



NYU

**TANDON SCHOOL
OF ENGINEERING**



Promoting robotic design and entrepreneurship
experiences among students and teachers

Lesson 11: 3D CAD Modeling with Tinkercad and 3D Printing

Innovative Technology Experiences for Students and Teachers (ITEST), Professional Development Program, July 2017 - 19

Mechatronics, Controls, and Robotics Laboratory, Department of Mechanical and Aerospace Engineering, NYU Tandon School of Engineering



- 3D CAD modelling
- VEX EDR clawbot CAD

- **TASK/ACTIVITY:** Tinkercad – Setup, configuration, 3D CAD modelling

CAD – Computer Aided Design

- **3D CAD** or three-dimensional computer-aided design, is technology used for designing in various industries
- Some of the industries mainly include:
 - Manufacturing
 - Architecture
 - Medicine
 - Entertainment, etc.

CAD – Computer Aided Design

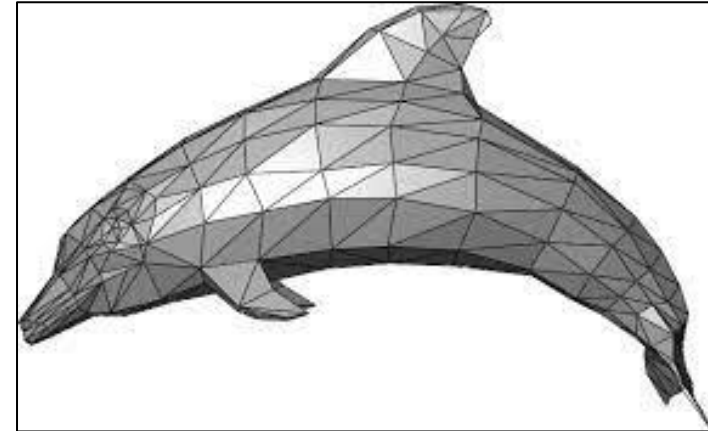
- There are three main types of 3D modeling:
 - **Solid modelling:** It generally works with three-dimensional shapes like cubes, spheres and prisms
 - They act as the building blocks for the design



[Source](#)

CAD – Computer Aided Design

- **Wireframe modelling:** It is used when the surface is complex and curved. It represents shapes as a network of (minimum 3) **vertices/polygons**
- A 3D mesh is the structural build of a 3D model consisting of polygons

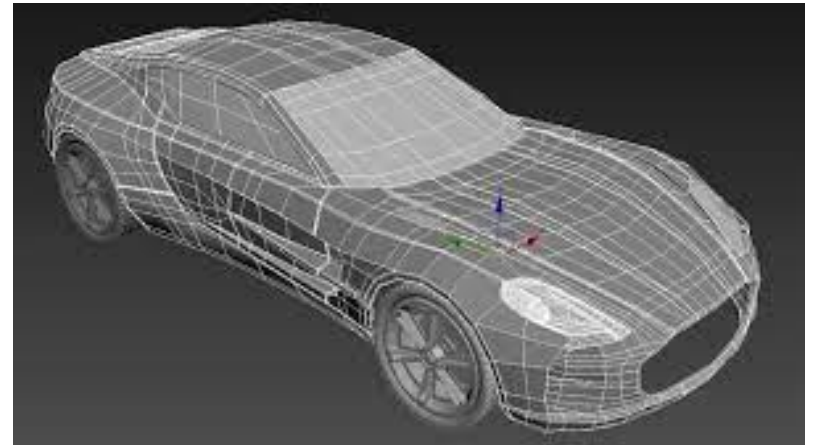


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NOTE: All models are exported to meshes before printing

CAD – Computer Aided Design

- **Surface modelling:** This is used in complex designs with freedom to shape the model's geometry according to designer's requirements



[Source](#)

CAD – Computer Aided Design Softwares

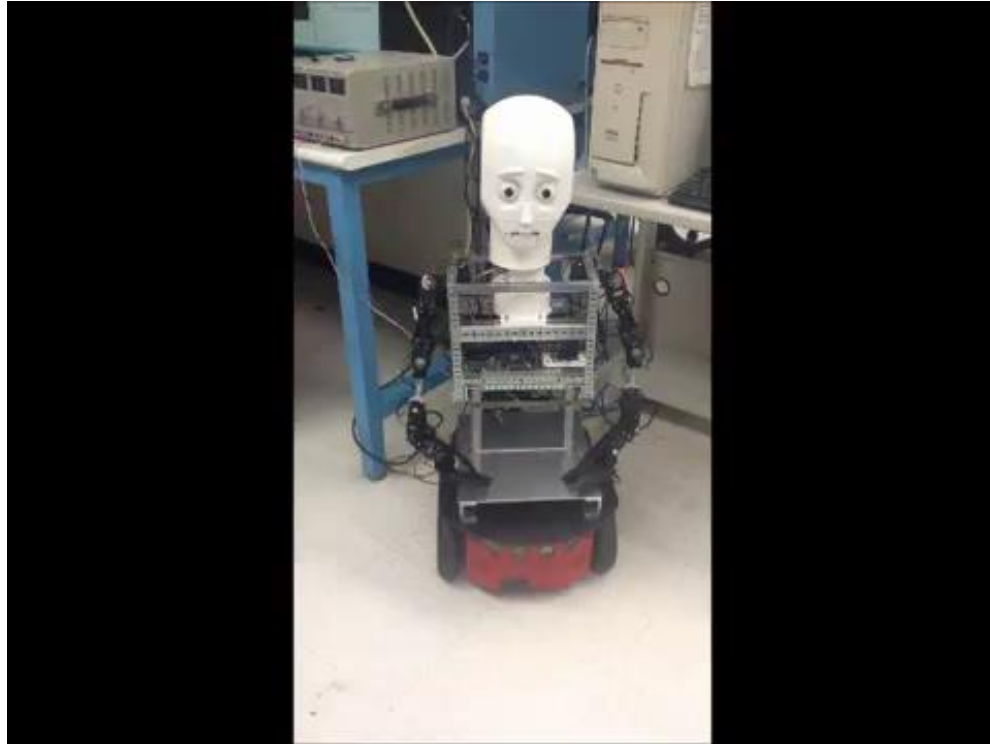
- AutoCAD
- SolidWorks
- Fusion 360
- 123D Design
- TinkerCAD
- Blender
- Rhyno
- Z Brush

