Exercițiul 2

Folosind "Metoda Secțiunii de Aur" găsiți valoarea x care minimizează funcția:

$f(x) = x^4 - 14x^3 + 60x^2 - 70x$ în intervalul $[0,2]$ cu o precizie $\varepsilon = 0.3$

$f : [0,2] \to \mathbb{R}$ $\quad [a_1, b_1] = [0,2]$; $\alpha = 0{,}618$

P1

$$\begin{cases} \lambda_1 = a_1 + (1-\alpha)(b_1 - a_1) = 0{,}382 \cdot 2 = 0{,}764 \\ \mu_1 = a_1 + \alpha(b_1 - a_1) = 0{,}618 \cdot 2 = 1{,}236 \\ f(\lambda_1) = f(0{,}764) = (0{,}764)^4 - 14 \cdot (0{,}764)^3 + 60 \cdot (0{,}764)^2 \\ -70 \cdot 0{,}764 = -24{,}36 \\ f(\mu_1) = f(1{,}236) = (1{,}236)^4 - 14 \cdot (1{,}236)^3 + 60 \cdot (1{,}236)^2 \\ -70 \cdot 1{,}236 = -18{,}95 \end{cases}$$

ITERAȚIA 1

$$\begin{cases} |b_1 - a_1| = 2 > \varepsilon \\ f(\lambda_1) < f(\mu_1) \Rightarrow [a_2, b_2] = [a_1, \mu_1] = [0, 1{,}236] \\ \lambda_2 = a_2 + (1-\alpha)(b_2 - a_2) = 0 + 0{,}382 \cdot 1{,}236 = 0{,}472 \\ \mu_2 = \lambda_1 = 0{,}764 \\ f(\mu_2) = f(\lambda_1) = -24{,}36 \\ f(\lambda_2) = f(0{,}472) = -21{,}09 \end{cases}$$

ITERAȚIA 2

$$|b_2 - a_2| = 1{,}236 > \varepsilon$$

$$f(\lambda_2) > f(\mu_2) \Rightarrow [a_3, b_3] = [\lambda_2, b_2] = [0{,}472, 1{,}236]$$

$$\lambda_3 = \mu_2 = 0{,}764$$

$$\mu_3 = a_3 + \alpha(b_3 - a_3) = 0{,}472 + 0{,}618 \cdot (1{,}236 - 0{,}472)$$

$$\mu_3 = 0{,}944$$

$$f(\lambda_3) = f(0{,}764) = f(\mu_2) = -24{,}36.$$

$$f(\mu_3) = f(0{,}944) = -23{,}59$$

ITERAȚIA 3

$$|b_3 - a_3| = 0{,}764 > \varepsilon$$

$$f(\mu_3) > f(\lambda_3) \Rightarrow [a_4, b_4] = [a_3, \mu_3] = [0{,}472, 0{,}944]$$

$$\lambda_4 = a_4 + (1-\alpha)(b_4 - a_4) = 0{,}6525$$

$$\mu_4 = \lambda_3 = 0{,}764$$

$$f(\lambda_4) = f(0{,}6525) = -23{,}83$$

$$f(\mu_4) = f(0{,}764) = -24{,}35$$

ITERAȚIA 4

$$|b_4 - a_4| = 0{,}472 > \varepsilon$$

$$f(\mu_4) < f(\lambda_4) \Rightarrow [a_5, b_5] = [\lambda_4, b_4] = [0{,}6525, 0{,}944]$$

$$\lambda_5 = \mu_4 = 0{,}764$$

$$\mu_5 = a_5 + \alpha(b_5 - a_5) = 0{,}8328$$

$$|b_5 - a_5| = 0{,}2915 < \varepsilon \Rightarrow \text{STOP}$$

$$\Rightarrow x_{min} = \frac{a_5 + b_5}{2} = 0{,}78$$