Calculating Max Print Size

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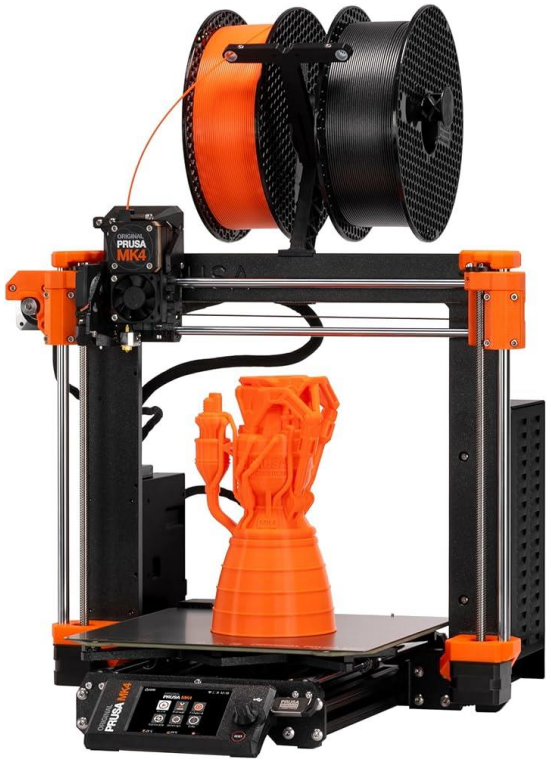
3D Printing

- I am currently employed as an Engineering Intern and have been using a 3D printer a lot. I have one at home but always just printed toys. At work, I am using it to print and design parts for projects and manufacturing.
- However, when designing parts I want very precise measurements. I use calipers and the slicer does not let me go past build plate zone but that does not help me.

3D Printers



Options

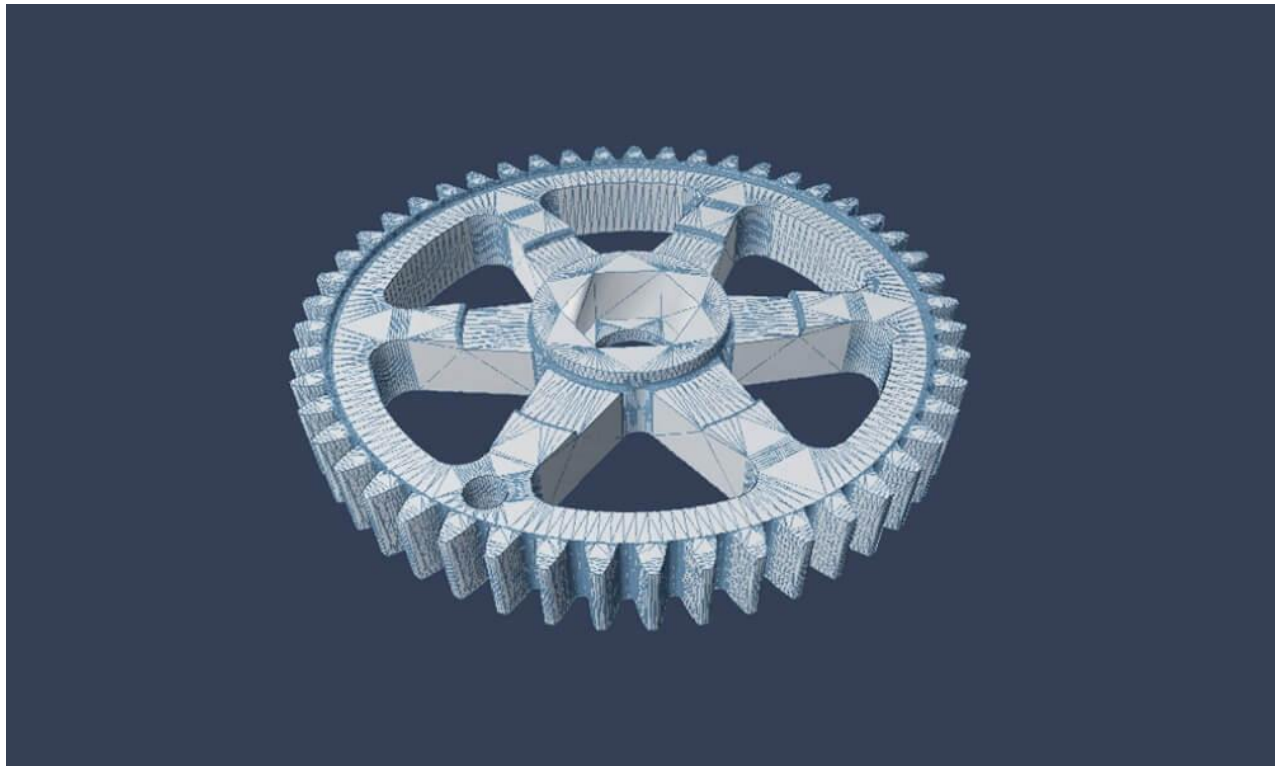
- Here, we have a few 3D printer options. They all print the same material, but some are used for different applications. Currently, for my project I am using the Creality K1C.
- The printer specs are, 600mm/s speed,

