

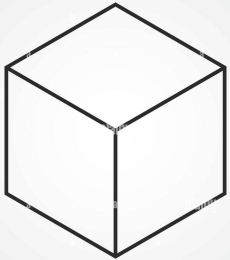


Overview of 3D Design and Its Applications

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What is 3D?

- A three-dimensional object has three dimensions
- This would generally include length, width, and height
- It is different from 2D
 - 2D only involves two dimensions such as length and width



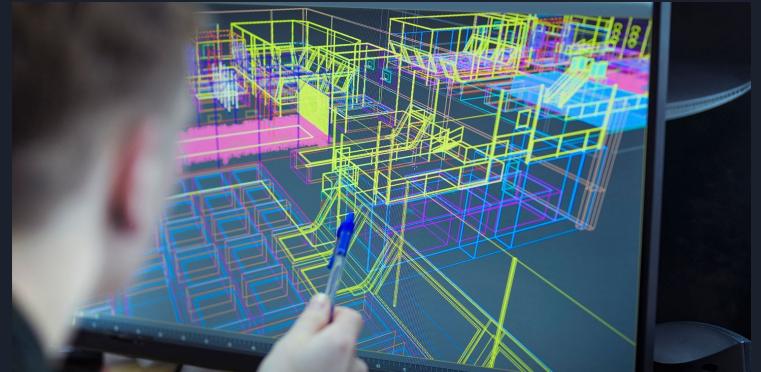
What is 3D Design?

- Using software to create a digital model of a three-dimensional shape or object
- It allows you to determine object size, shape, and texture
- The process tends to work with points, line, and polygons to create 3D shapes



How does 3D Modeling Work?

- 3D models are made up of vertices
- Each point on the model can be manipulated to change the shape
 - By using coordinate data, the software identifies the location of each vertical and horizontal point, all relative to a reference point
- To begin 3D modeling, the most common general way is to start with a basic shape and edit to your preferences as needed
 - a cube, box, sphere, etc.



3D Modeling Applications

- 3D Printing
 - Frequent in Healthcare
 - Easy to convert models into actual physical objects
 - Can make various objects such as mini figures and shapes from a printer at home
 - We will eventually be doing this!
- Game Development
 - Virtual Reality within 3D Environment
 - 3D models are used to create characters, settings, props, and entire worlds
- Architecture
 - Good for envisional final product
 - Better visual than hand-drawing
- Animation
 - Animated Movies for props, characters,etc.
- Product Development
 - Can help visual the final product
 - 360 View to fix minor errors and edit sizing



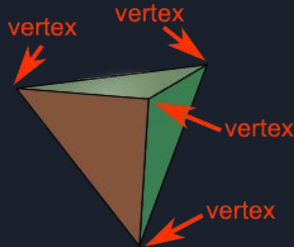
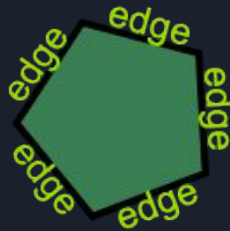
A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front parallelogram is blue, and the back one is a light green. They are positioned diagonally, with the blue one partially covering the green one.

Basic Terminology and Shapes

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Vertices, Edges, and Faces

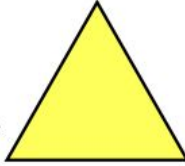
- Vertex(Plural: Vertices): A point where two or more line segments meet
 - Corners
- Edge(for a polygon): A line segment on the boundary joining one vertex (corner point) to another
 - For a polyhedron(typically more than six faces) an edge is a line segment where two faces meet
- Face: Any of the individual flat surfaces of a solid object



Types of Polygons

Triangle

- Has 3 sides and 3 vertices
- Has no diagonals
- Sum of the interior angles is 180°



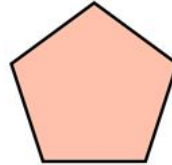
Quadrilateral

- Has 4 sides and 4 vertices
- Has two diagonals
- Sum of the interior angles is 360°



