#Tinkering Tuesdays

Science Venture SINCE 1991

3D Design with Tinkercad

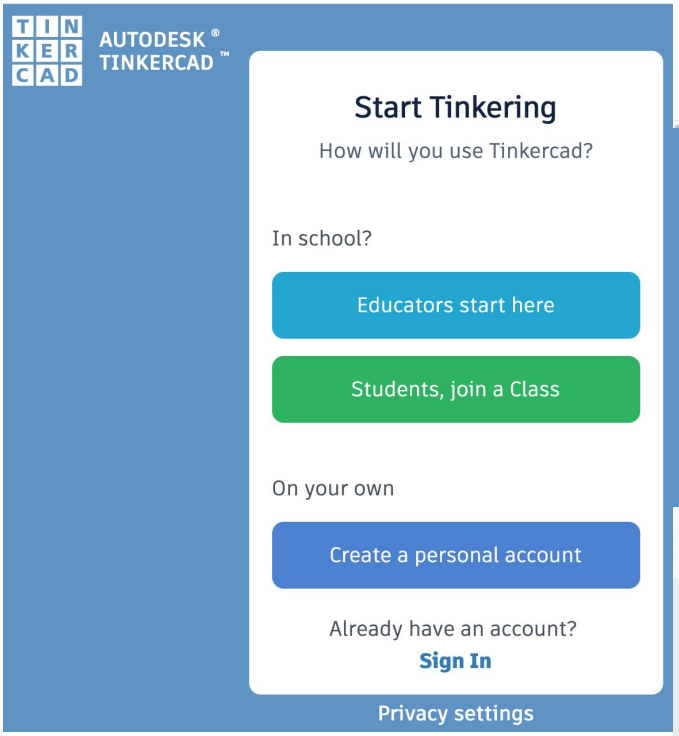
Discover 3D modeling through online free software called TinkerCad. CAD programs are used by engineers to build accurate detailed models that they can test and see before starting to make them.

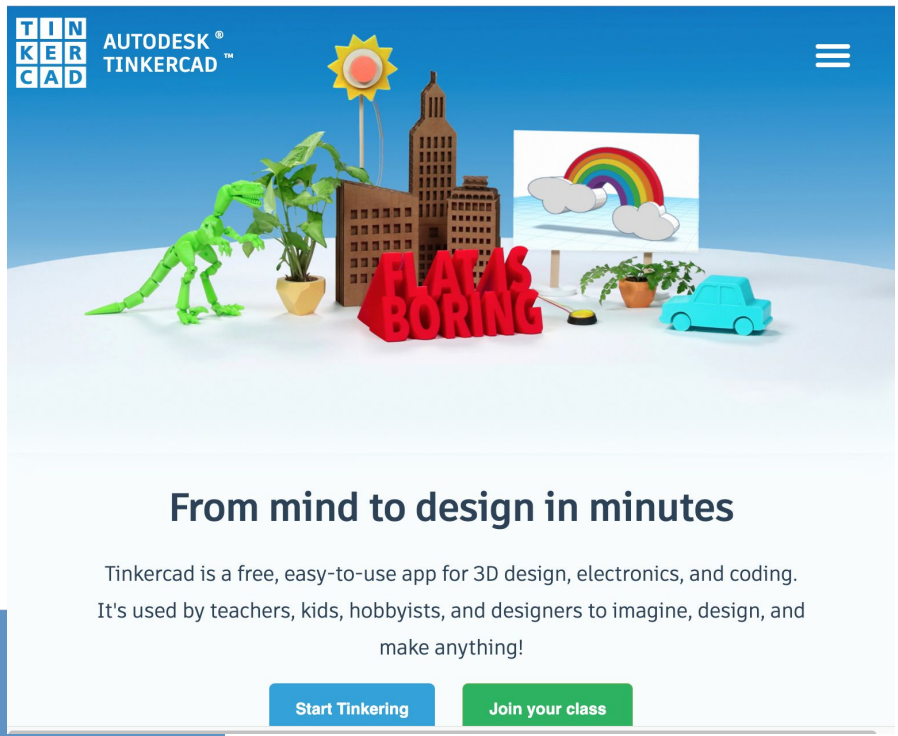
Let's Get Started!

This is TinkerCad (https://www.tinkercad.com/).

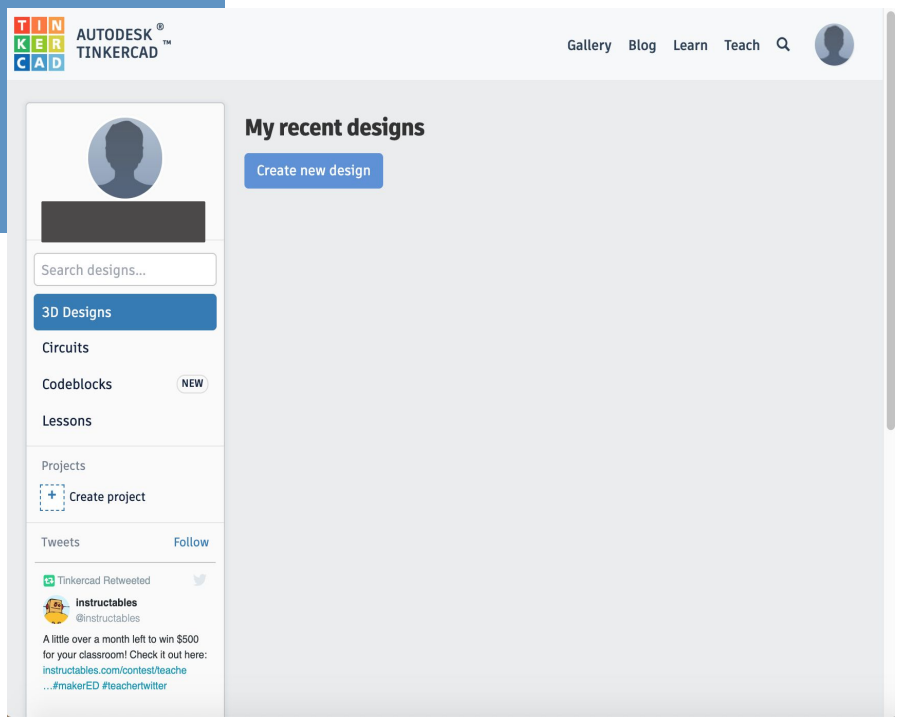
Click on the 'Start Tinkering' function.

