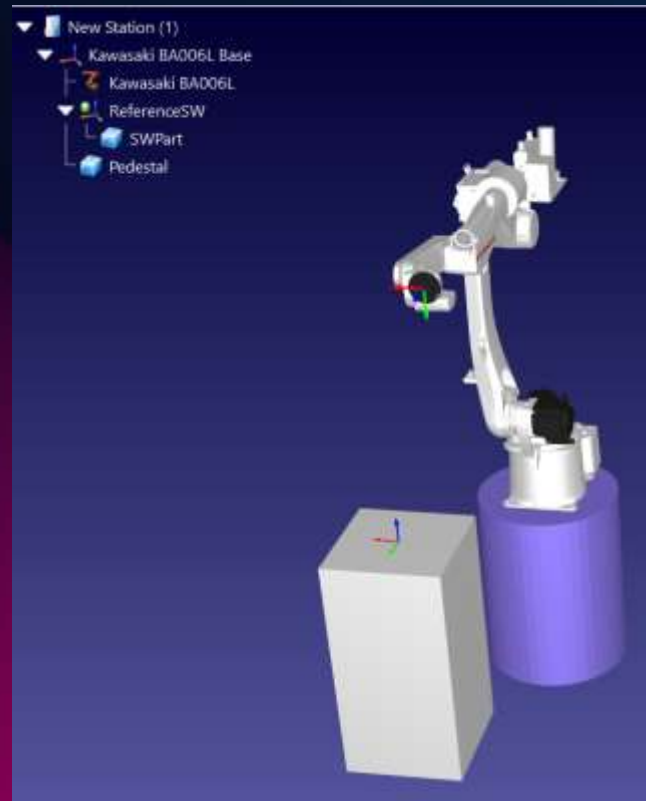
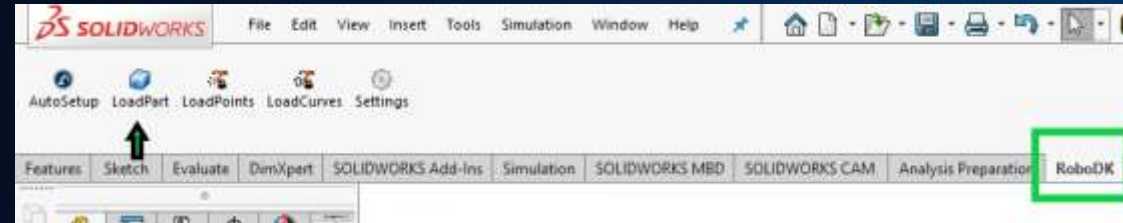
Model a table

1. Click on "Direction" so that feature will be extruded downwards
2. Set 1000mm as length of extrusion
3. Click "Ok"



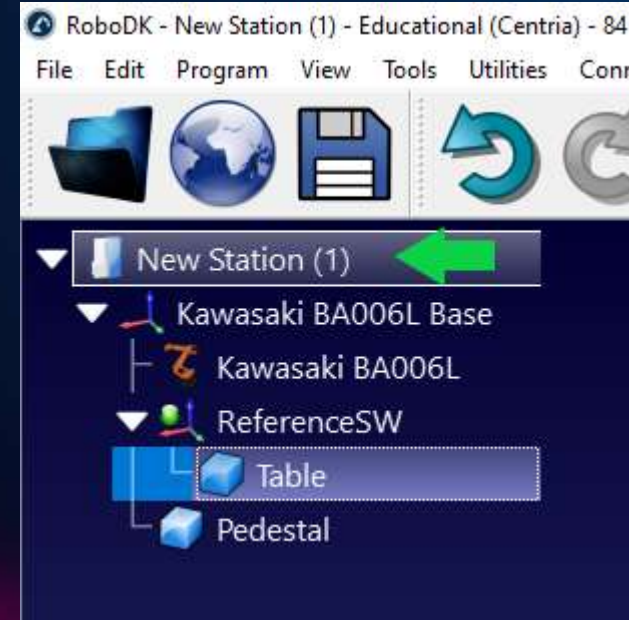
Load table to RoboDK

1. Click RoboDK on top ribbon bar
2. Click "Load Part"
3. Activate RoboDK window
4. Table should appear in RoboDK as SWPart



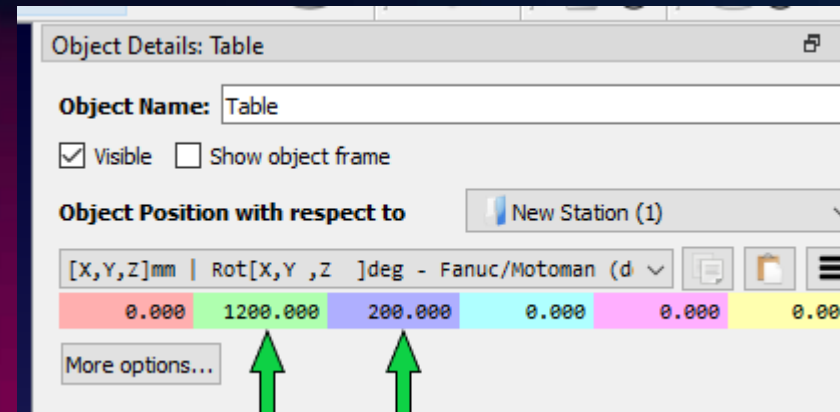
Load table to RoboDK

1. Rename "SWPart" to "Table"
2. Select "Table" with left mouse button
3. Drag and drop "Pedestal" over "New Station"
4. Change color of "Table"



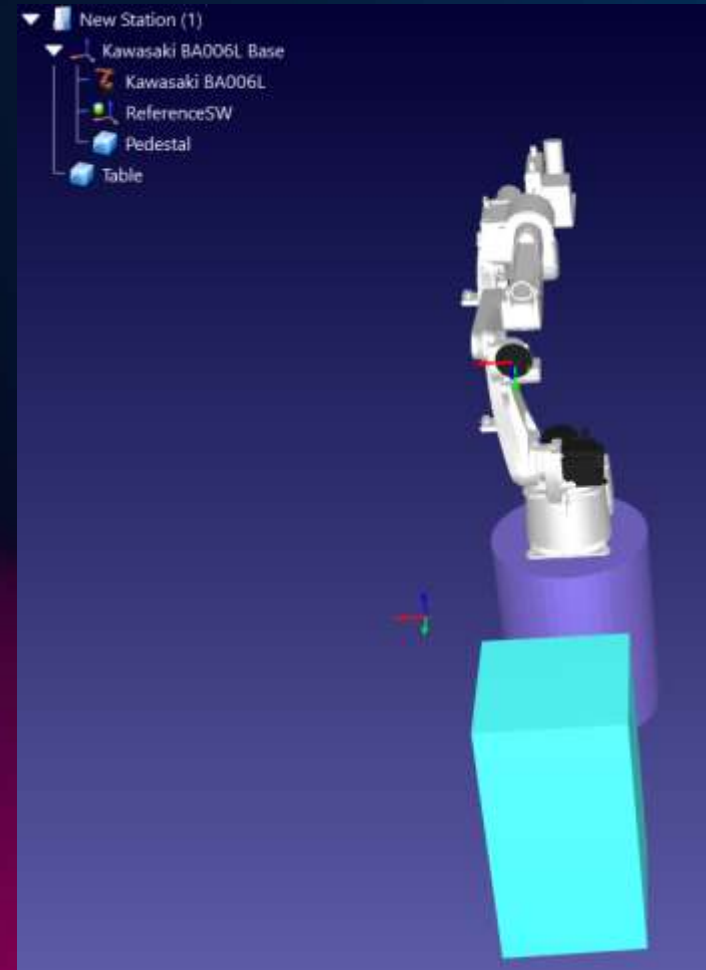
Position table in front of robot

1. Double click "Table" to open "Object Details" window
2. As table is 200 mm higher than robot pedestal input 200mm to Z translation
3. Input 1200mm to Y-translation



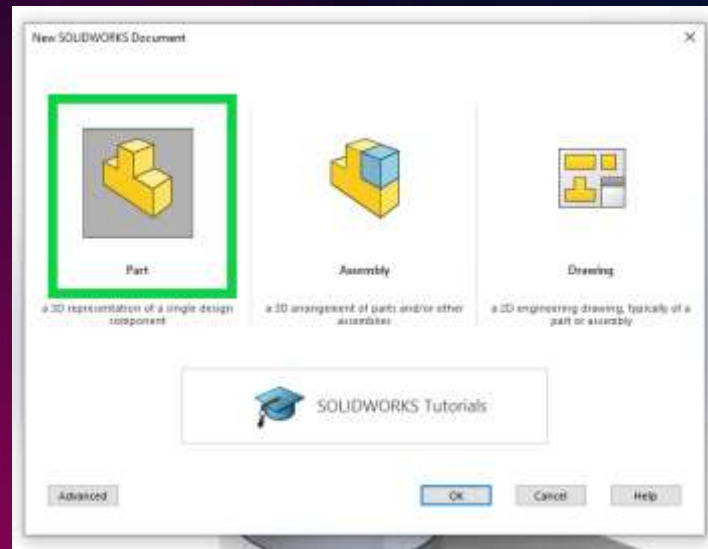
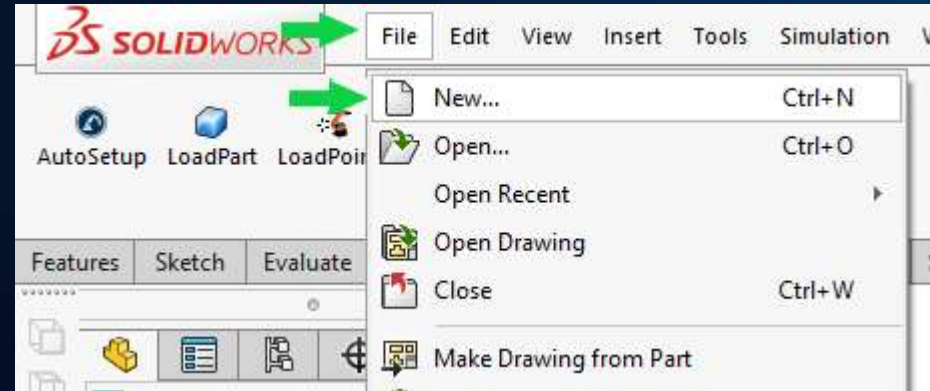
Check that view matches this

