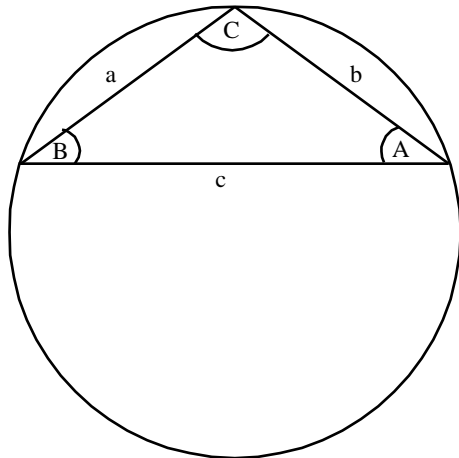


**Calculating the radius of an arc.**

Looking through an old maths text book I came across the following drawing, along with the formulae for the ratios of a, b, c and R. This is all we need to produce the formulae to calculate the arc radius, given the length and height of the arc.



R = radius of circle

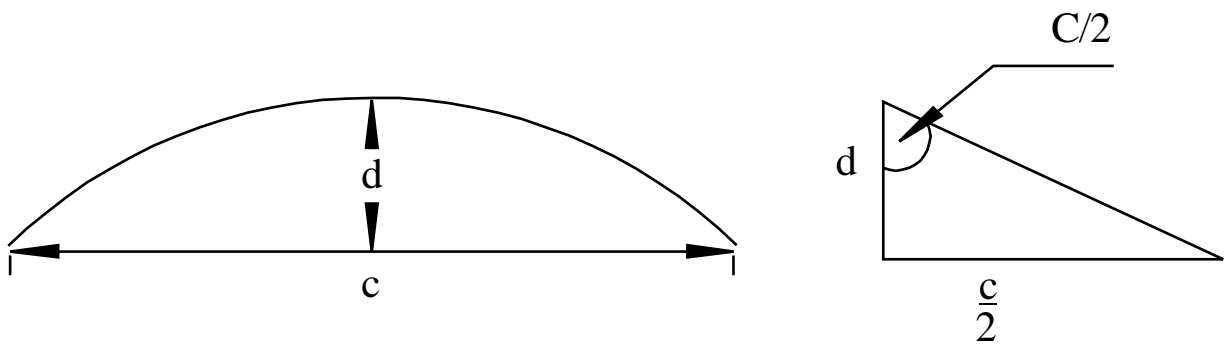
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

Using the formula, we can find R in terms of C

which gives us :

**Formula 1:**  $R = c / (2 \sin C)$

A more practical application would use the length and height of an arc to calculate its radius :



The dimensions of the arc, c and d, are used to draw the right angle triangle shown on the right. The division by two is because half of length c is the base of the triangle and the angle is half of angle C from the circle and triangle drawn previously.

Using this triangle we can find C in terms of c and d :

$C/2 = \tan^{-1} (c/2d)$   
and by rearranging this we get :

**Formula 2:**  $C = 2 \tan^{-1} (c/2d)$

Combining formulae 1 and 2 to find R from c and d :

$$\mathbf{R = c / (2 \sin(2 \tan^{-1} (c/2d)))}$$

Using the above formula, given the length and height of an arc, we can calculate the radius of the arc.

As an example, I went for an arc length of 20cm and height of 5cm. From the table, this gives a radius of 12.5cm.

There are no units used in the table because the formula is based on ratios so you can use centimetres, millimetres, inches or whatever units you prefer as long as you use the same units throughout.

The table was taken from a spreadsheet I created and this could be available for download for those that are interested in obtaining a copy.

For those like me, who would rather do wood turning instead of maths, here's a table of values that can be used to look up the radius, given the arc dimensions. The blanks are because I assumed that an arc would be less than a semi-circle otherwise it would be impossible to cut on a lathe.