Create an account.



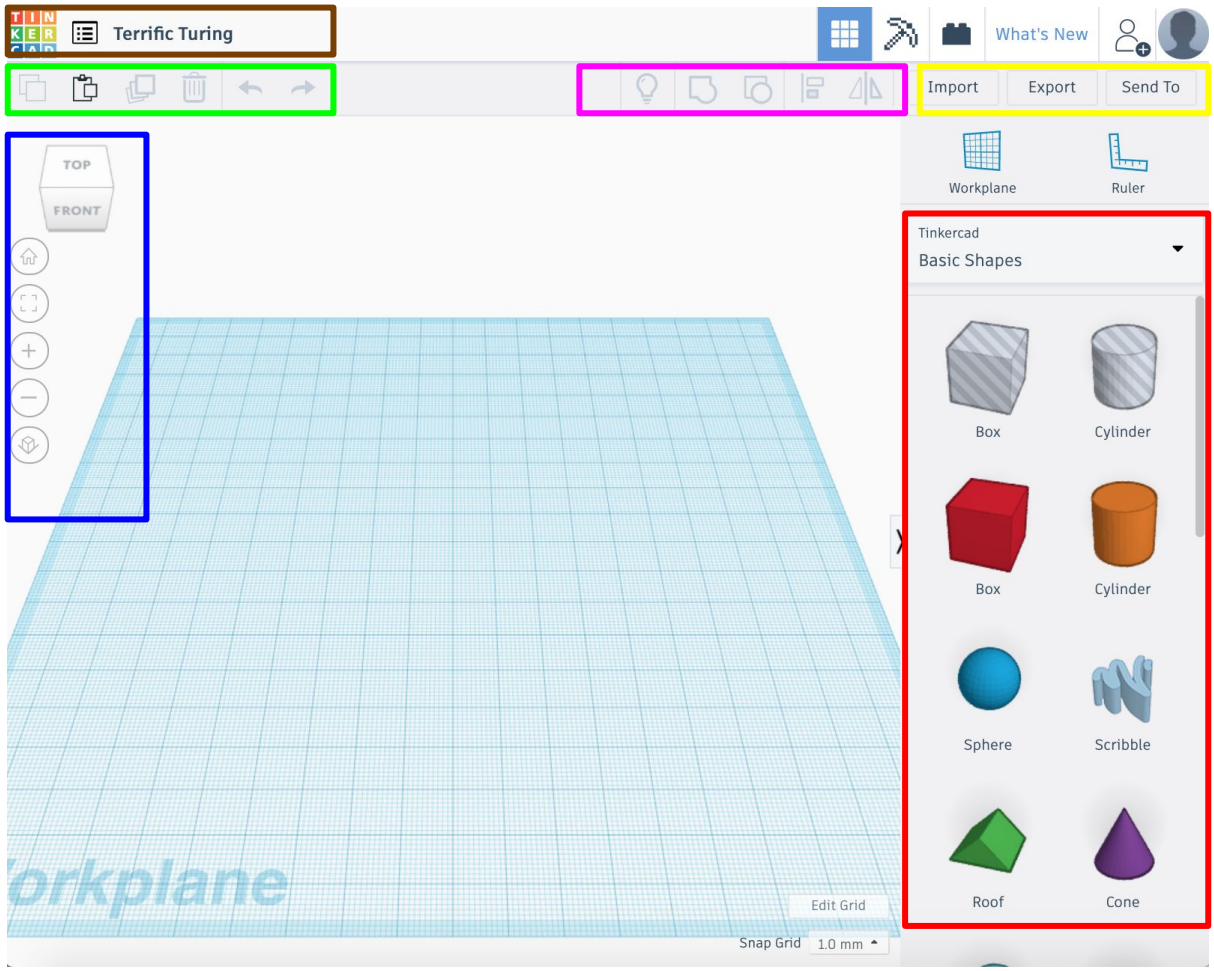


Educators can create a Class. This allows students to participate on one platform by signing in with a nickname and code you provide them.



To create a new design, click 'Create a New Design'.

Work Space



Blue - Camera controls

Green - Copy|Paste|Delete|Undo|Redo

Pink - Group and align objects

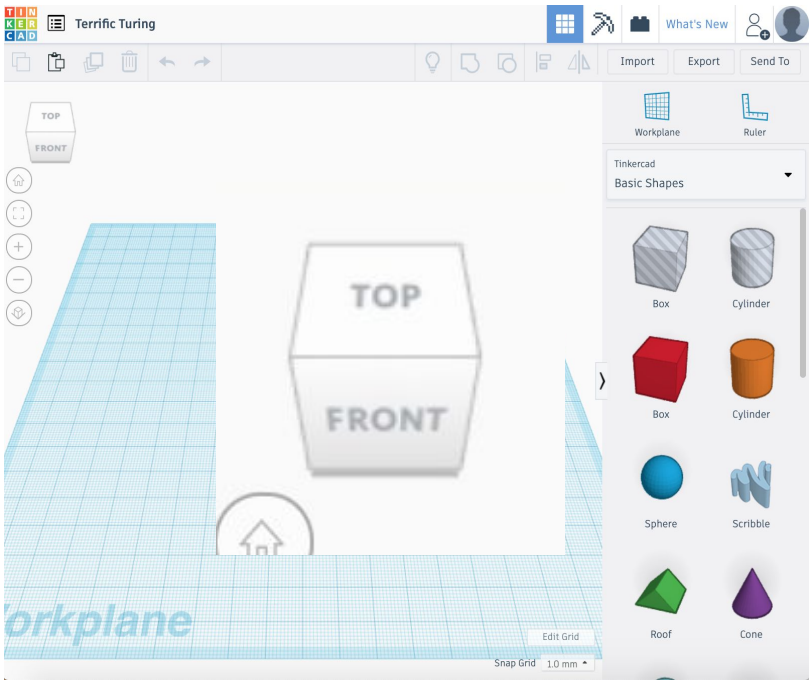
Yellow - Import|Export|Send

Red - Shapes creator

Brown - Name of your design

Remember to name your design or TinkerCad will pick a name for you!

