**Economics 111**

**Fall 2019**

**Homework #3**

**General Instructions:**

* Homework is due at the beginning of the lecture.
* Do not submit the homework questions. Just submit your answers: these answers should be neat, legible, and easy to follow. Be generous with your use of paper. Do not write in small, hard to read font. If asked to provide a graph, provide a generous graph.
* All homeworks should be stapled and on the front page your name should be legibly written.
* It is all right to do homework with a "study buddy": however, when asked to explain your answer your words should be significantly different from your "study buddy's" words. Homeworks that are too similar to one another will not receive any credit.
* To get full credit for the homework you need to answer every question that is asked. A failure to answer all the questions will result in a lower homework score.
* It is a good idea to make a copy of your homework so that you can compare your answers to the posted answers. Your copy (a digital photo) also provides a time-stamped proof that you did the homework.

**Elasticity:**

1. Consider the following demand curve for widgets where P is the price per widget and Q is the quantity of widgets.

Demand: Q = 3000 – 3P

a. Fill in the following table using the above information.

|  |  |  |
| --- | --- | --- |
| P | Q | Total Revenue = TR |
| $0 |  |  |
| 120 |  |  |
| 180 |  |  |
| 200 |  |  |
| 250 |  |  |
| 450 |  |  |
| 600 |  |  |
| 800 |  |  |

b. In your own words describe what happens to total revenue if the price of this good goes from $450 to $600. In your answer make sure you include references to the price and quantity effects.

c. What is the maximum total revenue that could be earned given this demand curve and holding everything else constant? Assume that the supplier is free to set any price they want and their goal is to set their price to maximize their total revenue. Note: this price may not be in the table you just filled in!

2. Consider the following market demand and market supply curves for scissors where P is the price per scissor and Q is the quantity of scissors.

Demand: P = 11 – (1/100)Q

Supply: P = 2 + (1/200)Q

a. Given the above information find the equilibrium price and quantity in this market. Show your work.

b. Calculate the point elasticity of demand at equilibrium. Provide the general formula and show your calculations. Is demand elastic or inelastic? Explain your answer. Given this answer, will producers enhance their total revenue by increasing or by decreasing the price they charge for scissors?

c. Calculate the point elasticity of supply at equilibrium. Provide the general formula and show your calculations. Is supply elastic or inelastic? Explain your answer.

d. Suppose the price increases by $1.00. Using the arc elasticity formula calculate the price elasticity of demand between the initial equilibrium and this new point on the demand curve. Provide the general formula and show your work. Is demand inelastic or elastic? Explain your answer.

3. a. You are told that the income elasticity of demand for bicycles is equal to 4. What does this mean if incomes in an economy increase by 20%?

b. You are told that the cross price elasticity of demand for bicycles and bike helmets is -2. What does this mean if the price of a bike helmet decreases by 10%?

c. You are told that the cross price elasticity of demand for bicycles and bus fares is equal to 1.5 What does this mean if the price of a bus fare increases by 5%?

4. Suppose your family runs a Greek yogurt factory which is famous in your town for its unique black Greek yogurt. After attending Econ 111 for a few weeks, you really feel like helping your father to make better pricing decisions. To begin with, you search for a market survey company to find out the demand curve for your black Greek yogurt, which turns out to be:

Q = 12 - 2P + 0.1I

where Q is the quantity demanded in US (in thousands of packages), P is the price for a package of Greek yogurt, and I is the median income in your town (in thousands of dollars).

Currently the price is set by your father at 2, and the median income is 40.

a. Using the point slope elasticity formula, what is the price elasticity of demand for Greek yogurt at the current price and income level?

b. Based on your result in part (a), do you think you should raise or lower the price in order to increase total revenue? (Think about the price elasticity of demand, and the price and quantity effects.)

c. Now verify your answer in part (b) by setting a new price which is $1 dollar higher/lower (based on your answer to part (b)) than the original price of $2 and then calculate the change in total revenue.

d. Using the two-point elasticity formula (the arc elasticity formula), what is the price elasticity of demand when you go from the original price to the new price?

Suppose the following two scenarios happen when your yogurt is priced at the new price level in part (c), and you hold your price unchanged during the following scenarios:

e. On the Greek yogurt market, your biggest rival is a kind of green Greek yogurt. Suppose the price of green Greek yogurt suddenly goes up from $3 to $3.5 due to an increase in the price of spinach, which is the main ingredient of the green Greek yogurt. Then, market investigation finds that this change causes the quantity demanded for your yogurt to increase by 2 units. So what is the cross-price elasticity of demand? Provide any formulas you use.

f. Your yogurt has an amazing effect of boosting productivity on the residents in your town, and this leads to an increase in the median income in your town: I goes from 40 to 50. Find the new quantity demanded for your yogurt and calculate the income elasticity of demand. Provide any formulas you use.

**Consumer Theory:**

5. Joe has $100 in income that he can spend on either good X or good Y. Good X costs $1 per unit while good Y costs $2 per unit.

a. Given the above information, draw a graph of Joe’s budget line (call it BL1) and write an equation in slope-intercept form for Joe’s budget line measuring good Y as the good on the vertical axis.

b. Given Joe’s income and the prices of these two goods and given Joe’s preferences he finds that he maximizes his satisfaction when he chooses to consume bundle A which consists of 60 units of good X and 20 units of good Y. Can Joe afford this bundle given his income and the prices of the two goods? Prove this mathematically. Does consumption of bundle A exhaust Joe’s available income?

