Numerical Analysis HW 2

Interpolation
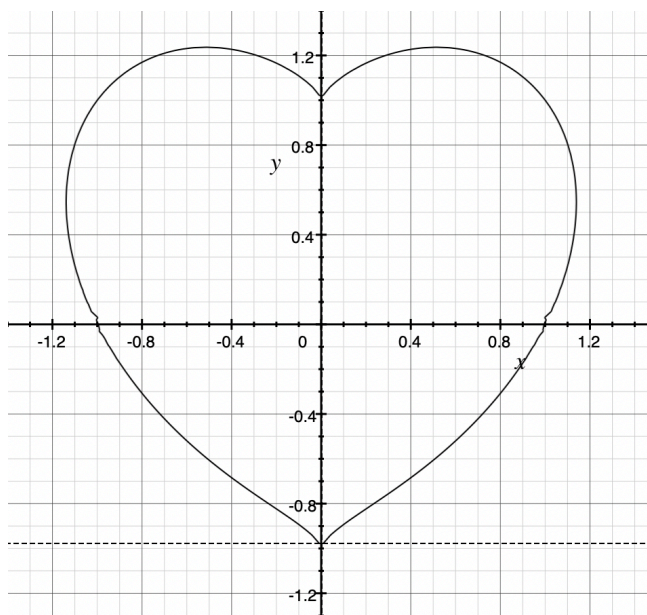
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