Software Recipes

Proven Tools

by D. James Benton

Just the Color Figures for Those Who Got the B&W Version
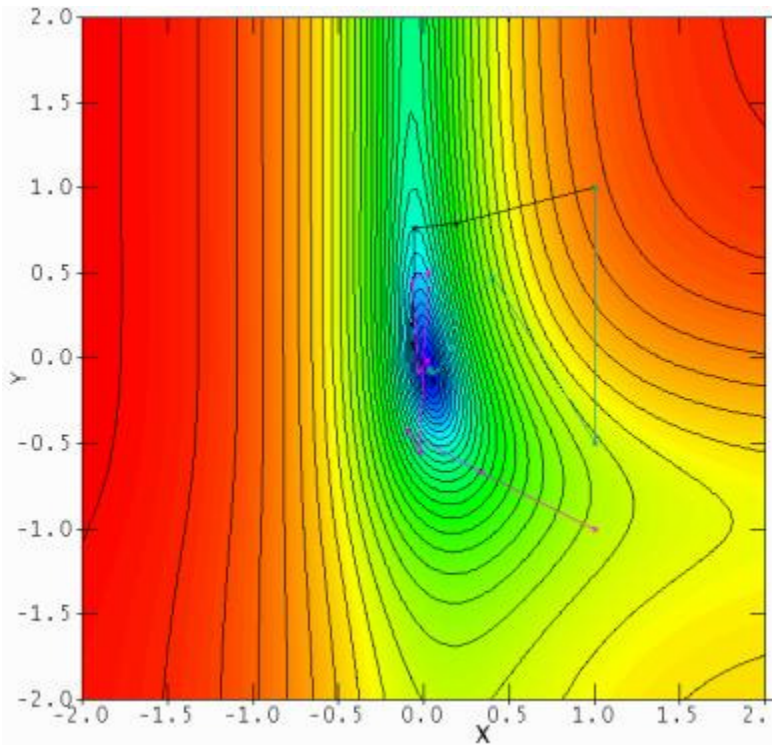
Figure 2. Finding the Minimum of a Function of Two Variables

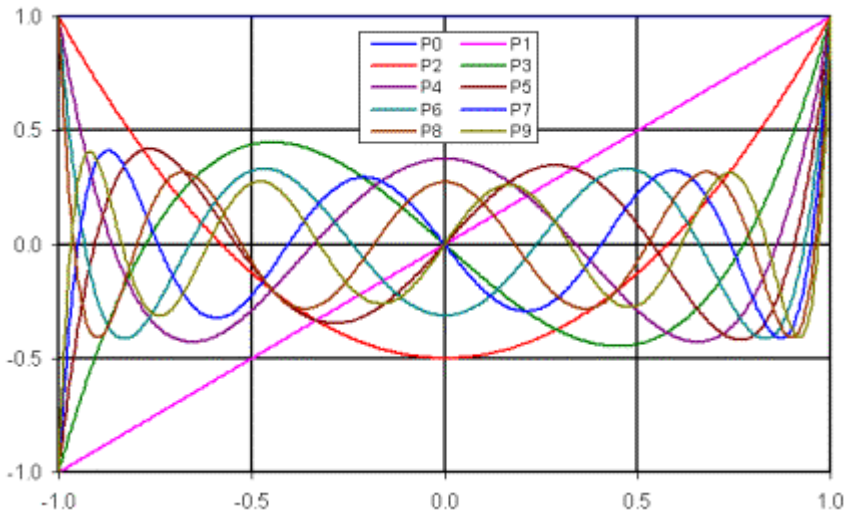**Figure 3. Legendre Polynomials**

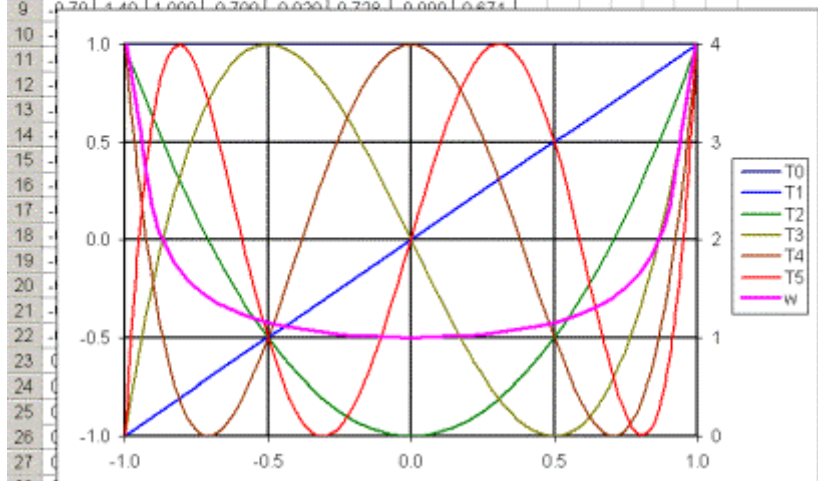|	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Chebyshev polynomials of the 1st kind								orthogonality test							
2	x	w	T0	T1	T2	T3	T4	T5		T0	T1	T2	T3	T4	T5	
3	-1.00	4.11	1.000	-1.000	1.000	-1.000	1.000	-1.000	T0	62	0	-1	0	0	0	
4	-0.95	3.20	1.000	-0.950	0.805	-0.580	0.296	0.017	T1	0	31	0	0	0	1	
5	-0.90	2.29	1.000	-0.900	0.620	-0.216	-0.231	0.632	T2	-1	0	31	0	0	0	
6	-0.85	1.90	1.000	-0.850	0.445	0.094	-0.604	0.933	T3	0	0	0	32	0	1	
7	-0.80	1.67	1.000	-0.800	0.280	0.352	-0.843	0.997	T4	0	0	0	0	32	0	
8	-0.75	1.51	1.000	-0.750	0.125	0.563	-0.969	0.891	T5	0	1	0	1	0	33	
9	-0.70	1.40	1.000	-0.700	0.020	0.728	0.000	0.671								

