

Interpolation

Final 2002F

1. Using the data in Table 1 answer the following questions:
 - a) What order polynomial do the data appear to observe?
 - b) Approximate $f(2.33)$ using a third order approximation. (Perform no arithmetic.)

Table 1. Difference Table for Interpolation

x	f(x)				
2.0	1.4000				
		0.4492			
2.1	1.8492		0.1518		
		0.6010		0.0206	
2.2	2.4502		0.1724		0.0010
		0.7734		0.0216	
2.3	3.2236		0.1940		0.0010
		0.9674		0.0226	
2.4	4.1910		0.2166		0.0010
		1.1840		0.0235	
2.5	5.3750		0.2401		0.0010
		1.4240		0.0245	
2.6	6.7990		0.2646		0.0010
		1.6886		0.0254	
2.7	8.4876		0.2900		
		1.9786			
2.8	10.4662				

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8. Using the data in Table 1 answer the following questions:
 - c) What order polynomial do the data appear to observe?
 - d) Approximate $f(4.3)$ using a second order approximation. (Perform no arithmetic.)

Table 1. Difference Table for Interpolation

x	f(x)				
1.0	4.2000				
		1.7000			
2.0	5.9000		-0.4000		
		1.3000			
3.0	7.2000		-0.4000		
		0.9000			
4.0	8.1000		-0.4000		
		0.5000			
5.0	8.6000		-0.4000		
		0.1000			
6.0	8.7000		-0.4000		
		-0.3000			
7.0	8.4000		-0.4000		
		-0.7000			
8.0	7.7000		-0.4000		
		-1.1000			
9.0	6.6000				

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4. Use the data below to estimate the value of $f(6.6)$ using third order approximation (i.e. - cubic polynomial).

x	0	2	4	6	8	10	12	14	16
f(x)	30	12	26	56	64	50	45	44	48

Hour Exam 3 2005F

1. Below are some regularly-spaced data from a polynomial function.

<u>x</u>	<u>f(x)</u>	<u>Df(x)</u>	<u>D²f(x)</u>	<u>D³f(x)</u>
1	1			
		0		
2	1		8	
		8		6
3	9		14	0
		22		6
4	31		20	0
		42		6
5	73		26	
		68		
6	141			

- a) What is the order of the polynomial from which the data appear to have been generated? **Why? Third Order since all differences above third order are zero.**
- b) Reconstruct the polynomial function that fits the data exactly.

$$f(x) = 1+0(x-1)/2+8(x-1)(x-2)/2+6(x-1)(x-2)(x-3)/6$$

$$= 1+4x^2-12x+8+x^3-3x^2+2x-3x^2+9x-6$$

$$= 3 - x - 2x^2 + x^3$$
- c) Show the best *first-order* approximation of $f(3.1)$.
Use the closest value to 3.1 for the x_0 (=3) term: $f(3.1) = 9+22(3.1-3) = 11.2$

3. Describe how to find the best values for the coefficients for the equation

$$f(x) = a + b \ln(x) + cx^3$$

given the following data:

x	f(x)	fcalc(x)	Error=(f(x)-fcalc(x)) ²
1	2.20	$= a + b \ln(1) + c1^3$	$[2.20 - (a + b \ln(1) + c1^3)]^2$
1.2	2.91	$= a + b \ln(1.2) + c(1.2)^3$	etc
1.6	4.28	$= a + b \ln(1.6) + c(1.6)^3$	etc
2.2	6.57	$= a + b \ln(2.2) + c(2.2)^3$	etc
3.1	11.47	$= a + b \ln(3.1) + c(3.1)^3$	etc
6.3	57.72	$= a + b \ln(6.3) + c(6.3)^3$	etc
5.4	38.72	$= a + b \ln(5.4) + c(5.4)^3$	etc
			Sum of Errors²

Search a, b, c space for MIN **Sum of Errors²** using Solver in Microsoft Excel®.

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5. Use the data below to estimate the value of $f(6.6)$ using third order approximation (i.e. - cubic polynomial).

x	0	2	4	6	8	10	12	14	16
f(x)	30	12	26	56	64	50	45	44	48