Camera Controls



On the left hand side, you will see a **small box** (magnified in the middle of the image).

This is the **camera control**, which allows you to change what orientation you can see the object at.

Click the faces of the cubes to adjust the view. After you click on one face, the cube will rotate and show you other orientations that are possible. You can also click directly on the edges of the cubes to change the view to 'top left' or 'bottom right' angles as well.

To freely adjust the camera angle, hold the right mouse button down and drag the mouse around. If you're using a trackpad - click the control key and the trackpad and drag around to manually adjust the view.

The **Home button** resets the view

The **Frame button** sets the view so it shows all the objects in your scene

The **Plus and Minus buttons** zoom in and out

The **Cube button** switches from perspective view to orthographic view

The Workplane

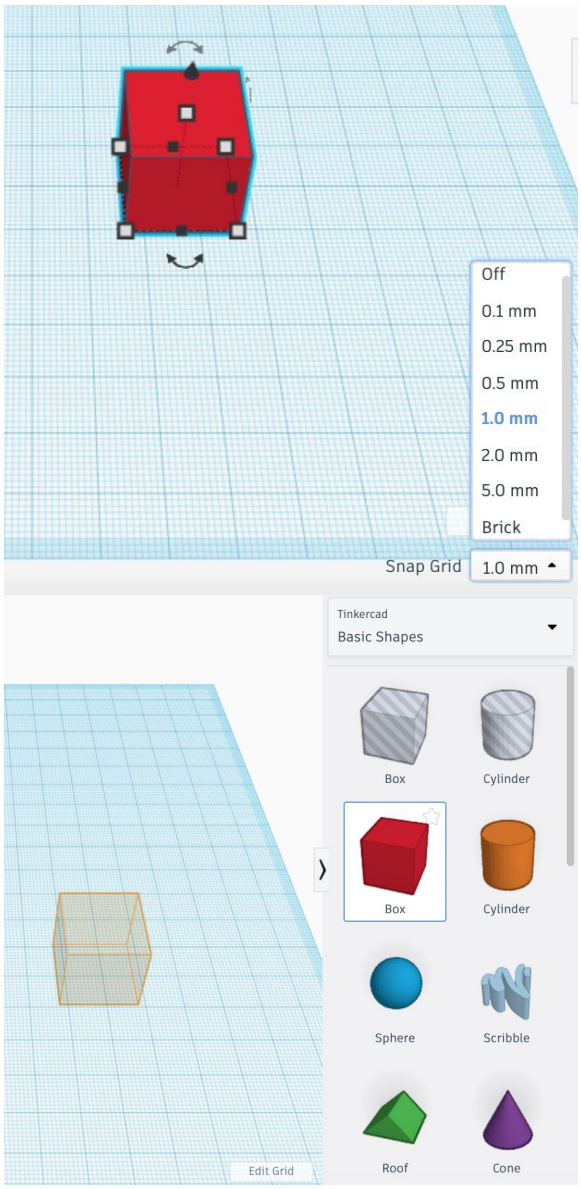
The **workplane** is a 3D space where all objects are placed.

You can change the size of the grid to allow for more detail or to make it easier to align.

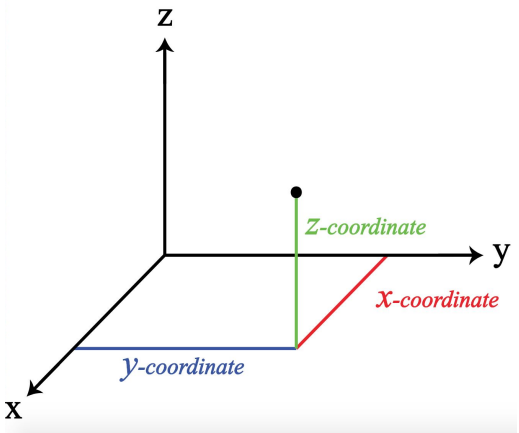
Typically smaller grids allow for more detailed work, and larger grids allow for easier movement/alignment of objects.

To create an **object** in your workplane, look through the objects in the shapes menu - then click and drag the shape onto the workplane.

You can also click on the object, let go, then click onto the workplane where you want to place the object.



TinkerCad uses a **Cartesian grid** with 3 dimensions. The x dimension, y dimension and z dimension. You may have seen this grid system before, as it is used in a lot of mathematics.



