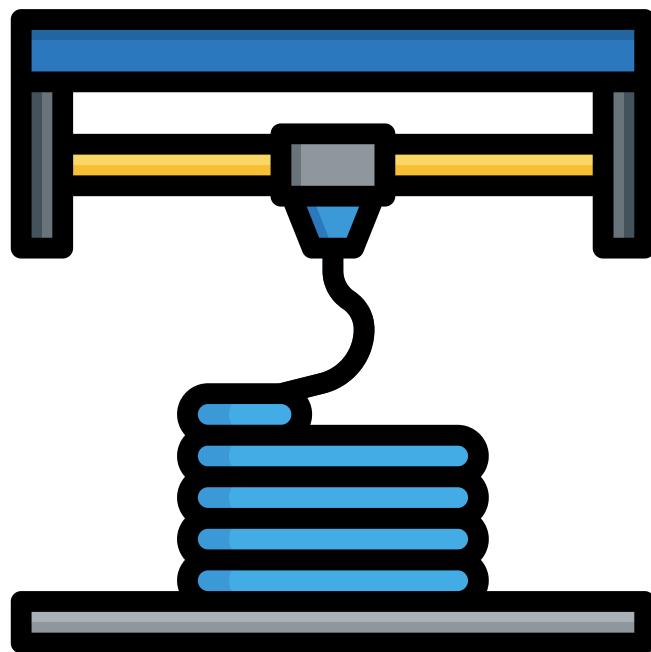


3D DESIGNING & PRINTING



3D Design and Printing

Session 1

Design a Rocket and 3D print it

Introduction to Rockets



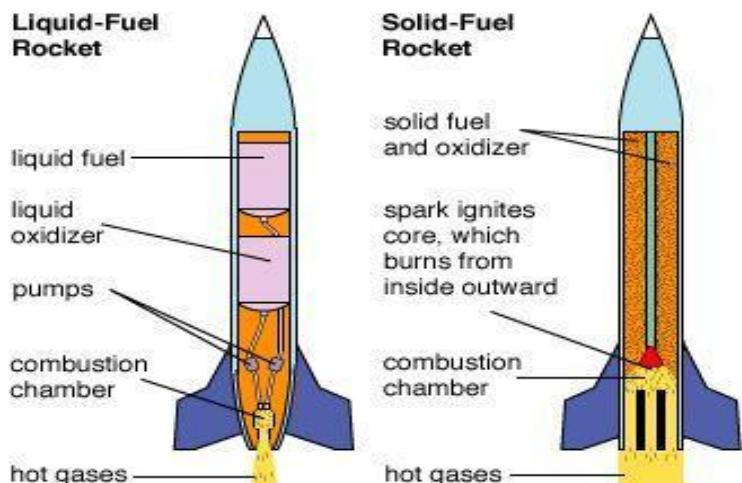
Rockets are devices that produce the force, or push, needed to move an object forward. Rockets are used to launch **spacecraft**. They are also used to shoot missiles and fireworks.

How Rockets Work?

Rockets carry fuel that is burned inside a chamber. The fuel burns when it is mixed with oxygen gas and ignited, or set on fire. As the fuel burns, it gives off hot gas that shoots out from an opening at the back of the chamber. The force of the gas moving backward pushes the rocket forward. This action is called jet propulsion.

The engines of a jet airplane also use jet propulsion. But unlike a jet engine, rockets carry their own oxygen supply. This makes rockets valuable in outer space, where there is no oxygen.

Rocket fuel can be liquid or solid. Two solid-fuel booster rockets launched the shuttle into space. Three liquid-fuel rocket engines allowed the shuttle to move in and out of orbit.



Source: kids.britannica.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer



⌚ : 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:

3D Printing and Design allows children to think, visualize their imaginative concepts and create prototypes on their own. It also enables the children to understand the basic design concepts while differentiating between 2D and 3D images.

Learning Goals:

1. Learners will be able to understand the basic concepts of 3D design.
2. Learners will explore and learn to use a simple 3D design software called Tinkercad.
3. Learners will design and 3D print a Rocket exploring the possibilities of 3D Printing.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
10 Min	Introduction to module
20 Min	Activity
15 Min	Challenge
09 Min	Reflection and Learnings

Icebreaker (5 mins):

I went to market and bought a _____

To play, Form a circle, one person starts off by saying, 'I went to market and bought a _____', adding a grocery item he or she would buy. The next player continues by saying, 'I went to market and bought a <first player's item> and a _____'. Each player continues, adding items to the list as they go along. When a player makes a mistake, they are eliminated and the game continues until there is only one person left.

Safety Measures:

1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off



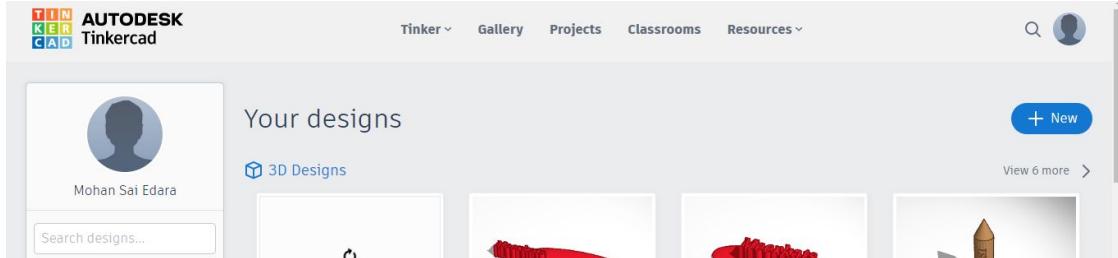
Activity: Design & 3D Print a Rocket



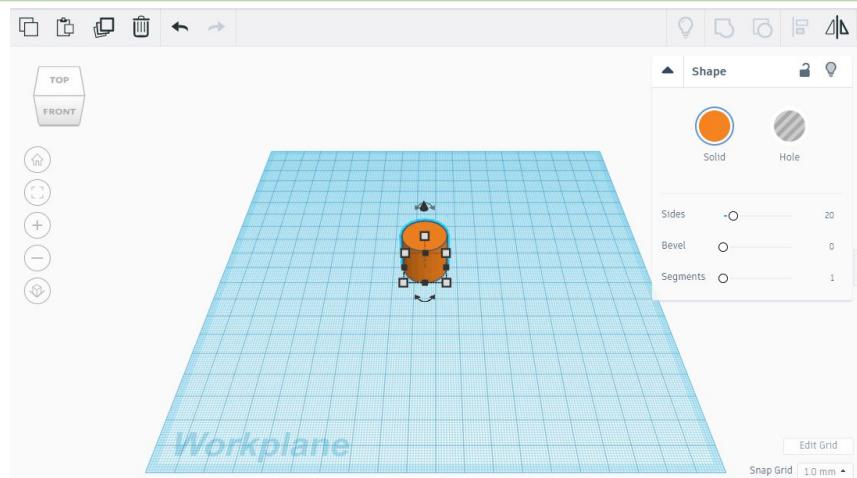
In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D Rocket and 3D print it.