Change color of table and check
that view matches this



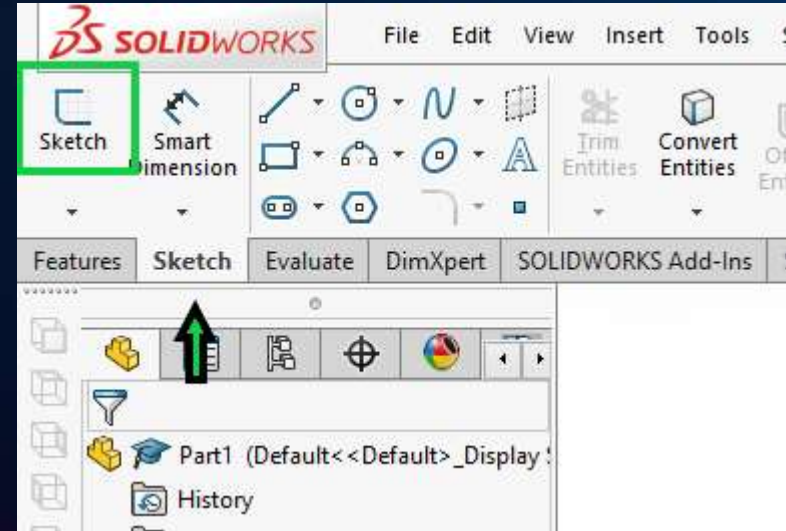
Model a tool

1. Activate Solidworks Window
2. Click "File" from top bar
3. Click "New"
4. Double-click "Part"

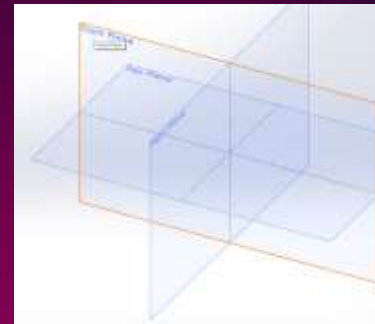


Model a tool

1. Select "Sketch" from top ribbon bar
2. Click "Sketch"
3. Hover mouse over "Front Plane" frame
4. Left click to select "Front Plane" for sketching



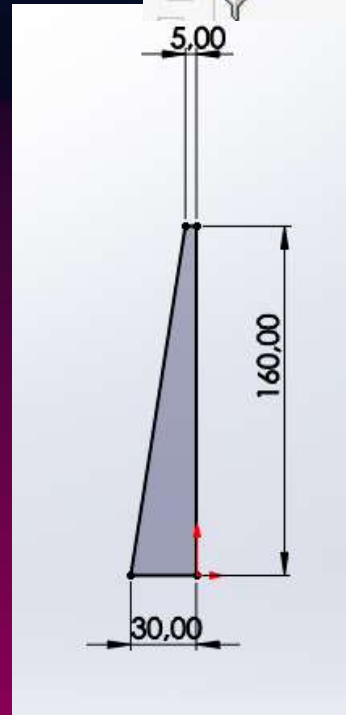
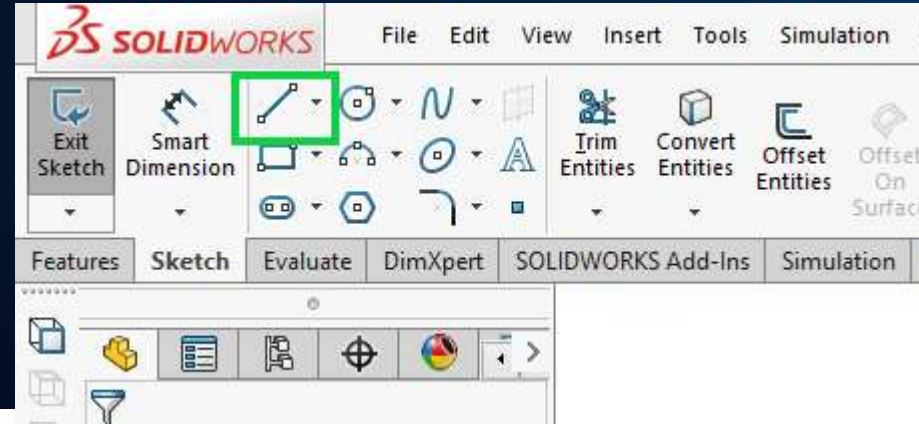
1,2



3,4

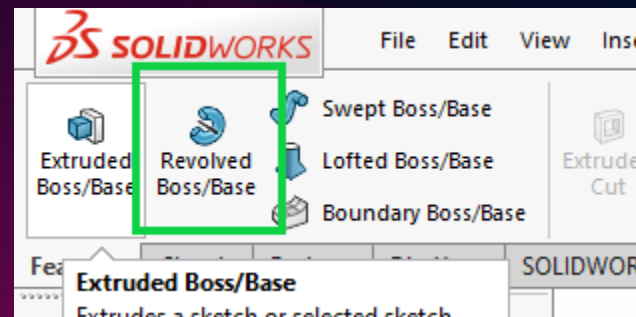
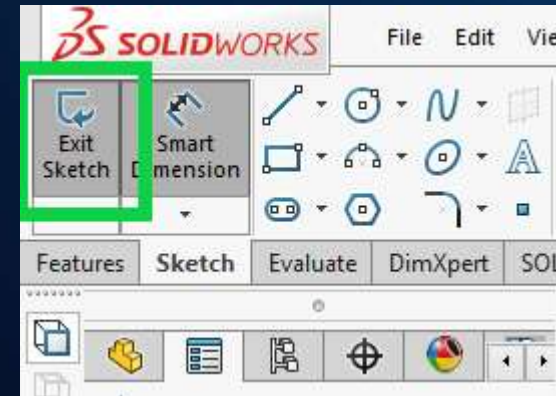
Model a tool

1. Select "Line" tool from menu
2. Draw a shape and dimension it as appears in picture below



Model a tool

10. Click "Exit Sketch"
11. Select "Features" from ribbon bar
12. Click "Revolved Boss/Base"



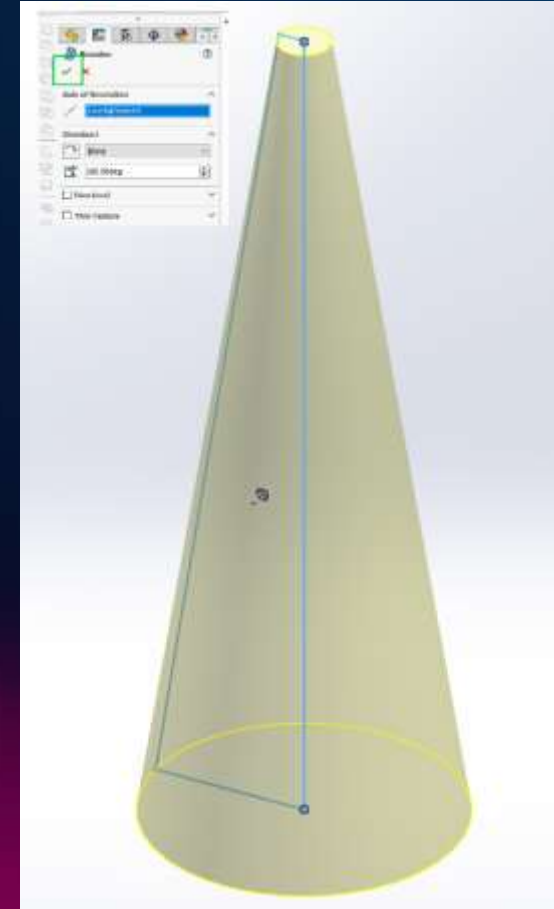
Model a tool

1. Click line shown in pic to set it as "Axis of revolution"

2. Click "ok"



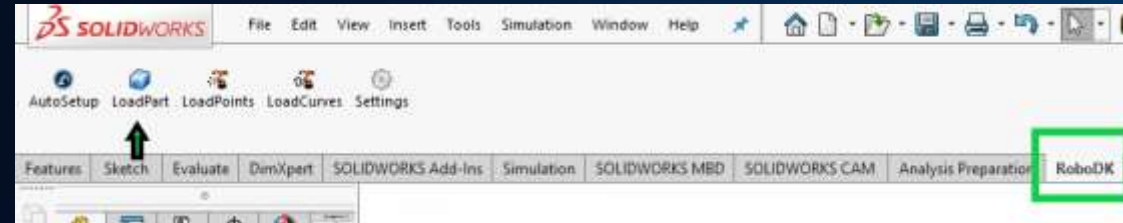
1



2

Load tool to RoboDK

1. Click RoboDK on top ribbon bar
2. Click "Load Part"
3. Activate RoboDK window
4. Tool should appear in RoboDK as SWPart



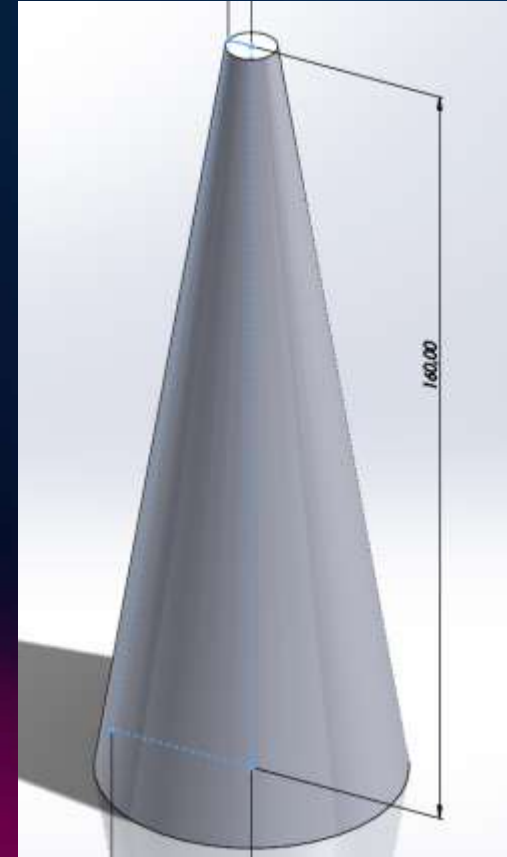
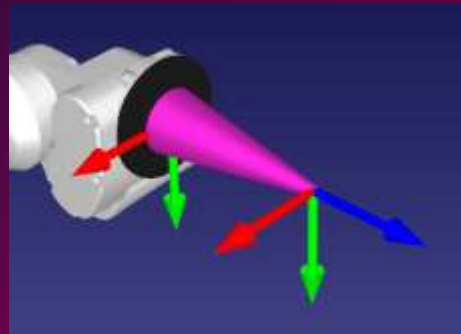
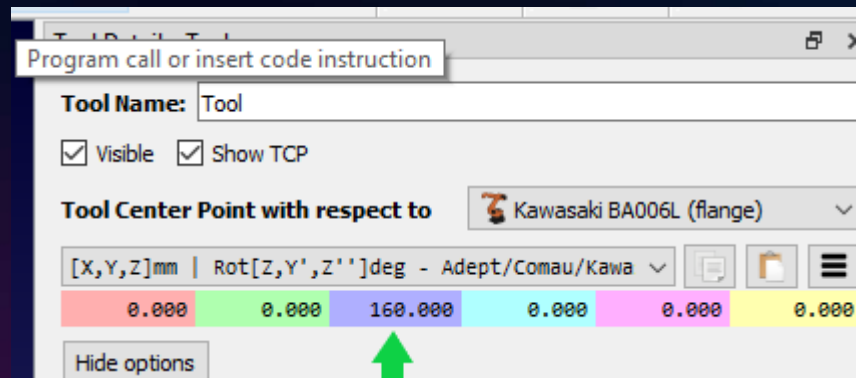
Load tool to RoboDK

1. Rename "SWPart" to "Tool"
2. Select "Table" with left mouse button
3. Drag and drop "Tool" over "Kawasaki BA006L"
4. Change color of "Tool"

