

# APEC 3001 Discussion

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March 26, 2021

# Today's Agenda

- ① Housekeeping
- ② Chapters 4-8 Practice Problems
- ③ Questions

# Housekeeping

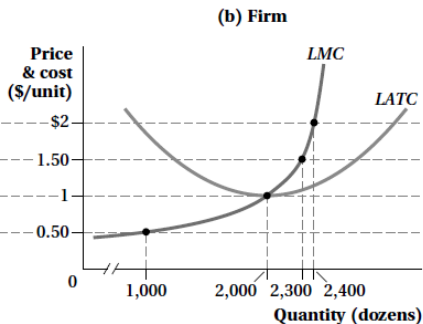
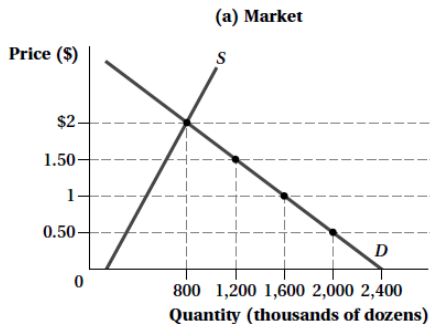
- State your presence in the Zoom chat for a record of attendance
- Take a minute to download these slides from [Canvas under Week 10](#)
- [Midterm Exam II](#) is on Thursday, April 1st
- Exam week TA Office Hours: Tue 12PM-1PM CDT and Wed 1-3PM CDT (Wed by appointment only). No office hours Thursday.
- Follow link in TA bio on course Canvas page to sign up for [Wednesday office hours](#)
- For additional support, [Peer Tutors](#) are offered through the University library SMART Learning Commons

## Chapter 8 - Profit Maximization in a Competitive Market

The egg industry comprises many firms producing an identical product. Supply and demand conditions are indicated in the left-hand panel of the figure below; the long-run cost curves of a representative egg producer are shown in the right-hand panel. Currently, the market price of eggs is \$2 per dozen, and at that price consumers are purchasing 800,000 dozen eggs per day.

- 1 Determine how many eggs each firm in the industry will produce if it wants to maximize profit.
- 2 How many firms are currently serving the industry?
- 3 In the long run, what will the equilibrium price of eggs be? Explain your reasoning, and illustrate your reasoning by altering the graphs above.
- 4 In the long run, how many eggs will the typical firm produce?
- 5 In the long run, how many firms will comprise the industry?

# Chapter 8 - Profit Maximization in a Competitive Market (Cont'd.)

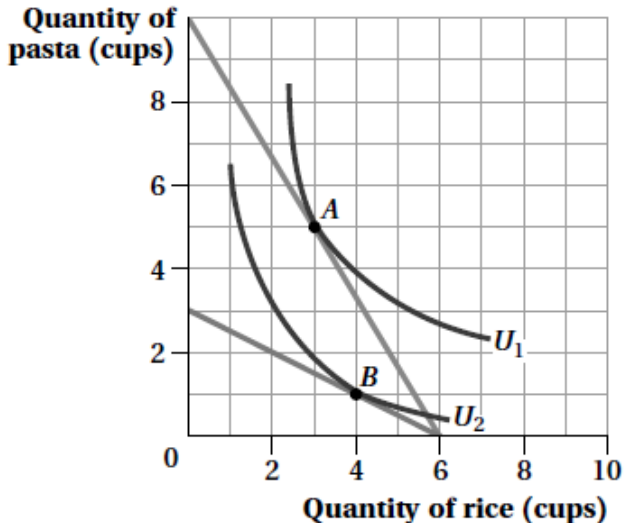


## Chapter 5 - Substitution and Income Effects

Suppose that Sonya faces an increase in the price of pasta, as depicted below, moving her from an optimum bundle of rice and pasta at  $A$  to an optimal bundle at  $B$ .

- 1 Draw a compensated budget line on the graph
- 2 Indicate the compensated optimal bundle ( $A'$ ) on the graph
- 3 What is the substitution effect for rice? Show on graph
- 4 What is the substitution effect for pasta? Show on graph
- 5 What is the income effect for rice? Show on graph
- 6 What is the income effect for pasta? Show on graph
- 7 What is the total effect for rice? Show on graph
- 8 What is the total effect for pasta? Show on graph
- 9 Is rice a normal good, inferior good or income inelastic for Sonya?
- 10 Is pasta a normal good, inferior good or income inelastic for Sonya?

## Chapter 5 - Substitution and Income Effects (Cont'd.)



## Chapter 6 - Production in Short-Run & Long-Run

A production function is given by  $Q = 5K^{0.5}L^{1.5}$ .

- 1 What is the marginal product of capital ( $MP_K$ )?
- 2 What is the marginal product of labor ( $MP_L$ )?
- 3 Does the production function exhibit diminishing marginal returns to capital?
- 4 Does the production function exhibit diminishing marginal returns to labor?
- 5 What is the marginal rate of technical substitution between labor and capital ( $MRTS_{LK}$ )?



## Chapter 4 - Consumer Utility Maximization Problem

Chrissy spends her income on fishing lures ( $L$ ) and guitar picks ( $G$ ). Lures are priced at \$2, while a package of guitar picks cost \$1. Assume that Chrissy has \$30 to spend and her utility function can be represented as  $U(L, G) = L^{0.5} G^{0.5}$ .

