Trabalho I – MNII-2017.1

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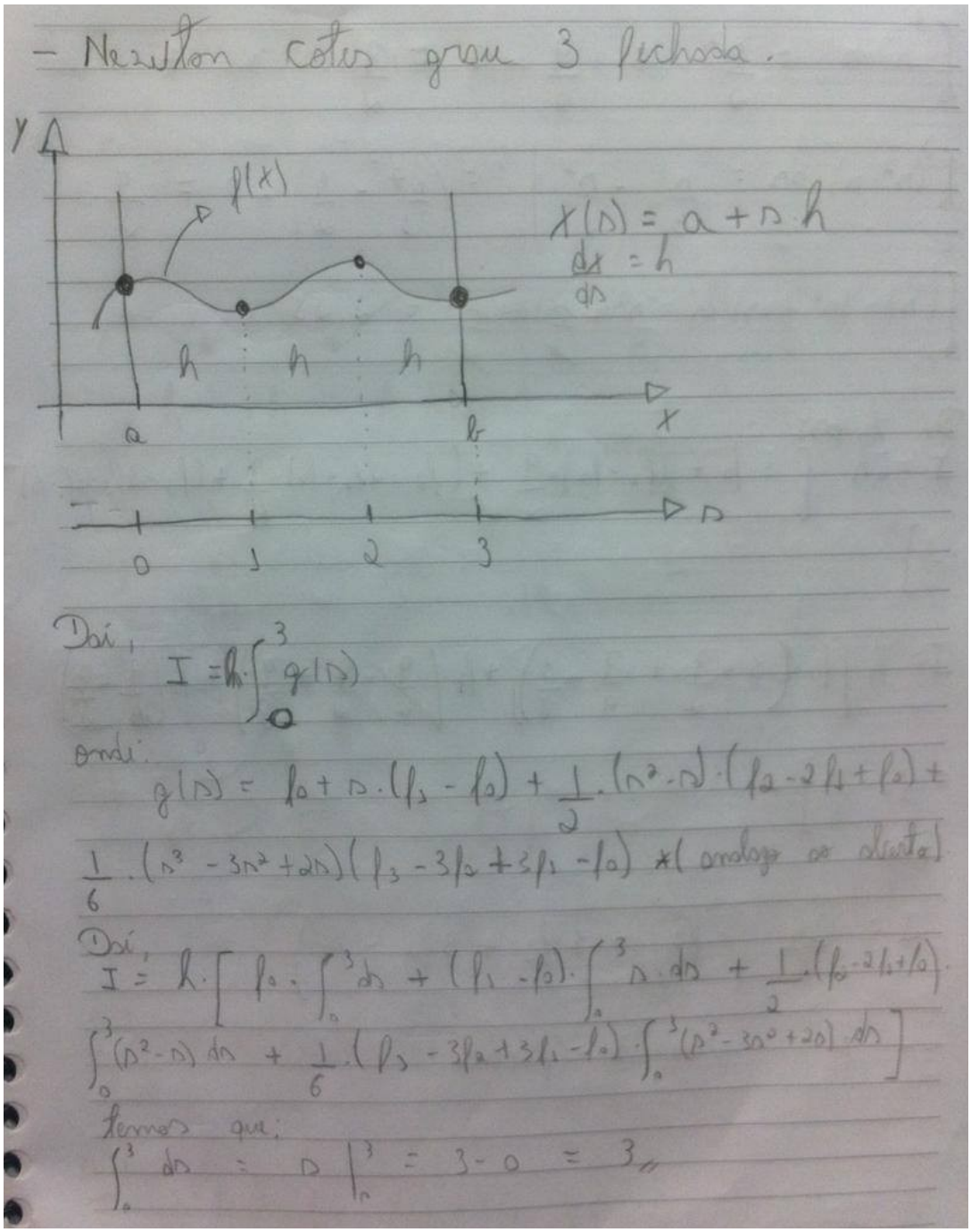
Desenvolvimento

Grau 3 – Fechado



$$\int_0^3 \Delta \cdot d\Delta = \frac{\Delta^2}{2} = \frac{9}{2} - 0 = \frac{9}{2}$$

$$\int_0^3 (\Delta^2 - \Delta) \cdot d\Delta = \frac{\Delta^3}{3} - \frac{\Delta^2}{2} \Big|_0^3 = \left(\frac{27}{3} - \frac{9}{2}\right) - 0 = \frac{9}{2}$$

$$\int_0^3 (\Delta^3 - 3\Delta^2 + 2\Delta)\, d\Delta = \frac{\Delta^4}{4} - \cancel{\Delta^3} + \cancel{\Delta^2} = 2.25$$