20000mm/s^2 acceleration, and a 220x220x

250mm^2 build size.

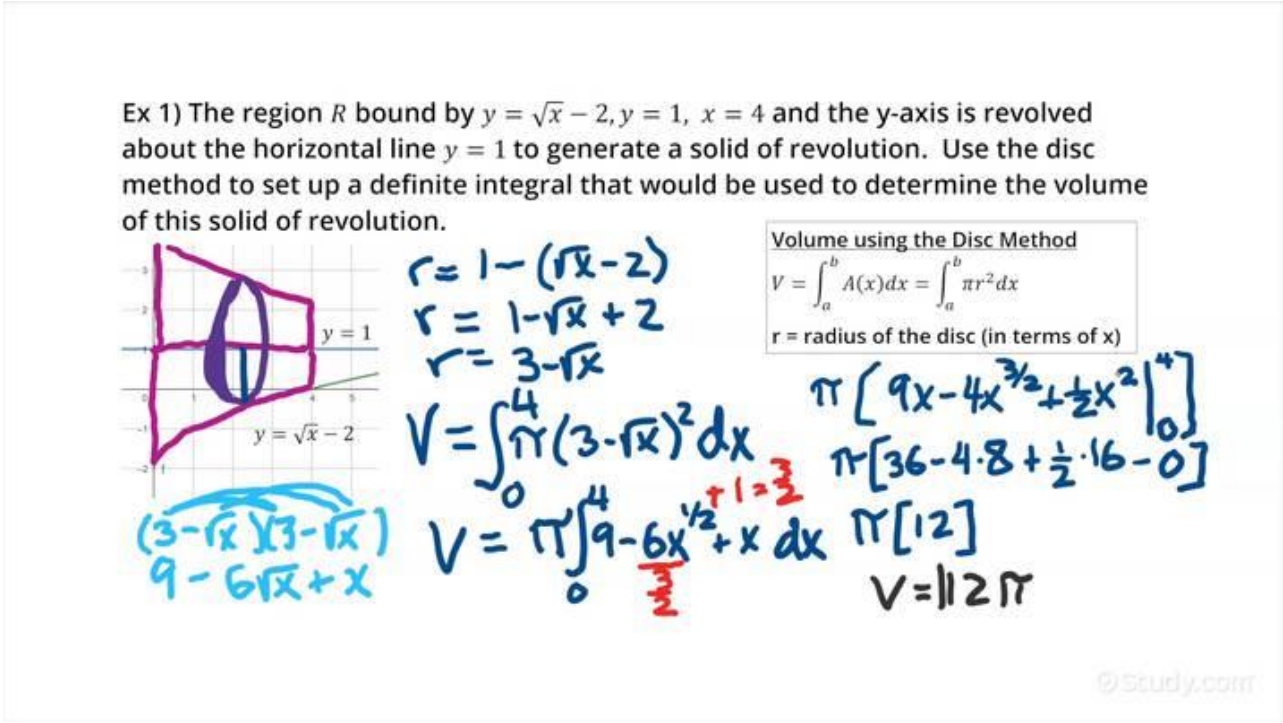
Volume of Solids of Revolution

- Using this method I can measure the max print size for any shape.



