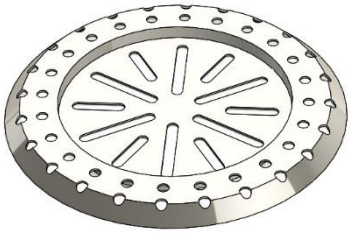
Drain Protector



[1]

Introduction:

The drain protector is comprised of an assortment of slots and holes in a circular pattern. The use of Variable Pattern feature in their construction makes the task of drawing the patterns of the object quite easy.
https://youtu.be/_J4IHQUKWps

Learning Intentions:

This lesson will focus on the improvements made to circular patterns. It will focus on the Variable Pattern Feature which is new in SolidWorks 2015. It allows for greater control and manipulation of features which are patterned.

Prerequisite knowledge:

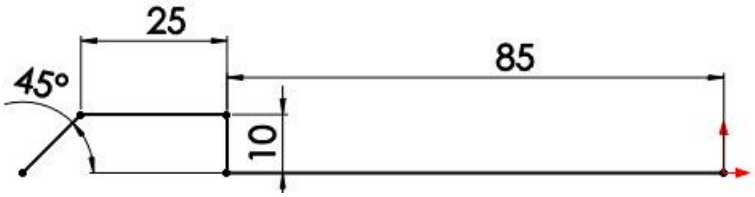
To complete this exercise you should have a working knowledge of SolidWorks 2009 and a knowledge of the following commands are required in this lesson: Sketching (dimensioning), **Extruded Boss/Base, Revolved Boss/Base Extrude Cut, Fillet, and Adding Appearances.**

[1] https://www.flickr.com/photos/mikethetiler/3256234581

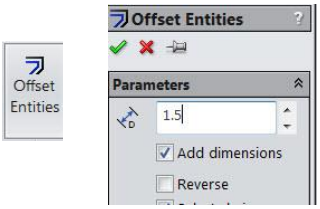
New Part

Start by creating **a New Part** and saving this part as "**Drain Protector**"

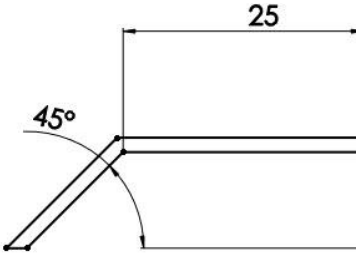
On the **Front plane** draw the Sketch to the given dimensions.



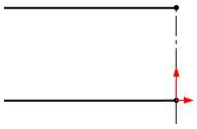
Offset the sketch by **1.5mm**.



Using the **Extend** and **Trim** command close the sketch on the left as shown.

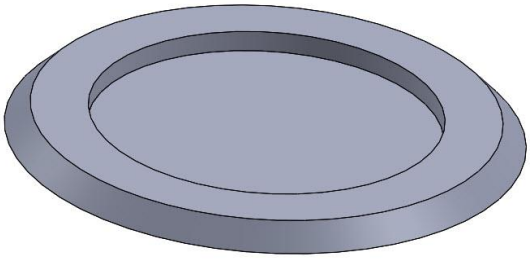


Draw a centreline to close the sketch on the right.

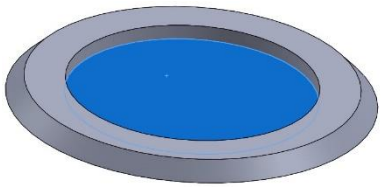


Accept the sketch.

Revolve Boss/Base about the centreline.

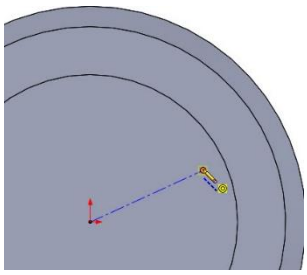


The slot is drawn on the face.



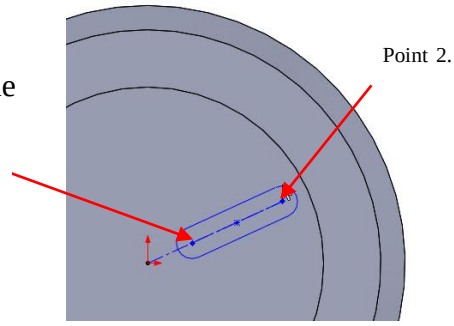
Begin by selecting the face shown.

Draw a construction line at any angle from the centre as shown.



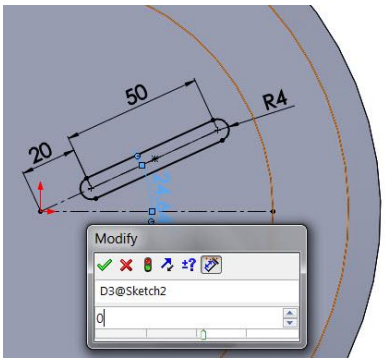
Select the straight slot command. 

Click in the construction line near the origin for point one and at the end of the line for point two.



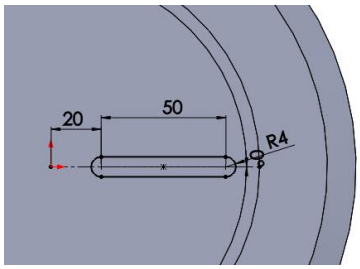
Draw a horizontal construction line.