CREATING 3D CAD MODELS



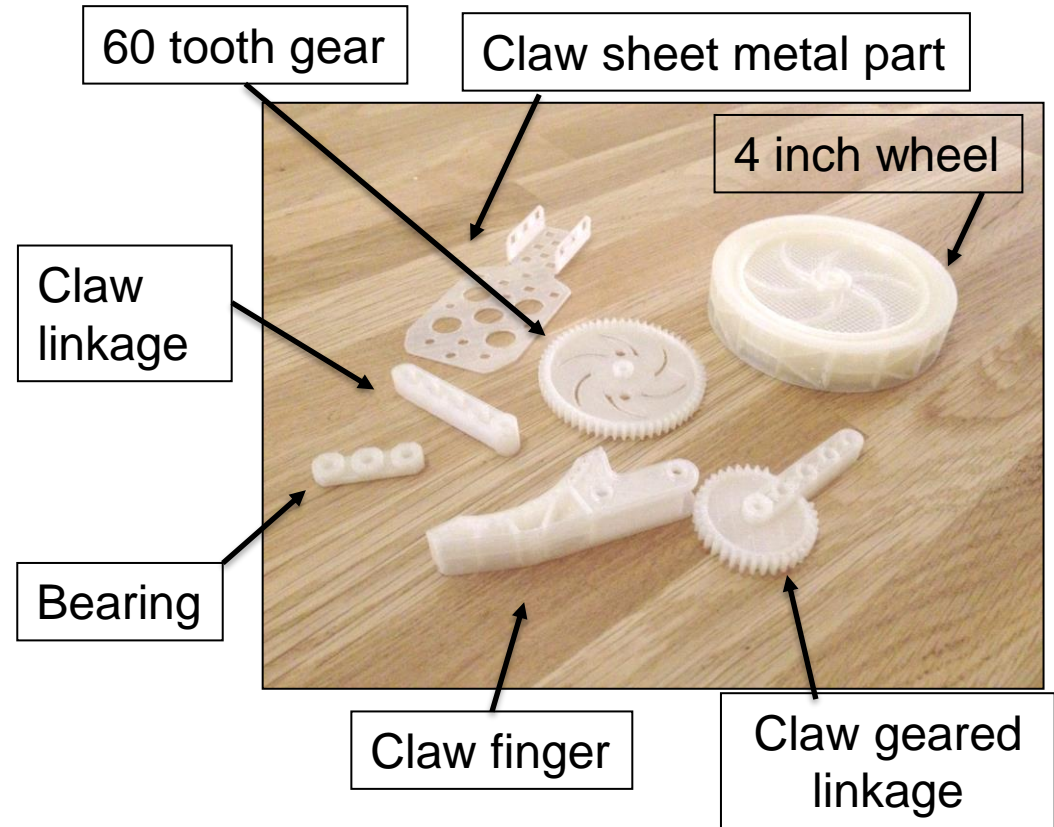
[Video Tutorial: AutoCAD modelling of a mag wheel](#)

EXPRESSIVE HUMANOID ROBOT WITH 3D PRINTED PARTS



VEX CLAWBOT CAD

- The **VEX Clawbot** has been modelled in **Autodesk Inventor**, a software for design and assembly of 3D parts
- All parts (bearings, gears and other similar components) can easily be reproduced
- These parts are ideal for the process of 3D printing

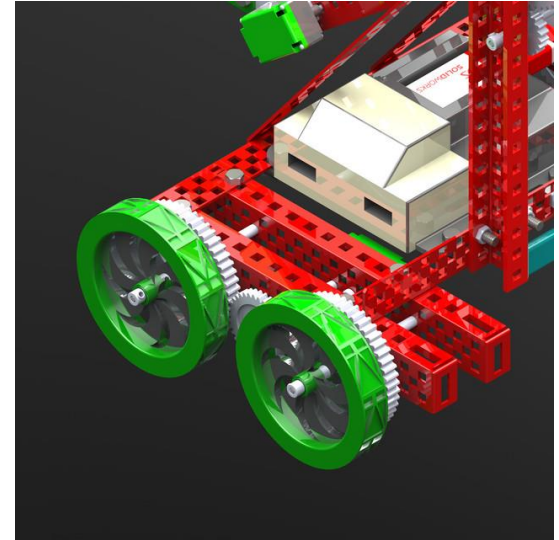
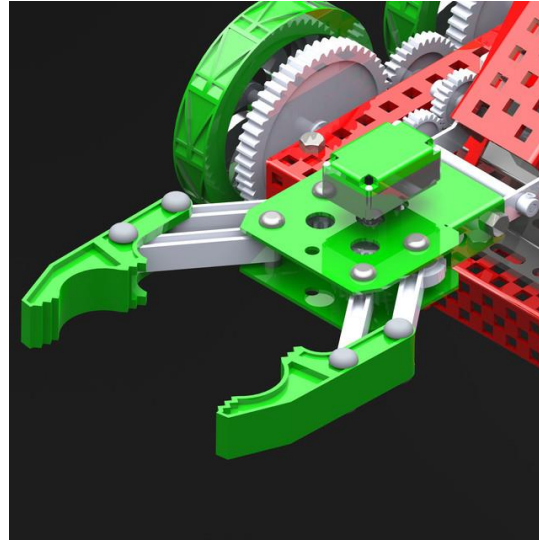
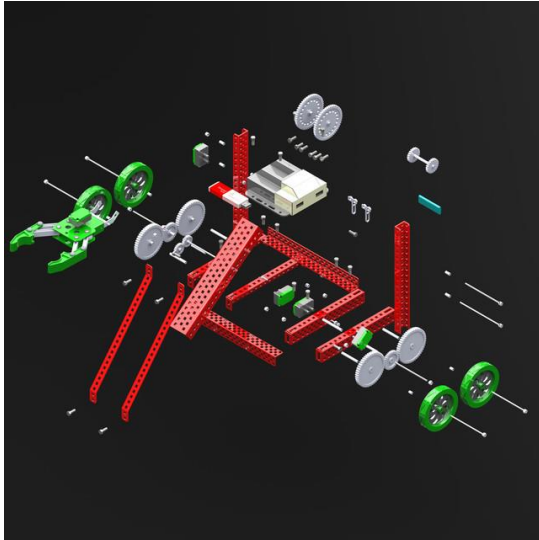