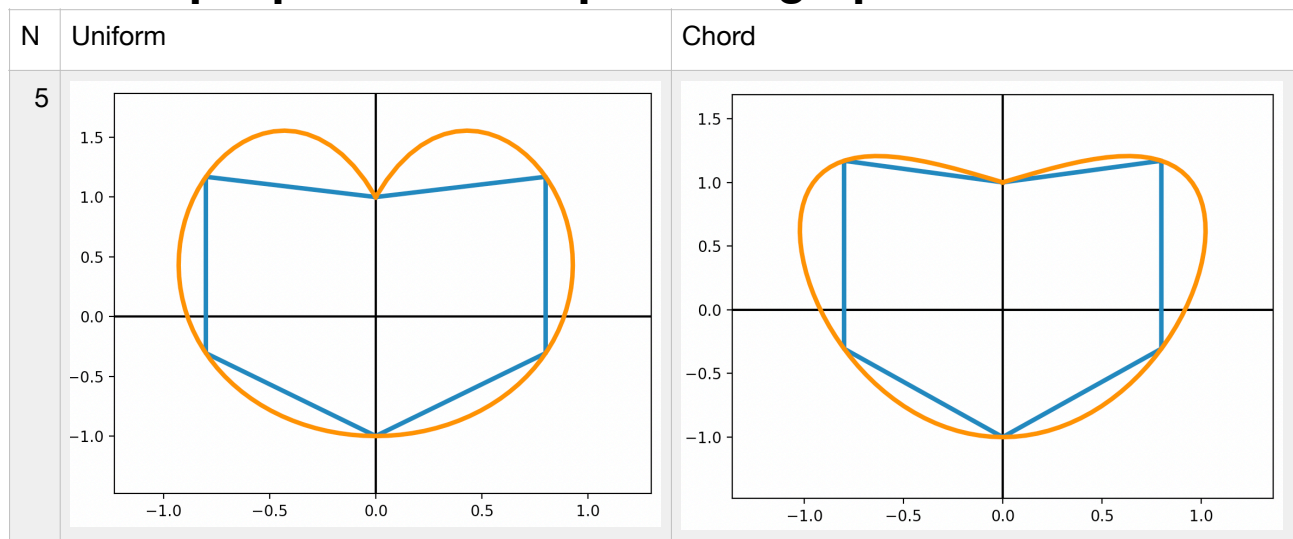系級：資工 4 B
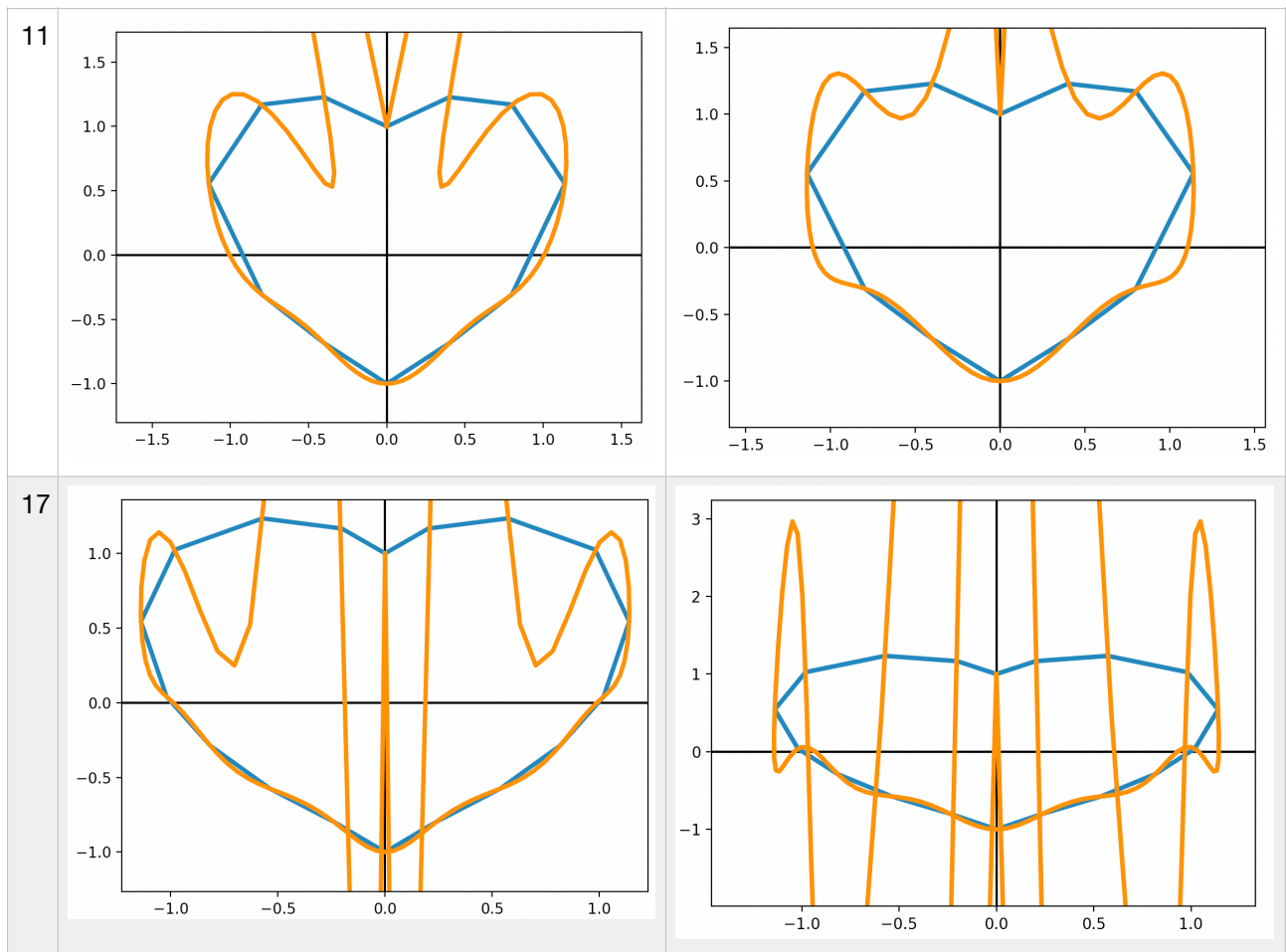
1. Original Shape & Function