Add the following dimensions.

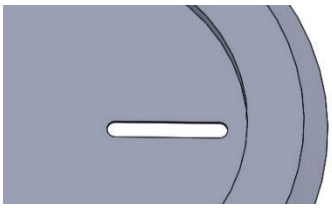


Change the angle between the construction lines to be 0°.

This is important for later.

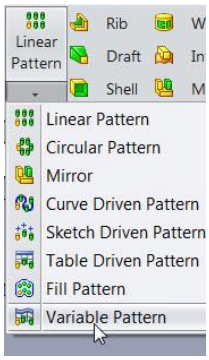


Accept the sketch and **Extrude Cut** through all.

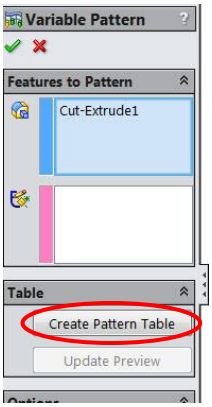


To draw the rest of the slots **Variable Pattern** will be used. It is found under the 

Linear Pattern command.

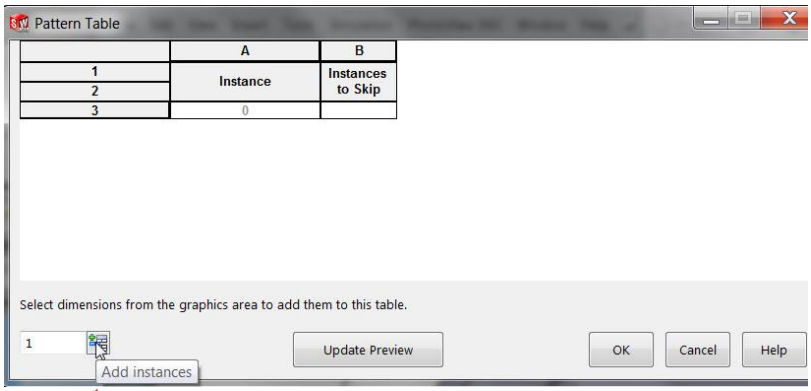


In selecting **Variable Pattern** this window appears.



Select the slot as features to pattern from the design tree.

Select **Create Pattern Table.**



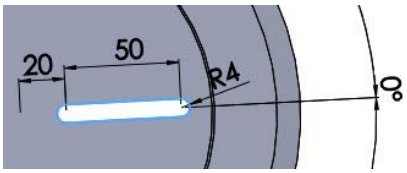
This window appears.

Click on the button to add instance.

	A	B
1	Instance	Instances to Skip
2		
3	0	
4	1	

On the screen select the dimensions visible. First select the angle (0°), then select the distance from the centre (20mm), then the distance from point 1 to point 2 on the slot (50mm).

These measurements will be transferred into the table.



	A	B	C	D	E	F
1	Instance	Instances to Skip	Sketch2			
2			D3	D2	D1	D4
3	0		0.00deg	20.00mm	50.00mm	4.00mm
4	1	☐	0.00deg	20.00mm	50.00mm	4.00mm

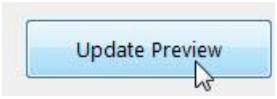
As there will be 12 instances input 30 or type 360/12 into the degree column, and click out of the table to activate the calculation.

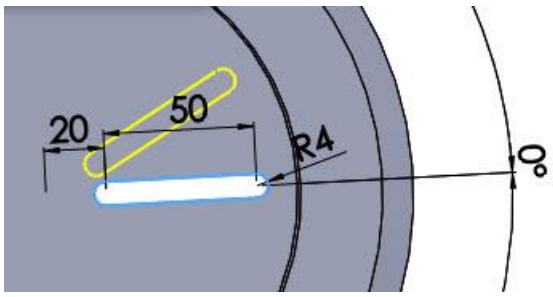
A	B	C
Instance	Instances to Skip	D3
0		0.00deg
1	☐	360/12