VEX CLAWBOT CAD

- **Injection moulded** parts and the **3D printed** parts for the VEX EDR ClawBot

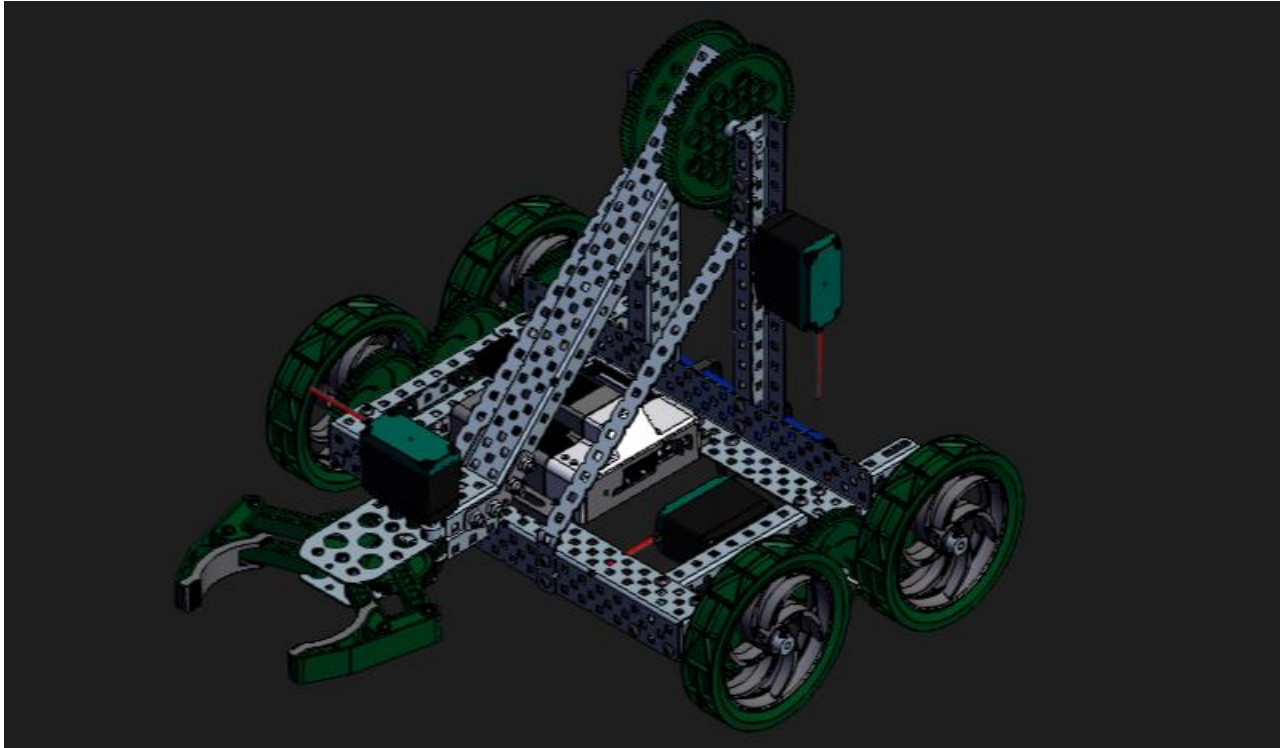


VEX CLAWBOT CAD



[Autodesk VEX Robotics Parts Library and Basic Commands Overview](#)
[Tutorial: VEX Clawbot CAD modelling](#)

VEX CLAWBOT CAD



GrabCAD: VEX Clawbot 3D printing design parts

TINKERCAD

Tinkercad: A free website to create 3D design, electronic circuit design and coding.

Why should we use 3D printing in STEM?

- **3D Design platform:** Free web-based Tinkercad for designing
- **Math:** Use measurement and geometry in the design to analyze surface area and volume of composite shapes
- **Science:** Incorporate science in design and testing of race car to study motion, and building of bridges to study modeling and scaling, etc.