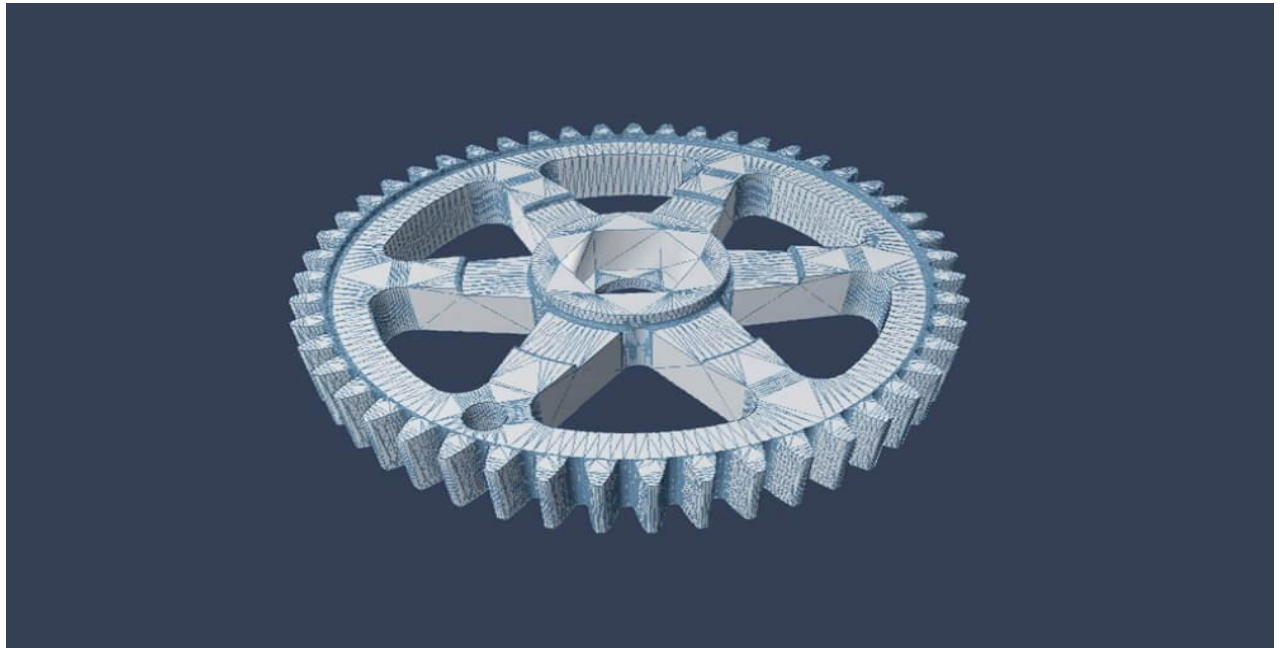
What is Volume of Solids of Revolution

- Using this method. I can find a volume of a 3-dimensional shape by rotating a 2-dimensional curve around an axis.
- This can either be a disk method or a washer method depending on the axis of rotation used.