Dois termos:

$$I = h \cdot \left[3 f_0 + (f_1 - f_0) \cdot \frac{9}{2} + (f_2 - 2f_1 + f_0) \cdot \frac{9}{4} + (f_3 - 3f_2 + 3f_1 - f_0) \cdot \frac{3}{8} \right]$$

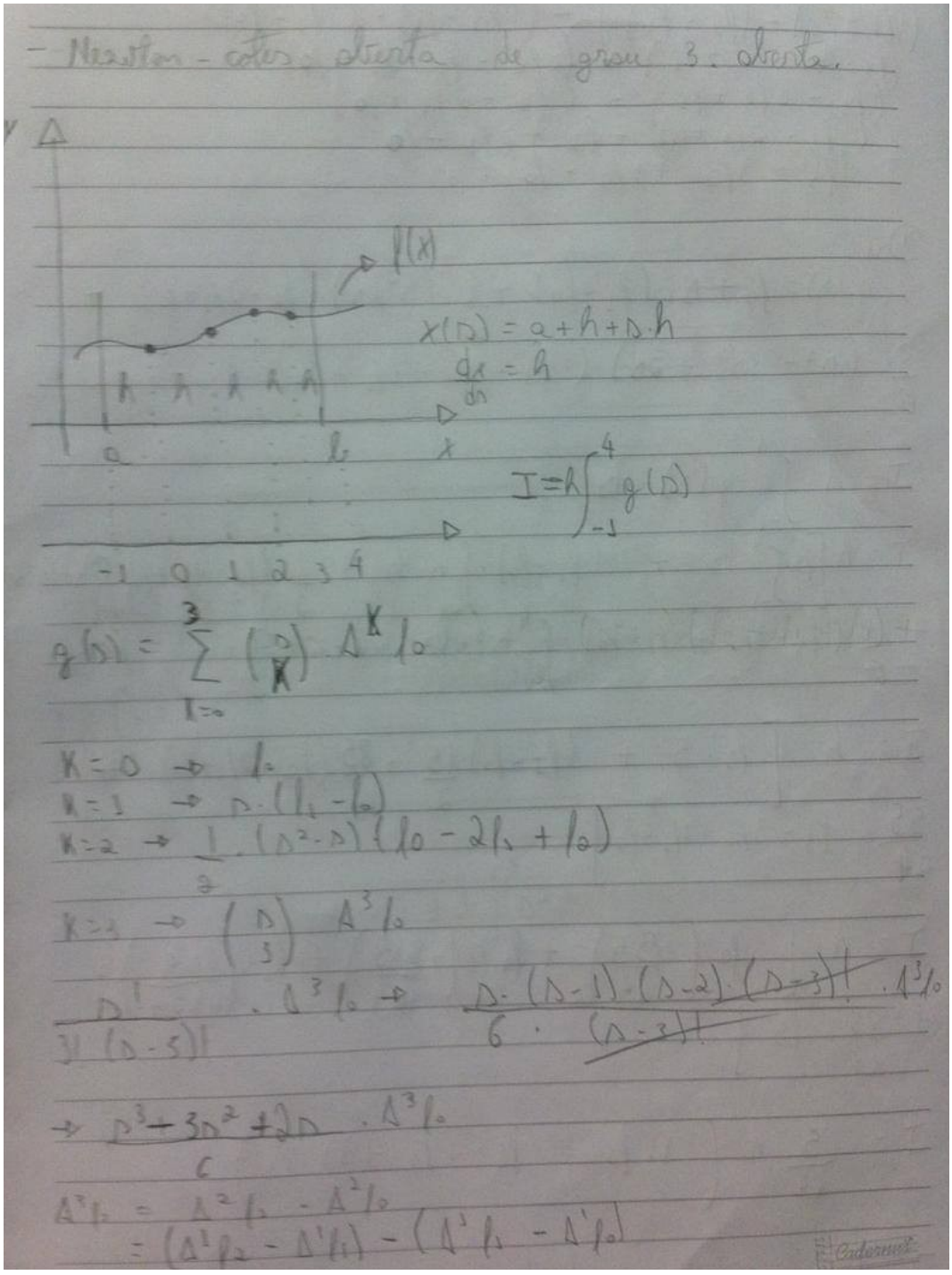
$$I = h \cdot \left[f_0 \cdot \left(3 - \frac{9}{2} + \frac{9}{4} - \frac{3}{8}\right) + f_1 \cdot \left(\cancel{\frac{9}{2}} - \cancel{\frac{9}{2}} + \frac{9}{8}\right) + f_2 \cdot \left(\frac{9}{4} - \frac{9}{8}\right) + f_3 \cdot \frac{3}{8} \right]$$