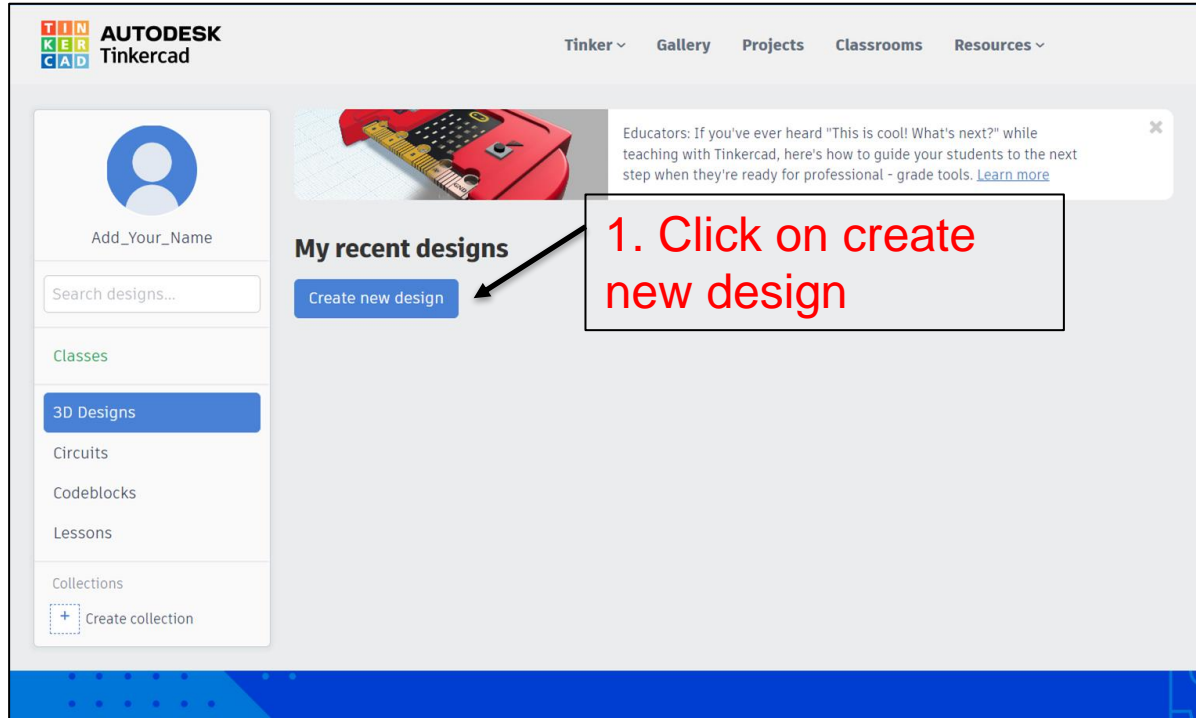


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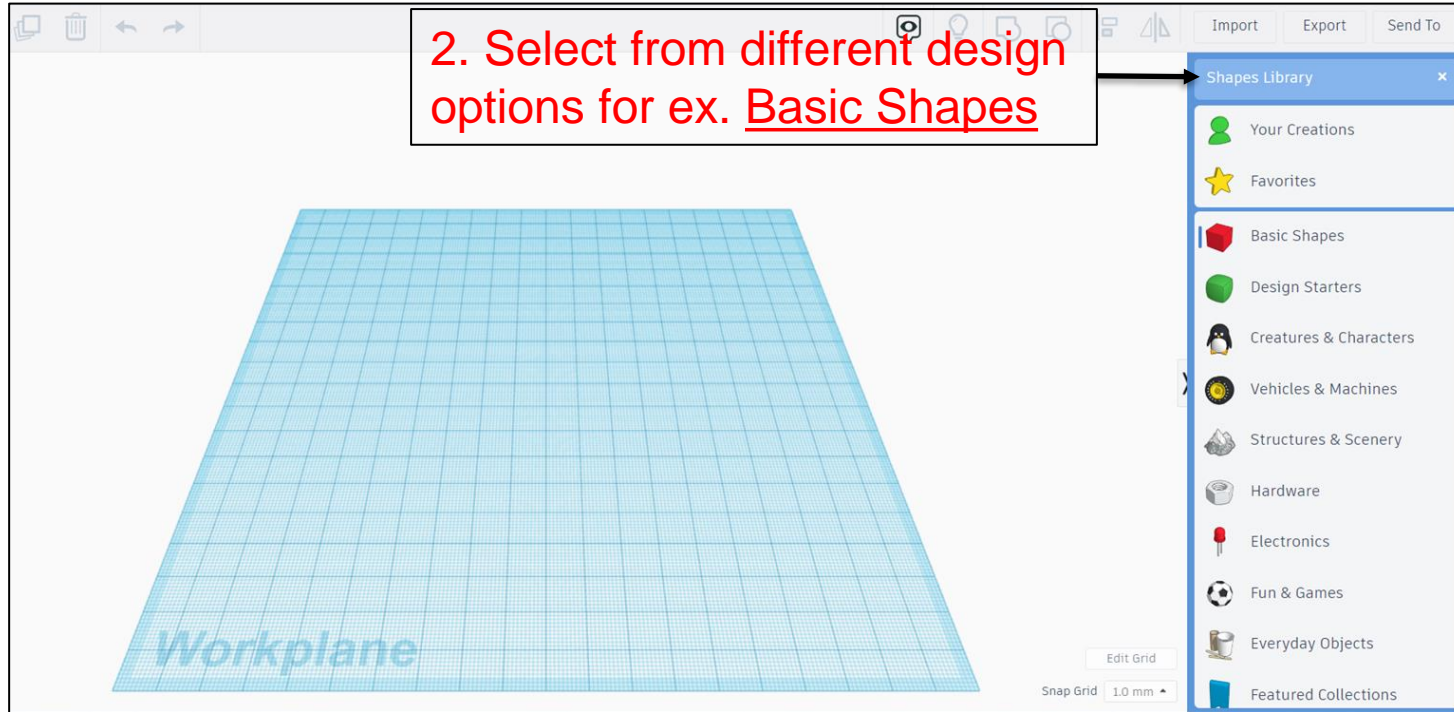
Start using Tinkercad

1. Go to [Tinkercad.com](https://tinkercad.com) in a browser
 - a. Use Google Chrome or Firefox (recommended)
 - b. When using Safari, you must enable WebGL
2. Click on Sign up for a free account
3. Click on Personal account
4. Sign up with email/Sign in with Google or Apple