Arc Length	Arc Height									
	1	2	3	4	5	6	7	8	9	10
10	13.0	7.25	5.67	5.13	5.0					
12	18.5	10.0	7.5	6.5	6.1	6.0				
14	25.0	13.25	9.67	8.13	7.4	7.08	7.0			
16	32.5	17.0	12.17	10.0	8.9	8.33	8.07	8.0		
18	41.0	21.25	15.0	12.13	10.6	9.75	9.29	9.06	9.0	
20	50.5	26.0	18.17	14.5	12.5	11.33	10.64	10.25	10.06	10.0
22	61.0	31.25	21.67	17.13	14.6	13.08	12.14	11.56	11.22	11.05
24	72.5	37.0	25.5	20.0	16.9	15.0	13.79	13.0	12.5	12.2
26	85.0	43.25	29.67	23.13	19.4	17.08	15.57	14.56	13.89	13.45
28	98.5	50.0	34.17	26.5	22.1	19.33	17.5	16.25	15.39	14.8
30	113.0	57.25	39.0	30.13	25.0	21.75	19.57	18.06	17.0	16.25
32	128.5	65.0	44.17	34.0	28.1	24.33	21.79	20.0	18.72	17.8
34	145.0	73.25	49.67	38.13	31.4	27.08	24.14	22.06	20.56	19.45
36	162.5	82.0	55.5	42.5	34.9	30.0	26.64	24.25	22.5	21.2
38	181.0	91.25	61.67	47.13	38.6	33.08	29.29	26.56	24.56	23.05
40	200.5	101.0	68.17	52.0	42.5	36.33	32.07	29.0	26.72	25.0
42	221.0	111.25	75.0	57.13	46.6	39.75	35.0	31.56	29.0	27.05
44	242.5	122.0	82.17	62.5	50.9	43.33	38.07	34.25	31.39	29.2
46	265.0	133.25	89.67	68.13	55.4	47.08	41.29	37.06	33.89	31.45
48	288.5	145.0	97.5	74.0	60.1	51.0	44.64	40.0	36.5	33.8
50	313.0	157.25	105.67	80.13	65.0	55.08	48.14	43.06	39.22	36.25
52	338.5	170.0	114.17	86.5	70.1	59.33	51.79	46.25	42.06	38.8
54	365.0	183.25	123.0	93.12	75.4	63.75	55.57	49.56	45.0	41.45
56	392.5	197.0	132.17	100.0	80.9	68.33	59.5	53.0	48.06	44.2
58	421.0	211.25	141.67	107.13	86.6	73.08	63.57	56.56	51.22	47.05
60	450.5	226.0	151.5	114.5	92.5	78.0	67.79	60.25	54.5	50.0
62	481.0	241.25	161.67	122.13	98.6	83.08	72.14	64.06	57.89	53.05
64	512.5	257.0	172.17	130.0	104.9	88.33	76.64	68.0	61.39	56.2
66	545.0	273.25	183.0	138.13	111.4	93.75	81.29	72.06	65.0	59.45
68	578.5	290.0	194.17	146.5	118.1	99.33	86.07	76.25	68.72	62.8
70	613.0	307.25	205.67	155.13	125.0	105.08	91.0	80.56	72.56	66.25
72	648.5	325.0	217.5	164.0	132.1	111.0	96.07	85.0	76.5	69.8
74	685.0	343.25	229.67	173.13	139.4	117.08	101.29	89.56	80.56	73.45
76	722.5	362.0	242.17	182.5	146.9	123.33	106.64	94.25	84.72	77.2
78	761.0	381.25	255.0	192.13	154.6	129.75	112.14	99.06	89.0	81.05
80	800.5	401.0	268.17	202.0	162.5	136.33	117.79	104.0	93.39	85.0
82	841.0	421.25	281.67	212.13	170.6	143.08	123.57	109.06	97.89	89.05
84	882.5	442.0	295.5	222.5	178.9	150.0	129.5	114.25	102.5	93.2
86	925.0	463.25	309.67	233.13	187.4	157.08	135.57	119.56	107.22	97.45
88	968.5	485.0	324.17	244.0	196.1	164.33	141.79	125.0	112.06	101.8
90	1013.0	507.25	339.0	255.13	205.0	171.75	148.14	130.56	117.0	106.25
92	1058.5	530.0	354.17	266.5	214.1	179.33	154.64	136.25	122.06	110.8
94	1105.0	553.25	369.67	278.13	223.4	187.08	161.29	142.06	127.22	115.45
96	1152.5	577.0	385.5	290.0	232.9	195.0	168.07	148.0	132.5	120.2
98	1201.0	601.25	401.67	302.13	242.6	203.08	175.0	154.06	137.89	125.05
100	1250.5	626.0	418.17	314.5	252.5	211.33	182.07	160.25	143.39	130.0