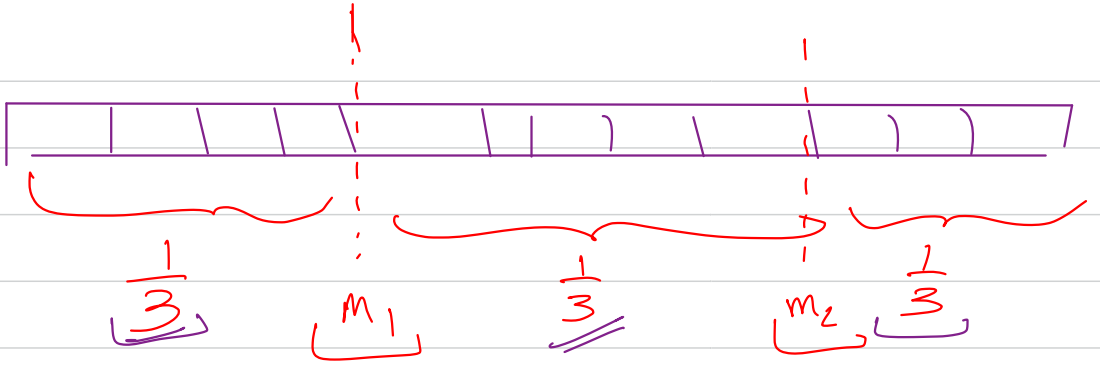
Ternary Search

Binary Search → divide our search space into 2 halves & reject one half of the space.

Ternary Search → divide your search space into 3 equal parts, reject $\frac{2}{3}^{rd}$ of the search space & accept $\frac{1}{3}^{rd}$ of the search space


1/3
m1
1/3
m2
1/3

BS

$T(n) = T(\frac{n}{2}) + O(1)$

$T(\frac{n}{2}) = T(\frac{n}{4}) + O(1)$

$T(\frac{n}{4}) = T(\frac{n}{8}) + O(1)$

$\vdots$

$T(2) = T(1) + O(1)$

K

$T(n) = T(1) + K \times 1$

$\hookrightarrow O(\log n)$

$\log_2 n$ comparisons

TS

$T(n) = T(\frac{n}{3}) + O(2)$

$T(\frac{n}{3}) = T(\frac{n}{9}) + O(2)$

$T(\frac{n}{9}) = T(\frac{n}{27}) + O(2)$

$\vdots$

$T(3) = T(1) + O(2)$

K'

$T(n) = T(1) + K' \times 2$

$O(\log n)$

$2 \log_3 n$ comparisons

For K

$$n \longrightarrow \frac{n}{2} \longrightarrow \frac{n}{4} \longrightarrow \frac{n}{8} \cdots\cdots \frac{n}{2^K}$$

$$\frac{n}{2^K} = 1$$

$$K = \log_2 n$$

For K'

$$n \longrightarrow \frac{n}{3} \longrightarrow \frac{n}{9} \longrightarrow \frac{n}{27} \cdots\cdots \frac{n}{3^{K'}}$$