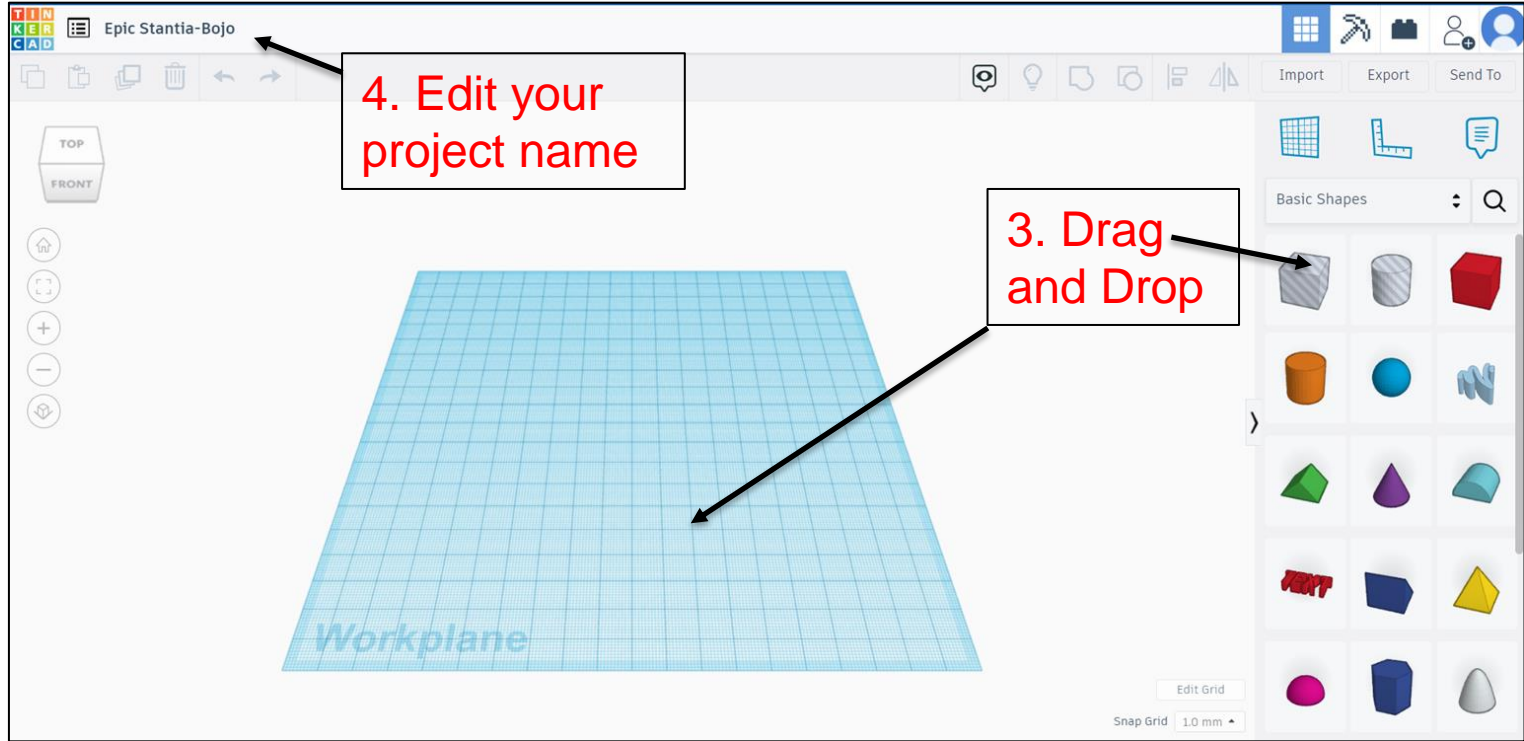
Start creating a new design



The screenshot shows the Tinkercad website interface. At the top left is the Tinkercad logo with the text 'AUTODESK Tinkercad'. To the right are navigation links: 'Tinker', 'Gallery', 'Projects', 'Classrooms', and 'Resources'. On the left side, there is a user profile section with a placeholder for a name and a search bar for designs. Below that is a sidebar menu with options: 'Classes', '3D Designs' (highlighted in blue), 'Circuits', 'Codeblocks', 'Lessons', 'Collections', and 'Create collection'. The main content area features a 'My recent designs' section with a 'Create new design' button. A red box highlights this button, and a black arrow points from a text box containing the instruction '1. Click on create new design' to the button. Above the 'My recent designs' section, there is a featured image of a red 3D printer and a text box for educators with a 'Learn more' link.

