





3) Production functions.

a) Draw the production function  $Q=f(L, \bar{K})$  noting areas that are not feasible, not efficient and at the frontier of technological efficiency.

b) Show what technological progress looks like on a production function such as the one you drew for (a)

c) Draw an isoquant of the production function  $Q=f(L, K)$  noting areas that are not feasible, not efficient and at the frontier of technological efficiency for producing a target production level  $Q'$ .

4) Types of Goods.

a) What type of good goes in which blank?

|               | Rival | Non Rival |
|---------------|-------|-----------|
| Exclusion     |       |           |
| Non Exclusion |       |           |

b) Illustrate how deriving the aggregate demand curve for a public good differs from deriving the demand curve for a private good, and explain how this difference relates to your answers to (a).

Aggregate demand for a private good:

Aggregate demand for a public good:

Explanation

5) Benefit cost.

We are comparing two proposals for use of decentralized climate funds in Senegal. These are funds available to help local communities fund public goods that will help them adapt to anticipated climate change. One community has proposed the following two proposals and we have to select one. The time horizon and our planning horizon is four years:  $t=0,1,2,3$ .

**Community seed storage** The seed storage facility will cost 80,000 dollars to construct in year zero and will cost 25,000 dollars to operate in years 1, 2, and 3. Currently seed damaged in storage at farmers' houses requires farmers to buy seeds in the planting season that in aggregate cost 60,000 dollars for the community per year. The benefit is that if the facility is built these seed purchases will not be necessary as seed damage in storage will be eliminated in years 1,2, and 3.

**Dry season market garden.** Senegal has an 8 month long season when it does not rain. To grow things you need a well and a fence to keep out grazing animals. We could drill a well and put up a fence around a field that is not currently used for cultivation for 50,000 dollars in year zero. The anticipated costs of upkeep of the garden are 10,000 dollars per year in years 1,2, and 3. The new revenues from sales of things produced in the garden expected in years 1,2, and 3 are 30,000 per year.

a) Which is the better option if the discount rate is 10%?

b) If my estimate of the garden revenue is 5,000 higher (35,000 per year in years 1,2,and 3) is the choice made in part (a) still the best option?



7) Tax policy.

a. Illustrate on a supply and demand graph a specific tax of size  $\tau$  placed on producers.

b. Illustrate on a supply and demand graph the impact of an ad valorem tax rate  $\alpha$  placed on consumers.

c. Explain the concept of Consumer Incidence using the labels of your graph for part b.

8) True or False

| Statement   | The statement is<br>(circle the correct answer) |       |
|---|---|-------|
| The expansion path traces out all points that are the minimum cost ways of producing target levels of output. | True  | False |
| Consumer surplus is calculated as the area below the demand curve and above the price line.                   | True  | False |
| The slope of an indifference curve is called the marginal rate of technical substitution.                     | True  | False |
| The income elasticity of demand for an inferior good is a positive number.                                    | True  | False |
| MRS=MRT at the optimal bundle for an interior solution.   | True  | False |
| Decreasing the discount rate increases the present value of future costs and benefits.                        | True  | False |
| A monopolist is a single supplier of a good for which there is no close substitute.                           | True  | False |
| The free rider problem leads to overprovision of a public good.   | True  | False |



9) Public goods, voting, and benefit cost.

A community of five people is voting to decide on public good provision. There are three proposals:

Proposal A: Build a wall around the community to prevent anyone entering or exiting. Total cost is \$3,000 (\$600 each).

Proposal B: Rebuild the roads in the town as the infrastructure is crumbling. Total cost is \$5000 (\$1,000 each).

Proposal C: Increase hours worked by local police to crack down on crime. Total cost is \$7,500 (1,500 each)

This table records each household's WTP for each proposal.

|         | Proposal A- wall | Proposal B-roads | Proposal C-police |
|---------|------------------|------------------|-------------------|
| Taylor  | \$800            | \$ 800           | \$1,400           |
| Feeney  | \$200            | \$2,500          | \$1,000           |
| Badger  | \$200            | \$ 900           | \$4,500           |
| Bennett | \$900            | \$1,900          | \$1,200           |
| McPeak  | \$700            | \$ 500           | \$1,300           |

a) How will they vote for each proposal and which proposal or proposals will pass with a majority? (circle)

|              | Proposal A |    | Proposal B |    | Proposal C |    |
|--------------|------------|----|------------|----|------------|----|
| Taylor       | Yes        | No | Yes        | No | Yes        | No |
| Feeney       | Yes        | No | Yes        | No | Yes        | No |
| Badger       | Yes        | No | Yes        | No | Yes        | No |
| Bennett      | Yes        | No | Yes        | No | Yes        | No |
| McPeak       | Yes        | No | Yes        | No | Yes        | No |
| Pass or not? |            |    |            |    |            |    |

b) If the costs are present value costs, and the willingness to pay figures are present value benefits, what is the net present value of each proposal?

| Proposal A- wall | Proposal B - roads | Proposal C – police |
|------------------|--------------------|---------------------|
|                  |                    |                     |

c) Did voting lead us to select the proposal that had the highest net present value? Explain why or why not.

