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SHOW ALL WORK!

In each problem, round all presented results to 4 places after the decimal point.

Problem 1 (35 pts)

A tutoring service has kept records of performance on a standardized test and the number of days students attend their review classes. The performance rating Y represents the per cent improvement in the test score students attain after taking the exam a second time. X is the number of attendance days in the review class.

X, Attendance Days	x_0 1	x_1 2.5	x_2 5	x_3 6.5	x_4 9
Y, % Improvement	y_0 2	y_1 5	y_2 11	y_3 14	y_4 17

a) Estimate $f(4)$, the % improvement in one's score after 4 days of attending review classes, assuming $y = f(x)$ is the true function relating X and Y . Base your result on a third order Newton divided-difference interpolating polynomial $f_3(x)$. Fill in the table of divided differences below to find the appropriate coefficients.

i	x_i	y_i	Δ	Δ^2	Δ^3	Δ^4
0						
1						
2						
3						
4						

b) Estimate the error in the interpolated value $f(4)$. Use the extra data point. i.e. the one not used in Part a) to obtain your answer.

c) Fit a power equation to the data.

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Problem 2 (35 pts)

Given the following system of equations

$$\begin{aligned} x_1 + x_2 + x_3 - 3x_4 &= 2 \\ -x_1 + x_3 - x_4 &= 1 \\ 2x_1 - x_2 + 3x_3 - 8x_4 &= 2 \\ 5x_1 + x_2 + 4x_3 - 13x_4 &= 5 \end{aligned}$$

a) Show the system of equations are consistent by converting the augmented matrix into its echelon form. How many (if any) arbitrary unknowns are there?

b) If there are one or more arbitrary unknowns, determine whether x_2 can be arbitrary **without finding the solution.**

c) Convert the augmented matrix into its row reduced echelon form.

d) Is x_4 arbitrary? Explain.

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Problem 3 (30 pts)

Measurements of an object's speed were recorded at uniform increments of time. The results are tabulated below.

t sec	$v(t)$ ft/sec	t sec	$v(t)$ ft/sec
0.0	29.6	5.0	86.9
1.0	42.8	6.0	98.6
2.0	54.5	7.0	109.2
3.0	57.5	8.0	119.5
4.0	76.5	9.0	128.3

a) Find the Normal equations used to solve for the coefficients of the Least Squares line. Use the table below to assist with the calculations.

b) Find the equation of the Least Squares line.

c) Calculate SSE, SST and SSR.

d) Find the correlation coefficient *r*.

t_i	v_i	t_i^2	$t_i v_i$	$\hat{v}_i = a_0 + a_1 t_i$	$e_i = v_i - \hat{v}_i$	e_i^2
0	29.6					
1	42.8					
2	54.5					
3	57.5					
4	76.5					
5	86.9					
6	98.6					
7	109.2					
8	119.5					
9	128.3					
$\sum_{i=1}^{n} t_i$	$\sum_{i=1}^{n} v_i$	$\sum_{i=1}^{n} t_i^2$	$\sum_{i=1}^{n} t_i v_i$			$\sum_{i=1}^{n} e_i^2$