

Topic 10 – Production, Costs, and Profits

Big Question – How can we model production?

I. Production Function

$$Q = A \cdot f(\text{Inputs})$$

a. Factors of Production

Watch “*How Sriracha Is Made*” and write down as many factors of production (inputs) as you can.



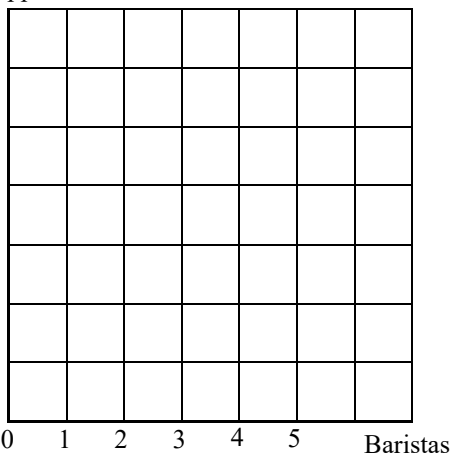
b. Fixed vs. Variable Inputs

Fixed inputs do not vary with the _____ of production, but variable inputs do.

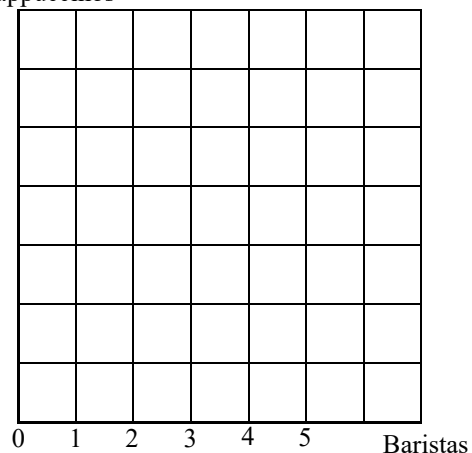
Example: You run a small coffee shop with 2 espresso makers. The size of your coffee shop and available equipment are fixed in the short-run. Calculate the daily marginal product of each barista.

Baristas	Espresso Makers	Output (Cappuccinos)	Marginal Product
0	2	0	
1	2	180	
2	2	320	
3	2	420	
4	2	480	
5	2	500	

Total Product
Cappuccinos



Marginal Product of Labor = $\frac{\Delta Q}{\Delta L}$
Cappuccinos



Diminishing Marginal Returns: The marginal product of a variable input will decrease as the variable input increases while other inputs remain fixed.

II. Production Costs

$$Total\ Cost = Variable\ Costs + Fixed\ Costs$$

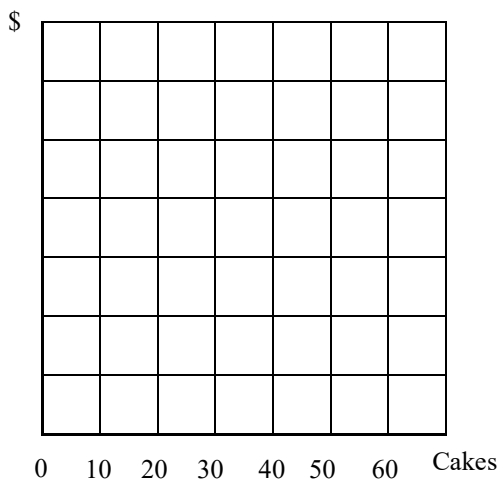
$$Marginal\ Cost = \frac{\Delta TC}{\Delta Q}$$

$$Average\ Total\ Cost = \frac{TC}{Q}$$

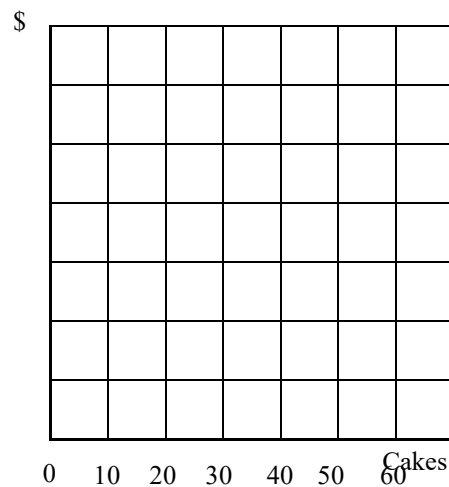
Example: Suppose there is a small bakery in town that makes cakes. The bakery must pay each baker \$60 per day and also pays \$20 per day in rent. Ingredient costs are negligible.

Bakers	Cakes	FC	VC	TC	MC	ATC
0	0					
1	20					
2	35					
3	45					
4	50					
5	53					

Total Cost



Marginal Cost / Average Total Cost



- a. What is the total cost of producing 35 cakes?

- b. What is the marginal cost of producing the 40th cake?

- c. What is the average total cost of cakes if you hire 5 workers?

III. Profit

$$\text{Profit } (\pi) = TR - TC$$

$$\text{Profit} = (P - ATC) \cdot Q$$

Bakers	Cakes	TC	MC	TR	Profit
0	0	20	--		
1	20	80	3		
2	35	140	4		
3	45	200	6		
4	50	260	12		
5	53	320	20		

Profit Maximization

Keep producing as long as

$$MR \geq MC$$

Profit will be positive as long as

$$P > ATC$$

a. If the bakery sells cakes for \$10, how many workers should be hired to maximize profits?

b. If the market price is \$10, how much profit will they earn?

c. What will happen if the market price increases to \$15?

d. What will happen if the rent increases to \$50 and price remains at \$10?

Fixed costs are often _____ !

IV. Short-Run Shut-Down Condition

Firms will operate in the short-run if $\text{Revenue} \geq \text{Variable Cost}$ or $P \geq \frac{VC}{Q}$ (AVC)

Example: Suppose you run a successful ice cream shop. Demand for ice cream is very low in December and January, so you are trying to decide whether or not to keep your shop in these months. Your rent is \$1,085 per month or \$35 per day. In order to stay open, you have to staff the shop with one employee, who you pay \$60 per day. You sell your ice cream cones for \$3 over cost, and if you stay open you know that you will have about 30 customers per day during the winter months.

Example: Suppose you are considering opening a Trader Joe's and you want to know how many people to hire. The corporate office provides you with the following information about sales in their closest existing store. The cost of the store front you have leased is \$250 per day and you will pay each employee \$50 per day.

Workers	Sales	Fixed Cost	Variable Cost	Total Cost	Marginal Cost
0	0				
1	10				
2	17				
3	22				
4	25				
5	27				
6	28				

- a. Assume that on average the net revenue (revenue – product cost) per sale is \$20. How many workers should you hire in order to maximize your profits? How much profit will you earn?

- b. After you open the store, you discover that people tend to buy fewer groceries on Tuesdays - average net revenue per sale is only \$8. How many people should you staff on Tuesdays? How much profit will you earn on Tuesdays?

- c. Should you open the store on Tuesdays? Why or why not?

V. Assignments

- a. Problem Set 10 due at the beginning of class on 3/19/2020