Movement

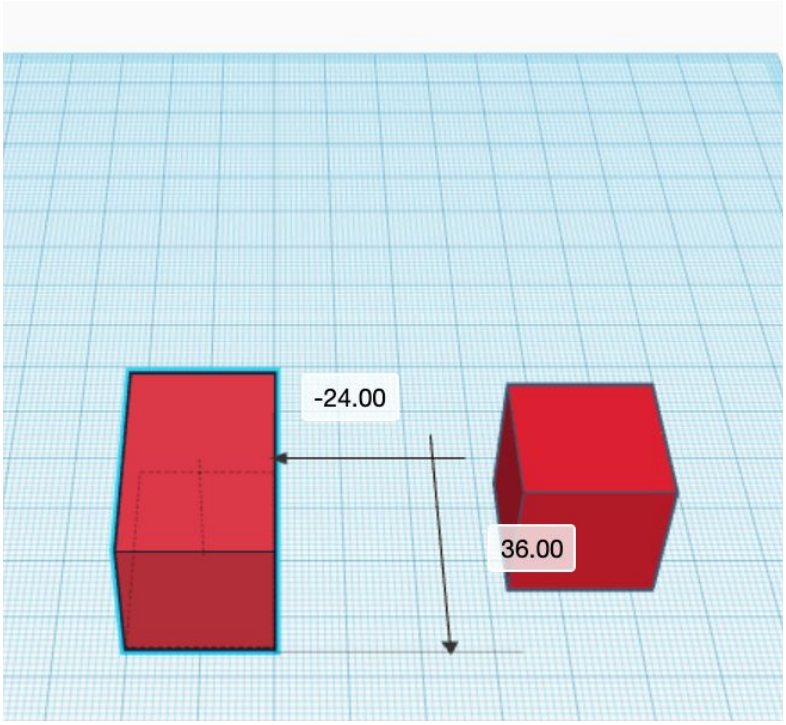
X and Y Direction

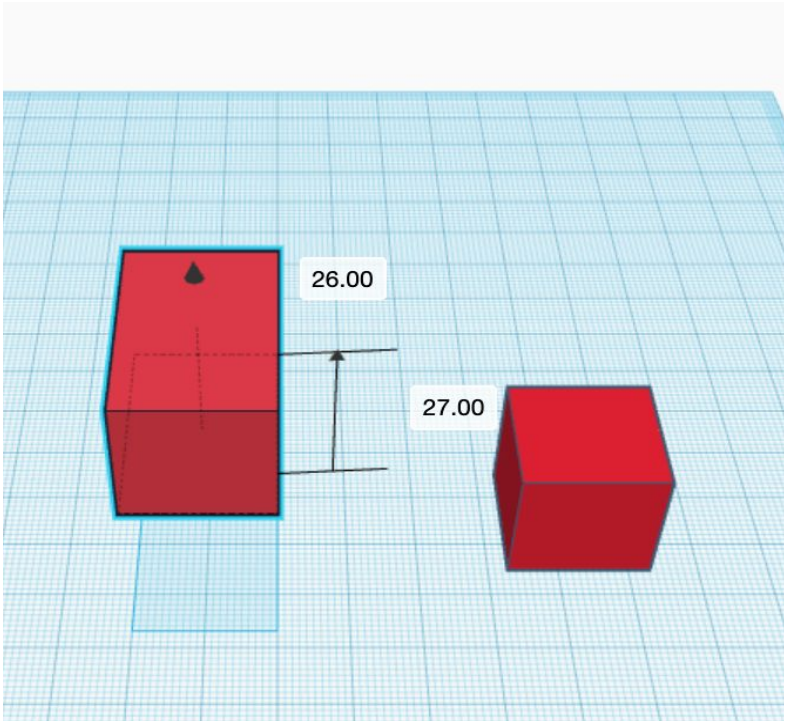
To move one or multiple shapes, select them.

To move **horizontally** click and drag the object by clicking anywhere near the centers of the faces and drag it.

**Avoid the black edges or the tiny black or white squares - this will change the objects size instead.*

When you **drag**, the distance you move is displayed next to the arrows.





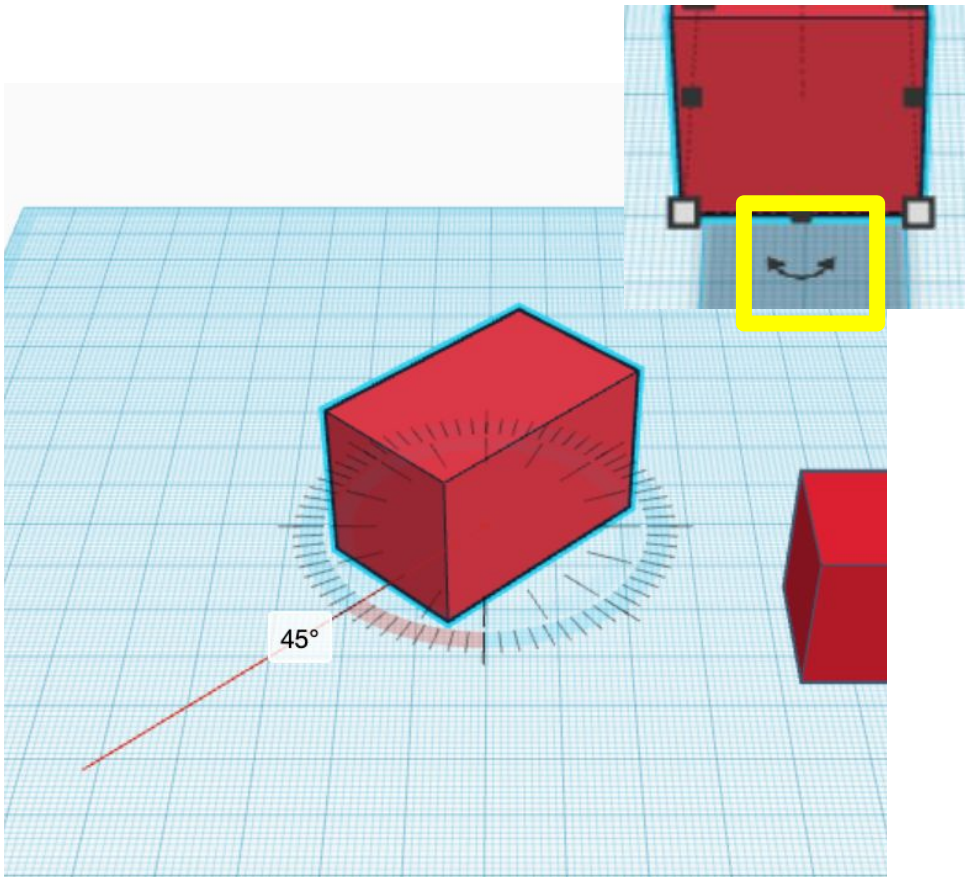
Z Direction

To move the shape up or down (z axis) click and drag the rounded black arrow above the shape.

The distance you have moved the object is displayed on the dop.

The other number below it shows you the absolute distance between the bottom of the object and the workplane.

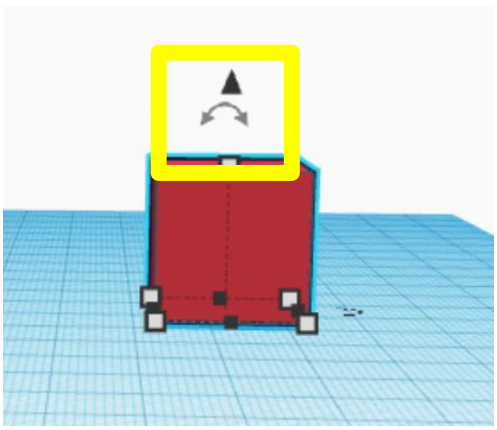
Rotation



To rotate an object, select it, click and drag the small arrow icon that displays beside the edge.