- 1 What is Chrissy's marginal utility of lures ( $MU_L$ )?
- 2 What is Chrissy's marginal utility of guitar picks ( $MU_G$ )?
- 3 What is Chrissy's marginal rate of substitution between lures and guitar picks ( $MRS_{LG}$ )?
- 4 What is the price ratio between lures and guitar picks ( $\frac{P_L}{P_G}$ )?
- 5 What is the optimal number of lures and guitar picks for Chrissy to purchase?
- 6 How much utility does this combination bring her?

## Chapter 4A - Utility Maximization with the Lagrangian

Katie likes to paint and sit in the sun. Her utility function is  $U(P, S) = 3PS + 6P$ , where  $P$  is the number of paint brushes and  $S$  is the number of straw hats. The price of a paint brush is \$1 and the price of a straw hat is \$5. Katie has \$50 to spend on paint brushes and straw hats.

- 1 What is Katie's objective function?
- 2 What is Katie's constraint?
- 3 Construct Katie's utility maximization problem statement.
- 4 Convert Katie's utility maximization problem statement to Lagrangian form.
- 5 Solve Katie's utility-maximization problem using a Lagrangian.
- 6 How much does Katie's utility increase if she receives an extra dollar to spend on paint brushes and straw hats?

## Chapter 5 - Market Demand Curve

Suppose that at a rural gas station in Toby Acres, there are only two customers, Johnny (who drives a 4X4 pickup) and Olivia (who drives a Prius). Johnny's demand for gasoline is  $Q_J = 32 - 8P$ , while Olivia's demand is  $Q_O = 20 - 4P$ , where  $Q$  is measured in gallons and  $P$  is the price per gallon.

- 1 What is Johnny's demand choke price?
- 2 What is Olivia's demand choke price?
- 3 Solve for the market demand equation (as a piece-wise function) for gasoline at Toby Acres.
- 4 Draw the market demand curve in a graph for gasoline at Toby Acres.

## Chapter 6 - Cost Minimization in Short-Run & Long-Run

A firm is employing 100 workers ( $W = \$15/\text{hour}$ ) and 50 units of capital ( $R = \$30/\text{hour}$ ). At the firm's current input use, the marginal product of labor is 45 and the marginal product of capital is 60.

- 1 Is this firm minimizing costs?
- 2 If not, what changes should the firm make in the short-run?
- 3 Similarly, what changes should the firm make in the long-run?

## Chapter 6A - Cost Minimization with the Lagrangian

A firm has the production function  $Q = K^{0.4}L^{0.6}$ . The wage is \$60, and the rental rate on capital is \$20.

- 1 What is the firm's objective function?
- 2 What is the firm's constraint?
- 3 What is the firm's cost-minimization problem statement?
- 4 Convert the cost-minimization problem statement to Lagrangian form.
- 5 Use the Lagrangian to find the firm's cost-minimizing amounts of capital and labor?

## Chapter 6 - Returns to Scale

Determine whether each of the production functions below displays constant, increasing, or decreasing returns to scale:

- 1  $Q = (K^{0.75}L^{0.25})^2$
- 2  $Q = K + L + KL$
- 3  $Q = \min(3K, 2L)$

## Chapter 7 - Producer Costs

Suppose a firm's total cost curve is  $TC = 15Q^2 + 8Q + 45$

- 1 Find the firm's fixed cost, variable cost, average total cost, average variable cost and marginal cost.
- 2 Find the output level that minimizes average total cost.
- 3 Find the output level at which average variable cost is minimized.

## Chapter 7 - Economies of Scale

Suppose the long-run total cost function for a firm is

$$LTC = 15,000Q - 200Q^2 + Q^3$$

- 1 What is the firm's long-run average total cost function?
- 2 What is the firm's long-run marginal cost function?
- 3 What is the output level that minimizes average total cost?
- 4 What is the firm's lowest average total cost?
- 5 For which levels of output will the firm face economies of scale?
- 6 For which levels of output will the firm face diseconomies of scale?



## Chapter 7A - Cost Structure in Short-Run vs. Long-Run

Margarita Robotics has a daily production function given by  $Q = K^{0.5}L^{0.5}$ , where  $K$  is the monthly number of hours of use for a precision lathe (capital) and  $L$  is the monthly number of machinist hours (labor). Suppose that each unit of capital costs \$40, and each unit of labor costs \$10. In the short run,  $\bar{K}$  is fixed at 16,000 hours.

- 1 What is the short-run demand for labor?
- 2 What are total cost, average total cost, average variable cost, and marginal cost in the short run?
- 3 Derive the cost-minimizing condition in the long run.
- 4 What are the long-run demands for capital and labor?
- 5 Derive total cost, average cost, and marginal cost in the long run.

# Questions

Any remaining questions?

# Additional Support Resources

- Boynton Mental Health Services
- Student Counseling Services
- Let's Talk
- Educational Workshops
- Academic Skills Coaching

## Appendix

Remember the distinction between certain economic terms:

- **Diminishing marginal product/returns of a factor of production:** when the marginal product of a given input (e.g., capital, labor) decreases as a firm increases that input
  - Ask how does the marginal product of an input change when the firm increases the amount of that input used
- **Returns to scale:** a change in the amount of output in response to a proportional increase in all of the inputs
  - Compare the proportional change in output to the proportional changes in all inputs for a given production function
- **Economies (Diseconomies) of scale:** when total cost rises at a slower (faster) rate than output rises
  - Compare the marginal cost ( $MC$ ) of producing a given output level ( $Q$ ) to the average total cost ( $ATC$ ) of producing the same amount of  $Q$