$$K' = \log_3 n$$

$\log 2^n < 2 \log 3^n$

$\log 2^n < \frac{2}{\log 2^3} \times \log 2^n$

$\log 2^n$ → less comparisons

$\frac{2}{\log 2^3} \times \log 2^n$ → more comparisons

Q:- Race line

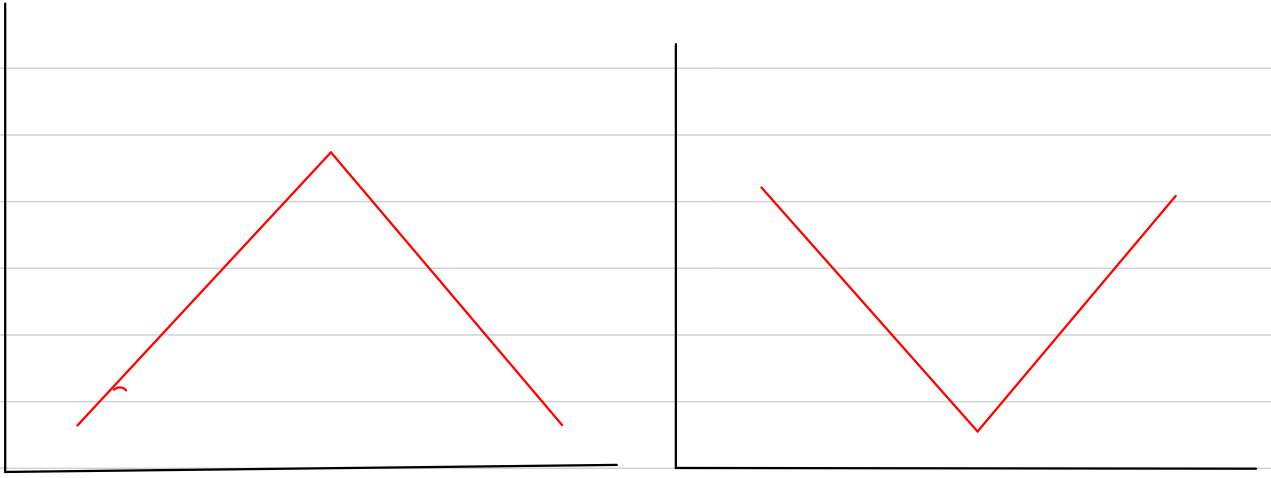
$t = 0 + \Delta T$ $\quad T = K$ → race ends

$P_i(t) = S_i \times T + D_i$

$f(t) = \max(P_i(t)) - \min(P_j(t))$

minimise $f(t)$

$f(t)$ →

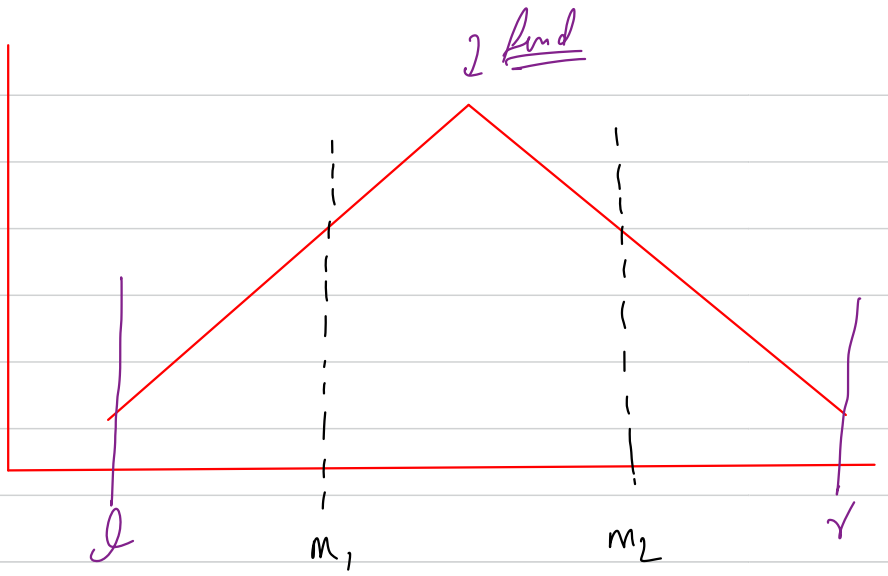


unimodal fun^{n}

$f(x) = \sin x \qquad 0 \le x \le \pi$

Ternary Search

(1)