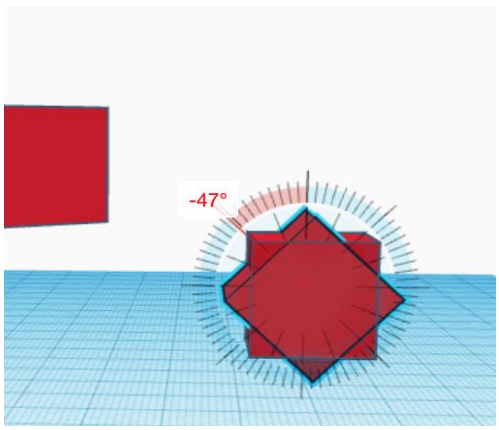
A compass will appear around the object and the number of degrees rotated will appear.

The farther away you drag the mouse from the object (while rotation selected) the finer control over the angle of rotation you will have.

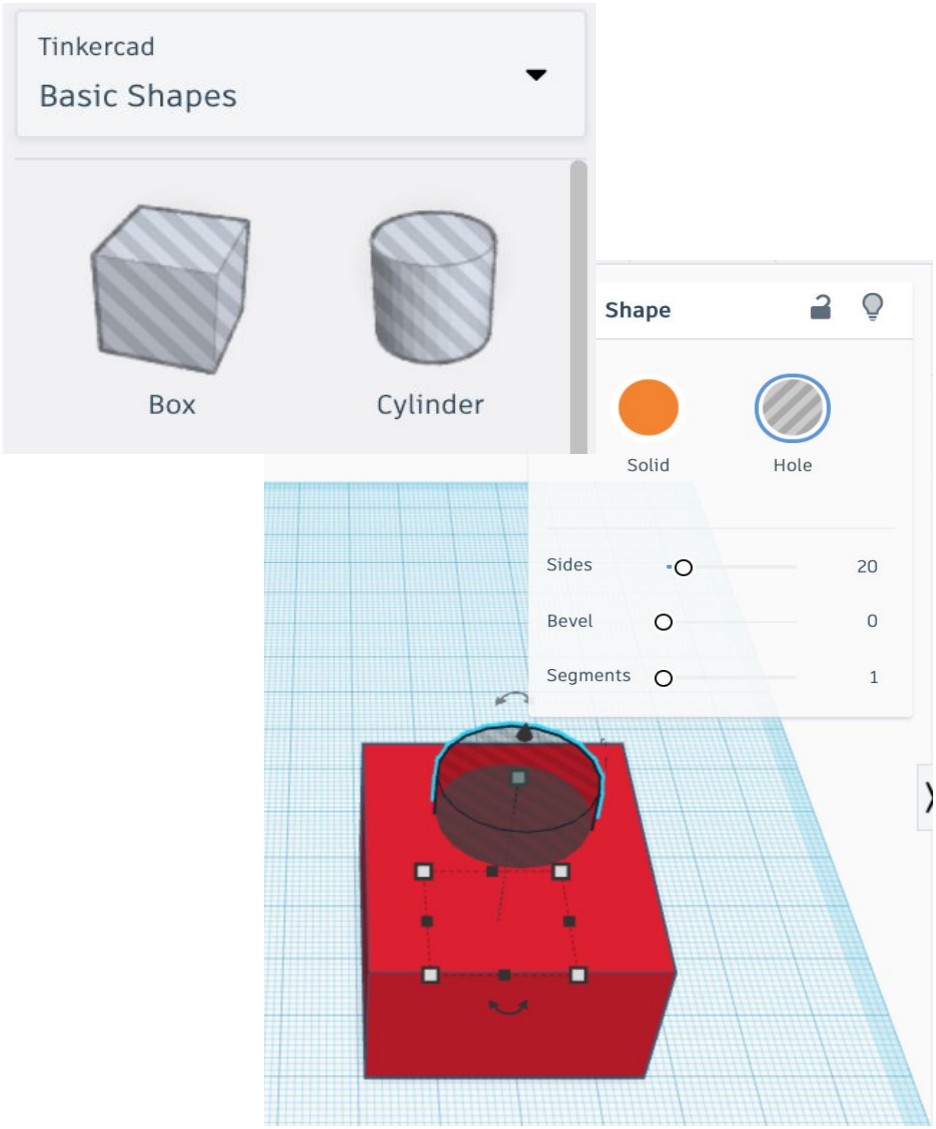


To rotate an object in vertical plane, use the camera view to view it from the side.

Select the object, the click and drag the curved arrows that appear under the Z arrow.



Hole Function



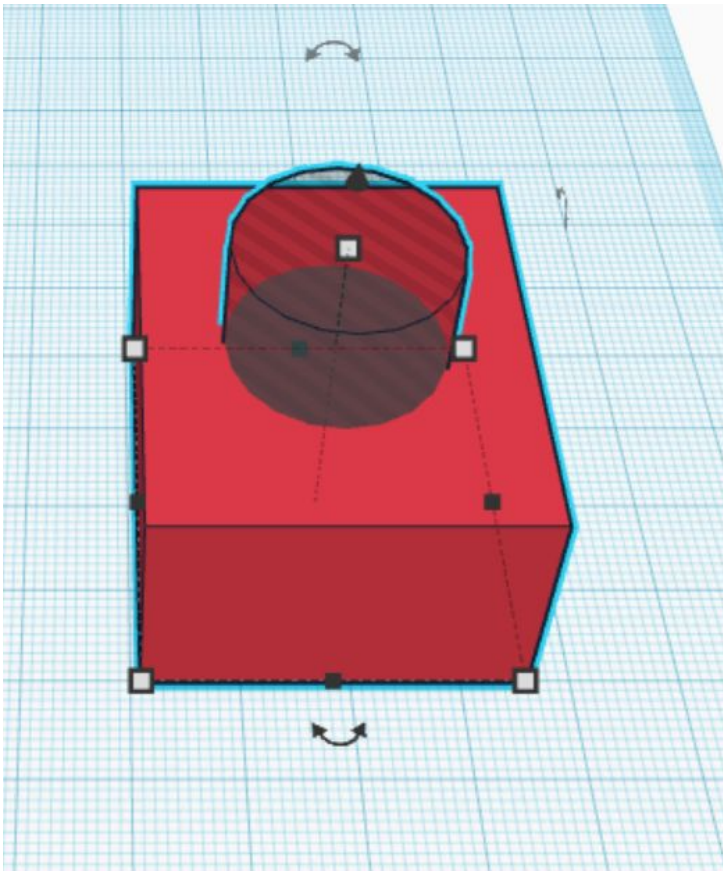
The Hole function can be used to change the shape of objects - almost like a 3D cookie cutter.