Step 1: Open a browser and type [tinkercad](http://tinkercad.com) in the url and press enter. Click on the first result www.tinkercad.com and you will be redirected to a tinkercad website. Click on sign in and use your google account or autodesk account to sign in to the tinkercad website.

Step 2: After logging in, click on “+ New” to start a new design.

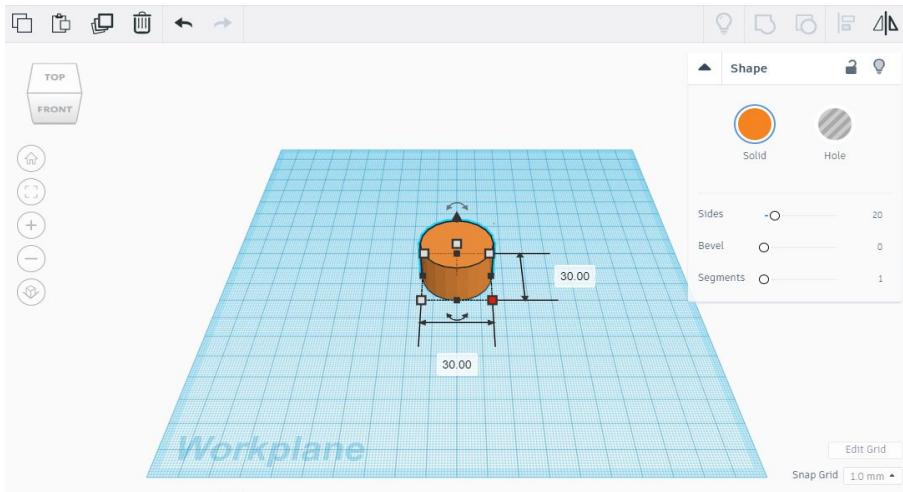


Step 3: Drag and drop a Cylinder from the basic shapes menu on to the work plane.

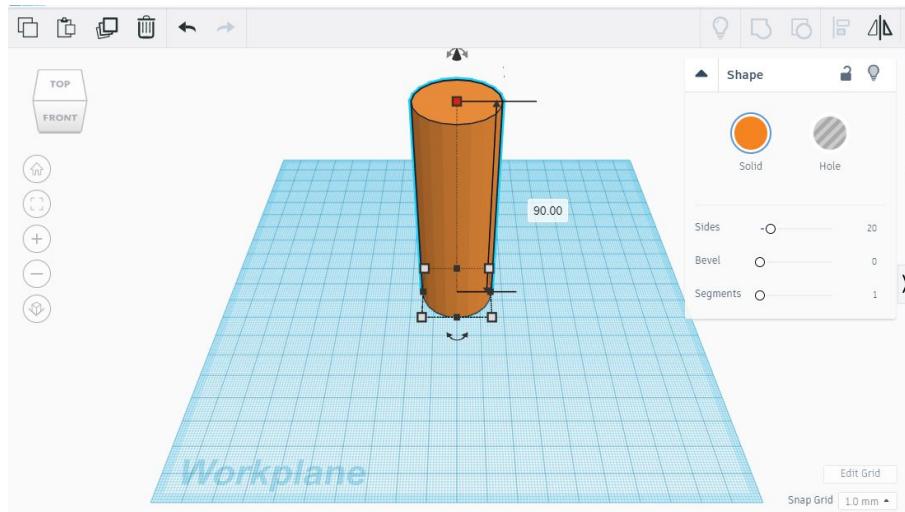


Source: tinkercad.com

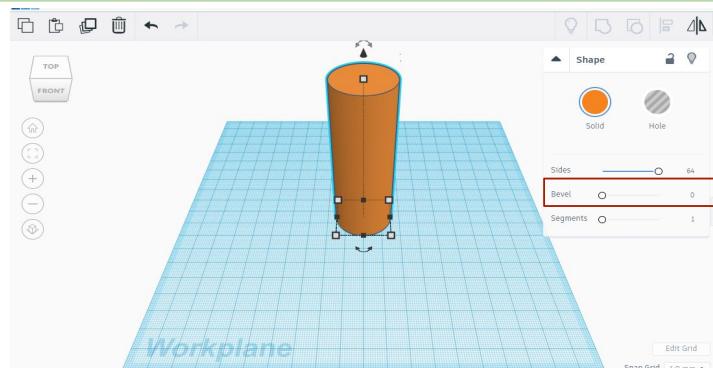
Step 4: Now let's increase the size of the cylinder to 30 mm. Hold the shift key and drag the corner of the cylinder to 30 mm.



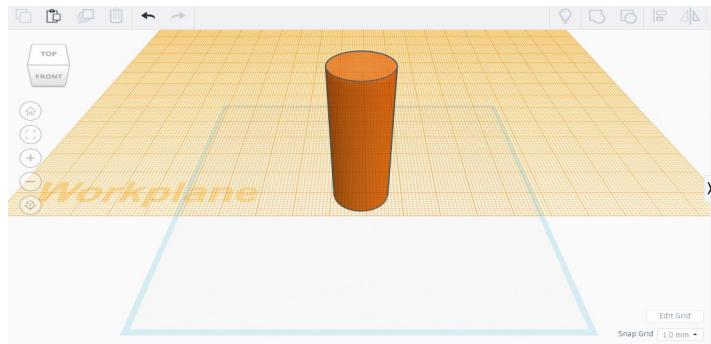
Step 5: Let's increase the height of the Cylinder to 90mm. Click on the middle dot on the top and enter 90.



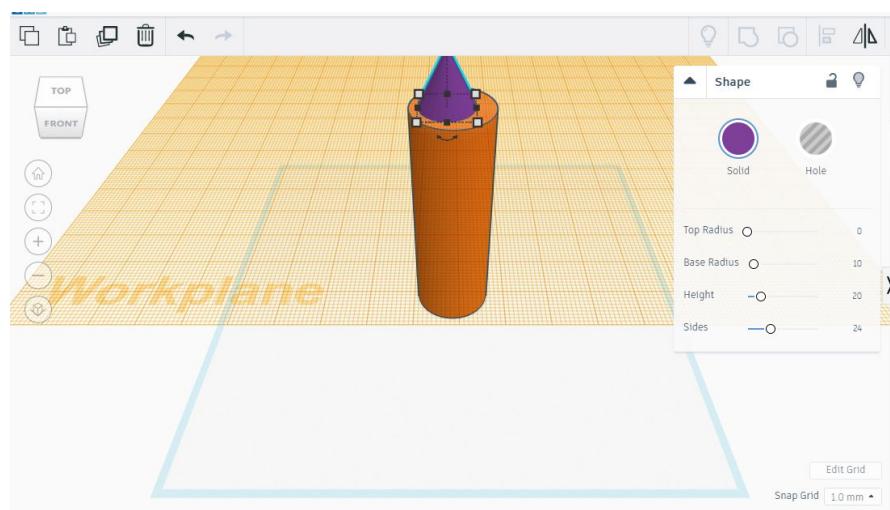
Step 6: Now let's make the surface of the rocket body smooth. In the shape toolbar increase the sides slide bar to 64.