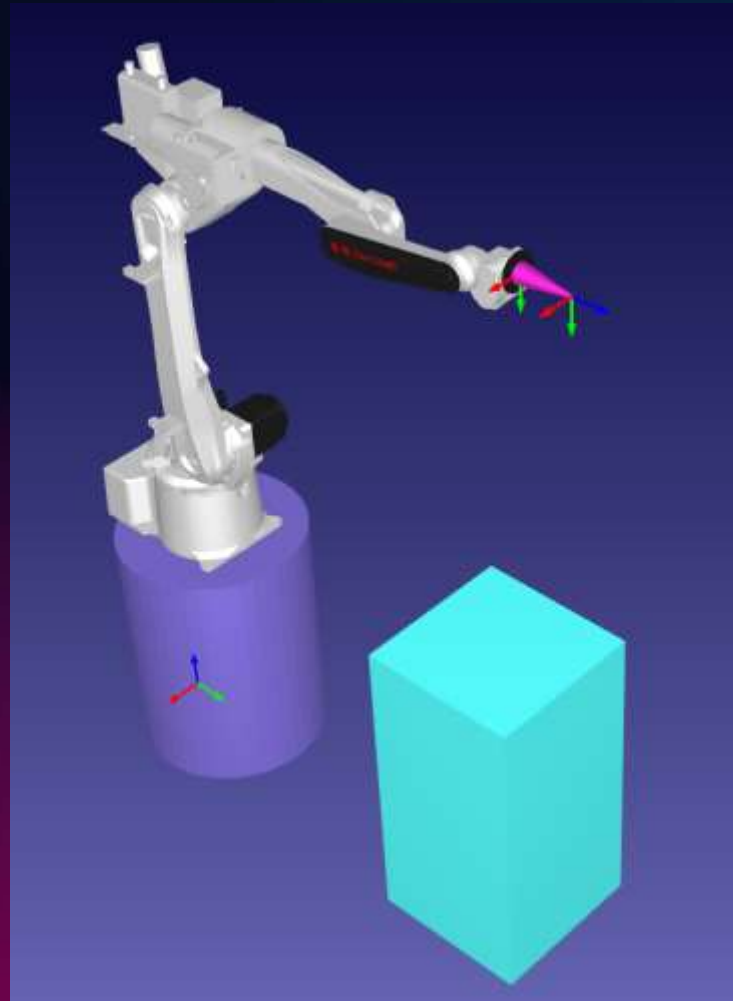


Correct Tool Centre Point

1. From "Tool Details" window change TCP according to picture



Check that view matches this



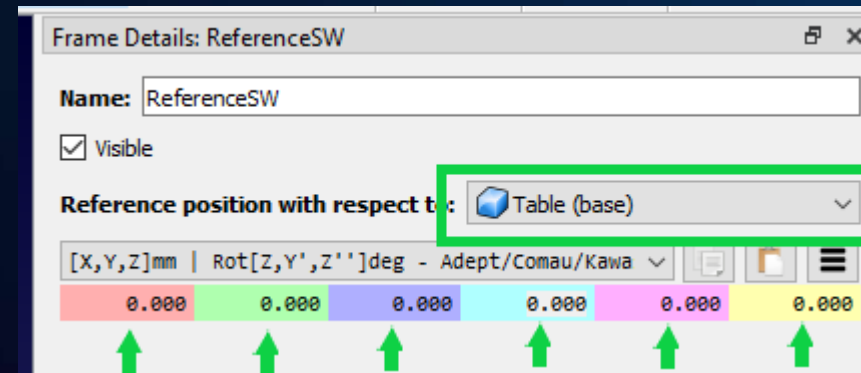
Move ReferenceSW on top of table

1. Select "ReferenceSW" with right mouse button
2. Drag and drop it over "Table"
3. Select "Move Nested"



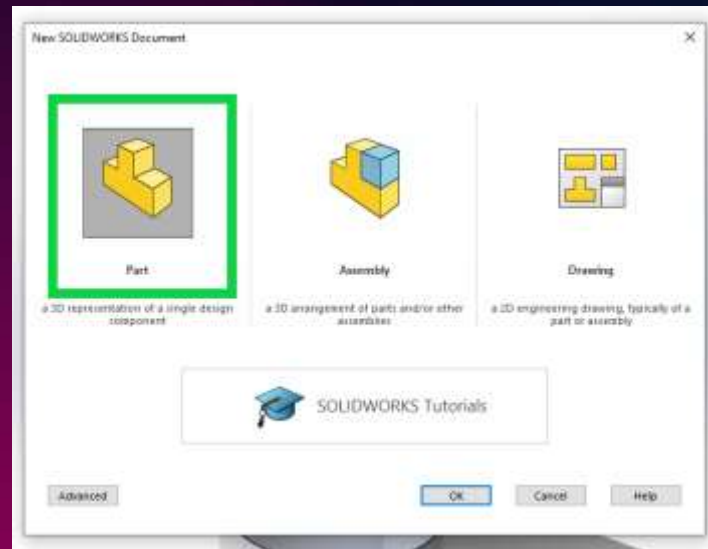
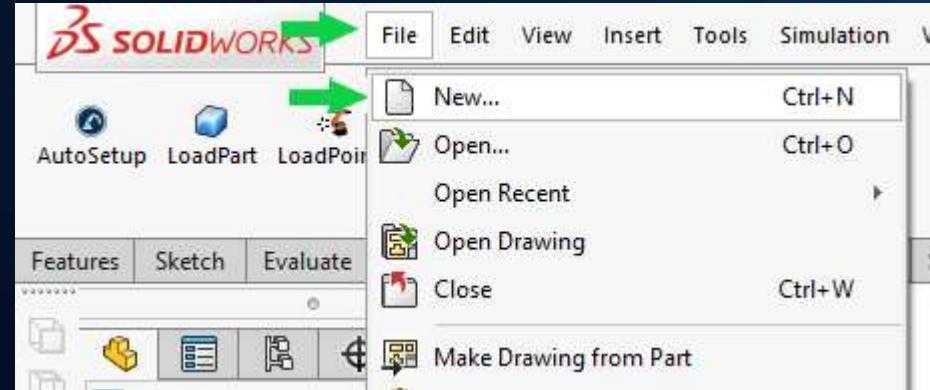
Move ReferenceSW on top of table

1. Double click "ReferenceSW" to open object details window
2. Select "Table" to "Reference position with respect to"
3. Set "0.0" to all translations



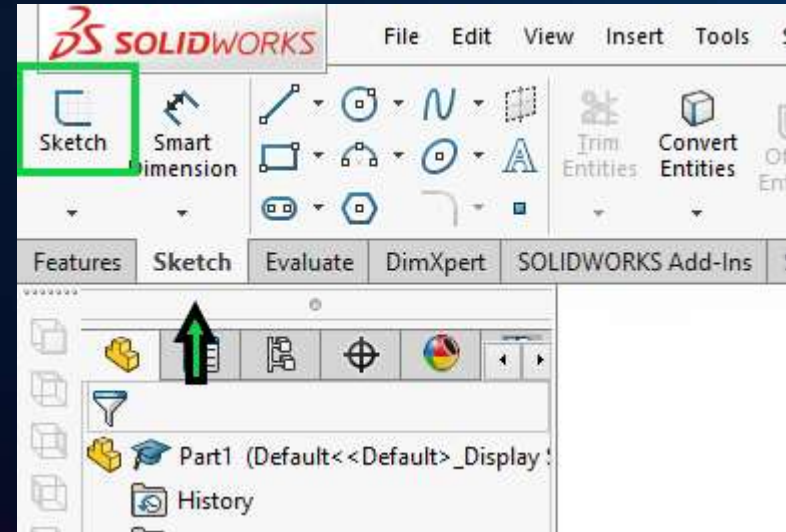
Model a workpiece

1. Activate Solidworks Window
2. Click "File" from top bar
3. Click "New"
4. Double-click "Part"

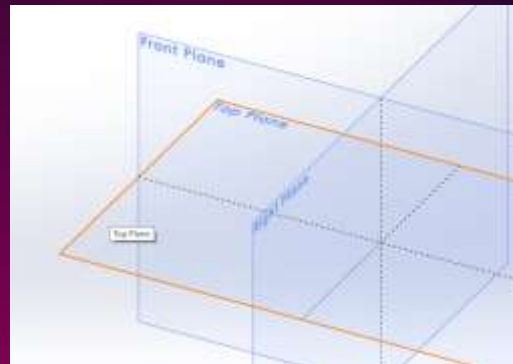


Model a workpiece

1. Select "Sketch" from top ribbon bar
2. Click "Sketch"
3. Hover mouse over "Top Plane" frame
4. Left click to select "Top Plane" for sketching



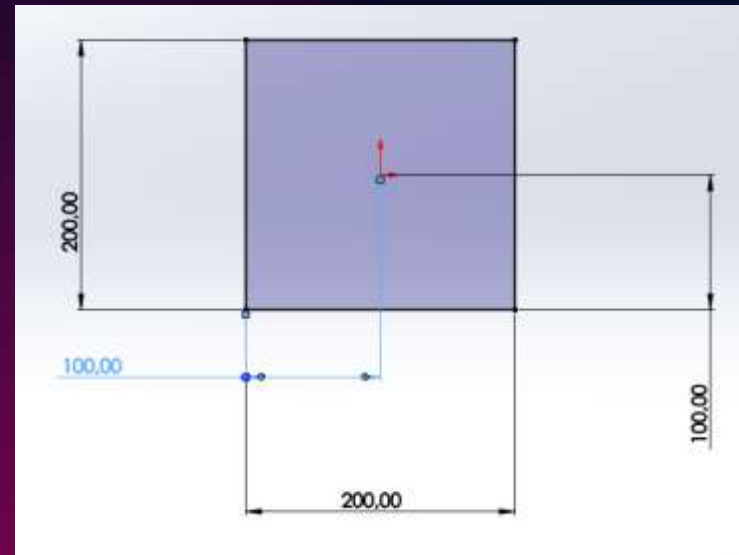
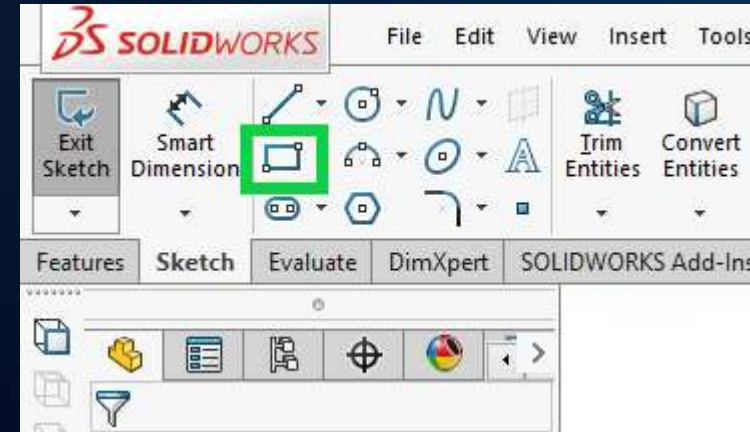
1,2