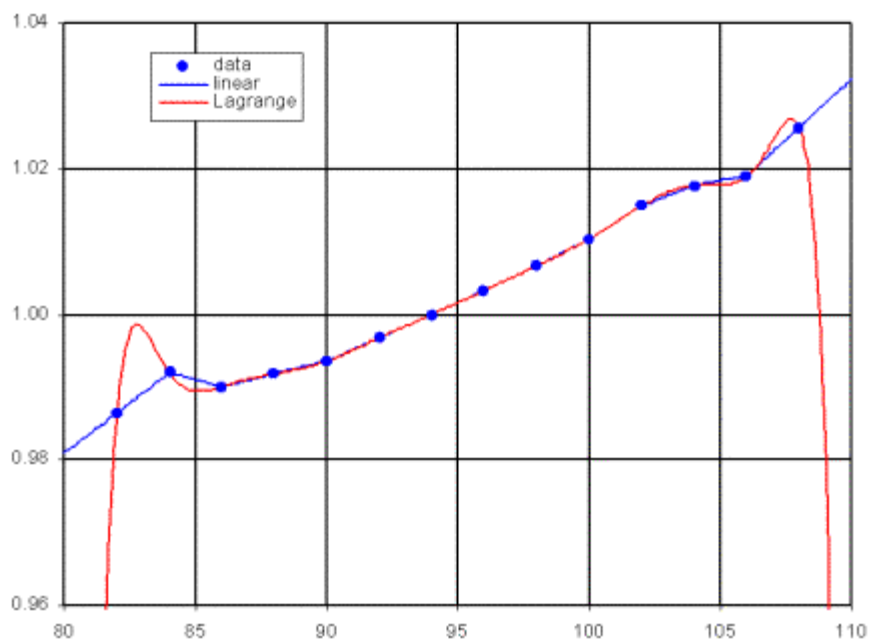
Figure 4. Chebyshev Polynomials
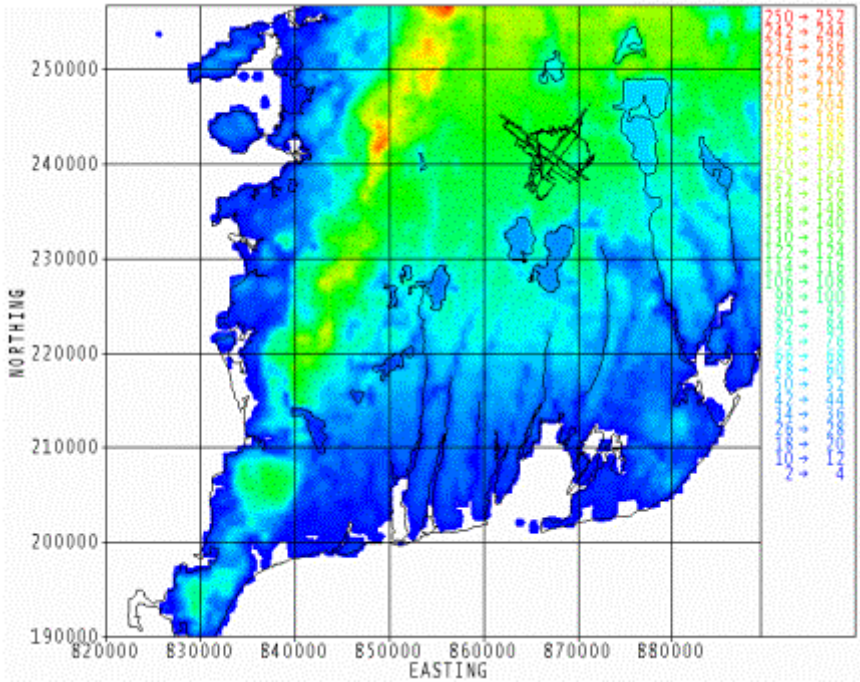
Figure 5. Interpolation

Figure 8. Western Cape Cod Elevations
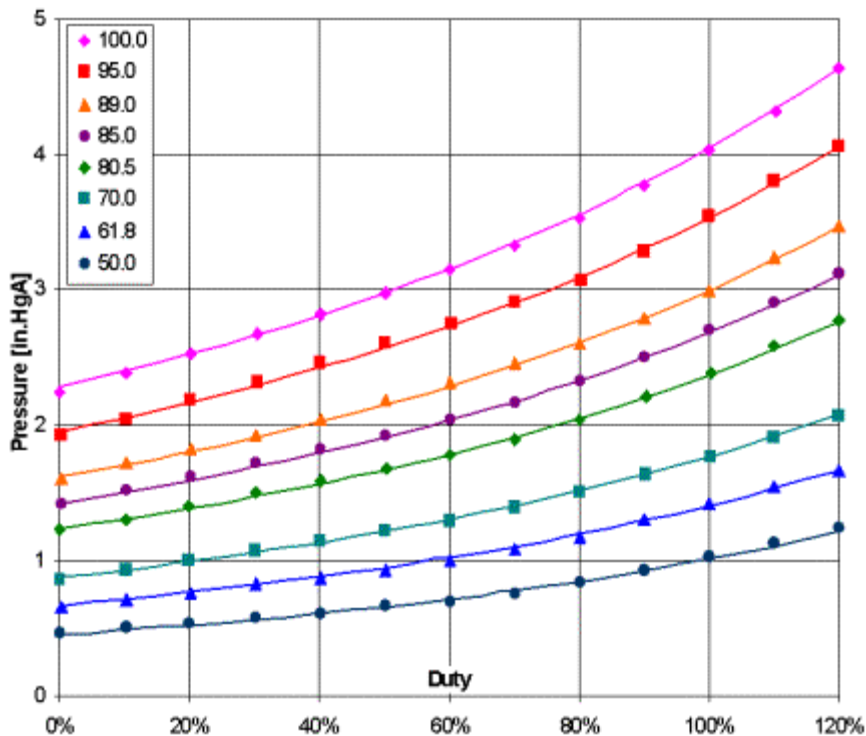
Figure 21. Digitized Points and Regression Curves
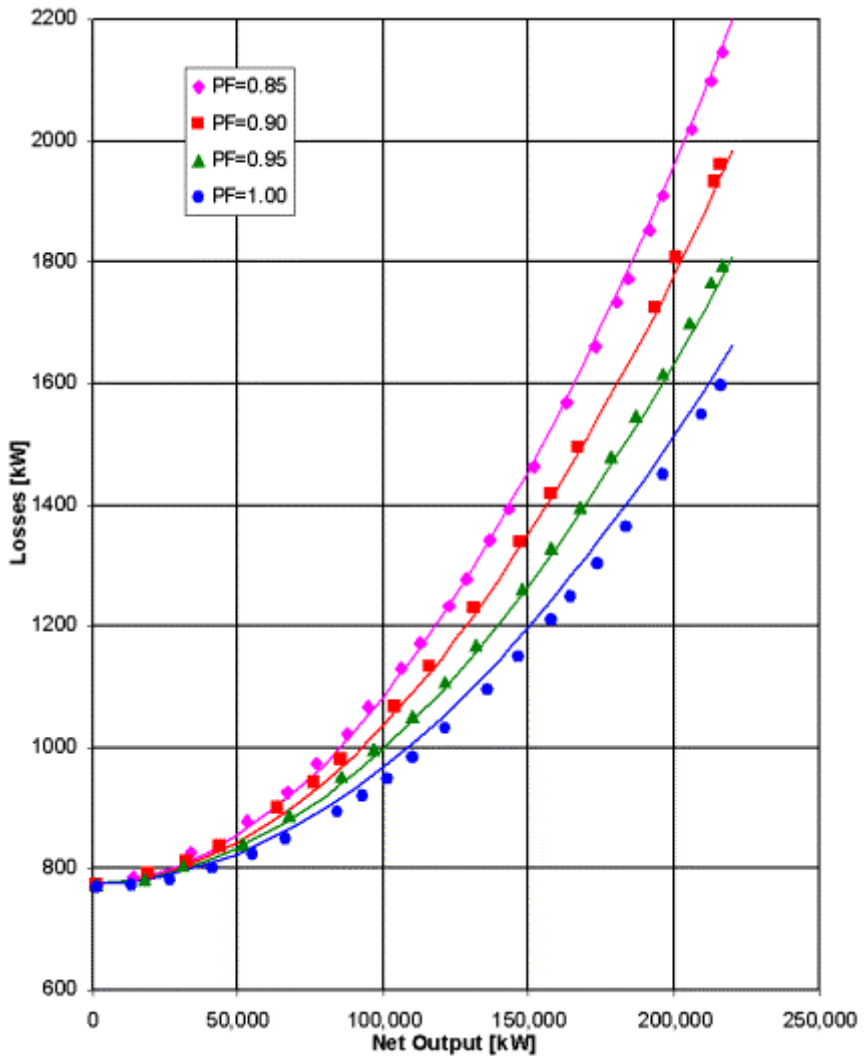
Figure 25. Generator Digitized Points and Regression Results