C
D3
0.00deg
360/12

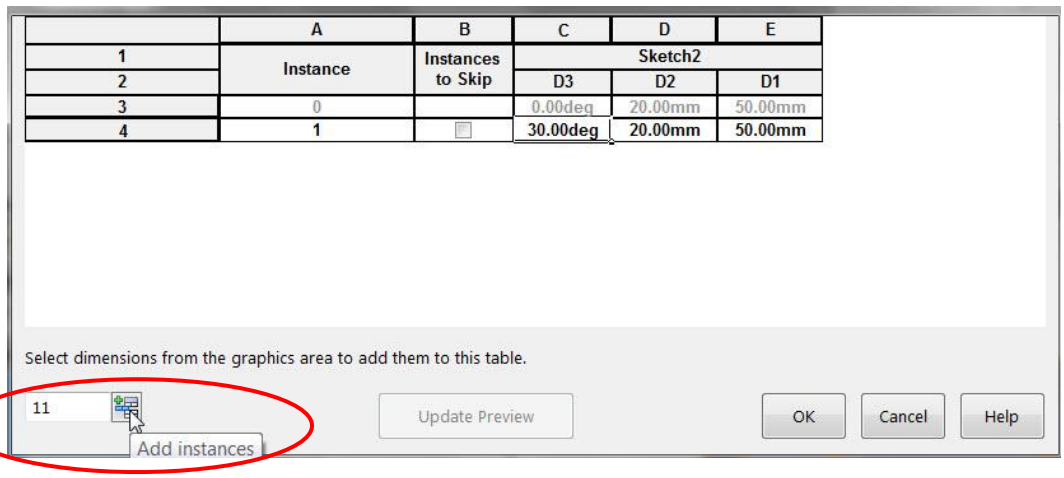
C
D3
0.00deg
30.00deg

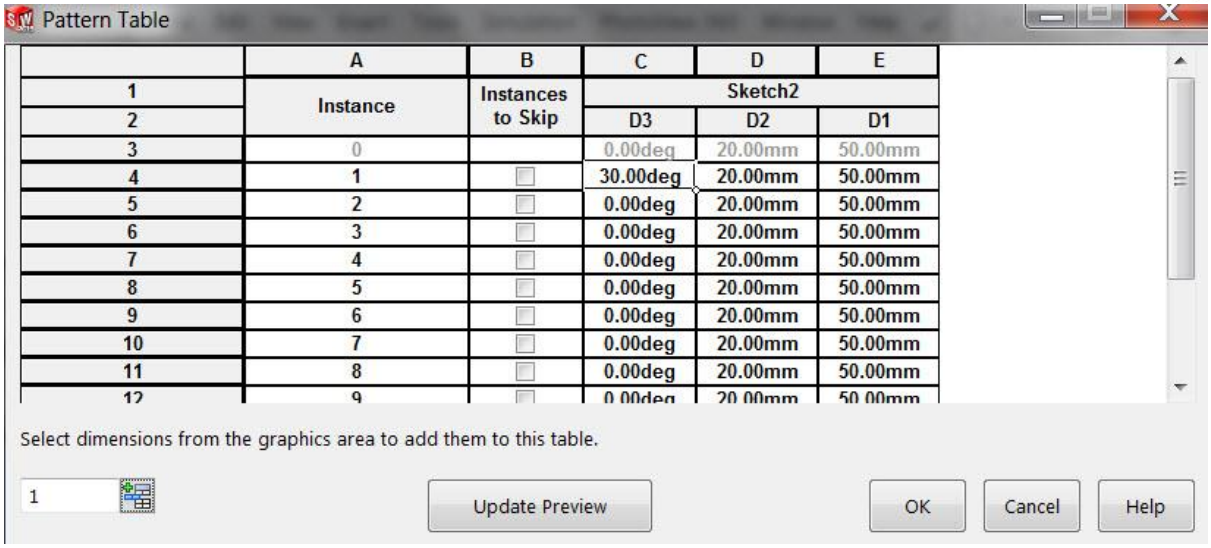
Select **Update Preview** at the bottom of the table to view the result before accepting.





In the **Add Instances** type **11** and select add instances.

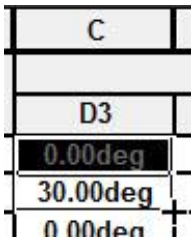




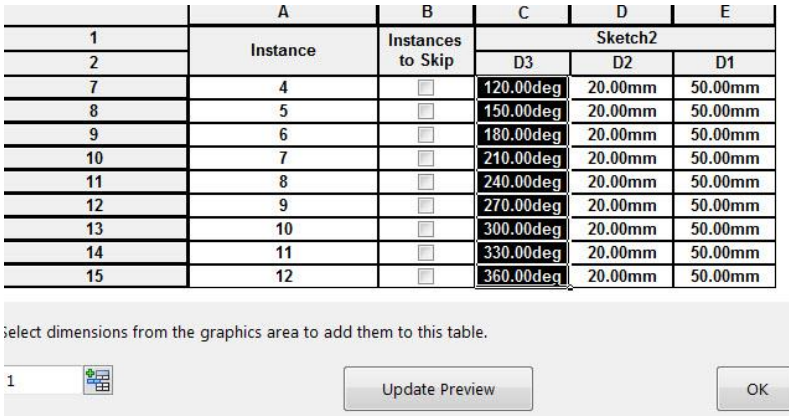
The table created presents like an Excel sheet.

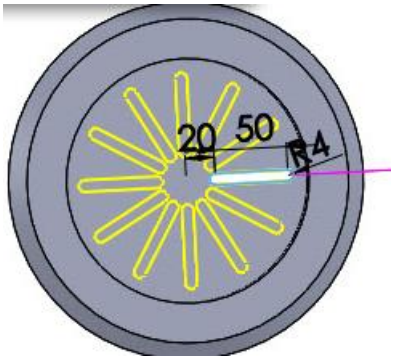
In table D3 the degrees should be increasing by 30° each time as we move down the table.

The quick way of doing this is to "**Auto Populate**" as in an Excel sheet. Highlight the top two columns by left click on the mouse and drag the mouse over the top two columns.



Then holding down the mouse drag to the bottom of the column to get the other angles.



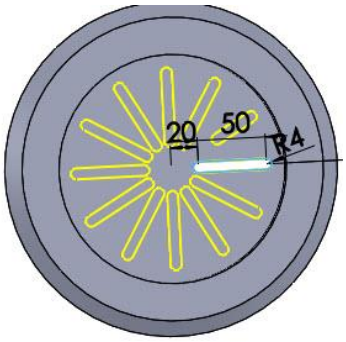


Select **Update Preview**.