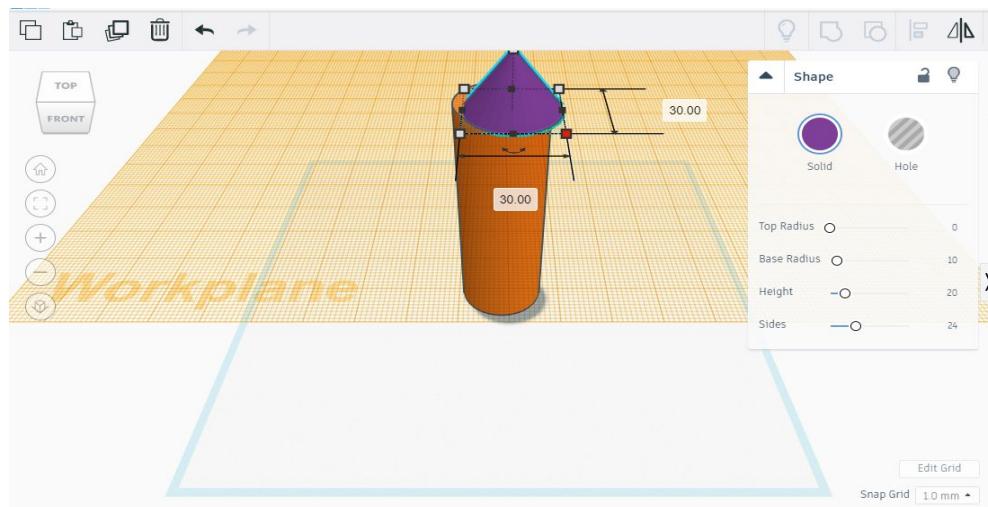
Step 7: Drag and drop a work plane and place it on the cylinder as shown in the image.



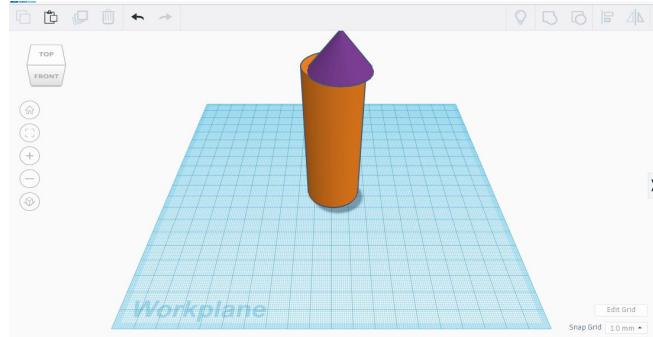
Step 8: Now let's make the rocket head. Drag and drop a cone from the basic shapes toolbar on to the cylinder top.



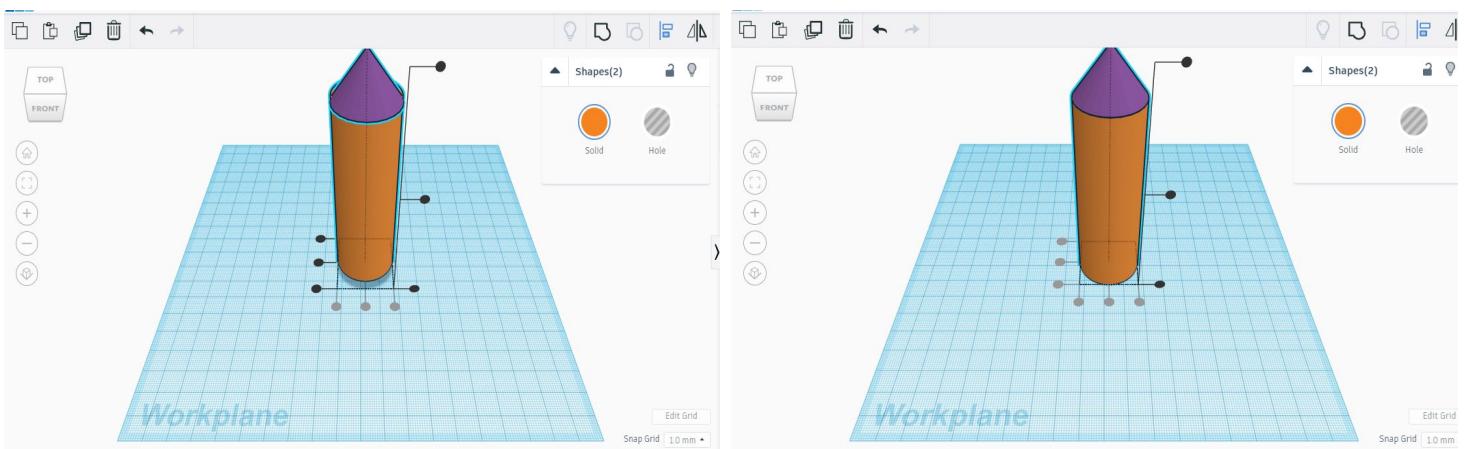
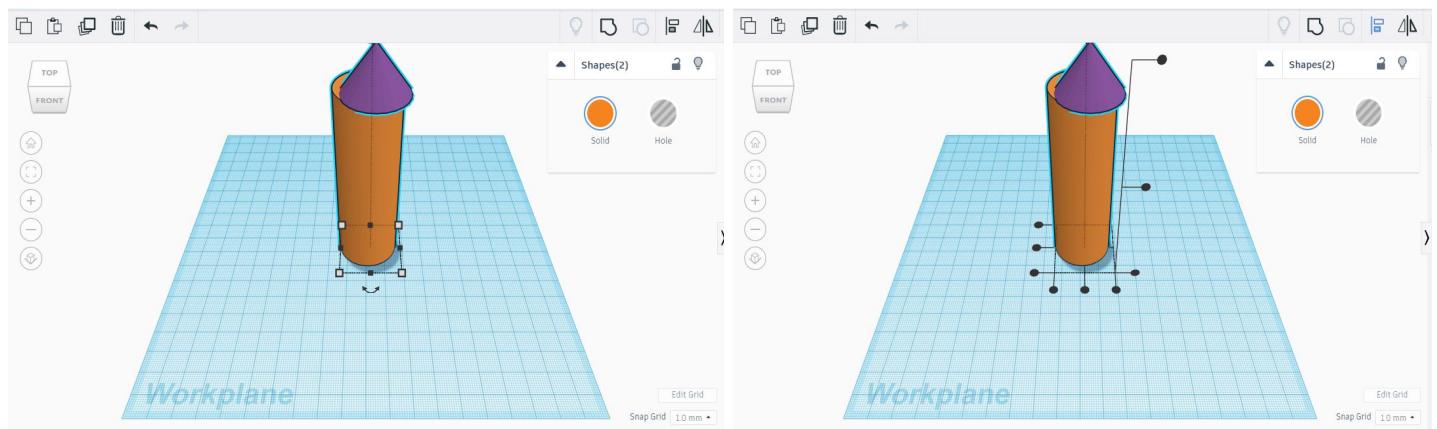
Step 9: Click on the corner of the shape and enter 30 on both sides to change the dimensions to 30 mm.