A hole can be longer or larger than the object it is supposed to cut, if the hole has the same size as one of the dimensions, it can create problems.

To cut through, it should stick out both sides.

Holes can be applied to the regular shapes using groups

Grouping Tool

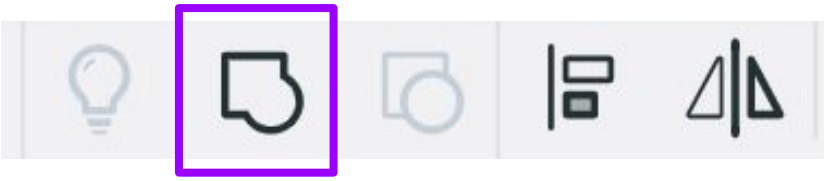


Objects can be grouped together into a single composite object.

A composite object (two or more objects grouped together) can be easily duplicated, scaled (change in size) and moved.

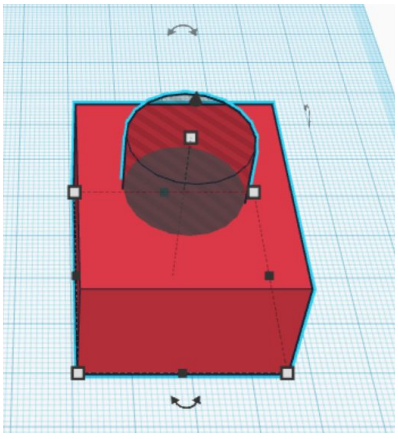
Groups of shapes and holes can be used to cut and modify shapes

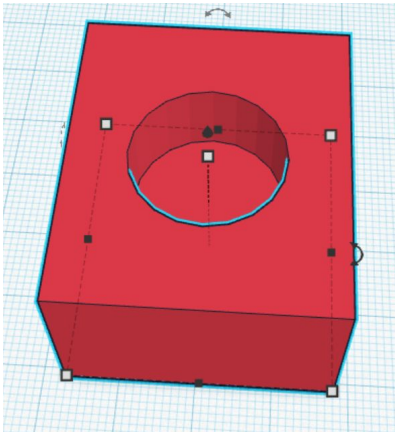
To group 2 objects together, select both objects using the shift key and clicking.



Near the top right of the work screen, hit the button the looks like a fused circle and square.

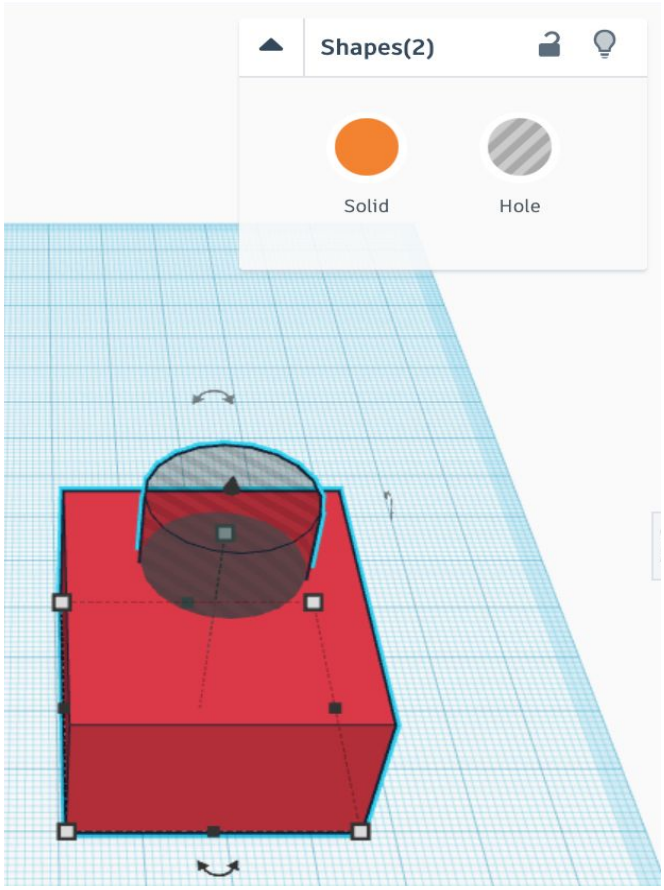
To ungroup, select the object and click the button to the right, the non-joined circle and square.





Align Tool

When two objects are selected, they can be aligned (centered) relative to each other.



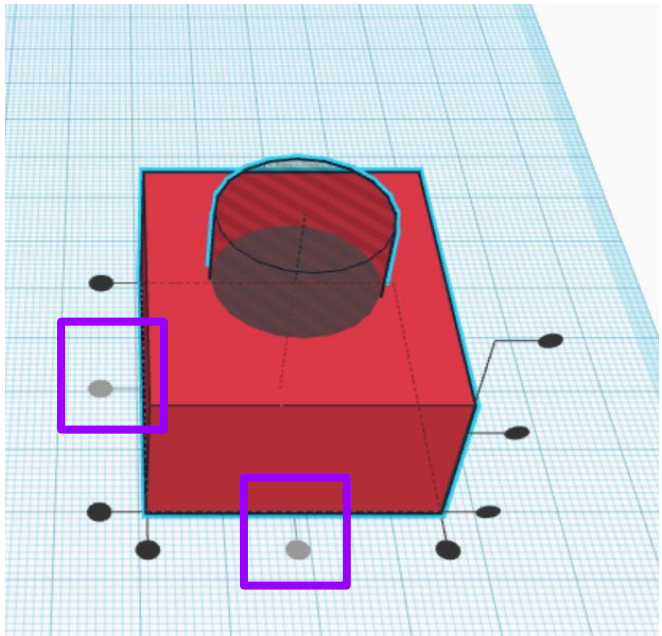
Select the two objects and press the align button.