Every second slot in this feature will now be edited to **30mm** in length. Point 1 will now be changed to **40mm** away from the centre.

Change the second row in column D to **40mm**, and the second row of column E to **30mm** and press **Update Preview**.

B	C	D	E
Instances to Skip	Sketch2		
	D3	D2	D1
	0.00deg	20.00mm	50.00mm
☐	30.00deg	40.00mm	30.00mm
☐	60.00deg	20.00mm	50.00mm

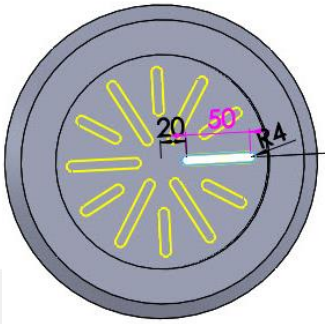


Then use Cut and Paste to repeat these measurements in every second row as shown.

	A	B	C	D	E
1	Instance	Instances to Skip	Sketch2		
2			D3	D2	D1
7	4	☐	120.00deg	20.00mm	50.00mm
8	5	☐	150.00deg	40.00mm	30.00mm
9	6	☐	180.00deg	20.00mm	50.00mm
10	7	☐	210.00deg	40.00mm	30.00mm
11	8	☐	240.00deg	20.00mm	50.00mm
12	9	☐	270.00deg	40.00mm	30.00mm
13	10	☐	300.00deg	20.00mm	50.00mm
14	11	☐	330.00deg	40.00mm	30.00mm
15	12	☐	360.00deg	20.00mm	50.00mm

Select dimensions from the graphics area to add them to this table.

1 Update Preview Update preview geometry OK Cancel Help

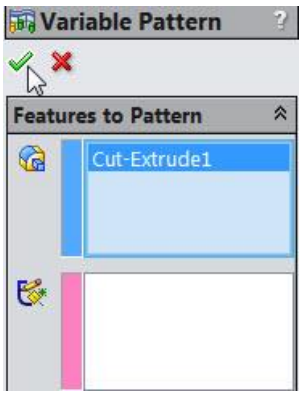


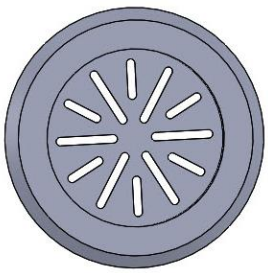
Click **OK.**

Accept the Variable Pattern.

20.00mm	50.00mm
40.00mm	30.00mm
20.00mm	50.00mm
40.00mm	30.00mm
20.00mm	50.00mm

OK Cancel Help

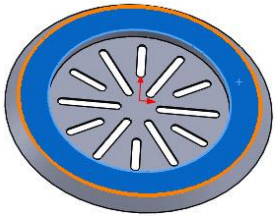




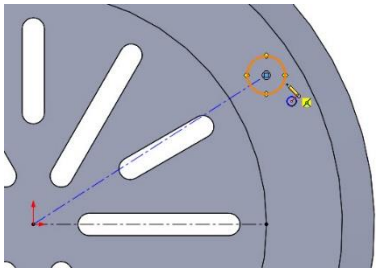
The circular holes are created in a similar manner.

From the centre draw a horizontal centreline on the face shown.

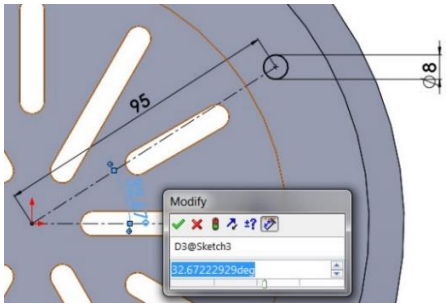
Then draw another centreline at any angle.

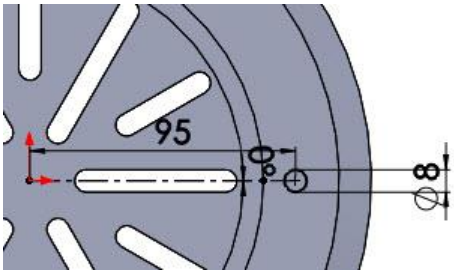


Draw a circle onto the end of the sloping line.

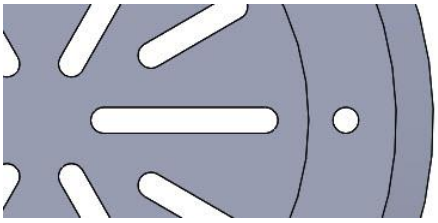


Add the following dimensions and set the angle between the centrelines to 0°.