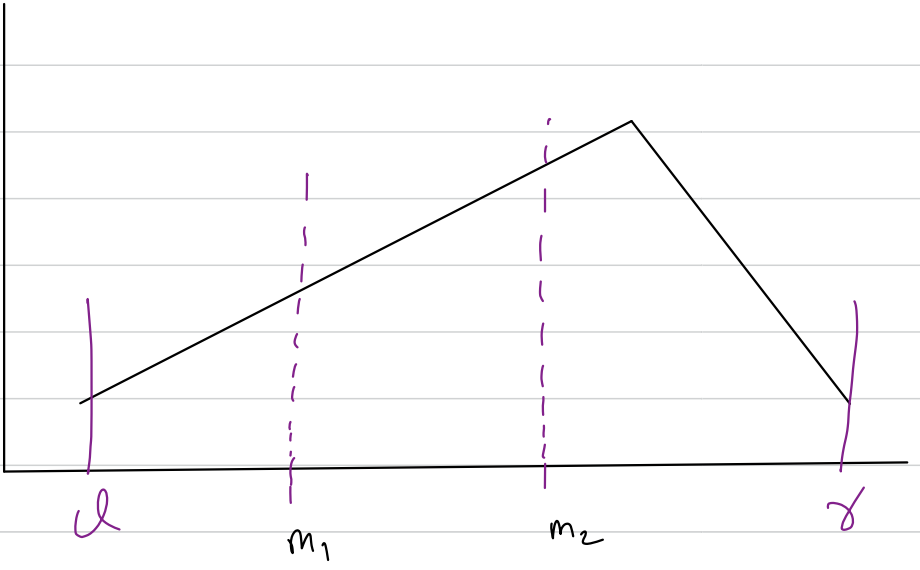


2 find

$f(m_1) = f(m_2)$

$[l, r] \longrightarrow [m_1, m_2]$

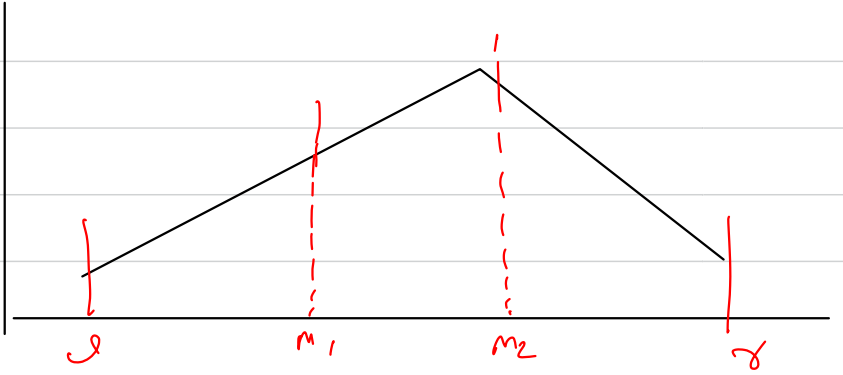
2



$f(m_1) < f(m_2)$

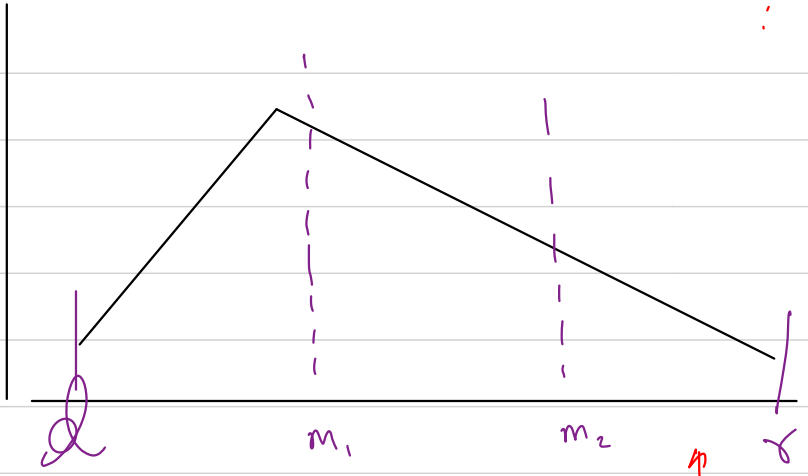
$n \to \frac{2n}{3}$

$\to [m_1, \gamma]$



$f(m_1) < f(m_2)$

3



$f(m_1) > f(m_2)$

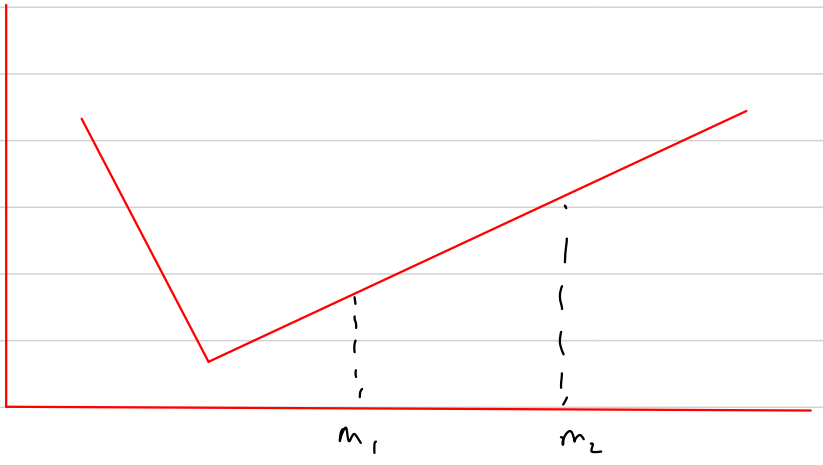
$\eta \to \frac{2\eta}{3}$

$[\alpha, \gamma]$?

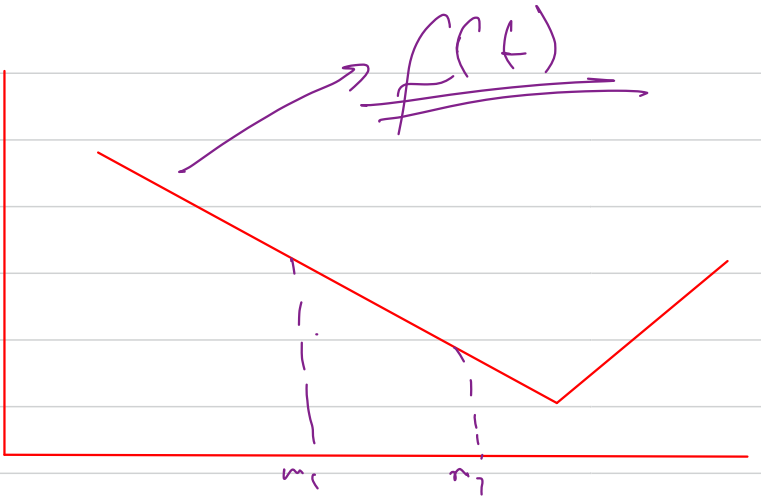
