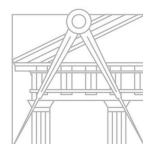


MODELAÇÃO GEOMÉTRICA E GENERATIVA



20241201

LEILA BLUE VAN
ELSWIJK



ÍNDICE

SUMÁRIO:

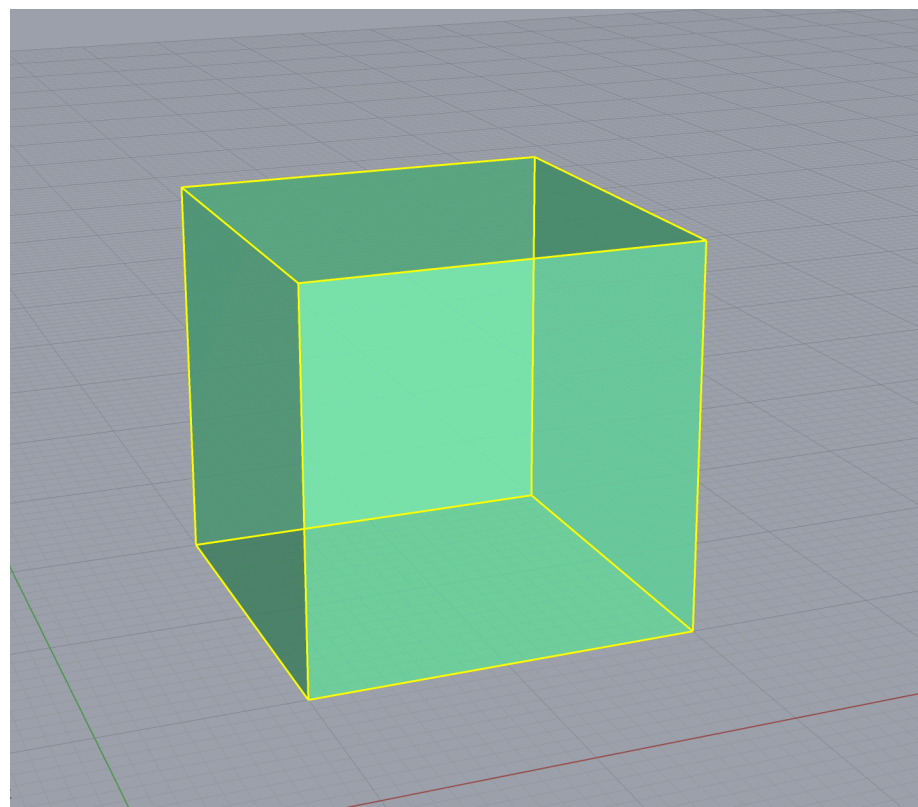
APRESENTAÇÃO



SUMÁRIO:

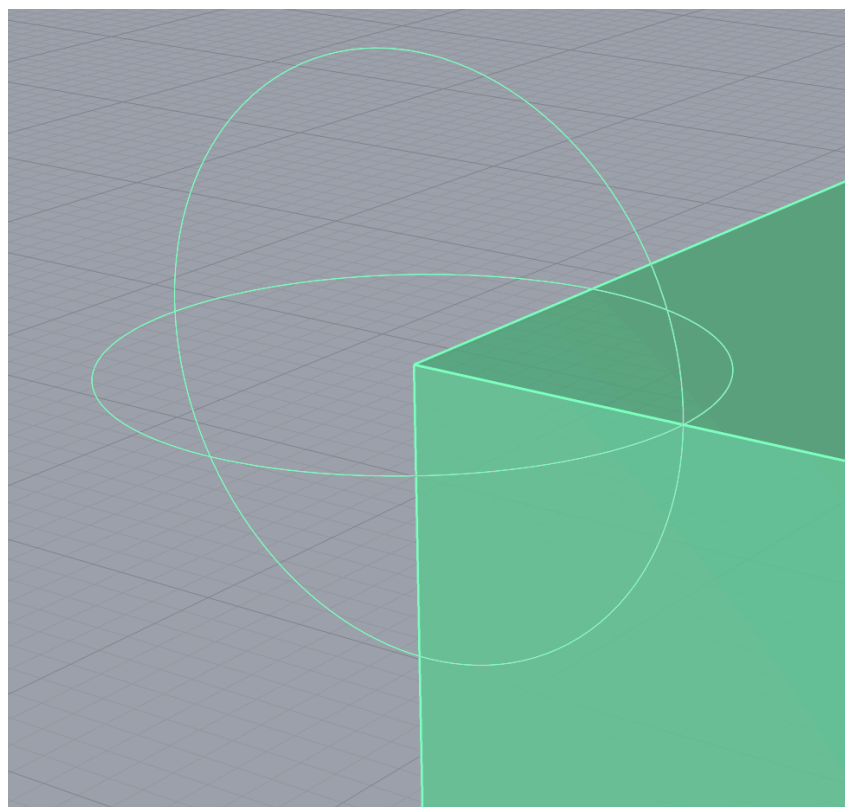
- Introdução RHINO;
- Cubos truncados

1º



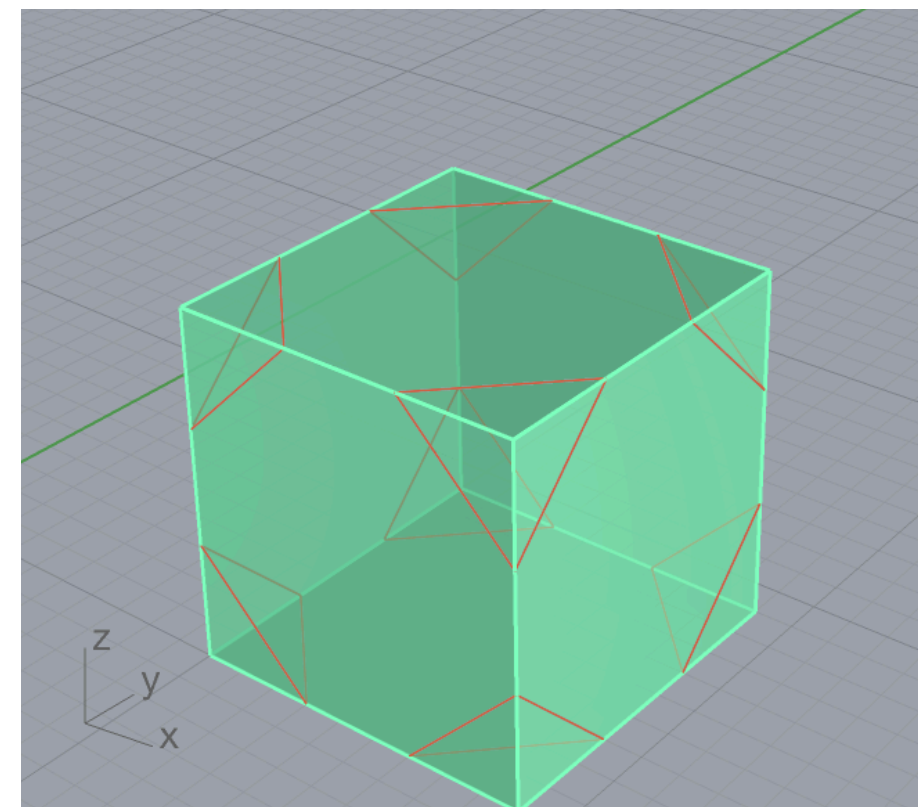
Fazer uma box(9*9*9)

2º

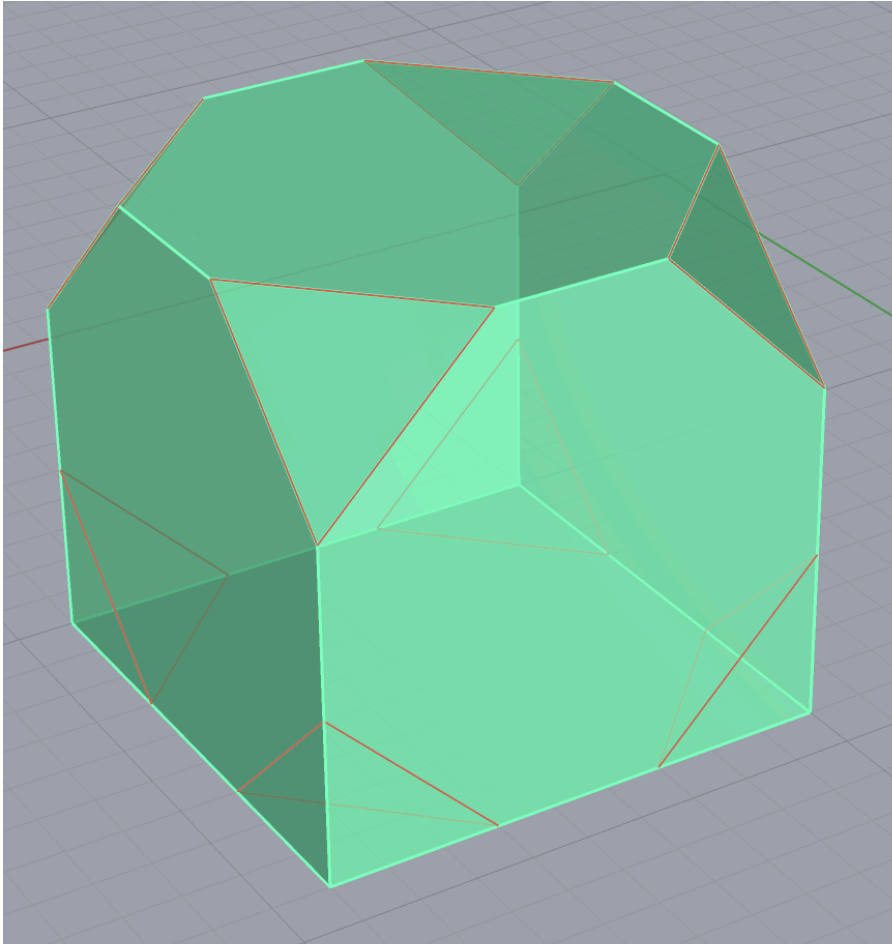


Fazer 2 circulos com 3 raio
numa aresta. (para encontrar
1/3)

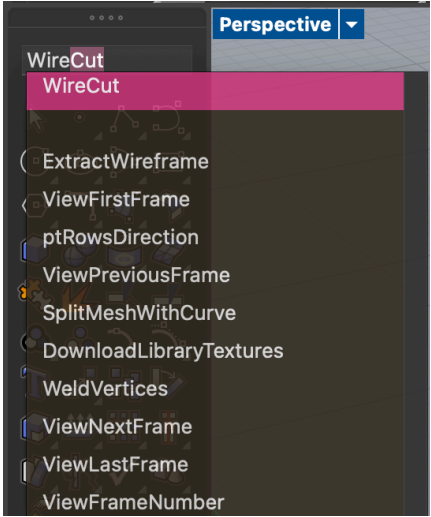
3º



Desenhar triângulos em polyline e
fazer mirror para todas as arestas
do cubo.

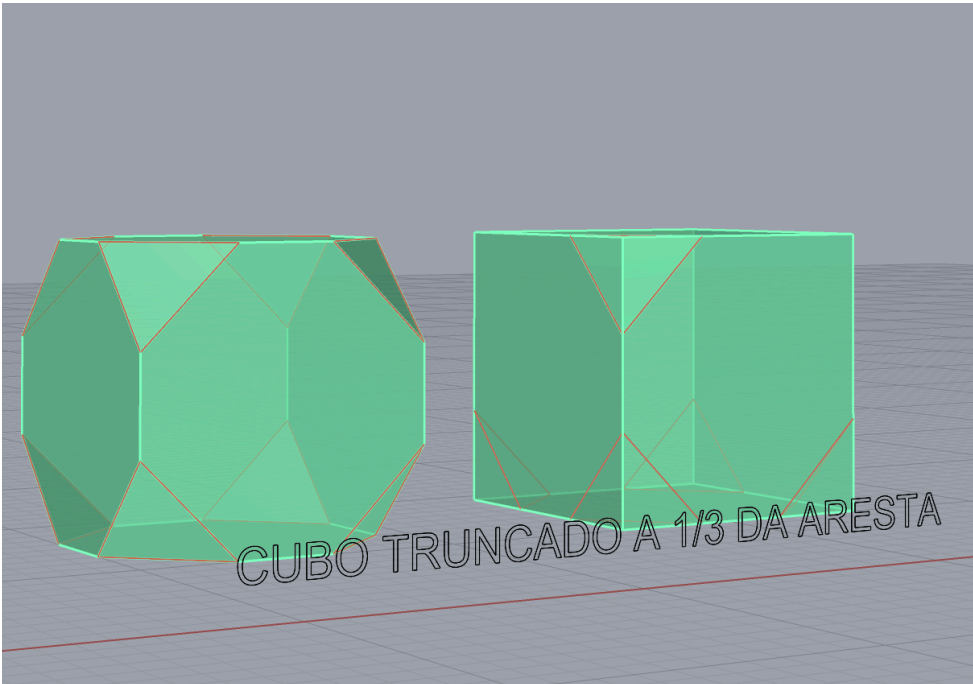


Usar comando “WIRECUT” para cortar o cubo pelos triângulos e retirá-los.

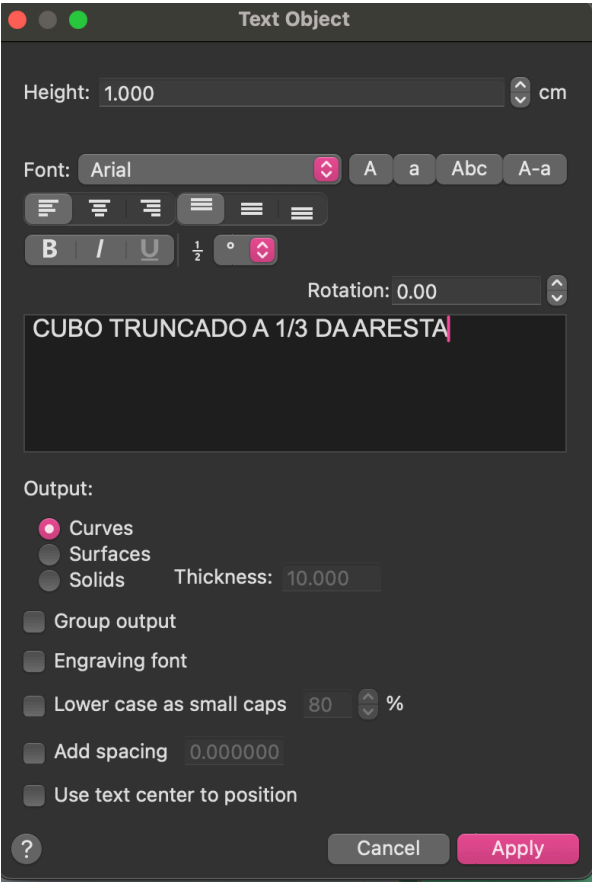


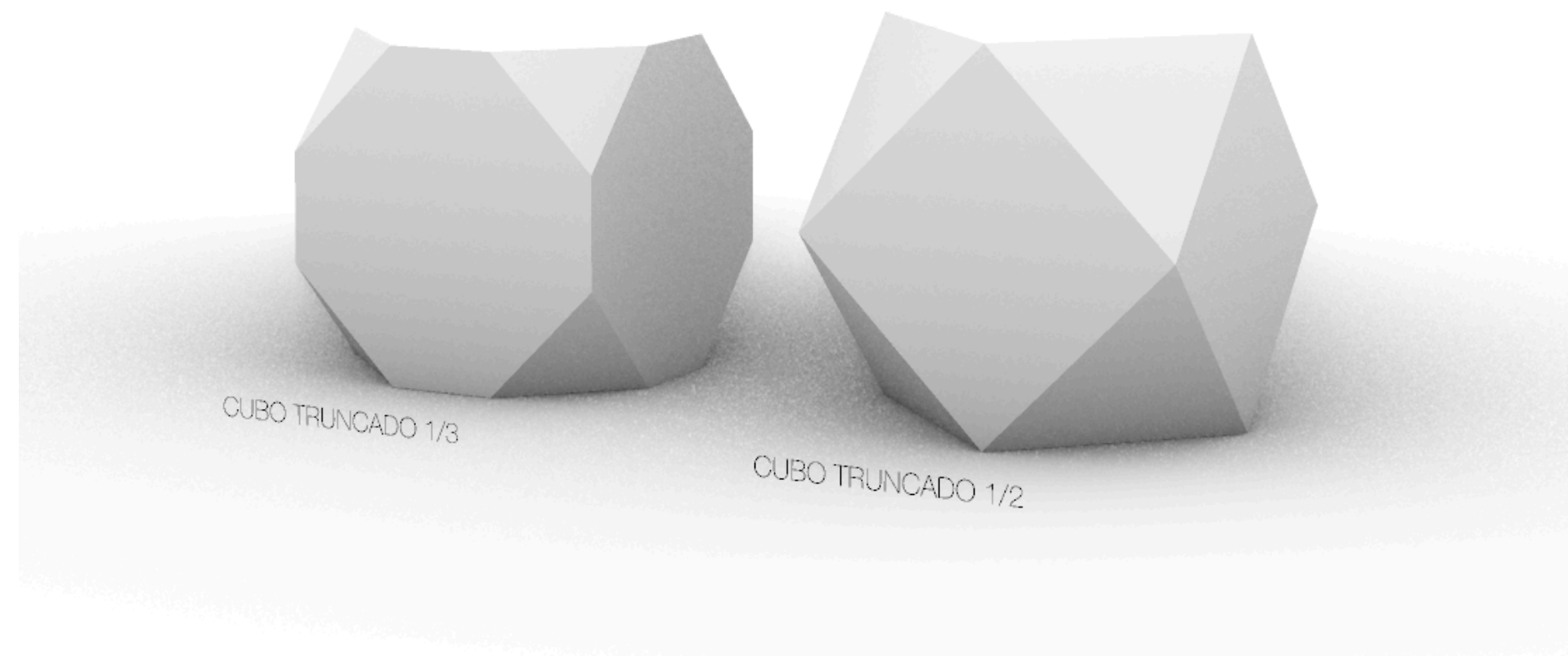
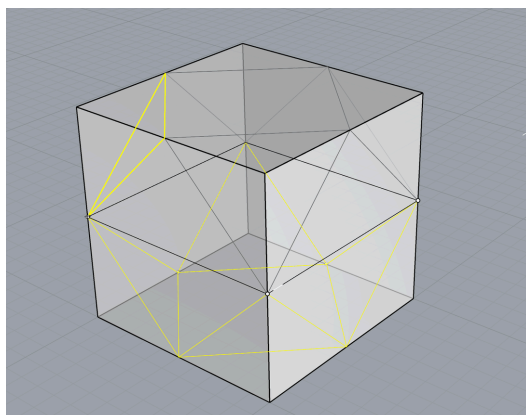
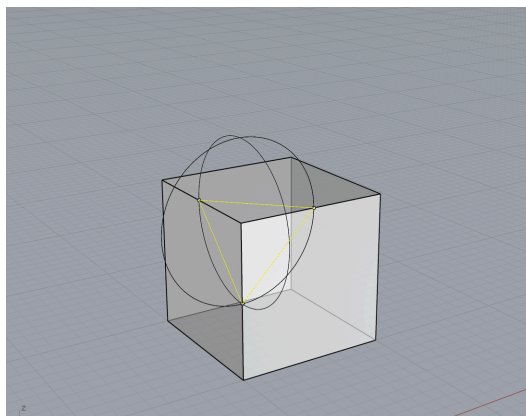
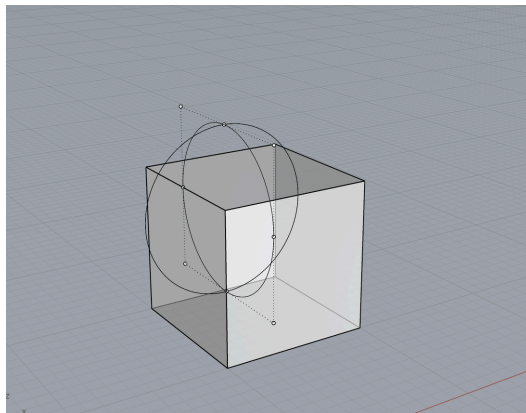
4º

5º

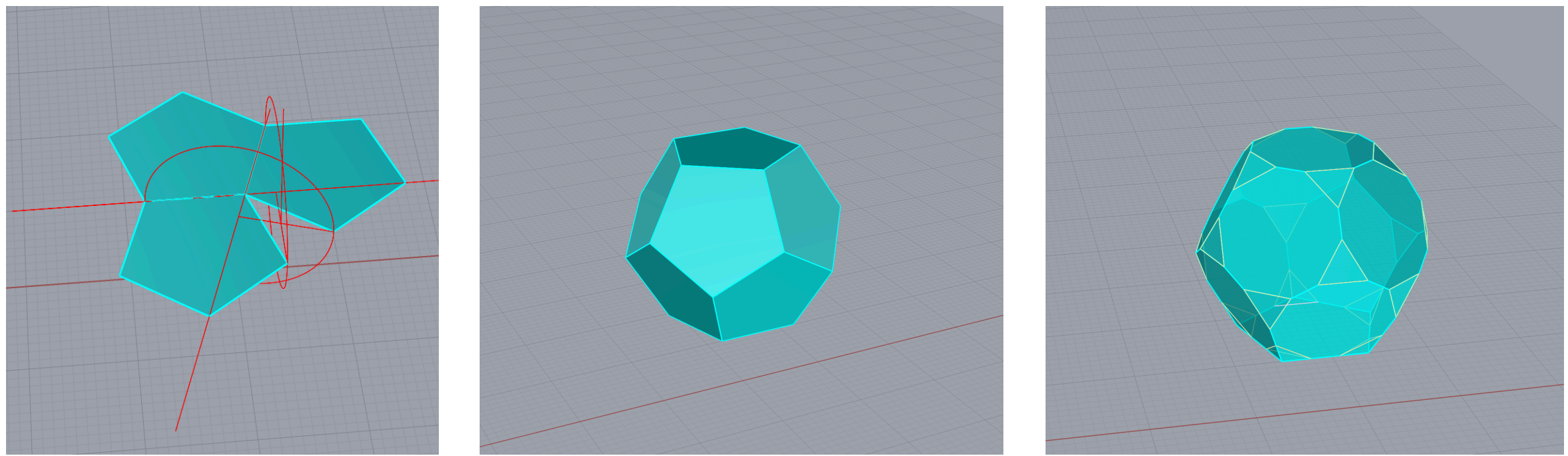


Inserir “TEXT” e usar “ROTATE3D” - 90º

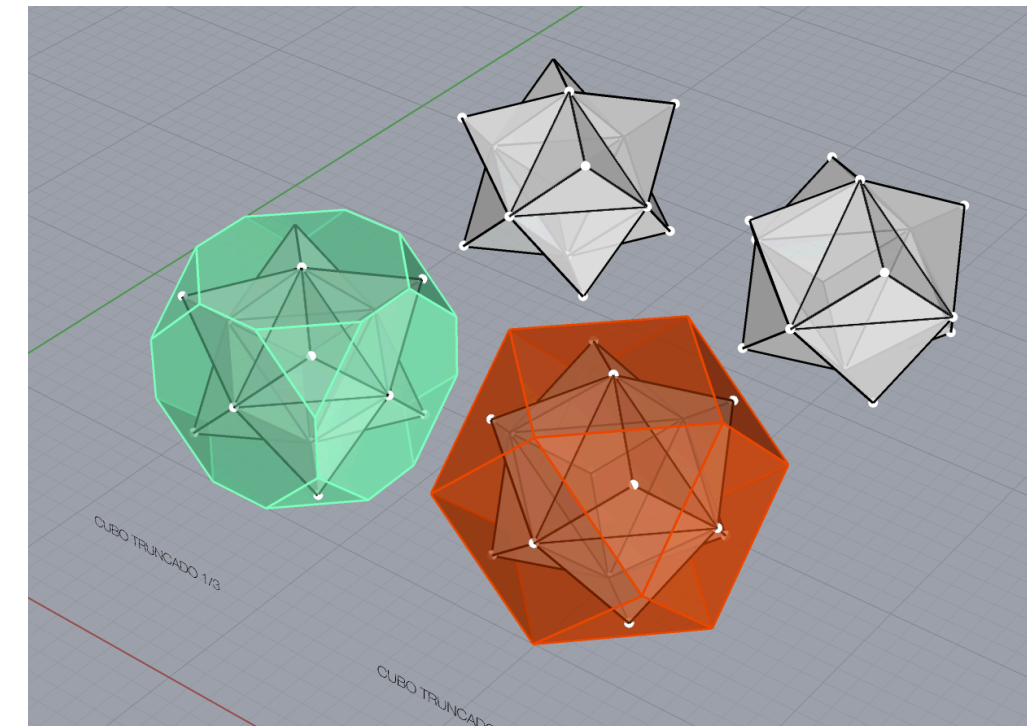
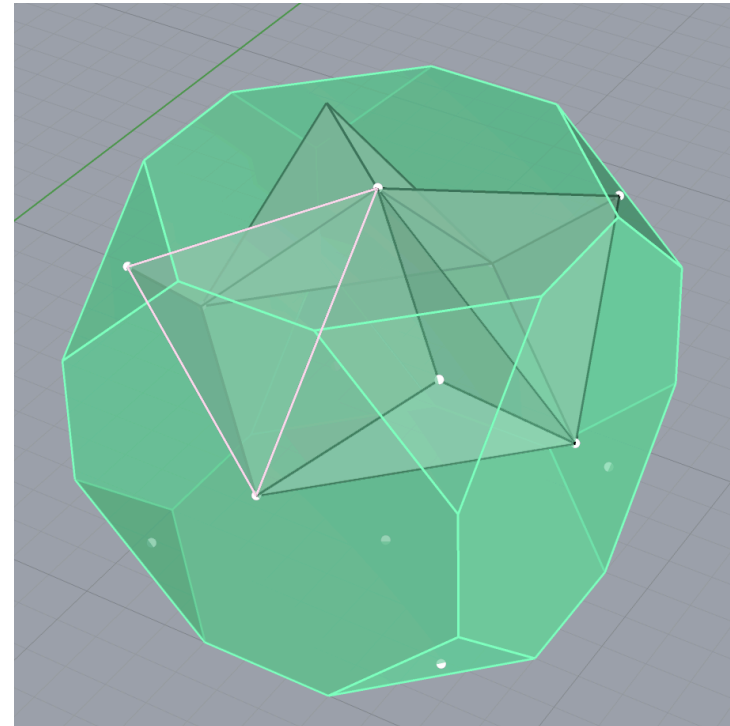
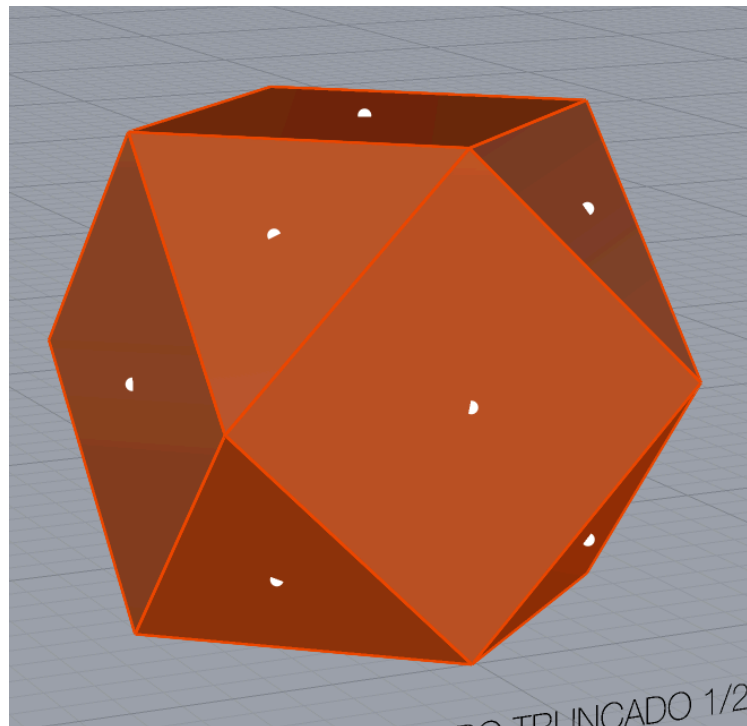


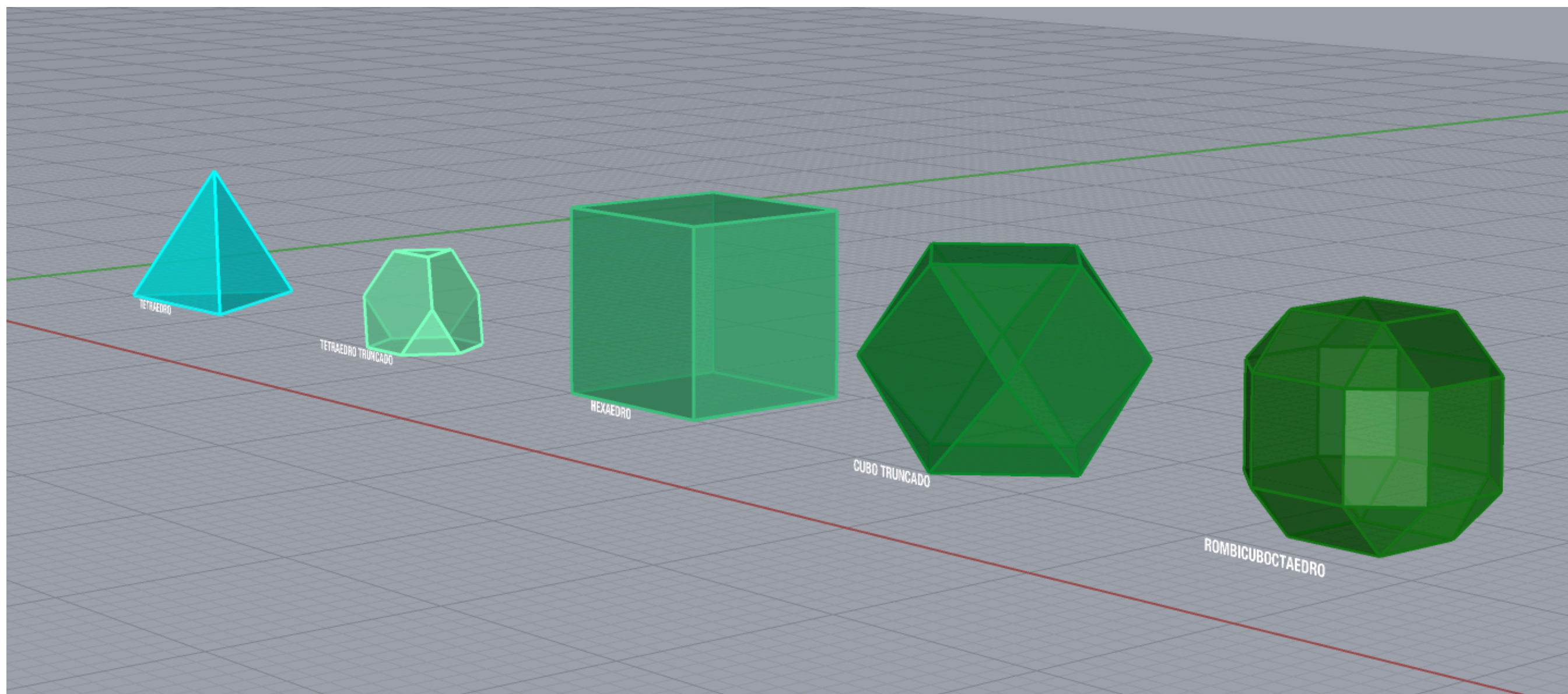


construção do DODECAEDRO

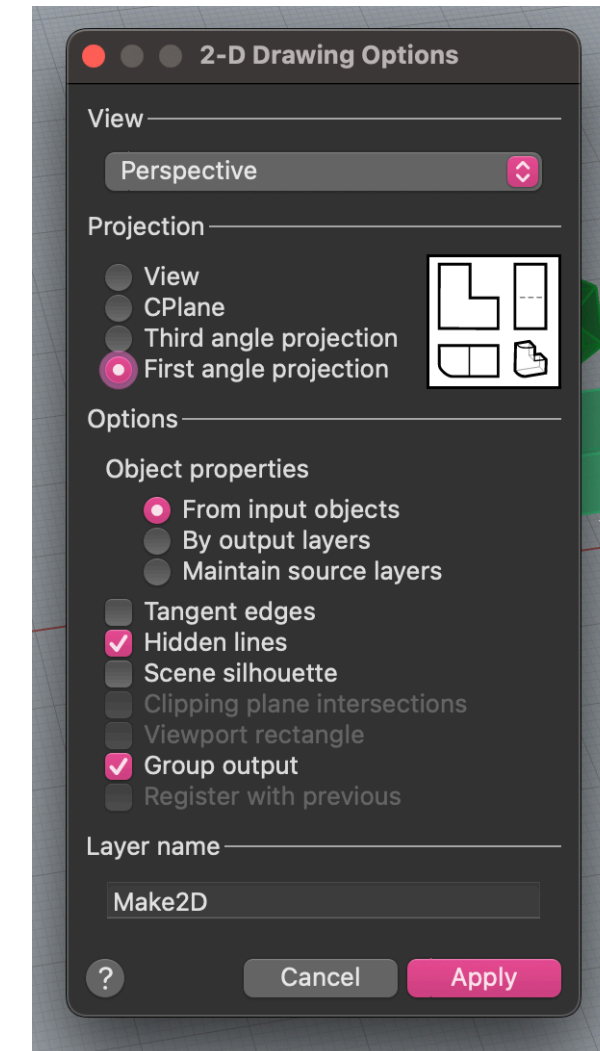
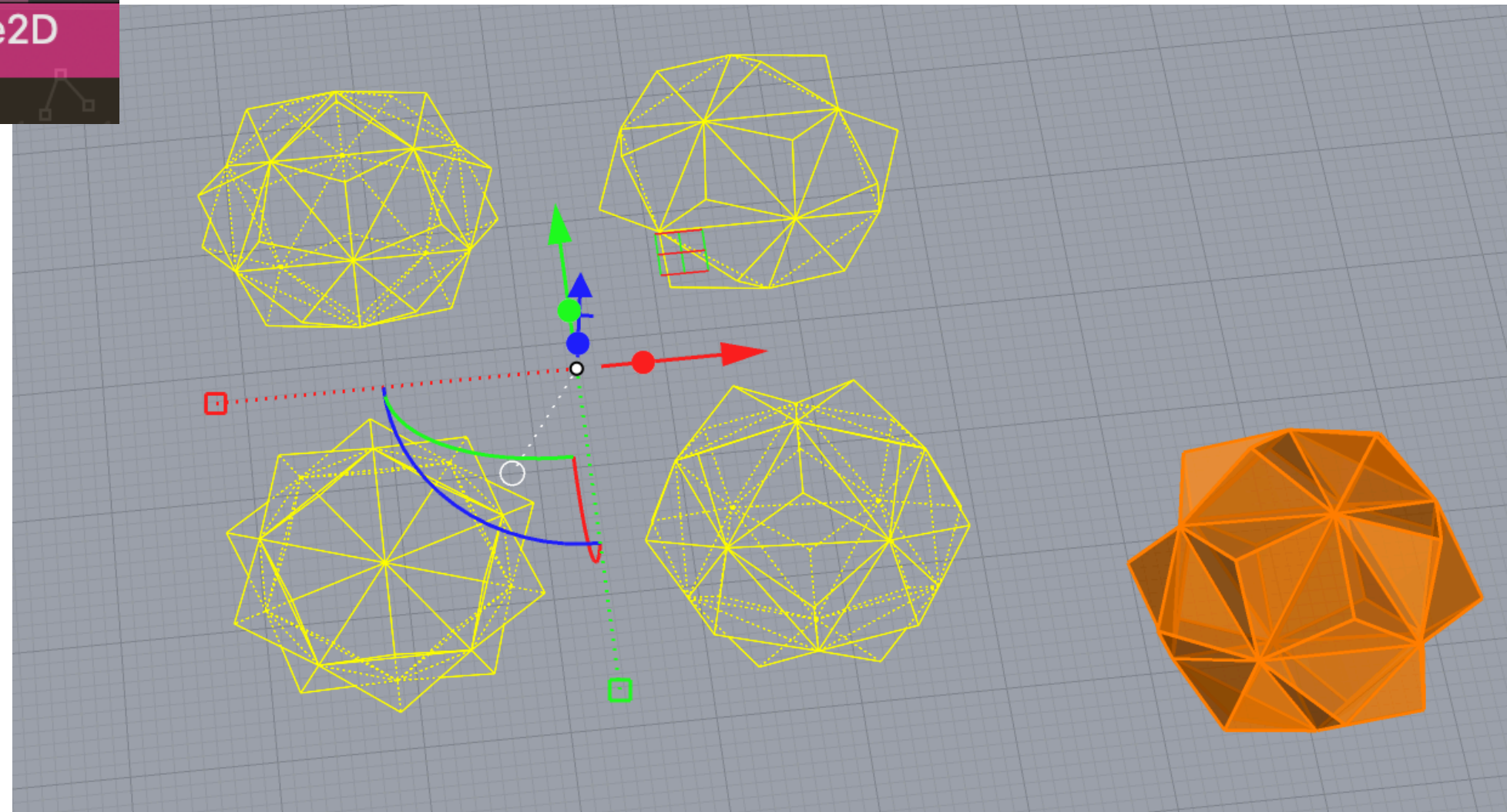
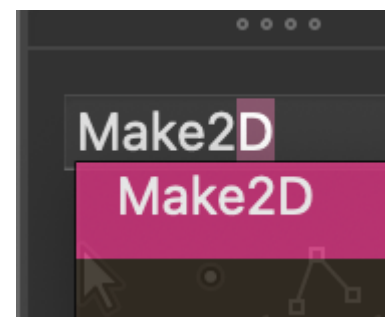


CRIAÇÃO DOS DUAIS DOS CUBO TRUNCADOS

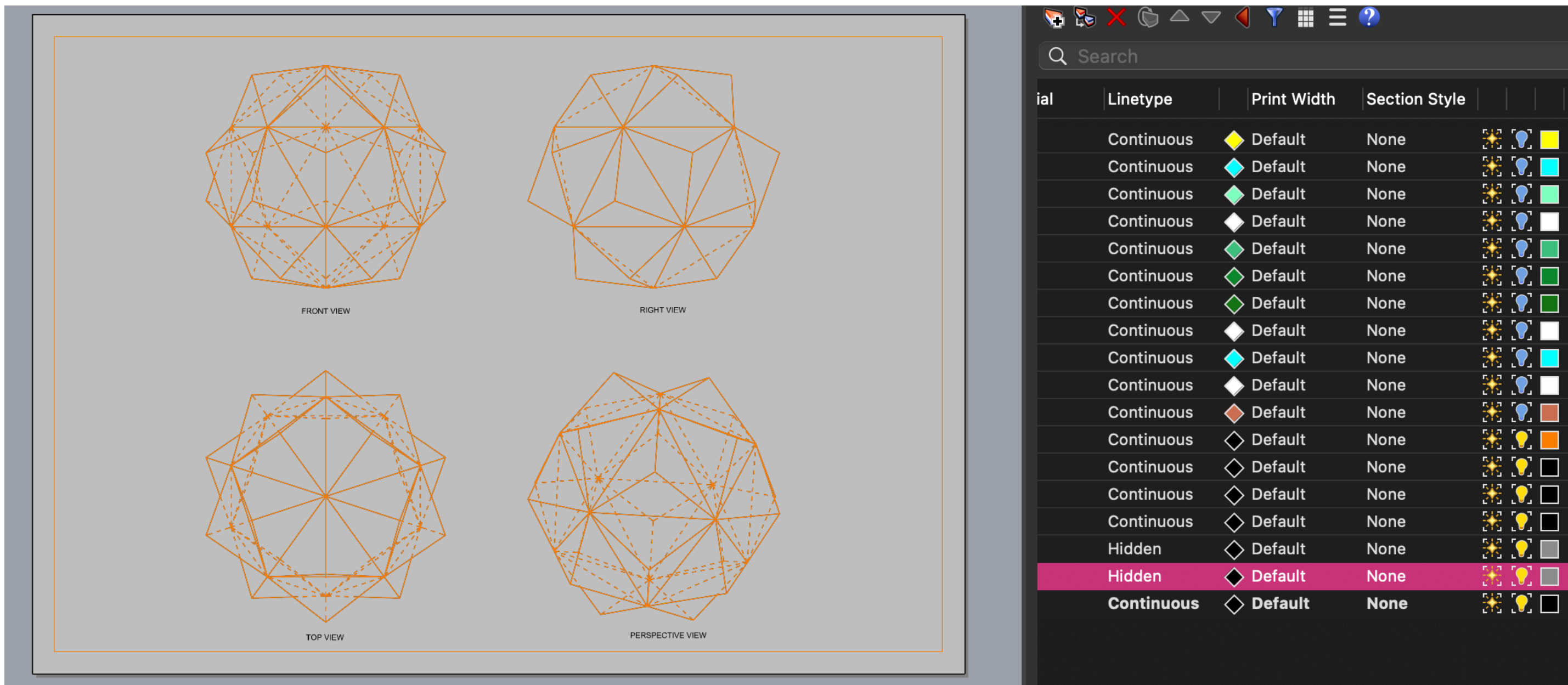


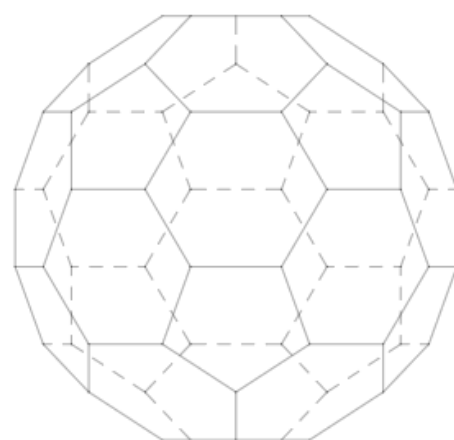


REPRESENTAÇÃO EM 2D:

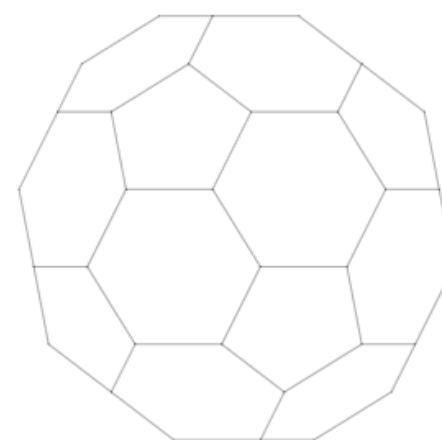


- 1º Selecionar objeto
- 2º comando MAKE2D
- 3º properties (first angle projection faz as 4 vistas)

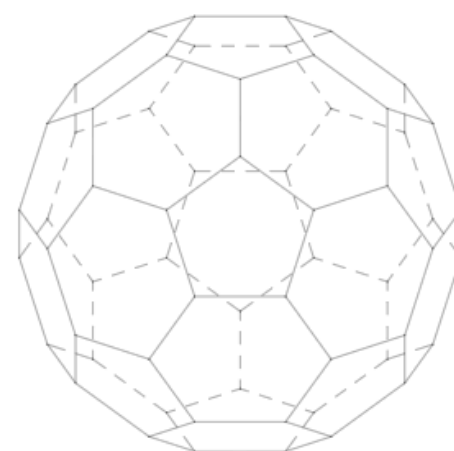




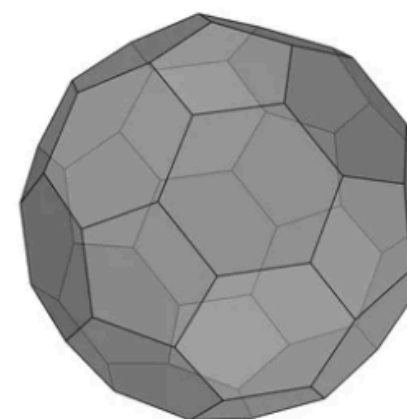
FRONT VIEW



RIGHT VIEW



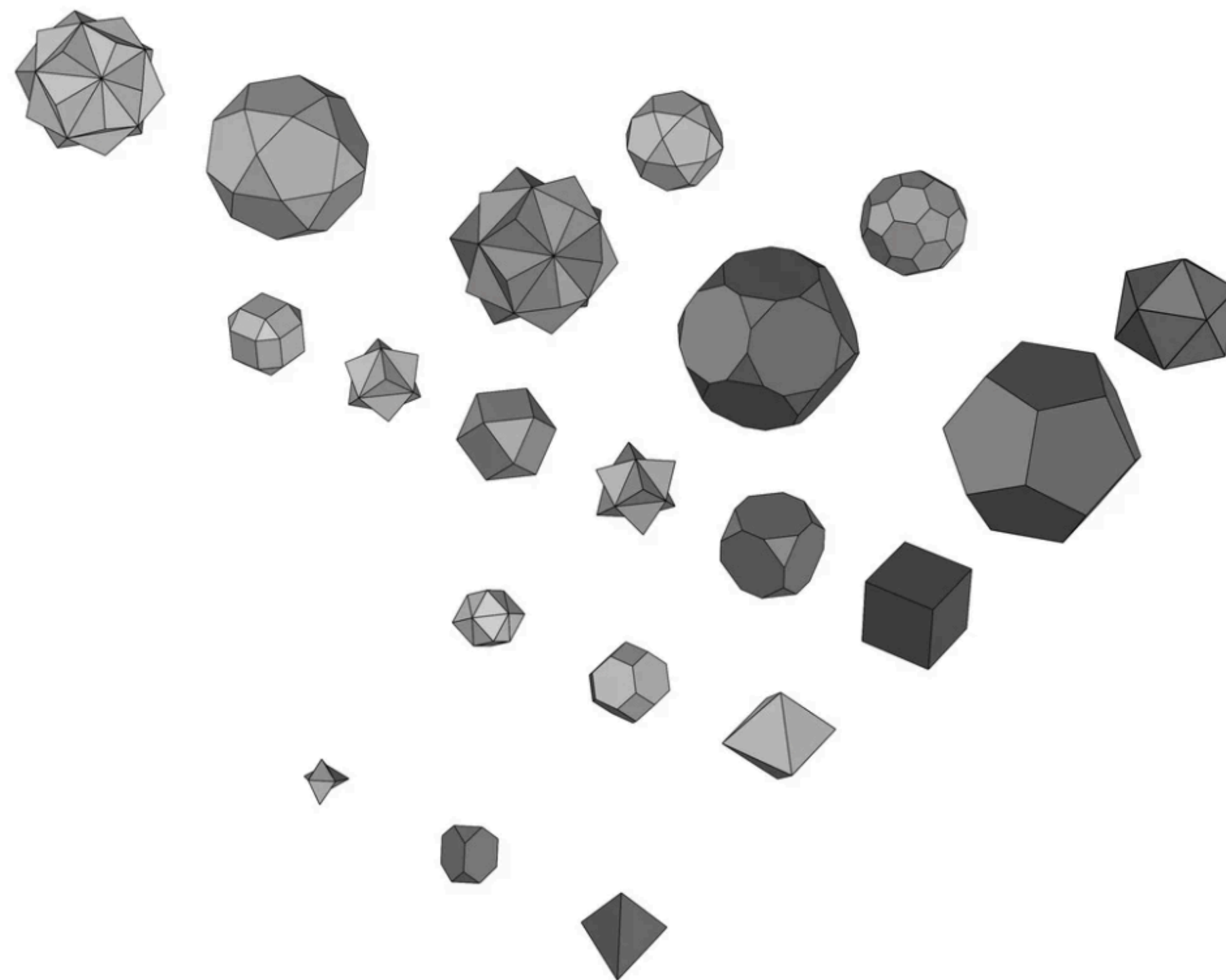
TOP VIEW



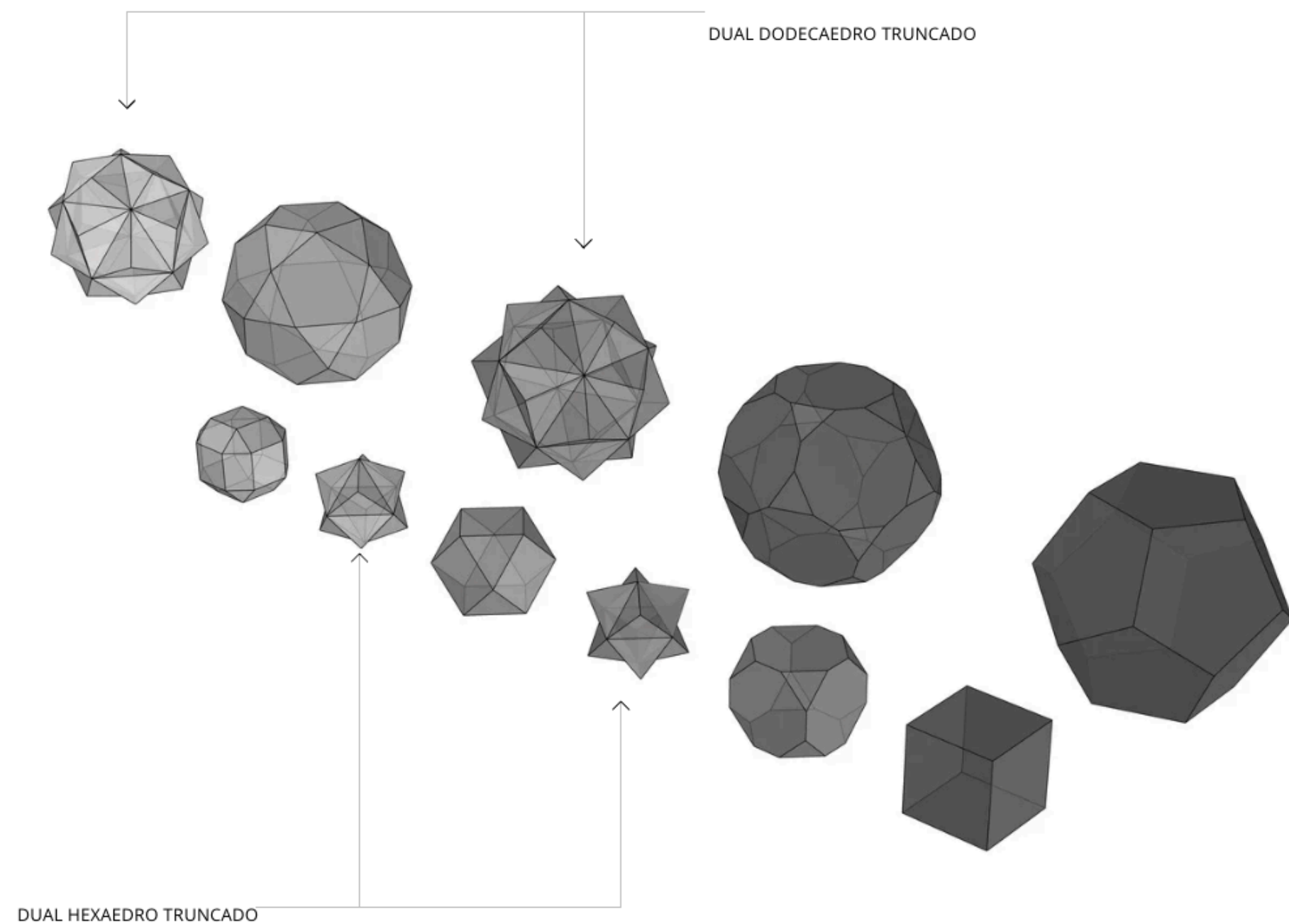
PERSPECTIVE VIEW

**ICOSAEDRO TRUNCADO
A 1/3 DA ARESTA**

1:2



Sólidos produzidos



Ao comparar os sólidos modelados, reparei que o dual do hexaedro truncado a $1/2$ e a $1/3$ resulta exatamente na mesma forma, tal como acontece com o dodecaedro truncado a $1/3$ e a $1/2$. Isto acontece porque o dual é construído a partir dos centros das faces do sólido original, cuja posição se mantém independentemente do tamanho da truncagem.