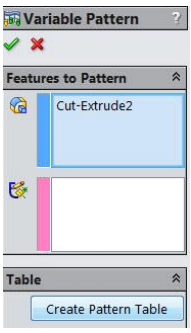


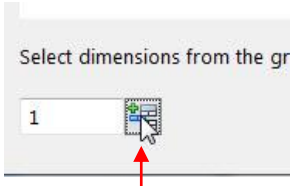


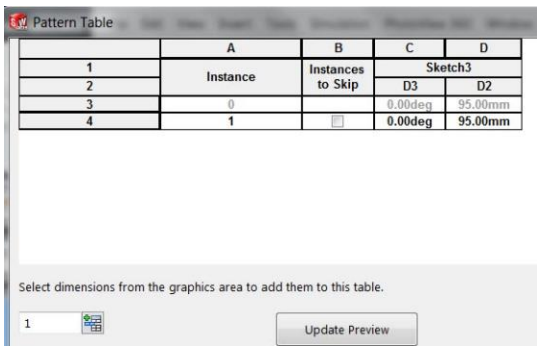
Accept sketch and **Extrude Cut,** Through All.



Select **Variable Pattern** under the **Linear Pattern** feature.



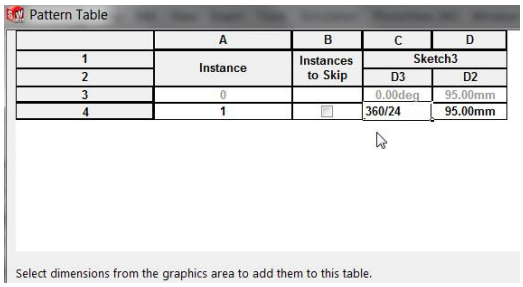




Select **Create Pattern Table**.

Press **Add Instance** button above.

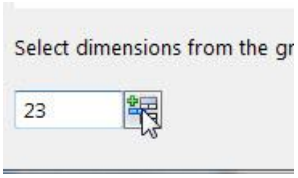
There will be 24 instances here so type 360/24 and move the cursor outside the table and click to get the result.



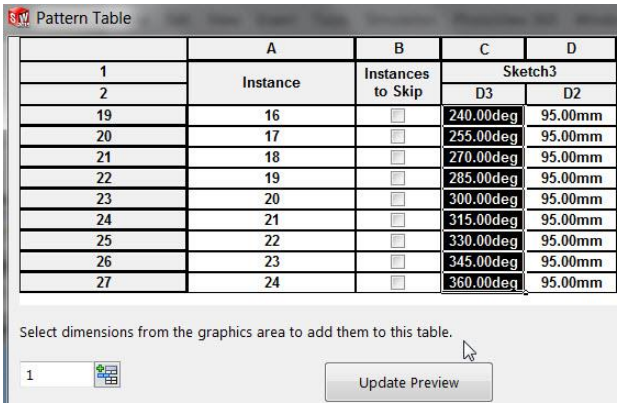
	A	B	C	D
1	Instance	Instances to Skip	Sketch3	
2			D3	D2
3	0		0.00deg	95.00mm
4	1		360/24	95.00mm

	A	B	C	D
1	Instance	Instances to Skip	Sketch3	
2			D3	D2
3	0		0.00deg	95.00mm
4	1		15.00deg	95.00mm

At the bottom of the window type 23 more instances in the box. Press the button to show the new table.

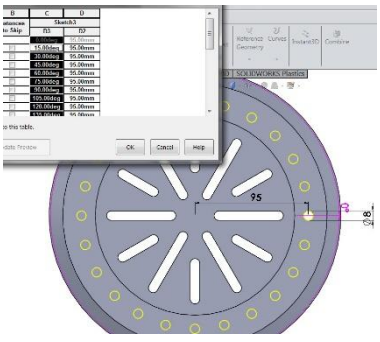


As before, copy the first and second column of **D3** down to the bottom of the row to fill in the angles.

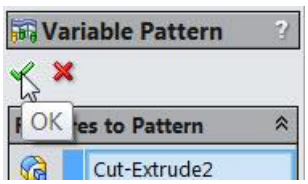


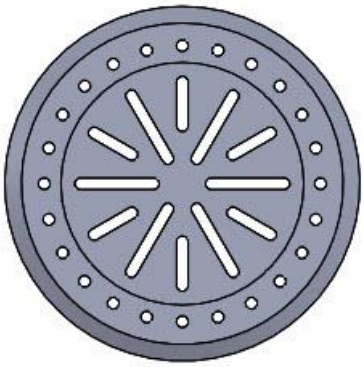
	A	B	C	D
1	Instance	Instances to Skip	Sketch3	
2			D3	D2
19	16		240.00deg	95.00mm
20	17		255.00deg	95.00mm
21	18		270.00deg	95.00mm
22	19		285.00deg	95.00mm
23	20		300.00deg	95.00mm
24	21		315.00deg	95.00mm
25	22		330.00deg	95.00mm
26	23		345.00deg	95.00mm
27	24		360.00deg	95.00mm

Select **Update Preview**.