Logo.

$$I = \frac{3h}{8} \cdot \left(f_0 + 3 f_1 + 3 f_2 - f_3 \right).$$

-- fim grau 3 - fechado

Grau 3 – Aberto



$((f_2 - f_1) - (f_1 - f_0)) - ((f_1 - f_0) - (f_0 - f_{-1}))$

$(f_2 - f_1 - f_1 + f_0) - (f_1 - f_0 - f_0 + f_{-1})$

$(f_2 - 2f_1 + f_0) - (f_1 - 2f_0 + f_{-1})$

$f_2 - 2f_1 + f_0 - f_1 + 2f_0 - f_{-1}$

$f_2 - 3f_1 + 3f_0 - f_{-1}$

Daí,

$$g(x) = f_0 + x \cdot (f_1 - f_0) + \frac{1}{2} \cdot (x^2 - x) \cdot (f_2 - 2f_1 + f_0) + \frac{1}{6} \cdot (x^3 - 3x^2 + 2x) \cdot (f_3 - 3f_2 + 3f_1 - f_0)$$

$$I = h \cdot \int_{-1}^{4} g(x) \cdot dx =$$

$$I = h \left[f_0 \cdot \int_{-1}^{4} dx + (f_1 - f_0) \cdot \int_{-1}^{4} x \cdot dx + \frac{1}{2} (f_2 - 2f_1 + f_0) \int_{-1}^{4} x^2 - x \cdot dx + \frac{1}{6} (f_3 - 3f_2 + 3f_1 - f_0) \cdot \int_{-1}^{4} x^3 - 3x^2 + 2x \cdot dx \right]$$

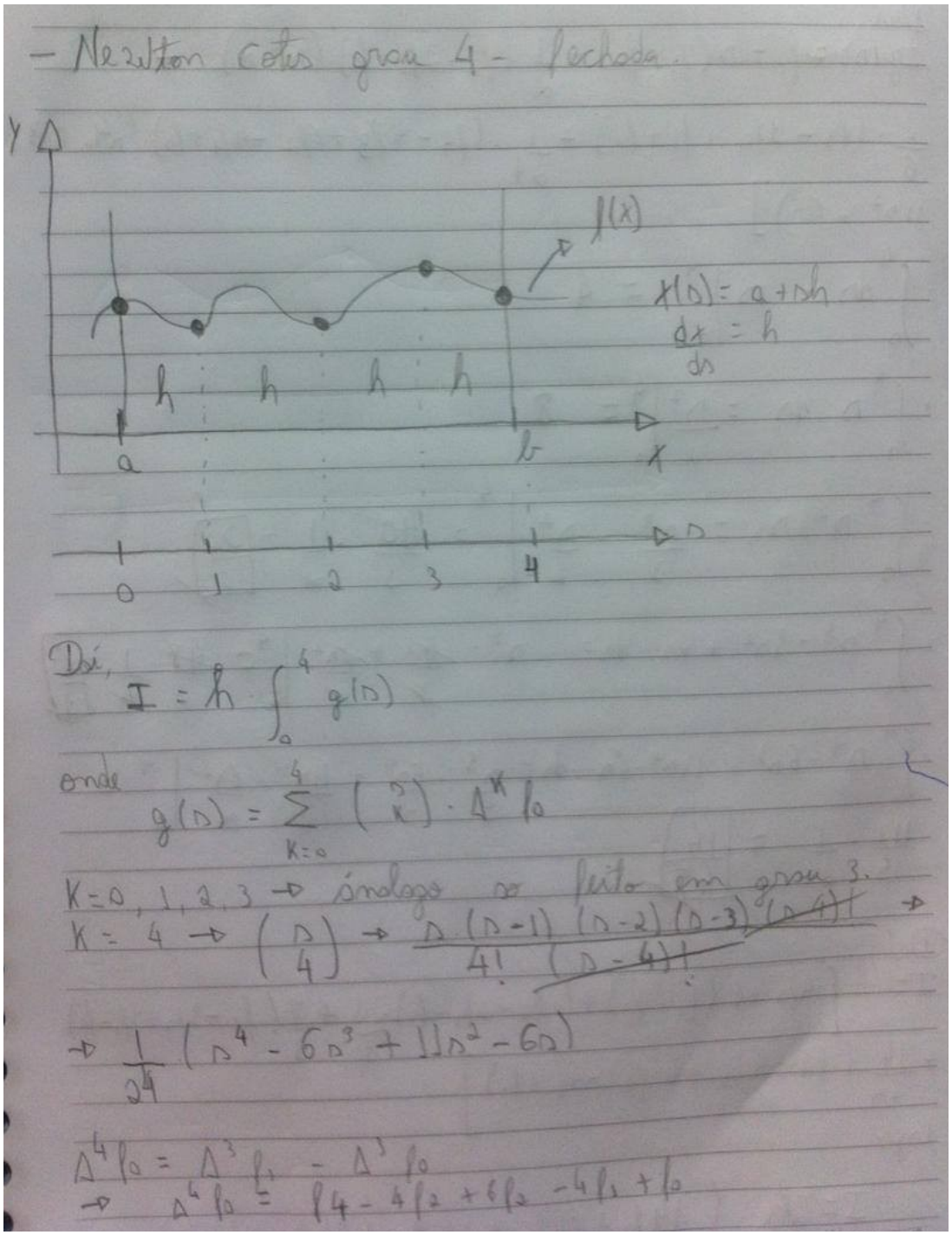
$$I = h \left[f_0 \cdot 5 + (f_1 - f_0) \cdot \frac{15}{2} + \frac{85}{12} \cdot (f_2 - 2f_1 + f_0) \cdot + \frac{55}{24} \cdot f_3 - 3f_2 + 3f_1 - f_0 \right]$$