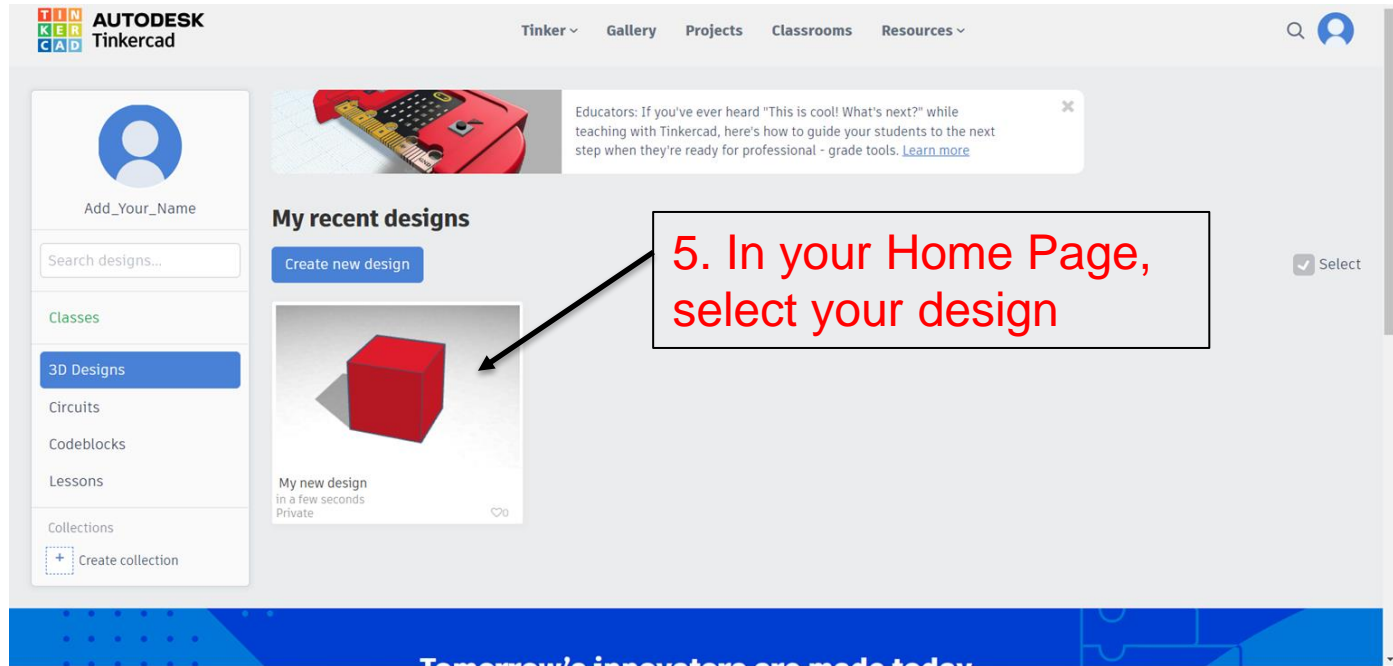


TINKERCAD

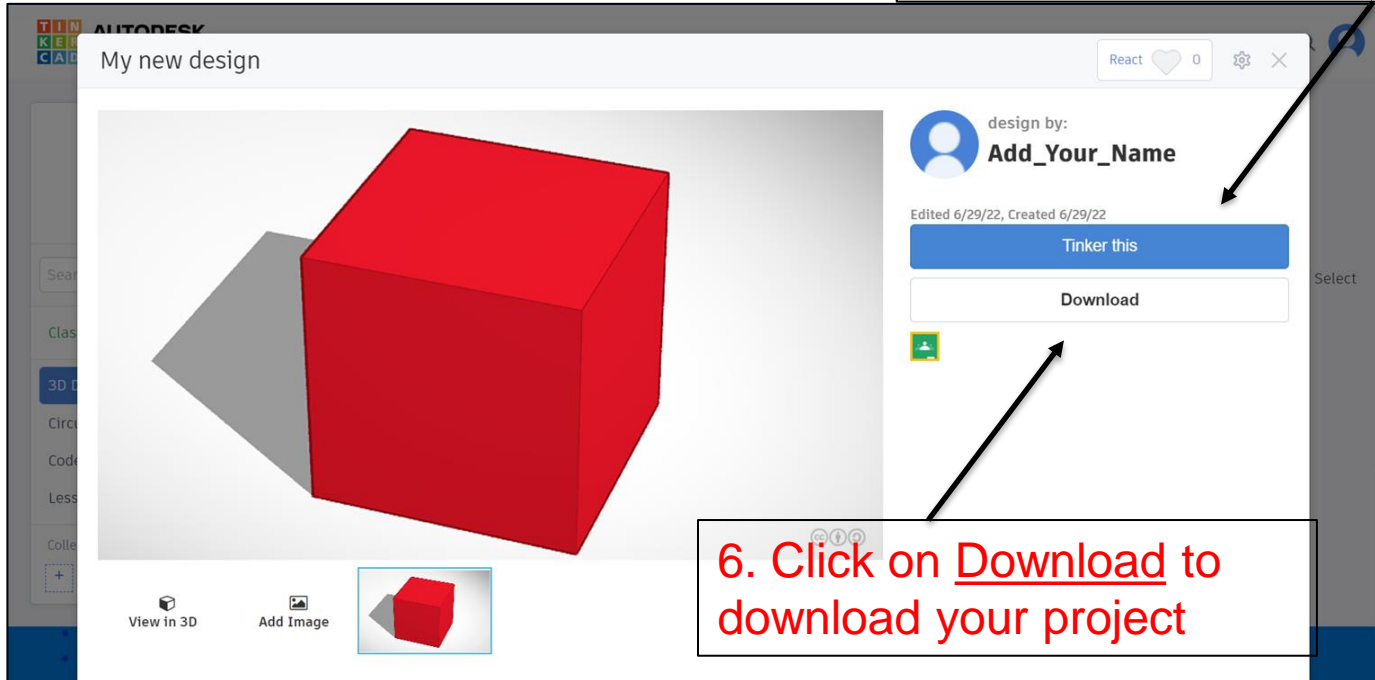




- You can also edit your existing project



6. Click on Tinker this to edit the project



The screenshot displays the Tinkercad web interface. On the left, a 3D view of a red cube is shown on a light gray surface. Below the 3D view are icons for 'View in 3D' and 'Add Image'. On the right, a social sharing sidebar is visible, featuring a 'React' button with a heart icon and a '0' count, a 'Share' icon, and a close 'X' icon. Below these is a profile picture and the text 'design by: Add_Your_Name'. Further down, it says 'Edited 6/29/22, Created 6/29/22'. Two buttons are present: a blue 'Tinker this' button and a white 'Download' button. A small green icon with a download symbol is located below the 'Download' button. Two black arrows point from the text boxes to the 'Tinker this' and 'Download' buttons respectively.

6. Click on Download to download your project

THINGS TO REMEMBER

CAD files must be:

- **STL** or **OBJ** format
- Manifold (watertight, no holes)

The models for printing **cannot** have:

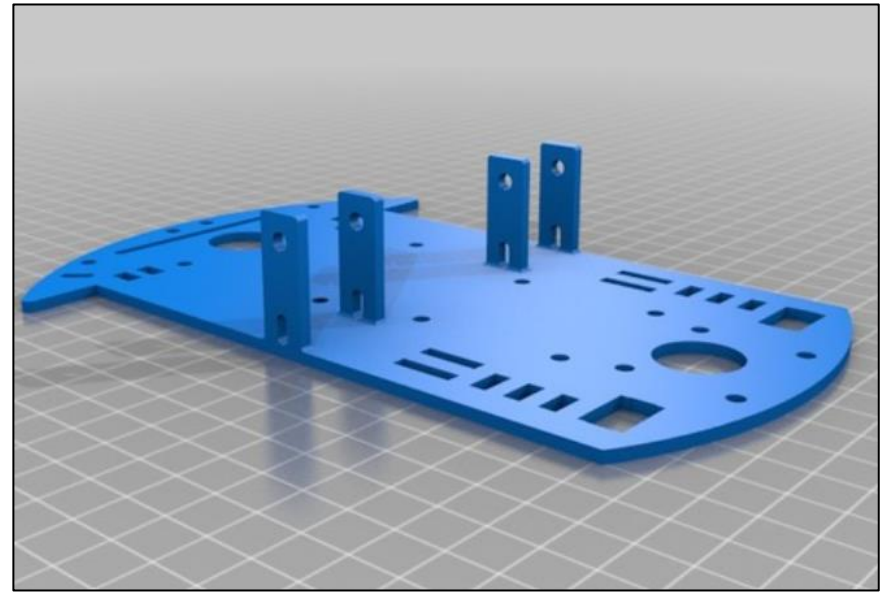
- Overhangs
- Loose faces
- Inverted normal
- Intersecting geometry

A few websites to find models/designs:

- [Thingiverse](#)
- [Yeggi](#)
- [Cults 3D](#)
- [All3DP](#)
- [GrabCAD](#)