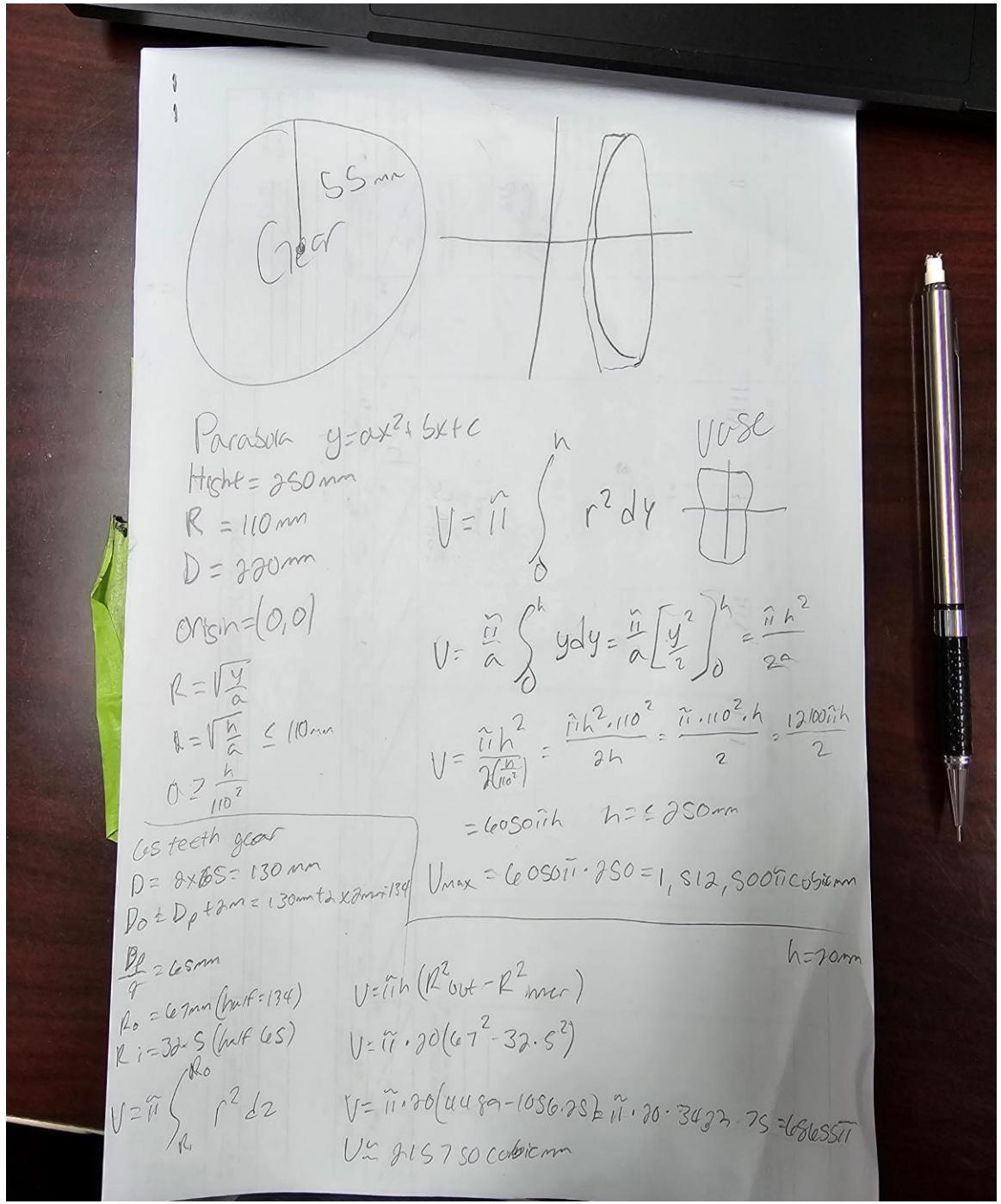
Finding Print Size

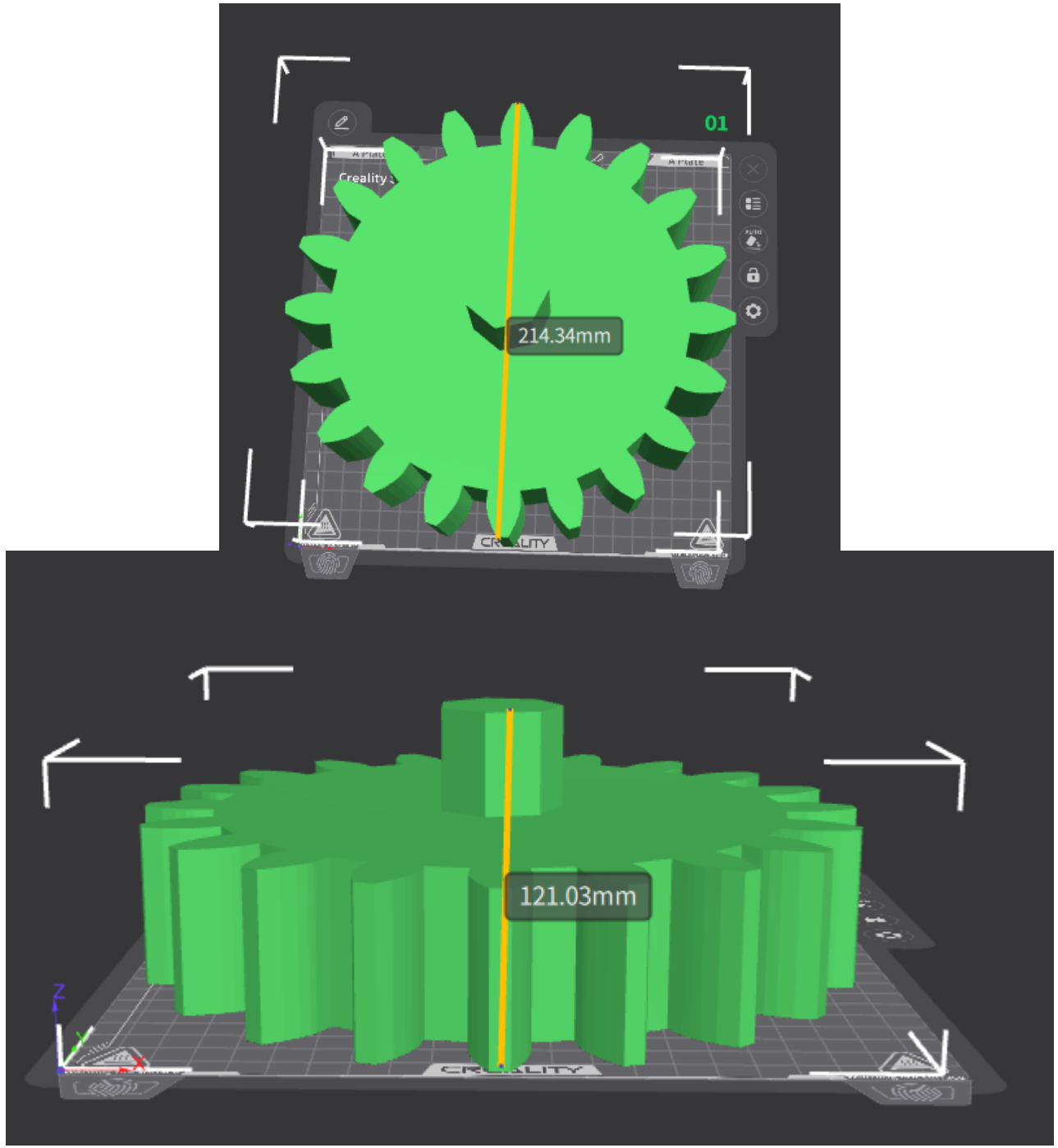
- I am wanting to print a large gear with many teeth used in my internship project
- This gear will be used for 3 turn ratio for a paint applicator.
- Again my bed size is 220x220x250mm^3



Vase / Gear

- Using this method I can calculate max cubic mm size for a vase and or a gear.
- This purpose I am wanting to print a gear. Doing this I can figure out I can print volume I can print with certain constraints being air.


55 mm
Gear
Parabola $y=ax^2+bx+c$
Height = 250 mm
R = 110 mm
D = 220 mm
origin = (0,0)
$R=\sqrt{\frac{y}{a}}$
$h=\sqrt{\frac{h}{a}} \le 110mm$
$0 \ge \frac{h}{110^2}$