3,4

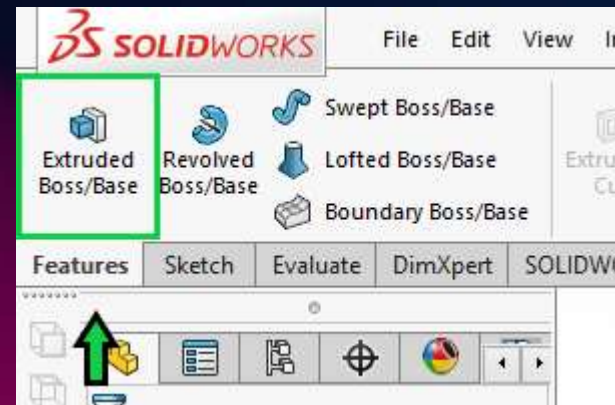
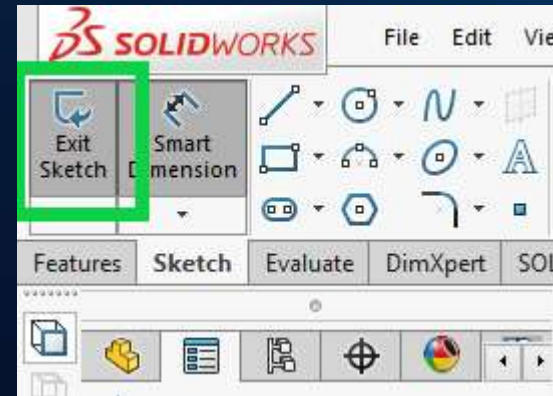
Model a workpiece

1. Select "Rectangle" tool from menu
2. Draw a rectangle and dimension it as appears in picture below



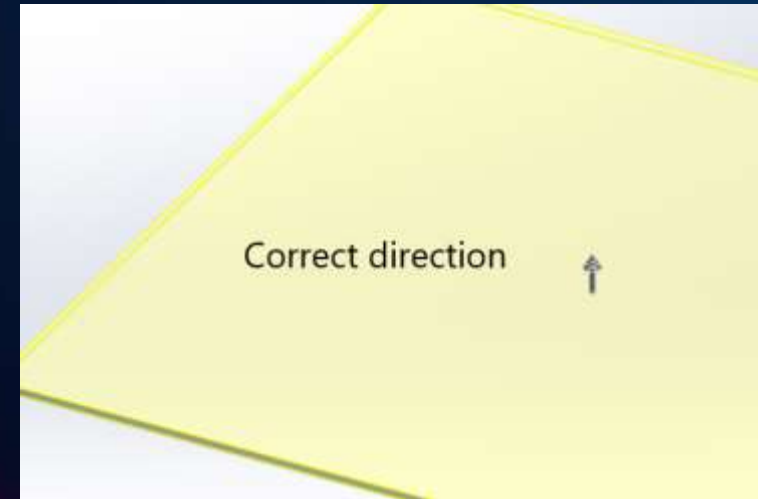
Model a workpiece

10. Click "Exit Scketch"
11. Select "Features" from ribbon bar
12. Click "Extruded Boss/Base"



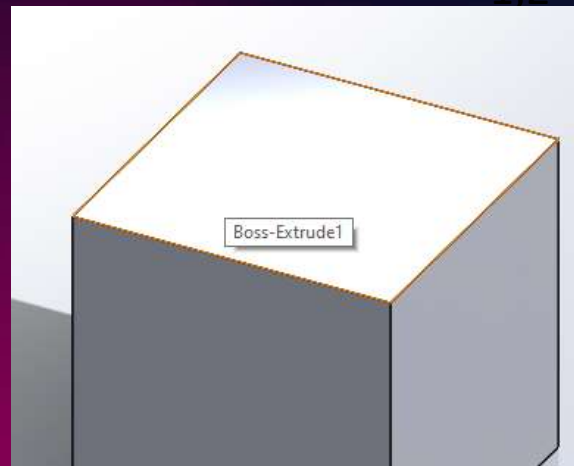
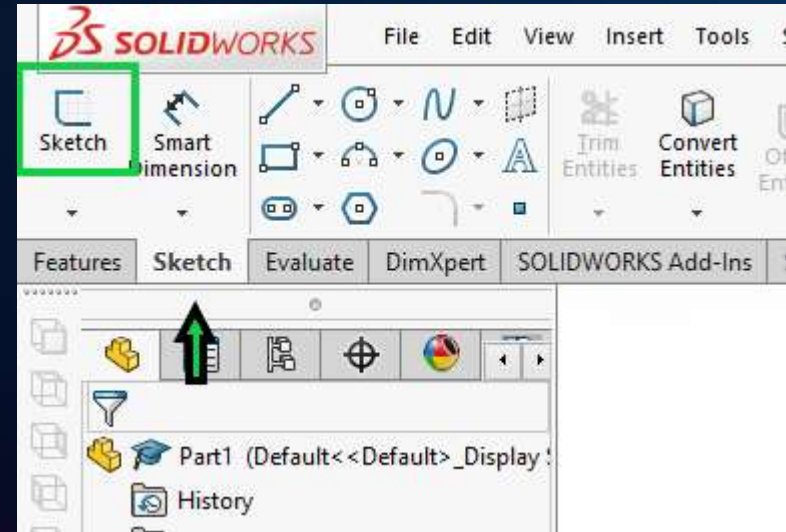
Model a workpiece

1. Click on "Direction" so that feature will be extruded upwards
2. Set 200mm as length of extrusion
3. Click "Ok"



Model a workpiece

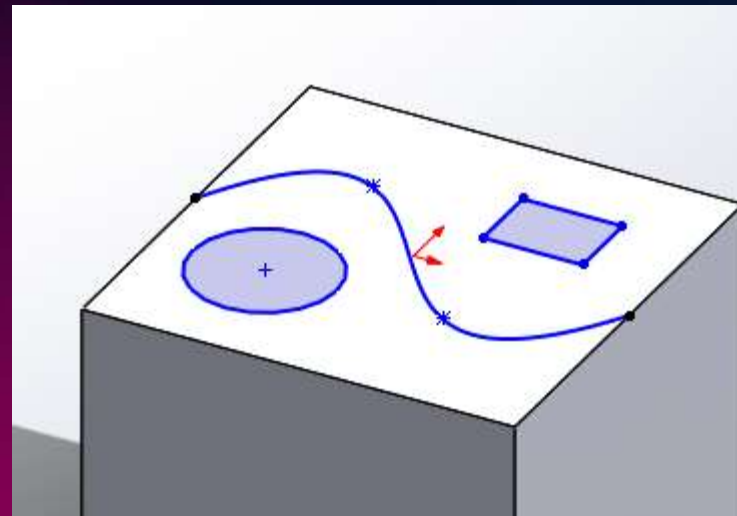
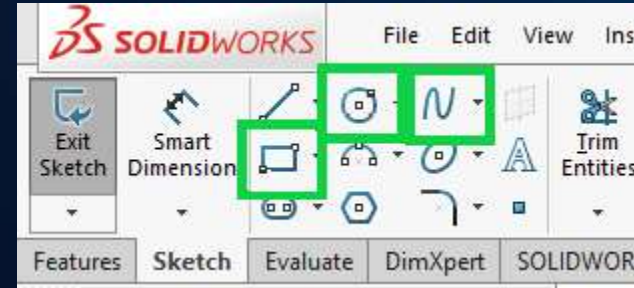
1. Select "Sketch" from top ribbon bar
2. Click "Sketch"
3. Hover mouse over "Top Plane" of cube extruded
4. Left click to select cube "Top Plane" for sketching



3,4

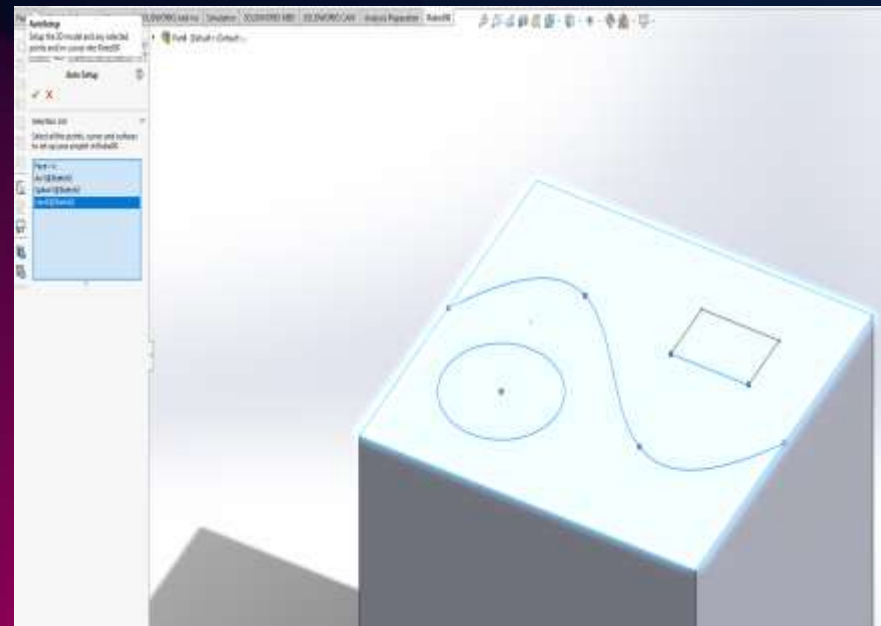
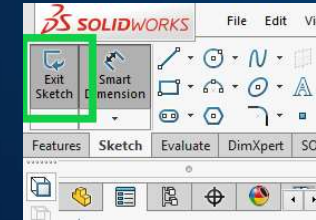
Model a workpiece

1. Use spline tool to sketch a spline over cube
2. Select rectangle tool to sketch a rectangle over cube
3. Select circle tool to sketch a circle over cube
4. Note: Spline can be ended by pressing "esc"



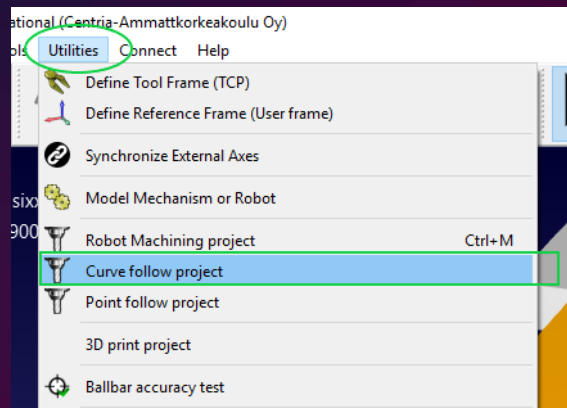
Add curves to follow

1. Click "Exit Sketch"
2. Click RoboDK ribbon on top ribbonbar
3. Click "Autosetup"
4. Select features sketched and Face 1
5. Click "ok"