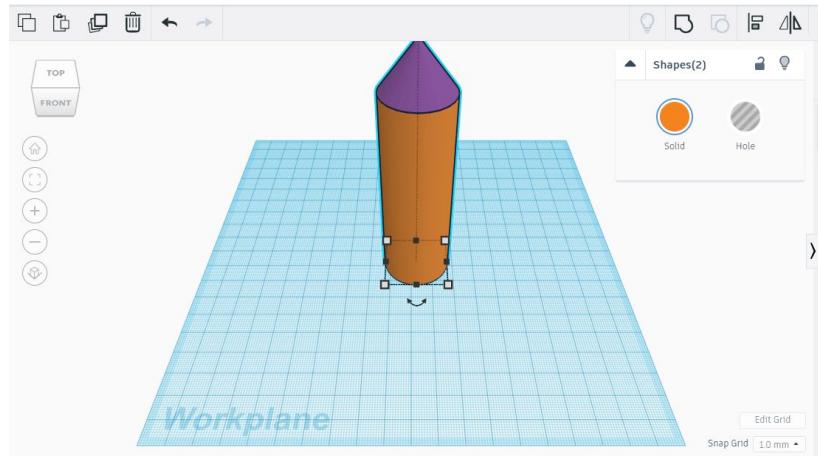
Step 10: Drag and drop a work plane on the basic work plane. This will remove the existing workplane we have added earlier.



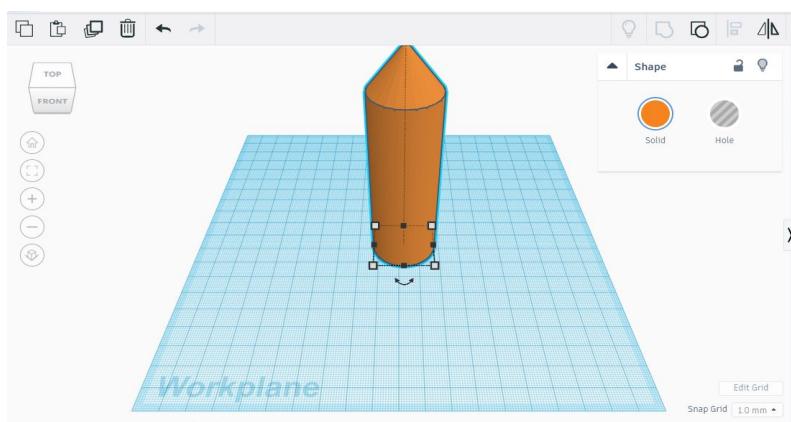
Step 11: Now let's Align the shapes. Select all the shapes and click on Align icon or Press L. Then center align the shapes as shown in the images.



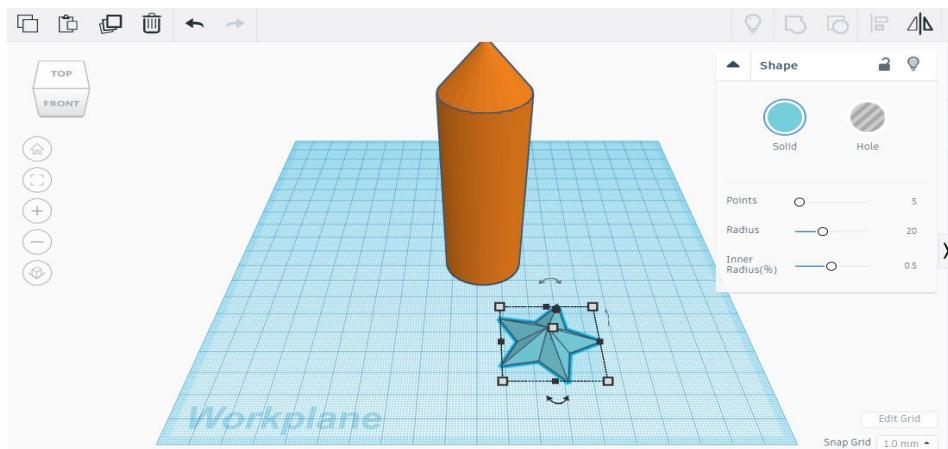
Step 12: Now click on the align icon again to deactivate the command.



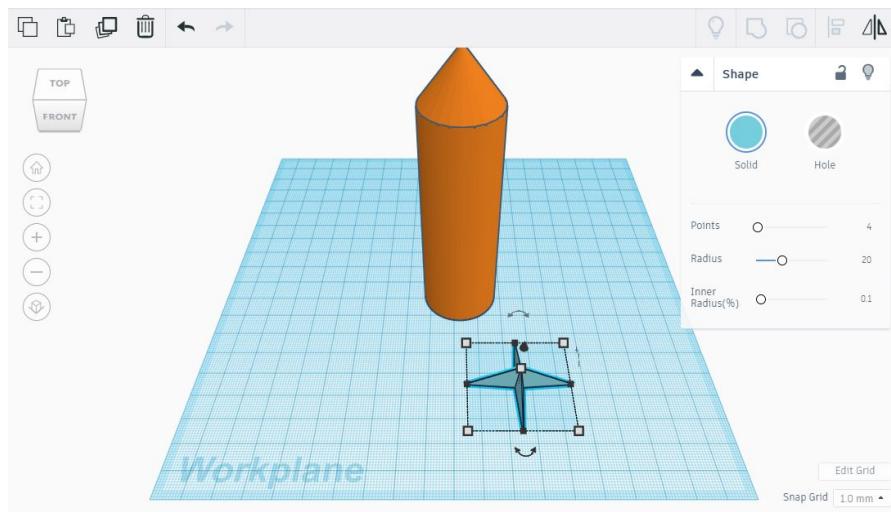
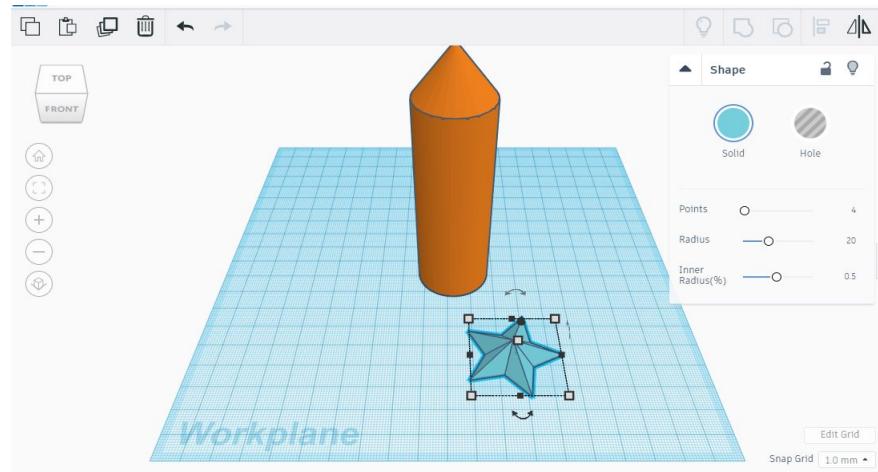
Step 13: Click on the Group icon or press Ctrl+G to group the shapes.