|	A	B	C	D	E	F	G	H	I	J	K	L
1	data		least sq.		min/max		4th order	approximations				
2	x	y	fit	err	fit	err	least-squares	x	sq	mm		
3	-5.99	0.49	0.61	0.12	-0.56	1.05	4.491900028	-6.0	0.62	-0.55		
4	-4.56	0.19	0.15	0.04	-0.38	0.58	0.580399094	-5.9	0.51	-0.60		
5	-3.40	1.82	1.04	0.78	0.71	1.11	-0.21789963	-5.8	0.41	-0.64		
6	-2.24	1.20	2.36	1.16	2.10	0.90	-0.01543159	-5.7	0.32	-0.67		
7	-1.41	3.75	3.30	0.45	3.08	0.67	0.003181404	-5.6	0.25	-0.69		
8	-0.70	3.72	3.98	0.26	3.79	0.07	4th order	-5.5	0.19	-0.70		
9	0.07	5.22	4.53	0.69	4.39	0.83	min/max	-5.4	0.14	-0.70		
10	0.79	4.15	4.81	0.66	4.73	0.58	4.345230041	-5.3	0.10	-0.69		
11	1.99	4.43	4.71	0.28	4.78	0.35	0.655767257	-5.2	0.08	-0.67		
12	3.49	5.04	3.68	1.36	3.94	1.10	-0.19945184	-5.1	0.06	-0.65		
13	4.39	1.91	2.72	0.81	3.02	1.12	-0.01463946	-5.0	0.06	-0.62		
14	5.32	2.04	1.64	0.40	1.88	0.16	0.002358918	-4.9	0.07	-0.57		
15	6.02	0.27	0.90	0.63	0.97	0.70		-4.8	0.08	-0.53		
16	7.61	0.36	0.16	0.20	-0.76	1.12		-4.7	0.11	-0.47		
17			max=	1.36	>	1.12		-4.6	0.14	-0.41		
18			sumsq=	6.32	<	9.31		-4.5	0.18	-0.34		
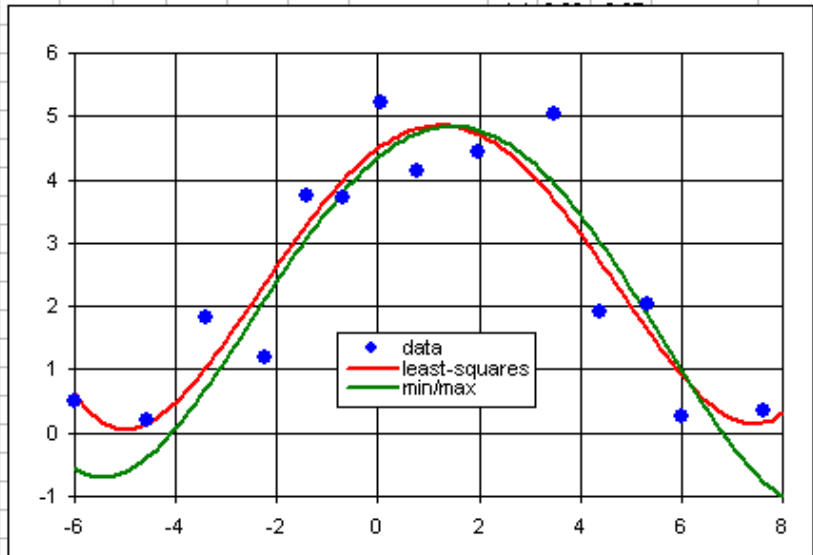
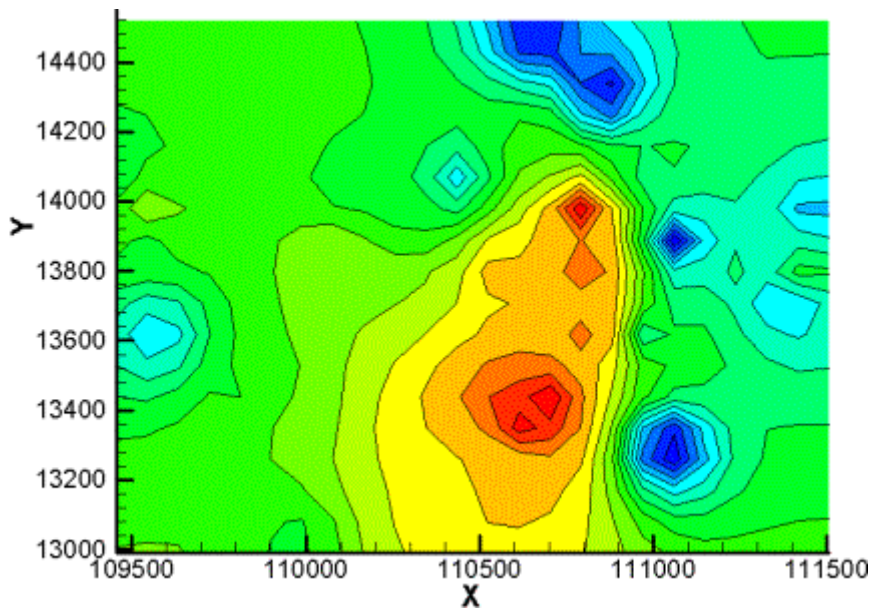**Figure 26. Example of Min/Max Fit**

