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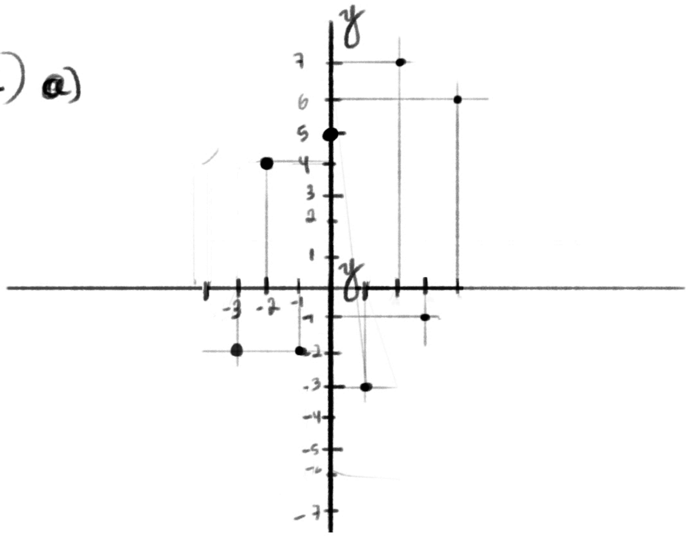
1) a)



b)

$$A = \begin{bmatrix} 8 & 0,9893 & -0,038 \\ 0,9893 & 3,9336 & 0,8347 \\ -0,038 & 0,8347 & 7,1755 \end{bmatrix} \cdot \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} = \begin{bmatrix} 14 \\ 2,4768 \\ 28,3065 \end{bmatrix}$$

$$A = G^T \cdot G$$

$$A = \begin{bmatrix} 8 & 0,9893 & -0,038 \\ 0,9893 & 3,9336 & 0,8347 \\ -0,038 & 0,8347 & 7,1755 \end{bmatrix} = \underbrace{\begin{bmatrix} g_{11} & 0 & 0 \\ g_{21} & g_{22} & 0 \\ g_{31} & g_{23} & g_{33} \end{bmatrix} \cdot \begin{bmatrix} g_{11} & g_{21} & g_{31} \\ 0 & g_{22} & g_{23} \\ 0 & 0 & g_{33} \end{bmatrix}}$$

$g_{11} = 2,8284$ $\quad g_{22} = 1,9802$

$g_{21} = 0,3497$ $\quad g_{32} = 0,4239$

$g_{31} = -0,0134$ $\quad g_{33} = 2,6787$

$$\therefore \quad z = \begin{bmatrix} 4,9497 \\ 0,3766 \\ 10,5324 \end{bmatrix} \qquad \alpha = \begin{bmatrix} 1,8492 \\ -0,6515 \\ 3,9319 \end{bmatrix}$$

$$\varphi_2(x) = 1,8492 - 0,6515\,\mathrm{Sen}(2x) + 3,9319\,(3x)$$

c)

k	x_k	y_k	$\varphi(x_k)$	$\varphi(x_k) - y_k$	$[\varphi(x_k) - y_k]^2$
1	-3	-2	-1,9153	0,0847	0,0072
2	-2	4	5,1314	1,1314	1,2801
3	-1	-2	-1,4509	0,5491	0,3015
4	0	5	5,7811	0,7811	0,6101
5	1	-3	-2,6357	0,3646	0,1327
6	2	7	6,1175	-0,8825	0,7788
7	3	-1	-1,5512	-0,5512	0,3038
8	4	6	4,5226	-1,4774	2,1827

$er_{min} =$

$$F_{min} = \sum_{k=1}^{8} [\varphi(x_k) - y_k]^2 = 5,5970$$

2- a) $y = \dfrac{1}{\alpha_1 + \alpha_2 x + \alpha_3 x^2} \Rightarrow z = \dfrac{1}{y}$, $z = \alpha_1 + \alpha_2 x + \alpha_3 x^2$

$g_1(x) = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$, $g_2(x) = \begin{bmatrix} -2 \\ -1 \\ 0 \\ 1 \\ 2 \end{bmatrix}$, $g_3(x) = \begin{bmatrix} 4 \\ 1 \\ 0 \\ 1 \\ 4 \end{bmatrix}$

$$A = \begin{bmatrix} \langle g_1, g_1 \rangle & \langle g_1, g_2 \rangle & \langle g_1, g_3 \rangle \\ \langle g_2, g_1 \rangle & \langle g_2, g_2 \rangle & \langle g_2, g_3 \rangle \\ \langle g_3, g_1 \rangle & \langle g_3, g_2 \rangle & \langle g_3, g_3 \rangle \end{bmatrix}, \quad b = \begin{bmatrix} \langle z, g_1 \rangle \\ \langle z, g_2 \rangle \\ \langle z, g_3 \rangle \end{bmatrix}, \quad z = \begin{bmatrix} 4,7619 \\ 4,1666 \\ 5 \\ 8,3333 \\ 12,5 \end{bmatrix}$$

$$\Downarrow$$

$$A = \begin{bmatrix} 5 & 0 & 10 \\ 0 & 10 & 0 \\ 10 & 0 & 34 \end{bmatrix}, \quad b = \begin{bmatrix} 34,7613 \\ 19,6429 \\ 81,5475 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 0 & 10 \\ 0 & 10 & 0 \\ 10 & 0 & 34 \end{bmatrix} \cdot \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} = \begin{bmatrix} 34,7613 \\ 19,6429 \\ 81,5475 \end{bmatrix} \Rightarrow \alpha = \begin{bmatrix} 5,2347 \\ 1,9643 \\ 0,8588 \end{bmatrix}$$

$z = 5,2347 + 1,9643x + 0,8588x^2$

b) $l(x) = 5,2347 + 1,9643x + 0,8588x^2$

k	x_k	y_k	z_k	$l(x_k)$	$l(x_k) - z_k$	$[l(x_k) - z_k]^2$
1	-2	0,21	4,7617	4,7413	-0,0206	0,0004
2	-1	0,24	4,1666	4,1292	-0,0375	0,0014
3	0	0,2	5	5,2347	0,2347	0,0551
4	1	0,12	8,333	8,0578	-0,2755	0,0759
5	2	0.08	12,5	12,5985	0.0985	0,0097

$$E = \sum_{k=1}^{5} [l(x_k) - z_k]^2 = 0,1425$$

c) O número de etapas foram aumentadas pelo aumento de número de variáveis, ocasionando em uma incerteza maior. Portanto, não podemos afirmar que o erro quadrático é mínimo.