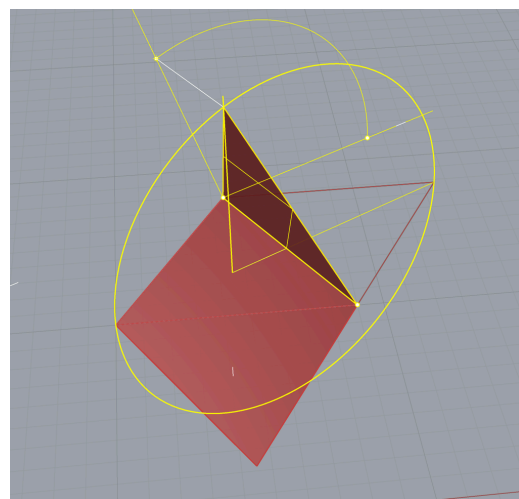


fig. 1

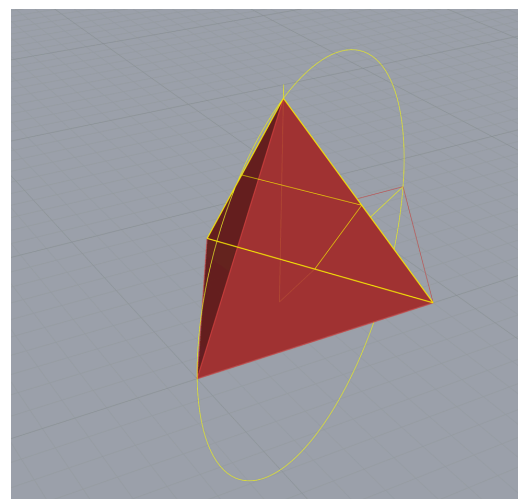


fig. 2

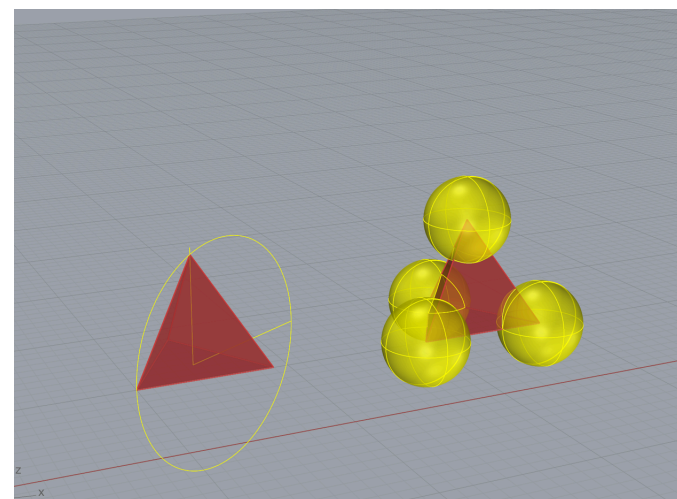


fig. 3

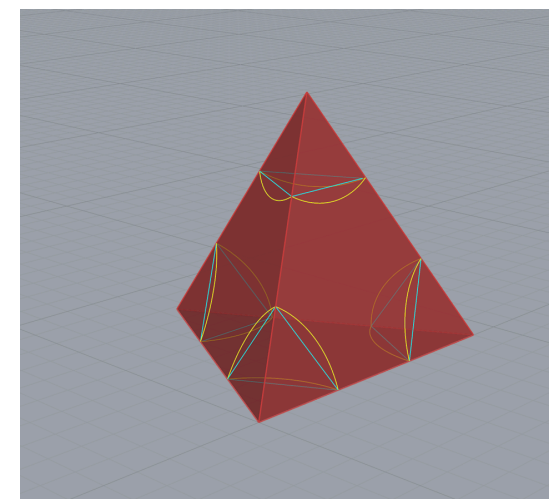


fig. 4

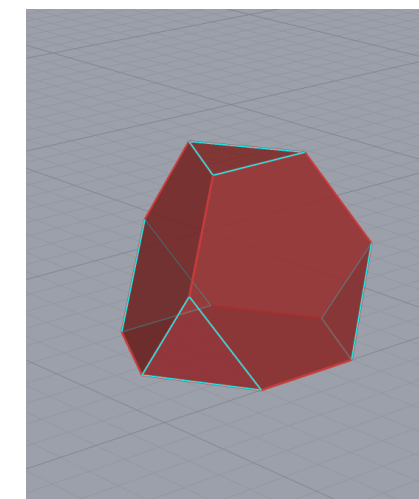


fig. 5

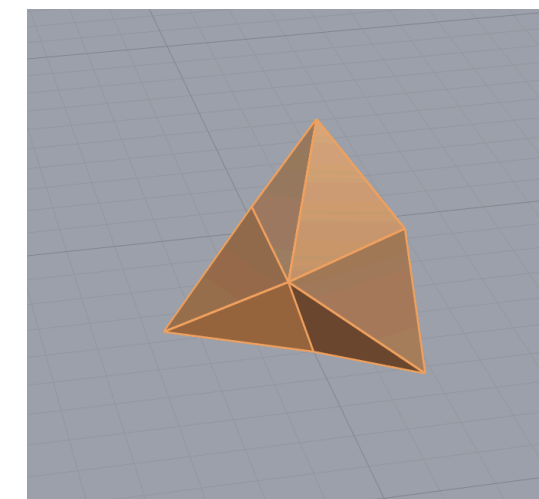


fig. 6

O tetraedro foi criado a partir da junção de três triângulos equiláteros. Para tal, foram inicialmente desenhadas linhas auxiliares que permitiram definir corretamente a geometria da forma. Posteriormente, os triângulos foram posicionados no espaço utilizando o comando **ROTATE3D** (fig.1) e organizados através do **ARRAY POLAR**, permitindo construir o sólido tridimensional (fig.2).

A partir desta forma base, foi desenvolvido um tetraedro truncado a 1/3 da aresta. Este processo foi realizado através da criação de esferas com 3 cm de raio (fig.3), posicionadas nos vértices do tetraedro. A interseção destas esferas com as arestas gerou novos triângulos (fig.3), que posteriormente foram removidos utilizando o comando **WIRECUT** (fig.4), originando assim o sólido truncado (fig.5).

Por curiosidade e exploração geométrica, foi também criado o dual desta forma. Para isso, foram colocados pontos, comando **POINT**, nos centros de cada face do sólido e posteriormente ligados entre si, criando novas superfícies através do comando **SURFACE** (fig.6).

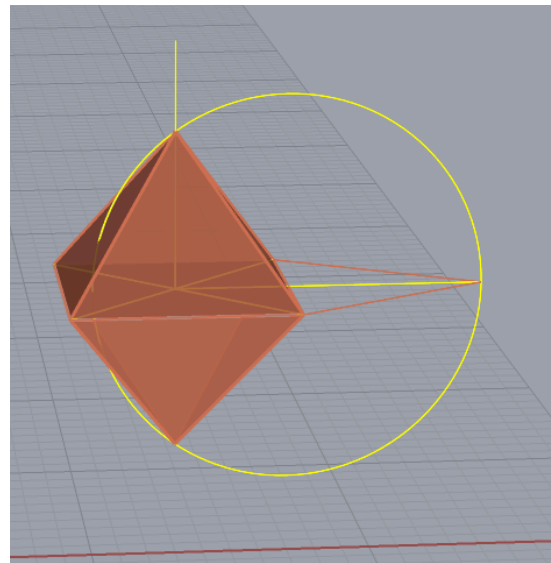


fig. 1

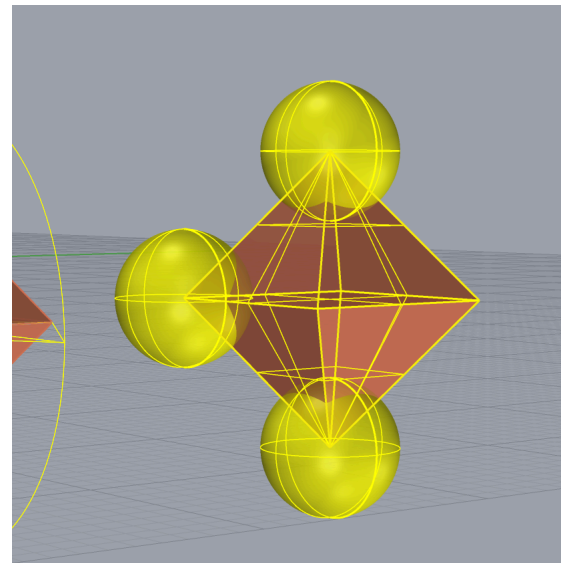


fig. 2

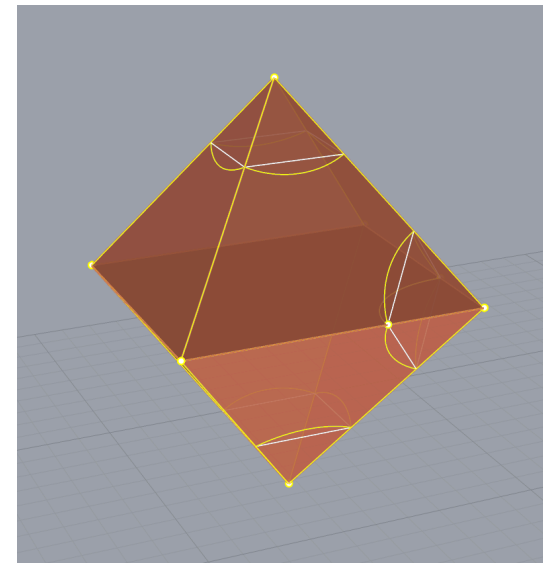


fig. 3

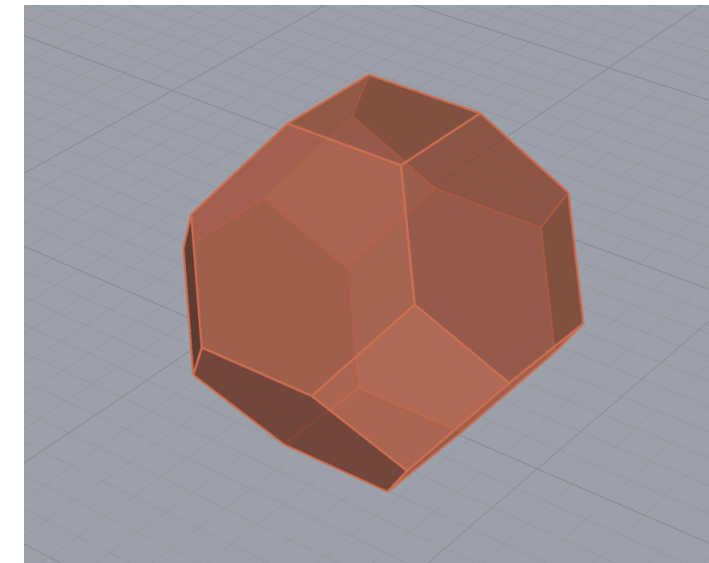


fig. 4

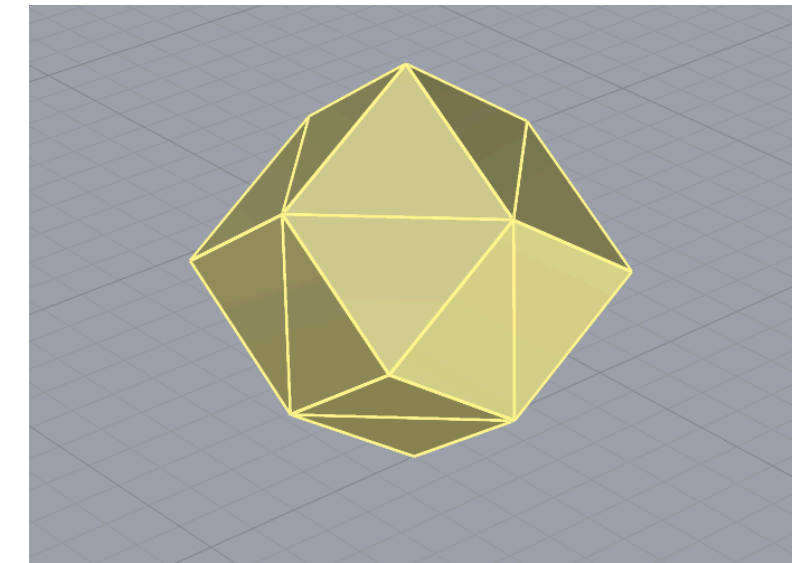


fig. 5

O octaedro foi construído a partir do tetraedro inicial. Para isso, foi utilizada a operação **MIRROR** com a opção **ORTHO** ativada, permitindo gerar a forma simétrica necessária para completar o sólido (fig.1).

A partir desta forma foi também desenvolvido um octaedro truncado a 1/3 da aresta, seguindo a mesma lógica aplicada anteriormente no tetraedro truncado. Ou seja, através da interseção de esferas posicionadas nos vértices (fig.2) e posterior remoção das partes resultantes (fig.3 e fig.4)

Foi criada também um dual do tetraedro truncado (fig.5)

O Hexaedro serviu como base para a criação de várias outras formas geométricas (fig.5). Este sólido foi inicialmente criado através do comando **BOX**.

A partir desta forma base foi desenvolvidos:

- Hexaedro truncado a 1/2 da aresta
- Hexaedro truncado a 1/3 da aresta
- Dual de ambos os Hexaedros truncados (resultam na mesma figura)
- Romicuboctaedro

O Romicuboctaedro foi criado com base no Hexaedro truncado a 1/2 da aresta, que de seguida foi truncado mais uma vez a 1/2 da aresta (fig.3 e fig.4). Utilizando o mesmo processo referido anteriormente.

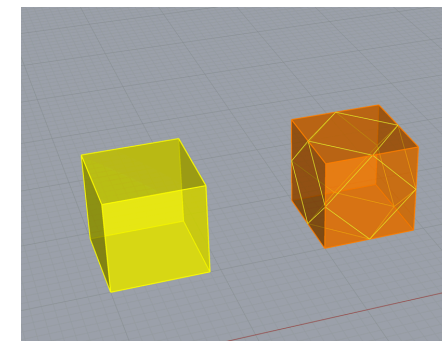


fig. 1

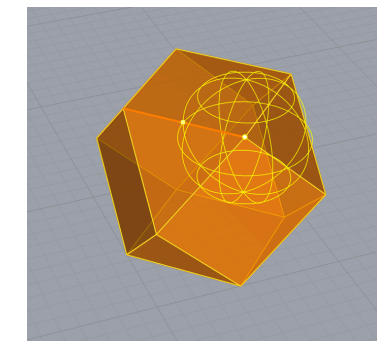


fig. 2

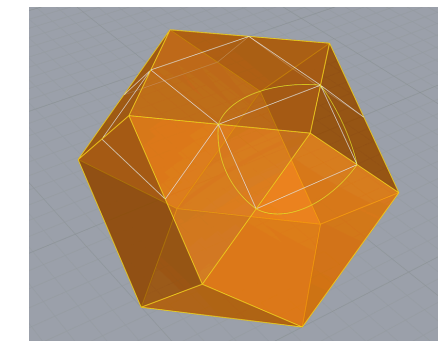


fig. 3

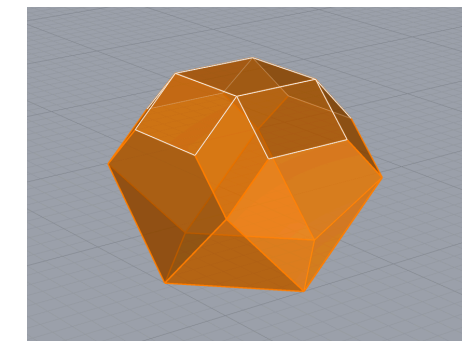


fig. 4

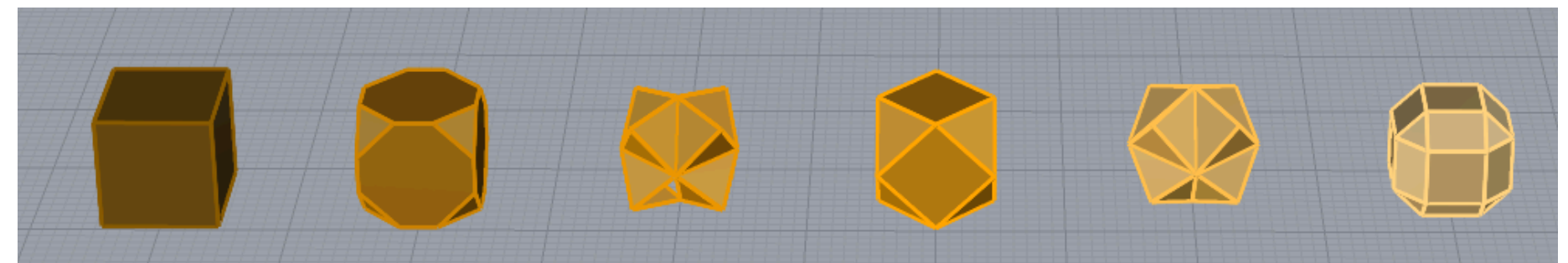


fig. 5

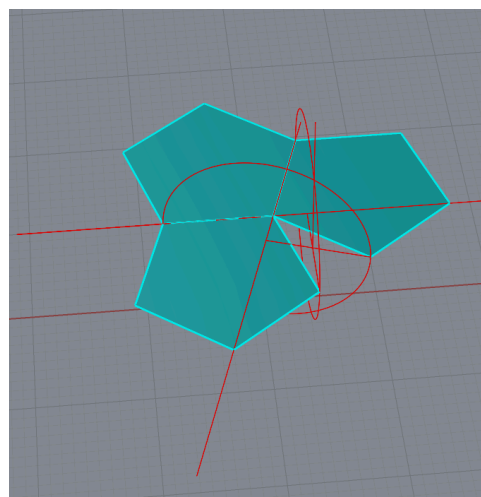


fig. 1

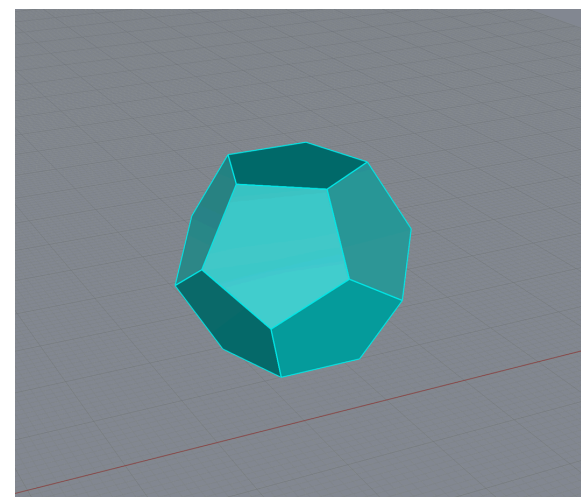


fig. 2

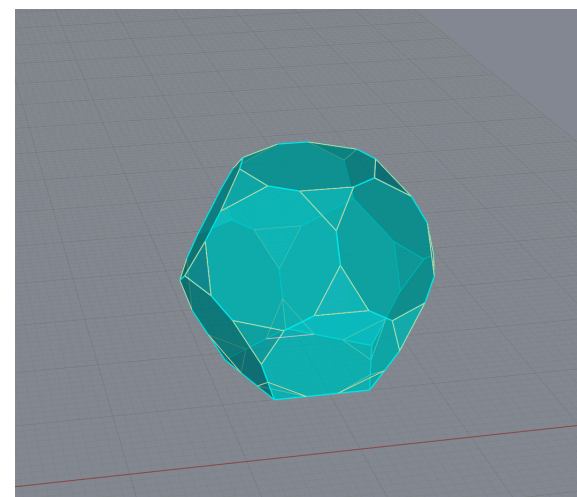


fig. 3

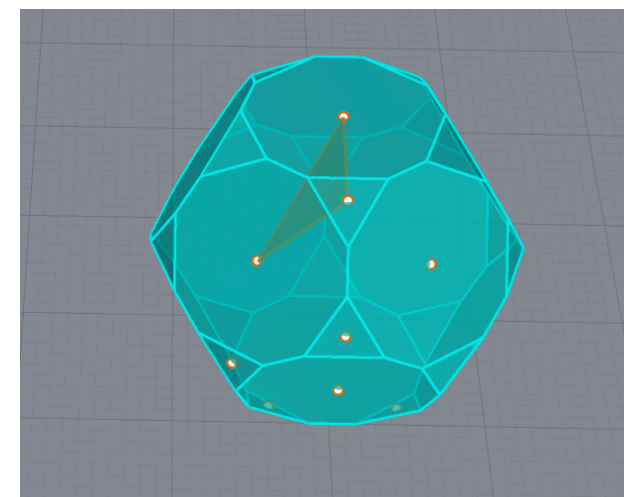


fig. 4

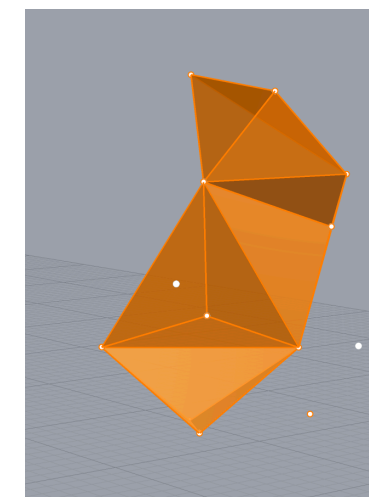


fig. 5

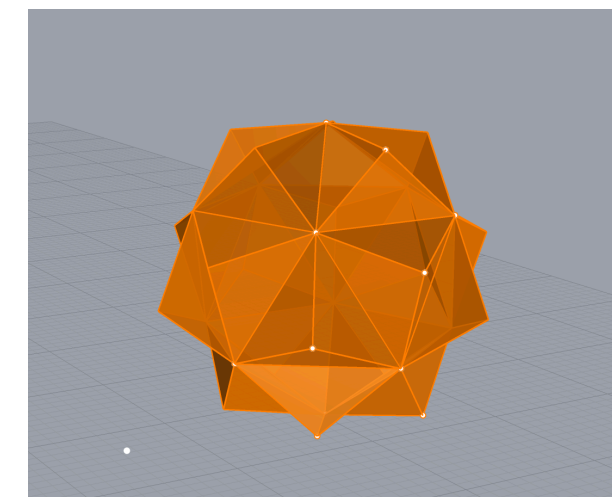


fig. 6

A partir do dodecaedro (fig.2) foram também exploradas diferentes variações geométricas. Este sólido serviu como base para a criação de dodecaedros truncados (1/2 e 1/3 da aresta) (fig.3) e para o dual do dodecaedro truncado (fig.6), que resultam em formas idênticas.

O dual foi construído a partir da colocação de pontos nos centros das faces. Em seguida, cada ponto central da face triangular foi ligado a dois pontos centrais das faces pentagonais adjacentes (fig.4), formando as faces da figura. A partir dessa base foi criada a superfície entre o ponto superior e o inferior (fig.5), utilizando posteriormente o comando **ARRAY POLAR** para gerar a figura completa (fig.6).

CONSTRUÇÃO DO ICOSAEDRO

A construção do Icosaedro foi iniciada a partir de uma base pentagonal (fig.1), à qual foi associado um triângulo equilátero junto a uma das faces (fig.2).

Através de linhas auxiliares traçadas a partir do centro de ambas as figuras e de uma circunferência vertical (fig.3), foi possível utilizar o comando **ROTATE3D** para gerar uma pirâmide pentagonal (fig.5).

De seguida, foi duplicado um conjunto de duas faces da pirâmide (fig.6), que, com o comando **ORIENT3PT** (fig.7), puderam ser orientadas no ângulo correto (fig.8).

Posteriormente foram utilizados os comandos **ARRAYPOLAR** (fig.9), **MIRROR** (fig.10), um **ROTATE** de 36° (metade de 72°) (fig.11) e, por fim, **MOVE**, finalizando a figura (fig.12).

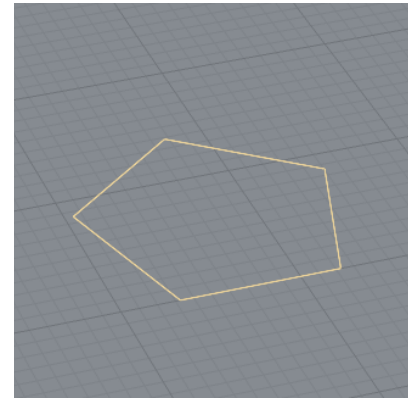


fig. 1

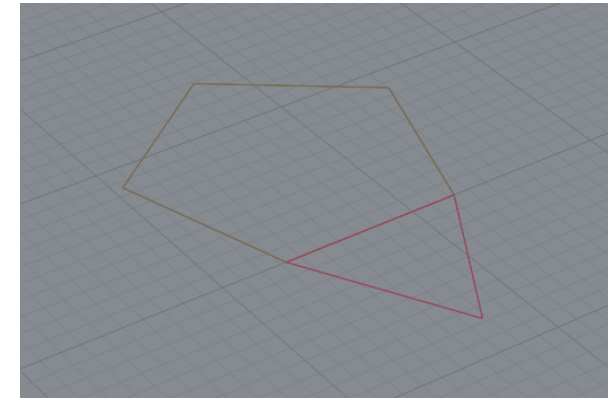


fig. 2

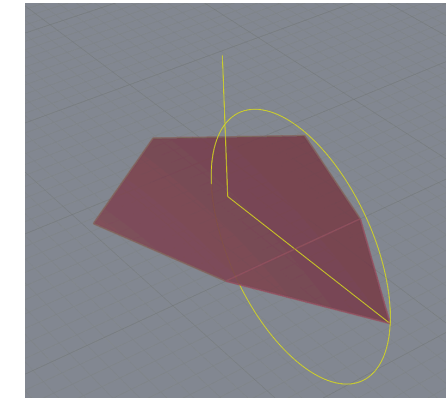


fig. 3

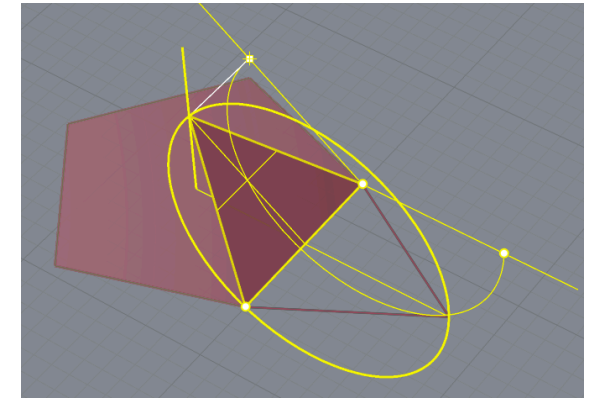


fig. 4

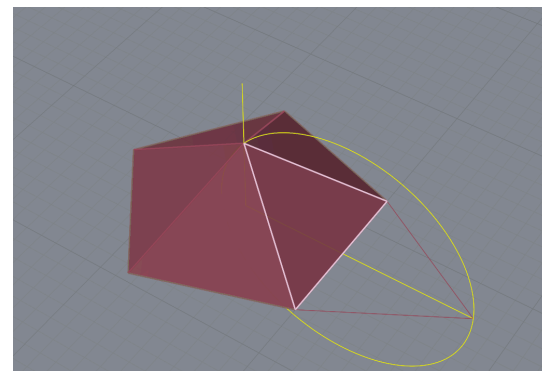


fig. 5

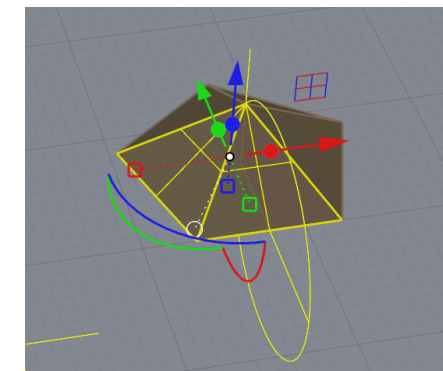


fig. 6

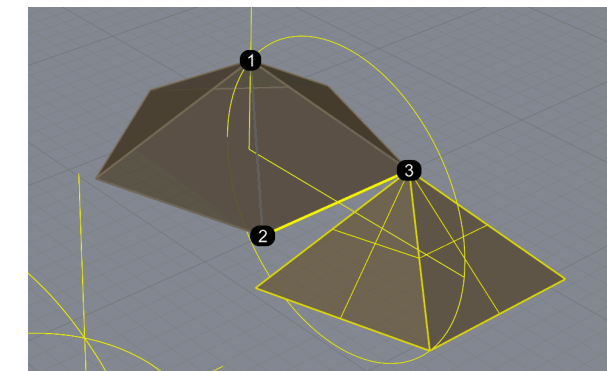


fig. 7

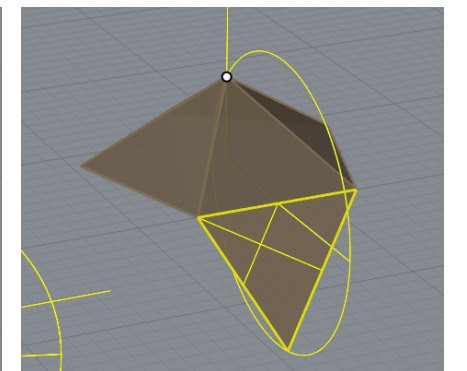


fig. 8

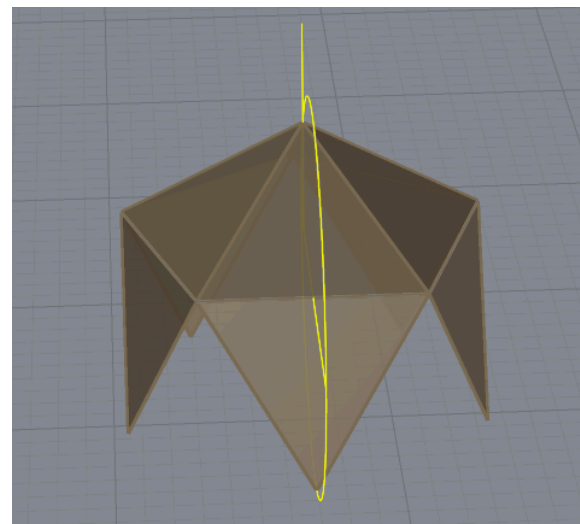


fig. 9

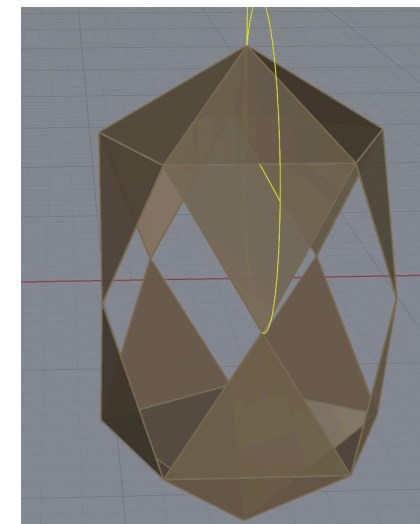


fig.10

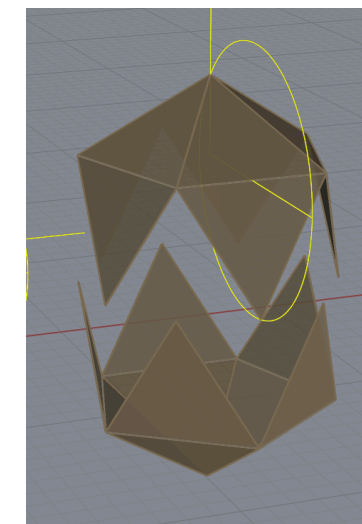


fig.11

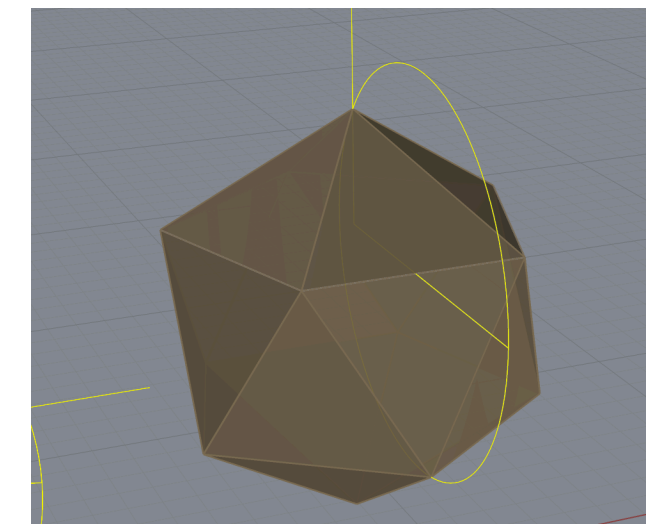


fig.12

Icosaedro

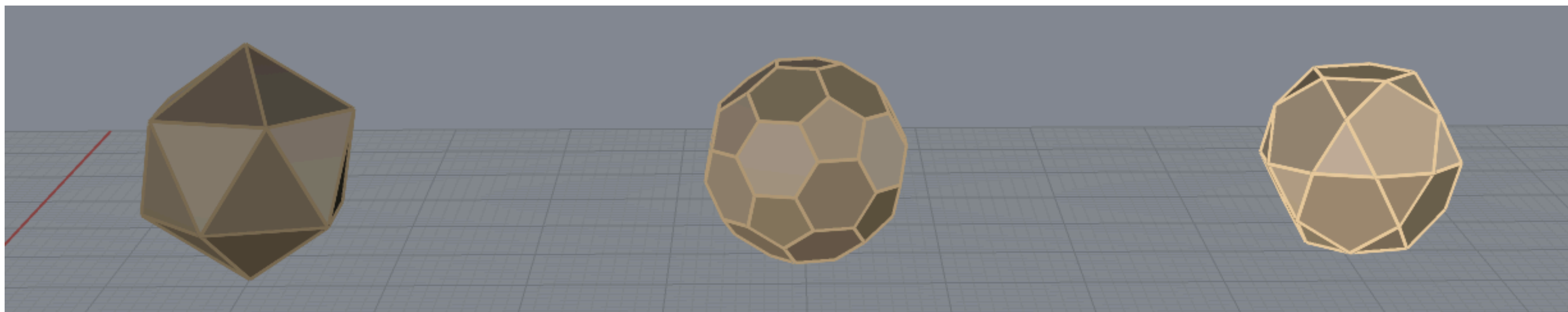
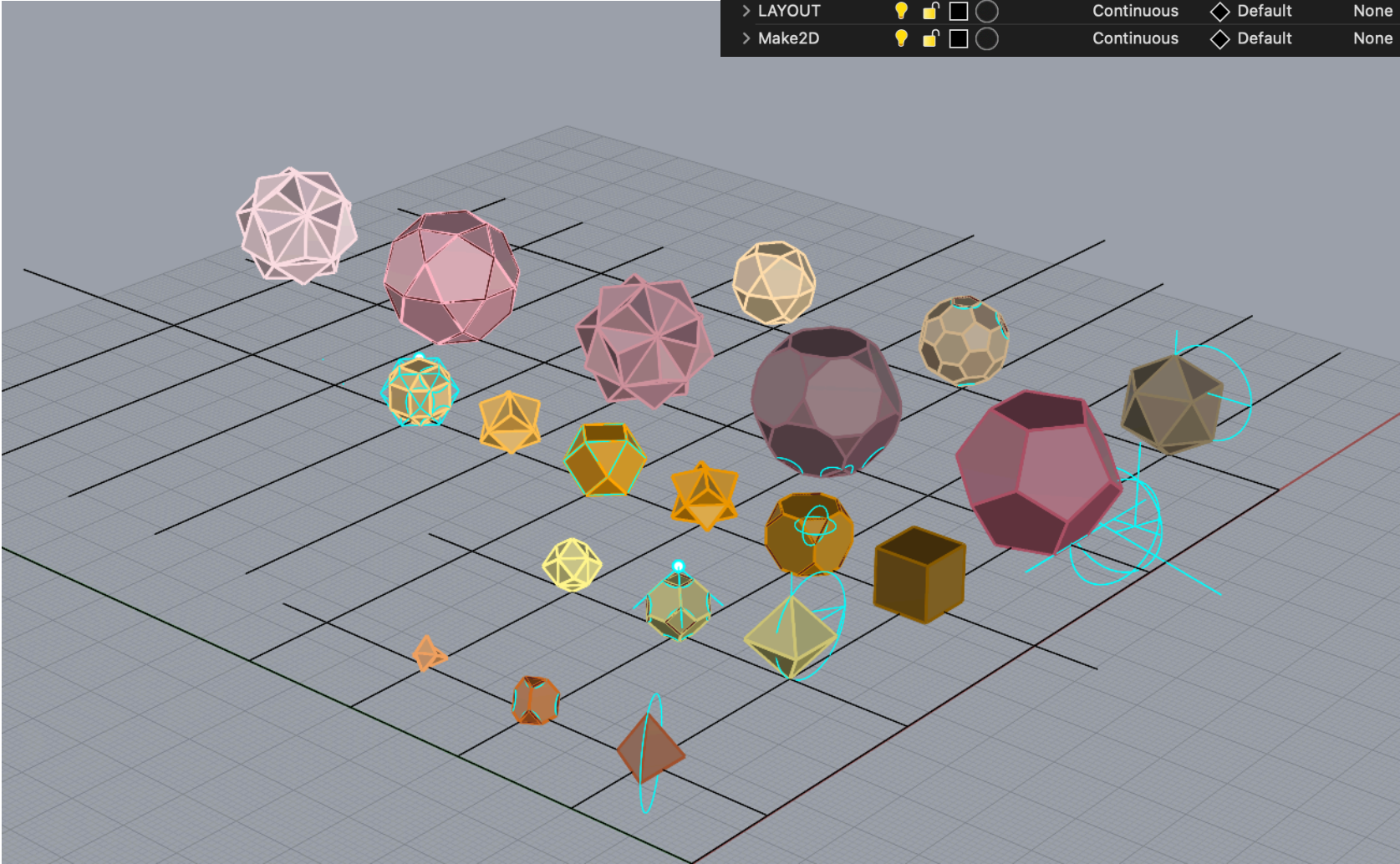
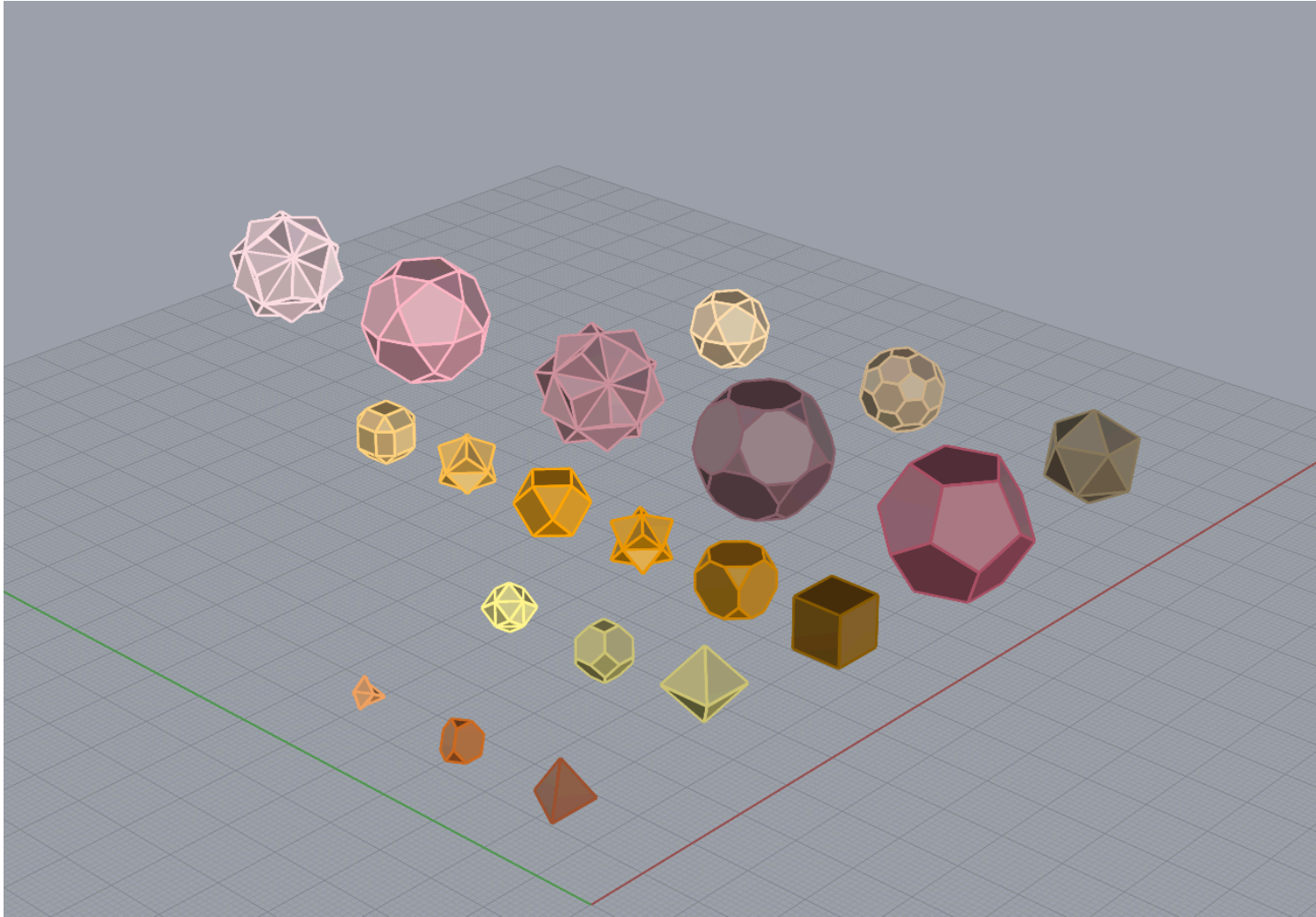


fig. 1

A partir do icosaedro foram também criadas as versões truncadas a $\frac{1}{3}$ e a $\frac{1}{2}$ da aresta, seguindo o mesmo processo aplicado nos sólidos anteriores.

Icosaedro

DOC FINAL DO RHINO SEM AUX E COM AUX

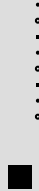


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> DODECAEDR	 	 	Continuous	 Default	None
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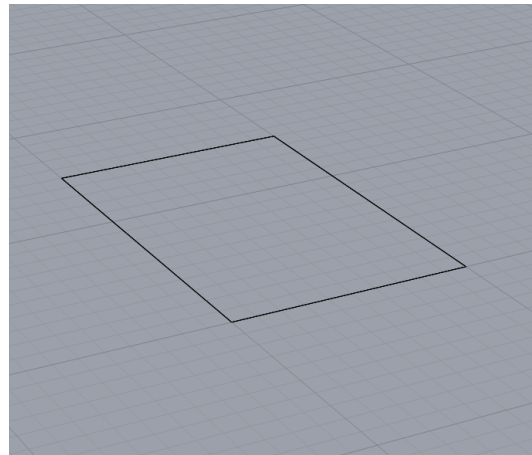
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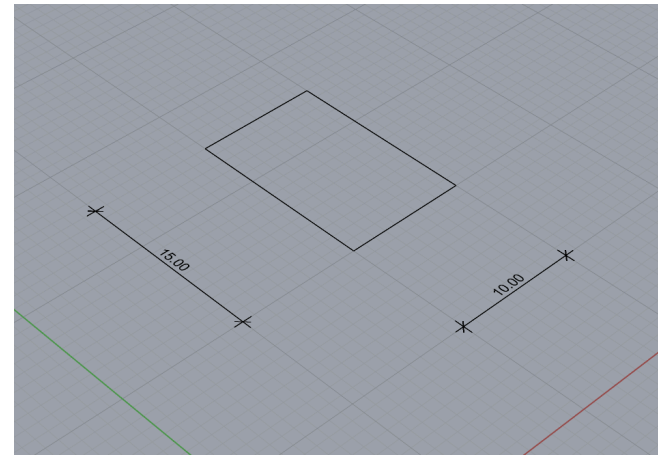
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- Abobada de Ogiva;
- Abobada Abatida.