c. Suppose that the price of good X increases to $2. Joe’s income and the price of good Y stay constant. Joe now finds that he maximizes his satisfaction when he consumes consumption bundle B which consists of 28 units of good X. Draw a graph that represents Joe’s BL1, his new budget line (BL2), bundle A and bundle B. Calculate how many units of good Y Joe consumes when he consumes consumption bundle B (make sure you show how you found this answer). Mark bundle B in your graph.

d. Suppose that Joe was constrained to stay on his first indifference curve-the one that bundle A sits on- while paying the new price for good X. We can construct this budget line 3 where Joe’s income has been compensated (in this case increased) so that he can reach the indifference curve that bundle A is on. On budget line 3 Joe finds that he maximizes his satisfaction by consuming bundle C which consists of 34 units of good x and 36 units of good Y. Draw a graph that illustrates BL1, BL2, BL3, bundle A, bundle B, and bundle C. Sketch in indifference curve 1 and indifference curve 2 in your graph.

e. How much would Joe’s income have to be increased by in order for him to have the same utility as he had initially while now facing the higher price for good X? You have all the necessary information at hand to calculate this increase in income. Show how you found your answer.

f. What is the amount of the substitution effect for good X given the above information? What is the amount of the income effect for good X given the above information? Explain your answer.

6. You are provided the following graph depicting Babette's budget line one, BL1, and Babette's budget line two, BL2. When Babette faces BL1 she maximizes her utility by consuming the consumption bundle designated as point A. When Babette faces BL2 she maximizes her utility by consuming the consumption bundle designated as point B. Suppose you also know that the price of good Y is $2 per unit.



Given the above information and holding everything else constant, what is the equation for Babette's demand curve for good X? Assume that her demand curve for quantities between 10 and 20 units can be described by a linear demand curve.

7. Martina's utility from consuming cookies (C) and milk (M) is described by the following information:

Utility = 2CM

Marginal utility of cookies = MUc = 2M

Marginal utility of milk = MUm = 2C

Martina's income is initially equal to $100 and the price of cookies is $5 per unit and the price of milk is $10 per unit.

a. Given the above information, write an equation for Martina's budget line. Let's refer to this budget line as BL1. In your work, measure cookies on the horizontal axis and milk on the vertical axis.

b. Given the above information find the consumption bundle (C, M) that maximizes Martina's utility. Show all your work in finding this bundle and explain the steps you are taking to get to your answer.

c. Suppose that the price of cookies increases to $10 per unit. Given this information and holding everything else constant, what is Martina's new utility if she maximizes her utility? Show all your work in finding this answer and explain the steps you are taking to get to your answer.

d. The price of cookies is still $10 per unit. Identify the size of the income effect and the substitution effect for this individual when they move from BL1 to BL2. Explain all your work and how you arrived at your final answer.

**Production and Cost:**

8. Consider an aggregate production function:

 Q = 4K1/2L1/2

where Q is the number of widgets, K is the number of units of capital, and L is the number of units of labor. For this question assume K is initially fixed at 100 units. You also know that total cost, TC, is given as:

TC = PkK + PlL

where Pk is the price of capital and Pl is the price of labor. Assume that the price of labor and the price of capital are both constant.

a. Fill in the missing cells of the table below based on the above information. (Hint: you might find it fun to do this with Excel: practice your spreadsheet skills and generate the numbers fast!). Calculate your answers to two places past the decimal. Note: the numbers you get may not generate U-shaped curves.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| L | K | Q | VC | FC | TC | AVC | AFC | ATC | MC |
| 0 |  |  |  | $400 |  | --- | --- | --- | --- |
| 1 |  |  |  |  |  |  |  |  |  |
| 4 |  |  | $80 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |
| 36 |  |  |  |  |  |  |  |  |  |
| 49 |  |  |  |  |  |  |  |  |  |

b. What is the price of capital? Explain how you got this answer.

c. What is the price of labor? Explain how you got this answer.

d. Given the above information and your work in (a), fill in the following table. Round your answers to two places past the decimal. (Hint: if you used Excel earlier, you can continue to use Excel in this part of the exercise-just a great way to keep building your spreadsheet skills!)

|  |  |  |
| --- | --- | --- |
| L | Q | MPL |
| 0 |  | --- |
| 1 |  |  |
| 4 |  |  |
| 9 |  |  |
| 16 |  |  |
| 25 |  |  |
| 36 |  |  |
| 49 |  |  |

e. Given your work, does the production of this good show diminishing marginal returns to labor? Explain your answer.

f. Suppose that K doubles and L doubles. Without using numeric values, can you prove this production function has constant returns to scale? That is, can you show that if K and L both double that output, Q, will also double?

**Perfect Competition:**

9. Consider a perfectly competitive industry composed of six identical firms that produce widgets. Suppose you are told that the representative firm has the following cost curves where TC is total cost measured in dollars and q is units of widgets produced by a particular firm:

Total Cost: TC = 4 + 4q + q2

Marginal Cost: MC = 4 + 2q

Suppose you also know that the market demand curve is given by the following equation where P is the market price in dollars and Q is the market quantity of widgets:

Market Demand: P = 19 – (1/2)Q

Q represents market quantity and q represents firm quantity.

a. Given the above information write an equation for the market supply curve. Explain how you found this equation.

b. Given the market supply curve you found in (a), calculate the short run market equilibrium quantity and price in this market. How many units of output will the representative firm produce in the short run? Calculate the short-run profits for the representative firm. Explain your work.

c. Given your calculations in (b), will the representative firm produce in the short-run? Explain your answer.

1. Given your answer in (b), what do you predict will happen in the long-run in this industry?

e. Given no changes in the firm’s cost curves or the market demand curve, calculate the following and explain how you found your answers:

Long-run equilibrium market price =

Long-run equilibrium market quantity = Level of production by the representative firm = \_

Number of firms in industry in the long-run = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_