



3D Printing

Student Workbook

WHAT IS 3D PRINTING?

3D printing work is different from other manufacturing processes. Making things usually involves a subtractive process: you start with a block of material – aluminium for instance – which you then machine (i.e. remove material) until you get the shape and size you're after. But 3D printing, or additive manufacturing, does the process in reverse. Instead of removing material, the “printer” dispenses it. The technology gradually deposits the material via a controlled nozzle, layer by layer, building up to a fully formed product.

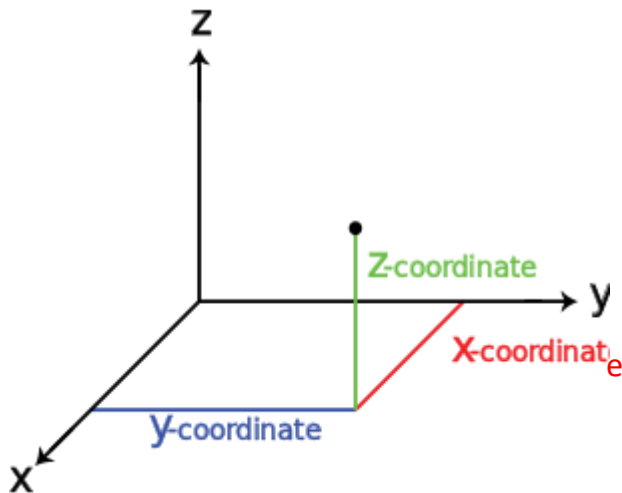
3D printing has many uses and can be found across a range of industries.

- 3D printers can manufacture custom hearing aids and braces, body parts, including ears, hips and even organs, in exact proportions to fit the patient.
- In disaster-stricken zones, portable 3D printers could allow faster setup and more adequate shelter, as design and alterations can be made on-site.
- The process could potentially allow astronauts to print objects as required in space, saving valuable weight at launch.
- Other applications include reconstructing fossils, replicating ancient artefacts, and reconstructing heavily damaged evidence acquired from crime scene investigations.

3D Printers

On the 3D printer, the platform on which the object is built is the xy plane.

To build an object in three dimensions, the printer moves this platform along the three axes.



Along the x axis: side to side

Along the y axis: front to back

Along the z axis: vertically adding additional layers

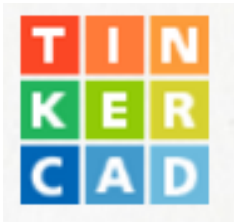
The movement of the build platform through these axes must be considered when designing your object.

For example:

- The object cannot be bigger than the build platform (the XY plane)
- As the object is built from the XY plane through the Z plane, the bottom part of the object must support the following structural elements. If the next layer steps out too far from the previous one scaffolding will need to be used to hold the layer up.
- The object cannot be taller than the Z plane



Computer Aided Design (CAD) with Tinkercad



tinkercad.com

Open a new account in Tinkercad:

- Open either Chrome or Firefox browser.
(Internet Explorer will not run this program)
- Go to tinkercad.com



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Enter the country

Enter date of birth details

Then create a user name and password

The user name will need to be unique from any existing names on Tinkercad so you may need to be creative.

Create account



Country, Territory, or Region

Australia

Birthday

Month

Day

Year

NEXT

ALREADY HAVE AN ACCOUNT? [SIGN IN](#)

- Go to the “Learn” section and work through the “Direct Starters”
- To start your own project click this button

