Projects

3D pendant

Design a pendant to 3D print and wear.

Step 1 Introduction

In this project, you will use BlocksCAD to design a 3D pendant. The pendant uses a geometric design based on the ‘Flower of Life’, a design which is often found in historical art.

BlocksCAD is a 3D model editor that you can use in a web browser on a desktop computer or tablet. You drag and drop code blocks to design 3D models that can be exported for 3D printing.

If you have access to a 3D printer, then you can print your pendant. The pendant is small and only uses a little bit of filament, and it is quick to 3D print.

What you will make

The finished pendant looks like this:

The pendant has a hoop on top so that you can put it on a necklace or cord.

The pendant has a diameter of 40mm, plus the hoop for hanging. It is 2mm thick, so it will 3D print quite quickly.

After this project, you'll also be able to code your own design and create a custom pendant.

What you will need

Hardware

- A 3D printer, and filament in a colour of your choice
- A necklace or cord to hang the pendant on

Software

- This project can be completed in a web browser using BlocksCAD blockscad3d.com/editor (https://www.blockscad3d.com/editor)

What you will learn

- How to use `count` loops to create geometric patterns
- How to use `difference` blocks to create hoops from cylinders

Additional information for educators

If you need to print this project, please use the printer-friendly version (https://projects.raspberrypi.org/en/projects/blockscad-pendant/print).

Download the finished project code at:
https://rpf.io/p/en/blockscad-pendant (https://rpf.io/p/en/blockscad-pendant).

Step 2 Create a hoop

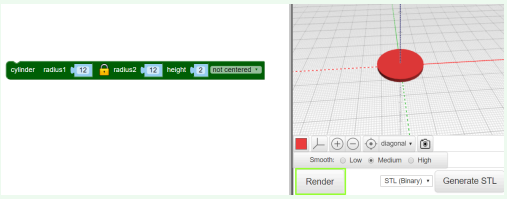
The design uses six interlocking hoops in the centre, and a larger hoop around the outside. The pendant is 4cm wide, plus the hoop for hanging. It is 2mm thick, so it will 3D print quite quickly.

First, make a single inner hoop.

Open the BlocksCAD editor in a web browser blockscad3d.com/editor/ (https://www.blockscad3d.com/editor/).

You can drag and drop blocks to write code to create 3D objects.

Create a `cylinder` with a radius of `12` and a height of `2` (the unit here is millimetres).



`Cylinders` are automatically centred along the X and Y axes. Select `not centered` so that the pendant sits on the surface. (This means that the Z axis value is larger than 0).

Click on the **Render** button after each change to your code to see the results.

Now, use `difference` to remove a smaller `cylinder` from the centre. This creates a hoop:

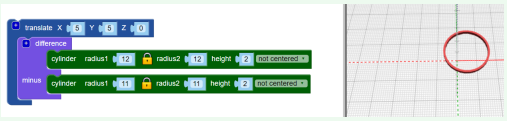
If you like, you can click on the coloured square to change the colour used in the viewer. This does not affect the colour of your pendant, as that depends on the colour of the filament that you use.

Step 3 Add more hoops

The design uses six intersecting hoops, and each hoop is moved out from the centre and rotated a different number of degrees.

In the final design, there is no central hoop: the hoops are all moved out from the centre.

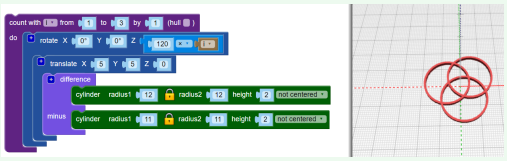
First, `translate` (move) the first hoop into position.



Now the hoop is a little off-centre.

You need multiple copies of this hoop, rotated around the centre. First, create three equally spaced hoops:

Add a `count` loop to create three hoops. To space the hoops, add a `rotate` block between the `count` loop and the `translate` block. `Count` sets the `i` variable from 1 to 3. `Rotate` moves each hoop by `120 × i` degrees, so the the three hoops are distributed equally around the 360 degrees of a circle (360 / 3 = 120).

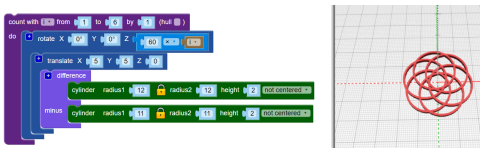


Look at the code and make sure you understand how it works.

The finished design has six hoops rather than three. Change your code so that it creates six equally spaced hoops.

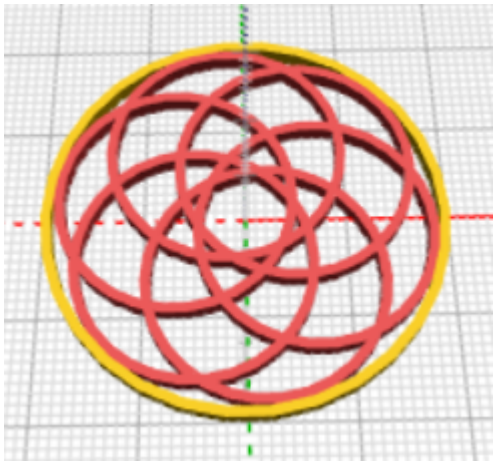
I need a hint

Your code should look like this:



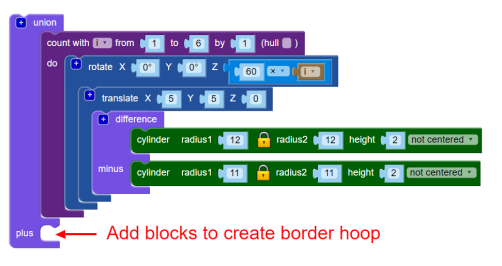
Step 4 Add a border

Next, add a border around the edge of the design.