$$I = h \cdot \left[f_0 \left(\frac{55}{24} \right) + f_1 \cdot \left(-\frac{5}{24} \right) + f_2 \cdot \left(-\frac{5}{24} \right) + \frac{55}{24} \cdot f_3 \right]$$

$$I = \frac{5}{24} \cdot h \left(11 f_0 + f_3 + f_2 + 11 \cdot f_3 \right)$$

-- fim - grau 3 deriva.

Grau 4 – Fechado



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Daí,

$$g(n) = f_0 + n(f_1 - f_0) + \frac{1}{2}\cdot(f_2 - 2f_1 + f_0)(n^2 - n) + \frac{1}{6}\cdot(f_3 - 3f_2 + f_1 + f_0) + \frac{1}{24}\cdot(f_4 - 4f_3 + 6f_2 - 4f_1 + f_0)(n^4 - 6n^3 + 11n^2 - 6n)]$$

$$\cdot \int_0^4 dn = n\Big|_0^4 = 4$$

$$\cdot \int_0^4 n\,dn = \frac{n^2}{2}\Big|_0^4 = 8$$

$$\cdot \int_0^4 n^2 - n = \frac{n^3}{3} - \frac{n^2}{2}\Big|_0^4 = \frac{40}{3}\cdot\frac{1}{2} = \boxed{\frac{20}{3}}$$

$$\cdot \int_0^4 n^3 - 3n^2 + 2n\,dn = n^4 - \frac{3n^3}{3} + \frac{2n^2}{2}\Big|_0^4 = \frac{48}{3}\cdot\frac{1}{6} = \boxed{\frac{8}{3}}$$

$$\cdot \int_0^4 n^4 - 6n^3 + 11n^2 - 6n\,dn = \frac{n^5}{5} - \frac{6n^4}{4} + \frac{11n^3}{3} - \frac{6n^2}{2}\Big|_0^4 = \frac{112}{15}\cdot\frac{1}{24} = \boxed{\frac{14}{45}}$$