Create new design

Designing your key-tag



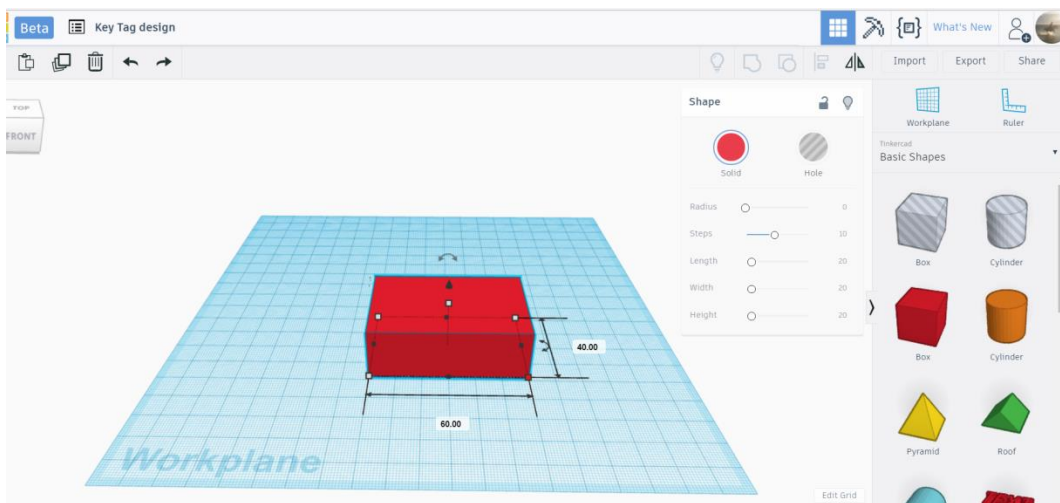
1. Click on the home button (top left)

Start your project by clicking - create new design

Create new design

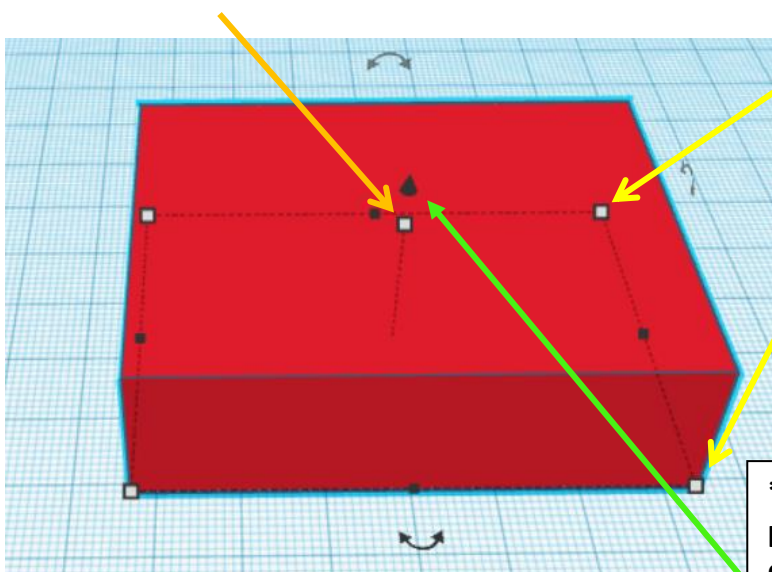
2. Workplane

- * Adjust the view of the Workplane by holding the right mouse button and moving the mouse around
- * Zoom in and out by moving the scroll wheel on the mouse

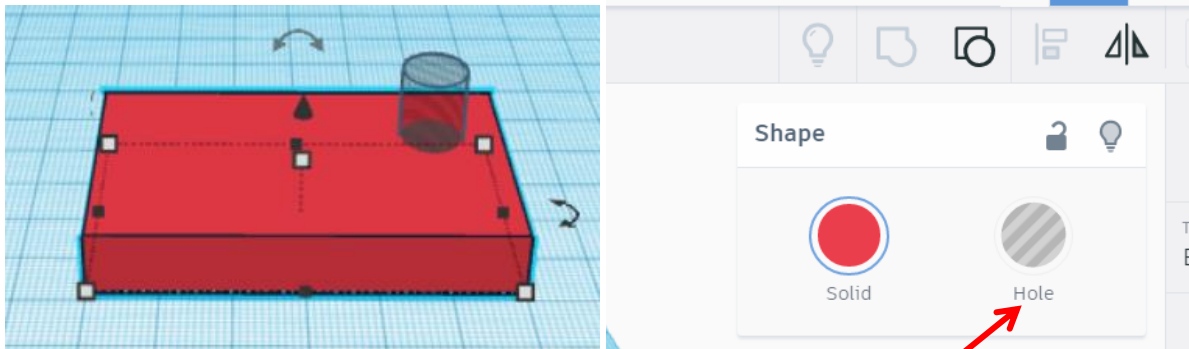


3. Drag and Drop

- * Choose an object, then drag and drop it onto the Workplane
- * Adjust the dimensions using the corner squares to get a 60 x 40 mm square
- * Adjust the height using the central square to get 9mm



* Until you have practised with this program avoid using the central black cone shape as this lifts and lowers the object and can leave it floating in mid-air.