$[\alpha, m_2]$

$f(m_1) > f(m_2)$

Q- Raw Law



$f(m_1) < f(m_2) \longrightarrow (l, m_2)$



$$f(m_1) > f(m_2)$$

$$[m_1, \infty]$$

[2, 5, -1, 6, 3, 0]

max = -∞

2

5

6

$$T(n) = T\left(\frac{2n}{3}\right) + O(n)$$

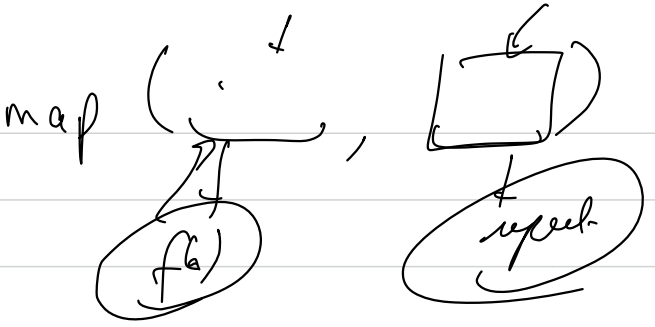
Q ⇒ $f(x) = \dfrac{x^2 + bx + c}{\sin x}$ $\quad 0 < x < \pi/2$

Find min value of $f(x)$

b, c

$b = 2 \qquad c = 2$

Ans ⟶ 5.883172561S


map
f(a)