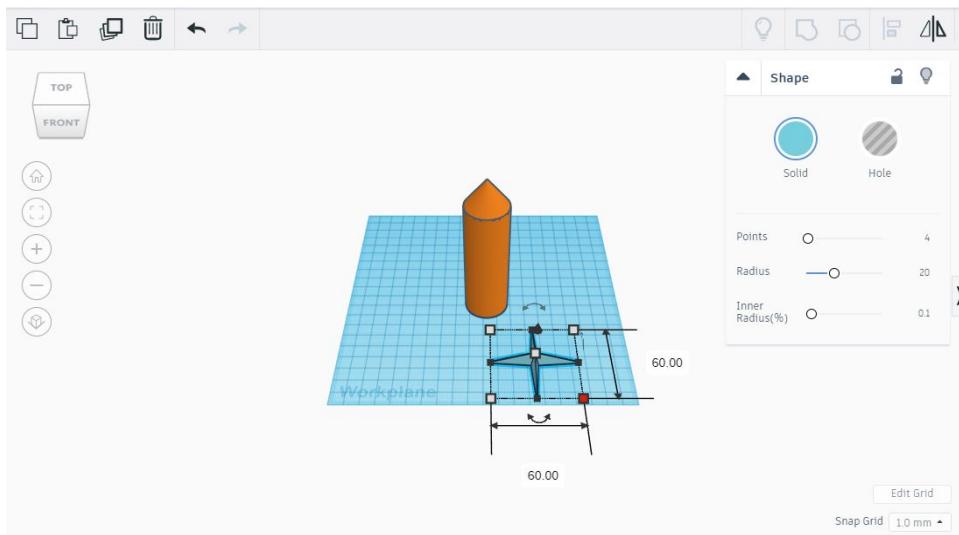
Step 14: Drag and drop a star from the shapes menu as shown in the image.



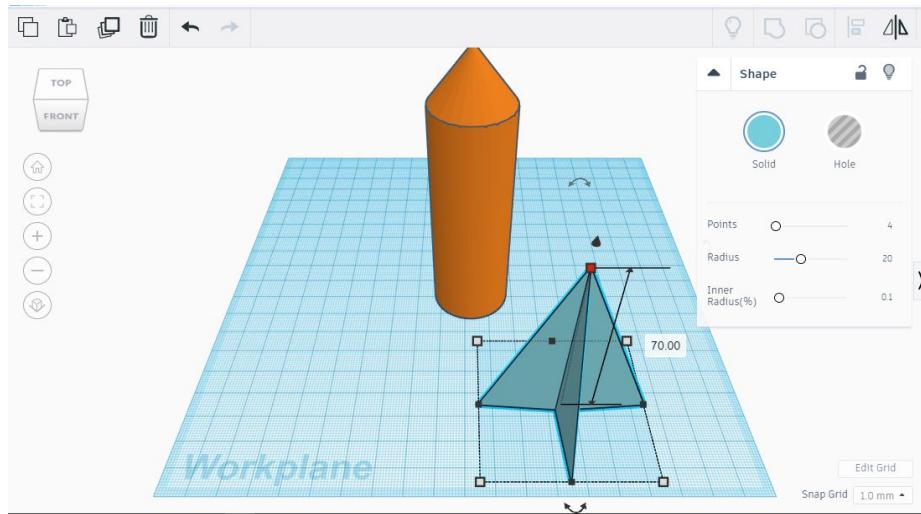
Step 15: Let's add 4 fins to the rocket. We need only 4 sides. Click on the points and enter 4 in place of 5 and then decrease the inner radius. Enter 0.1 in place of inner Radius%



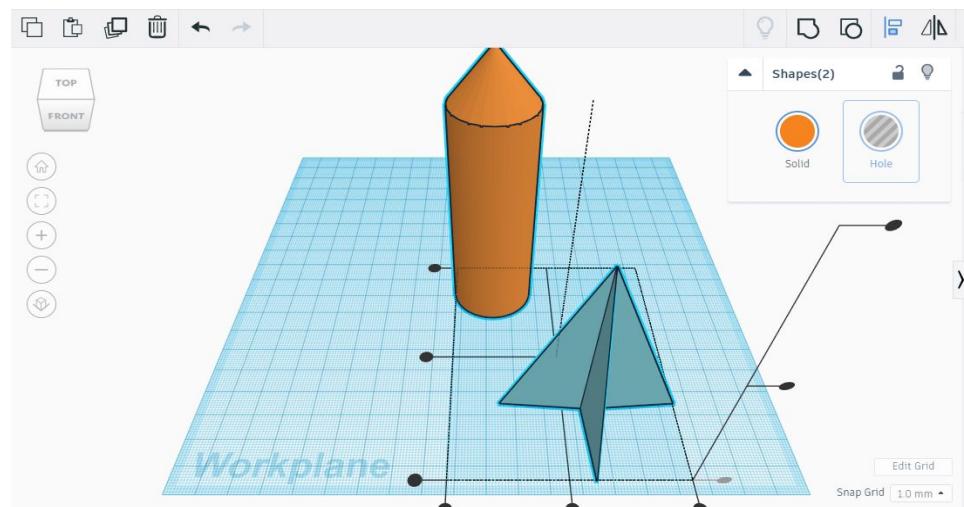
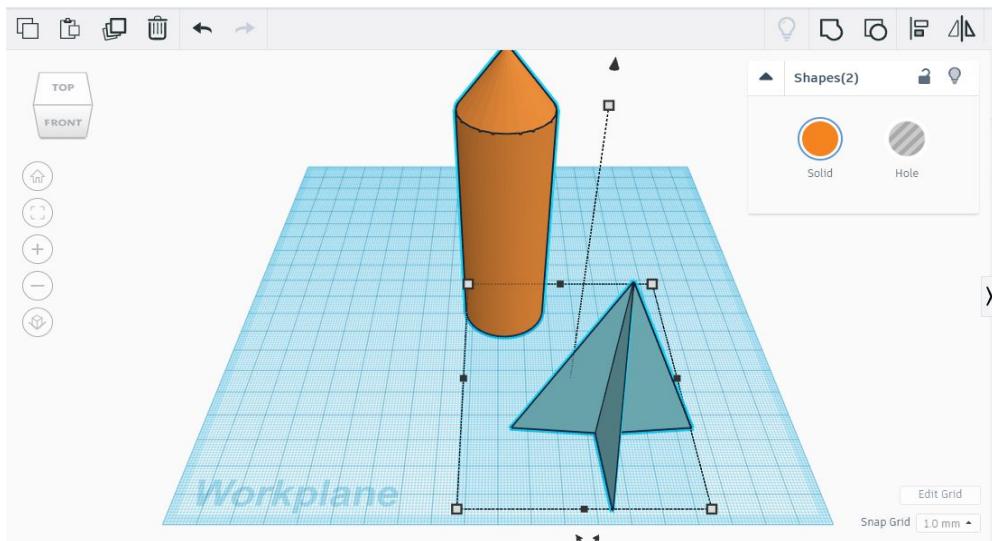
Step 16: Click on the corner and change the dimensions to 60mm on both sides as shown in the image.