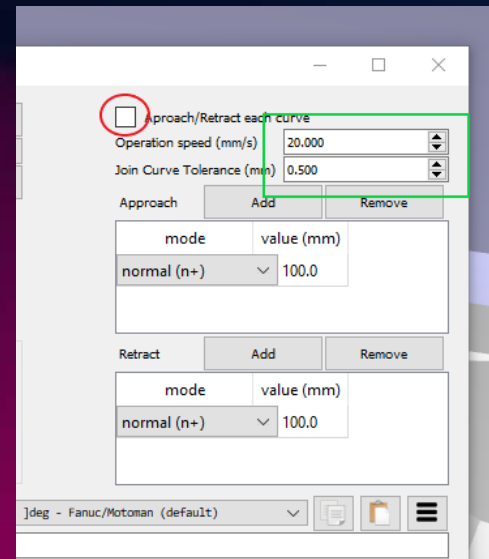


RoboDK – Creating trajectories

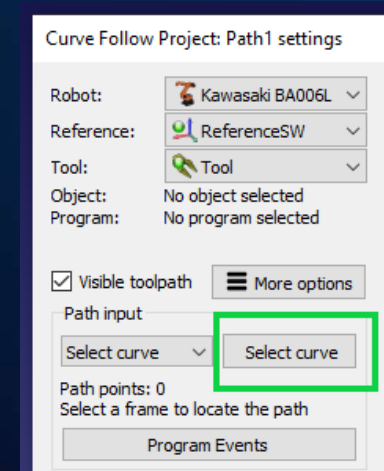
1. Select "Utilities" -> "Curve Follow Project" from the toolbar.
2. Make sure "Approach/Retract each curve" IS NOT checked.
3. Set "Operation speed" as 20 mm/s
4. Click "Select Curve"



1



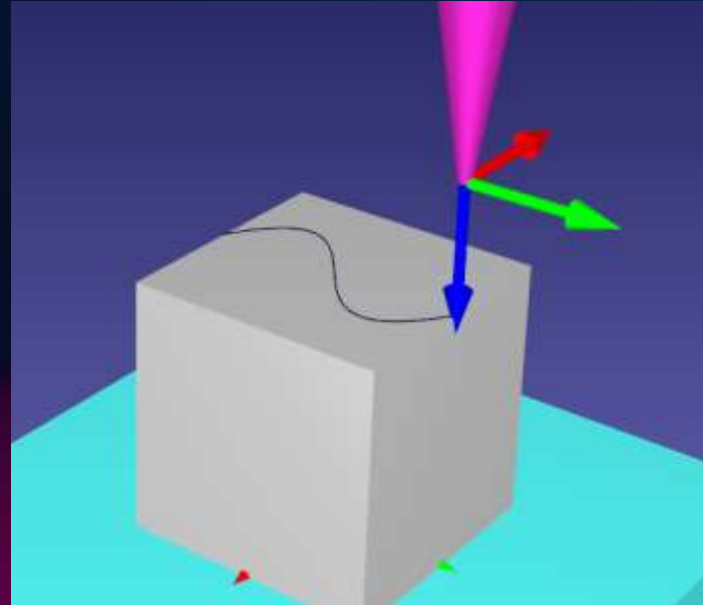
2,3



4

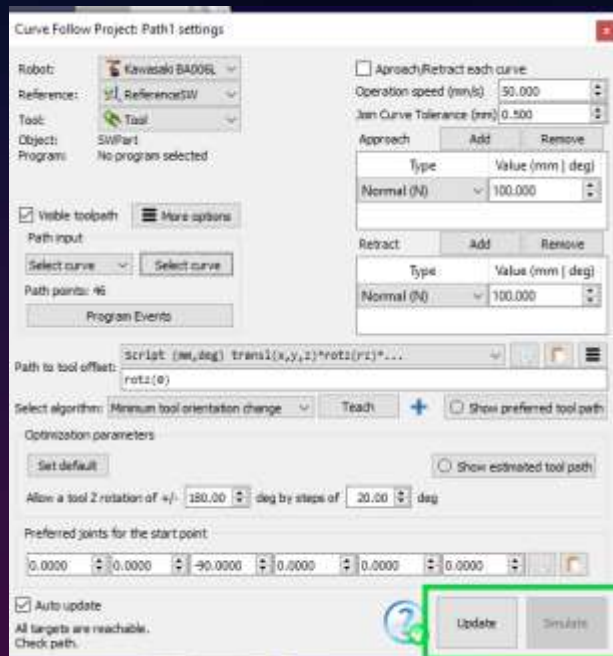
RoboDK – creating trajectories

1. Click on spline on top of workpiece.

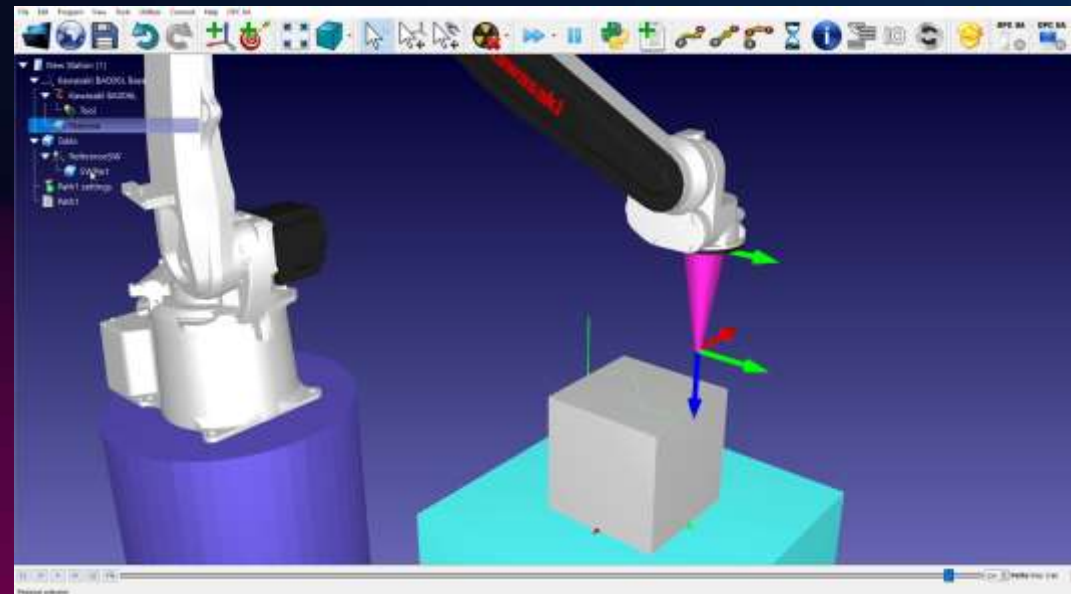


RoboDK – Creating trajectories

8. Click "Done"
9. Click "Update"
10. Click "Simulate"



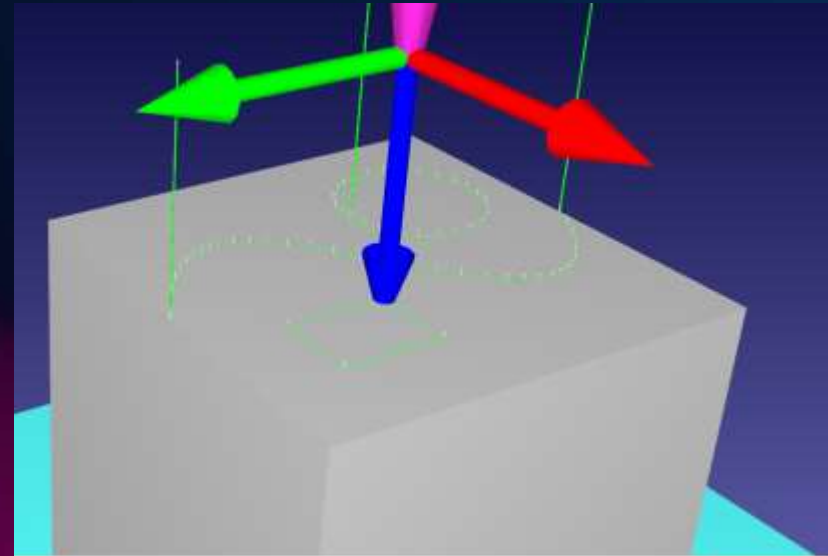
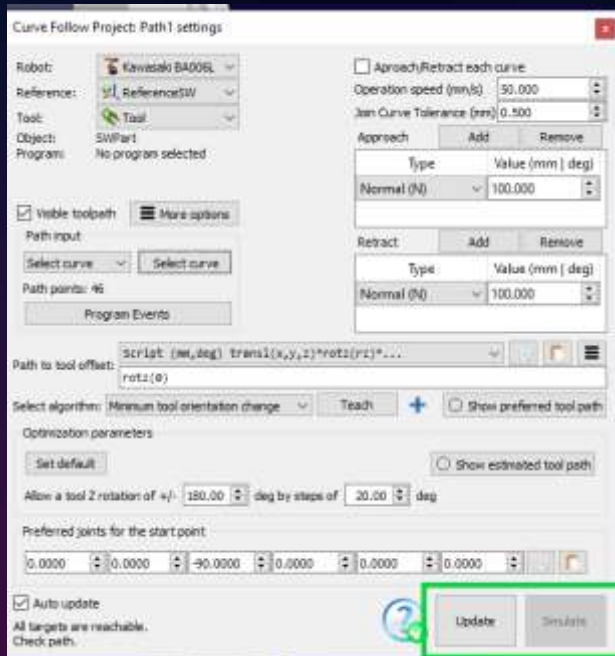
8,9



OK, result

RoboDK – Creating trajectories

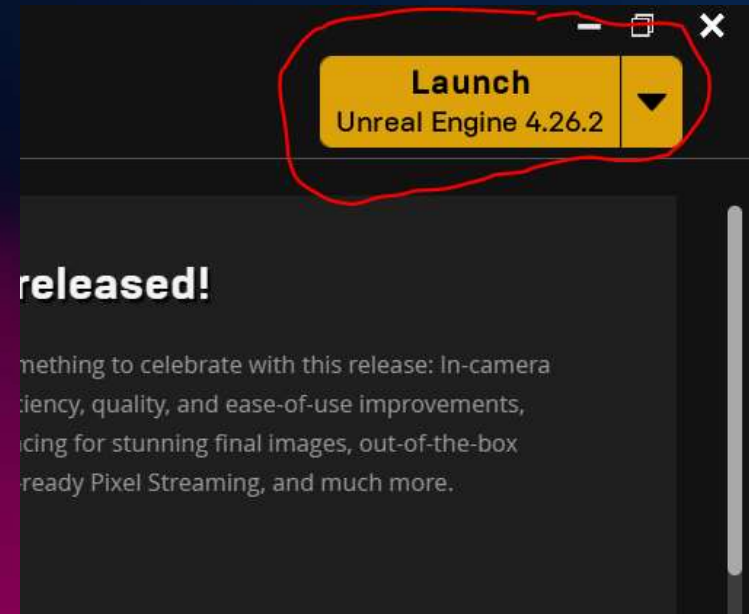
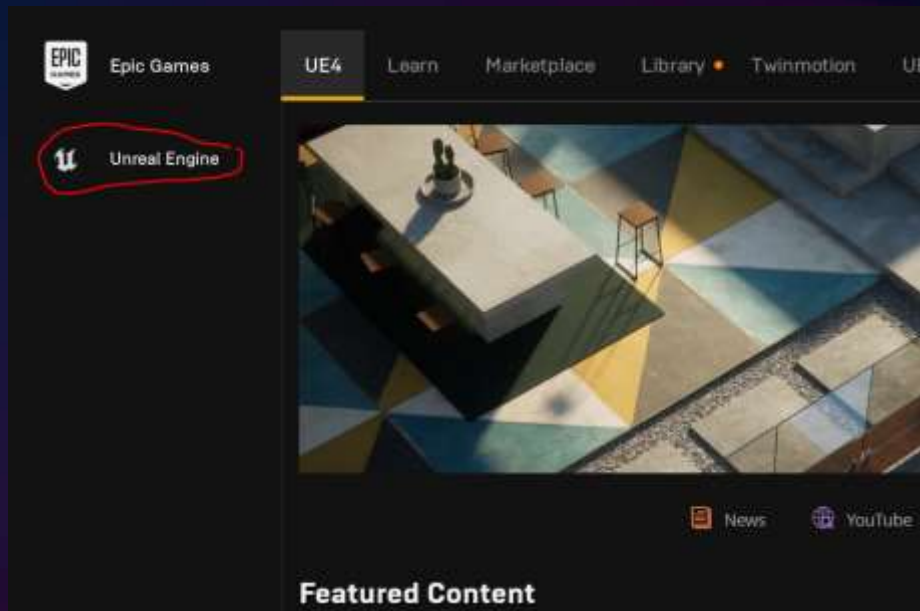
10. Return to “Creating trajectories” section number 1.
11. Create trajectories for box and circle.