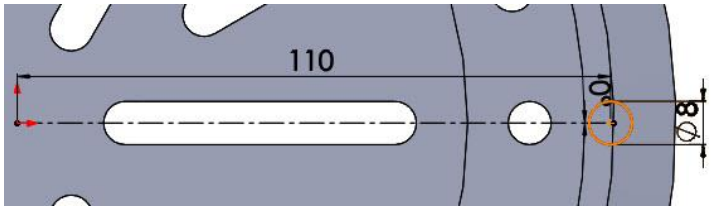


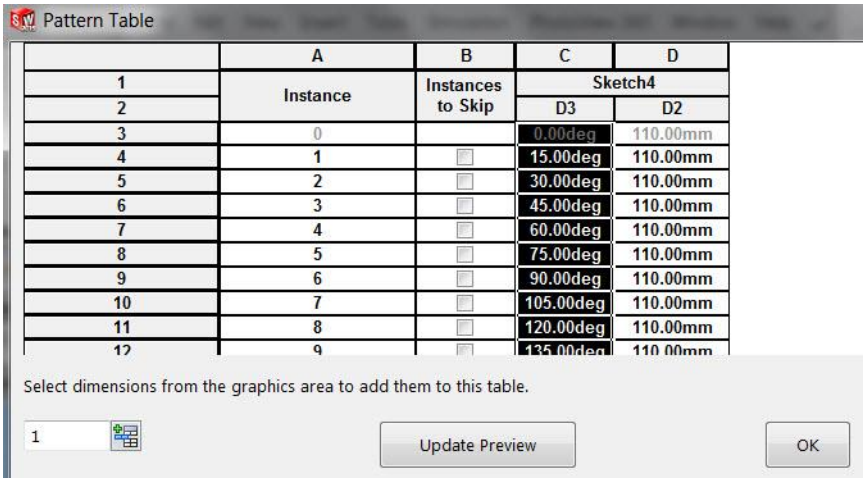
Accept.

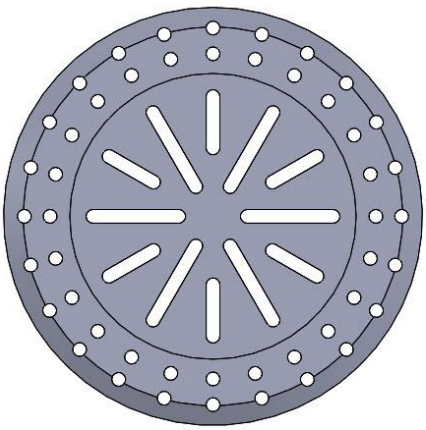




Another circular pattern can be completed in the same way having a distance of 110mm from the centre.



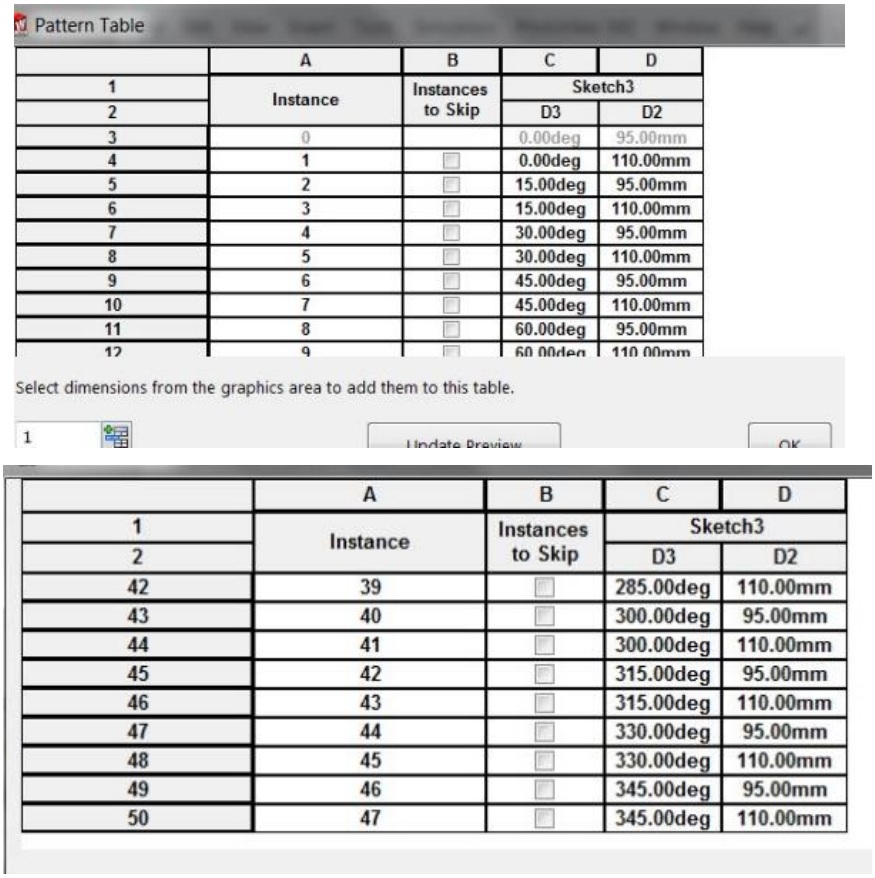




The advantage of this method is that changes can easily be made to the instances either by selecting them on the design tree or on the screen.

Note

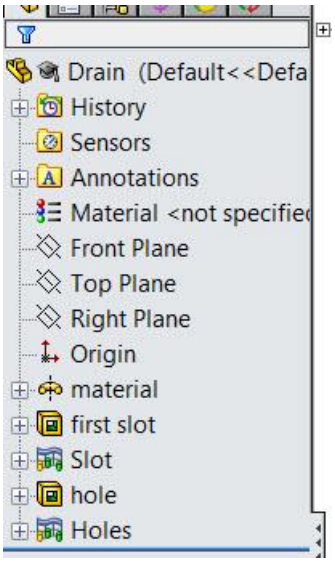
An alternative to drawing a second hole at 110m from the centre and using variable pattern again (as shown in page 10) is to include the second pattern into the first table as shown.