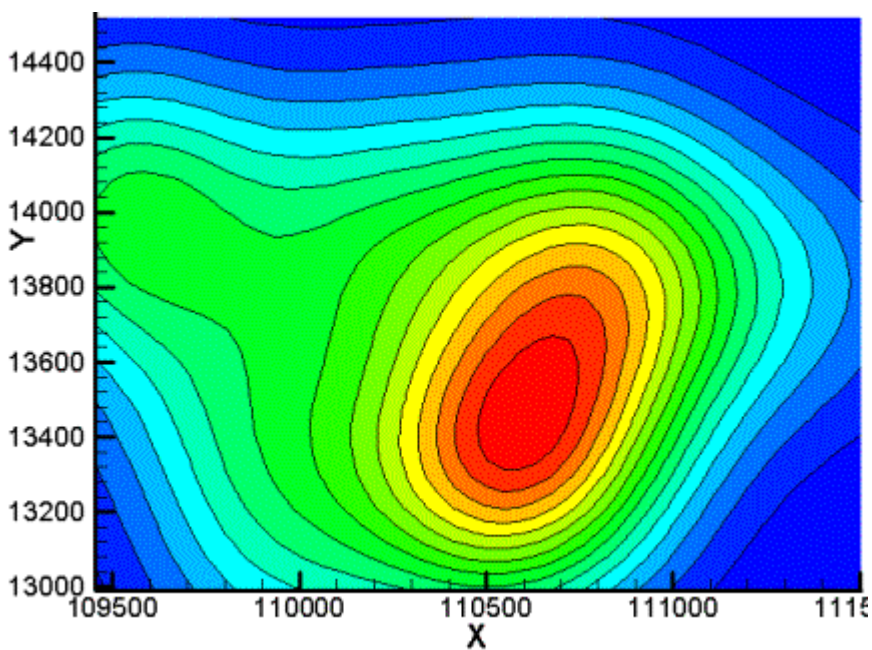**Figure 31. Typical Results of Inverse Distance Interpolation**

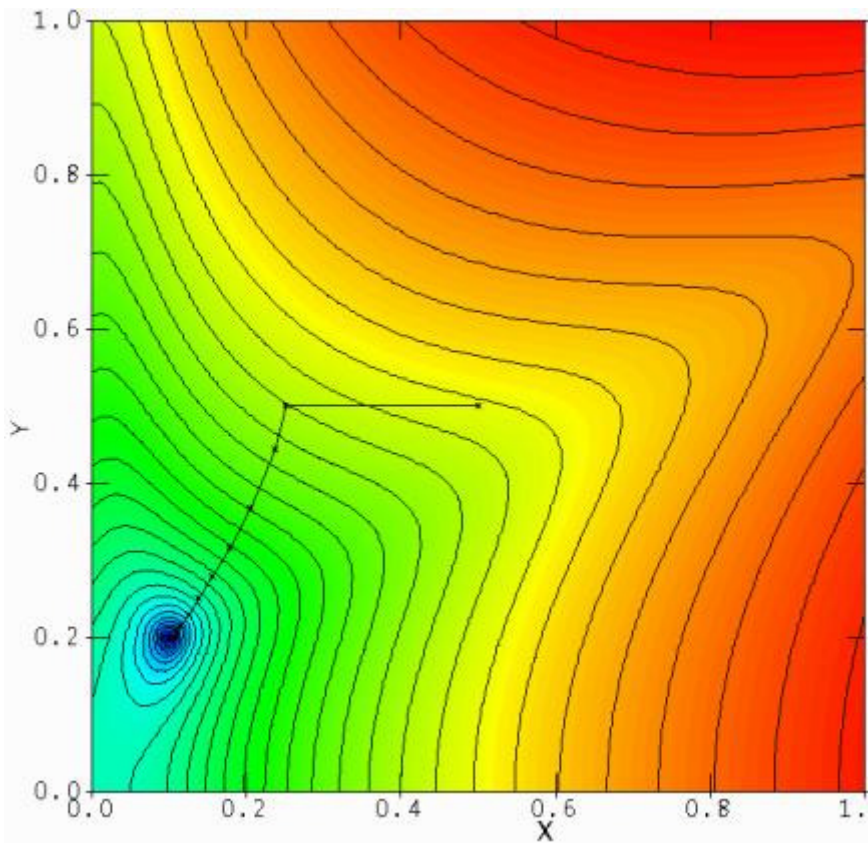**Figure 32. Typical Results of Kriging**

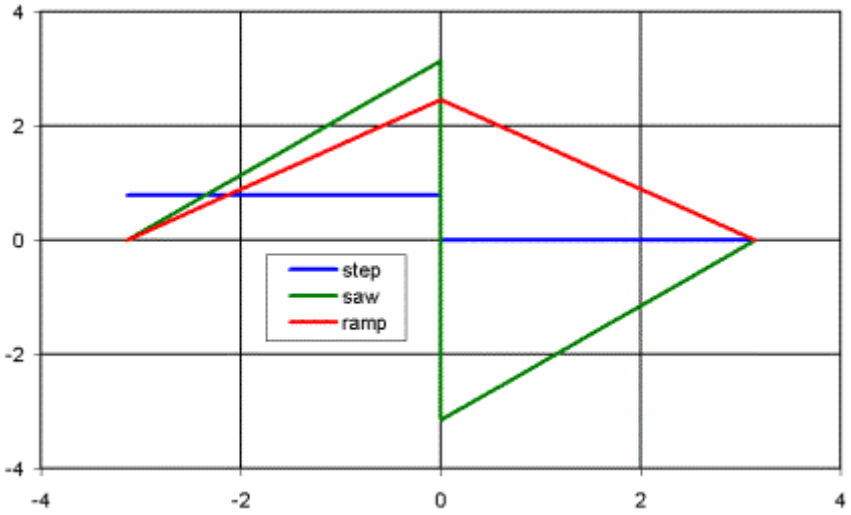**Figure 34. Example of Broyden's Method in 2D**

Figure 35. Example Shapes for FFT
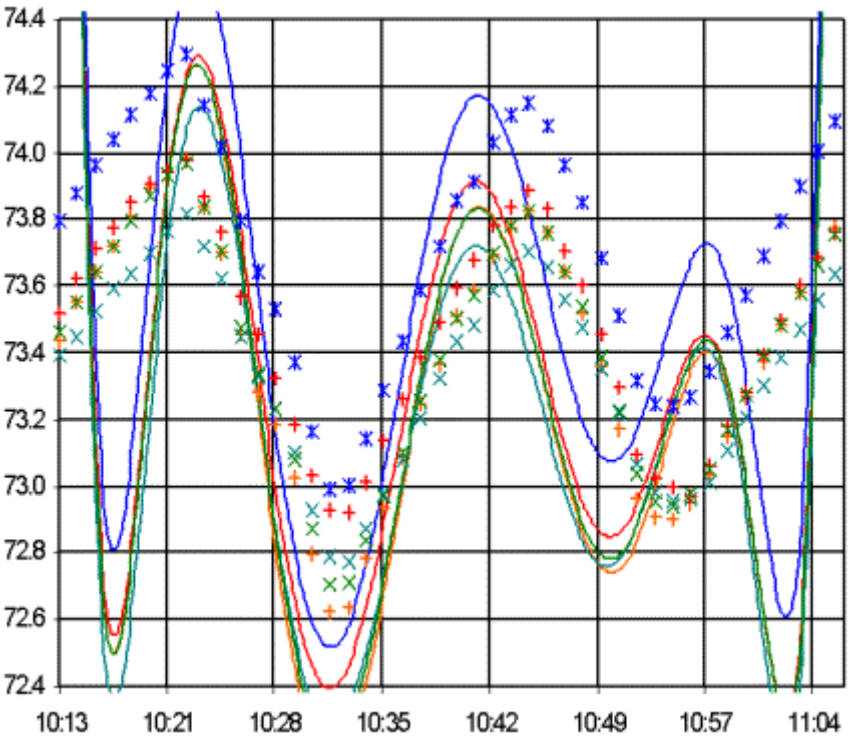
Figure 36. Example of Approximation Using Legendre Polynomials