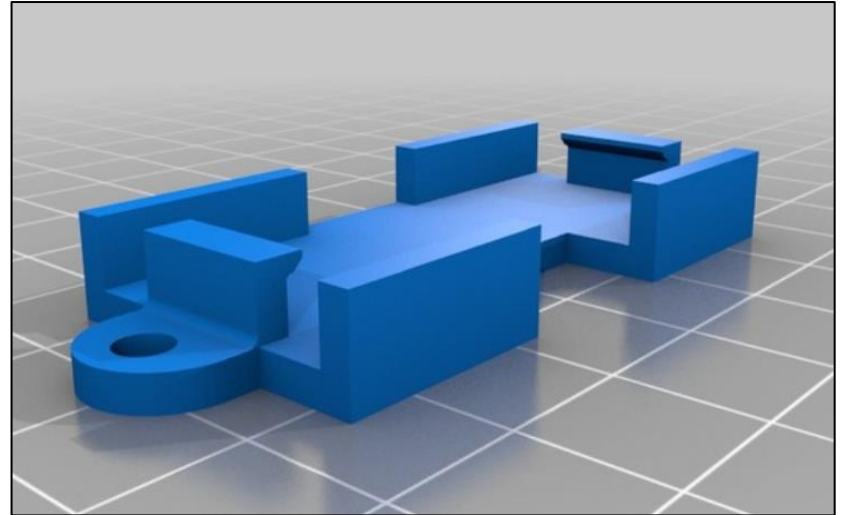
GETTING READY FOR 3D PRINTING

A FEW EXAMPLES...



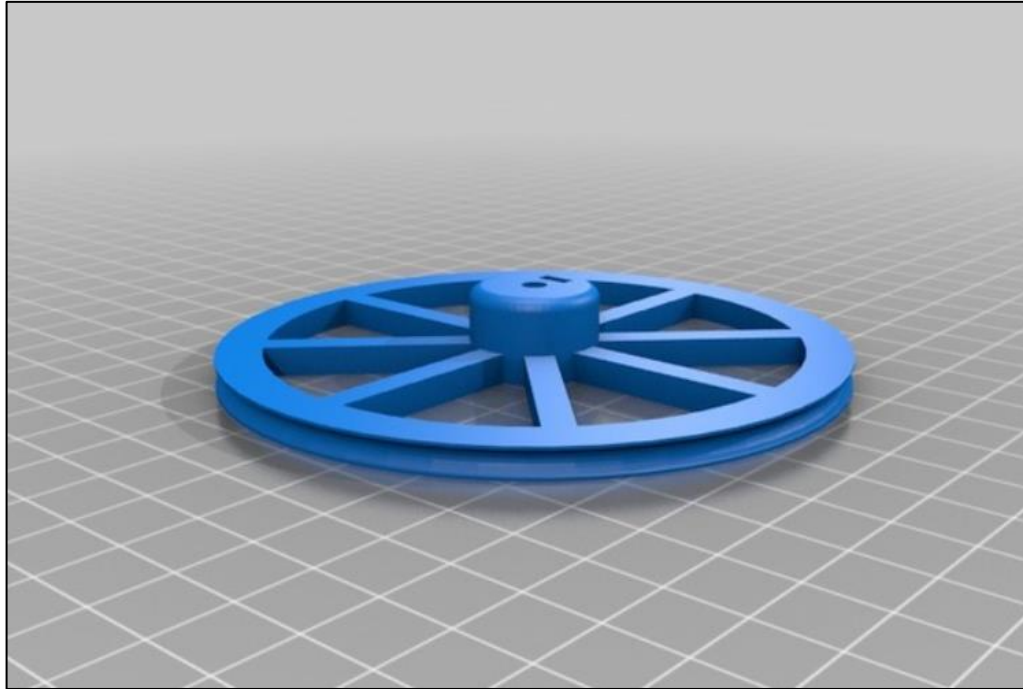
[Thingiverse: Robot chassis](#)

GETTING READY FOR 3D PRINTING



[Thingiverse: Sensor mount](#)