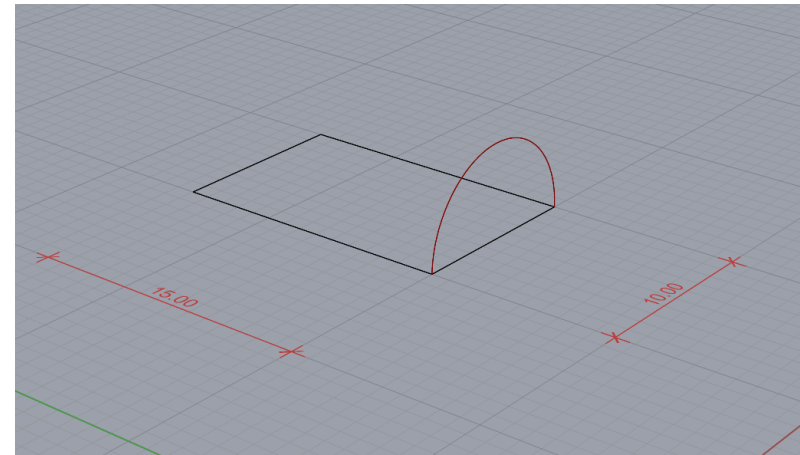
2.1 ABÓBADA DE BERÇO



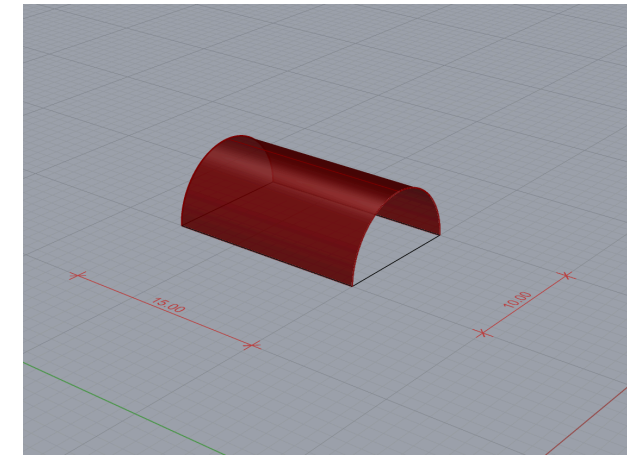
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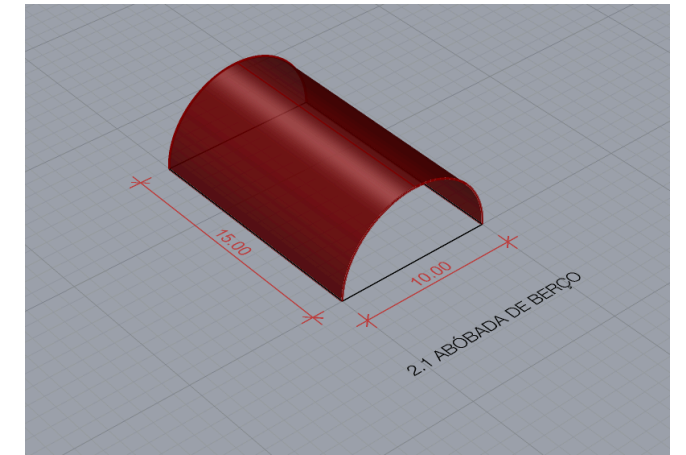
DRAFTING



CIRCLE / VERT / 2PT



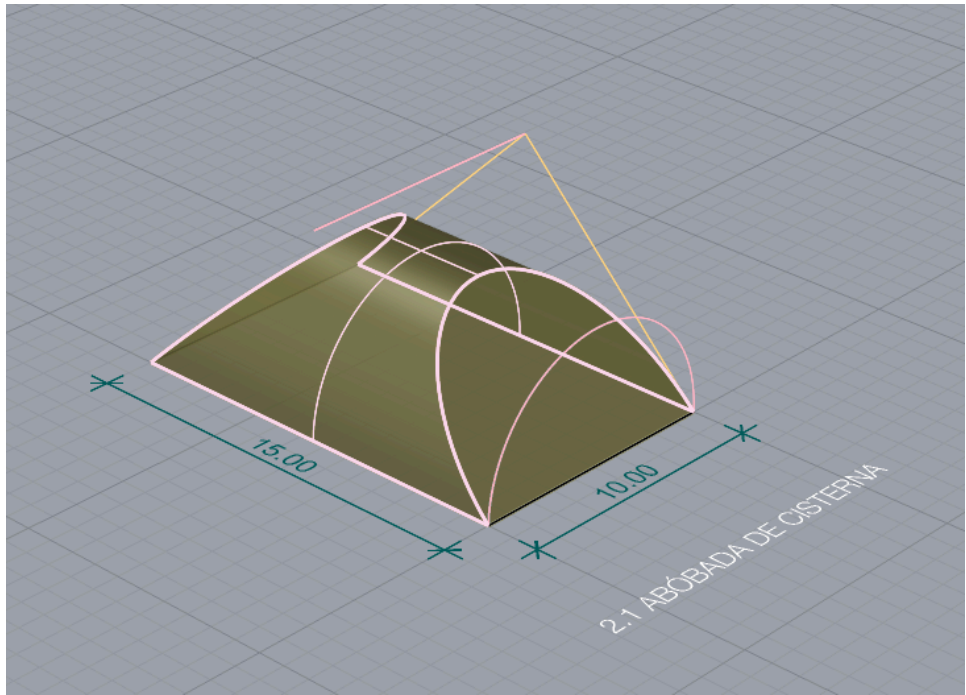
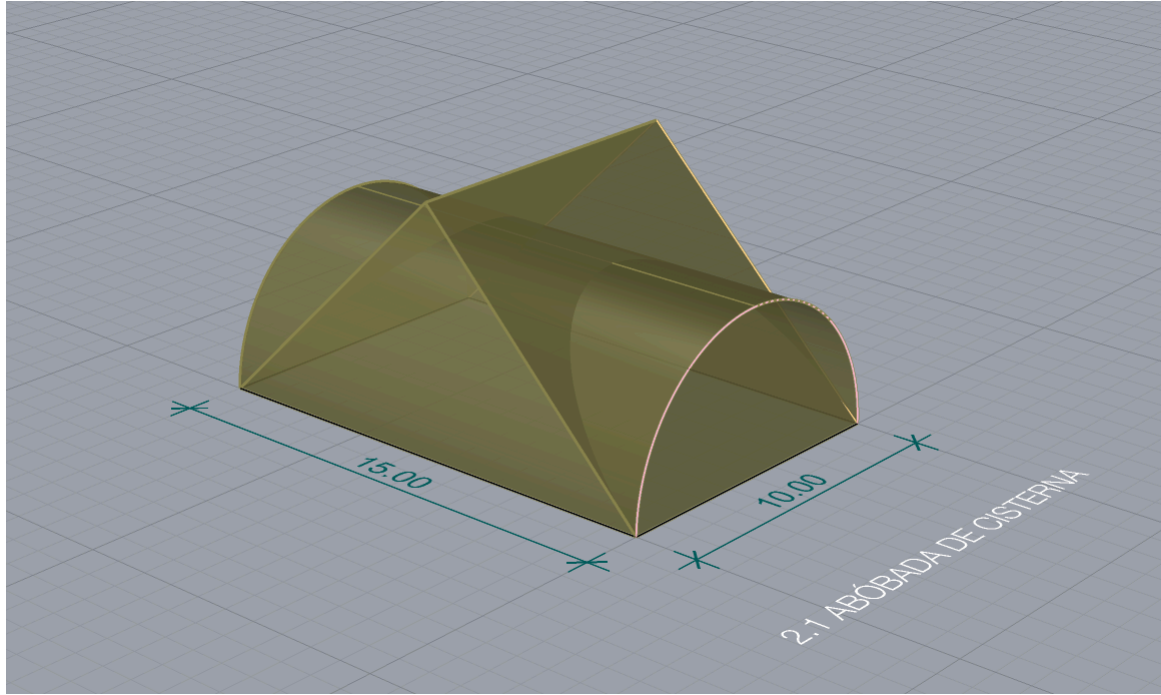
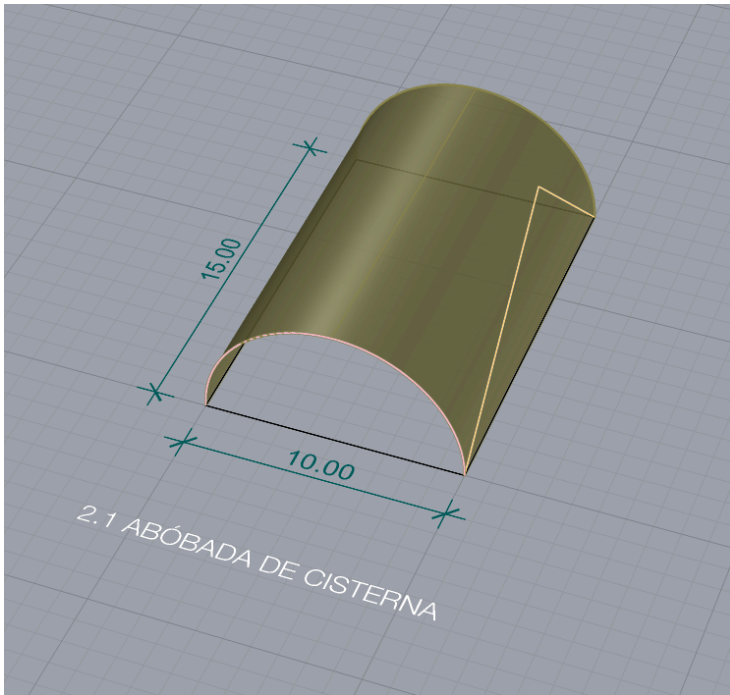
EXTRUDECRV



TEXT

Relative polar coordinates:
@DISTANCIA<ANGULO NO PLANO<ANGULO NA VERTICAL

Fillet
-radius: 0 (senão fica curvo)

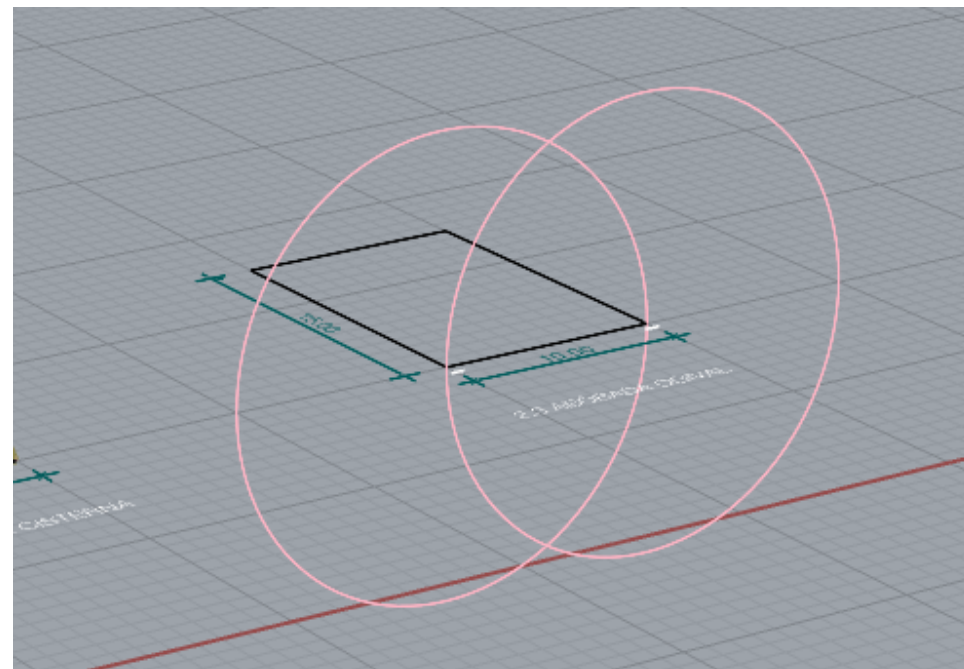


EXTRUDE

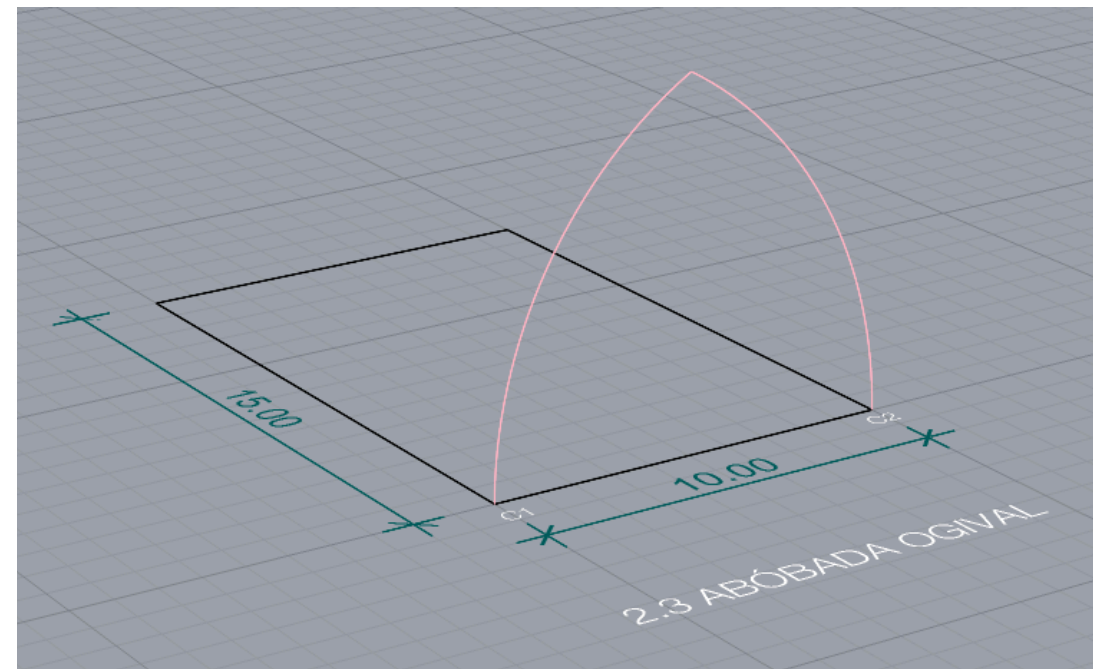
INTERSECT / TRIM

2.2 ABÓBADA DE CISTERNA

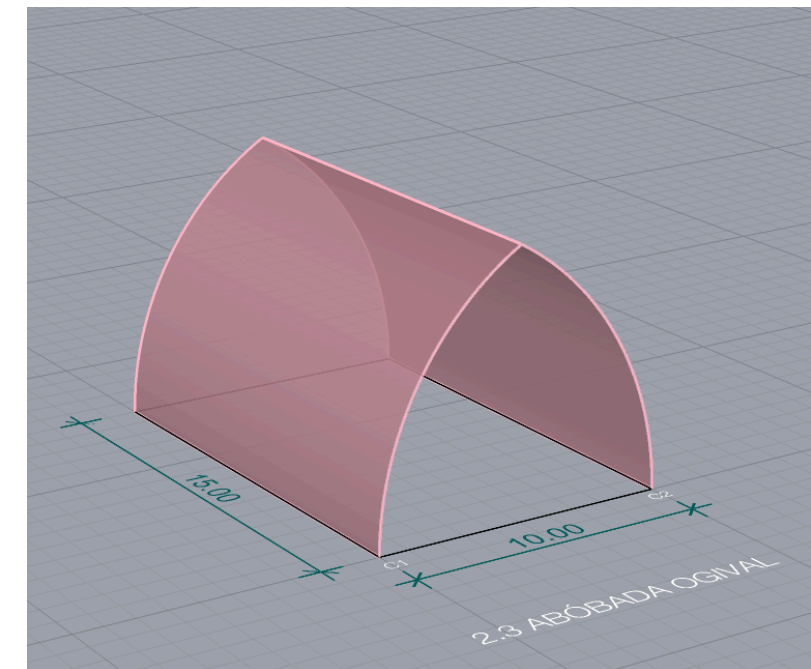
2.3 ABÓBADA OGIVAL



VERTICAL CIRCLE

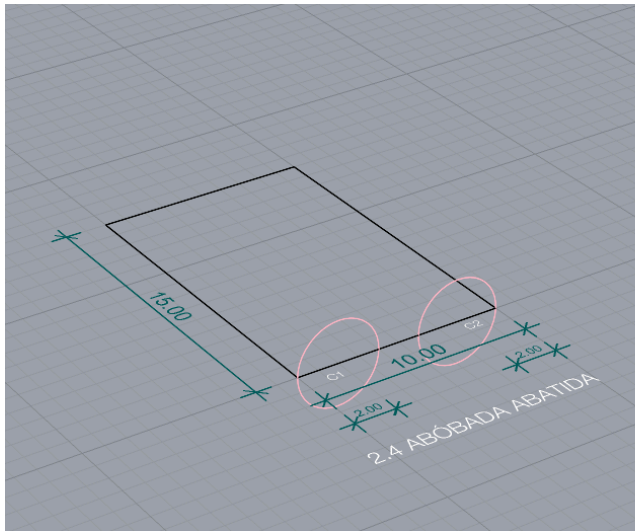
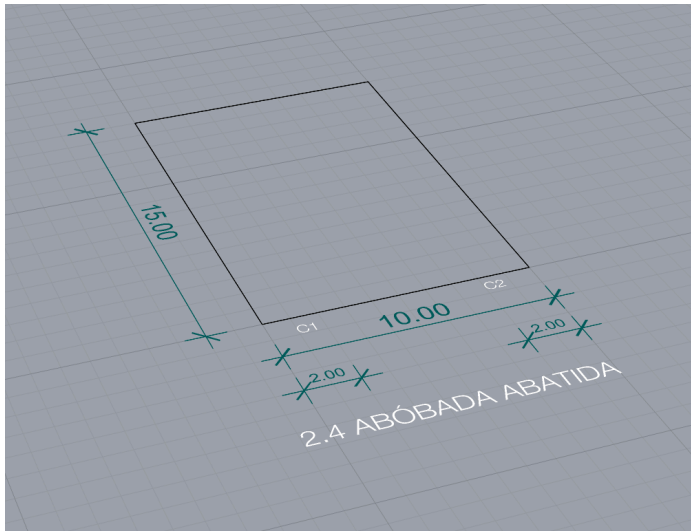


TRIM

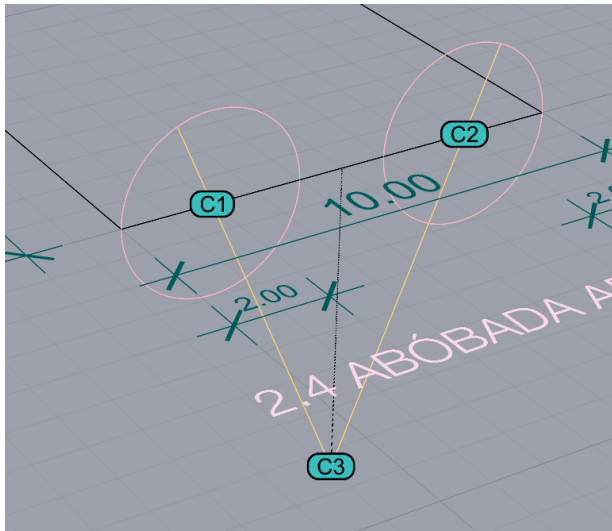


EXTRUDE

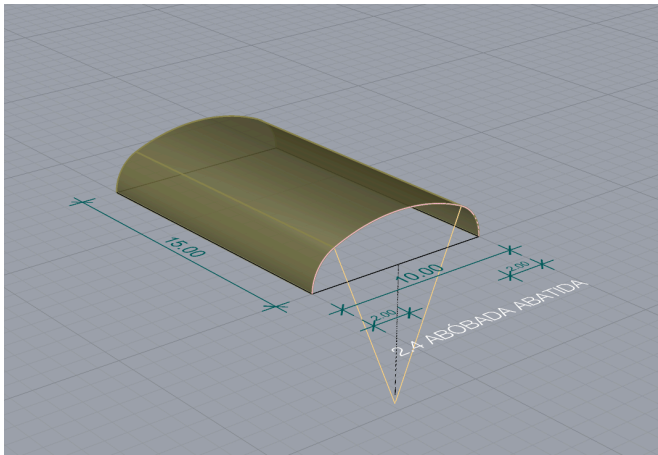
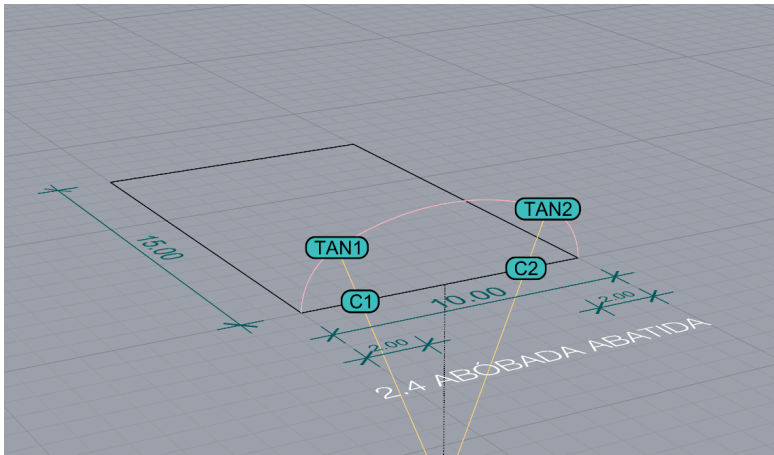
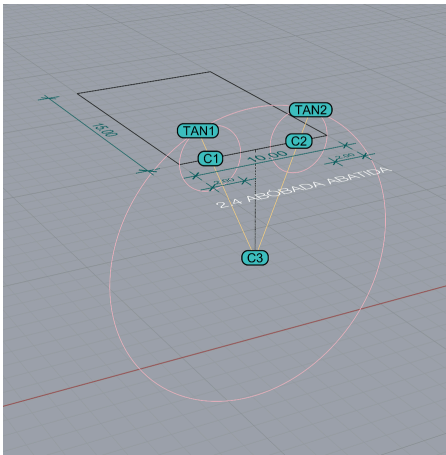
2.4 ABÓBADA ABATIDA



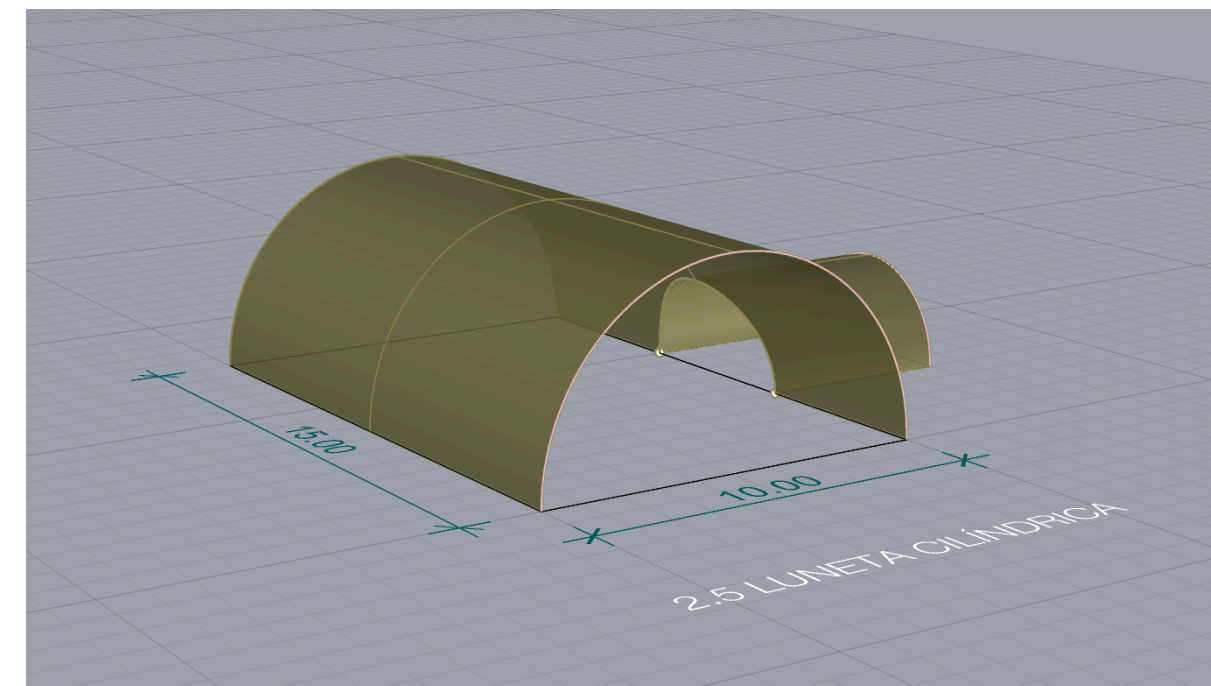
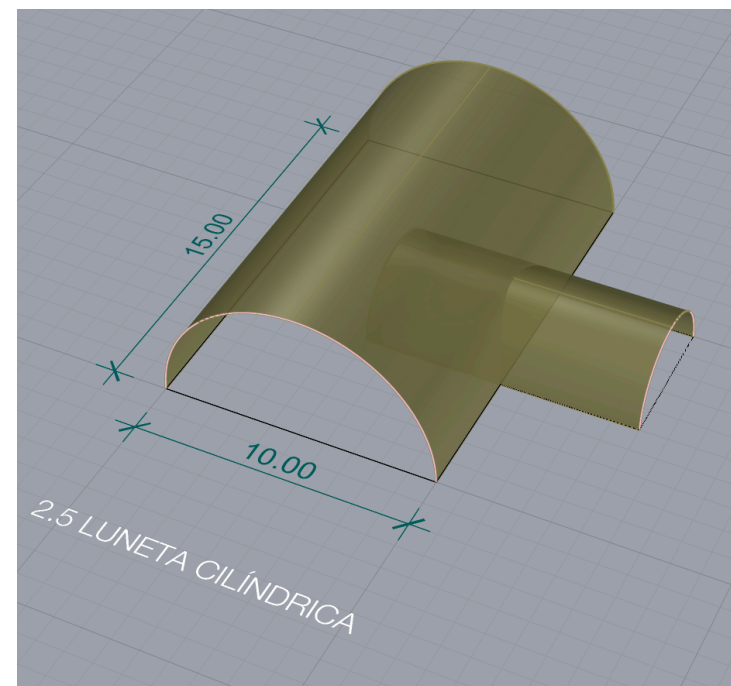
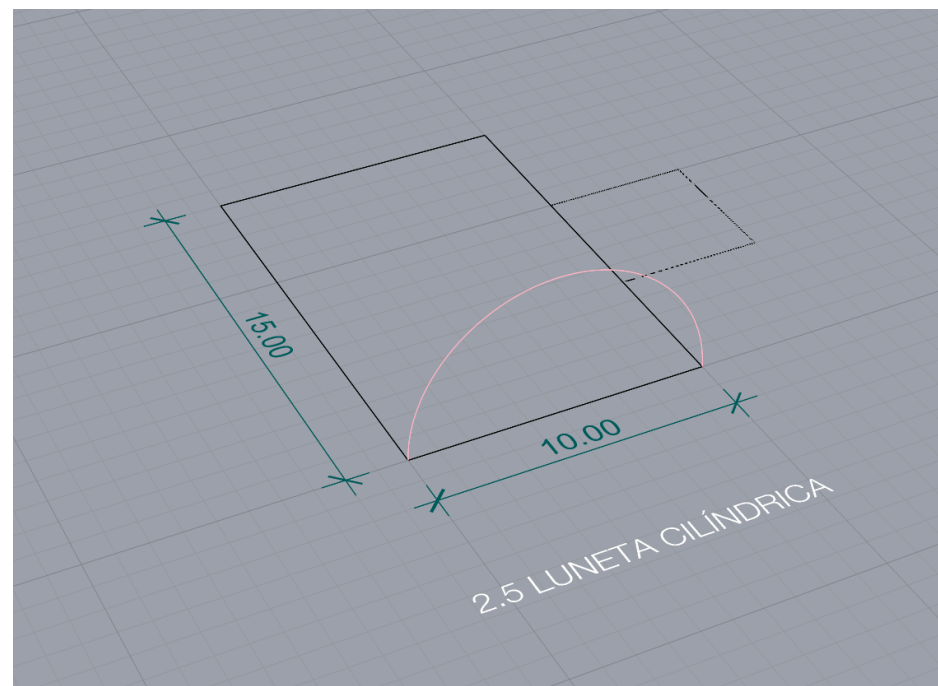
VERTICAL CIRCLE



DRAFTING / NOTES



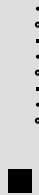
2.5 LUNETA CILÍNDRICA



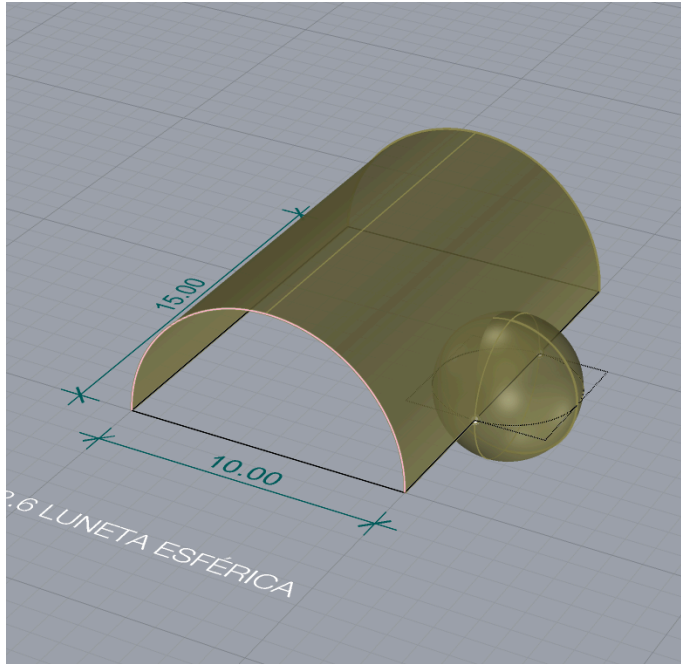
VERTICAL CIRCLE

SUMÁRIO:

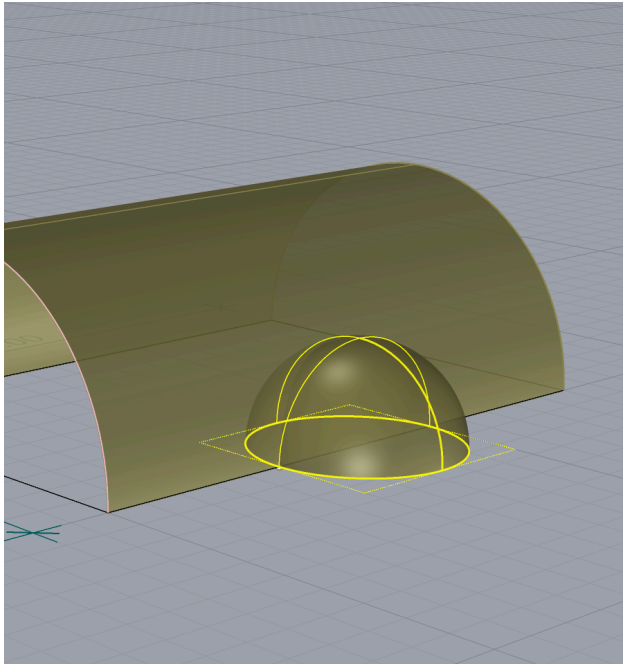
Fazer Luneta Esférica e Luneta Cónica



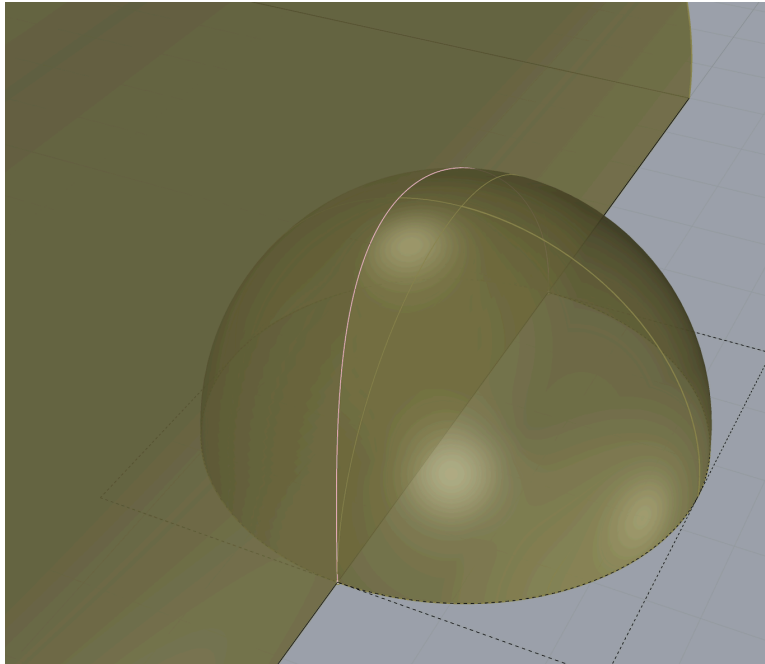
2.6 LUNETTA ESFÉRICA



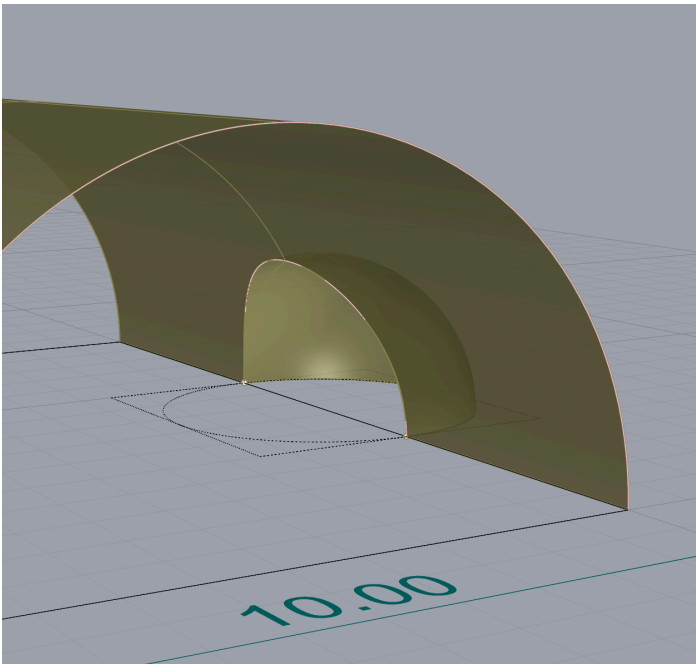
SPHERE



TRIM

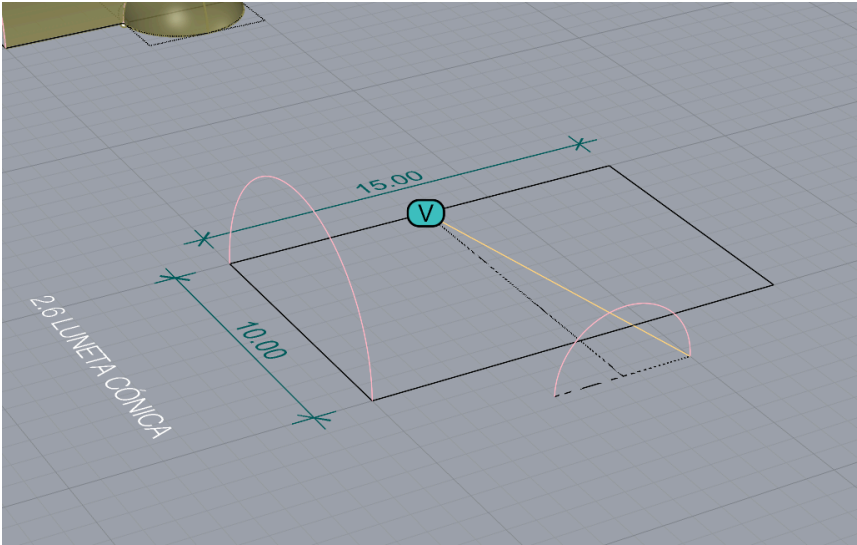


INTERSECT

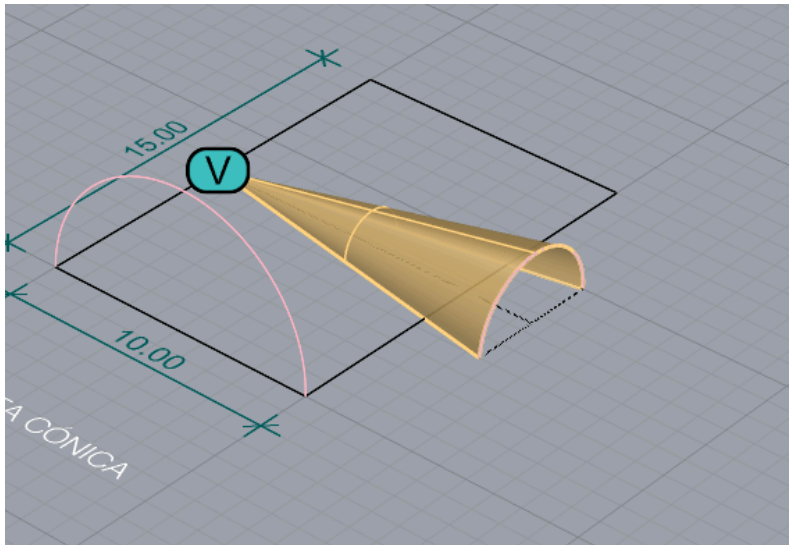


TRIM

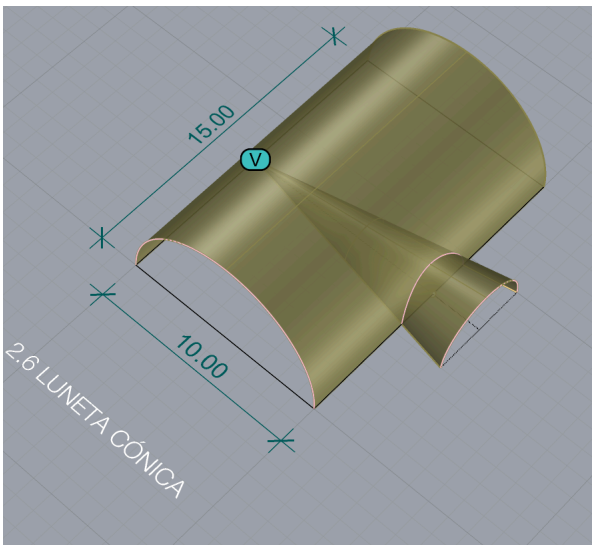
2.7 LUNETA CÓNICA



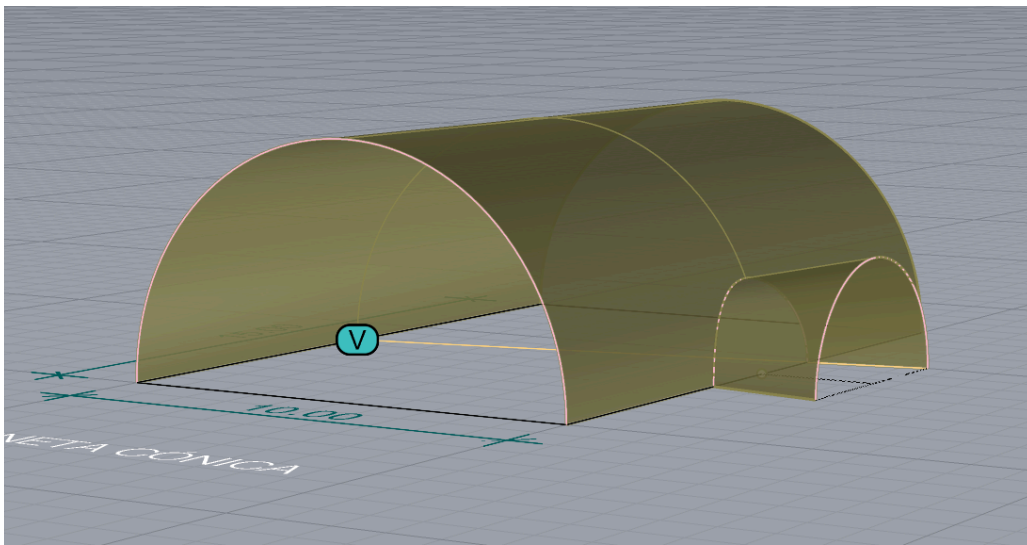
VERTICAL CIRCLE



RAIL REVOLVE
1º GERATRIZ
2º CIRCLE
3º VÉRTICE

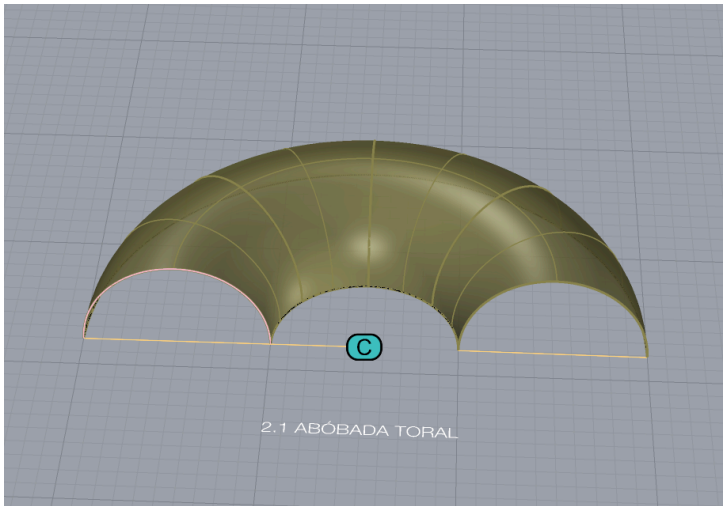
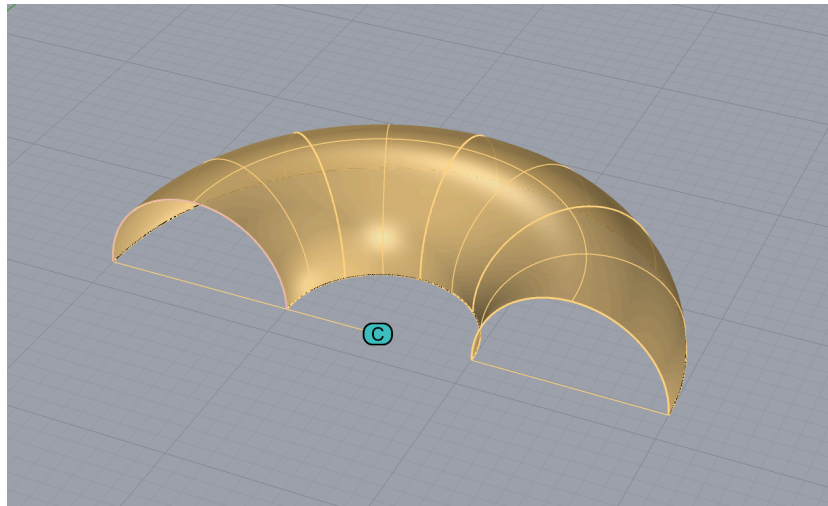
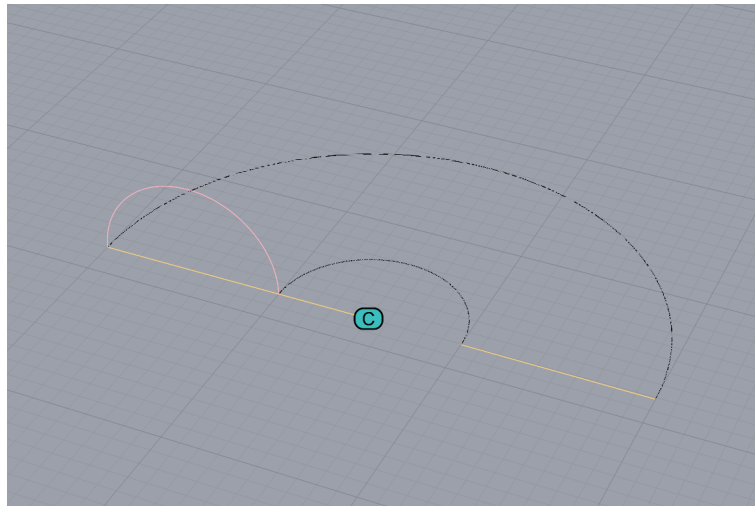
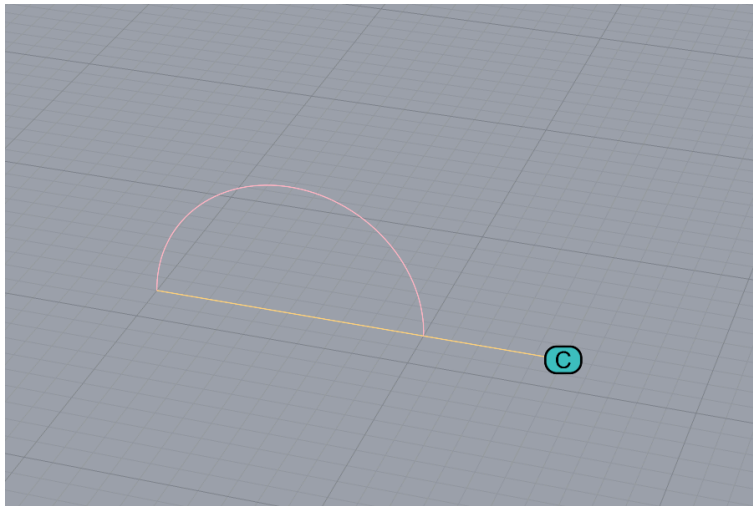


INTERSECT



TRIM

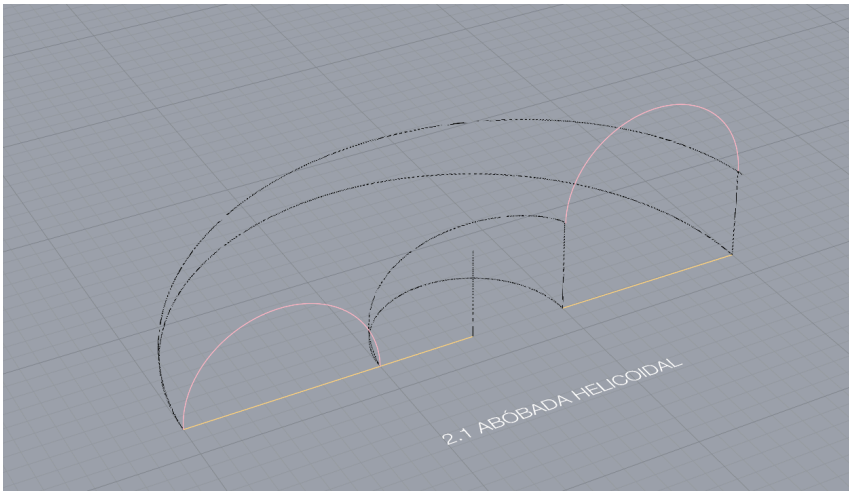
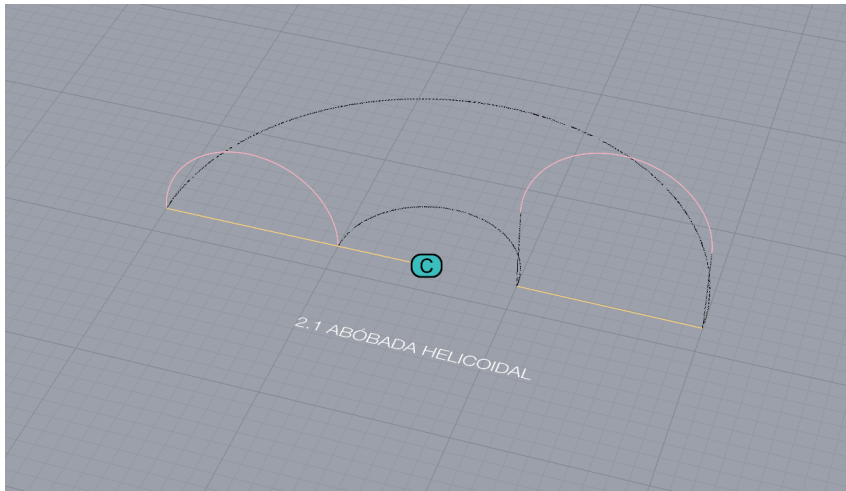
2.8 ABÓBADA TORAL