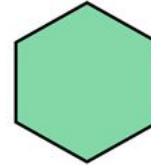
Pentagon

- Has 5 sides and 5 vertices
- Has 5 diagonals
- Sum of the interior angles is 540°



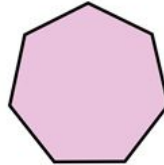
Hexagon

- Has 6 sides and 6 vertices
- Has 9 diagonals
- Sum of the interior angles is 720°



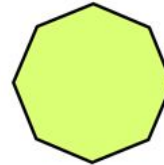
Heptagon

- Has 7 sides and 7 vertices
- Has 14 diagonals
- Sum of the interior angles is 900°



Octagon

- Has 8 sides and 8 vertices
- Has 20 diagonals
- Sum of the interior angles is 1080°



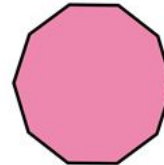
Nonagon

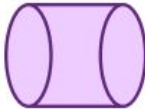
- Has 9 sides and 9 vertices
- Has 27 diagonals
- Sum of the interior angles is 1260°



Decagon

- Has 10 sides and 10 vertices
- Has 35 diagonals
- Sum of the interior angles is 1440°



Name of 3-D shape:	Picture of 3-D shape:	Attributes:
Cube		Faces : 6 Edges : 12 Vertices : 8
Rectangular Prism or Cuboid		Faces : 6 Edges : 12 Vertices : 8
Sphere		Curved Face : 1 Edges : 0 Vertices : 0
Cone		Flat Face : 1 , Curved Face : 1 Edges : 1 Vertices : 1
Cylinder		Flat Face : 2 , Curved Face : 1 Edge : 2 Vertices : 0