|	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Jacobi polynomials								orthogonality test							0.75	α
2	x	w	P0	P1	P2	P3	P4	P5		P0	P1	P2	P3	P4	P5	0.25	β
3	-1.00	0.00	1.000	-1.250	1.406	-1.523	1.619	-1.700	P0	33	0	0	0	0	0		
4	-0.95	0.78	1.000	-1.175	1.188	-1.096	0.929	-0.707	P1	0	18	0	-1	0	-1		
5	-0.90	0.91	1.000	-1.100	0.981	-0.727	0.398	-0.056	P2	0	0	12	0	-1	0		
6	-0.85	0.99	1.000	-1.025	0.788	-0.412	0.007	0.328	P3	0	-1	0	9	0	-1		
7	-0.80	1.04	1.000	-0.950	0.606	-0.148	-0.264	0.507	P4	0	0	-1	0	7	0		
8	-0.75	1.08	1.000	-0.875	0.437	0.068	-0.434	0.537	P5	0	-1	0	-1	0	6		
9	-0.70	1.10	1.000	-0.800	0.281	0.240	-0.510	0.464									
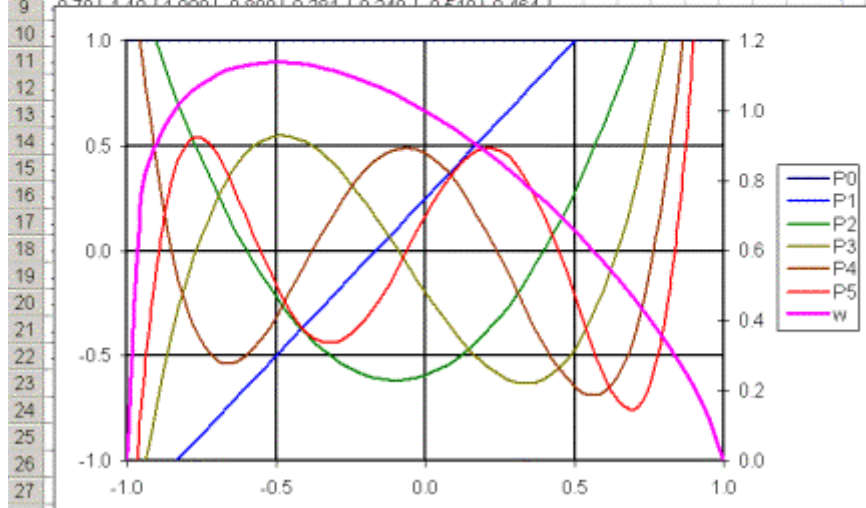
Figure 37. Jacobi Polynomials
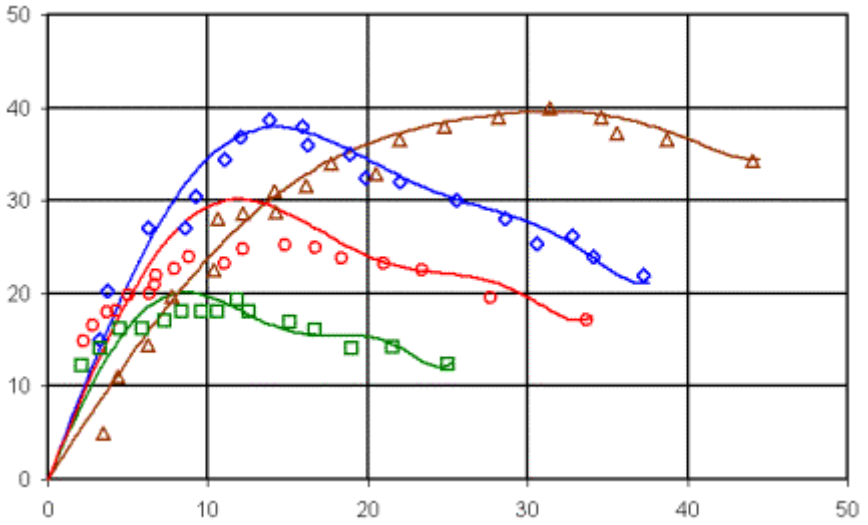
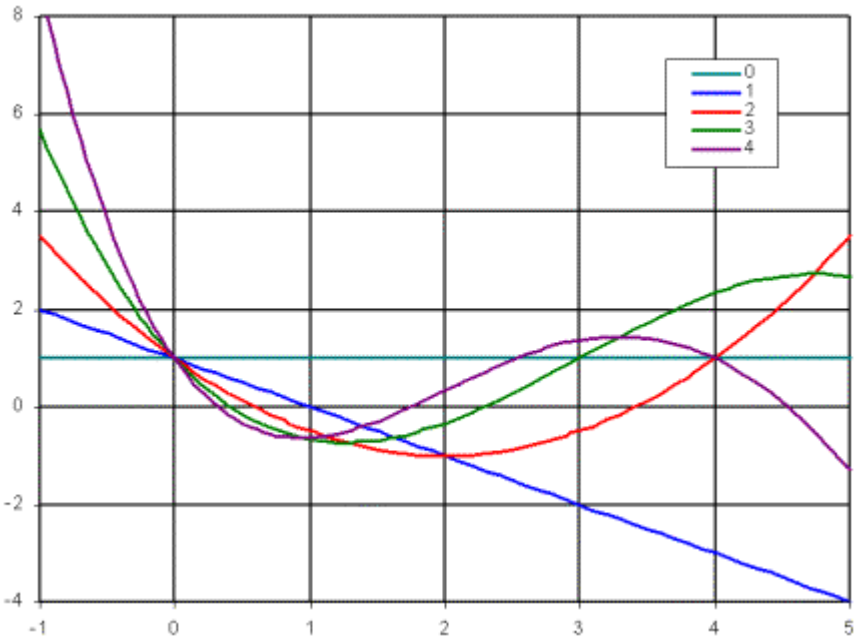**Figure 38. Approximation with Chebyshev Polynomials**
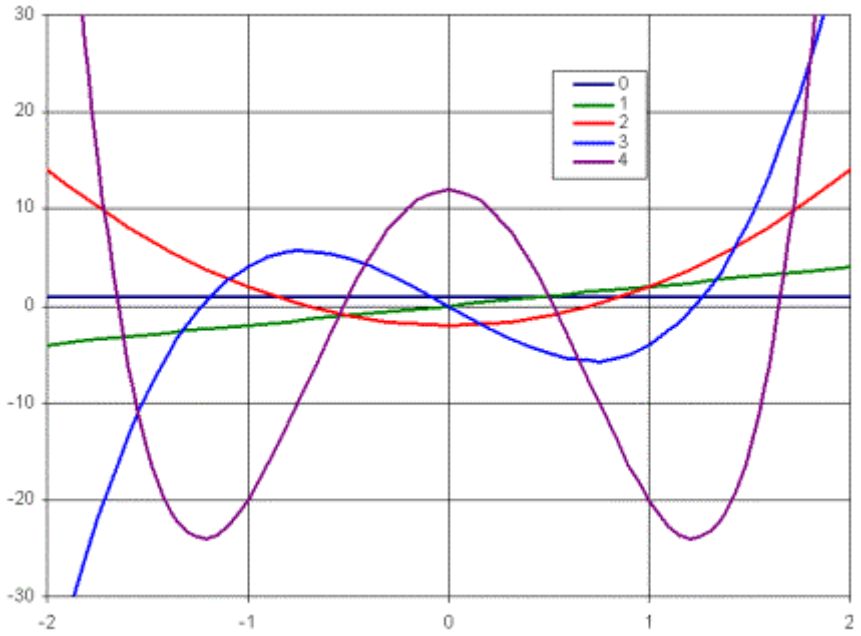