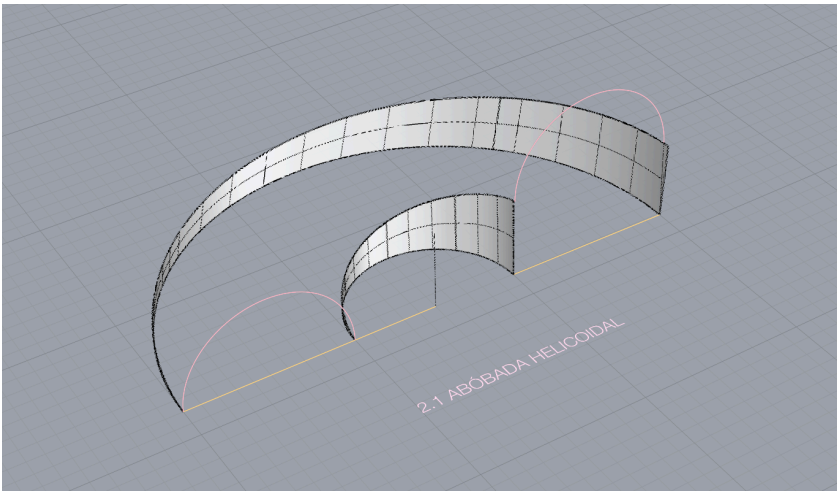
SWEEP2
1º RAIL - semicurva interior
2ºRAIL - semicurva exterior
3ºSHADE - semi circle



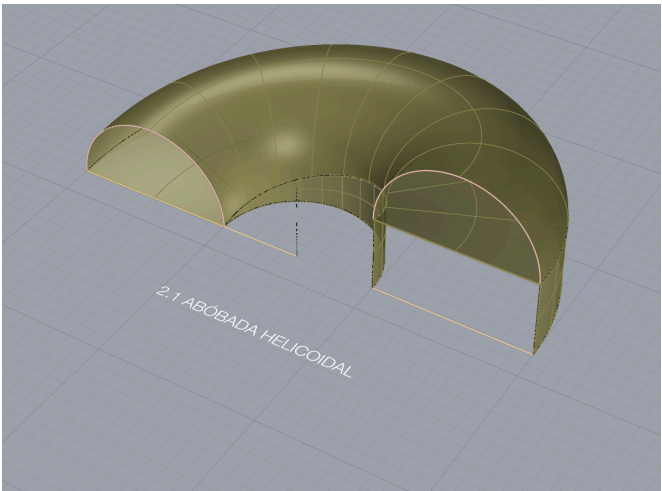
2.9 ABÓBADA HELICOIDAL



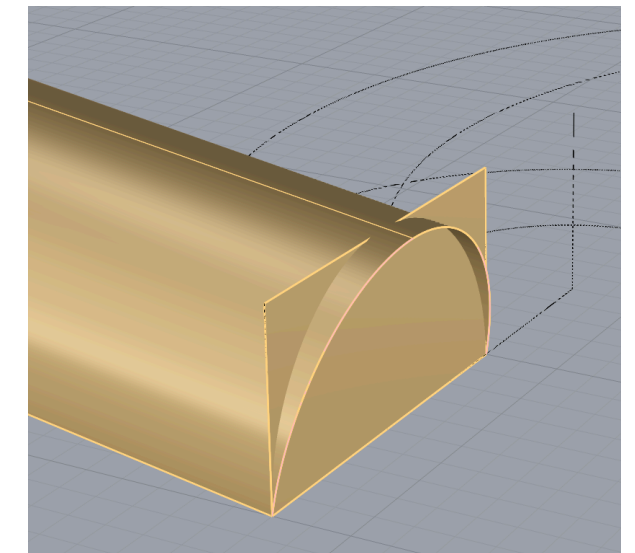
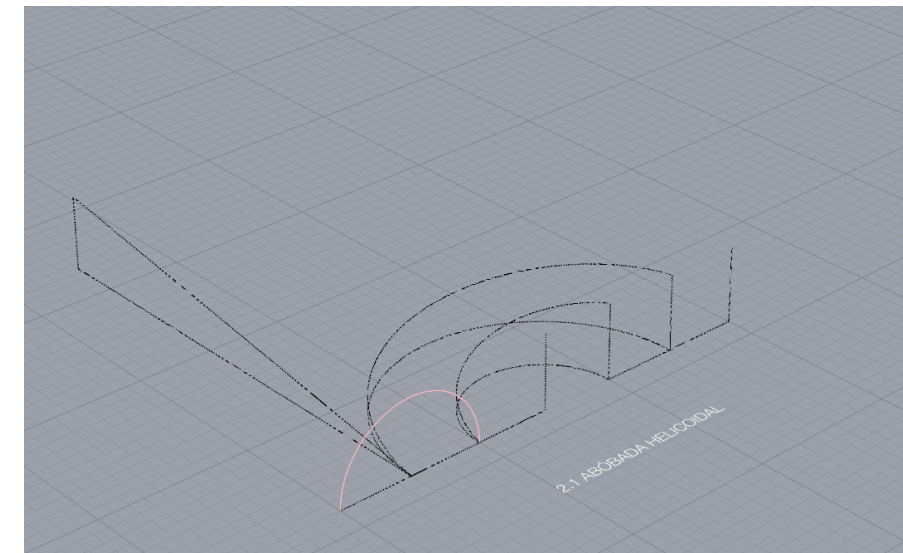
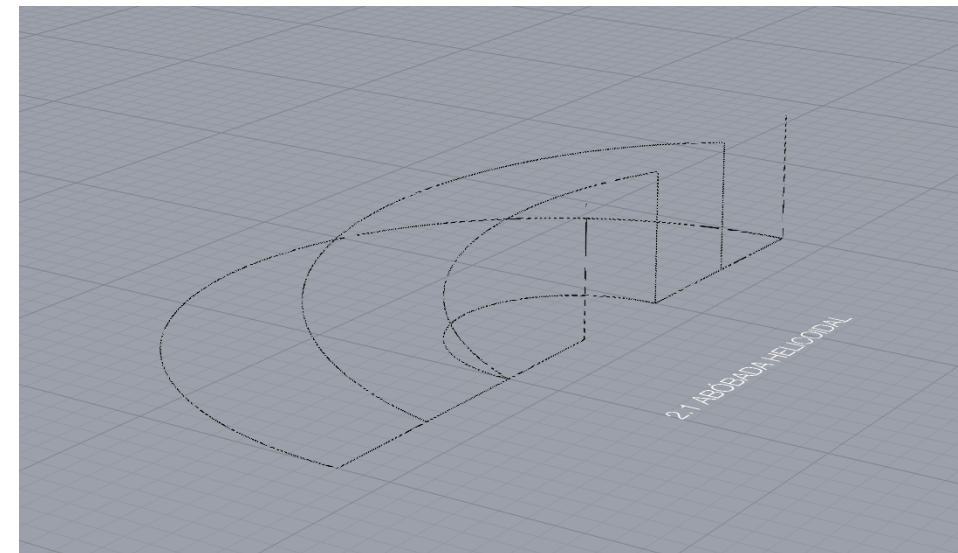
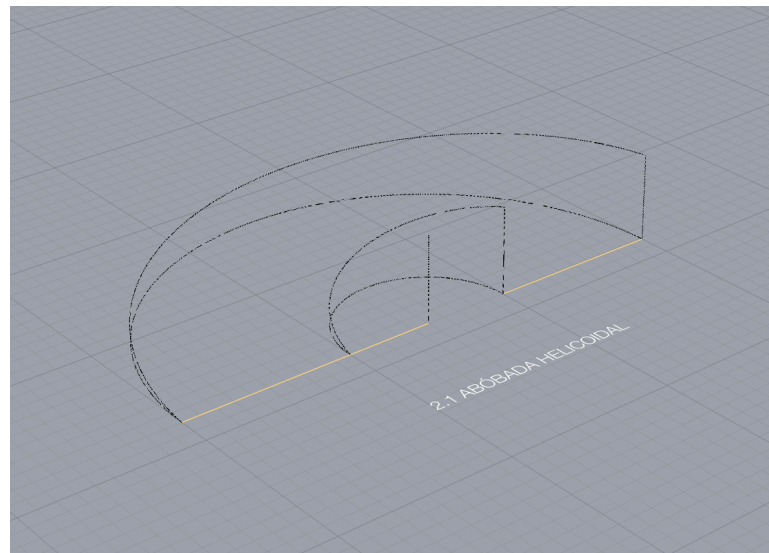
HÉLIX
1º RAIL - semicurva interior
2ºRAIL - semicurva exterior
3ºSHADE - semi circle



LOFT



2.10 ABÓBADA DE SAIN GILLES

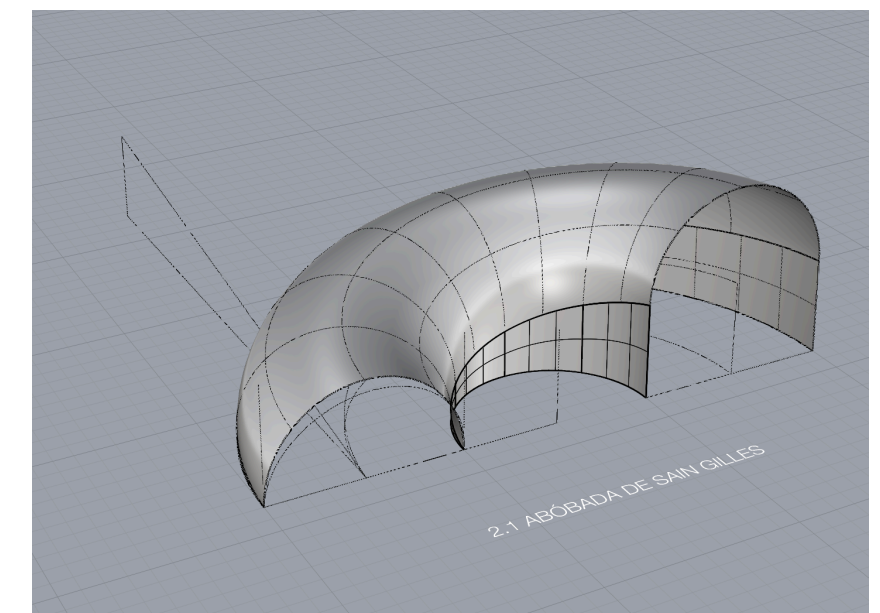
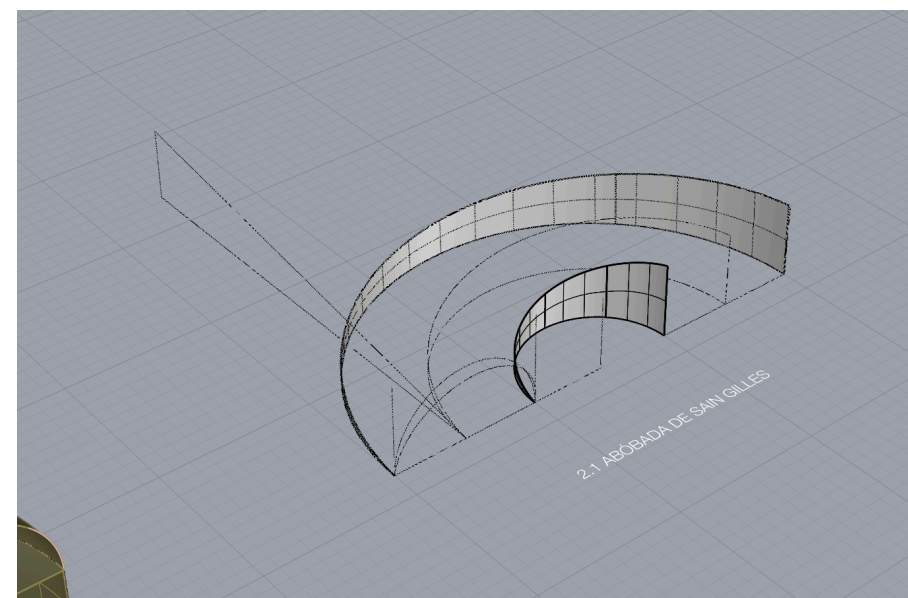


HÉLIX

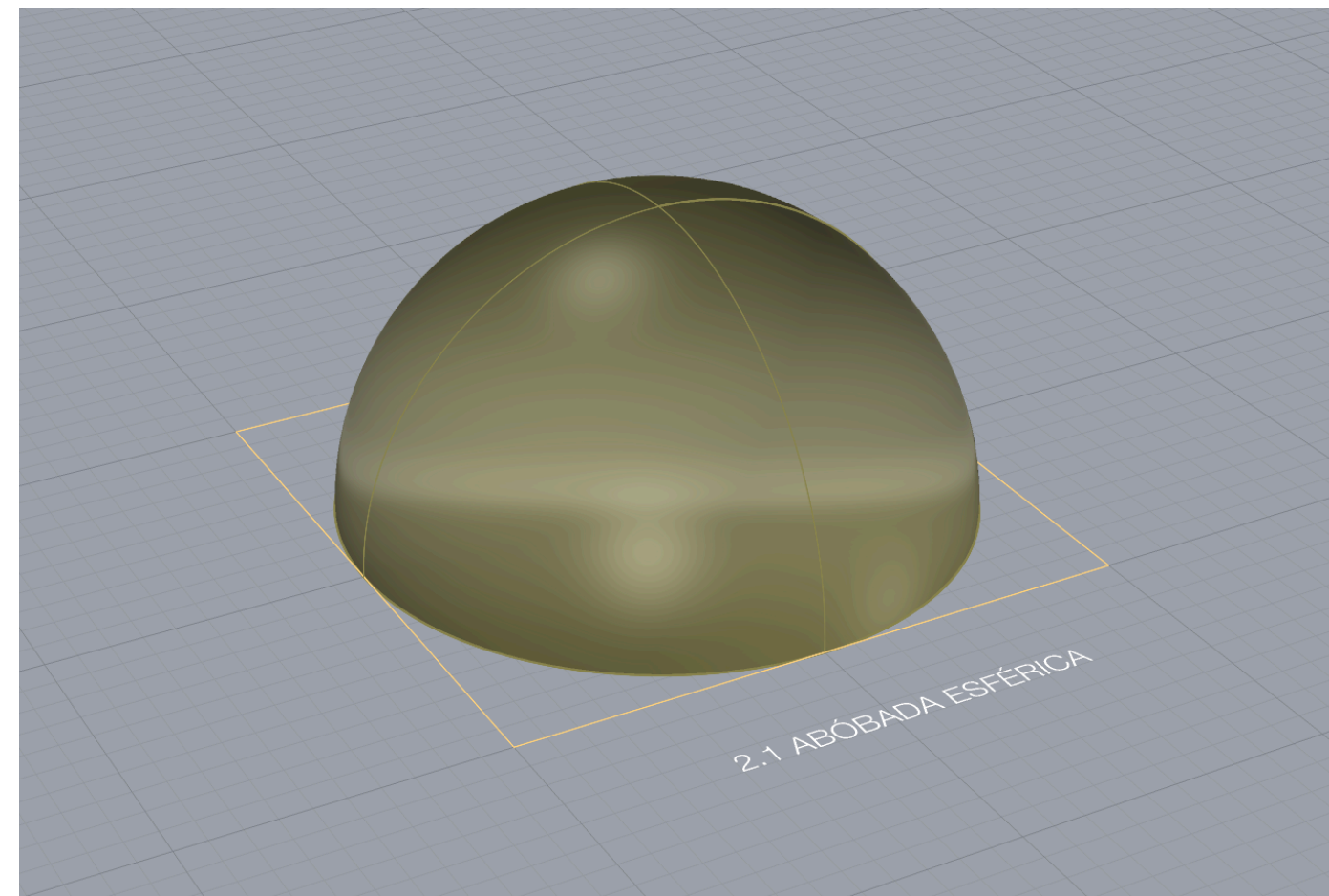
1º RAIL - semicurva interior

2º RAIL - semicurva exterior

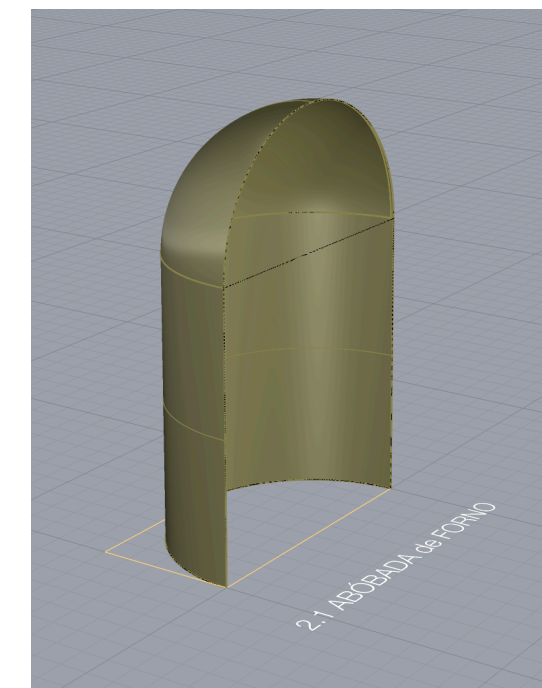
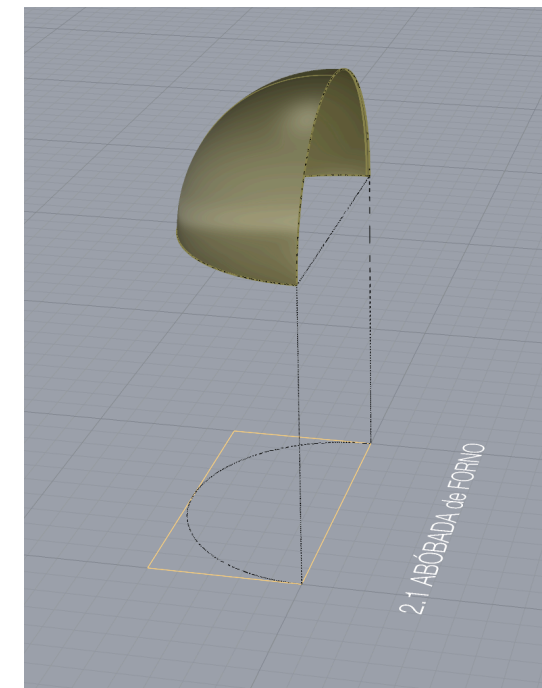
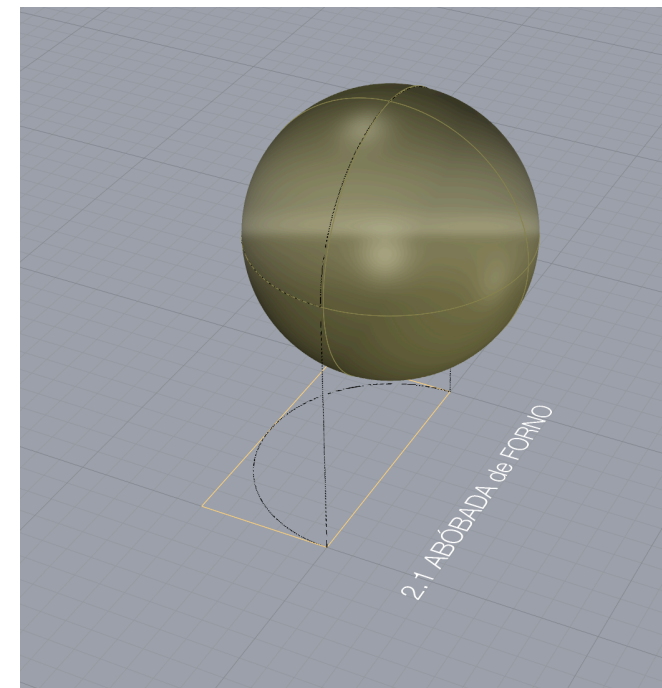
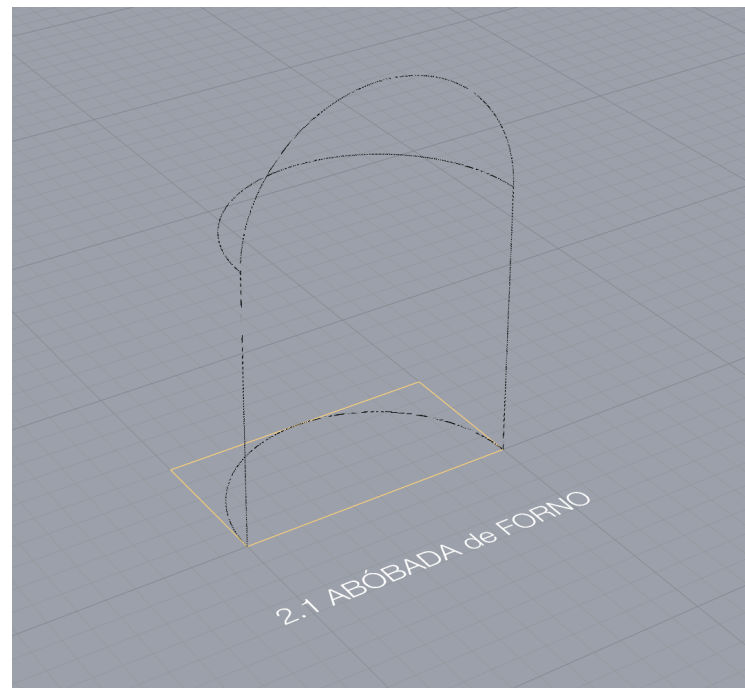
3º SHADE - semi circle



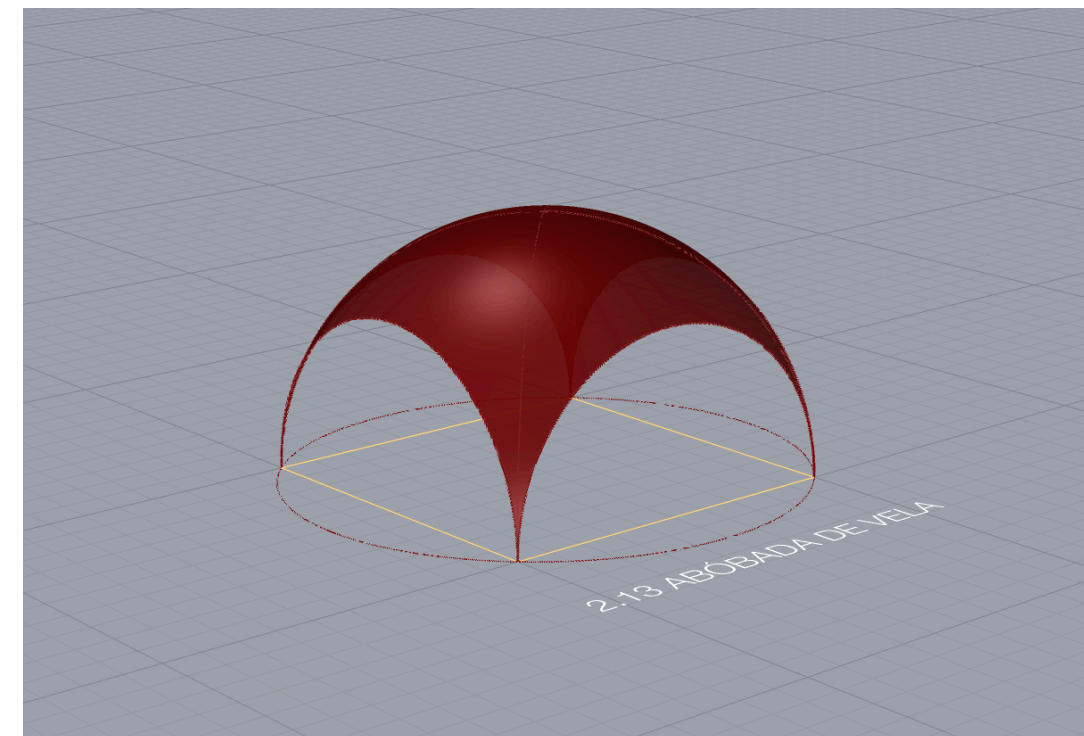
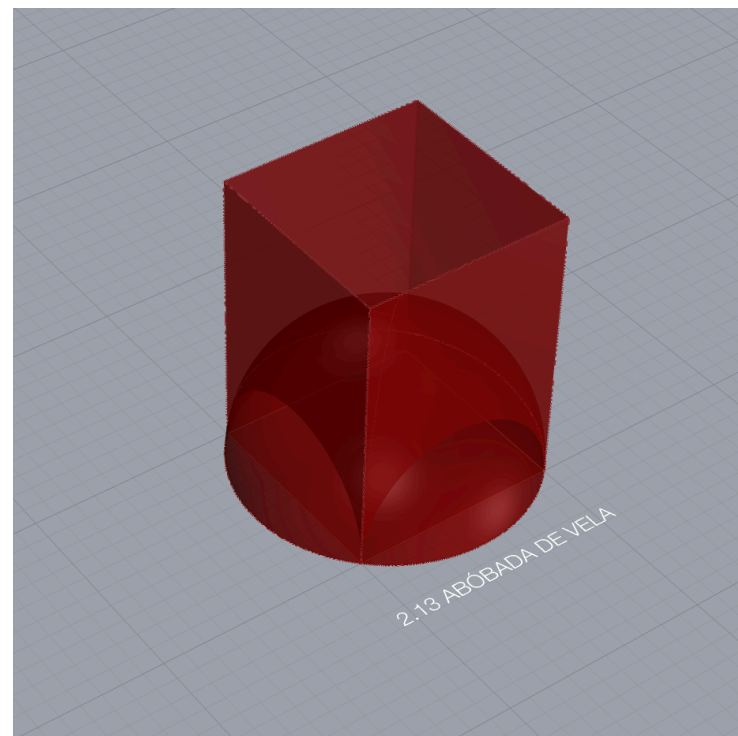
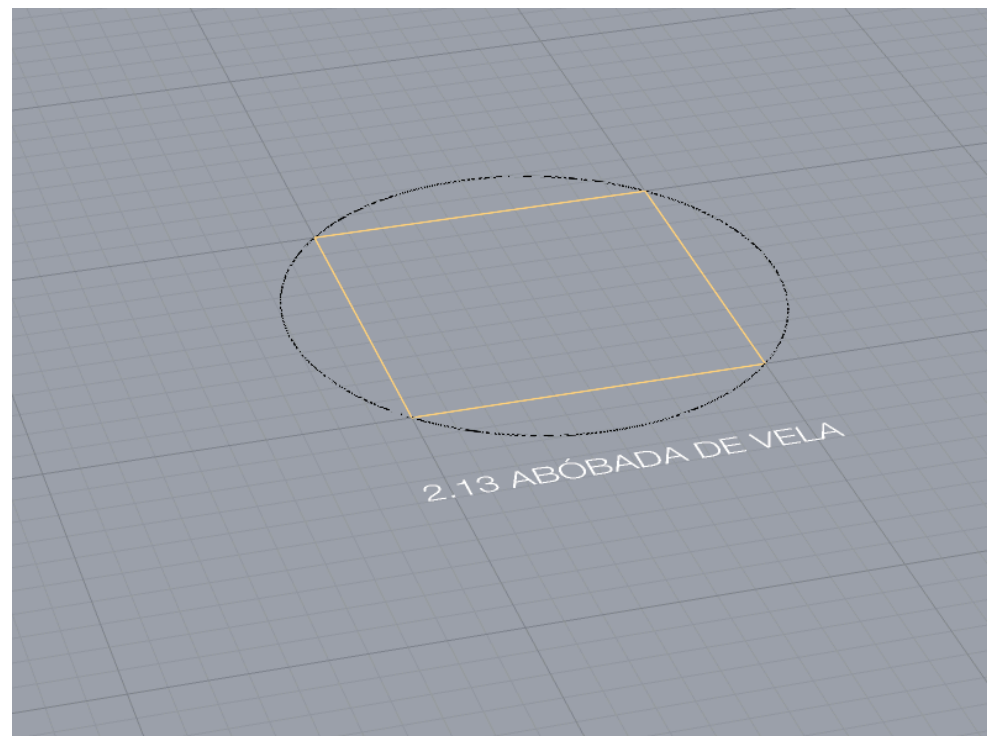
2.11 ABÓBADA ESFÉRICA



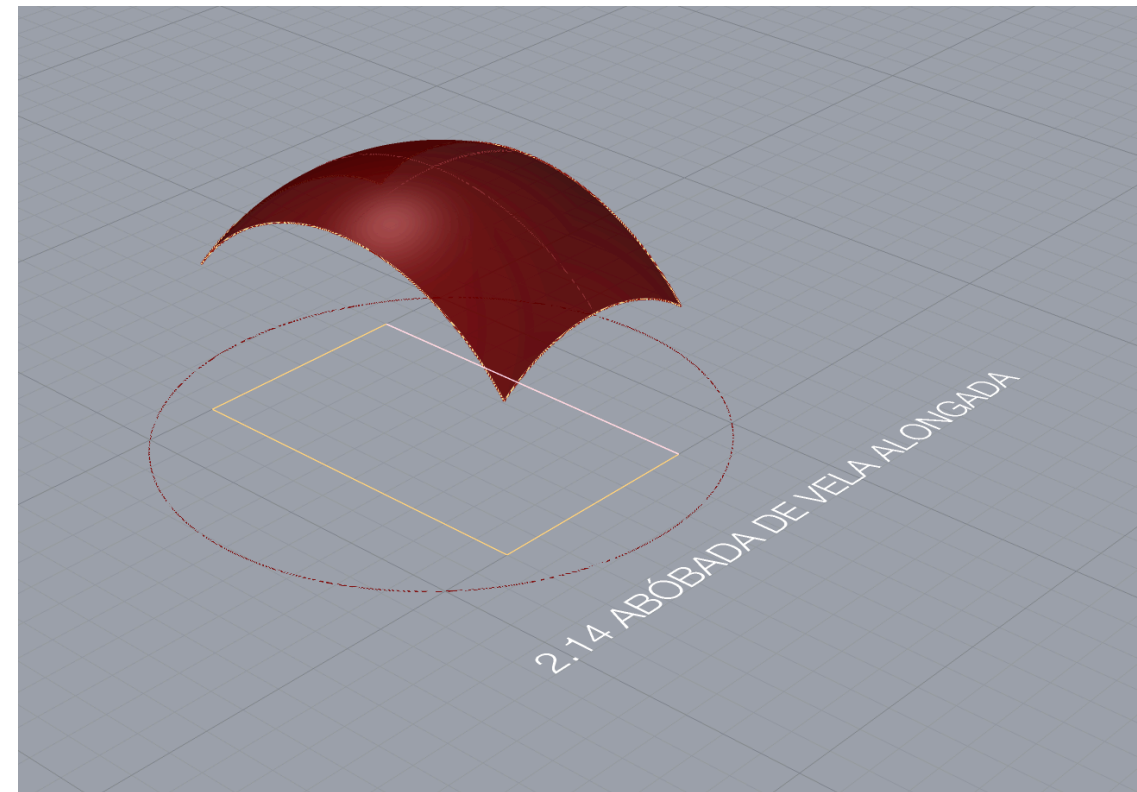
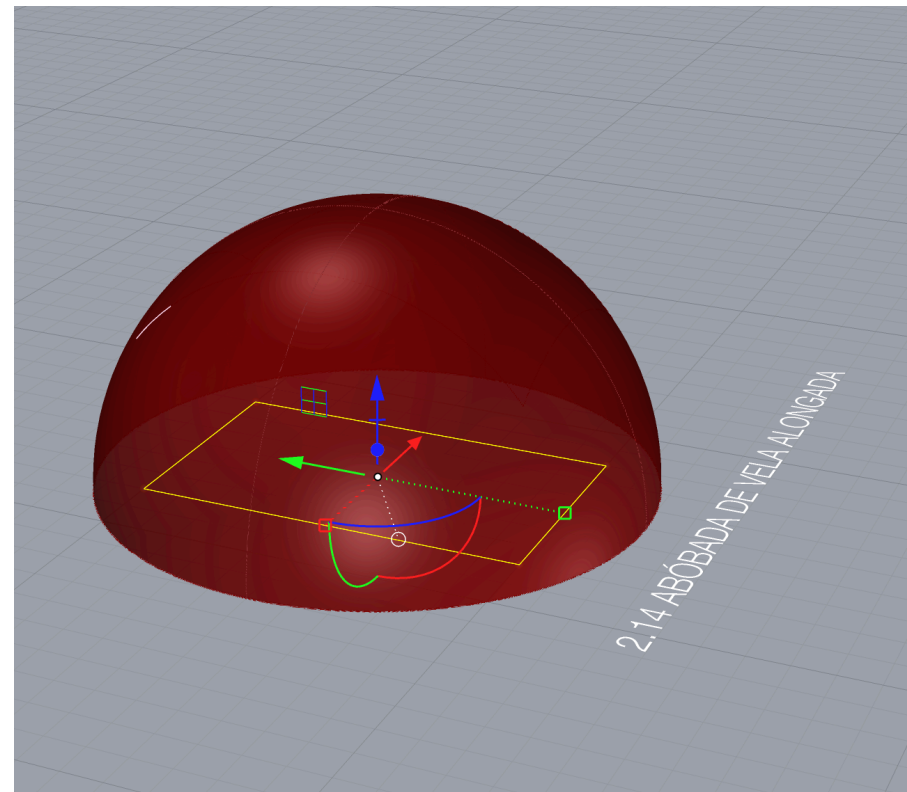
2.12 ABÓBADA DE FORNO



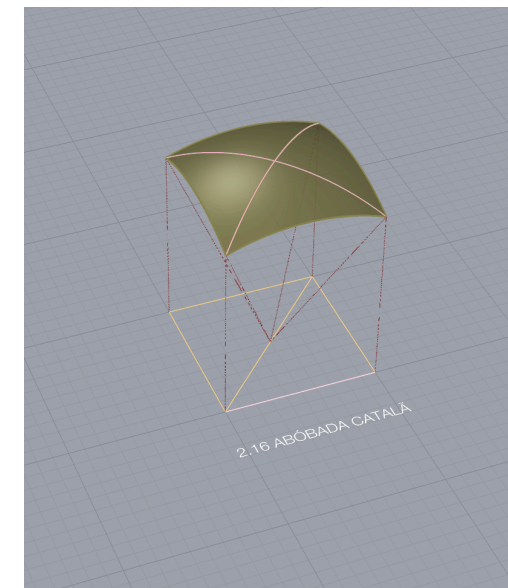
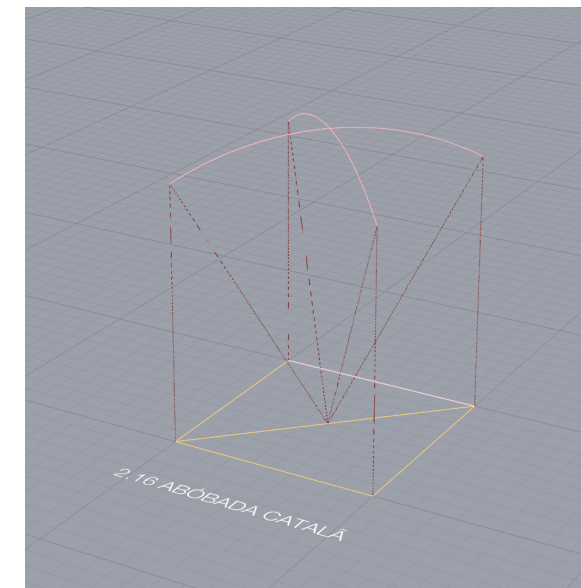
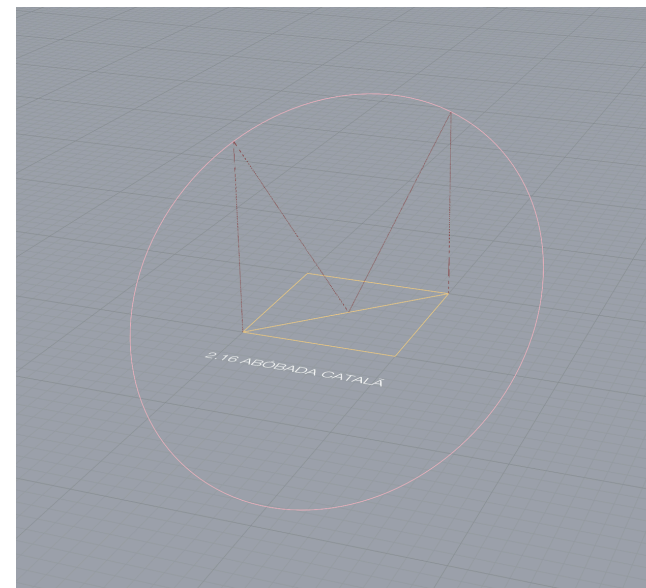
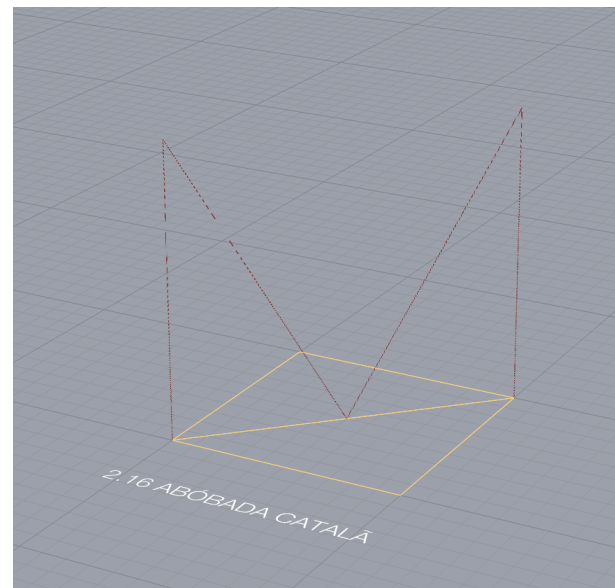
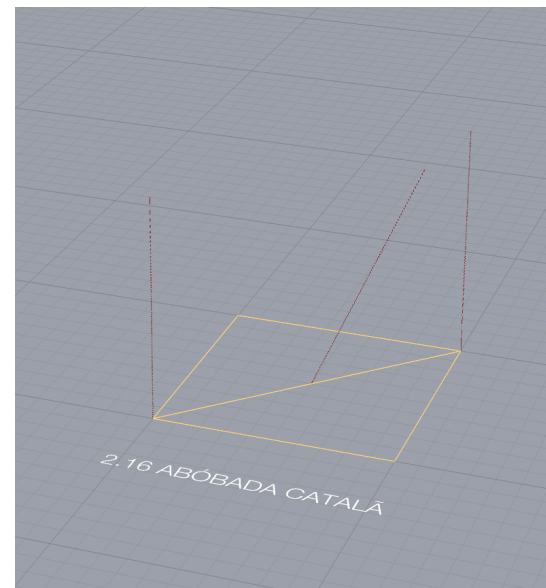
2.13 ABÓBADA DE VELA



2.14 ABÓBADA DE VELA ALONGADA



2.16 ABÓBADA DE CATALÃ

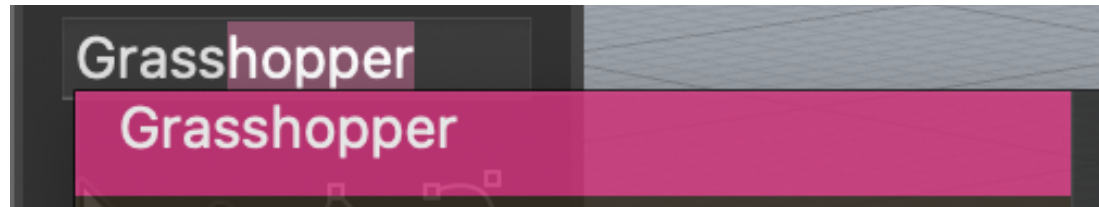


SUMÁRIO:

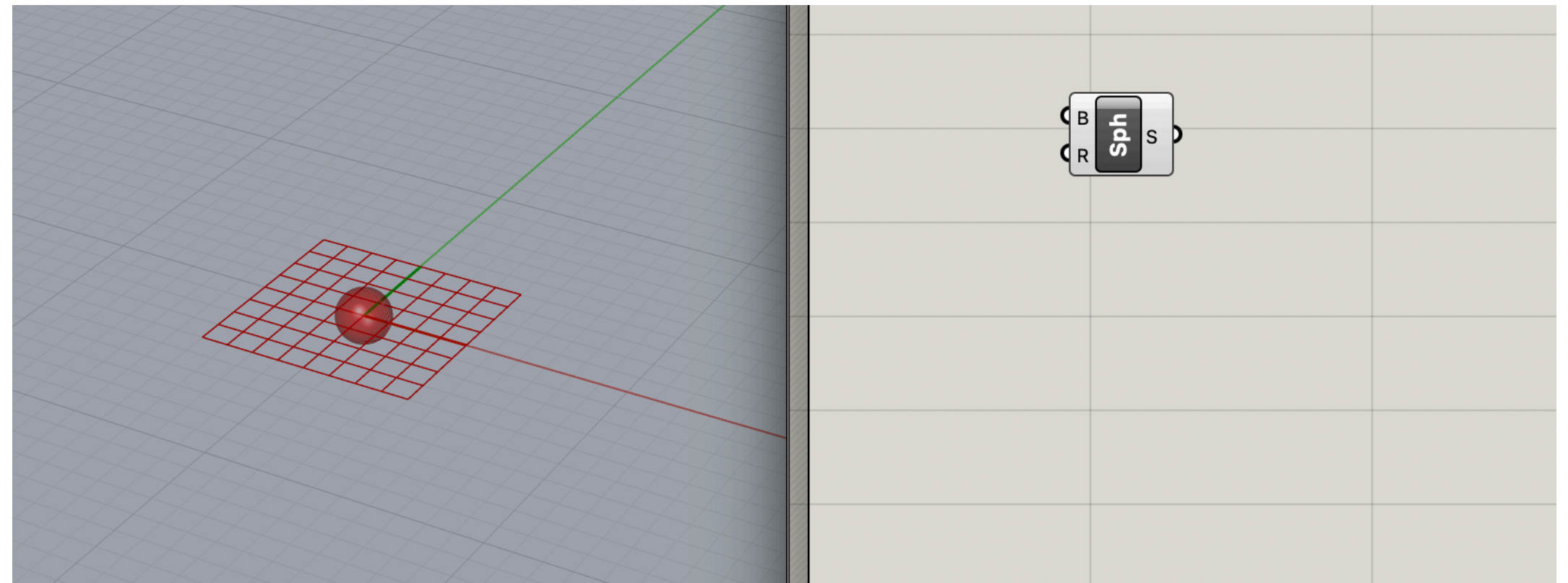
Introdução ao GrassHopper

Início da construção dos Moluscos



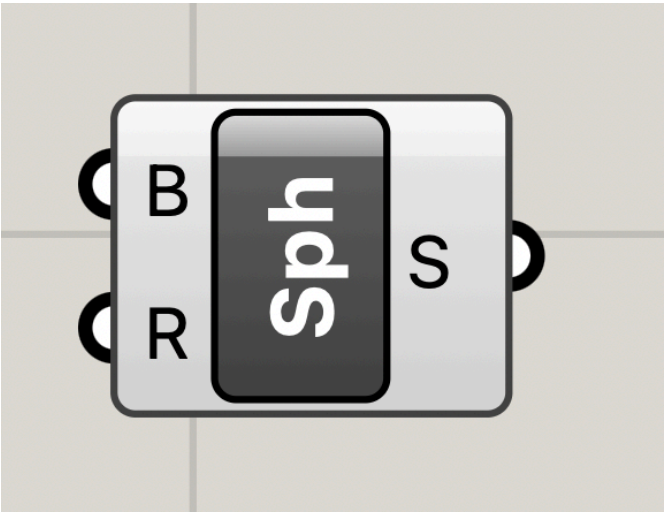


- Vamos poder escolher componentes e operações e colocá-los na sequência correta para a leitura deles.
- Trabalhar sempre com ambas as janelas em paralelo.
- Parametrizar as construções: usar valores que podem variar mas que permitem dimensionar determinados objetos.