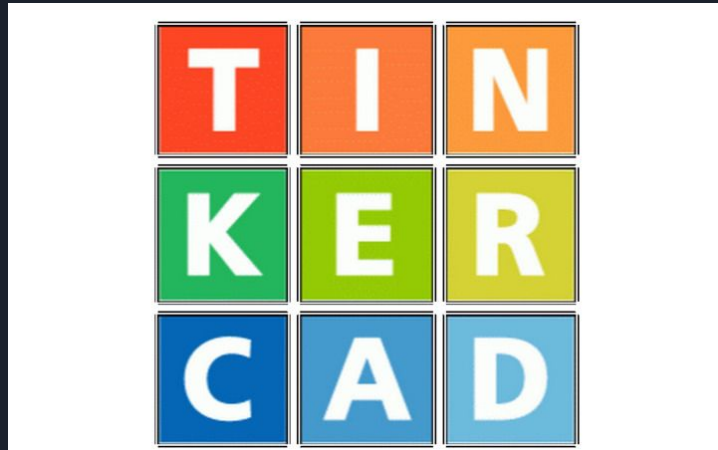


Introduction to TinkerCad

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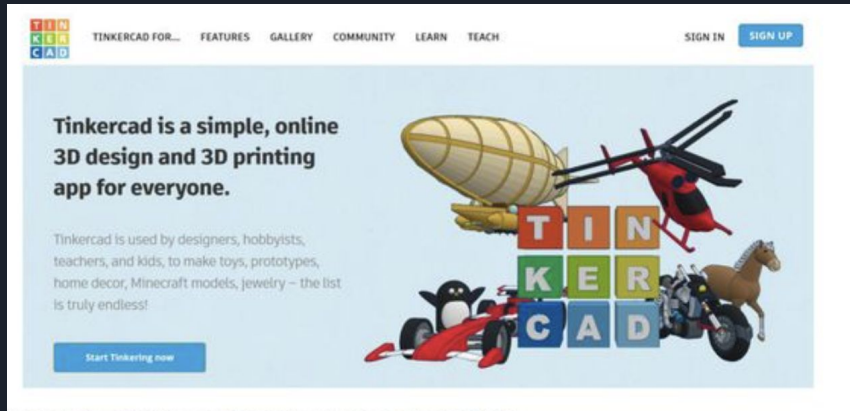
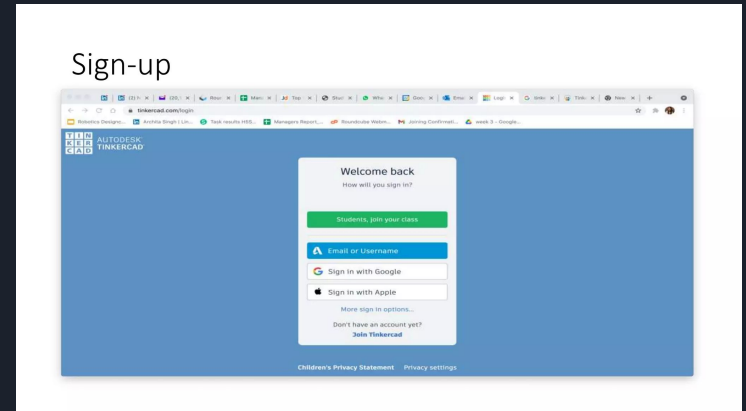
What is Tinkercad?

- Tinkercad is a free web-based 3D modeling application that can help anyone get started with designing and printing 3D objects
- There are other aspects of the software such as circuits, however, we will be focusing on the 3D modeling aspect



Signing Up

- Go to www.tinkercad.com
- Click on the Signup button to create your account if you are a new user
 - Returning users can hit sign in and use their preferred method of signing in