Figure 39. Laguerre Polynomials
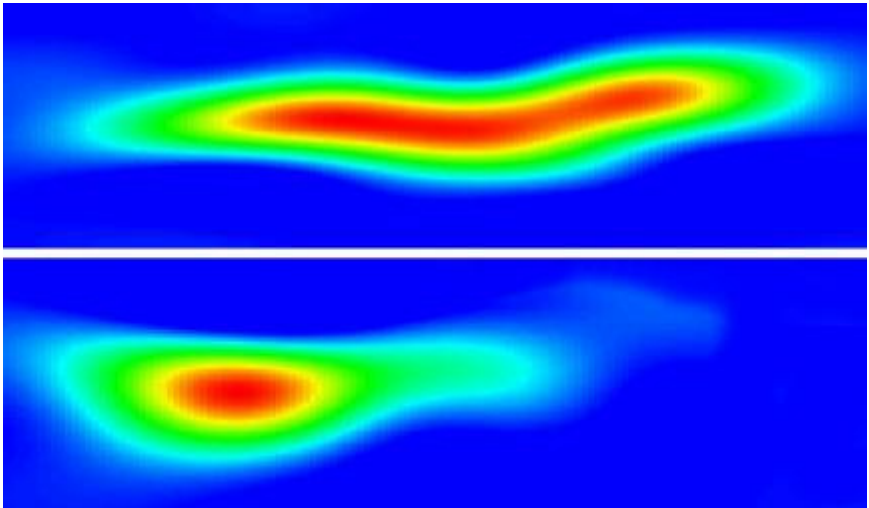
Figure 40. Hermite Polynomials
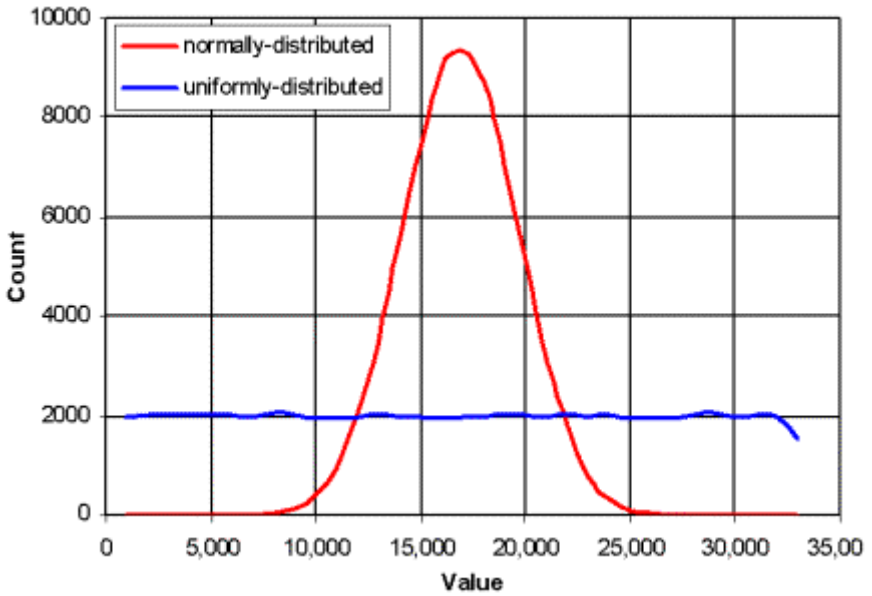

Figure 41. Approximated Contaminant Plumes

Figure 42. 65,534 Random Integers
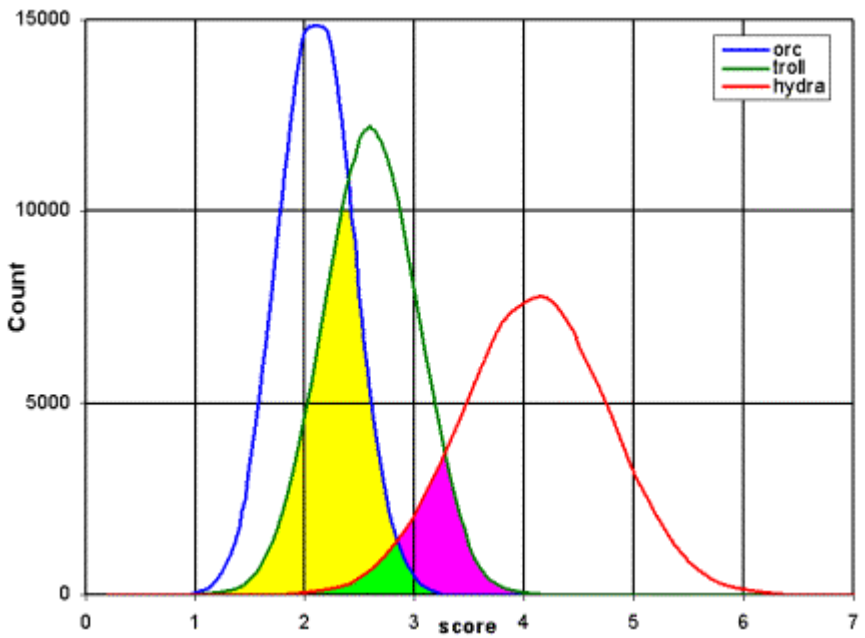
Figure 43. Battling Monsters' Chances of Winning