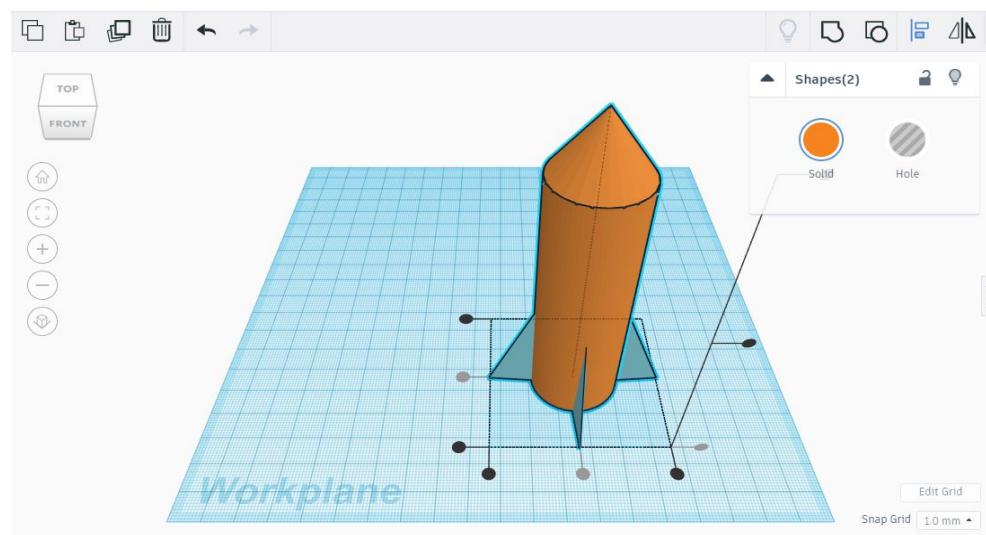
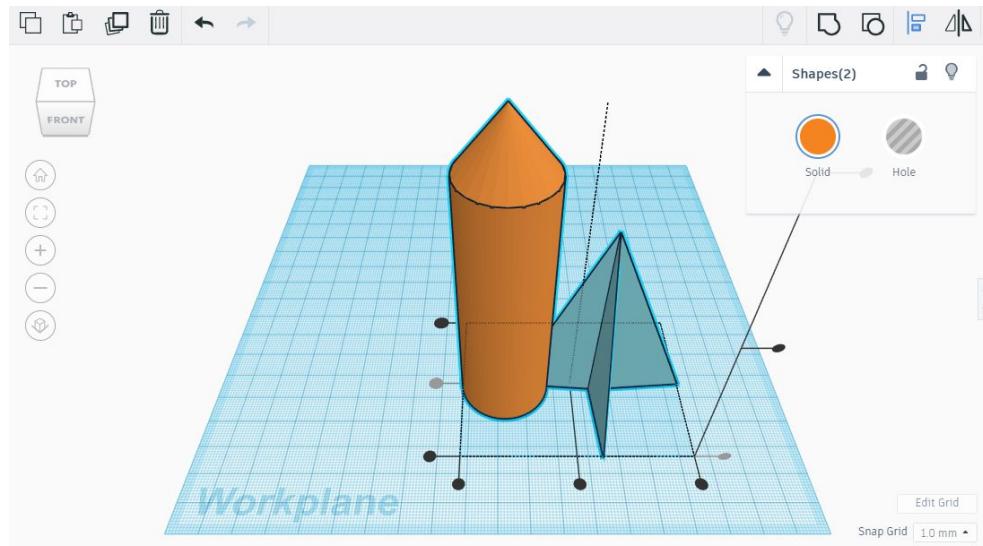


Step 17: Change the height of the fins to 70mm.

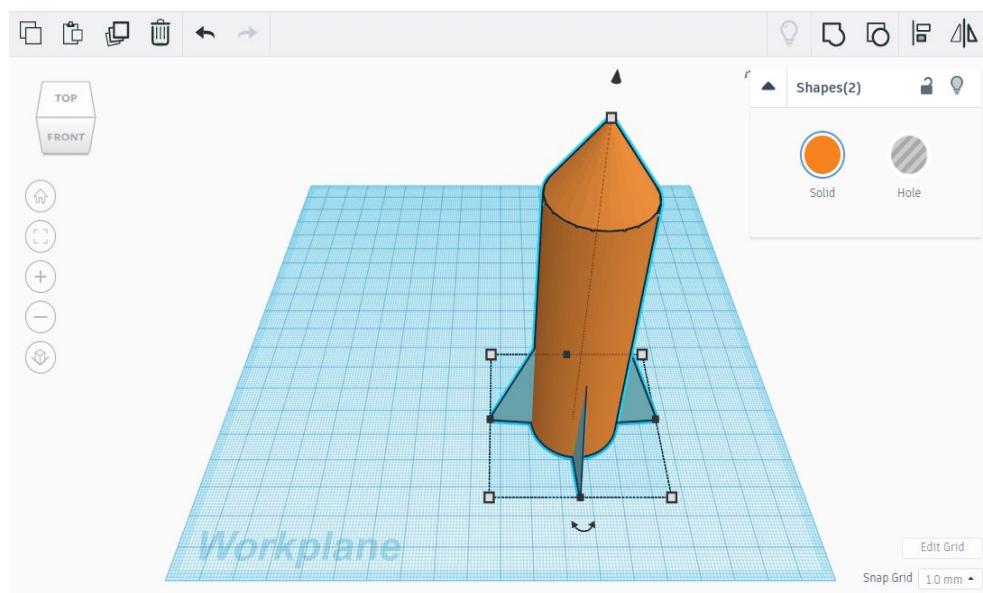


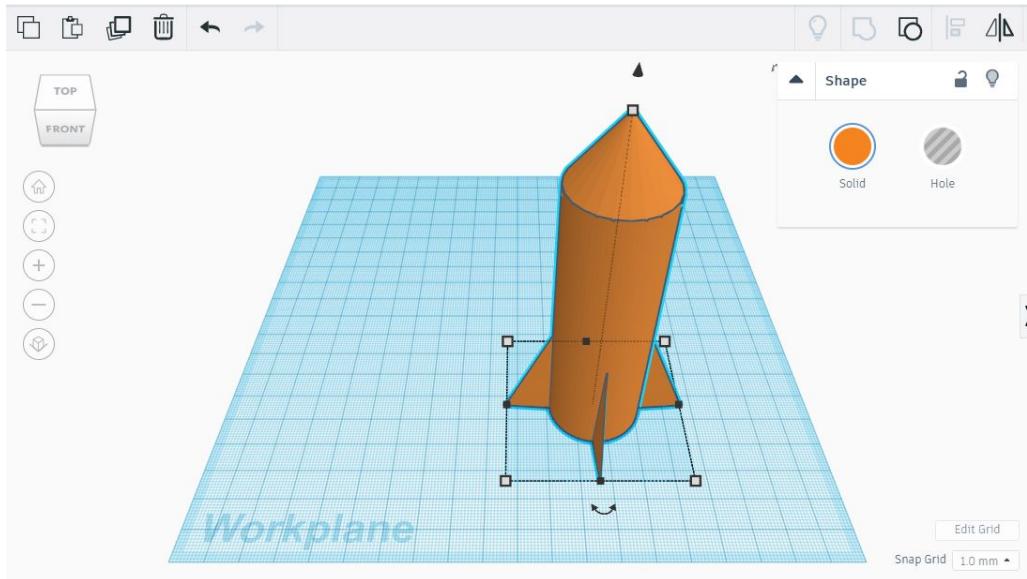
Step 18: Now, select the shapes and center align the rocket fins with the rocket body as shown in the images given below.