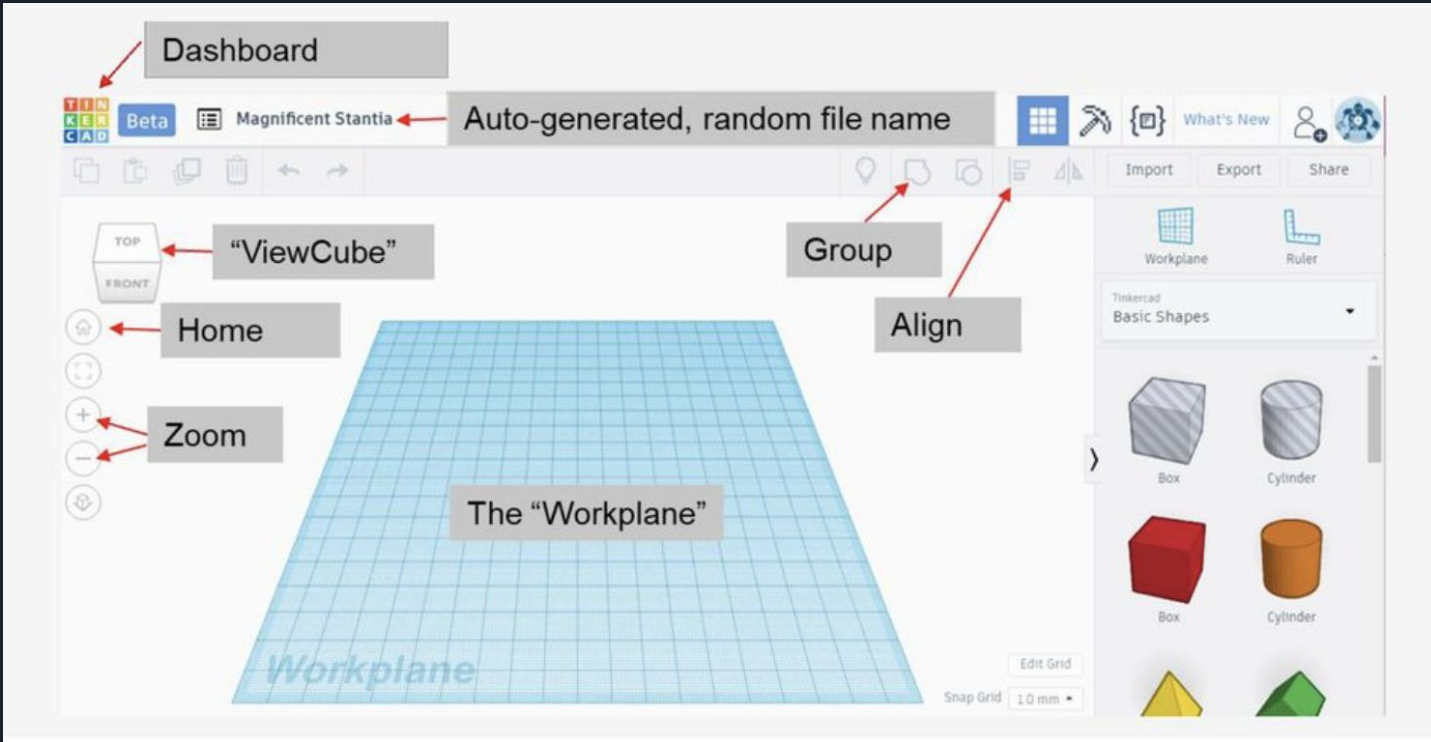




Tinkercad Dashboard

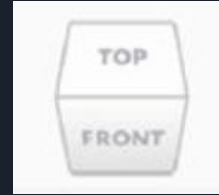
- Tinkercad designs are automatically saved to your account as you work. You can return to your designs and tinker with them anytime from any internet enabled computer.
- To start creating an object, click on the button in the My recent designs section

Tinkercad Interface



Navigating the Mouse

- You can use the tools to the left of the work plane or the mouse to manipulate the workplane. Use the mouse to:
 - Zoom in and out with the mouse scroll wheel
 - Rotate the workplane by right clicking and dragging
 - Change the view by clicking on a side of the View Cube



- Return to the default viewing perspective by clicking the home icon



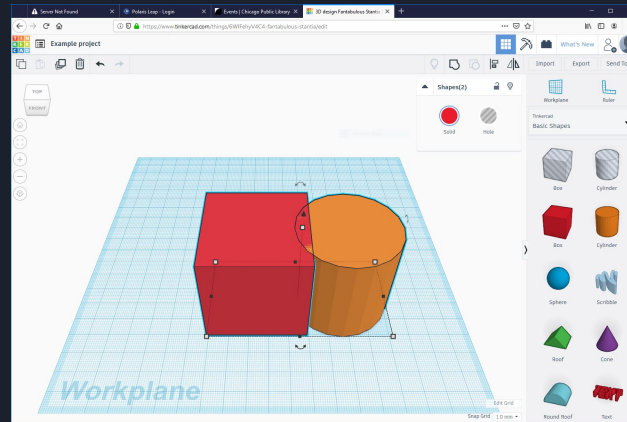


Designing Basic Structures

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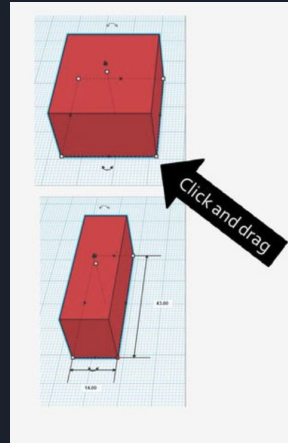
The Shapes Menu

- The shapes menu is on the right side of the interface. You will use these shapes to design your object.
- Practice moving these shapes by clicking and dragging some of the shapes to the Workplane.
- Try moving various shapes onto the plane/surface such as a cube, cylinder, etc.