OK, result

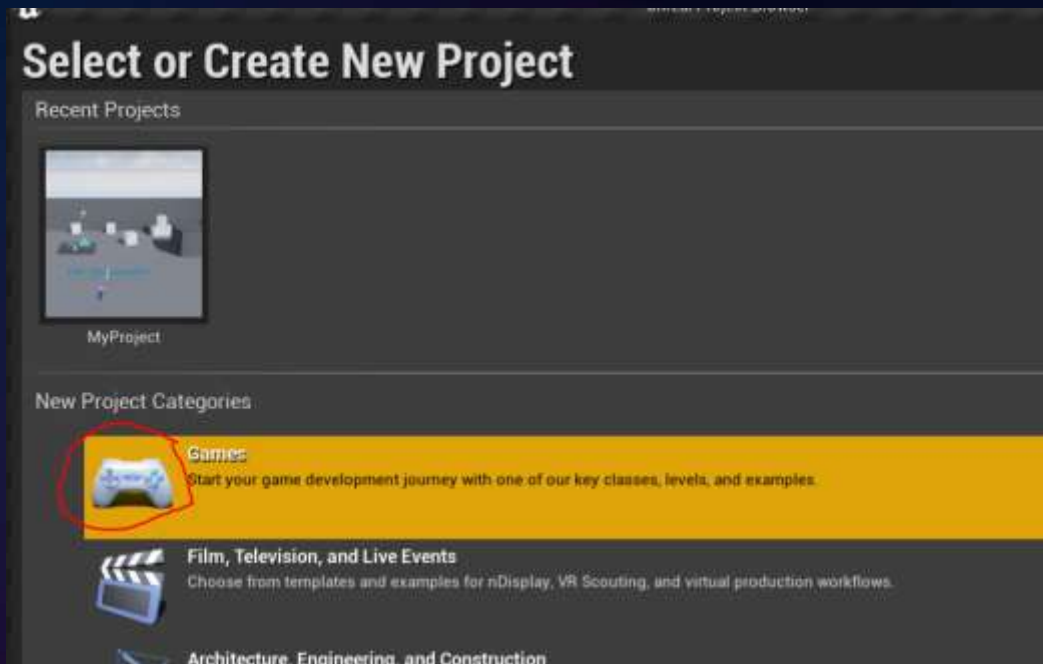
Unreal Engine - Startup

- Open “EPIC game launcher”
- Click “Unreal Engine”
- Select “Unreal Engine 4.26”
- Click “Launch”



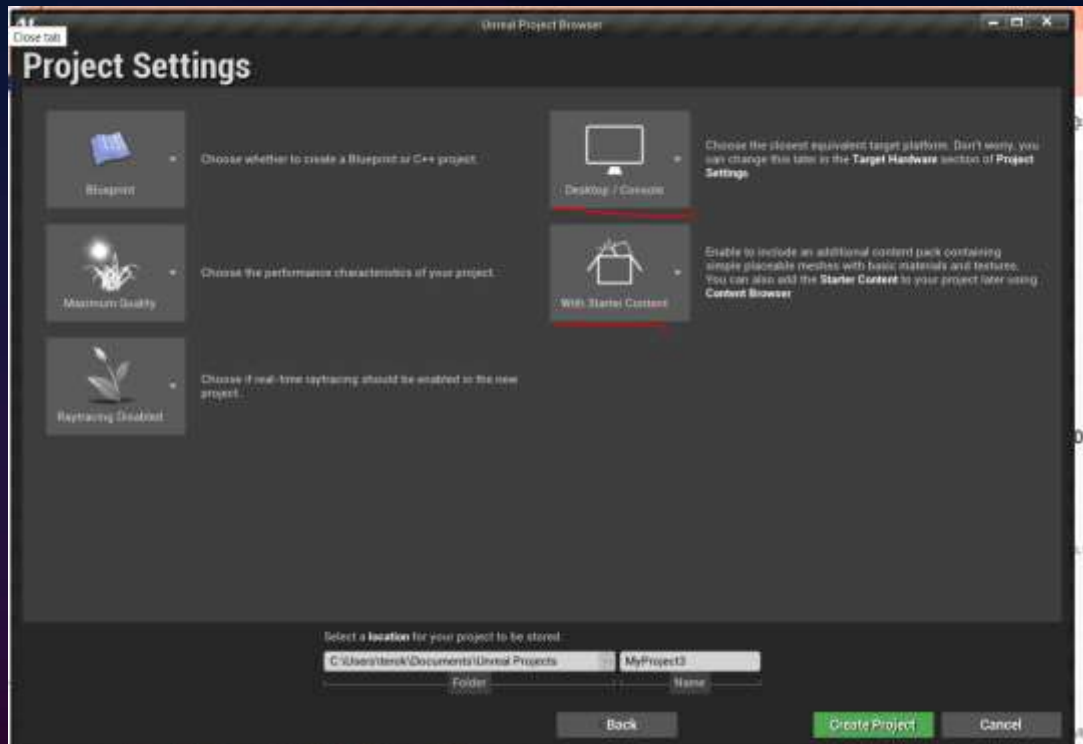
Unreal Engine – Create Project

- Select “New project” -> “Games”
- Select “Virtual Reality”



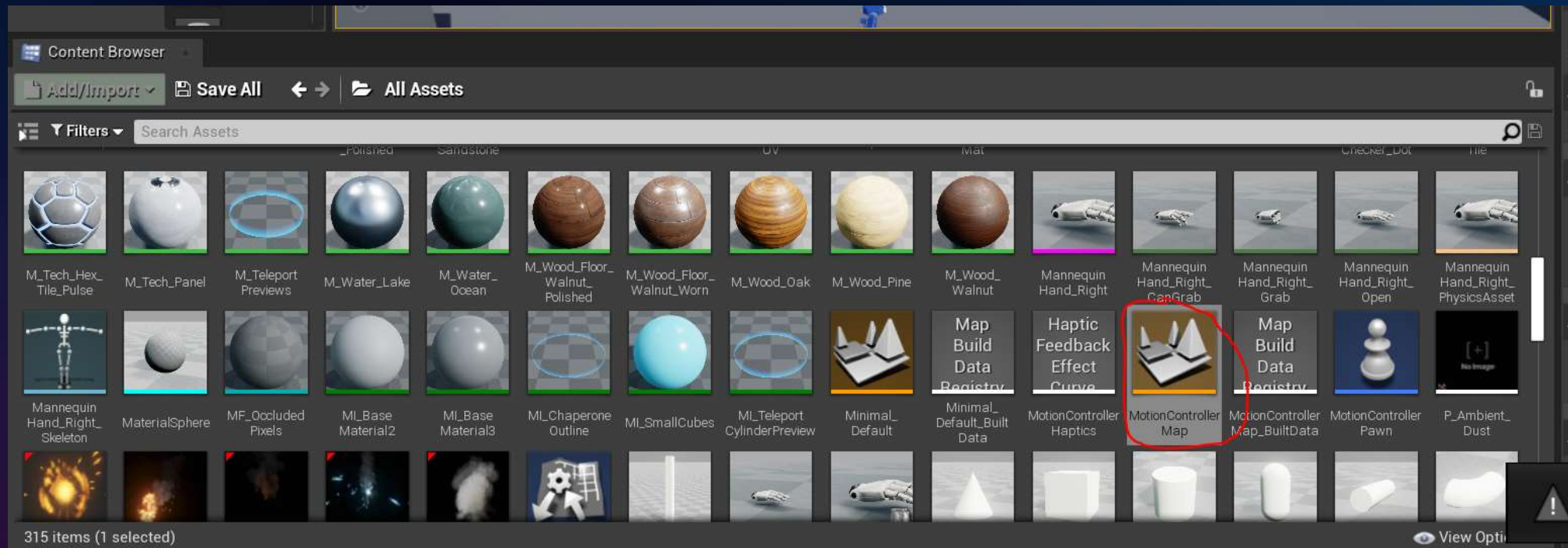
Unreal Engine – Create Project

- Select “Desktop/Console”
- Select “With Starter Content”
- Click “Create Project”