Step 19: Select both the shapes and group them.





Challenge



Try it yourself: Now that you have built the rocket, think of a creative name for your rocket and add it on the cylinder using the concepts you have learnt so far. An image has been added for your reference.

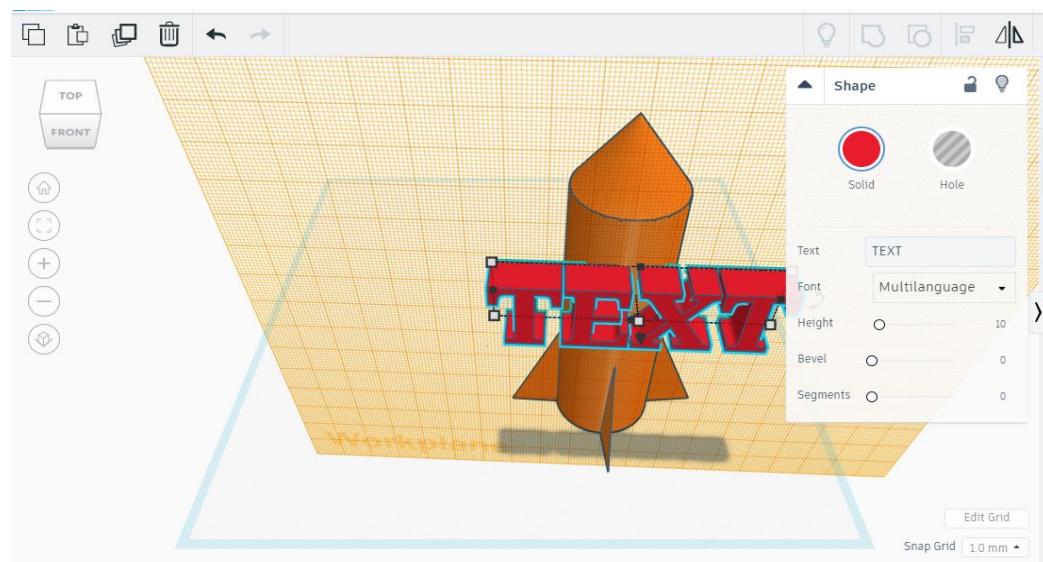


Image Source: tinkercad.com

Congratulations! You have successfully completed your activity.



Reflection and Learnings (9 mins):

1. What do you think is the difference between a Rocket and a Satellite?
2. What will happen when you use the “Workplane” option in TinkerCad?
3. Imagine yourself to be a rocket scientist, you along with your team got a chance to resign the shape of the rocket. Think creatively and draw your redesigned shape in the space given below.
4. What did you or your team struggle with while doing this activity and why? How can you improve next time?

Use the space to draw or write your reflections and learnings



3D Design and Printing

Session 2

Design a Simple mobile holder & 3D Print it

Wonders of 3D Printing: 3D Printed House (10 mins):



What is a 3D printed house?

Houses that are designed and built using construction technologies that use the 3D printing method are known as 3D printed homes. 3D printed homes are faster to build and are superior to the traditionally constructed structures in many ways.

Created by Tvasta Manufacturing Solutions, a start-up founded by the alumni of IIT-Madras, this 3D-printed house overcomes the pitfalls of conventional construction.

The process of building a 3D-printed Tvasta house is not just different but a lot quicker than conventional construction. It is built with focus on reduced build-time, zero-waste construction and optimised production. To start with, the structure was printed using a special concrete mix through which large-scale 3D structures were made. The concrete mix is a base of ordinary cement which has a lower water-cement ratio. While concrete is the primary material for typical construction projects as well, the energy consumed to mix and transport it is way more than in 3D printing.



Source: housing.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer

⌚ : 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:

3D design offers students the ability to sketch out their concepts and even their ideas and model them in the real world. The excitement and enthusiasm come naturally to students when they can touch and see things in real life rather than trying hard to imagine a picture in their minds.

Learning Goals:

1. Learners will be able to understand the basic concepts of 3D design.
2. Learners will explore and learn to use a simple 3D design software called Tinkercad.
3. Learners will design and 3D print a mobile holder exploring the possibilities of 3D Printing.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Six word story
10 Min	Introduction to 3D Printed House
35 Min	Activity: Design and 3D Print a mobile holder.
09 Min	Reflection and Learnings

Icebreaker (5 mins): Six word story

Make students describe their summers in a complete sentence using only six words. Have them switch papers with a classmate that has to add a comment comprised of only six words. It may appear easy but it's a lot more difficult than it seems.

Safety Measures:

1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off



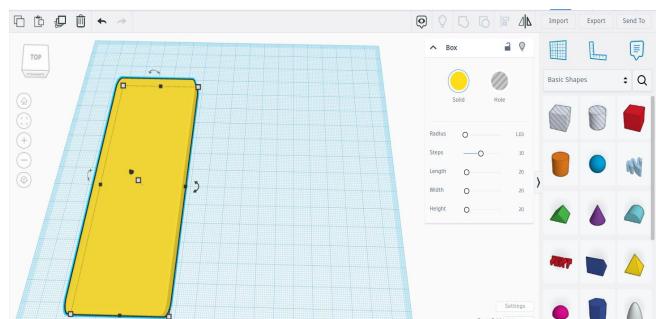
Activity: Design & 3D Print the Mobile holder



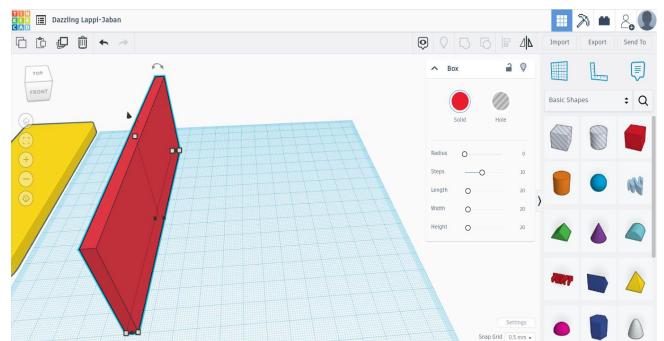
In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D Mobile Holder and 3D print it.

Step 1: Login in to TinkerCad Website.