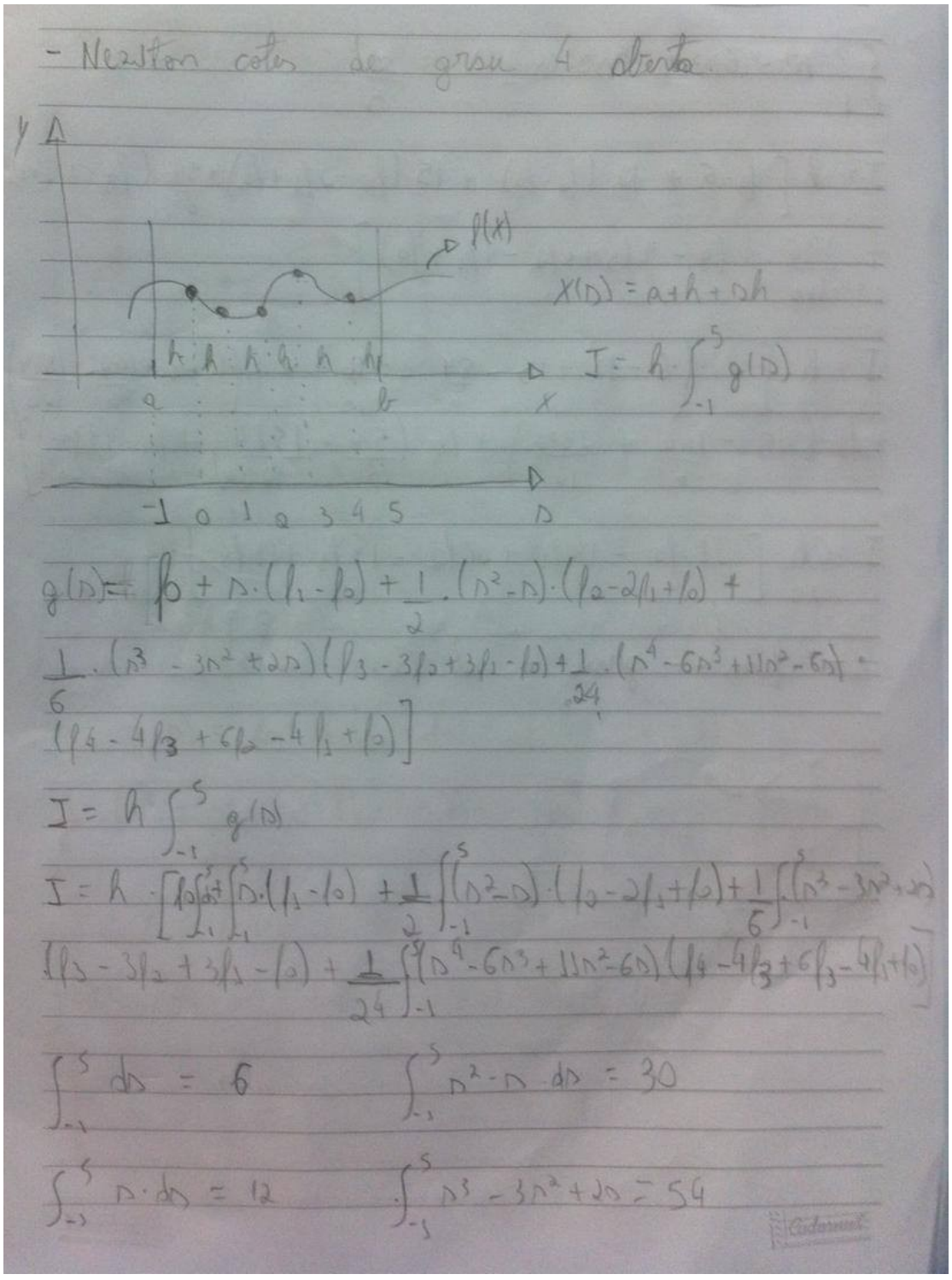
Daí,

$$I = h\left[4f_0 + 8(f_1 - f_0) + (f_2 - 2f_1 + f_0)\frac{20}{3} + \frac{8}{3}(f_3 - 3f_2 + 3f_1 - f_0) + \frac{14}{45}(f_4 - 4f_3 + 6f_2 - 4f_1 + f_0)\right]$$

Logo

$$I = \frac{h}{45}(14f_0 + 64f_1 + 24f_2 + 64f_3 + 14f_4)$$

Grau 4 – Aberto



$$\int_{-1}^{5} n^4 - 6n^3 + 11n^2 - 6n \cdot dn = \frac{396}{5}$$

$$I = h\left[l_0 \cdot 6 + 12 \cdot (l_1 - l_0) + 15 \cdot (l_2 - 2l_1 + l_0) + \frac{54}{6} \cdot (l_3 - 3l_2 + 3l_1 - l_0) + \frac{396}{120} \cdot (l_4 - 4l_3 + 6l_2 - 4l_1 + l_0) \right]$$

$$I = h \cdot \left[l_0 \cdot \left(6 - 12 + 15 - \frac{54}{6} + \frac{396}{120}\right) + l_1 \cdot \left(12 - 30 + \frac{162}{6} - \frac{1584}{120}\right) + l_2 \cdot \left(15 - \frac{162}{6} + \frac{2376}{120}\right) + l_3 \cdot \left(\frac{54}{6} - \frac{1584}{120}\right) + l_4 \cdot \left(\frac{396}{120}\right) \right]$$

$$I = \frac{6h}{20} \cdot \left[11 \cdot l_0 - 14 l_1 + 26 l_2 - 14 l_3 + 11 l_4 \right]$$

-- fim -- grau 4 aberta.