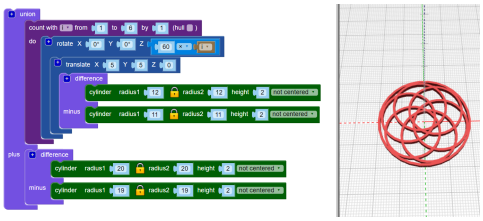
Create a centred hoop that touches the edges of the design. You can either do the maths to work out what the radius of the circle needs to be, or you can just create a circle and change the radius until it works. Either approach is fine!

Use the `union` block to join the border to the other hoops:



I need a hint

The radius should be around `20`. (In the introduction, it said that the finished pendant will be 40mm in diameter!)



You could also use maths to work out the diameter.

The diameter of each inner hoop is 24mm. If the hoops met at the centre of the pendant, then the border hoop would need to have a radius of 24mm. But the inner hoops overlap, because they are translated 5mm along the X and Y axes.

This removes a section from the radius. This section is on the arc, 5mm from the origin, so we know that we need to remove 5mm from 24mm. This means that the inner radius of the border hoop should be 19mm.

Maths is really useful when you need to be accurate. But it's fine to just change things until you get the result you need.

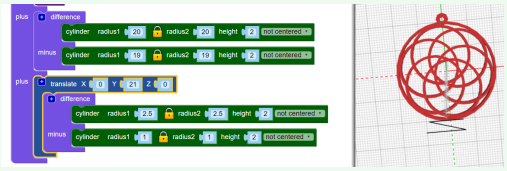
Step 5 Add a hanging hoop

Now, add a small hanging hoop through which you can thread a cord to make a necklace.

Tip: This code adds a small hoop that can be used with elastic necklace thread. If you have a bigger cord or chain, you can adapt the code to create a bigger hanging hoop.

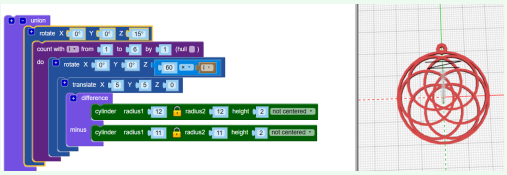
Add a small hanging hoop that you can put a thread through.

Click the `[+]` on the `union` block to add another section.



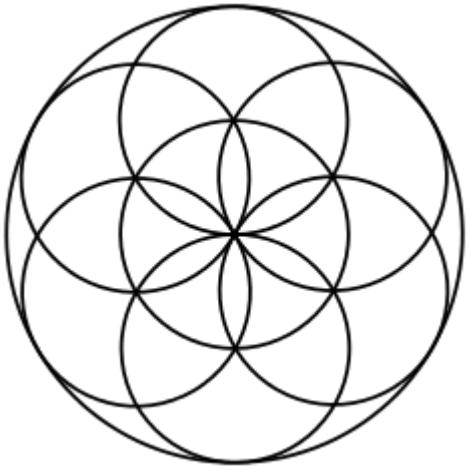
At the moment, the position of the hanging hoop isn't very visually pleasing.

Add a `rotate` block to move the inner hoops so that the hanging hoop is centred over one of the gaps between them.



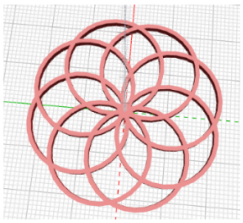
Step 6 Challenge: Change the pendant

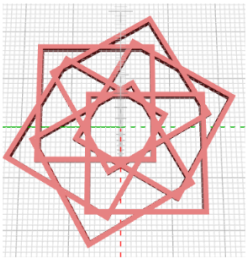
The design is influenced by the ‘Flower of Life’ pattern. If you like, you could research the ‘Flower of Life’ and see if you can create a design based on the ‘Seed of Life’ pattern.



Experiment and change some values in your pendant. For example, change the number of hoops, or the rotation.

You could also try to use cuboids (cubes) instead of cylinders to create a pattern.





Step 7 3D print and assemble your pendant

BlocksCAD 3D can export an `.STL` file for 3D printing.

- [ ] Render your model and then click **Generate STL**. Remember where you save the STL file.

- [ ] 3D print your pendant using a filament of the colour of your choice.

- [ ] Very carefully remove the 3D print from the print bed. The pendant is thin, so it's quite delicate.

- [ ] You might need to remove small strands of filament (especially from the hanging hoop) to tidy up the print.

- [ ] Thread the pendant on a chain or cord. If you want to use a thicker cord or necklace, then you can adjust the design to have a larger hanging hoop.

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(https://github.com/RaspberryPiLearning/blockscad-pendant)