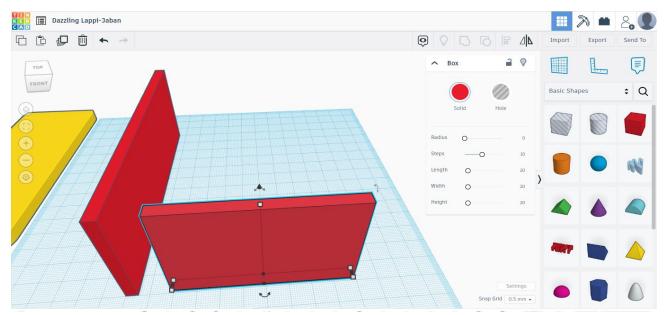
First Let's create the mobile phone's shape by inserting a box shape from the basic shapes menu and change the dimensions to approximate the size of a mobile phone (130MMX50MMX8MM).



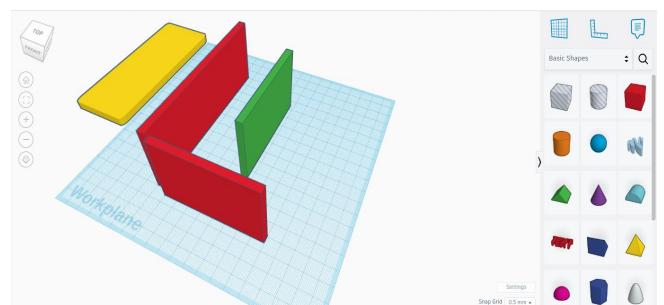
Step 2: Drag and drop the Box Shape from the basic shapes menu and change its dimensions to (130MMX50MMX5MM).



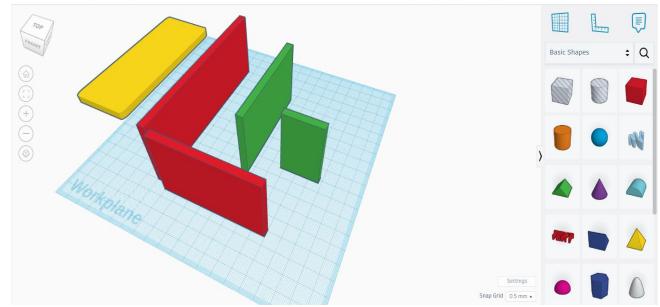
Step 3: Insert one more Box Shape and change its dimensions to (80MMX50MMX5MM) and rotate it to 90 Degrees as shown in the image.



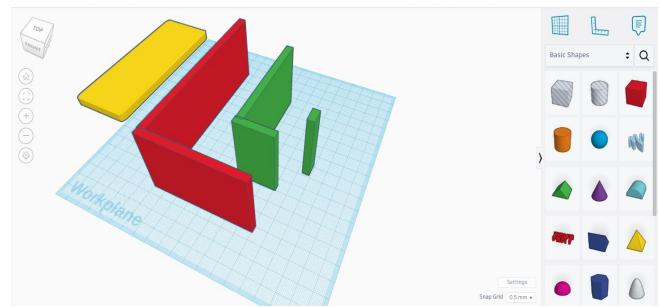
Step 4: Insert one more Box Shape and change its dimensions to (80MMX50MMX5MM) - Marked in Green Color for better understanding



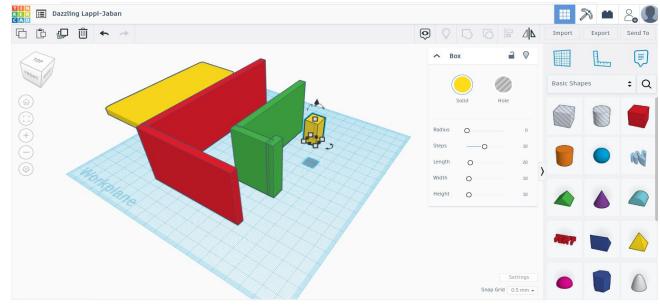
Step 5: Insert one more Box Shape and change its dimensions to (30MMX50MMX5MM.)



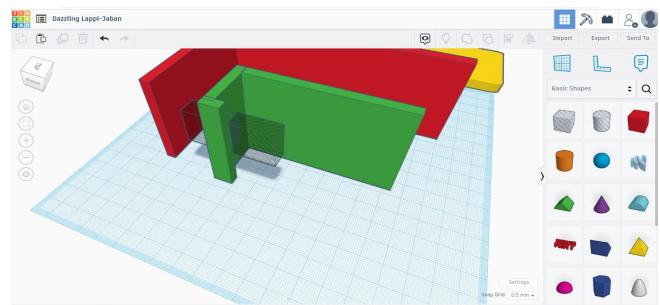
Step 6: Insert another Box Shape and change its dimensions to (10MMX50MMX5MM)



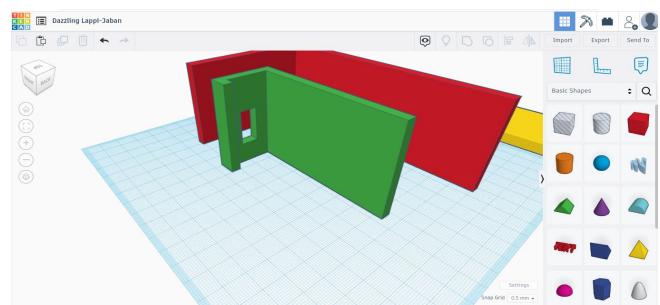
Step 7: Need to create a hole in the mobile holder for the charging cable, insert a small box shape (20MMX10MMX10MM). We need to subtract that from the green part.



For creating holes we need to change the box property from Solid to Hole



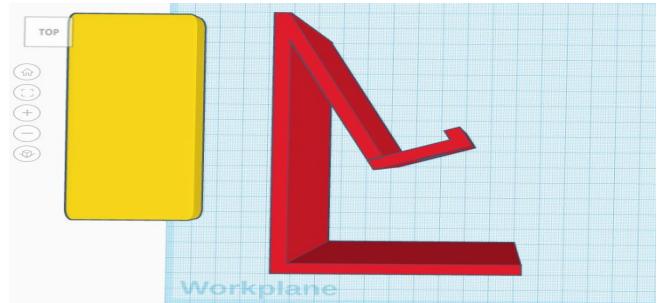
Step 8: Align and select all 3 parts of green part by pressing Ctrl + G (Shortcut for grouping)



Step 9: Rotate the green part and join with the mobile holder red part



Step 10: Select both Red and Green Parts and Group them (Ctrl+G)



Now the mobile holder is ready we can test with a dummy mobile 3D file (yellow color)



Step 11: Export the STL file and prepare Gcode using slicer software and 3D print it.

Source: tinkercad.com

AMAZING!



YOU HAVE SUCCESSFULLY COMPLETED THE ACTIVITY

Reflection and Learnings (9 mins):

1. Do you think we can 3D Print an Aeroplane? Analyse and write your thoughts on Pros and Cons of 3D Printing an Aeroplane.
2. How will you apply these skills outside class?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. Have you heard of the word sculpting? What do you think are the differences between sculpting and 3D Printing?

Try it yourself!

Using the concepts you have learnt so far, Try creating a simple gears as shown in the image.

Use the space to draw or write your reflections and learnings.