The align tool will align either the centers of the objects or two faces by moving them to the same location.

The black circle indicates which face will be aligned.

Clicking the circle in the middle of an edge will align the centres of the objects.

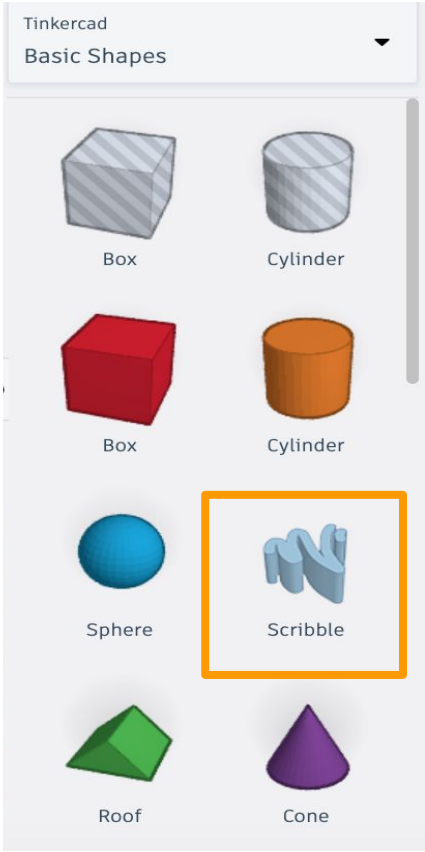
Clicking a circle at a corner will align the faces of the objects that are closest the that corner.



A preview will appear when you hover over one of the black circles.

For example, to align the centres of two objects in the horizontal plane, click the two black circles that are along the edges

Adding Drawings



The scribble tool can be used to draw a shape.

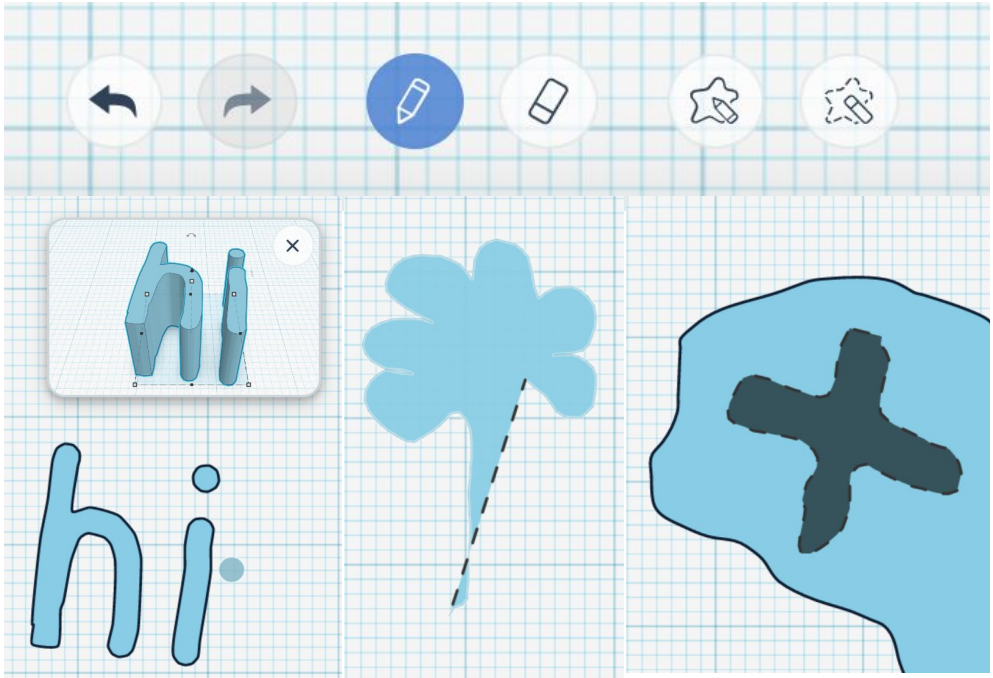
Select the scribble tool from the basic shapes menu.

Drug the scribble tool onto the workplane, this will open a new menu

The drawing tool can be used to create more nuanced and personalized shapes/designs.

In a top down perspective, you can draw with a pencil, eraser, shape or erase shape. The scribble will be extruded into a 3D object with a visible preview

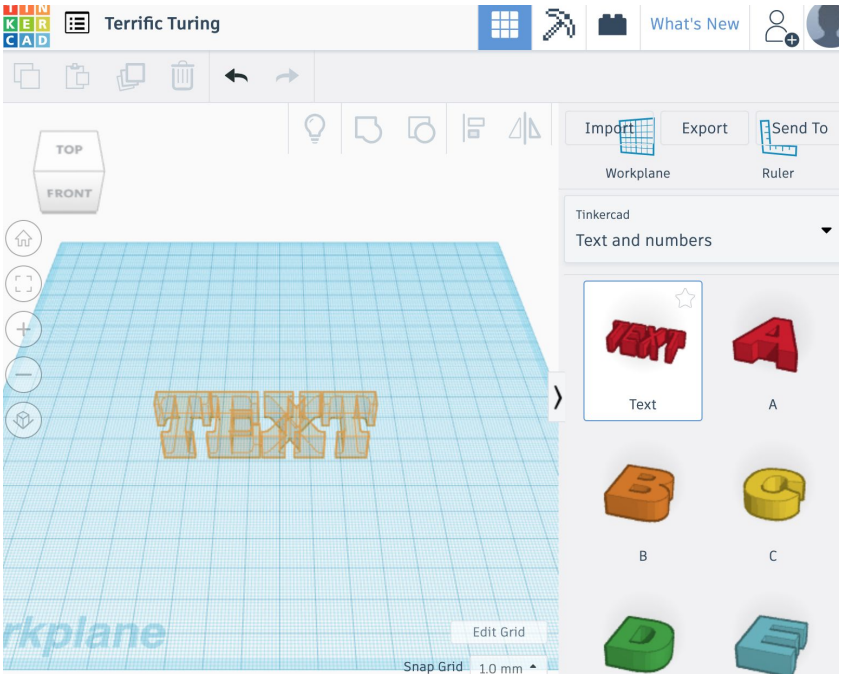
Once you are finished your drawing, you will be brought back to the workspace and able to put the creation in into place.