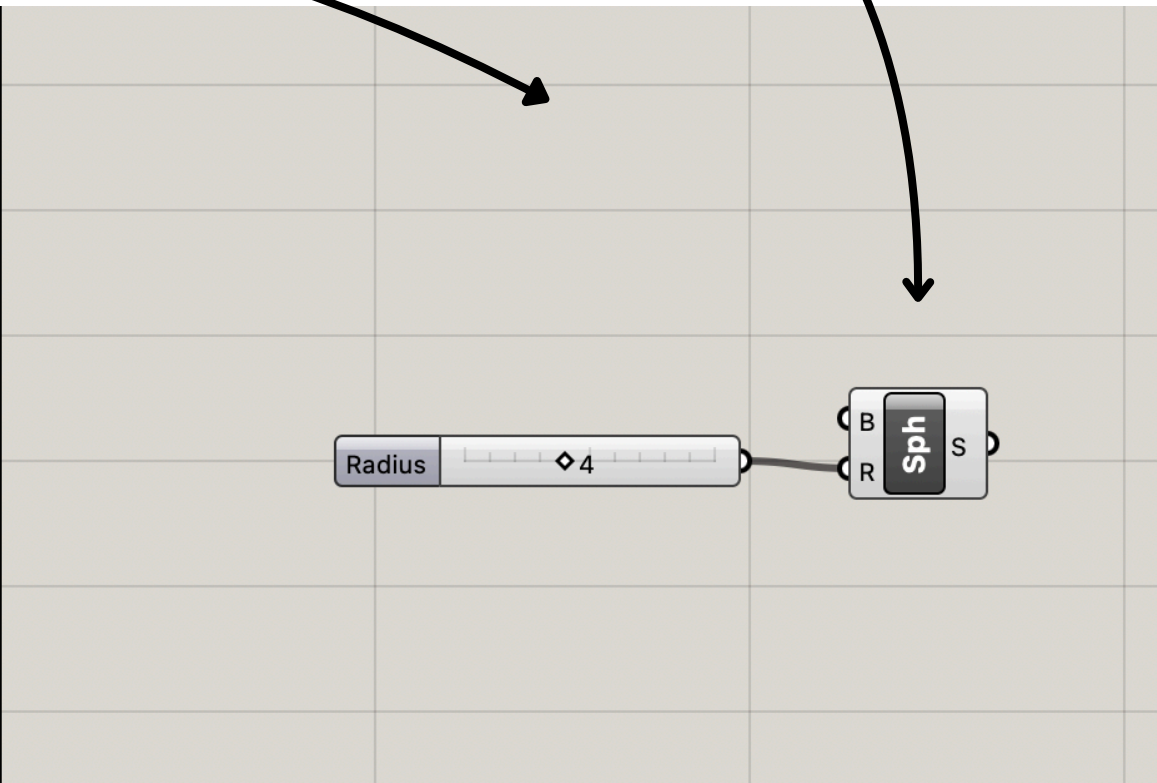
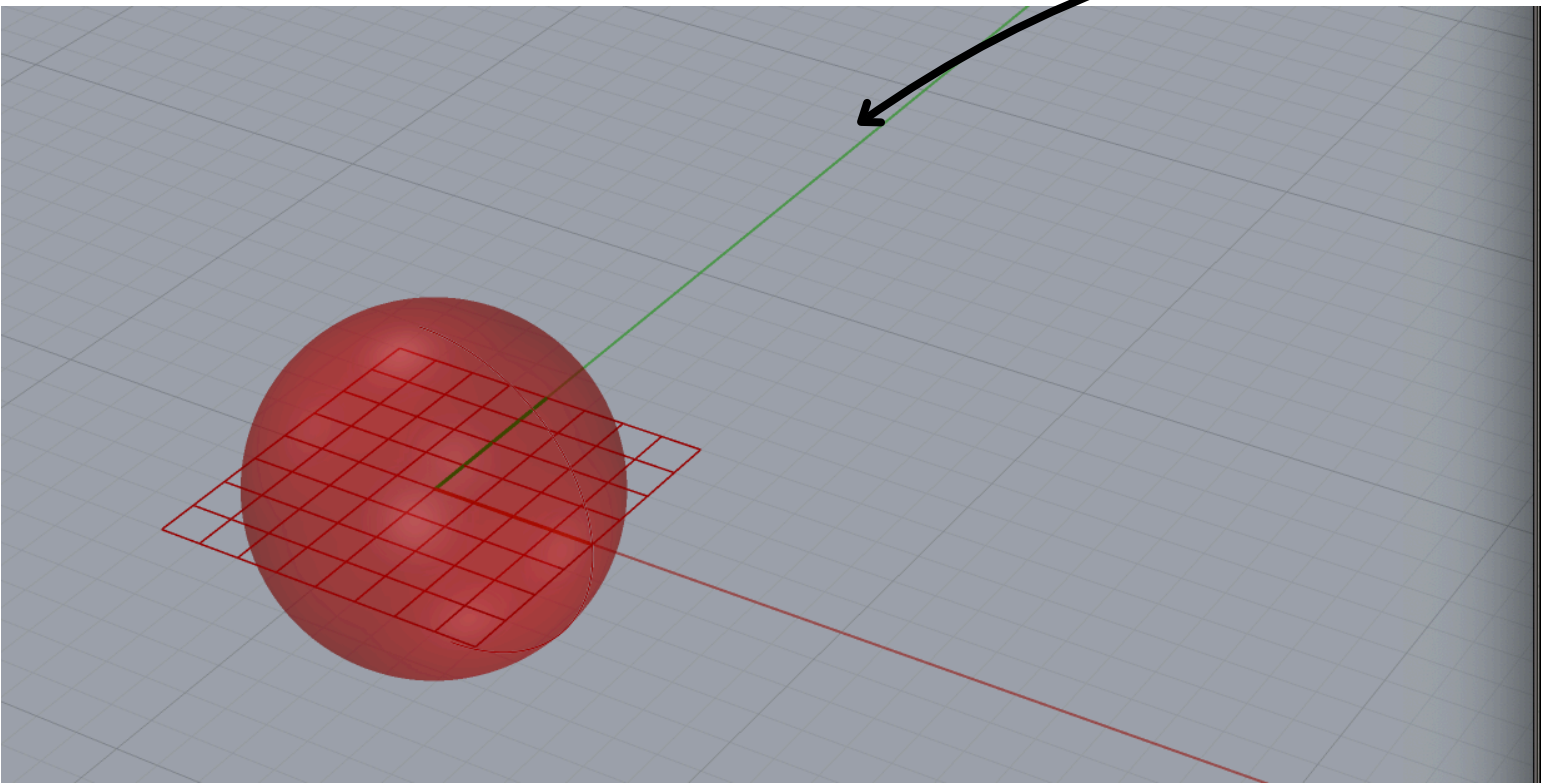
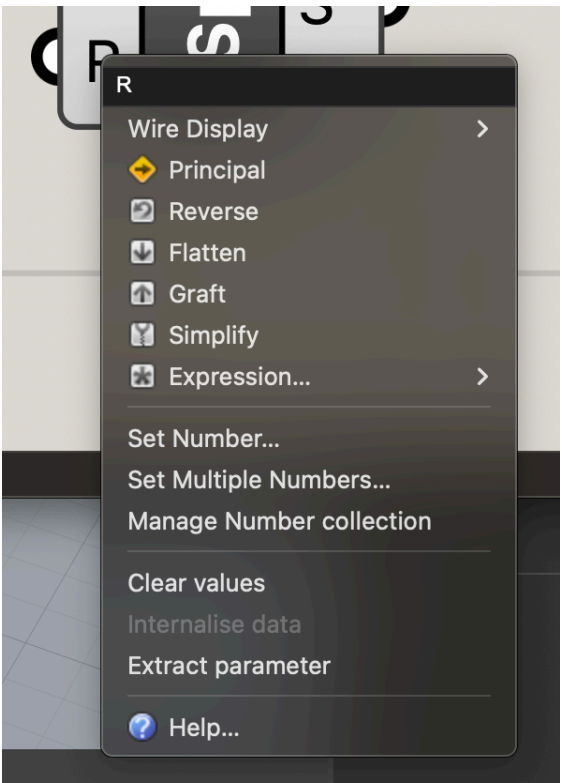
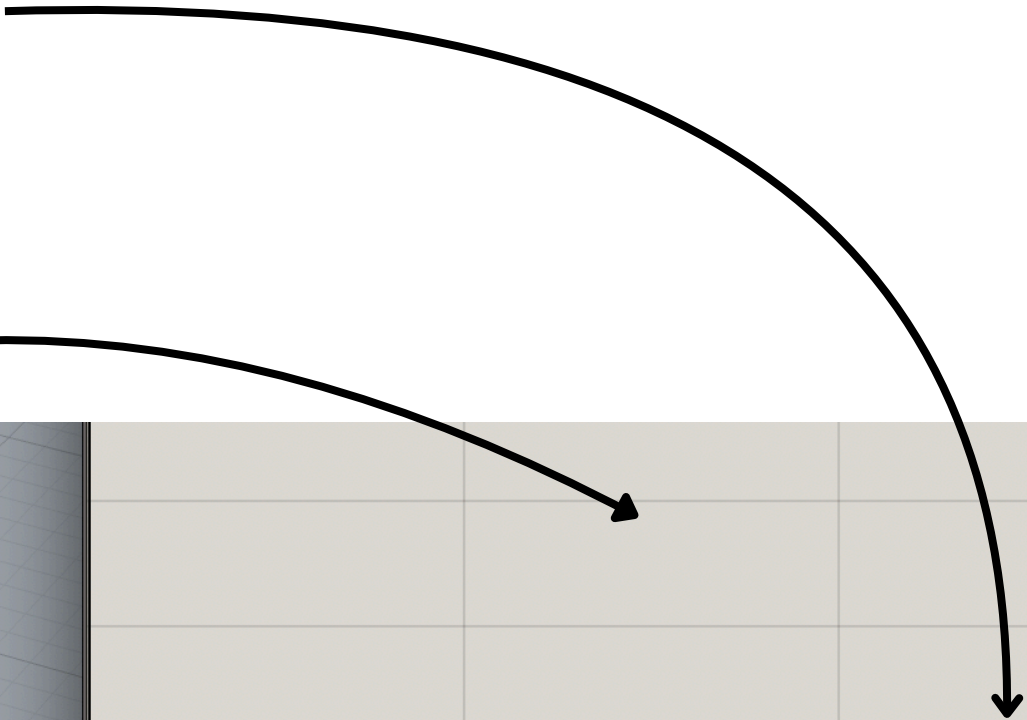


B- Base plane onde?

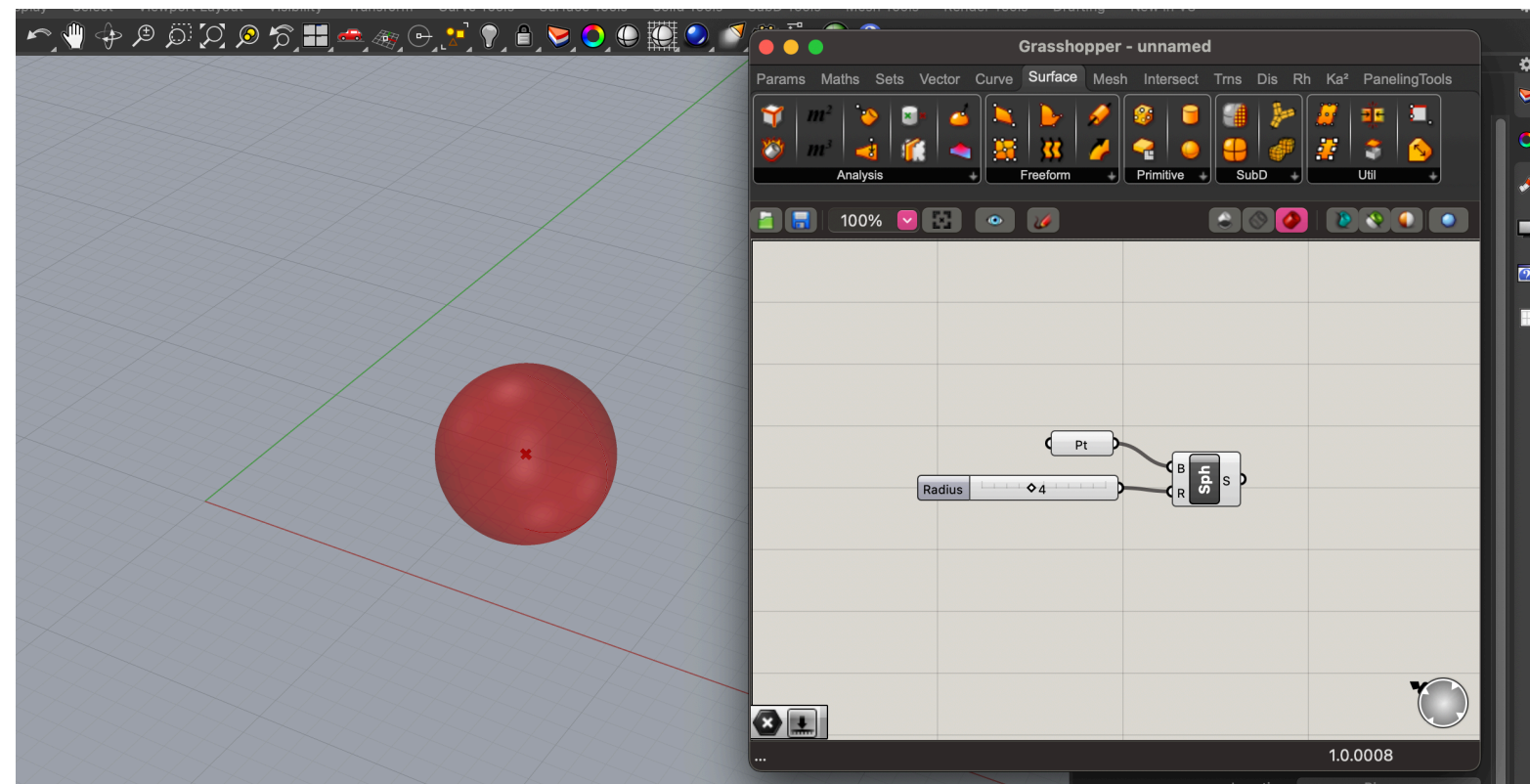
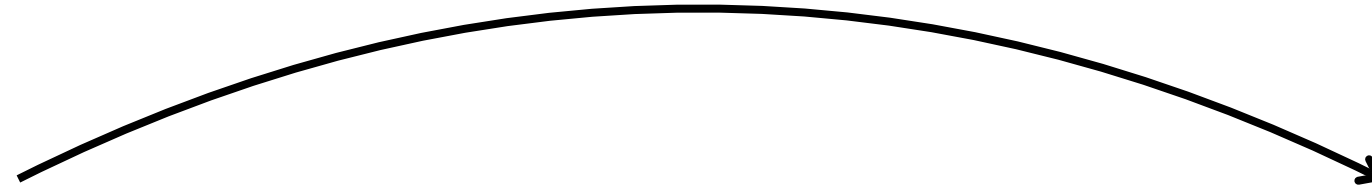
R- Raio



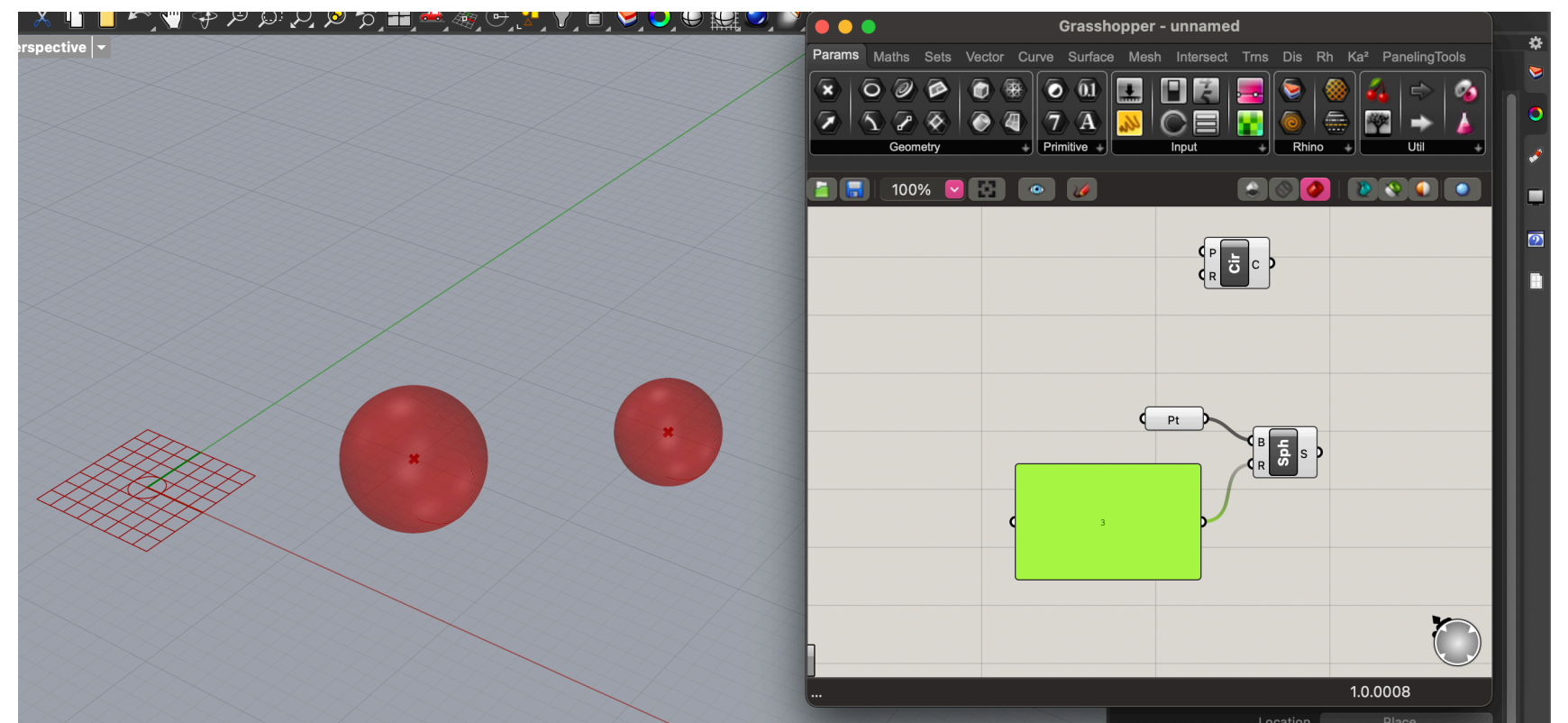
Esfera



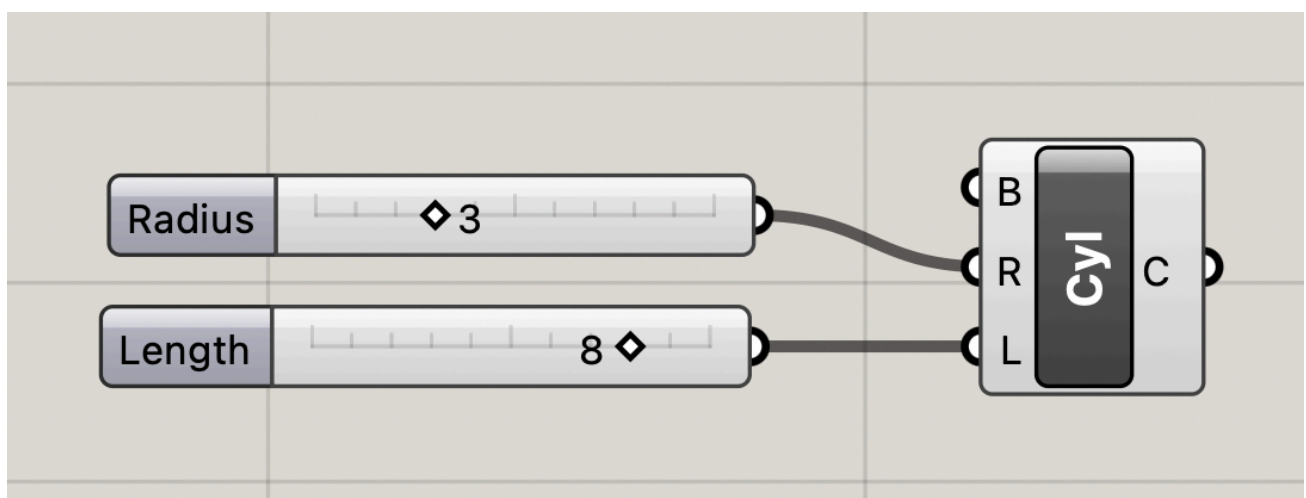
OU



Slide Bar

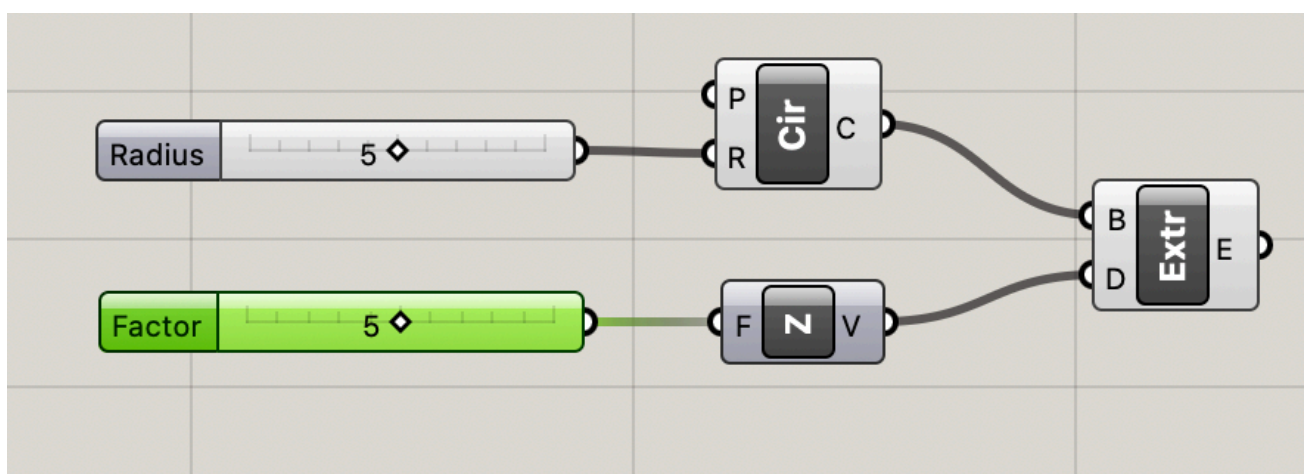


Panel

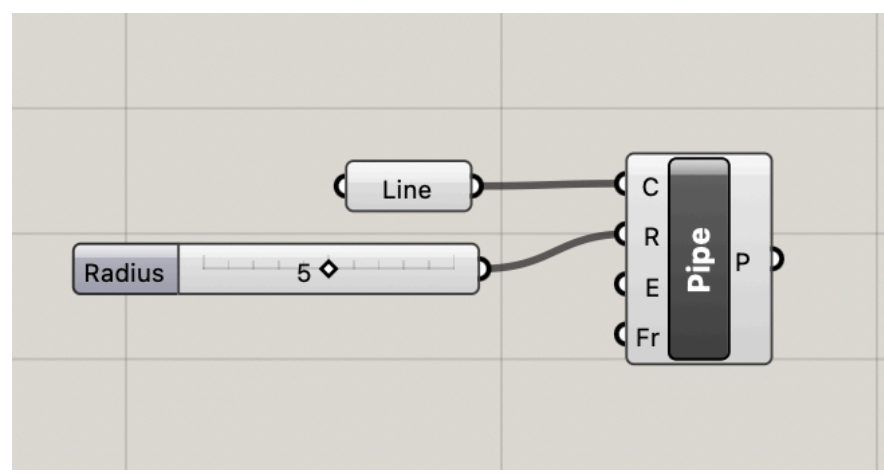


1

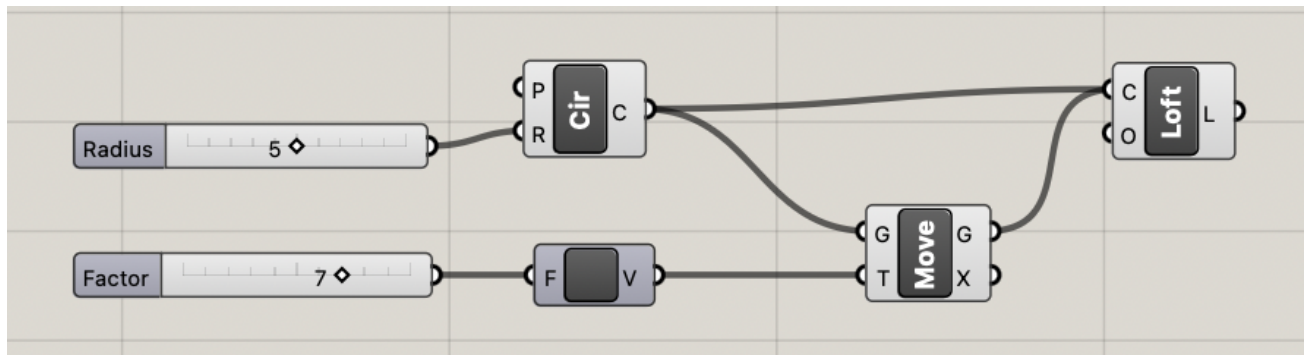
5 MADEIRAS DE CONSTRUIR UM CILINDRO



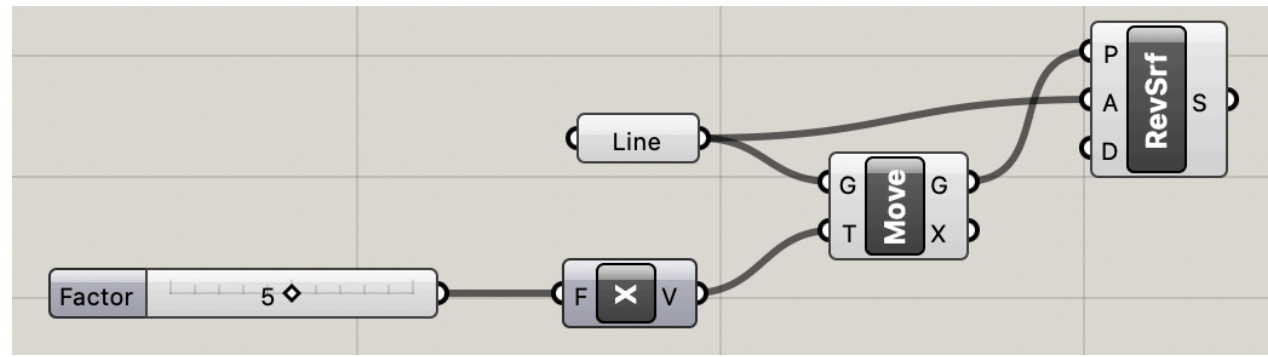
2



4



3



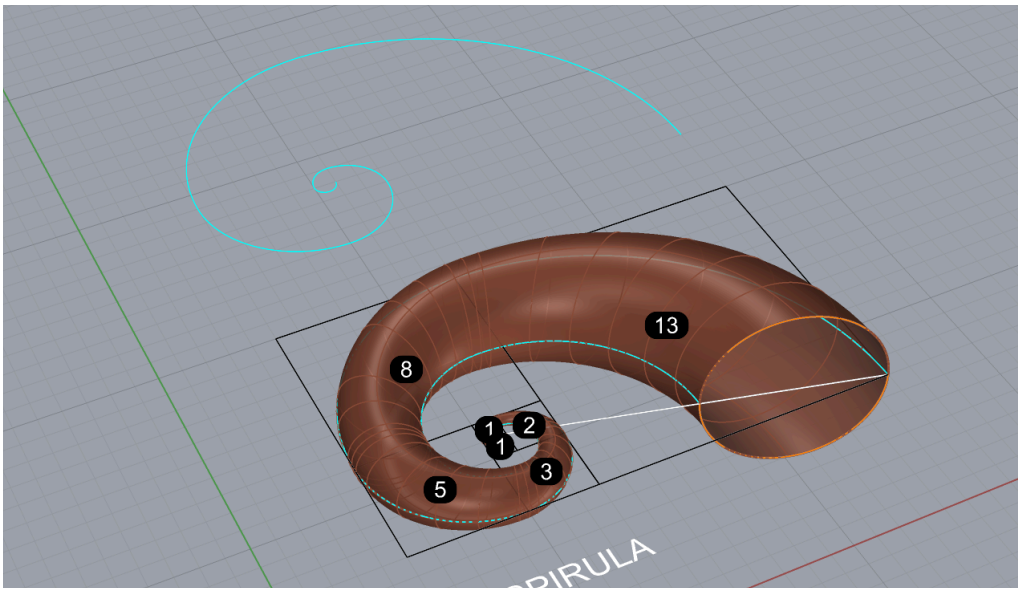
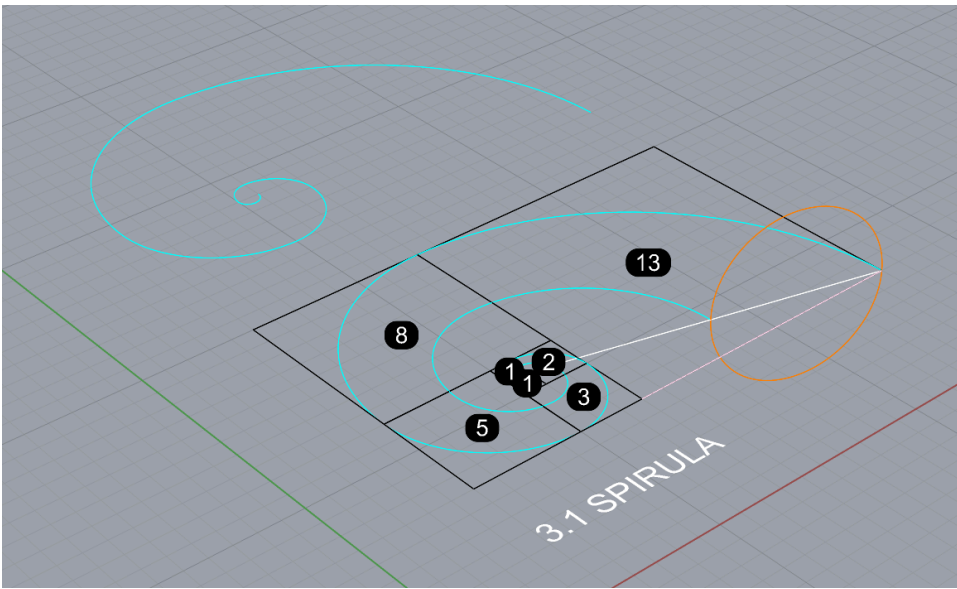
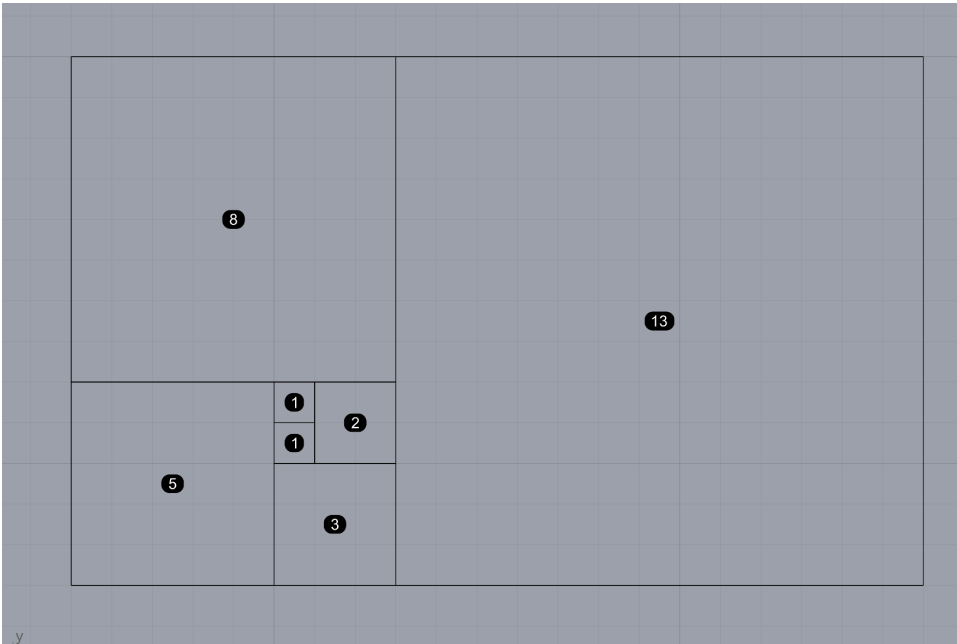
5

MOLUSCOS

- SPIRULA
- PLANORBI
- NAUTILUS
- CARACOL
- CARAMUJO DO MAR

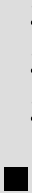


SPIRULA

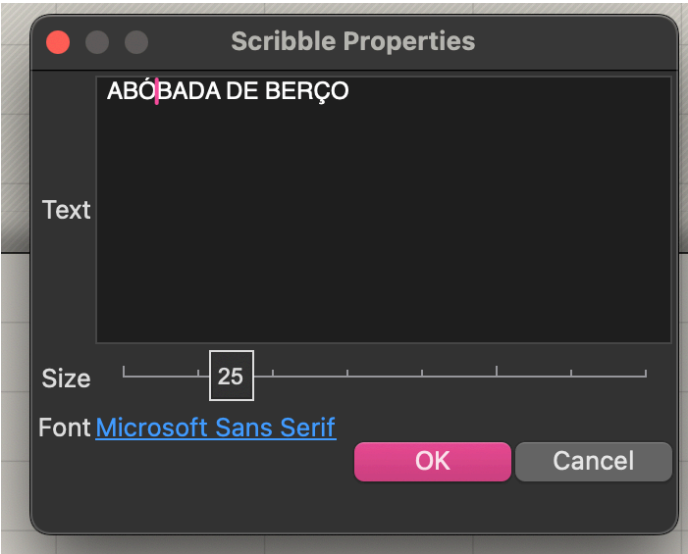
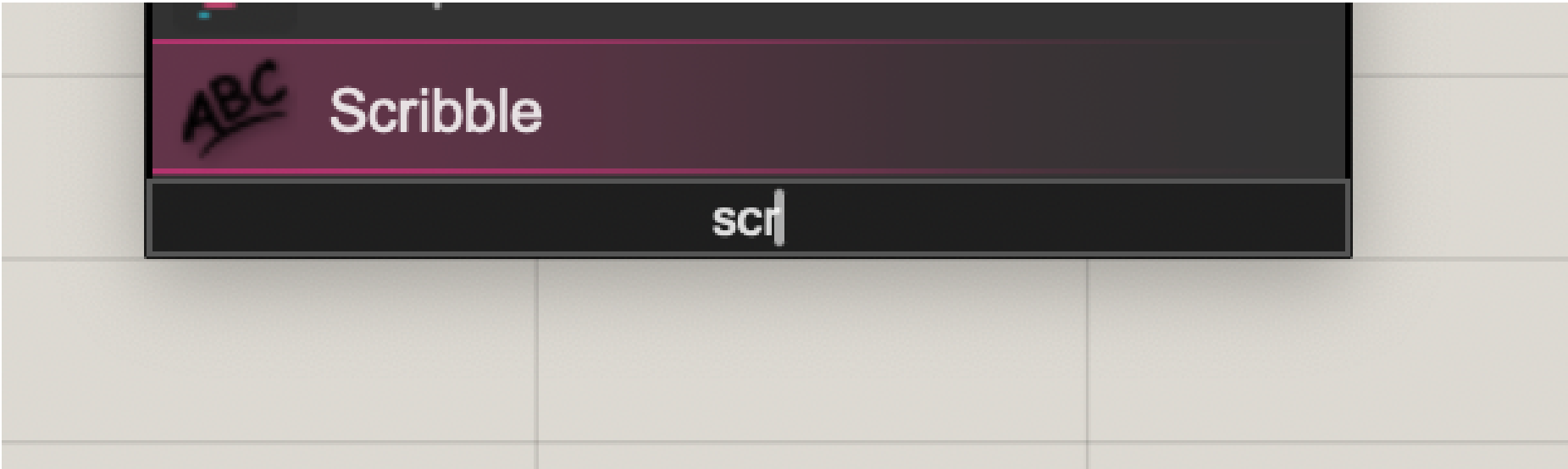


SUMÁRIO:

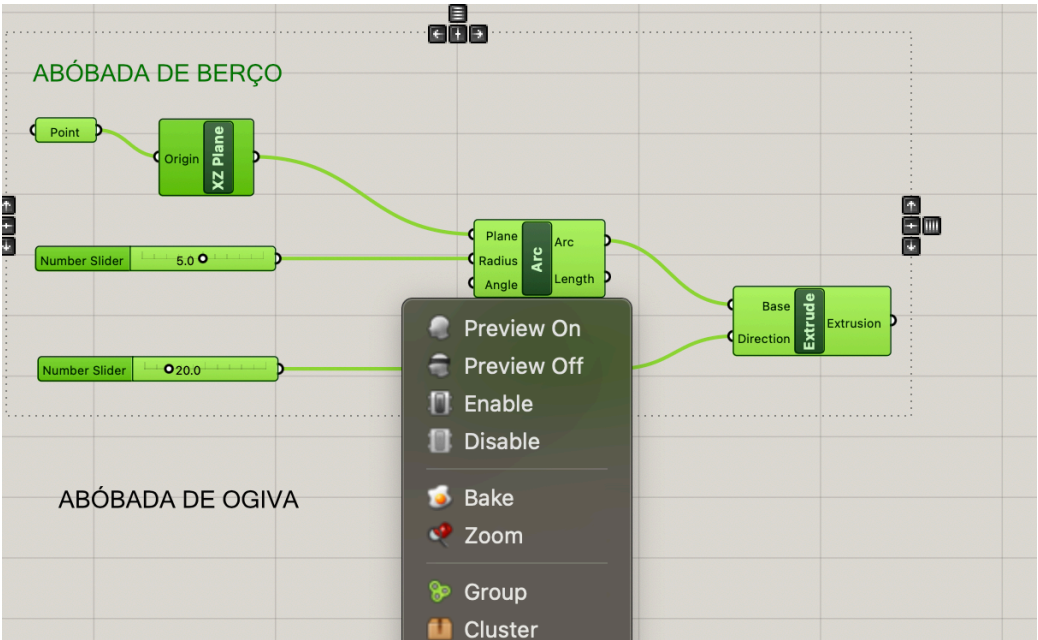
Abobadas com grasshoper



Escrever notas:



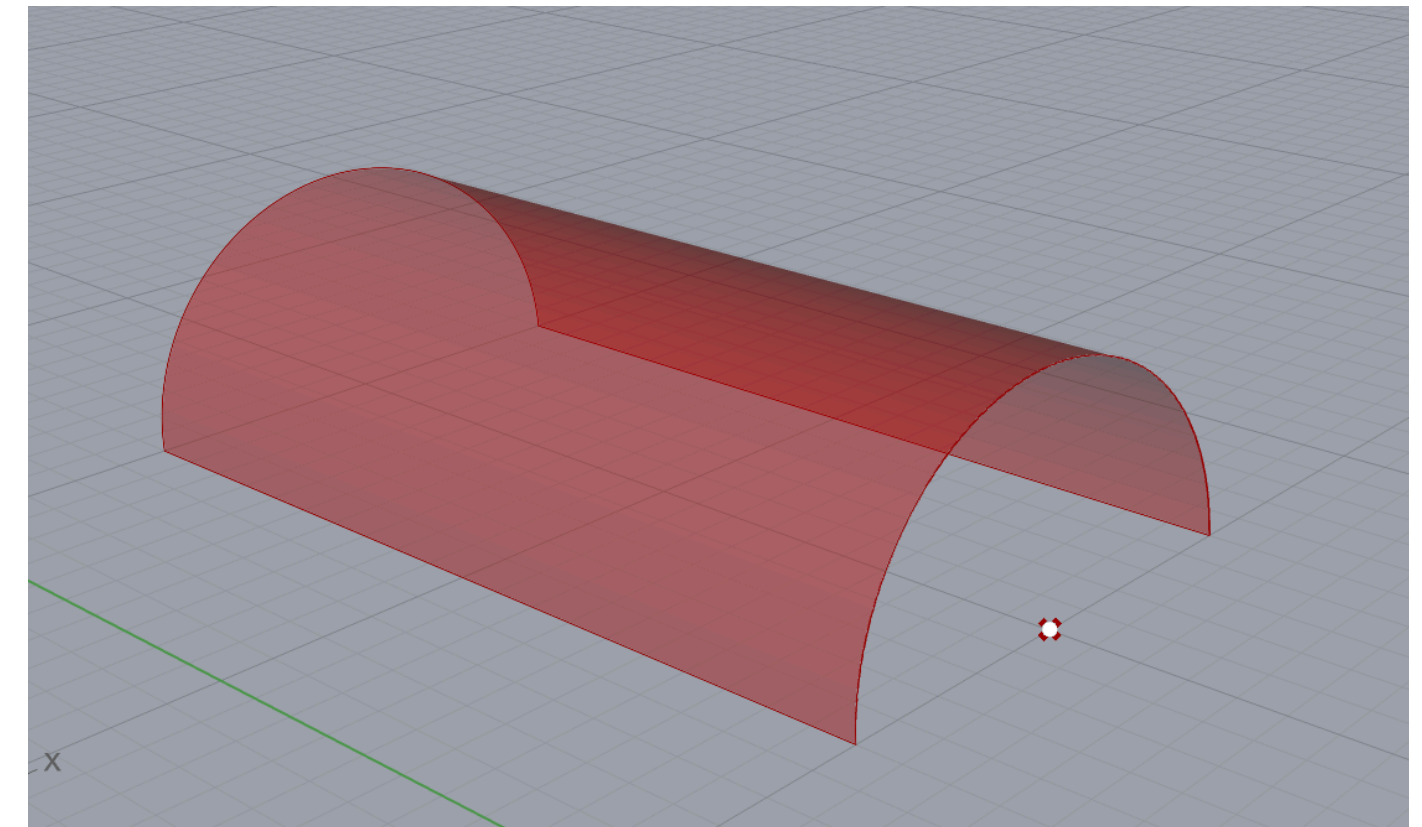
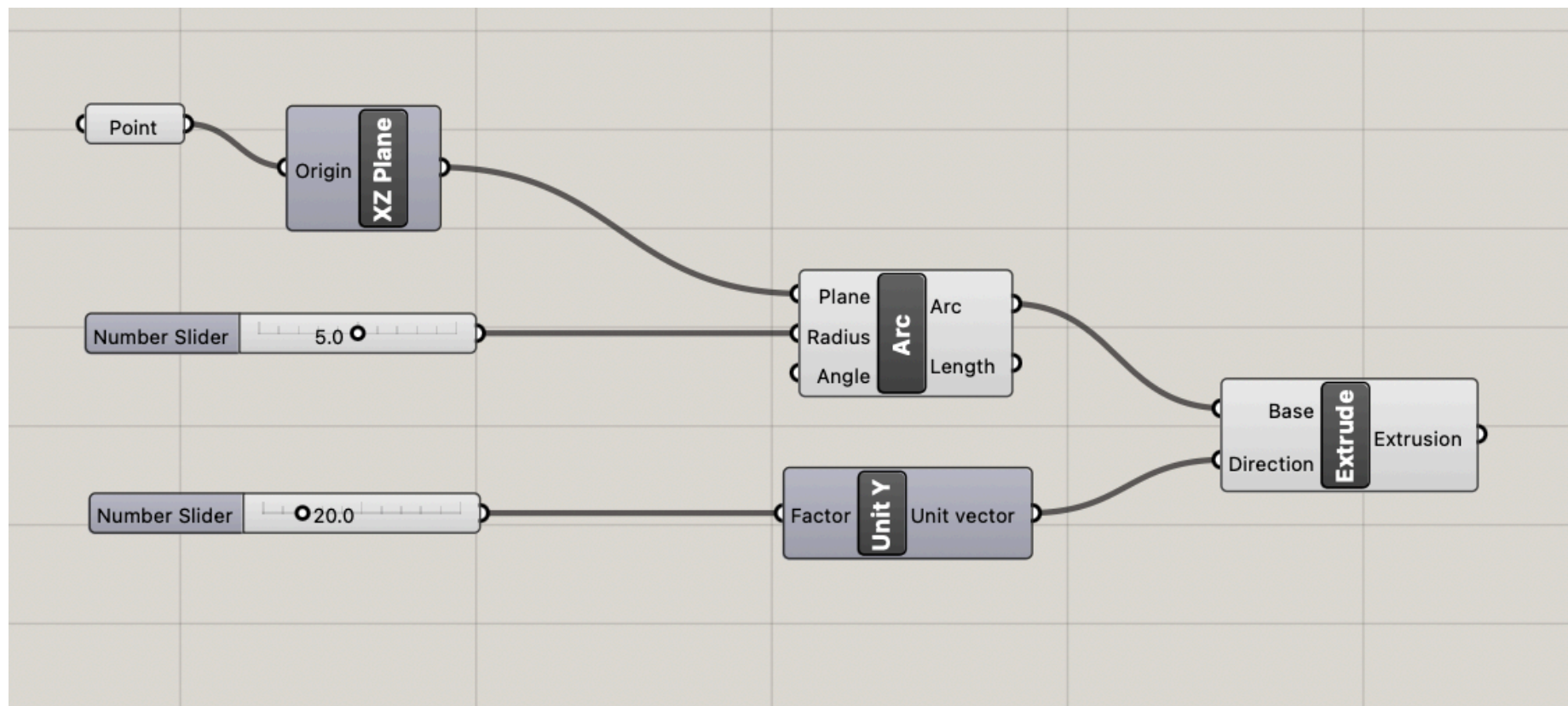
Agrupar:



ABÓBADA DE BERÇO

ABOBADA DE BERÇO: Arco 180° com centro - extrude do arco.

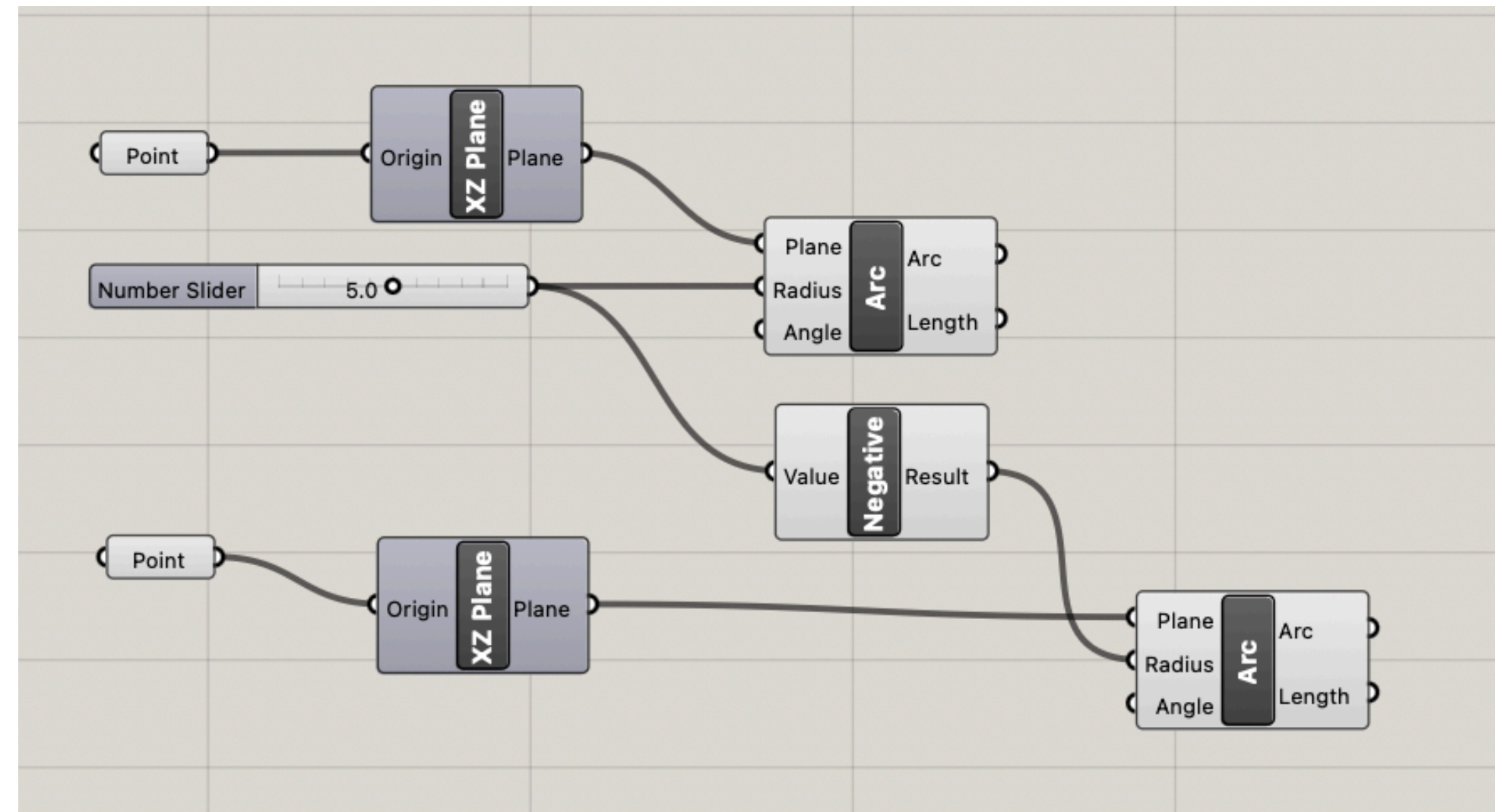
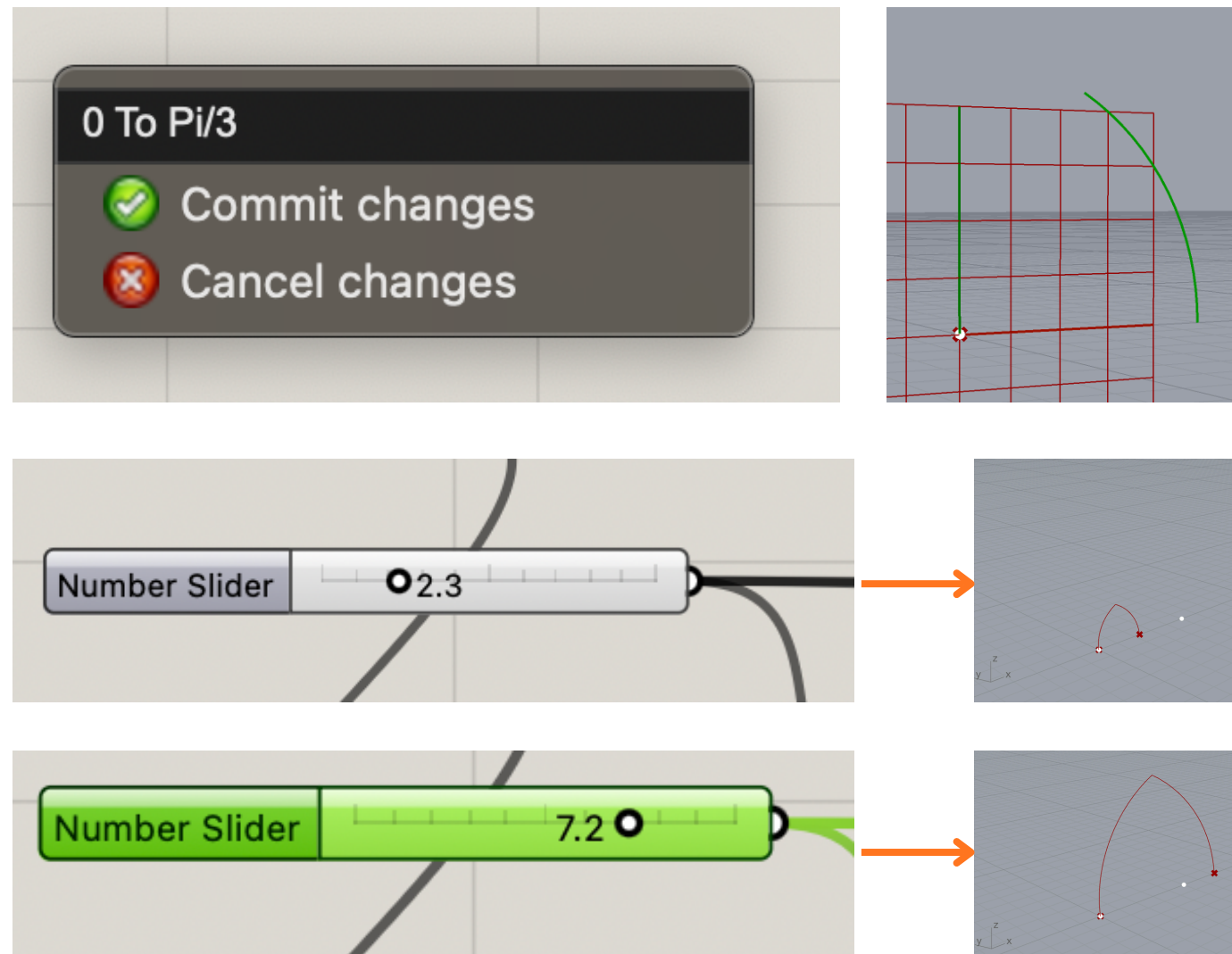
Agora podemos mudar as dimensões sem ter de apagar a forma .