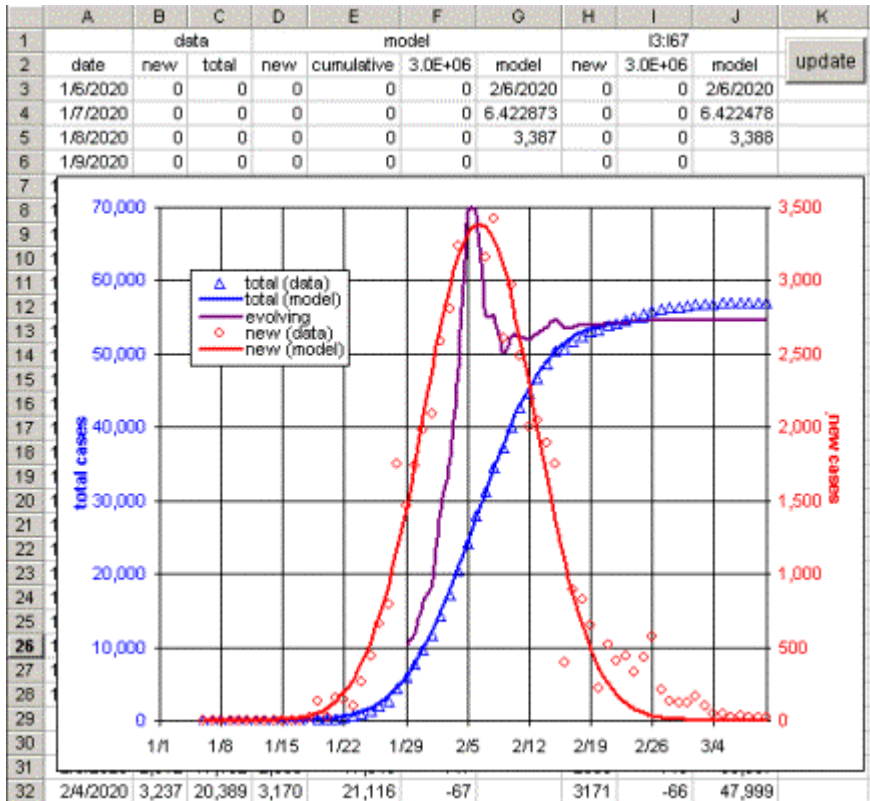|	data		model				13:167			
date	new	total	new	cumulative	3.0E+06	model	new	3.0E+06	model	update
1/6/2020	0	0	0	0	0	2/6/2020	0	0	2/6/2020	
1/7/2020	0	0	0	0	0	6.422873	0	0	6.422478	
1/8/2020	0	0	0	0	0	3,387	0	0	3,388	
1/9/2020	0	0	0	0	0		0	0		

| 2/4/2020 | 3,237 | 20,389 | 3,170 | 21,116 | -67 | | 3171 | -66 | 47,999 | |

Figure 44. COVID Spreadsheet

	A	B	C	D	E	F	G	H	I	J
1	IQ Scores			cumulative	Z					
2	score	46	number	probability	score					
3	80	47	2	0.0000545	-3.56					
4	123	48	0	0.0000545	-3.49					
5	104	49	4	0.0001634	-3.42					
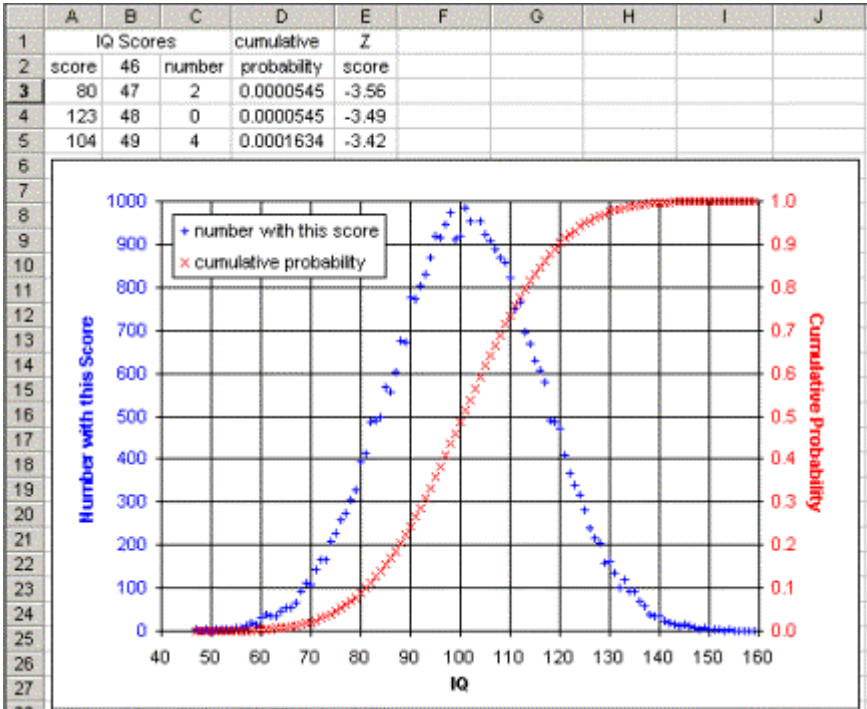
Figure 45. Typical IQ Scores Forming Bell-Shaped Curve

		NORMINV		NORMSINV	
x	z	z	check	z	check
20	-5.333	???	20.00	???	-5.333
30	-4.667	29.59	30.00	-4.694	-4.667
40	-4.000	40.00	40.00	-4.000	-4.000
50	-3.333	50.00	50.00	-3.333	-3.333
60	-2.667	60.00	60.00	-2.667	-2.667
70	-2.000	70.00	70.02	-2.000	-1.999
80	-1.333	80.00	79.91	-1.333	-1.340
90	-0.667	90.00	90.18	-0.667	-0.654
100	0.000	100.00	100.00	0.000	0.000
110	0.667	110.00	109.82	0.667	0.654
120	1.333	120.00	120.09	1.333	1.340
130	2.000	130.00	129.98	2.000	1.999
140	2.667	140.00	140.00	2.667	2.667
150	3.333	150.00	150.00	3.333	3.333
160	4.000	160.00	160.00	4.000	4.000
170	4.667	170.41	170.00	4.694	4.667
180	5.333	???	180.00	???	5.333

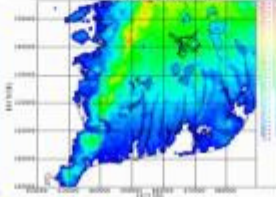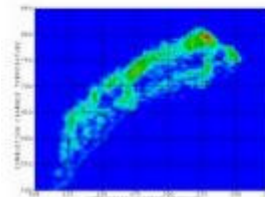**Figure 53. Comparison of Reverse (Inverse) Functions**
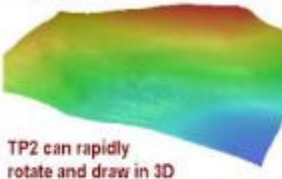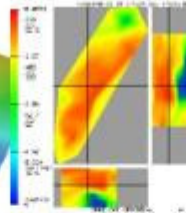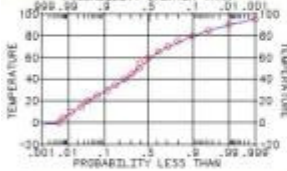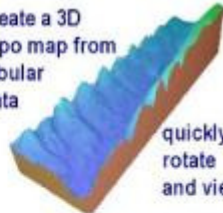
Figure 58. TP2 Samples (all included)