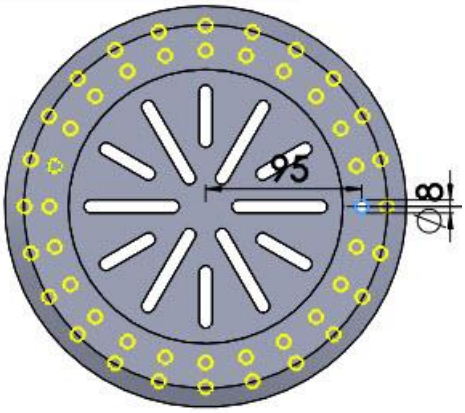


	A	B	C	D
1	Instance	Instances to Skip	Sketch3	
2			D3	D2
3	0		0.00deg	95.00mm
4	1		0.00deg	110.00mm
5	2		15.00deg	95.00mm
6	3		15.00deg	110.00mm
7	4		30.00deg	95.00mm
8	5		30.00deg	110.00mm
9	6		45.00deg	95.00mm
10	7		45.00deg	110.00mm
11	8		60.00deg	95.00mm
12	9		60.00deg	110.00mm

	A	B	C	D
1	Instance	Instances to Skip	Sketch3	
2			D3	D2
42	39		285.00deg	110.00mm
43	40		300.00deg	95.00mm
44	41		300.00deg	110.00mm
45	42		315.00deg	95.00mm
46	43		315.00deg	110.00mm
47	44		330.00deg	95.00mm
48	45		330.00deg	110.00mm
49	46		345.00deg	95.00mm
50	47		345.00deg	110.00mm

So instead of creating 24 instances, create 48 and in every second one change the distance from the centre to 110mm.

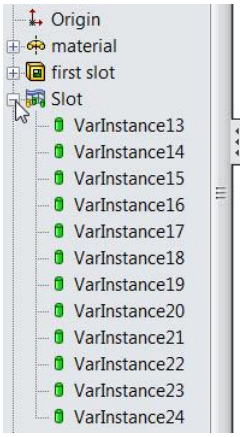


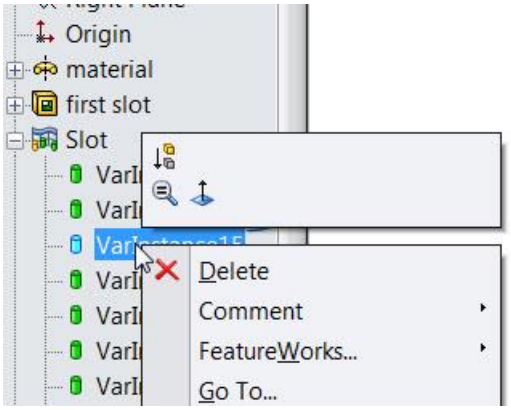


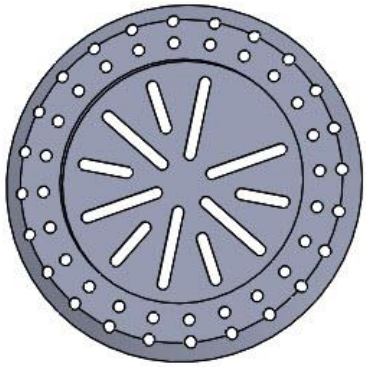
This reduces the features on the design tree.

Changes can easily be made to these instances in the design tree or on the screen.

To change on the design tree, expand the relevant Variable Pattern.



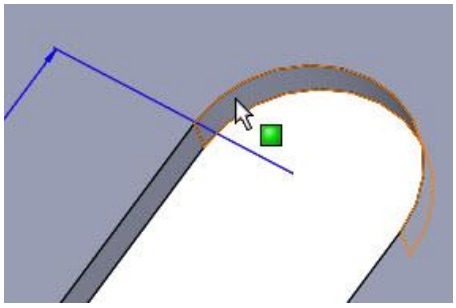


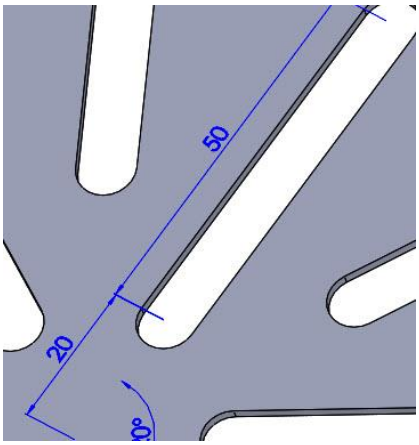


The instance can either be supressed or deleted.

Note Deleting the instance removes it from the table.

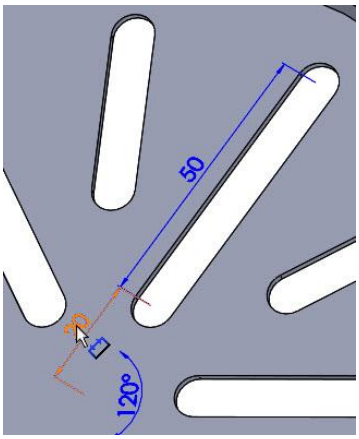
To change on the screen, double click on the inside face of a slot or hole and the associated dimensions will appear.