$V=\pi\int_0^h r^2\,dy$
Vase
$V=\frac{\pi}{a}\int_0^h y\,dy=\frac{\pi}{a}\left[\frac{y^2}{2}\right]_0^h=\frac{\pi h^2}{2a}$
$V=\frac{\pi h^2}{2\left(\frac{h}{110^2}\right)}=\frac{\pi h^2 \cdot 110^2}{2h}=\frac{\pi \cdot 110^2 \cdot h}{2}=\frac{12100\pi h}{2}$
$=6050\pi h \quad h=\le 250mm$
$V_{max}=6050\pi \cdot 250=1,512,500\pi$ cubic mm
65 teeth gear
$D=8\times65=130$ mm
$D_o \pm D_p \pm 2m = 130mm \pm 2\times2mm = 134$
$\frac{D}{2}=65mm$
$R_o=67mm$ (half = 134)
$R_i=32.5$ (half 65)
$V=\pi\int_{R_i}^{R_o} r^2\,dz$
h = 20mm
$V=\pi h(R^2_{out}-R^2_{inner})$
$V=\pi\cdot20(67^2-32.5^2)$
$V=\pi\cdot20(4489-1056.25)\pm\pi\cdot20\cdot3432.75=68655\pi$
$V=215750$ cubic mm


