1. NTU Bakery produces bread by employing bakers to use its ovens. When it employs \( L \) bakers and \( K \) ovens, it can produce \( Q = L^{1/2}K^{1/2} \) pieces of bread a day. Both \( L \) and \( K \) can be non-integer numbers. For example, a baker can work only one hour in a day. The wage of a baker is \( P_L = $2 \) a day while the rent of an oven is \( P_K = $12.5 \) a day.

(a) The bakery has signed a contract to rent exactly 4 ovens in December. Nonetheless, it can change the number of bakers as it wishes.

i. What is its short-run total production (\( TP \)) function for a single day in December?

What is its short-run marginal production of bakers (\( MPL \))?  

ii. What are its marginal cost (\( MC \)) functions in December?

iii. If the demand faced by NTU Bakery in December is \( D(p) = 400/p^2 \) for each single day, how much does it produce and at what price? What is its profit?

iv. Does \( MC \) equal \( P_L/MPL \)? What is the economic reason behind this result?

(b) The bakery will sign a new contract on ovens in January. Therefore, it can change the number of ovens.

i. How many ovens will the bakery rent if it expects to produce \( Q \) pieces of bread a day in January?

ii. Draw the firm’s expansion path.

iii. What is the total cost function in January?

iv. What are its marginal cost (\( MC \)) functions in January?

v. If the demand faced by NTU Bakery in December is \( D(p) = 400/p^2 \) for each single day, how much does it produce and at what price? What is its profit?

vi. Does the production function exhibit decreasing, constant, or increasing returns to scale?