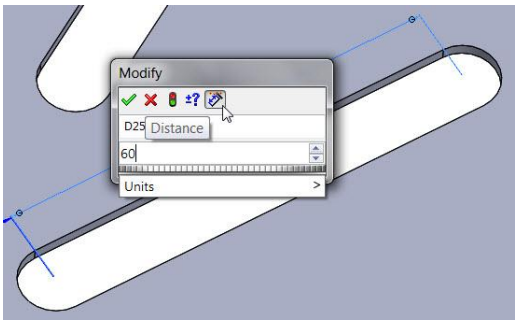


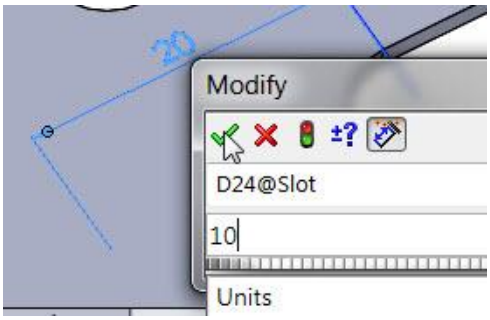


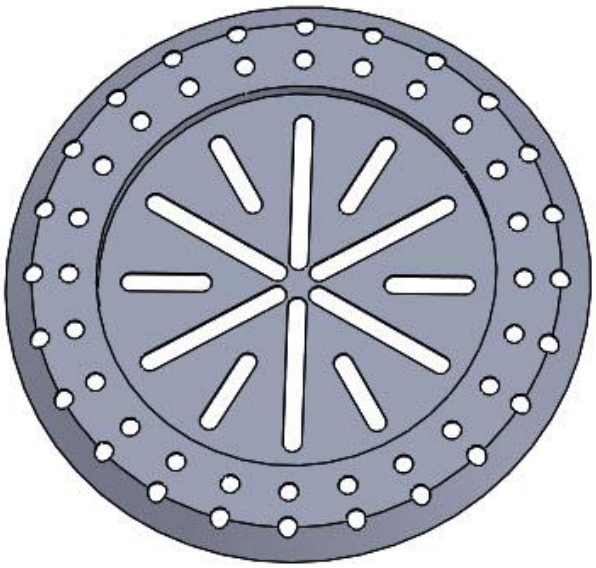
The dimensions can now be altered by double clicking on the dimension to be changed.

Here, the long slots lengths have been changed from 50mm to 60mm and the offset distance is changed from 20mm to 10mm.



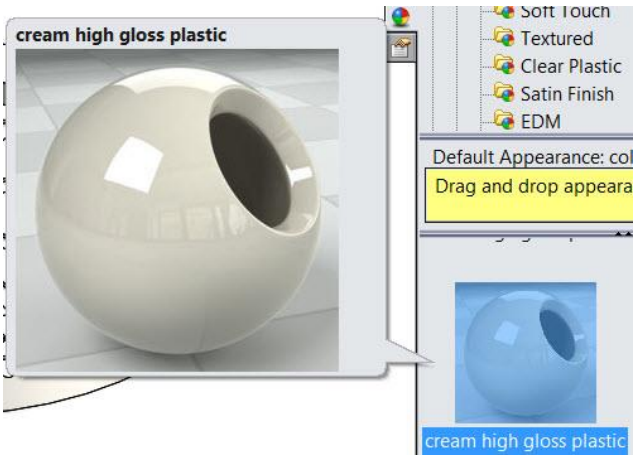


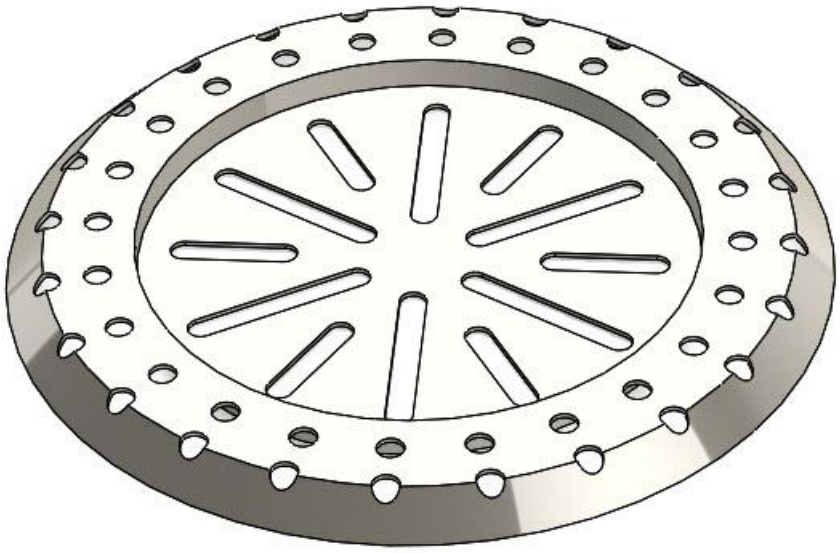




Appearance

Apply a cream high gloss plastic to the part.





Save