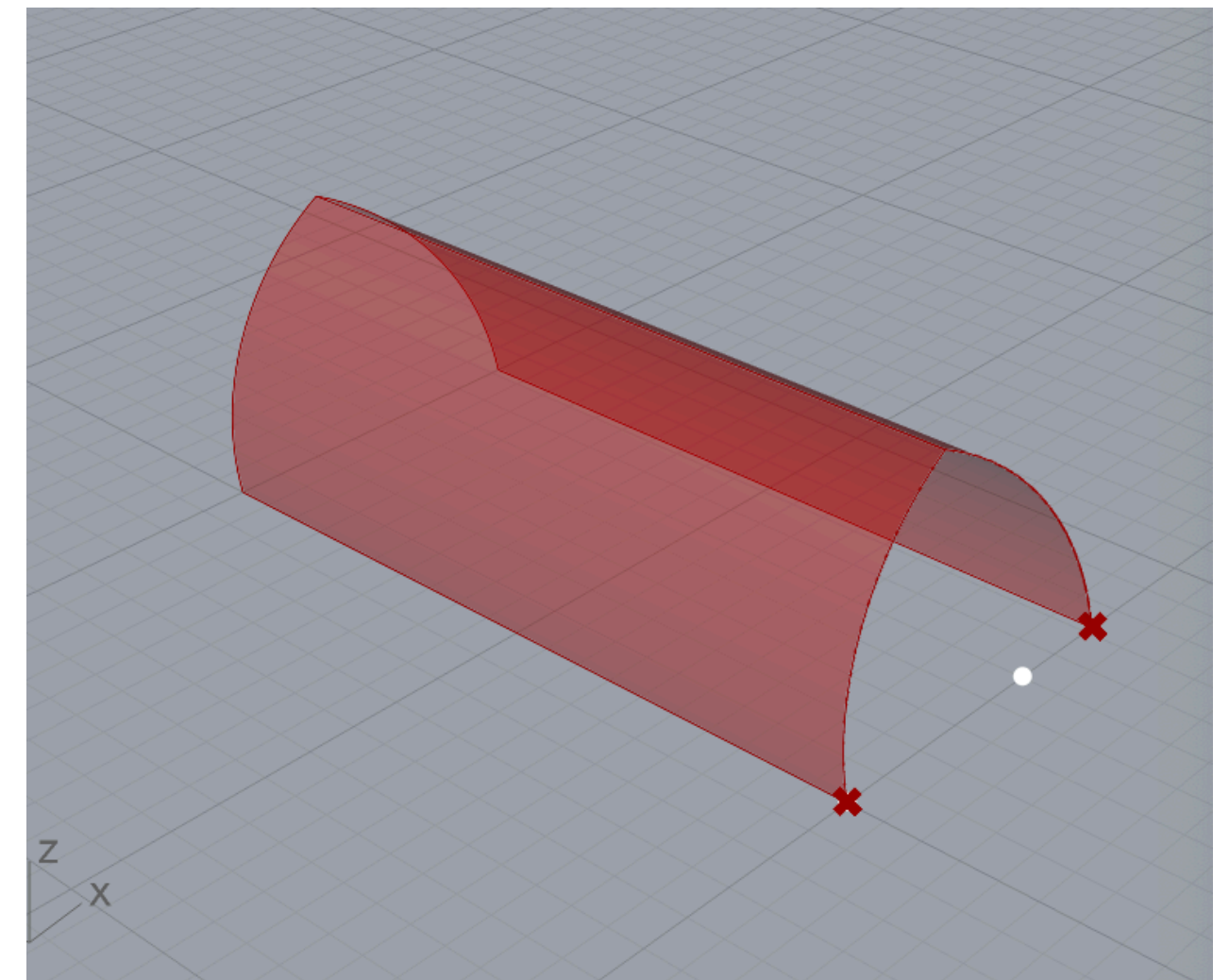
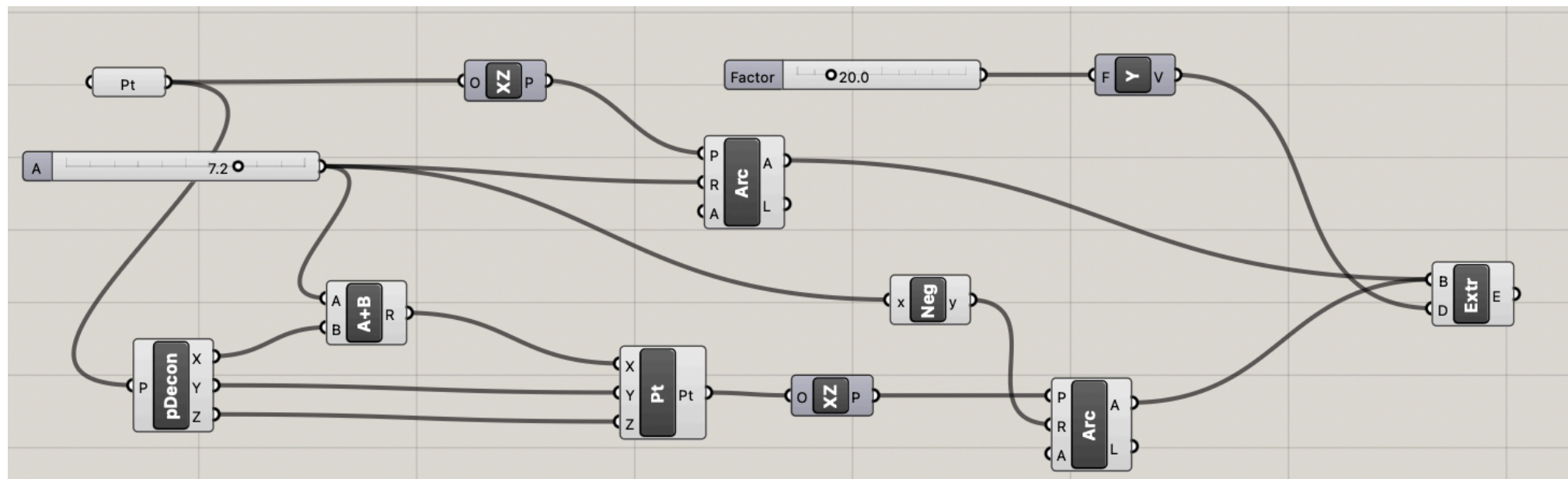
ABÓBADA DE OGIVA

ABOBADA DE OGIVA (arco gótico)

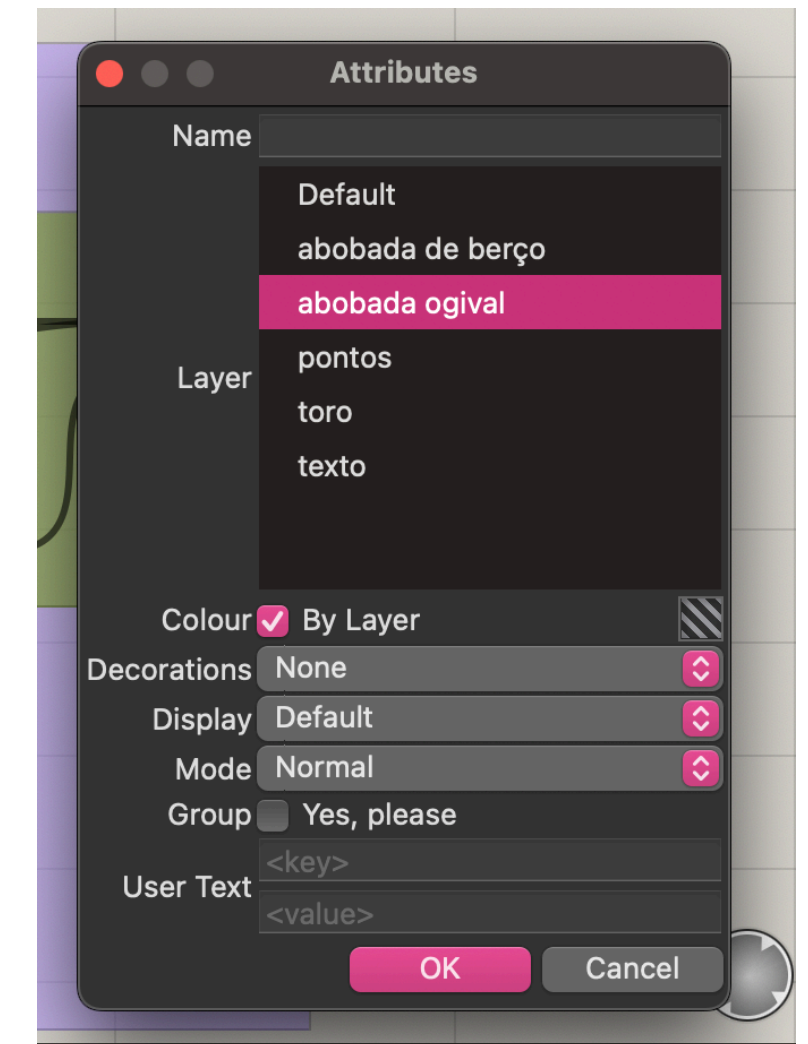
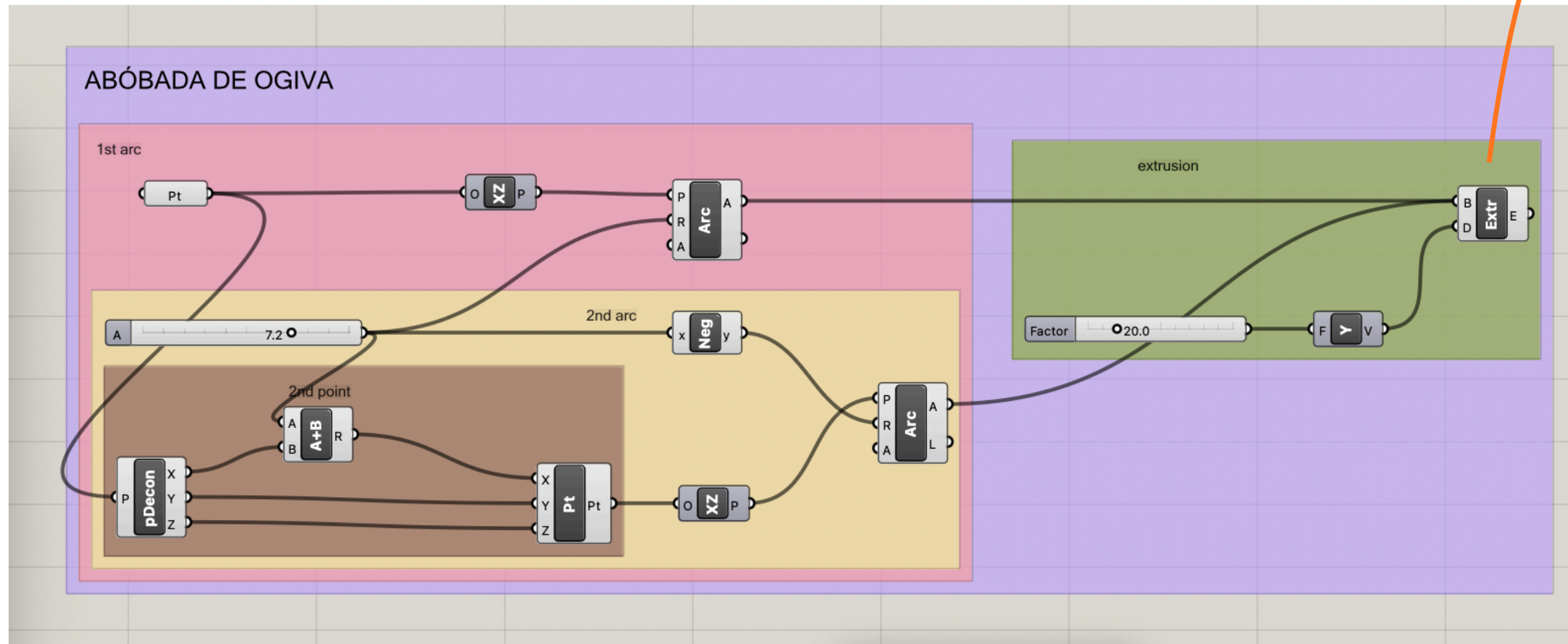
- pertence a um triângulo equilátero cm 60° .



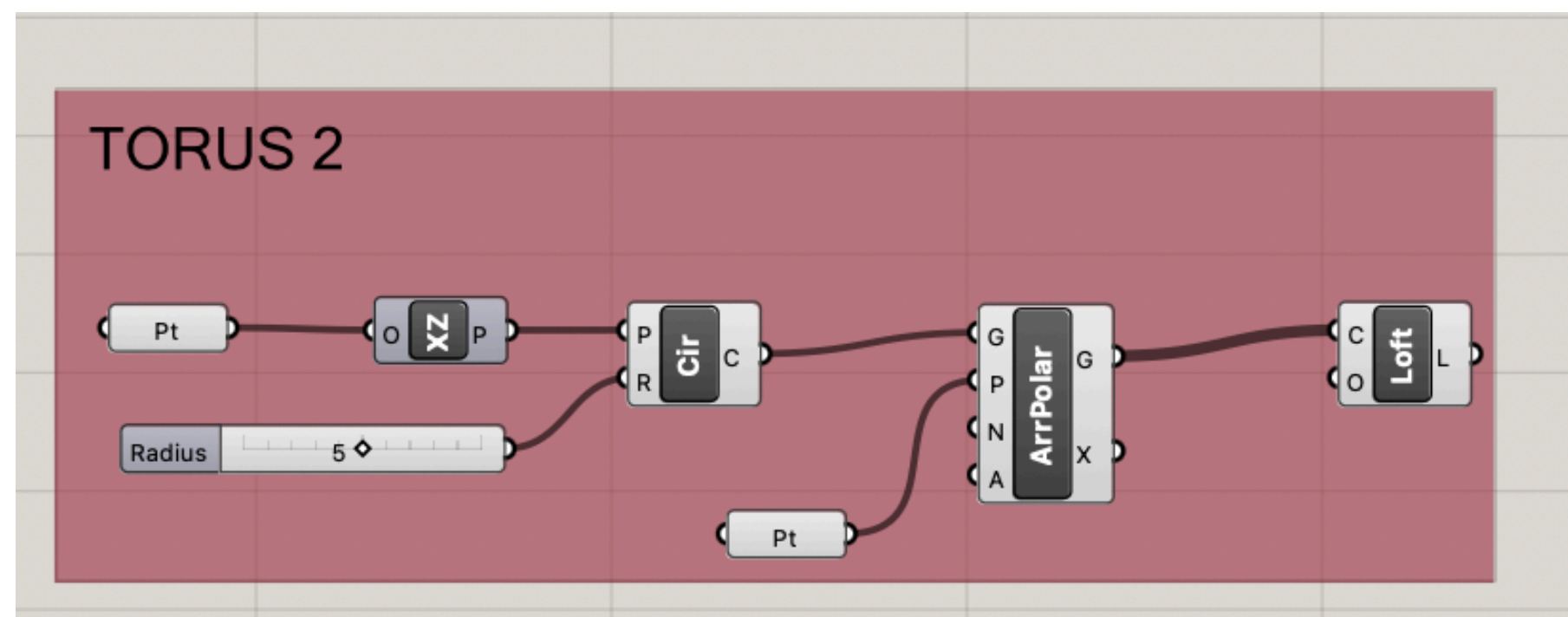
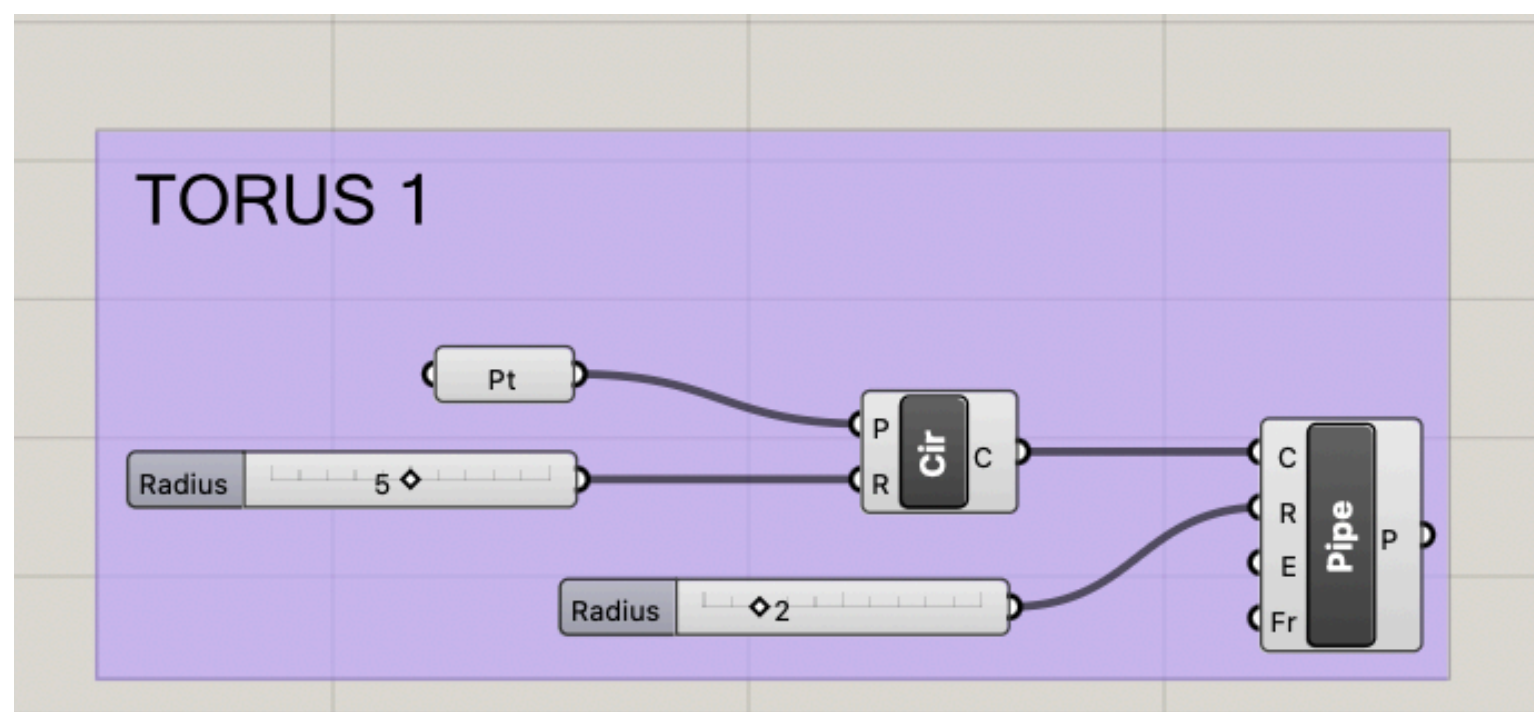
ABÓBADA DE OGIVA



fazer sempre o Bake do extrude final

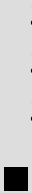


TORUS



SUMÁRIO:

Planorbis
listas
listas de listas



LISTAS E LISTAS DE LISTAS:

podemos ter um grupo com informação e pontos diferentes e criar uma lista. ou podemos separar todos os pontos e dizer que cada um pertence a uma lista.

lista independente: grupo de coordenadas.

grasshoper continuação...

CRIAR O TORUS:

grasshoper continuação...

expression designer: $x^2 - y^2$

surface 4 point

nunca esquecer BAKE

SUMÁRIO:

caramujo do mar no grasshopper

Caramujo

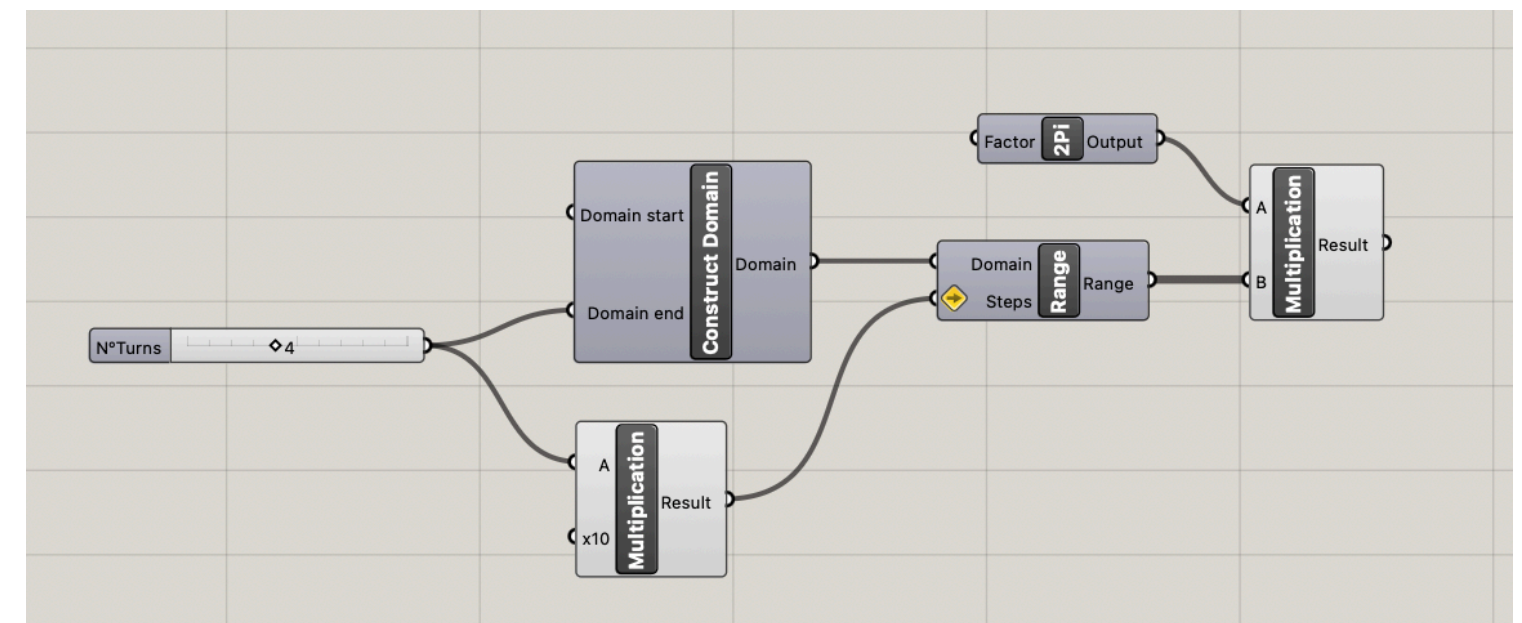
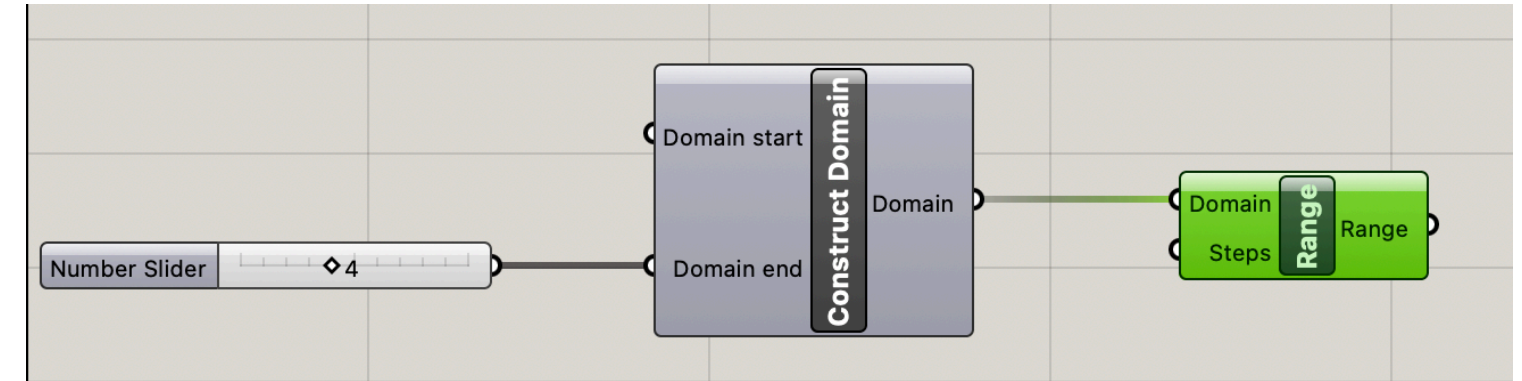
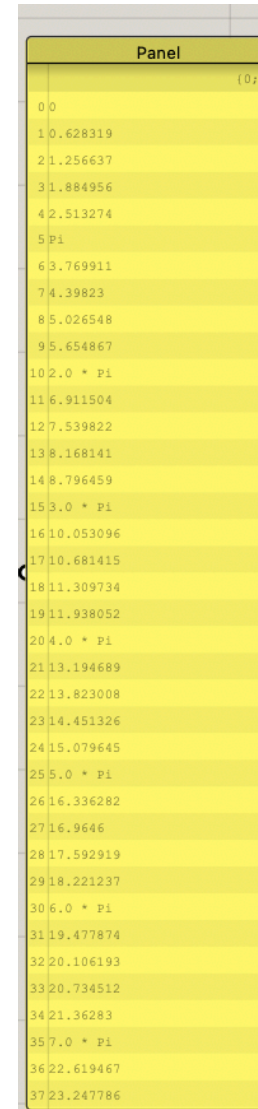
Uma hélix, depois depois e uma volta
diminuimos a $\frac{1}{2}$ e assim sucessivamente.

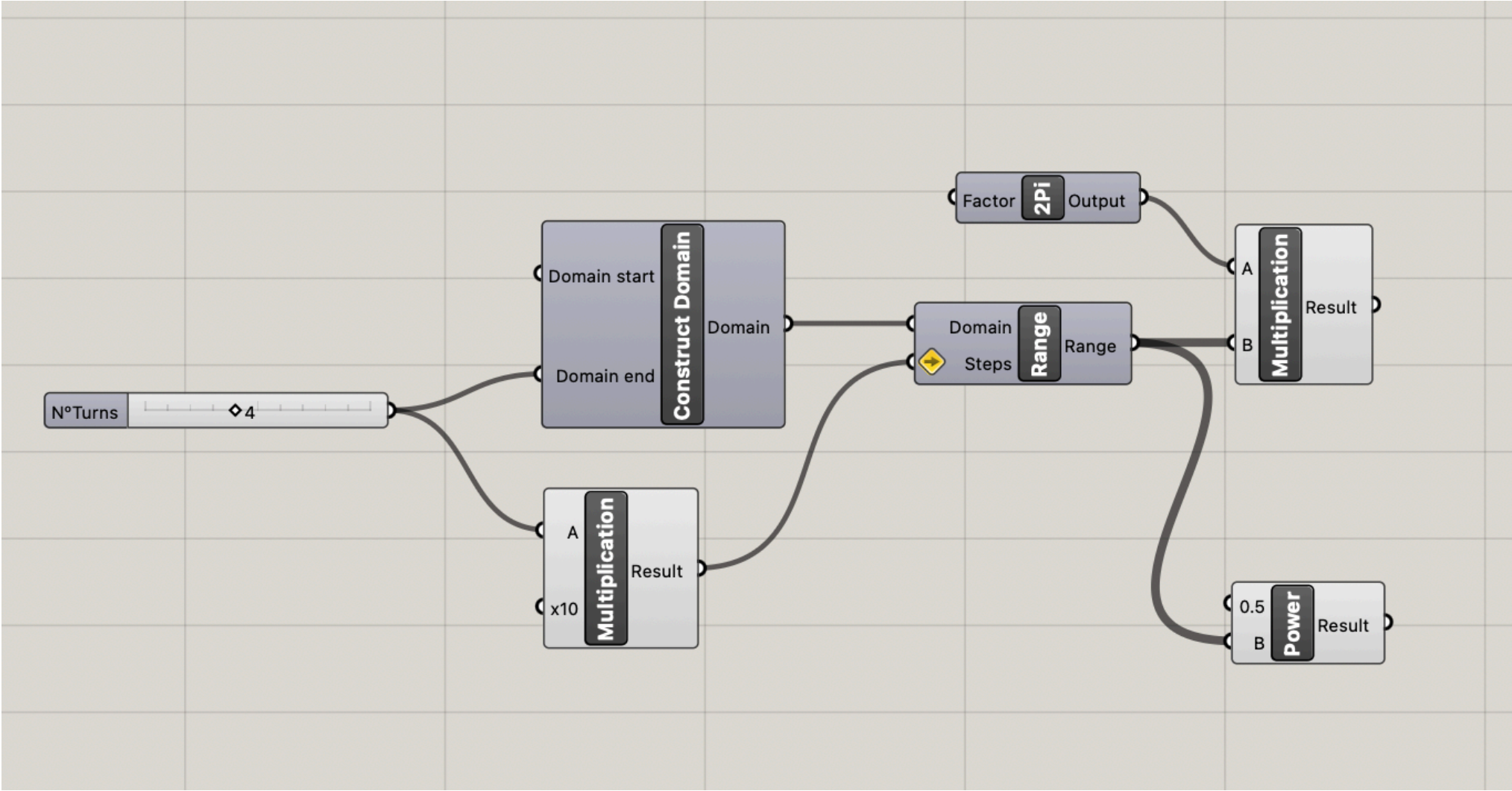
Número de voltas, loft, ...

1^a DOMAIN

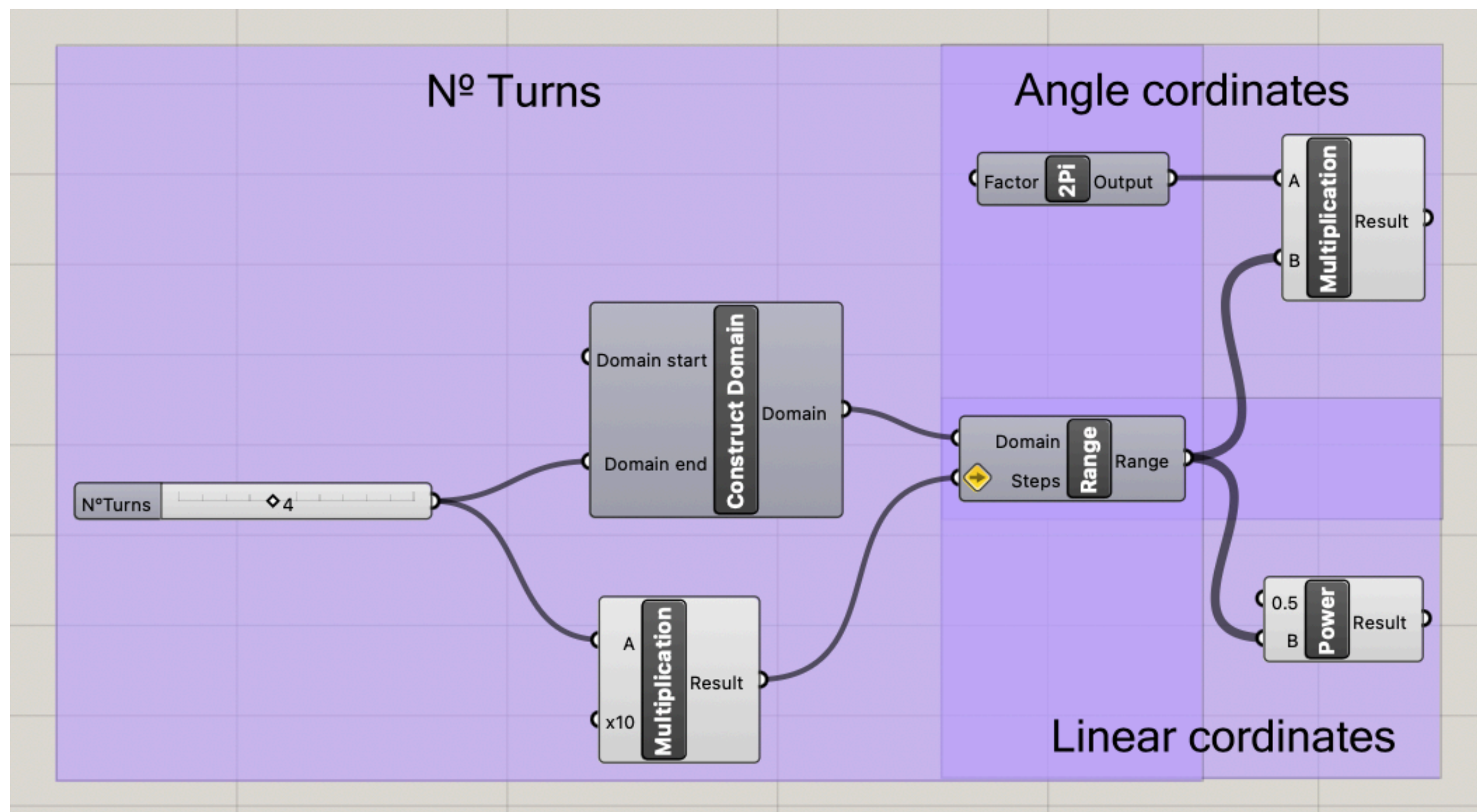
2°RANGE

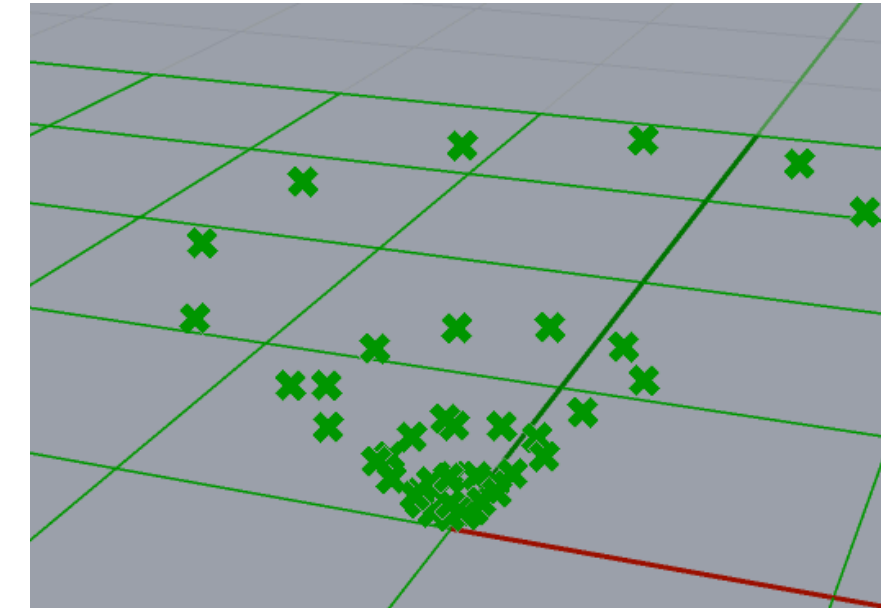
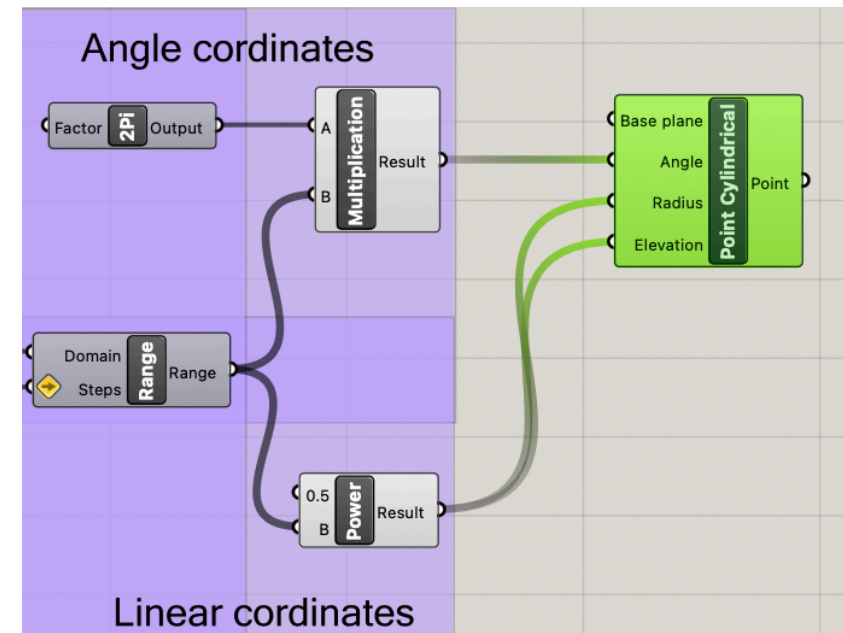
Resultado sao as rotation cordenates



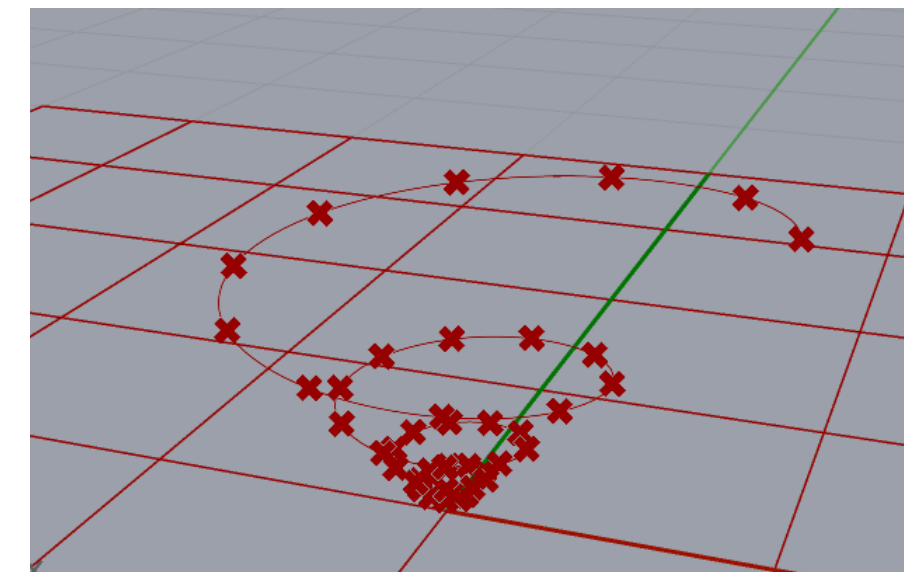
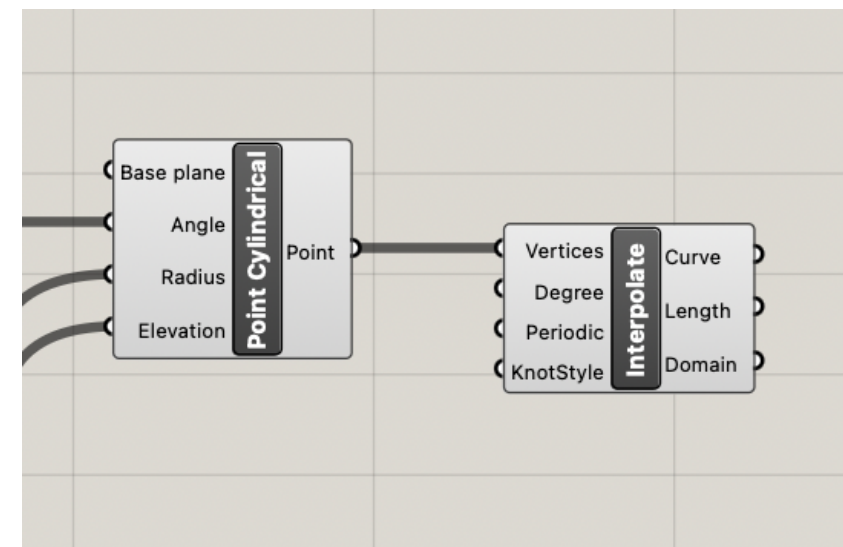


Panel	
	{0,0}
0	1
1	0.933033
2	0.870551
3	0.812252
4	0.757858
5	0.707107
6	0.659754
7	0.615572
8	0.574349
9	0.535887
10	0.5
11	0.466516
12	0.435275
13	0.406126
14	0.378929
15	0.353553
16	0.329877
17	0.307786
18	0.287175
19	0.267943
20	0.25
21	0.233258
22	0.217638
23	0.203063
24	0.189465
25	0.176777
26	0.164938
27	0.153893
28	0.143587
29	0.133972
30	0.125
31	0.116629
32	0.108819
33	0.101532
34	0.094732
35	0.088388
36	0.082469
37	0.076947
38	0.071794
39	0.066986
40	0.0625



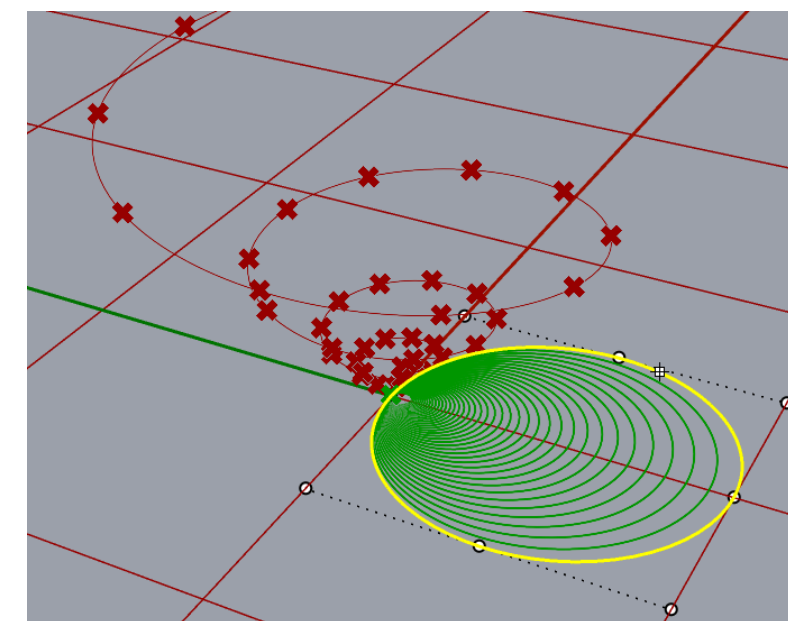
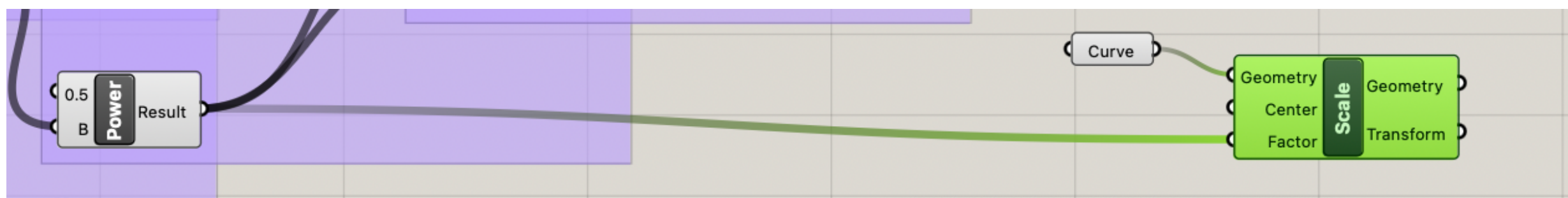
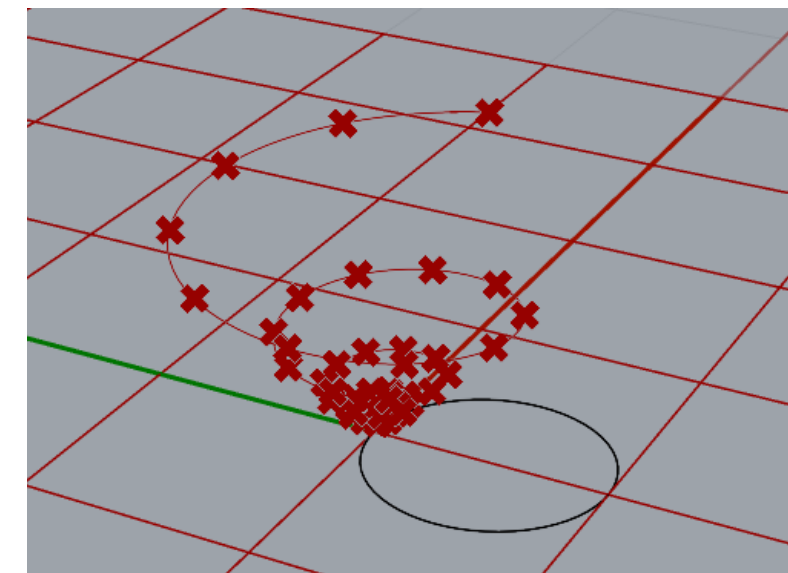


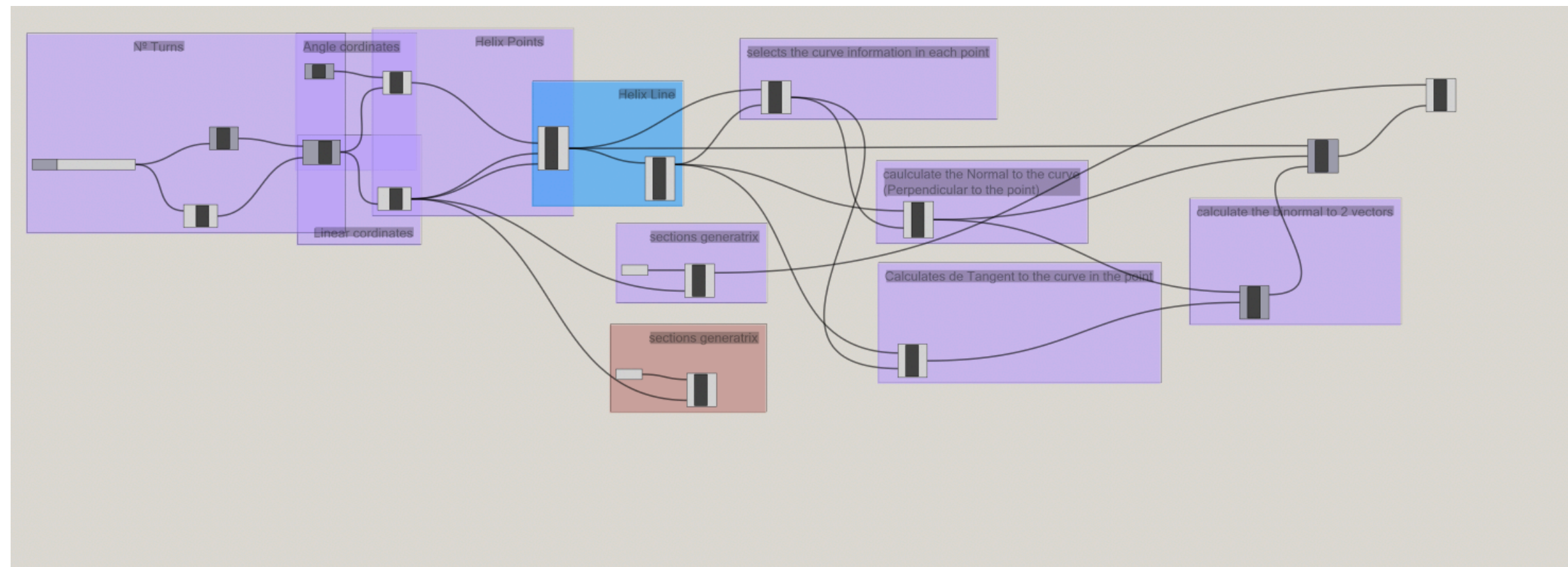
com os pontos feitos vamos utilizar uma SPLINE. que se chama interpolation (feito pelo computador) para conectar todos os pontos

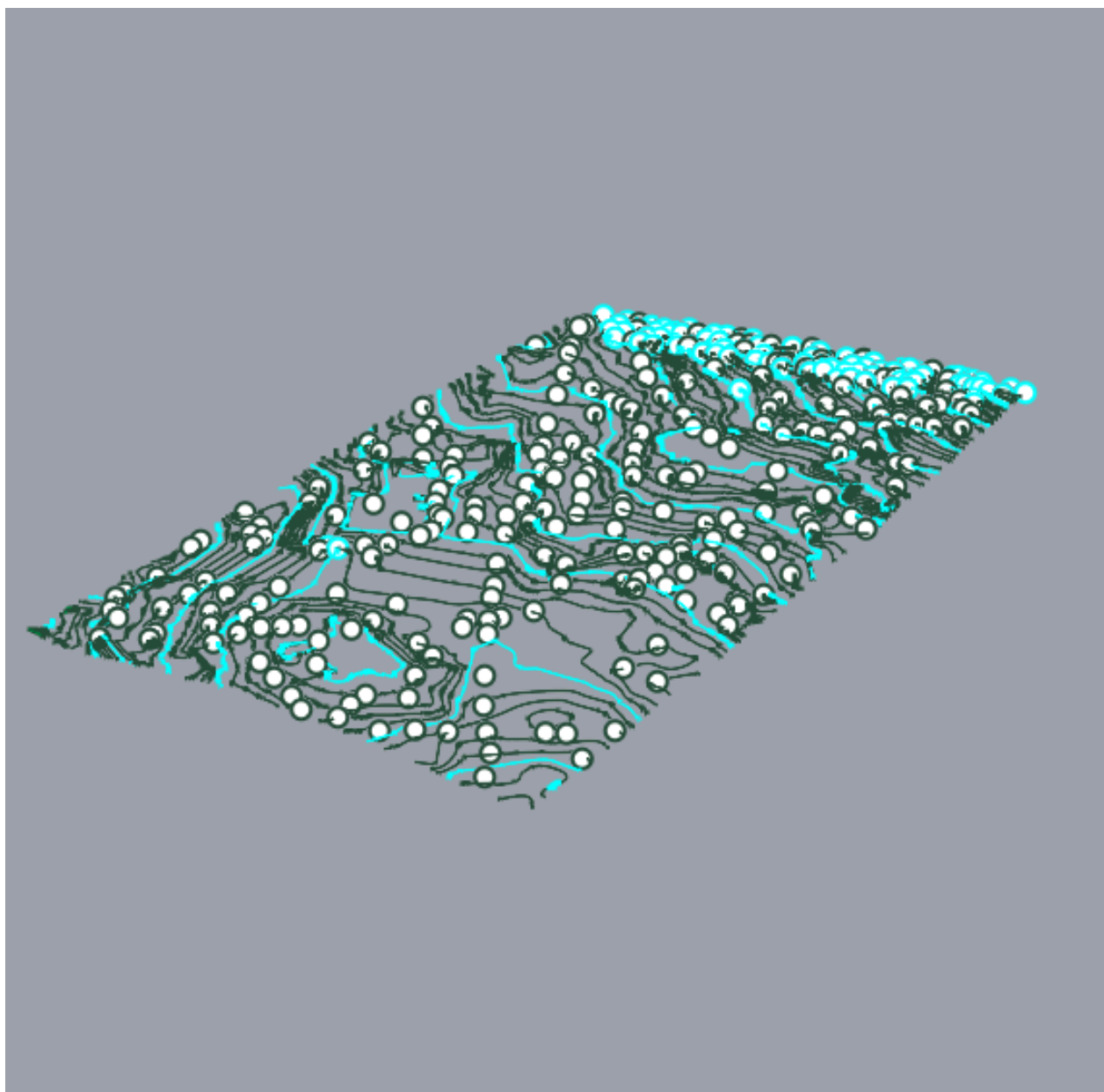


Caramujo

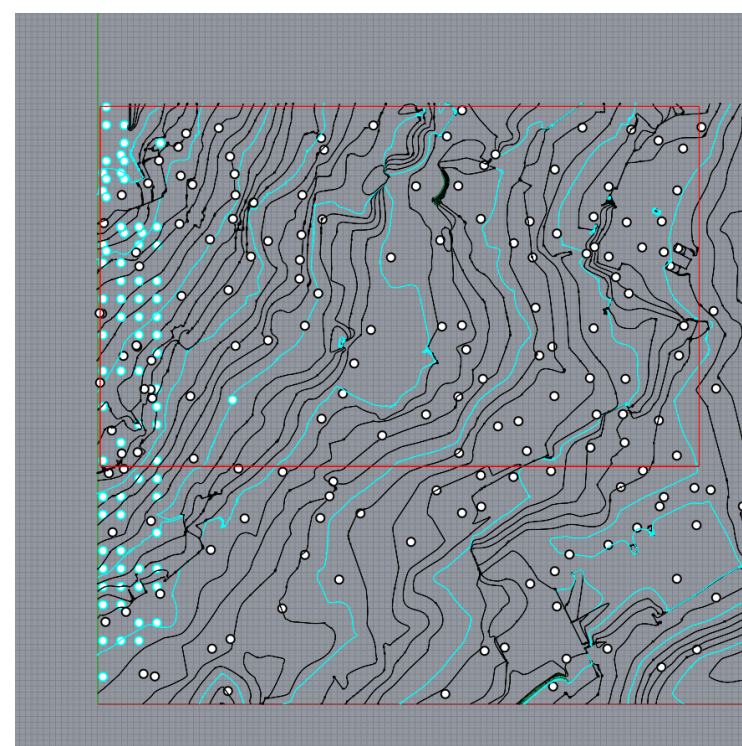
Agora vamos fazer planos a passar nos pontos, onde de seguida vamos “colar” a forma da concha.