01
214.34mm
121.03mm

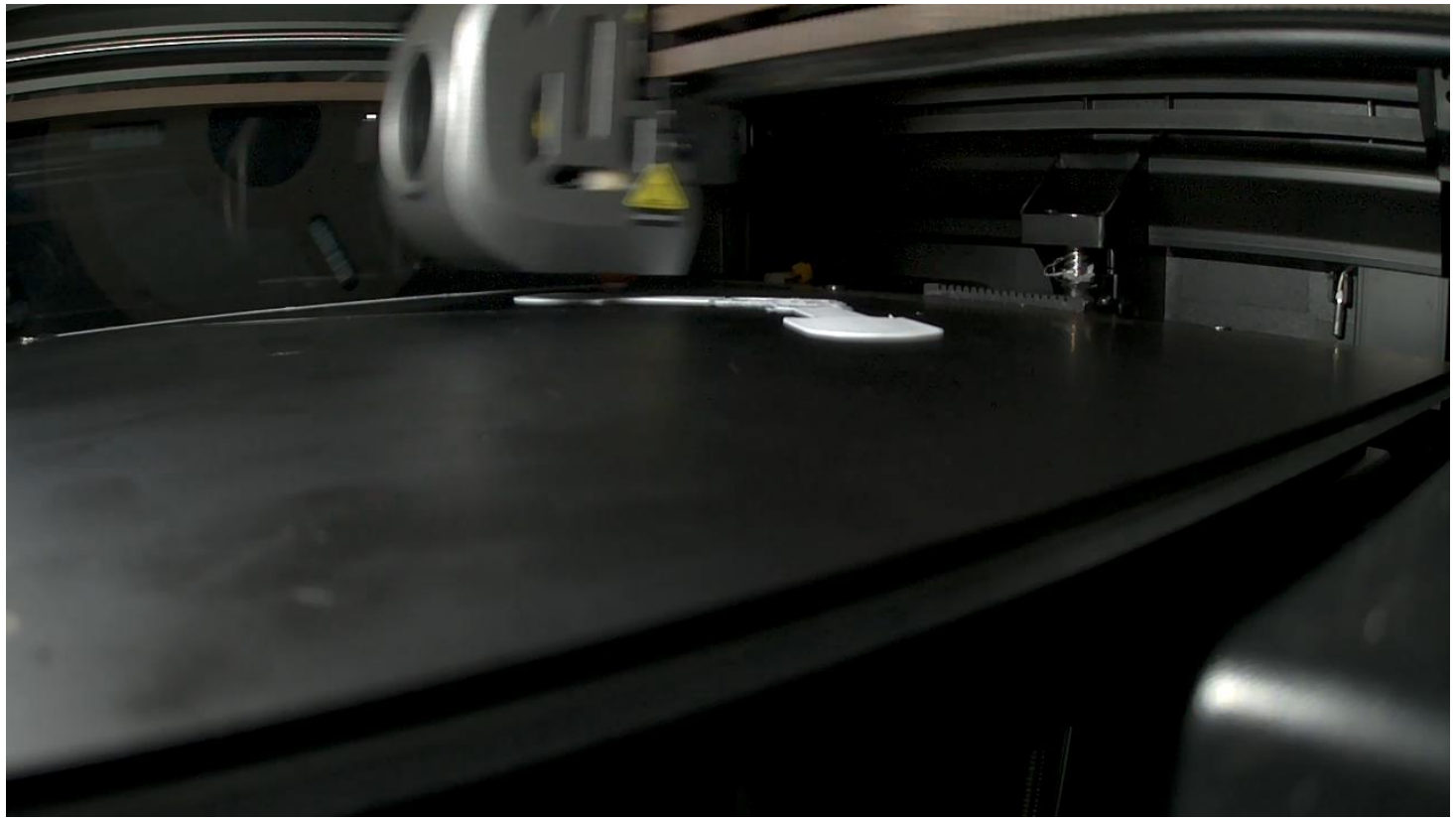
Calculation

- Converting the slicer plate height and length.
- Height = 4.7in or 77019 cubic mm
- Length = 8.4in or 137651 cubic mm
- Total = 214670 cubic mm

- My calculation was off slightly in the last slide because on the slicer plate there are about 15 decimal remainders.
- In the last slide I obtained max size being 215750 cubic mm
- Difference being 0.06590564inches

- Using volume of solids of revolution I can conclude that is does help me find the max print size using any printer as long as I know the build plate size.

- A few time lapse of project parts



What a failed print looks like