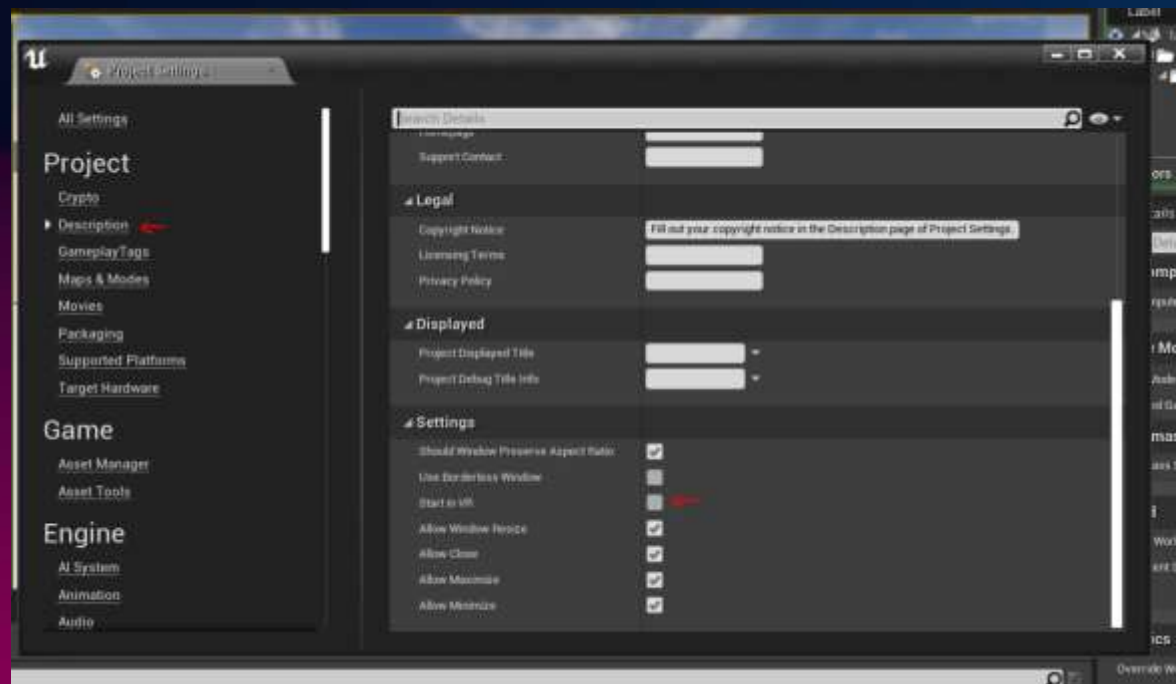
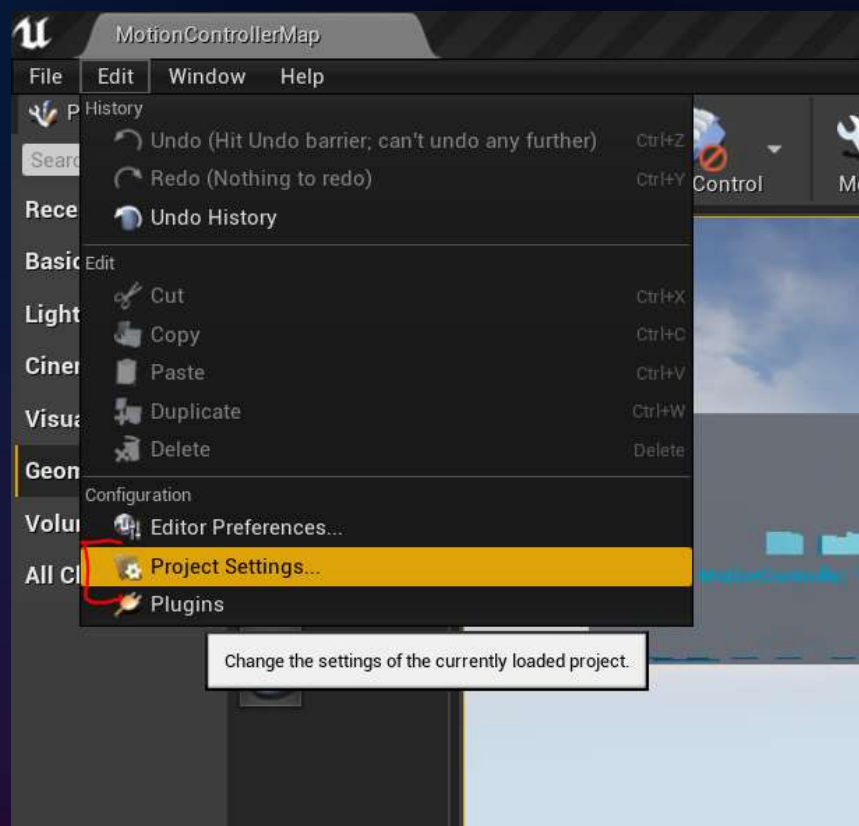
Unreal Engine – Select Correct Map

- Double click “MotionControllerMap” from “Content Browser”



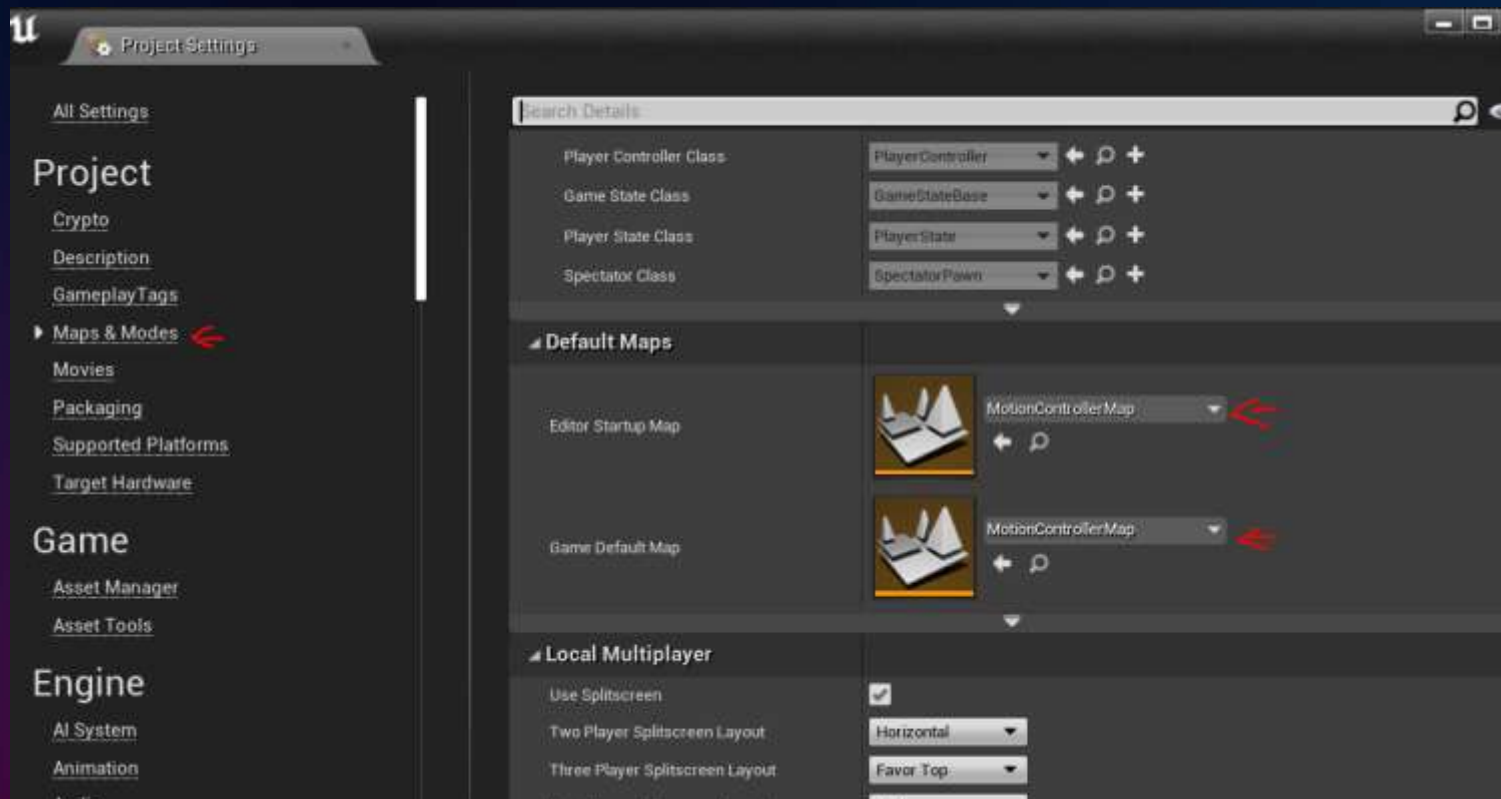
Unreal Engine – Project Settings

- Click “Edit” -> “Project Settings”
- Select “Start in VR”



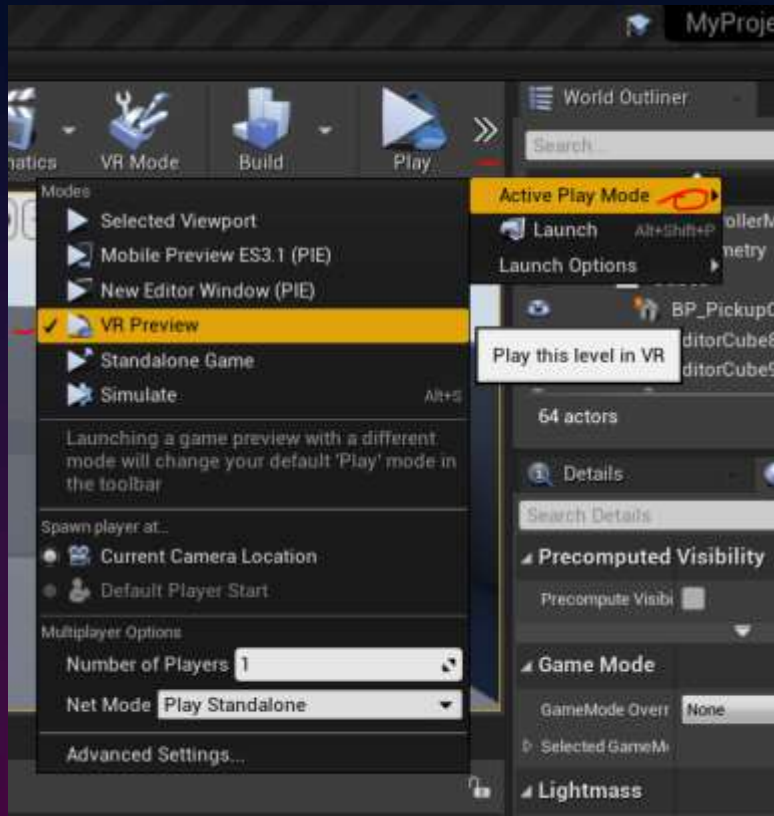
Unreal Engine – Project Settings

- Click “Maps & Modes”
- Select “MotionControllerMap” on both “Editor Startup” and “Game Default”
- Restart Unreal Engine



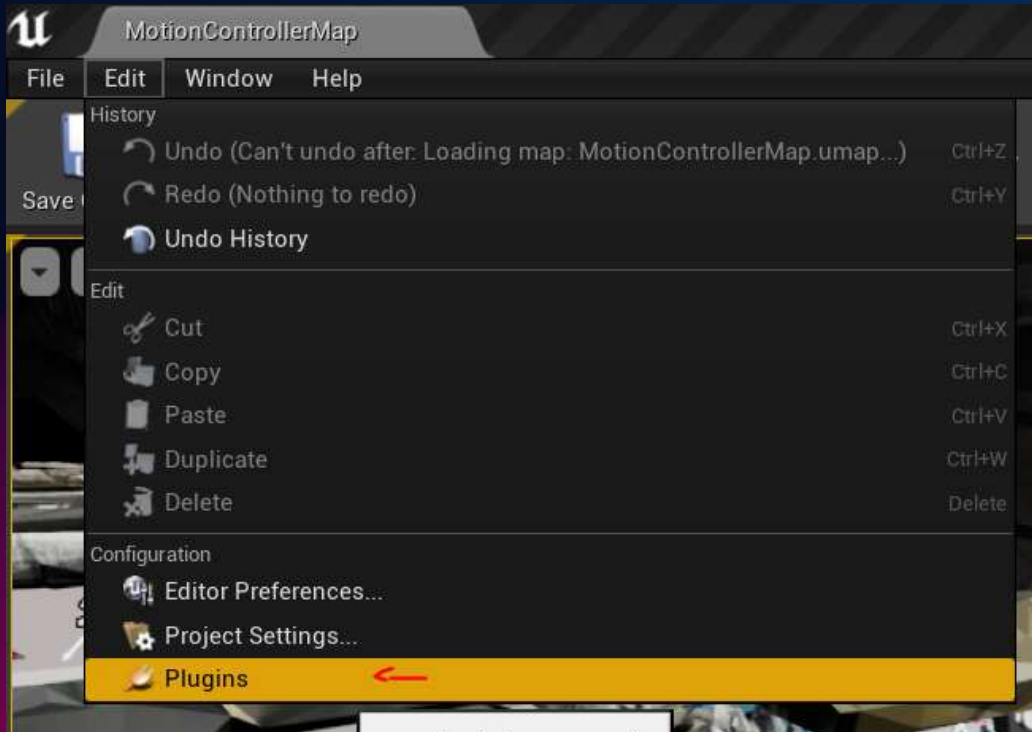
Unreal Engine – Play mode setup

- Click arrows beside “Play” button and select -> “Active Play mode” -> “VR Preview”
- Click “Play” and VR-preview starts on your headset