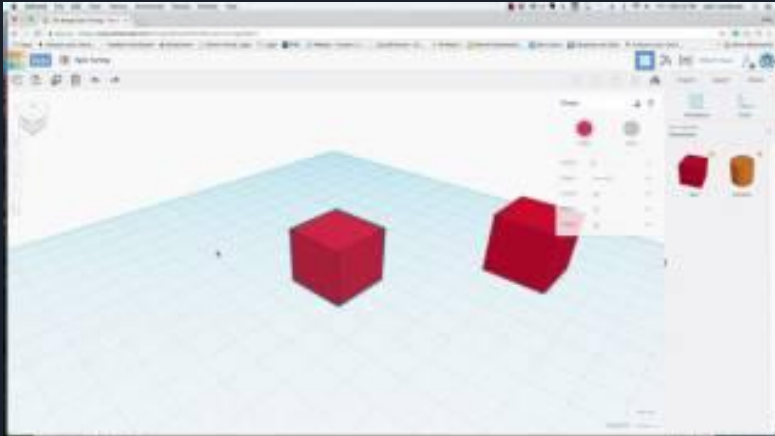
Modifying Shapes

- Notice the small white boxes around the shape.
- Stretch or reduce the shape by clicking and dragging the small white boxes at the corners.
- Change the height of the shape by clicking and dragging on the small white square on the top of the shape.
- The numbers you see are the dimensions in millimeters.

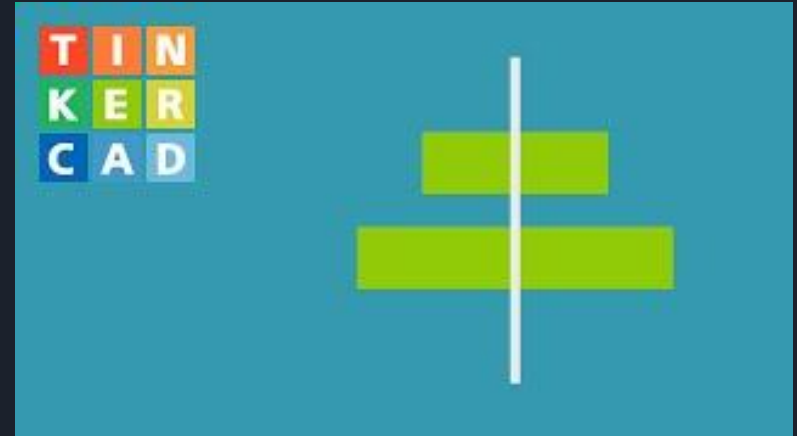


Modifying Shapes

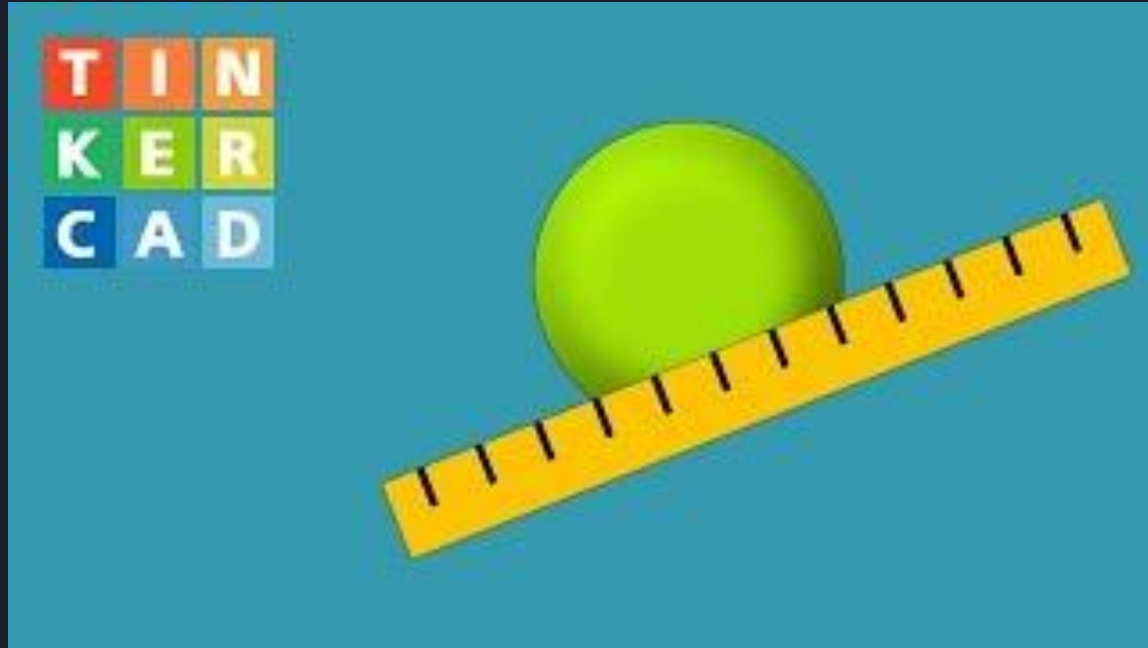
Extrusion, rotating, scaling, etc.:



Aligning Tool:

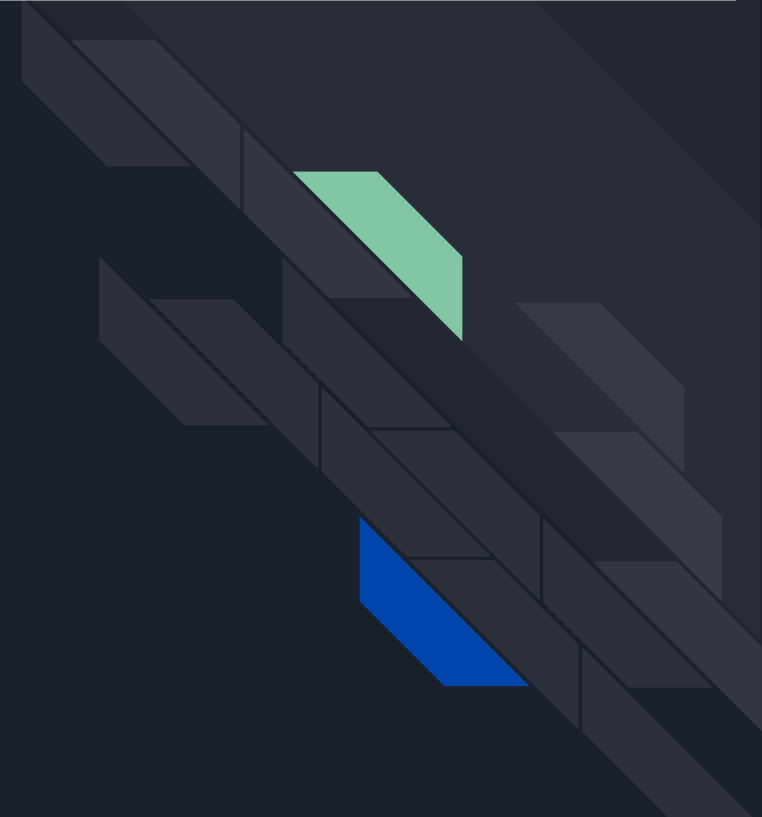


The Ruler Tool



Take shapes/designs from the right side bar and modify them to your desires! You can also use the search bar to view other projects made by various people in the software community.

Try building a house or a snowman in Tinkercad using the shapes menu. Customize and configure aspects such as size, color, etc. to your liking!





3D Printing From Tinkercad

- Once your design is complete, click the export button on the top right
- Hit file .STL for 3D printing
- Wait for the download to complete
- Make sure to download a slicer such Ultimaker Cura
- Either drag this file or select this file from your folders in cura
- Click the slice button to create the g-code file
- Take a USB with the sim card from the 3D printer and move the file to the selected USB disk
- Once the file is transferred, put the sim card back into the 3D printer
- Select the file in the printer control center and print!