Adding Text & Special Shapes

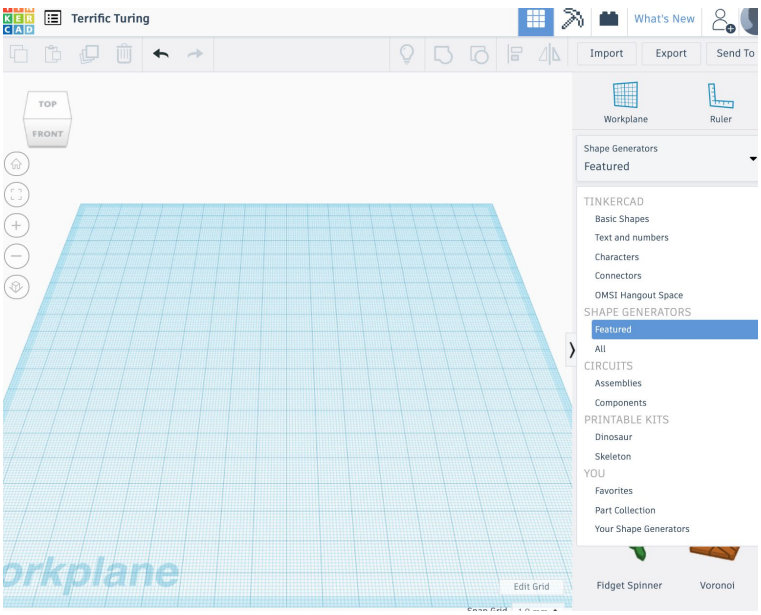
To add custom text, go to the text and numbers menu and click and drag the text icon.

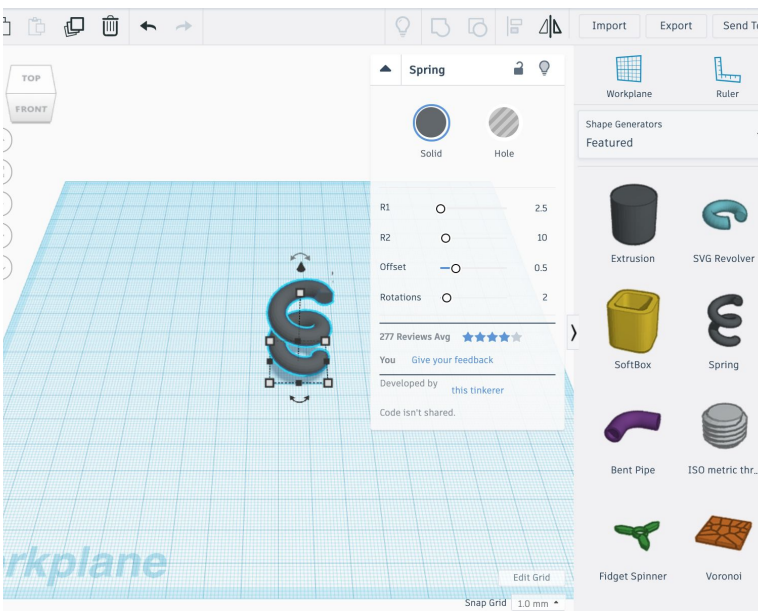
You can click on the shape and change the text in the shape specific menu.



In the shapes menu, switch to the feature shape generator category.

Here, you can add more complicated shapes and digitized versions of objects such as springs. You can even play around with some physics concepts such as the spring constants embedded in these features!





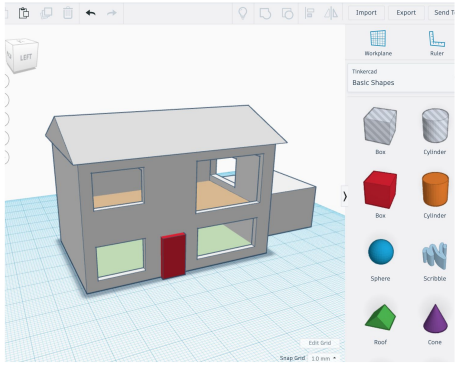
Design Challenge

Challenge:

It is time to get creative and use your 3D design knowledge to tackle a problem you are passionate about.

Design:

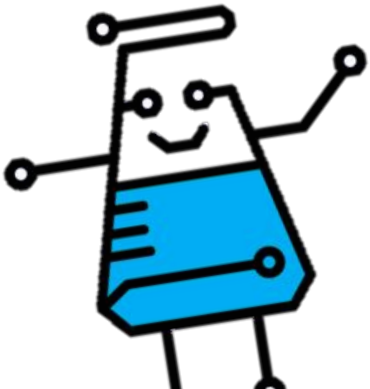
- A home powered by renewable energy
- A rocket to take you to Mars
- A conservation area for elephants
- A prosthetic joint
- Anything you can think of!



Can't wait to see your 3D model!

Engineering Design Process

1. Identify problem
2. Understand constraints
3. Brainstorm solutions
4. Select an idea to move forward
5. Build a prototype
6. Test
7. Reflect and analyze
8. Refine the redesign



Thank you!

Science Venture SINCE 1991

Provided Courtesy of Science Venture, University of Victoria

scienceventure.ca/onlinelearning

@ScienceVenture