10) Syracuse University and the City of Syracuse are considering options to deal with the parking issue around campus. SU is considering expanding the Waverly lot by putting in a parking garage there. COS is considering building a larger lot on Adams street. The following table sets out the profit per day to each if the following decisions are made

|                  |              | Syracuse University |        |              |       |
|------------------|--------------|---------------------|--------|--------------|-------|
|                  |              | Expand              |        | Don't Expand |       |
| City of Syracuse | Expand       | 8,100               | 7,100  | 10,500       | 6,600 |
|                  | Don't Expand | 7,500               | 10,000 | 9,200        | 8,400 |

a) Describe the full set of best response strategies for each player.

b) What is the Nash Equilibrium outcome of this game?

c) From the point of view of the City of Syracuse and Syracuse University, compare the Nash Equilibrium outcome to other outcomes represented in the table using the concepts of Pareto Optimality and Pareto Improving.

11) The demand curve is given to you as  $q=100-20*p$ .

- a. Fill out the following table (use the relatively higher price / relatively lower quantity pair for the denominator in the elasticity calculation)

| Price  | Quantity | Elasticity |
|--------|----------|------------|
| \$1.00 |          | -----      |
| \$1.50 |          |            |
| \$2.00 |          |            |
| \$2.50 |          |            |
| \$3.00 |          |            |
| \$3.50 |          |            |

- b. Draw this demand curve with price on the y-axis and quantity on the x – axis. Identify the range over which this curve is elastic or inelastic.

12) Cost.

a. Complete the following table.

| Total Output | Fixed Cost | Total Cost | Variable Cost | Average Variable Cost | Average Fixed Cost | Average Cost | Marginal Cost |
|--------------|------------|------------|---------------|-----------------------|--------------------|--------------|---------------|
| 0            |            | 8          | -----         | -----                 | -----              | -----        | -----         |
| 1            |            |            |               |                       |                    |              | 15            |
| 2            |            | 37         |               |                       |                    |              |               |
| 3            |            |            | 44            |                       |                    |              |               |
| 4            |            |            |               |                       |                    | 18           |               |
| 5            |            |            |               |                       |                    |              | 22            |

b. Is this short run or long run cost information? Why?

c. If market price for the output produced is 14, what level of output is profit maximizing for a firm if the market structure is perfectly competitive?

13) Monopoly.

- a. The inverse demand curve is  $p=48-2*q$ . The inverse supply curve is  $p=2*q$ . Illustrate on a graph the difference between a monopoly outcome and a perfectly competitive market outcome. Identify and calculate the values for areas corresponding to producer surplus, consumer surplus, and deadweight loss.

|                      | Perfect Competition | Monopoly |
|----------------------|---------------------|----------|
| Consumer Surplus     |                     |          |
| Producer Surplus     |                     |          |
| Deadweight Loss      |                     |          |
| Total Social Welfare |                     |          |

14) If  $p_1 = 20$ ,  $p_2=10$ , and  $Y=500$

a. Draw the budget constraint.

b. Show how you can derive the price consumption curve for a given consumer's preferences (drawn as you like so long as they obey the properties of indifference curves discussed in class) using the example of the budget line from (a) with  $p_1 = 10$ , a budget line if  $p_1 = 20$  all else constant, and a budget line of  $p_1 = 25$  all else constant.

c. Show how to derive the individual's demand curve from the graph in (b).

15) Circle the correct answer

| Condition A  | Condition B  | What type of condition is B for establishing A? |
|--|--|---|
| MC is below AC at q                                  | AC is downward sloping at q                                  | N, NS   S, NN   N,S                             |
| The good is homogeneous                              | The market is perfectly competitive                          | N, NS   S, NN   N,S                             |
| The market is perfectly competitive                  | Price taking behavior by buyers and sellers                  | N, NS   S, NN   N,S                             |
| Consumption of the good is characterized by rivalry. | The good is a private good                                   | N, NS   S, NN   N,S                             |
| The good is a public good.                           | The good is characterized by non-exclusion                   | N, NS   S, NN   N,S                             |
| The Nash Equilibrium is not economically efficient.  | The Nash Equilibrium is not a Pareto optimal outcome         | N, NS   S, NN   N,S                             |
| A quantity is the profit maximizing quantity         | The quantity is produced in a technologically efficient way. | N, NS   S, NN   N,S                             |
| The last dollar rule is satisfied at a bundle        | MRS=MRT at a bundle  | N, NS   S, NN   N,S                             |

N,NS : Necessary, not sufficient

S, NN: Sufficient, not necessary

N, S: Necessary and sufficient.

Work Page