1º manter apenas parte do terreno.
esenhar rec



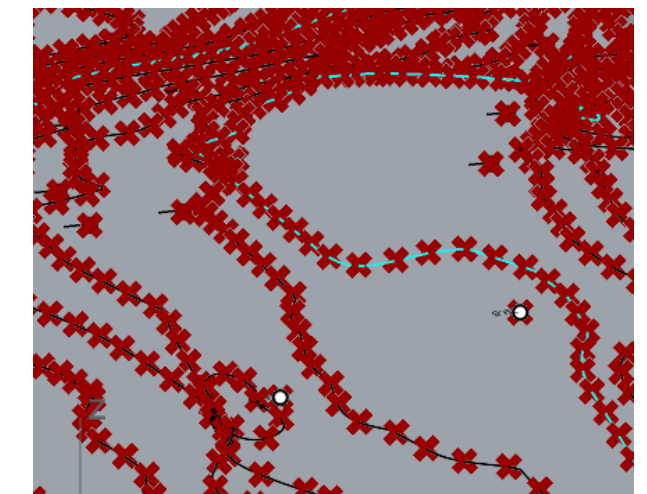
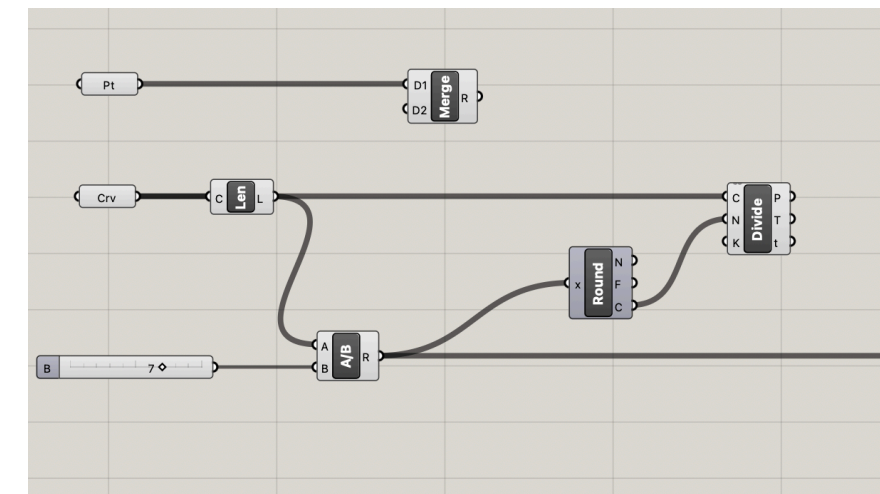
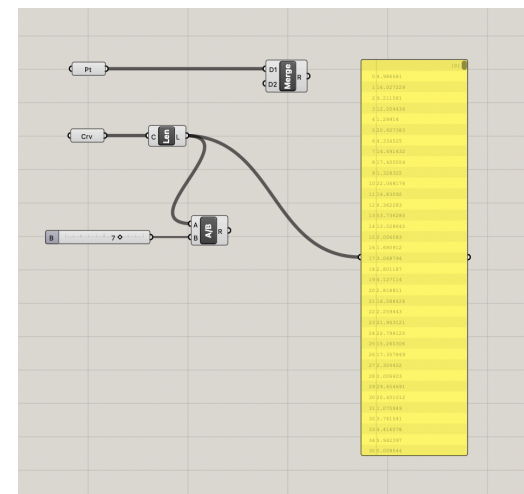
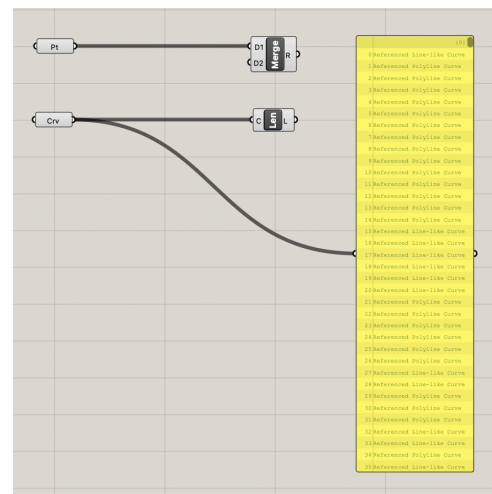
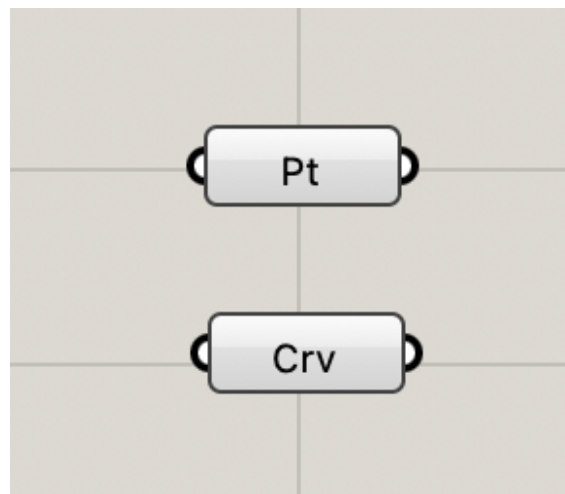
1ª criar POINT e associar aos pontos no rhino model e depois cCURVE e associar as curvas de nível também

2º adicionar MERGE. (Pt-D1).

3º medir curvas (LENGHT). e colocar pontos de 7 em 7. com o (DIVISION). e number slider de 7)

4º Arredondar os valores. (ex: em vez de 0.71 fica 1) ROUND - CELLING - CURVEDIVEDE

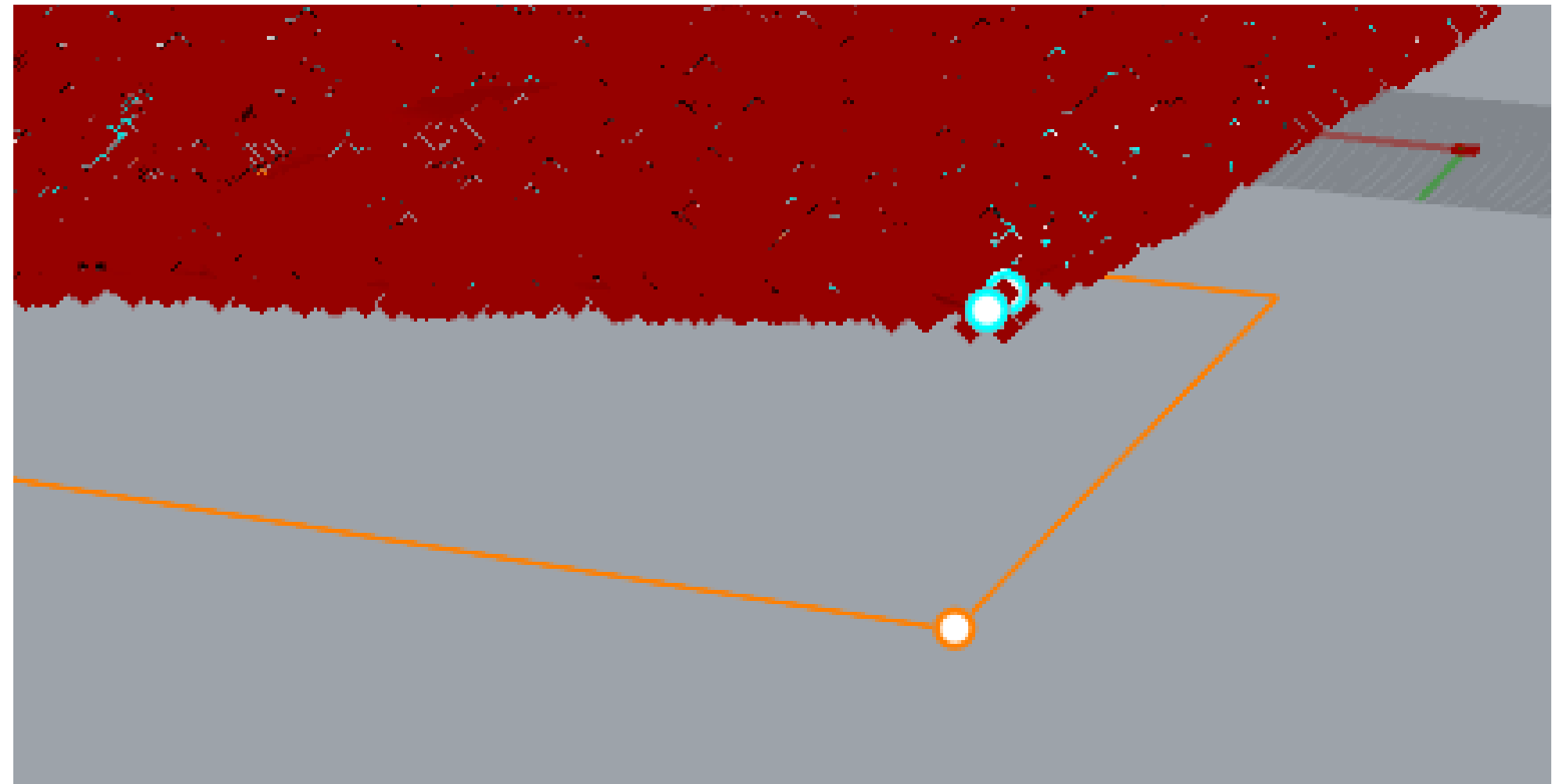
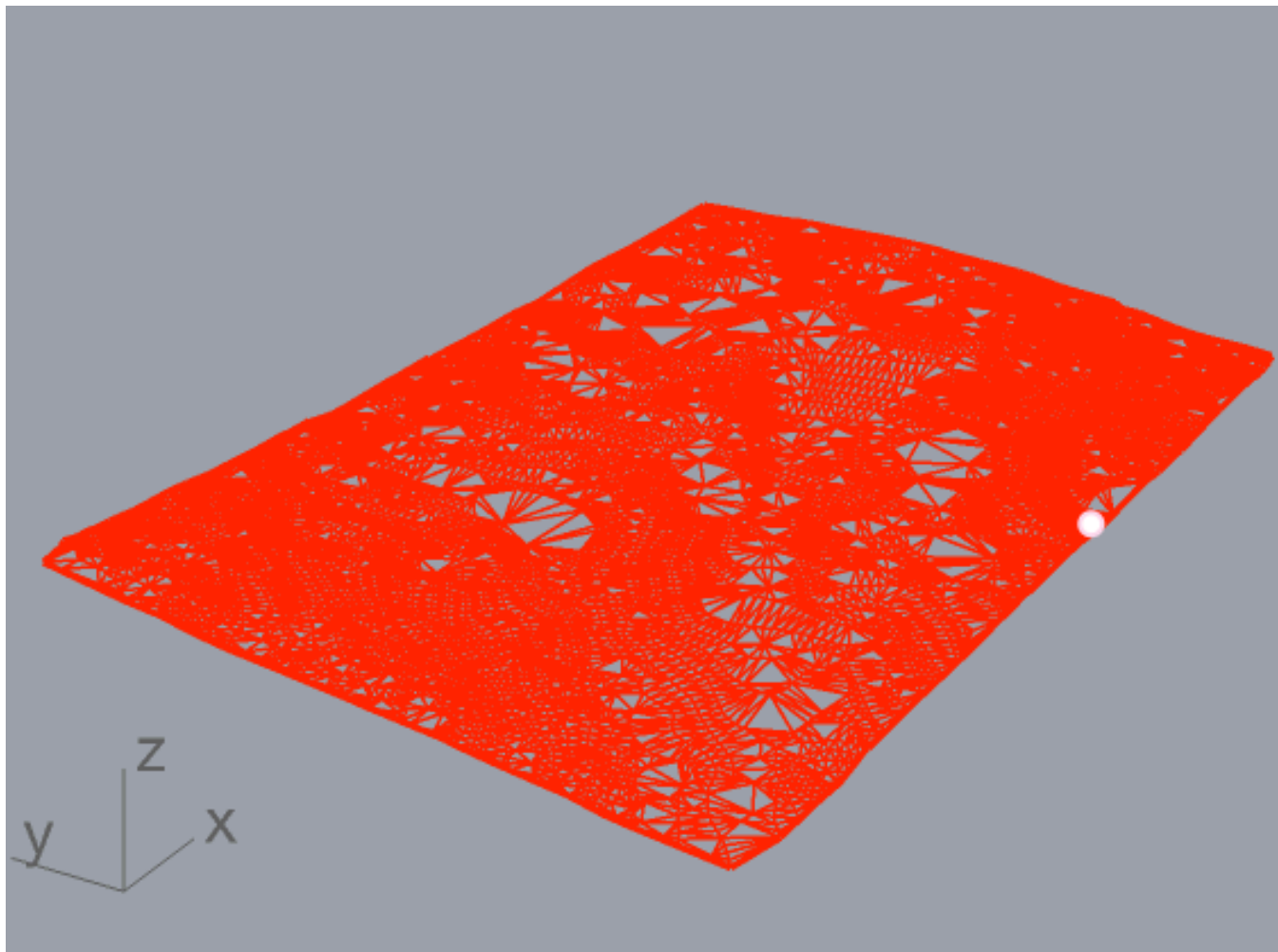
5º MERGE desses pontos com os pontos dados



6º Flatten information- mesma posição no merge box- 1 LISTA DE PONTOS CULL DUPLICATE (elimina pontos iguais da mesma posição) para a mesh ficar mais limpa) ELIMINA DUPLICADOS.

7º DELLAYNE MESH.

8º Desenhar retângulo e associar ponto no canto (dentro do rhino)



FAZER A GRID

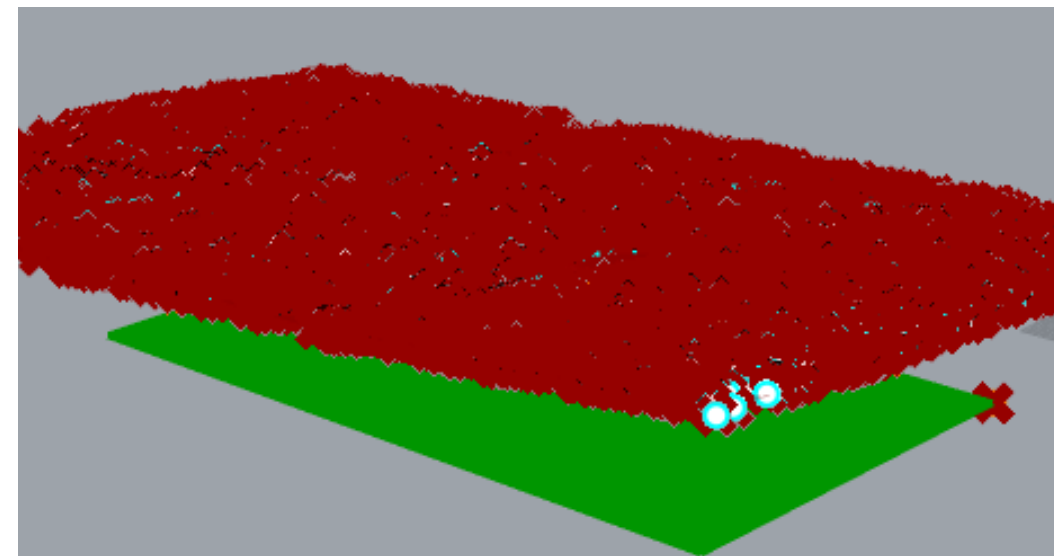
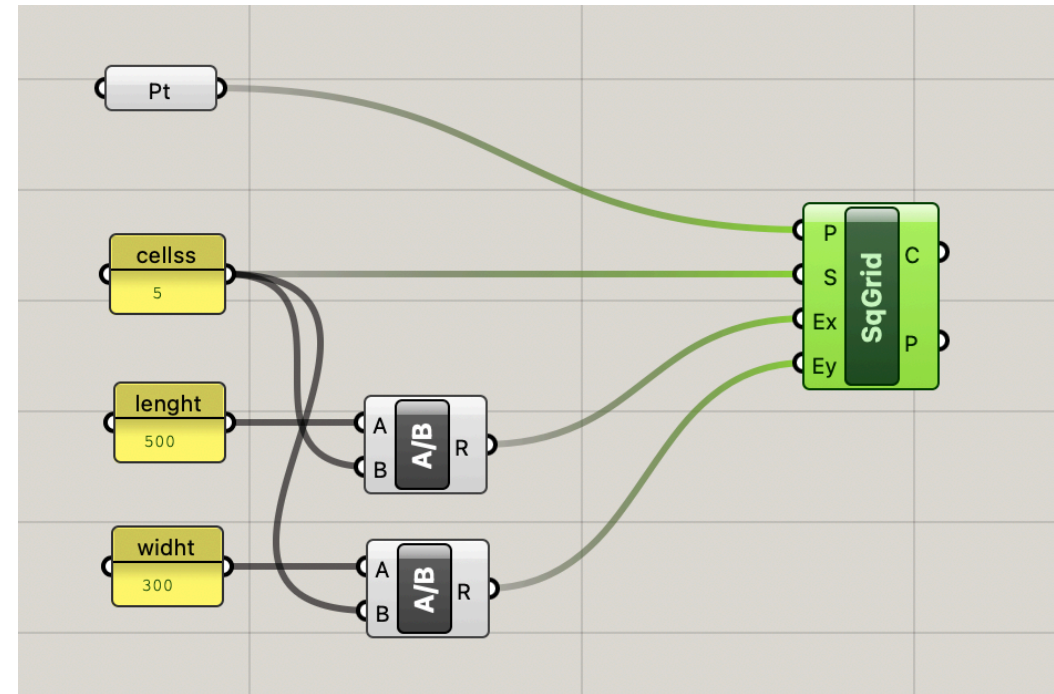
9º point e associar ao ponto.

10º square 2d grid

11º criars 2 paineis (500 e 300)

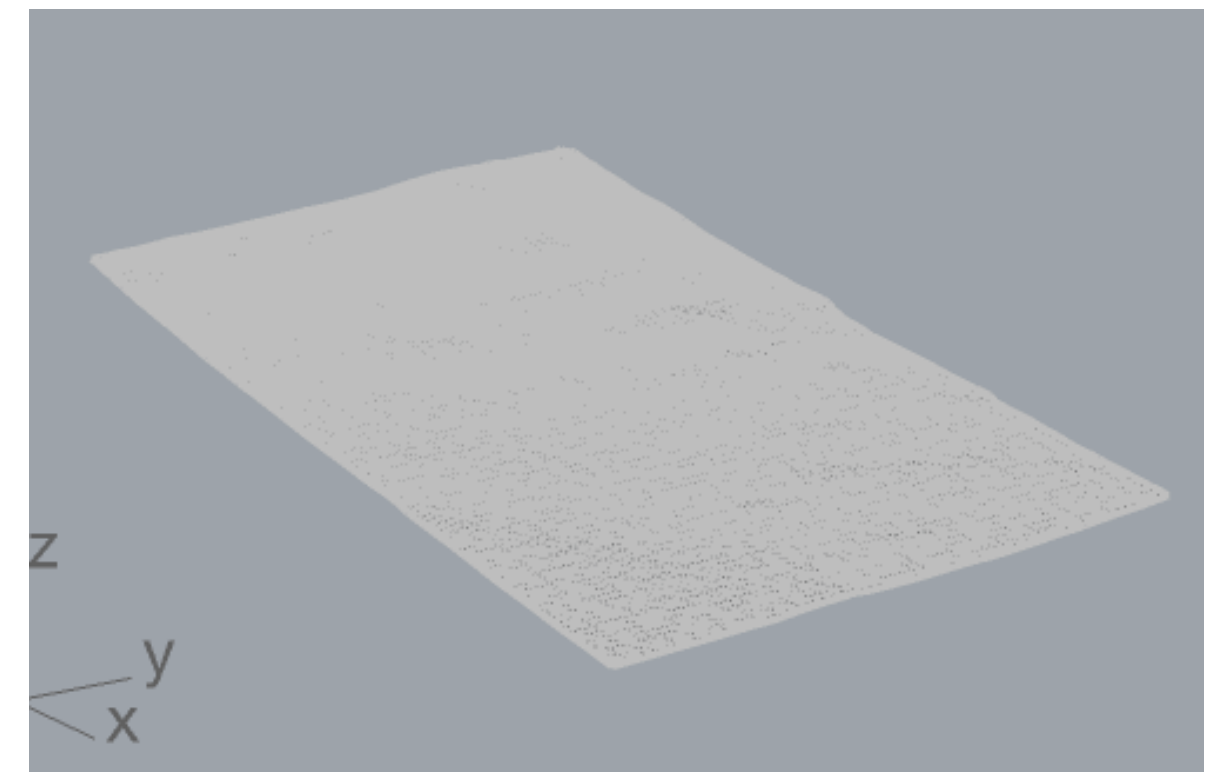
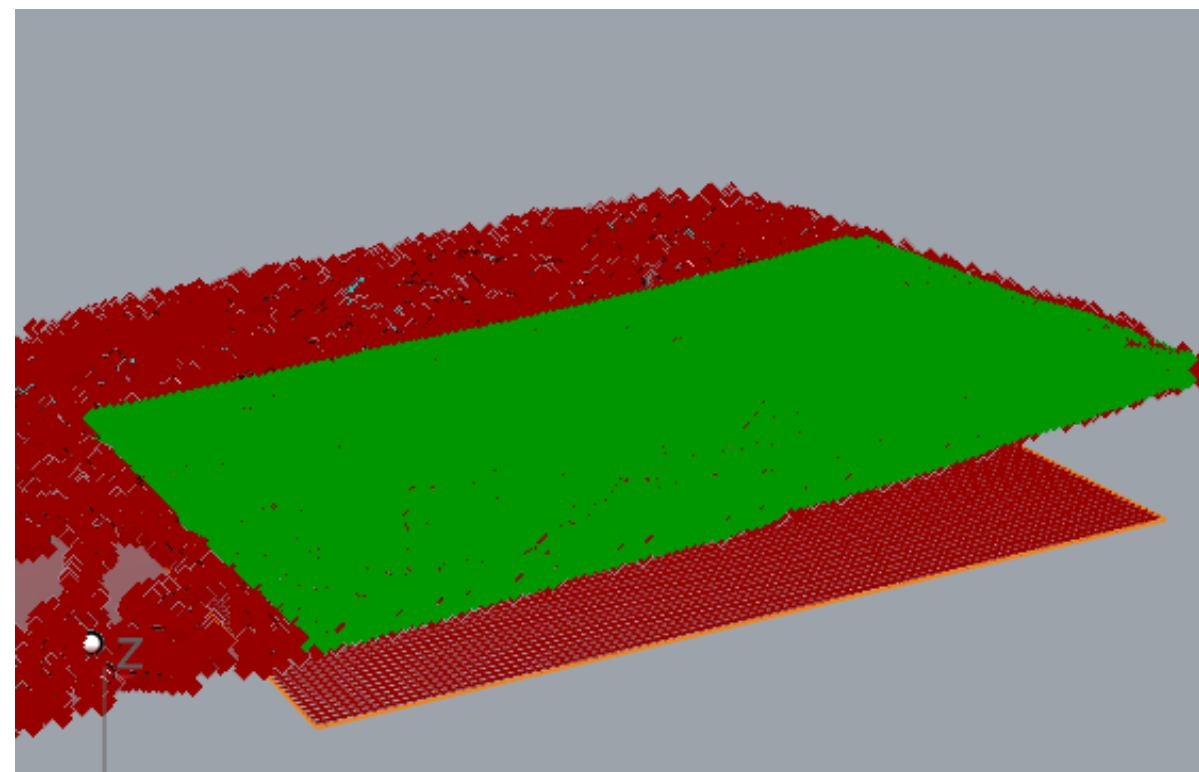
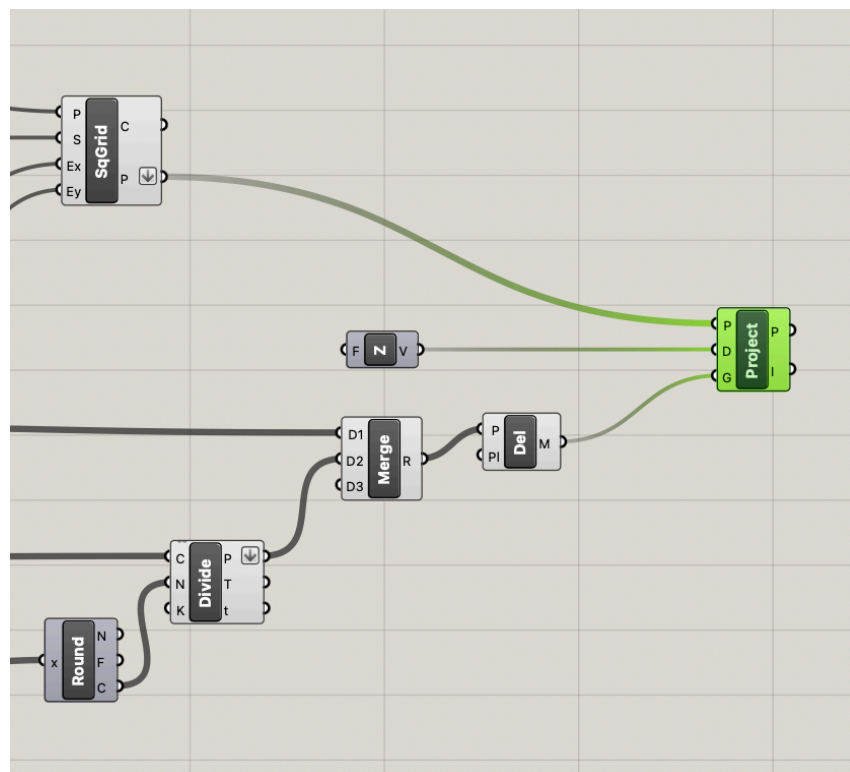
12ª grid no tamanho do retângulo.

13º projetar os pontos na mesh.



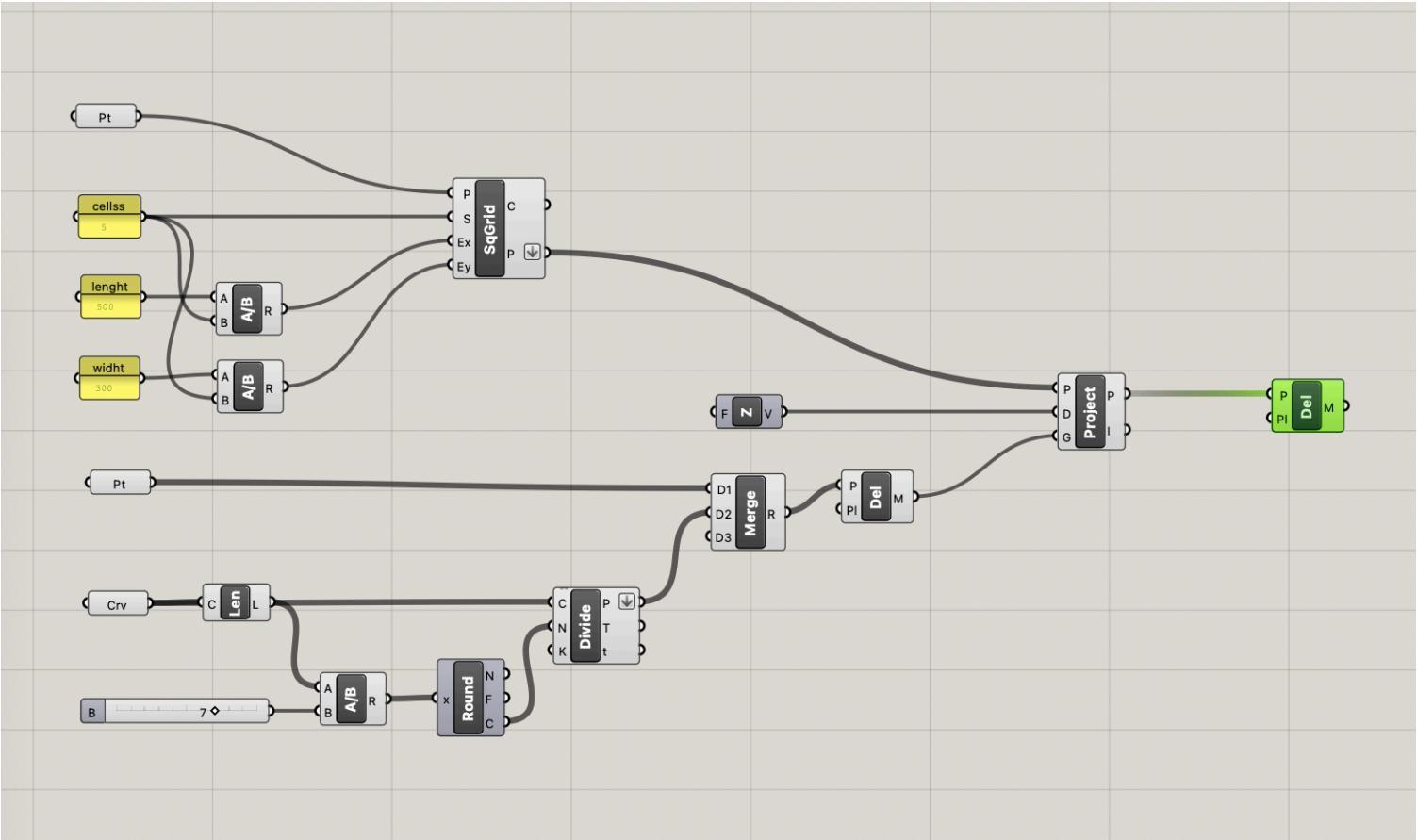
14ª fazer project dessas grid na mesh .

15ª Fazer bake

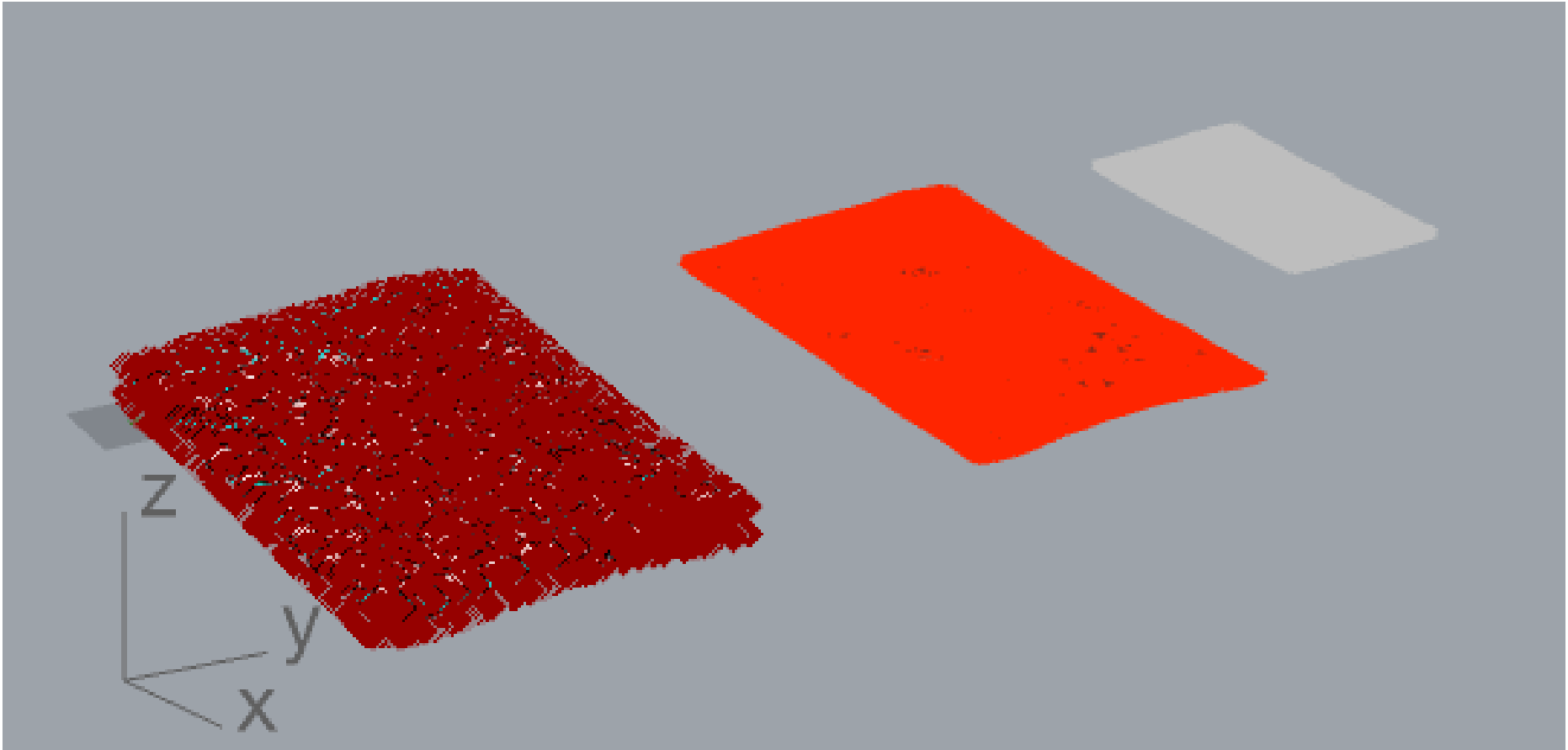


FINAL:

GRASSHOPPER



MODEL SPACE



CRIAÇÃO DE UMA COBERTURA ORGÂNICA

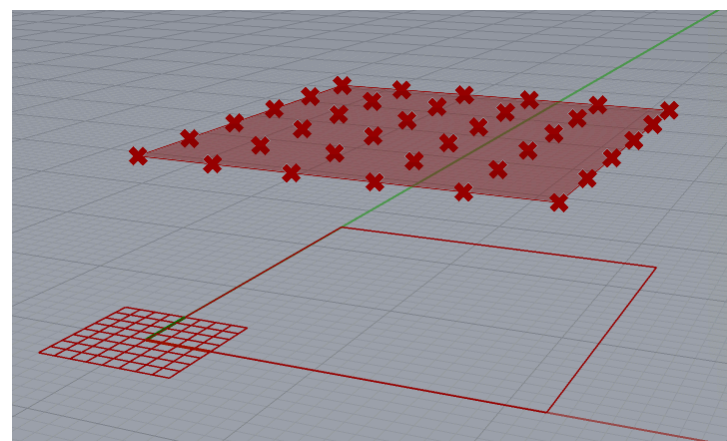
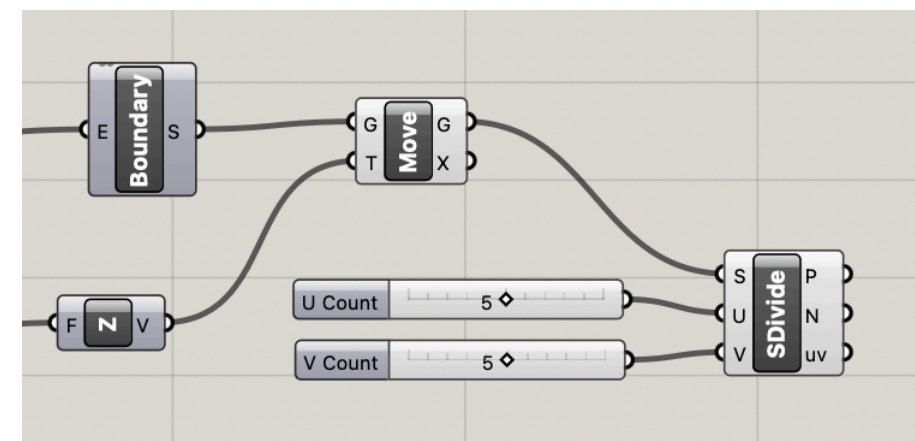
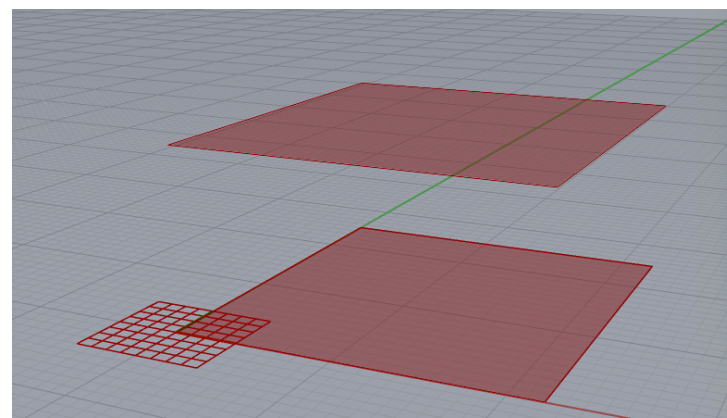
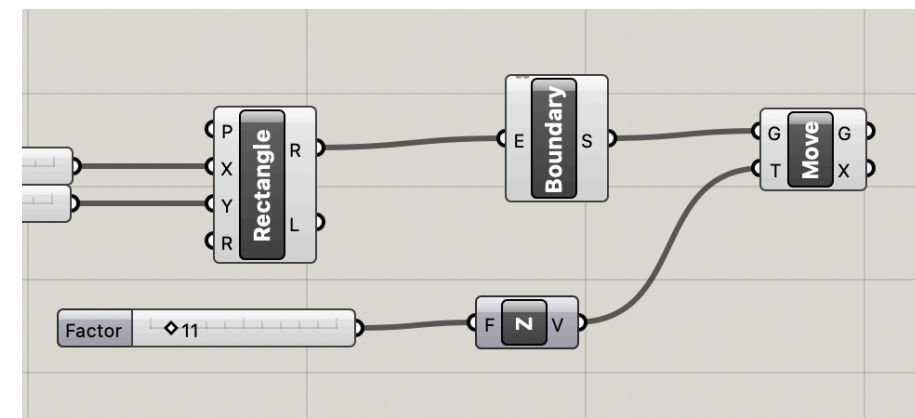
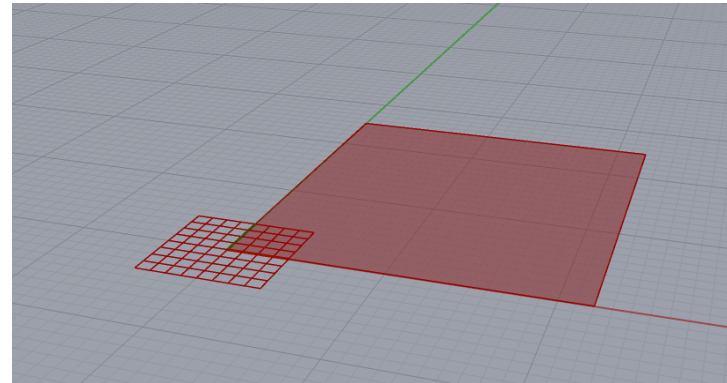
Grasshopper



LEILA BLUE VAN ELSWIJK

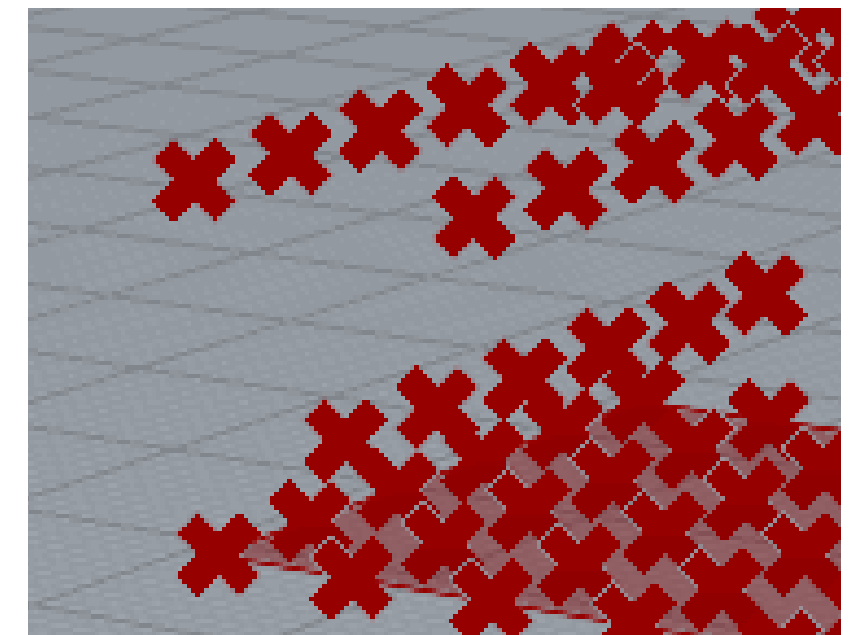
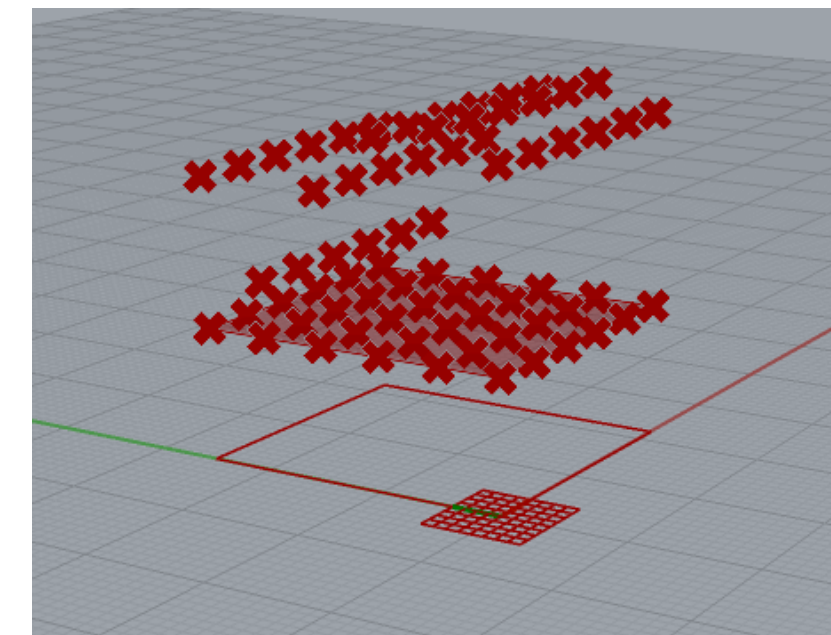
PROCESSO

The diagram shows a 'Rectangle' primitive. It has two input properties: 'X Size' and 'Y Size', both set to 44. It has four output ports: 'P' (top), 'R' (right), 'Y' (bottom), and 'L' (left). The 'X' and 'Y' ports are connected to the 'X Size' and 'Y Size' sliders respectively.