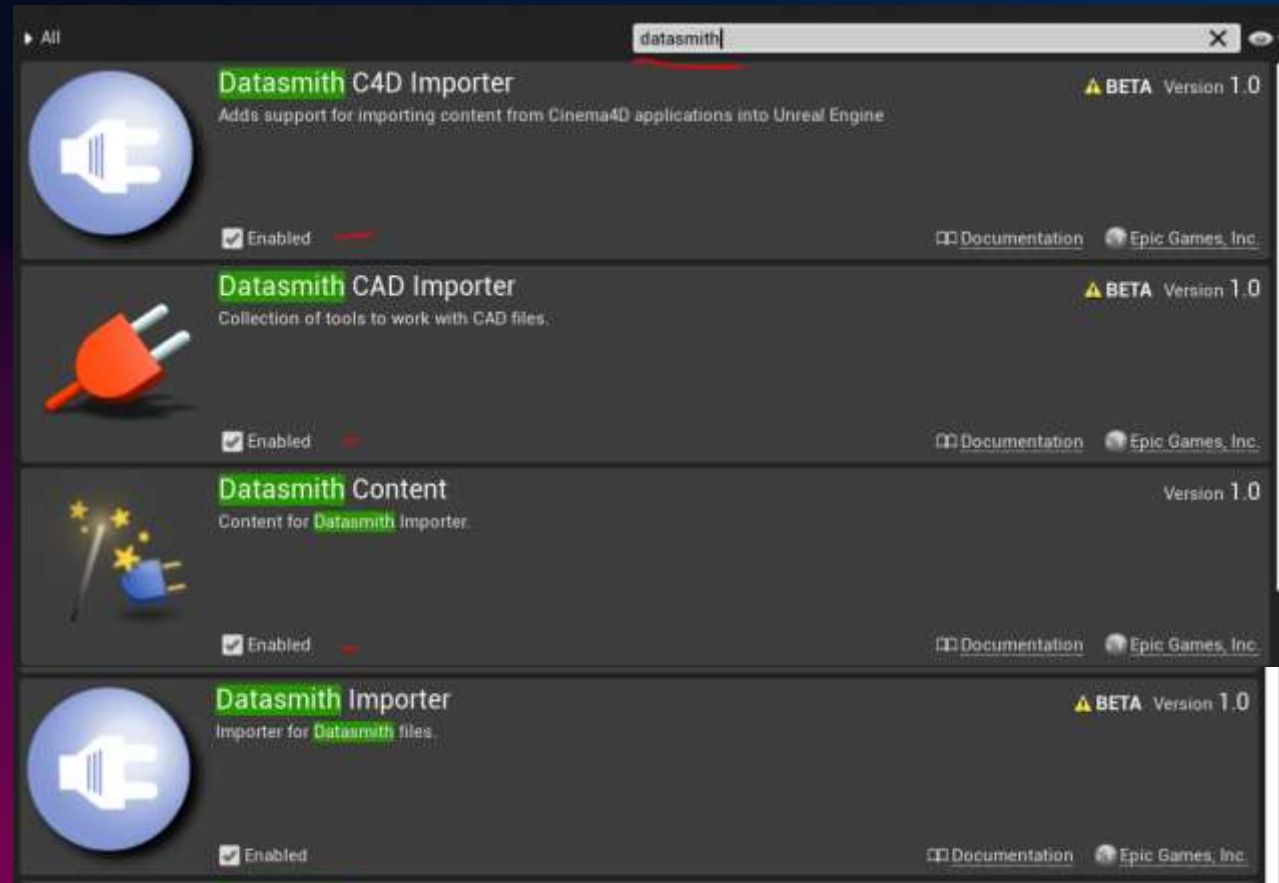
Unreal engine – Activate Datasmith

- Click “Edit”
- Click Plugins



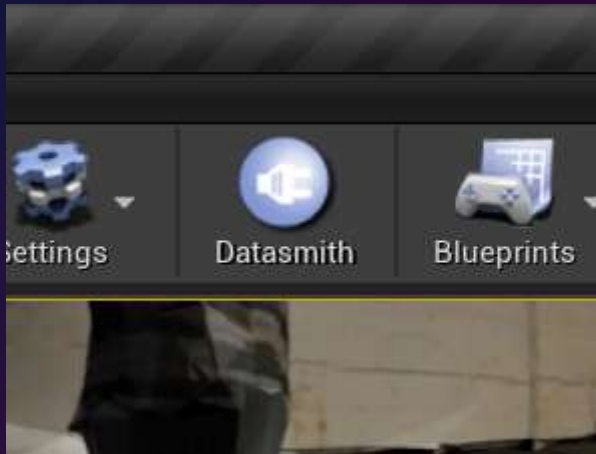
Unreal engine – Activate Datasmith

- Write “datasmith” in search bar
- Activate following Datasmith plugins
- Close “Plugins” Window



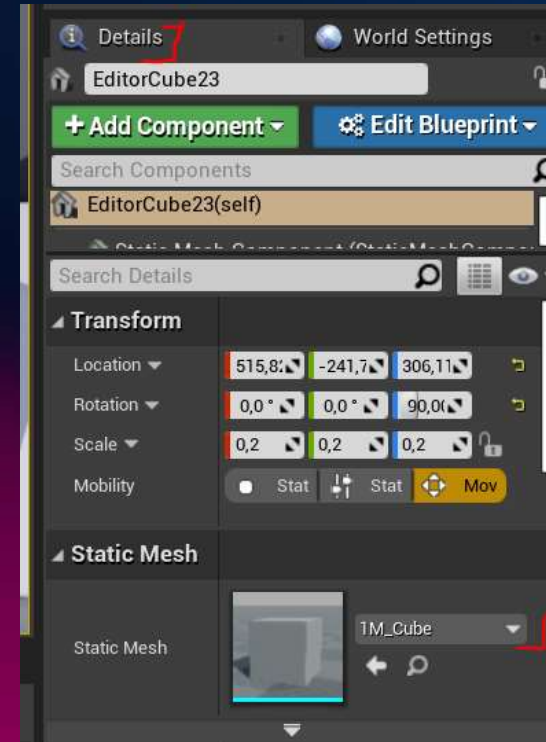
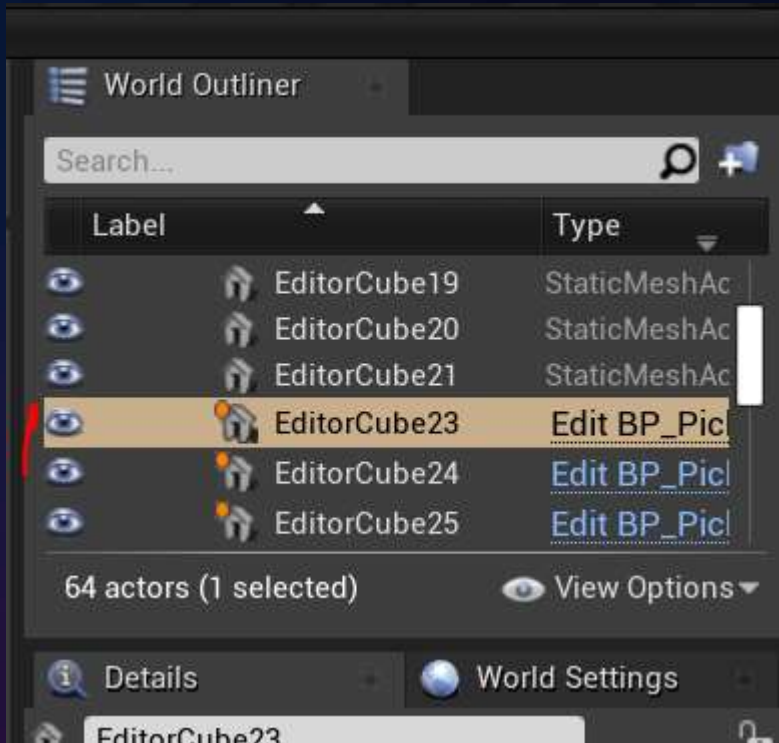
Unreal Engine - Datasmith

- Now clicking of Datasmith on toolbar enables opening files in variety of 3D-Cad formats such as SolidWorks



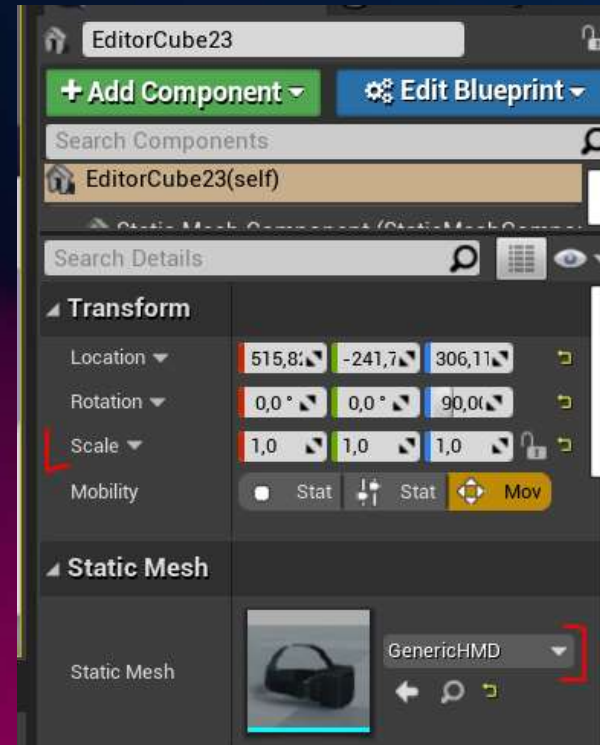
Unreal Engine - Swapping Mesh for an object

- Click “World Outliner”-window object “EditorCube23” as active
- Select “Details”



Unreal Engine - Swapping Mesh for an object

- Change “GenericHMD” as “Static Mesh”
- “Scale” 1 1 1





trinity