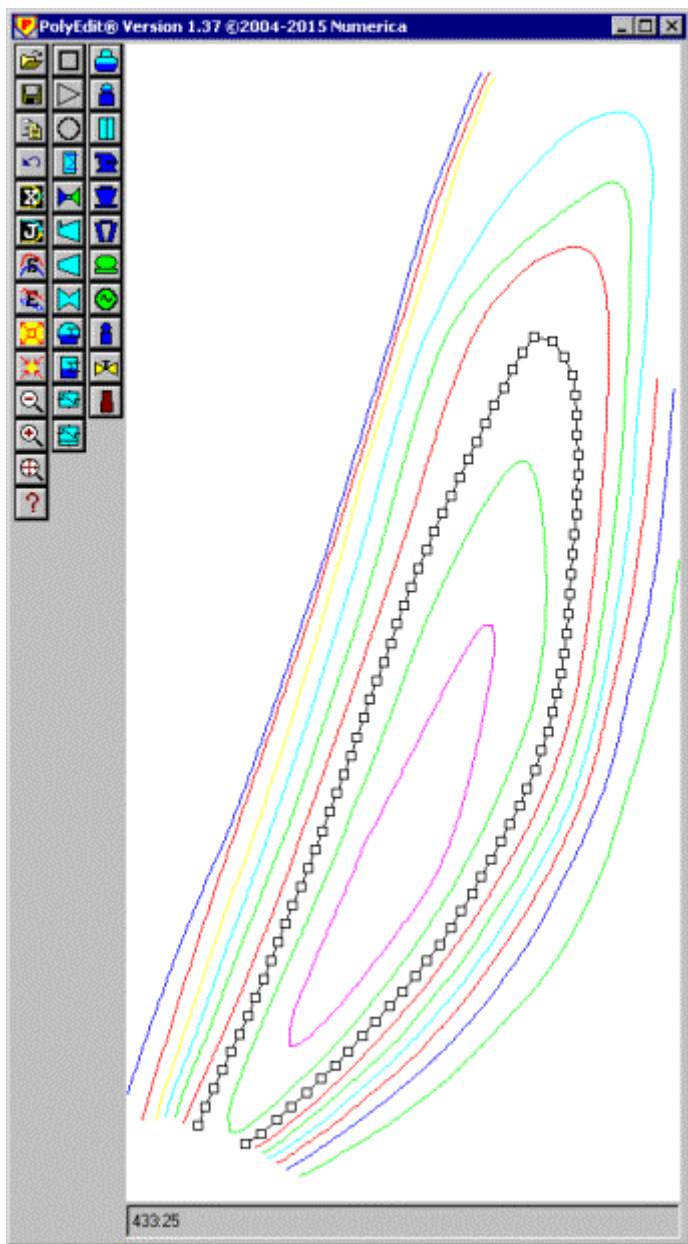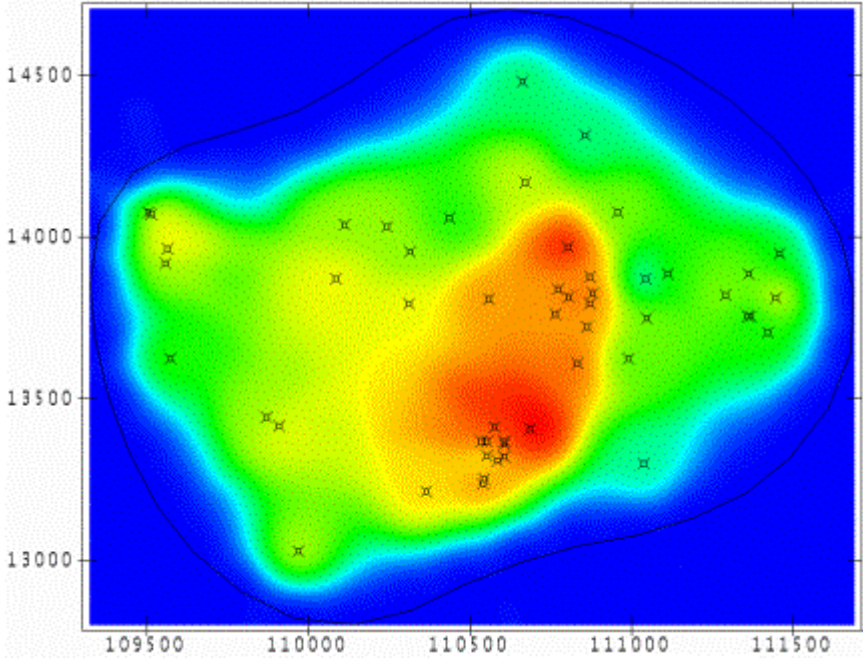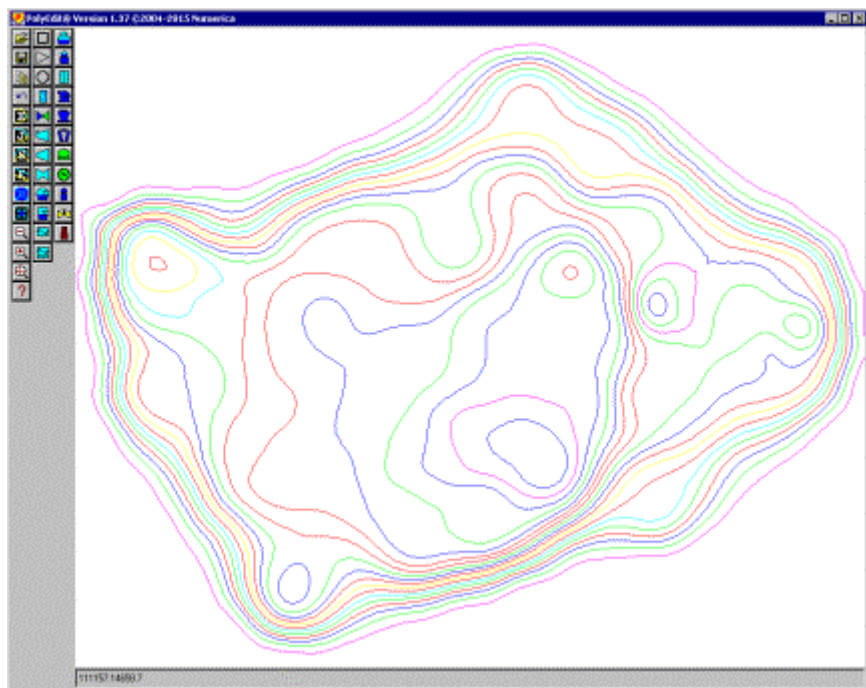**Figure 61. Turbocharger Curves in PolyEdit**

Figure 62. Typical Field or Surface

Figure 63. Extracted Contours