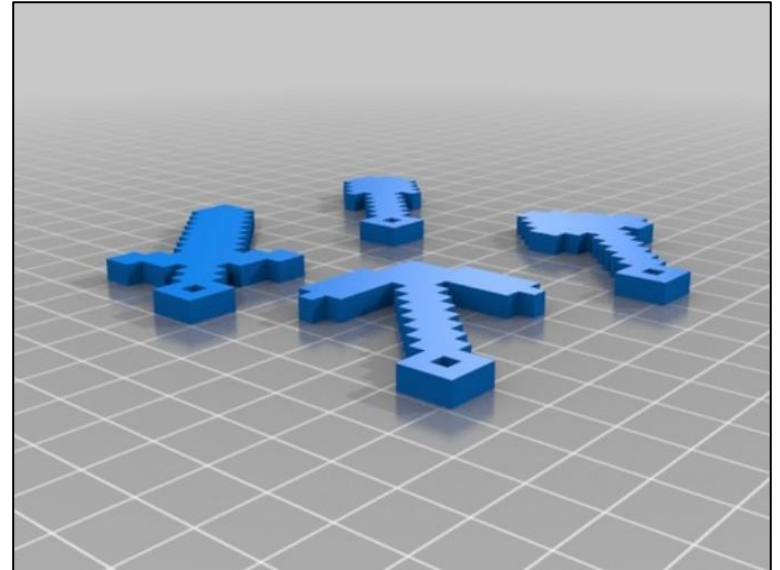
GETTING READY FOR 3D PRINTING



Yeggi: Robot wheel

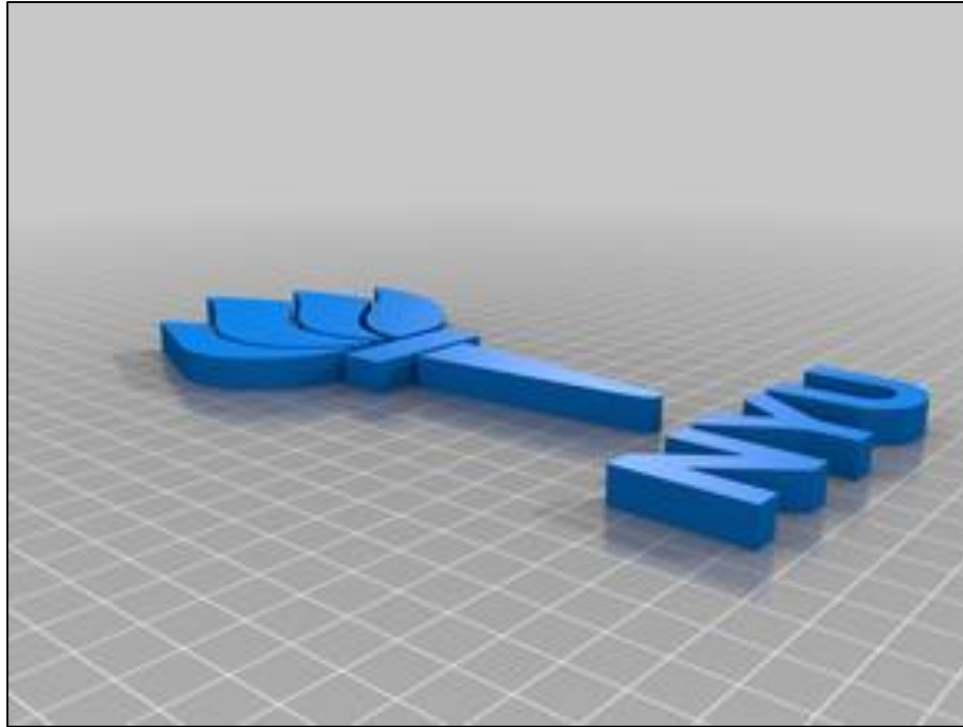
GETTING READY FOR 3D PRINTING

A FEW EXAMPLES...



[Source: Thingiverse](#)

GETTING READY FOR 3D PRINTING

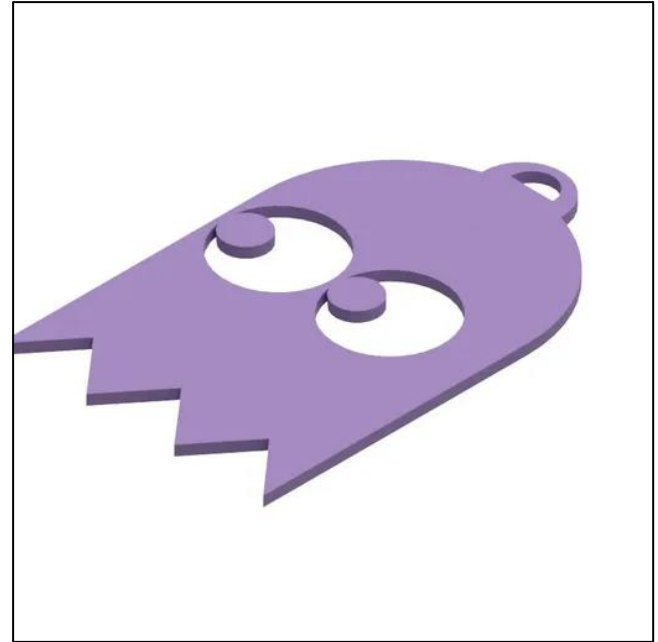


Source: Thingiverse

GETTING READY FOR 3D PRINTING

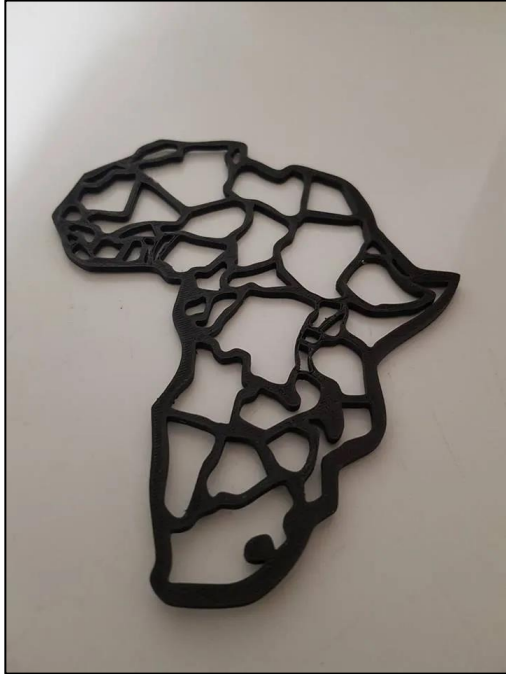


[Source: Cults 3D](#)

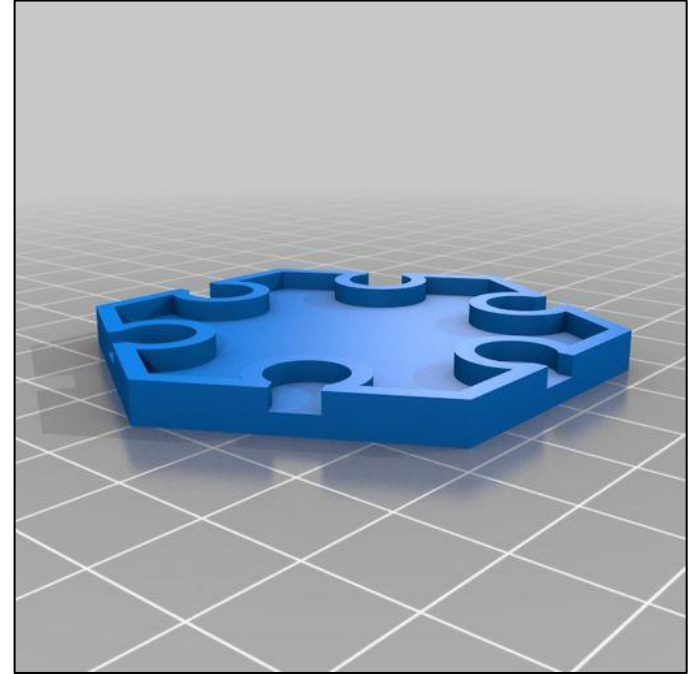


[Source: Cults 3D](#)

GETTING READY FOR 3D PRINTING



[Source: Cults 3D](#)



[Source: Cults 3D](#)

- Introduction to TinkerCAD (setup, configuration)
- Building a 3D object in TinkerCAD with specified dimensions
- Touring the Makerspace and introducing 3D printers, laser cutting machines, etc.
- Printing the 3D object using one of the available machines in the Makerspace



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Thank You!

Questions and Feedback?