4. Making a hole and adding text

- * Drag and drop a new shape onto the Workplane
- * Select the new object and change it into a hole
- * Adjust the size of the hole (approx. 10 x 10mm) and place it inside your object making sure it goes right through.



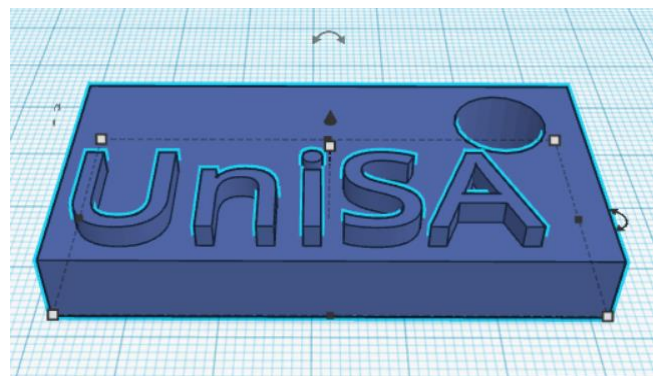
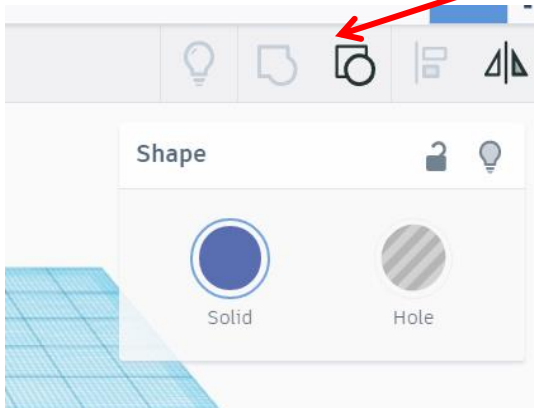
* Add text and other features to your design.

Make sure text is not the same height as the base shape or it will not be visible when printed.

To add text drag and drop the text icon onto the workplane and then adjust the text, font and height.

5. Grouping the object

- Highlight both objects (by making dragging the mouse to create a rectangular perimeter) you then click **Group** or press **Control + G**



The colour in Tinkercad is irrelevant, it is the printer plastic that determines the colour.

6. The design will automatically save to the classroom account. If you also need to save a copy onto USB you will need to do the following.

- a) Click **Export**
- b) Click **.stl**
- c) Right click on the downloaded file and click show in folder
- d) Copy and paste file to USB
- e) **Rename the file as *your name***

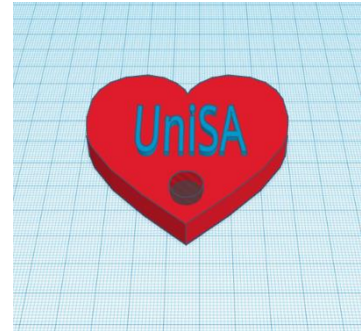


Extension Tasks:

Once you have mastered the basics of the key-tags, think about what you would change about it.

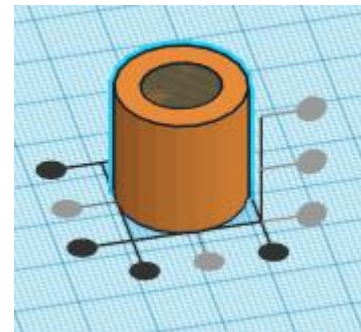
Some examples may include:

- Rounded edges
- Indented name
- Positioning of the text
- Shape of your key tag



Can you make a tube with a centralised hole using the align feature?

You will need to click on the two objects you want to align while holding down the shift key, then click on the align tool. You can then choose if you want to align the items on the X, Y or Z axis.



If you want a task even more complex, try and design a 3D jigsaw puzzle that interlocks