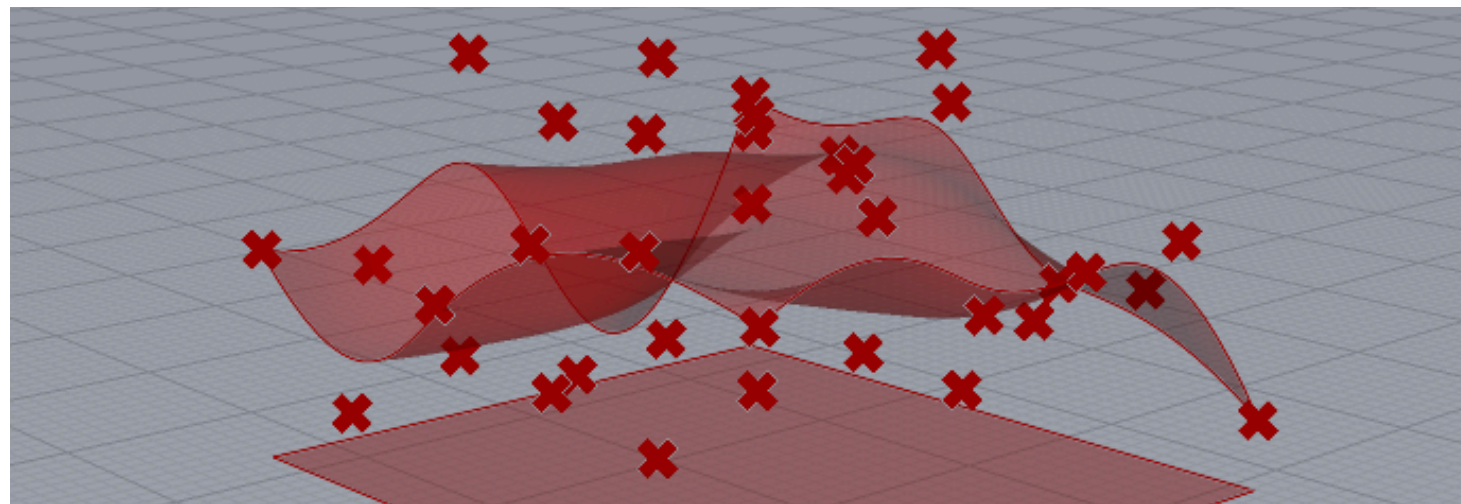
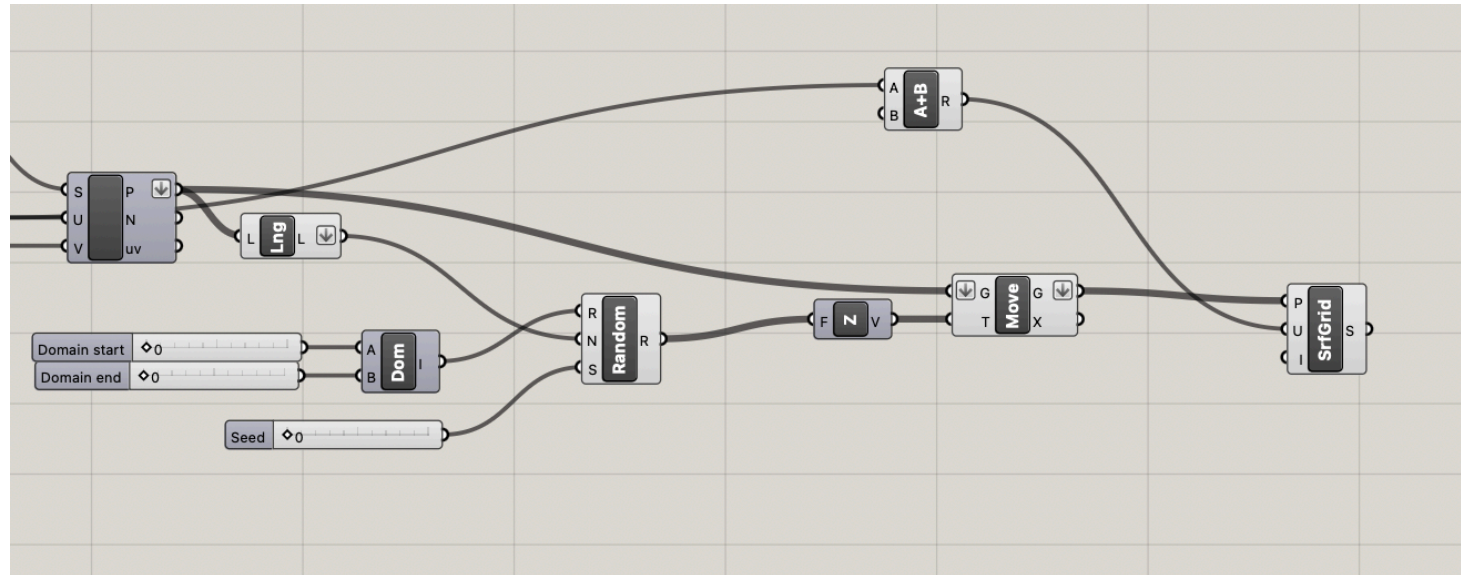


The screenshot shows a NetLogo simulation environment with a grid background. The interface includes several sliders and a network of nodes connected by lines. The nodes are labeled with letters and functions, and the connections are represented by solid and dashed lines.

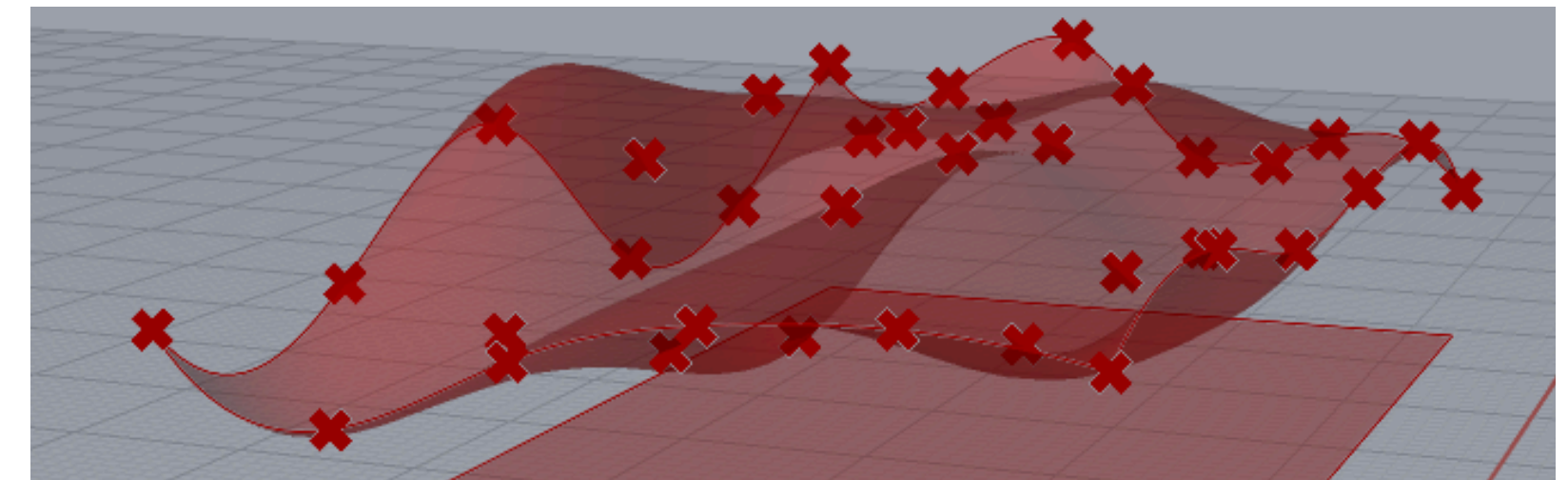
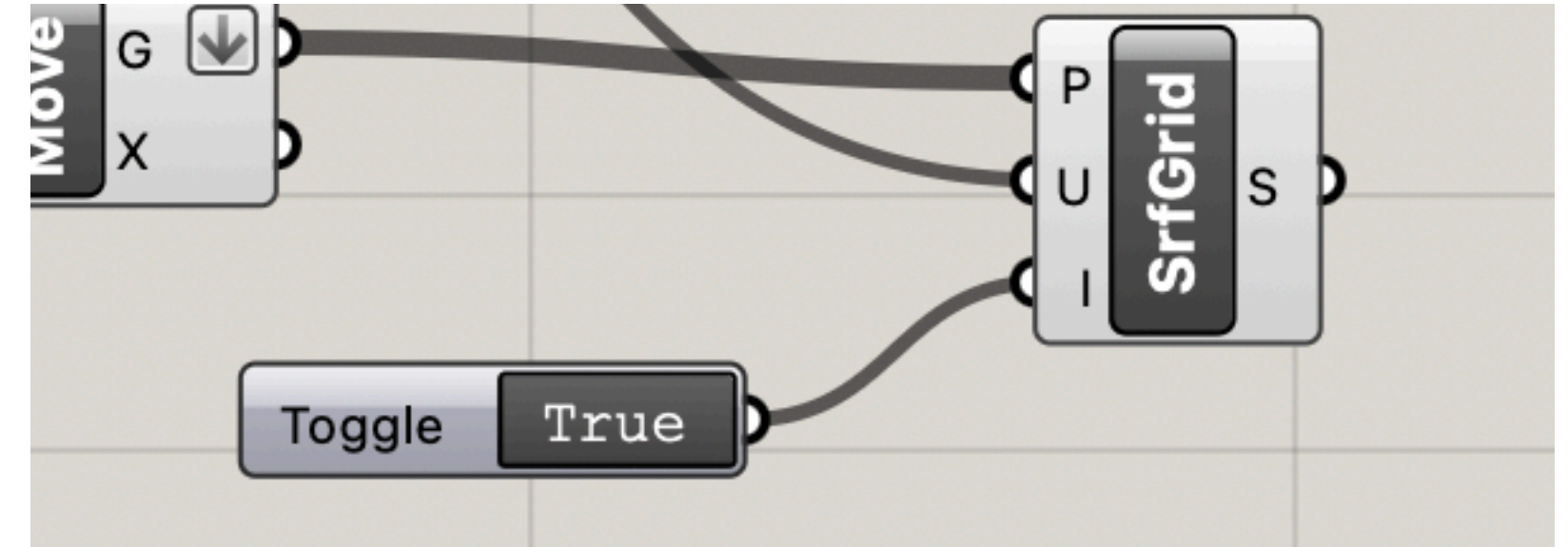
- Sliders:**
 - U Count:** Set to 5.
 - V Count:** Set to 5.
 - Domain start:** Set to 0.
 - Domain end:** Set to 20.
 - Seed:** Set to 0.
- Nodes and Connections:**
 - Top Left:** A node labeled 'Move' with inputs 'G' and 'T' and outputs 'G' and 'X'.
 - Top Center:** A node labeled 'SDivide' with inputs 'S' and 'U' and outputs 'P' and 'N'.
 - Top Right:** A node labeled 'Lng' with inputs 'L' and 'L' and outputs 'L' and 'L'.
 - Bottom Left:** A node labeled 'Dom' with inputs 'A' and 'B' and outputs 'I' and 'I'.
 - Bottom Center:** A node labeled 'Random' with inputs 'R' and 'N' and outputs 'R' and 'R'.
 - Bottom Right:** A node labeled 'Z' with inputs 'F' and 'V' and outputs 'Z' and 'Z'.
 - Far Right:** A node labeled 'Move' with inputs 'G' and 'T' and outputs 'G' and 'X'.
- Connections:**
 - Solid lines connect the 'Move' node at the top left to the 'SDivide' node, and the 'SDivide' node to the 'Dom' node.
 - Dashed lines connect the 'SDivide' node to the 'Lng' node, and the 'Lng' node to the 'Random' node.
 - Solid lines connect the 'Dom' node to the 'Random' node, and the 'Random' node to the 'Z' node.
 - Dashed lines connect the 'Random' node to the 'Z' node, and the 'Z' node to the 'Move' node at the far right.



3º CRIAÇÃO DA SURFACE GRID COM OS PONTOS

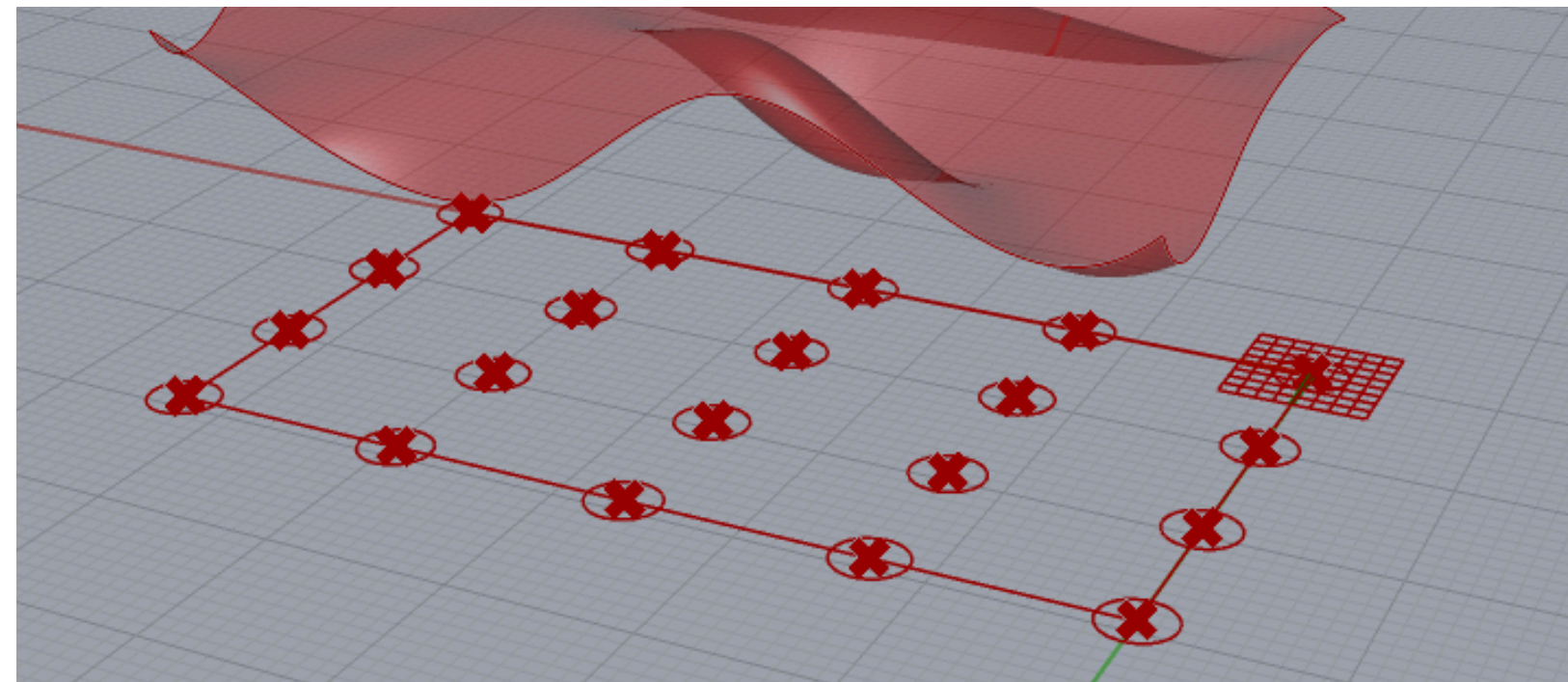
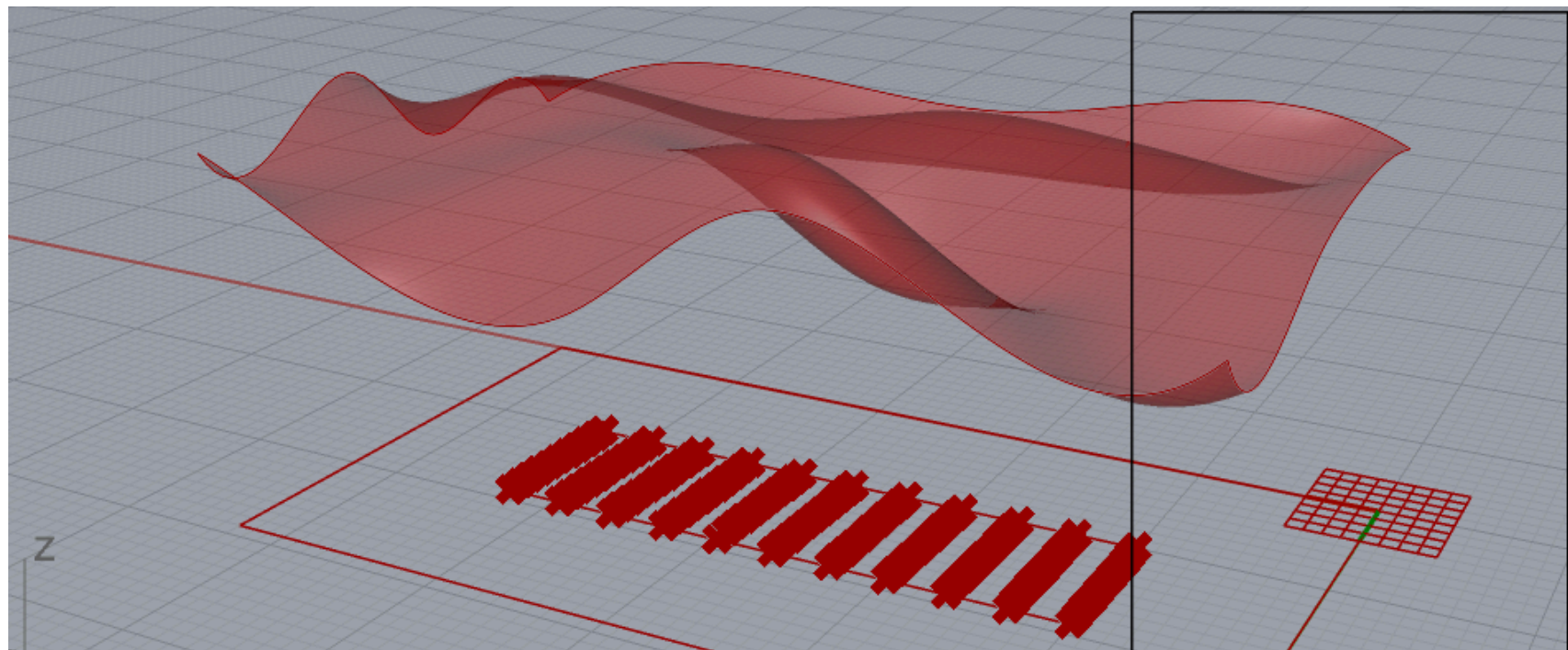


4º Utilizar TOGGLE TRUE (para a superfície passar nos pontos)

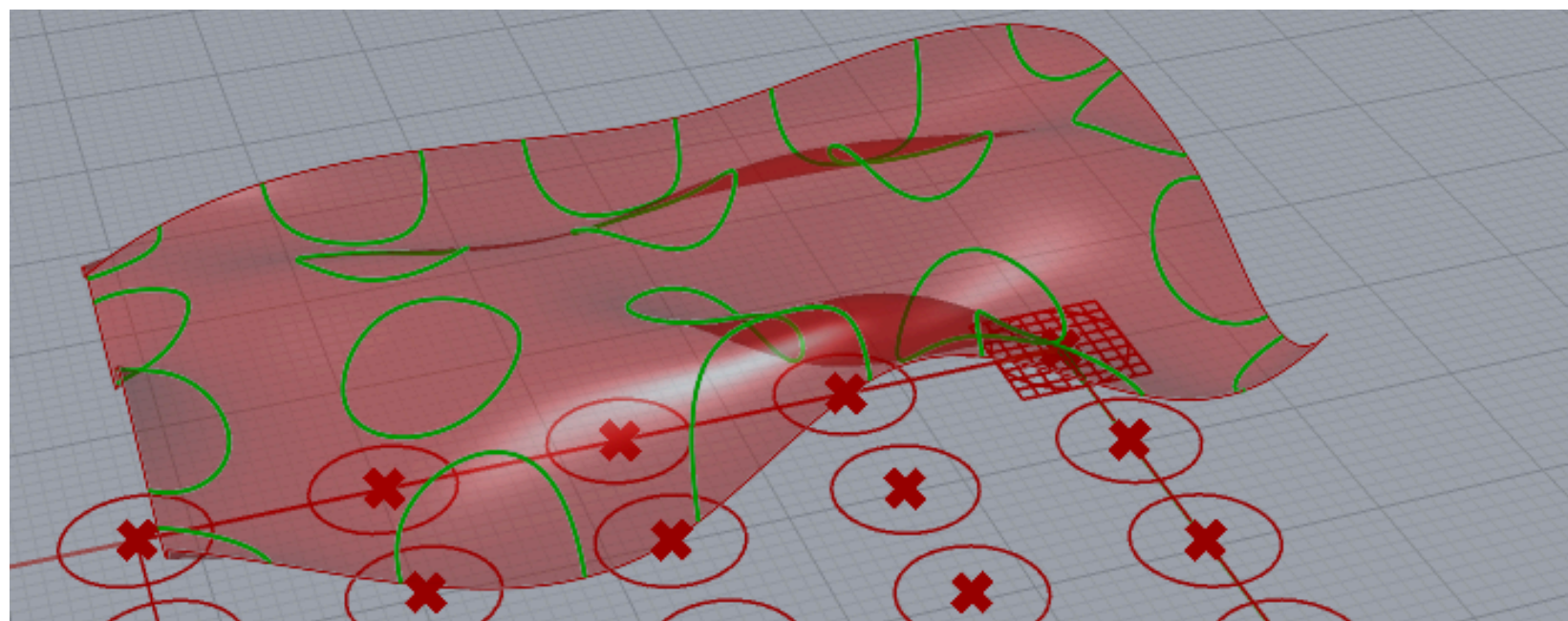
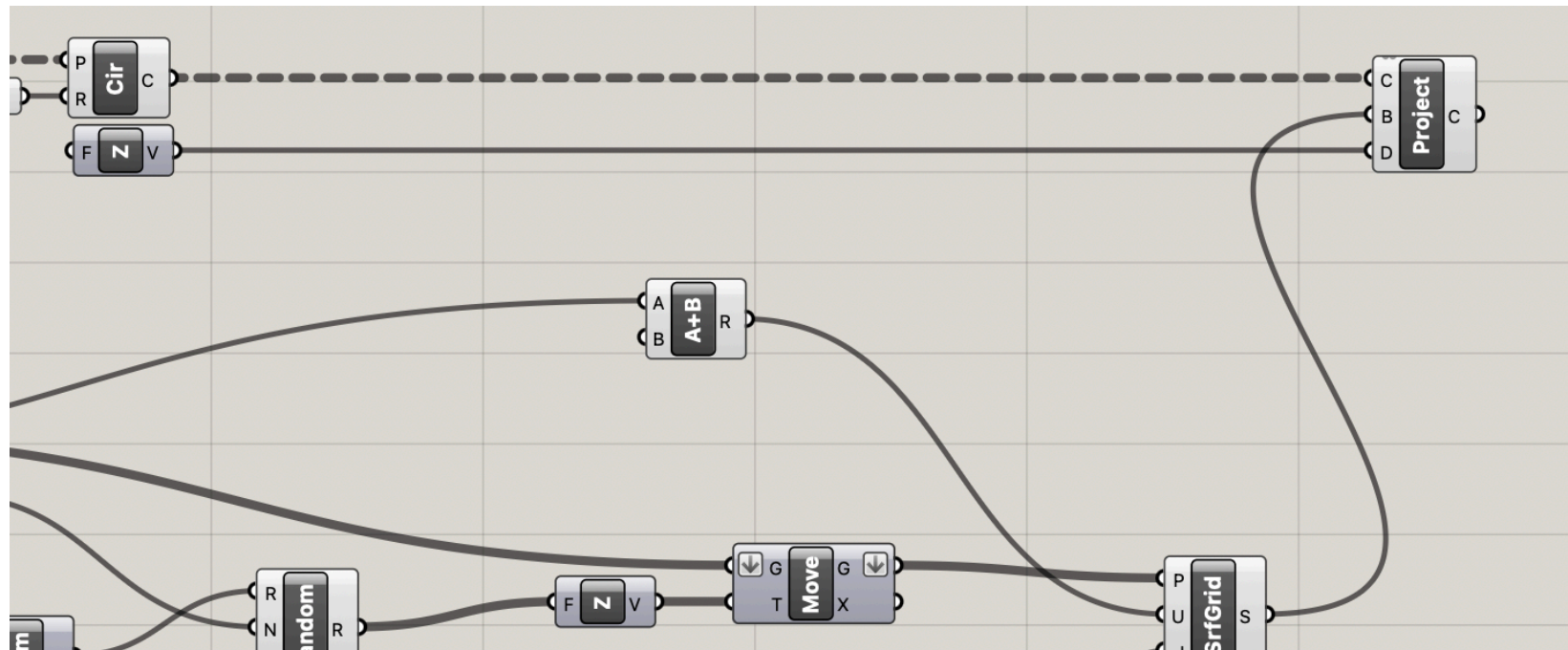


PROCESSO - parte 1

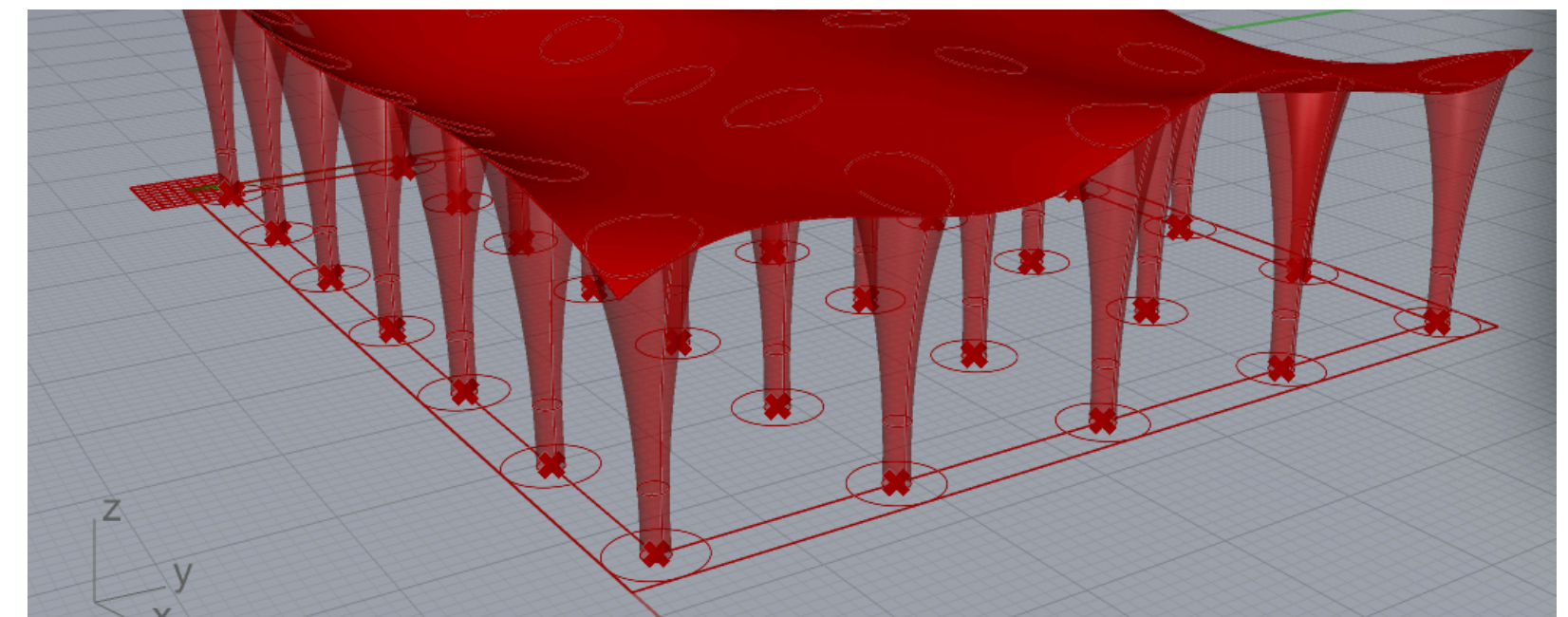
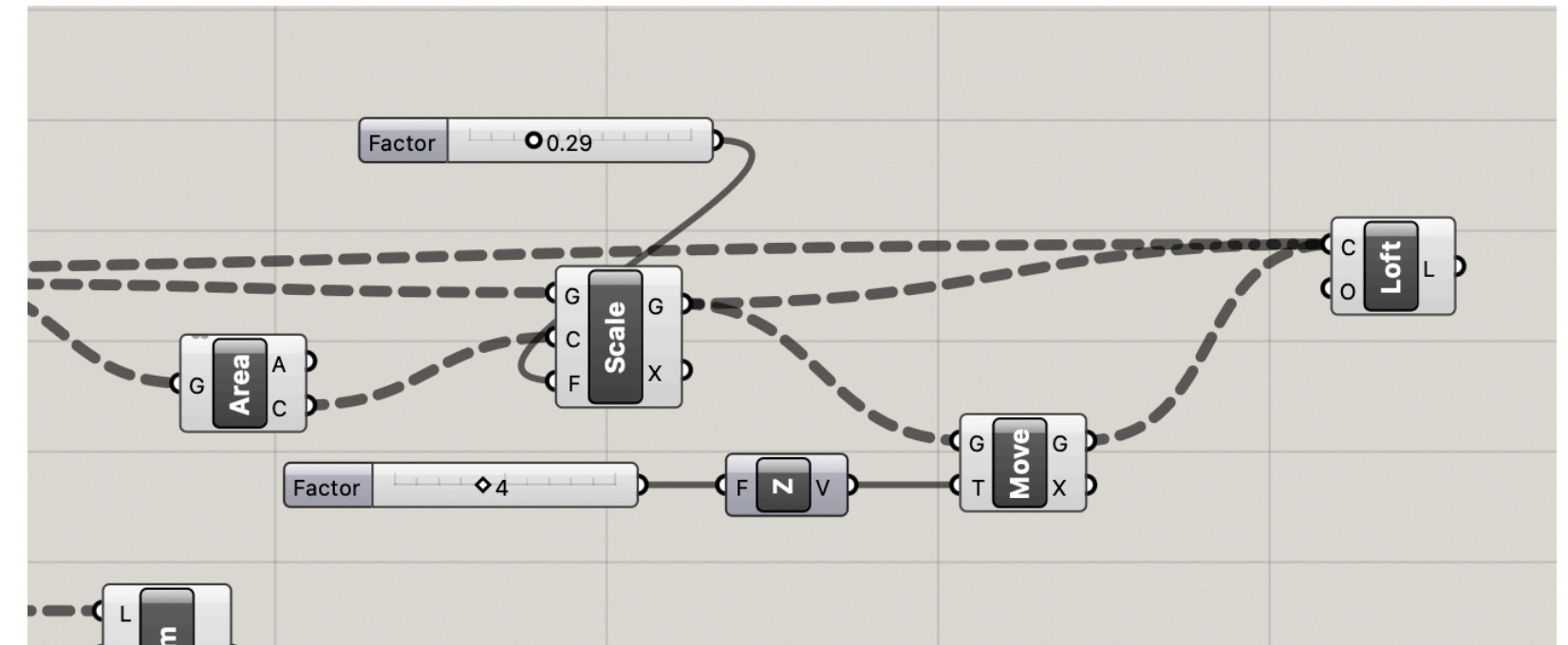
The screenshot shows a Pure Data patch on a grid background. On the left, a purple rectangular patch contains two input boxes: 'X Size' with a value of 53 and 'Y Size' with a value of 29. These are connected to a 'Rectangle' object. The 'Rectangle' object has four outlets labeled P, X, Y, and R. The 'X' and 'Y' outlets are connected to a 'Neg' (negate) object. The 'R' outlet is connected to an 'Offset' object. The 'Neg' object has two outlets labeled 'x' and 'y', which are connected to the 'C' and 'D' inputs of the 'Offset' object. The 'Offset' object has four inputs labeled C, D, P, and C, and one output labeled 'C'. This output is connected to an 'SDivide' object. The 'SDivide' object has six inputs labeled S, U, V, P, N, and uv.



7º PROJECT dos círculos na superfície criada anteriormente

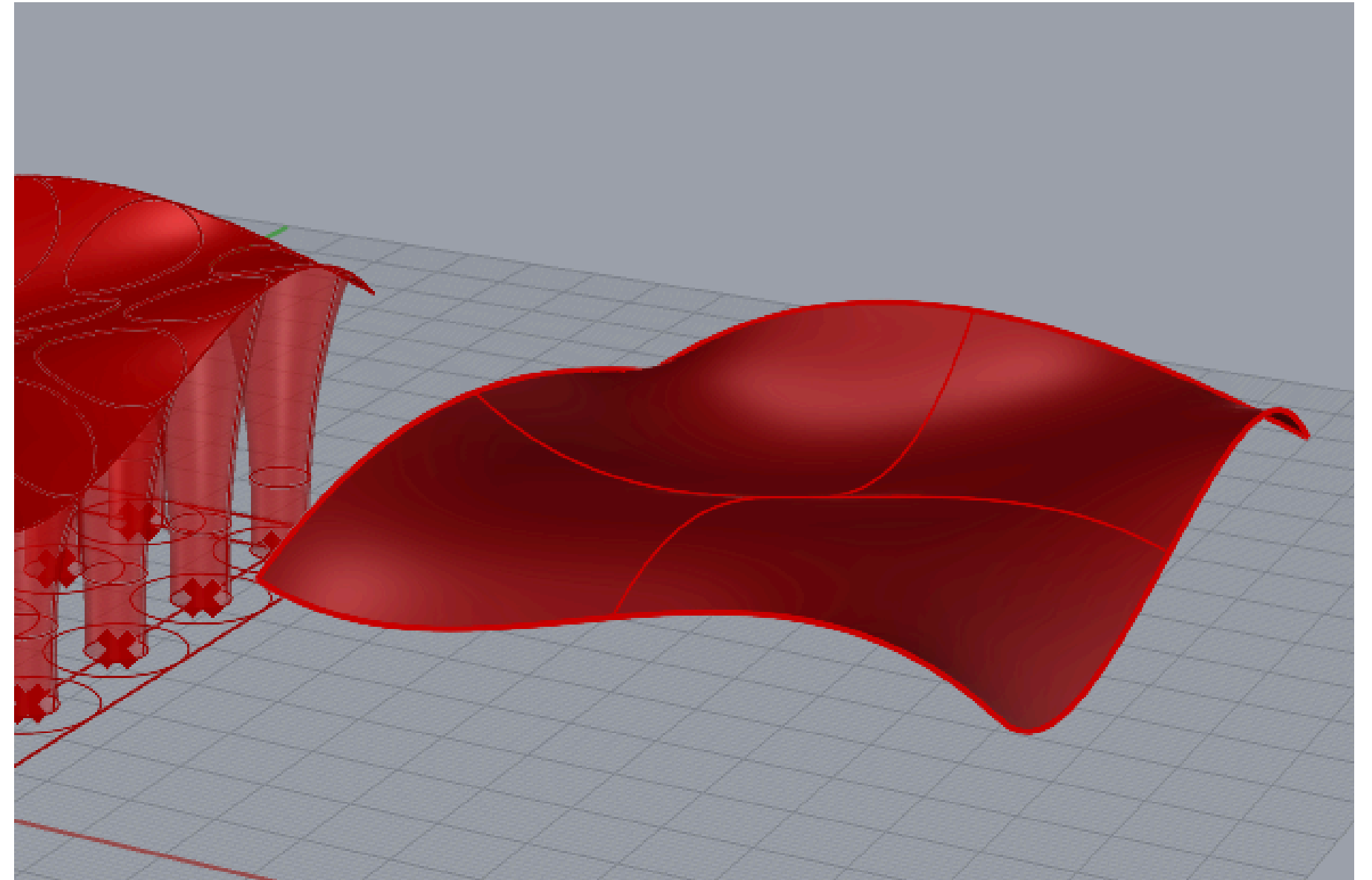
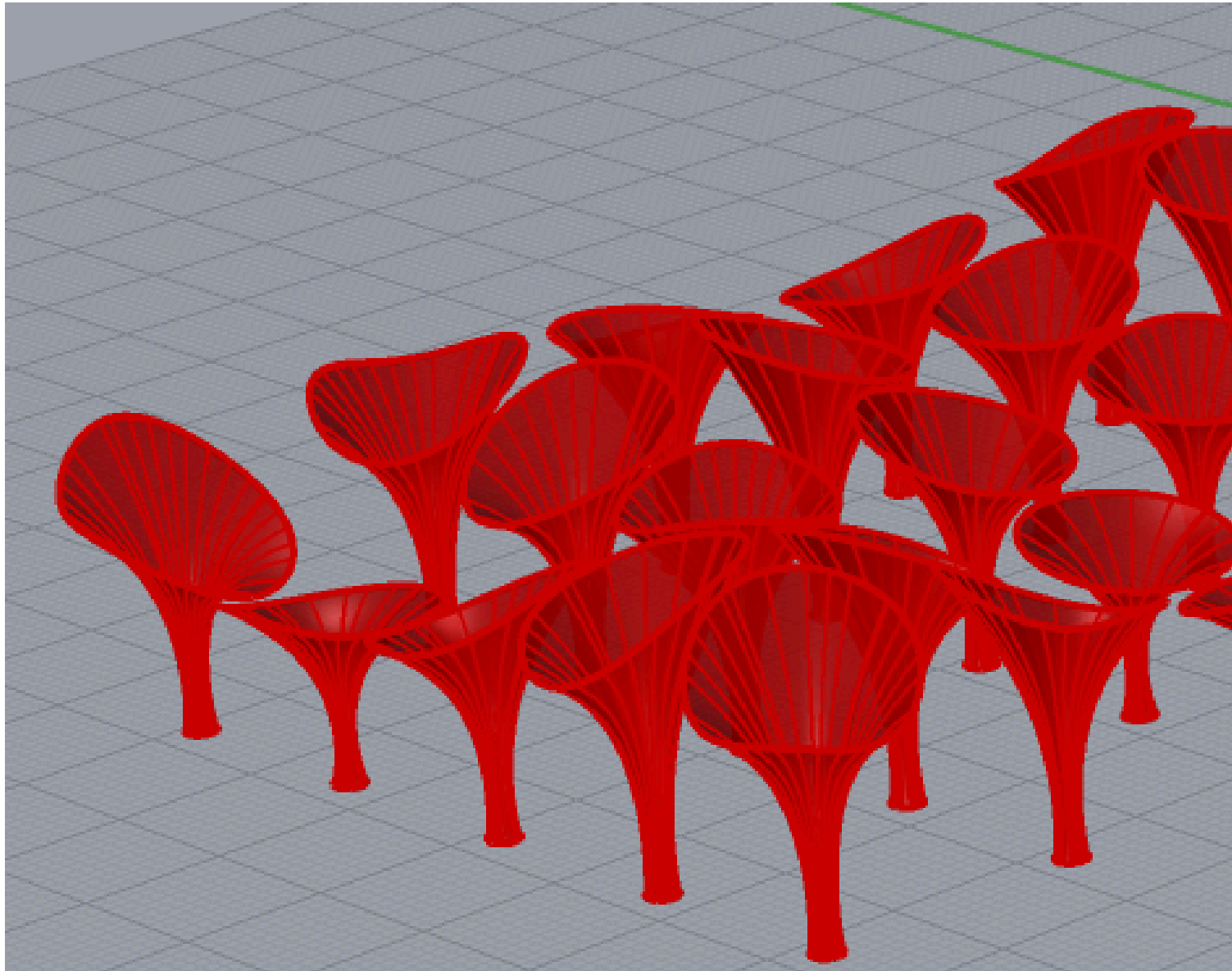


8ª Criação de um novo círculos (AREA e SCALE) e fazer LOFT

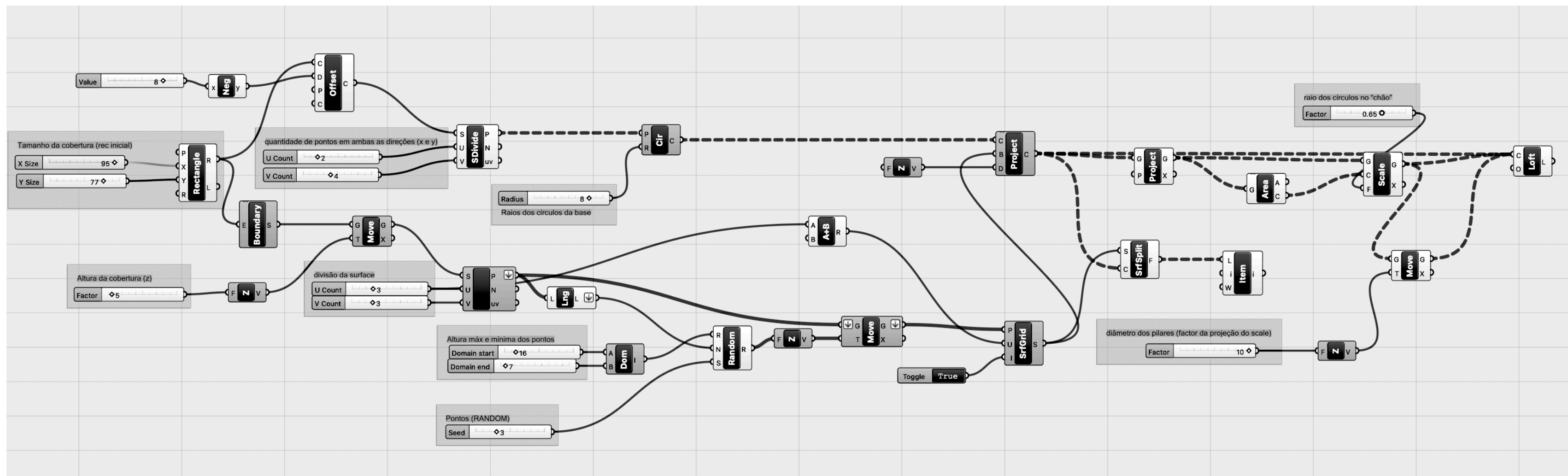


PROCESSO - parte 2

9º fazer BAKE

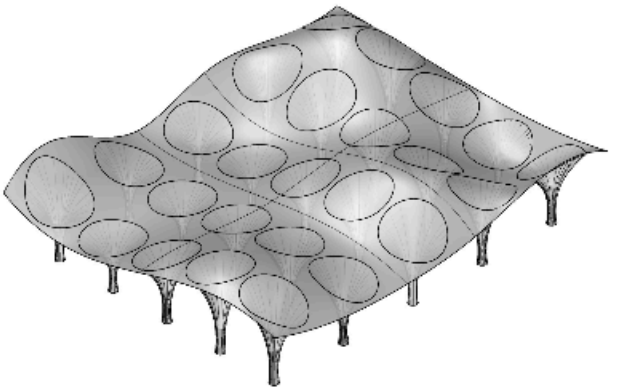
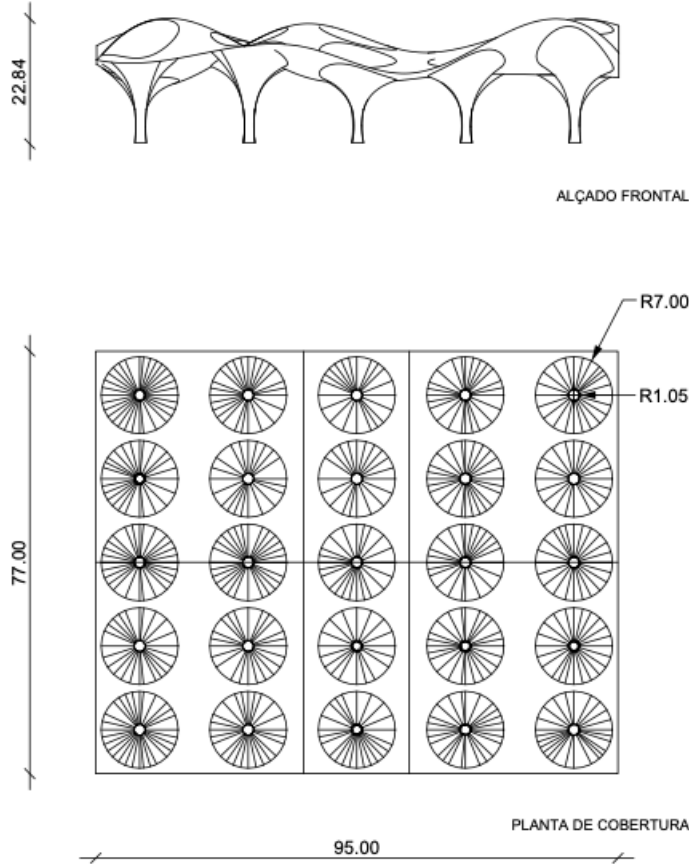


PROCESSO - parte 2

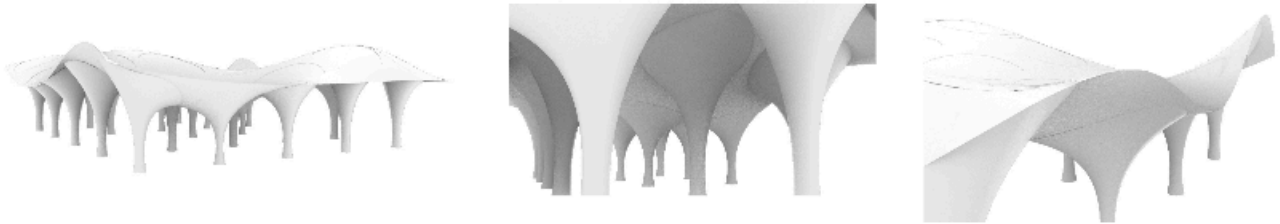


GRASSHOPPER FINAL

DESENHOS TÉCNICOS



AXONOMETRIA



PERSPECTIVAS

PROCESSO DE CRIAÇÃO

A cobertura foi desenvolvida através de modelação paramétrica em Grasshopper, partindo da criação de um retângulo base subdividido em vários pontos. A partir dessa malha, foi definido um domínio com alturas mínimas e máximas, combinado com um parâmetro aleatório (RANDOM), permitindo gerar diferentes variações e controlar a forma da superfície. Estes pontos foram depois ligados através de Interpolate, criando uma cobertura contínua e orgânica.

Numa segunda fase, foi criado um novo sistema de pontos para definir a implantação dos pilares. Em cada ponto foram aplicados círculos parametrizados, posteriormente projetados sobre a superfície principal. Através de operações como scale, move e loft, foi possível desenvolver a geometria final, mantendo todo o processo editável e ajustável, o que permitiu controlar de forma flexível as proporções, alturas e densidade estrutural da cobertura.



Grasshopper



Referência

PARAMETRIC ROOF STRUCTURE

1 : 1

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MODELAÇÃO GEOMÉTRICA E GENERATIVA



LAYOUT FINAL

