Amir Hossein Eyvazkhani

1747696

Exercise Sheet 1

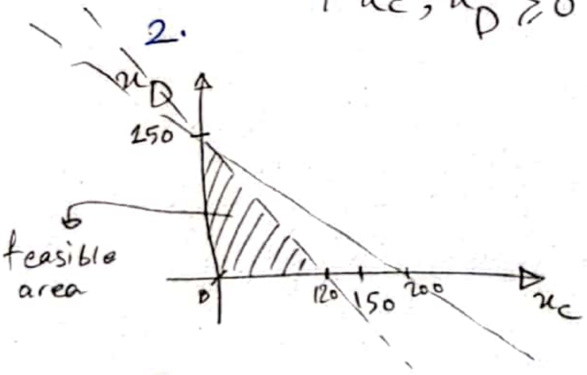
①

1. $\text{profit} = 2x_c + 3x_D$ ← maximize where

x_c: no of croissants
x_D: no of Danishes

Constraints
$$\begin{cases} 250x_c + 200x_D \leq 30{,}000 \\ 75x_c + 100x_D \leq 15{,}000 \\ x_c, x_D \geq 0 \end{cases}$$

2.



Possible optimal Solutions:

x_c	x_D	Profit
120	0	240
0	150	450
0	0	0

⇒ optimal Solution is 150 Danish and 0 croissants

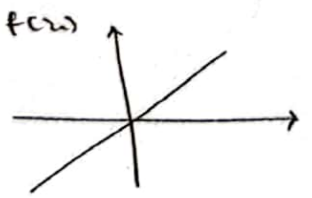
3.

The maximum profit is:

$150(3) + 0(2) = 450$

②

1. $f_1:(a,b)$ $f(x) = x$

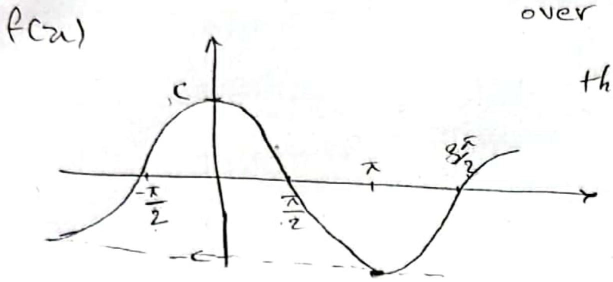


minimal $p^* = f(a) = a$

minimum $x^* = a$

x^* is unique

2. $f(x) = c \cdot \cos(x)$ $c > 0$ $D \in R$

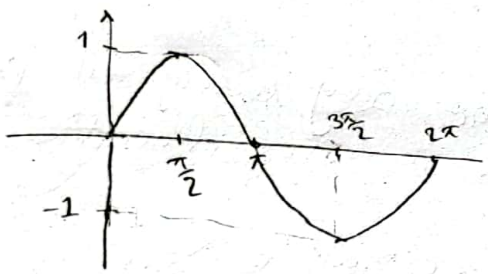


over R, the minimal $p^* = -c$

the minimum $x^* = k\pi$, $k \in Z - \{0\}$

x^* is not unique

3. $f(x) = \sin(x)$ $D \in [0, 2\pi]$

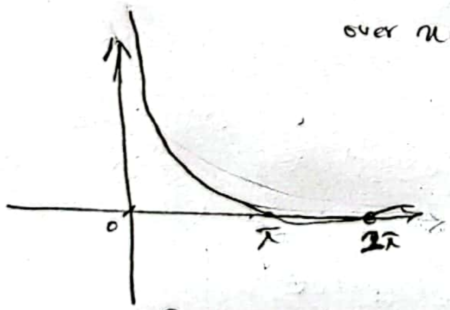


over $[0, 2\pi]$, minimal $p^* = -1$

minimum $x^* = \frac{3\pi}{2}$

x^* is unique

4. $f(x) = \frac{\sin x}{x^2}$, $D \in [0, 2\pi]$



over $x \in [0, 2\pi]$, minimal $p^* = -0.05$

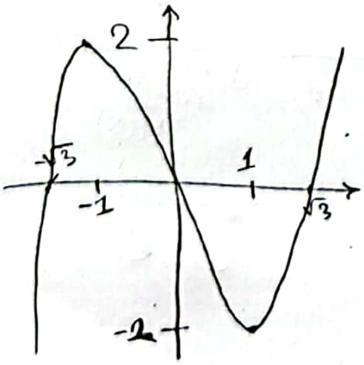
$x^* = 4.275$

x^* is unique

$$f'(x) = \frac{\cos x (x^2) - 2x \sin x}{x^4} = \frac{x \cos x - 2 \sin x}{x^3} = 0 \Rightarrow x^* = 4.275$$

$p^* = -0.05$

5. $f(x) = x^3 - 3x = x(x^2 - 3)$ $D_x \in R$



over $x \in R$ minimal p^* is unknown

therefore minimum x^* is unknown and not unique