$$(x^2 + y^2 - 1)^3 - x^2 y^3 = 0$$

2. Sample points & interpolation graph

N	Uniform	Chord
5		

Coefficent

N	Uniform	Chord

5	`c0: 0`
	`c1: -0.8`
	`c2: 0.4`
	`c3: 0`
	`c4: -0.0333333`
	`c5: 0.00666667`
	`c6: 0`
		`c0: 0`
		`c1: -6.55926`
		`c2: 19.175`
		`c3: -11.5501`
		`c4: -20.4454`
		`c5: 23.2854`
		`c6: 1.56319e-13`

11	c0: 0 c1: -0.4 c2: 0 c3: 0.0101667 c4: 0.0231667 c5: -0.0149167 c6: 0.00497222 c7: -0.00116369 c8: 0.000212897 c9: -3.2344e-05 c10: 4.10328e-06 c11: -3.73026e-07 c12: 0	c0: 0 c1: -6.1757 c2: -7.02267 c3: 136.698 c4: -357.651 c5: 469.412 c6: -78.9334 c7: -1108.29 c8: 2526.21 c9: -3098.93 c10: 3373.56 c11: -3607.2 c12: -1.02068e-08
17	c0: 0 c1: -0.2016 c2: -0.0844 c3: 0.0217833 c4: 0.00655833 c5: -0.00347833 c6: 0.0006325 c7: -1.73016e-05 c8: -2.27703e-05 c9: 7.77364e-06 c10: -1.58862e-06 c11: 2.38025e-07 c12: -2.73776e-08 c13: 2.41192e-09 c14: -1.56381e-10 c15: 6.84849e-12 c16: -2.04476e-13 c17: 1.2028e-14 c18: 0	c0: 0 c1: -5.54253 c2: -17.1723 c3: 150.453 c4: -73.6609 c5: -1720.17 c6: 8945.91 c7: -26643.4 c8: 55110.1 c9: -98040.7 c10: 407258 c11: -2.82292e+06 c12: 1.44827e+07 c13: -5.36198e+07 c14: 1.43339e+08 c15: -2.9047e+08 c16: 4.47704e+08 c17: -4.64603e+08 c18: -8.29697e-05

3.   Which parameterization is better? Why?

　　我認為當 n = 11 且採用 chord-length sampling 時會比較好。因為點的數量足夠描述圖形，上半部失真不會到太誇張。n = 5 時雖然看起來較為像是心形但我認為是因為這個演算法本身在兩點中內插就會有二次曲線的感覺，因此要我認為只是 n = 5 時我選的點剛好可以 match 到 traget shape 而已。
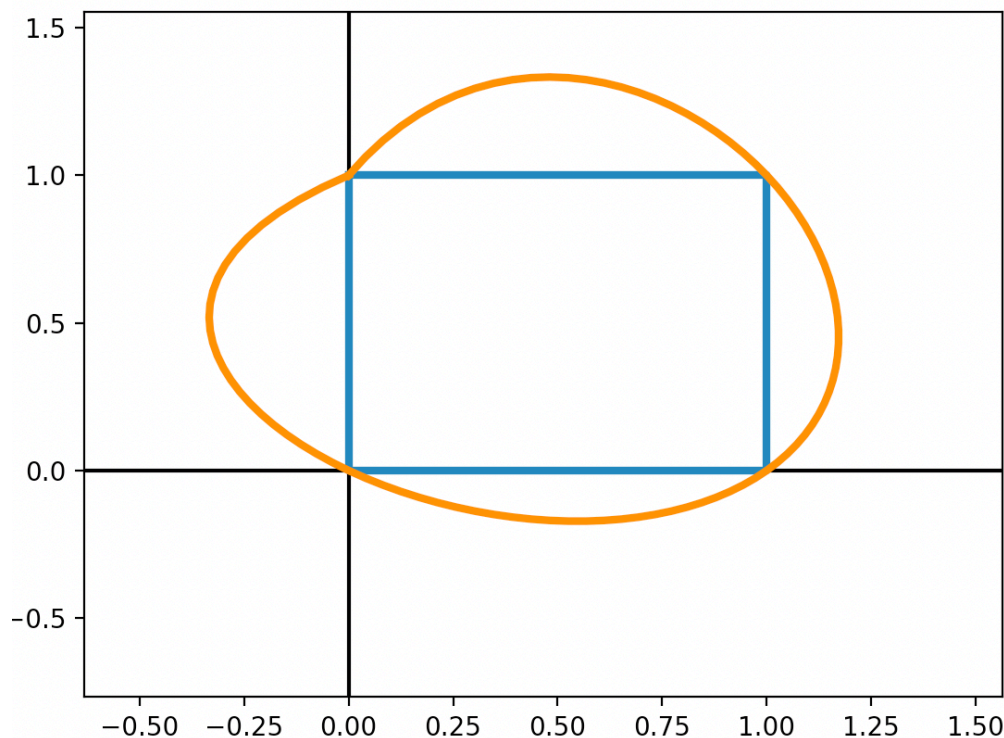
正方形內插結果

4.   As n increases, will the shape of the geometry improve? Why?

　　我認為當 n 過大時，形狀並不會越來越趨近目標圖形，目前測試過的資料在 n = 17 時都有嚴重的失真情形。

5.   Are the locations of the sample points important?

　　我認為一開始給定之點蠻重要的，sample points 應包含圖形特色，例如愛心形狀中上半部的內凹與下半部的尖角，左右之極值也應給定。