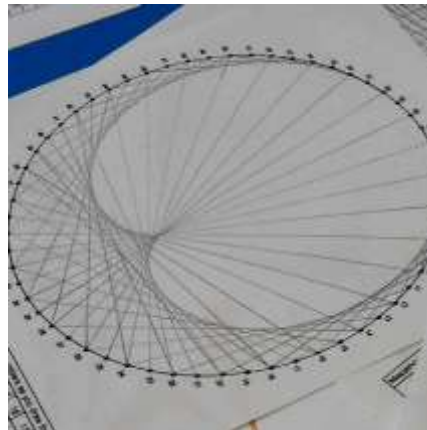


Use the circle template pdf to make a **cardioid** (this mathematical pattern).



You need the template, coloured pencils and a ruler

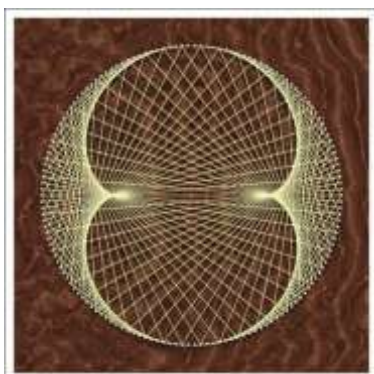
Use the grid, beneath the circle template to plan the numbers you are going to join. Double each number and write it in the box underneath. For example, beneath 1 is 2, beneath 2 is 4, beneath 3 is 6 and so on. **When you get to 30, the number underneath should be 60. Now start again. The number under 31 is 2 the number under 32 is 4, the number under 33 is 6 and so on up to 60**

Mapping is $n \rightarrow 2n \pmod{60}$										Score out numbers as you draw them									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
42	44	46	48	50	52	54	56	58	60	2	4	6	8	10	12	14	16	18	20
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60

Now use the grid to join up the dots. Join 1 to 2, 2 to 4, 3 to 6 and so on around the circle.

When you have completed it you can use colour to make patterns.

If you want to try a nephroid, see the instructions below



You can make this pattern if you complete the rid differently.

This time you need to multiply the number by 3 ($3n$)

So 1 joins 3, 2 joins 6, 3 joins 9, 4 joins 12 and so on. When you get to 20 you will make 60 so 21 will join 3 and 22 will join 6 etc.

An epicycloid is $4n$

