

ECON 310
Assignment #2
Answer Key

Use the following information for the next set of problems. Alice consumes goods X and Y. Alice's utility function is given by $U=X*Y$. From this equation, we know that $MU_x= Y$ and $MU_y= X$.

1. 4 pts. Suppose Alice has an income of \$120, the price of X, $P_x = \$3$, and the price of Y, $P_y = \$6$.

- i. Write the equation for Alice's budget line. Draw this graphically with good Y on the y-axis and good X on the x-axis. Make sure to label the intercepts. 2 pts.

$120 = 3X + 6Y$ or $Y = 20 - 1/2X$, graph has Y-intercept at (0,20) and X-intercept at (40,0).

- ii. What is the marginal value of X in terms of Y { $MV_{x/y}$ } at her optimal bundle? 1pt

$$MV = MU_x/MU_y = Y/X = P_x/P_y = 1/2$$

- iii. What is the optimal bundle of X and Y 1 pt

We know the optimal level of X and Y must satisfy the budget constraint and the condition found in part iii. So, $Y = 20 - .5 X$ and $1/2X = Y$. So, $(X,Y) = [20,10]$

- iv. What is Alice's utility at this point? 1 pt

$$U = XY = 20*10 = 200$$

2. 6 pts. Suppose Alice's income falls to \$60.

- i. Write the equation for Alice's new budget line. Illustrate this graphically on the graph from problem 1, part i. 2 pts

$60 = 3X + 6Y$, or $Y = 10 - .5 X$, graph has Y-intercept at (0,10) and X-intercept at (20,0). Thus, the increase in income has shifted the budget line back parallel to the one in number 1.

- ii. What is the new optimal bundle of X and Y? 1 pt

The new bundle must satisfy the new budget constraint ($Y = 10 - .5X$) and same condition as before where $X = 2Y$. The new optimal bundle $(X,Y) = [10,5]$

- iii. Is Y a normal or inferior good? 1 pt

Y is normal, when we decrease income, Alice consumes less Y

- iv. What is Alice's utility at this point? 1 pt

$$U = XY = 10 * 5 = 50$$

- v. Construct Alice's Engel curve for good Y using these 2 levels of income. 1 pt

Use points (10, 120) and (5,60) to construct a line with slope = $\frac{60-120}{5-10} = 12$.

$$\text{Equation : } I = 12 * Y$$

- vi. When her income changes from \$120 to \$60, what is Alice's income elasticity of demand (for good Y) in this region? 1 pt

$$IE = \frac{\% \text{change in } Y}{\% \text{change in income.}}$$

$$IE = \frac{[(5-10)/10]}{[(60-120)/120]} = 1$$

3. 6 pts. Now, suppose the price of good Y decreases from \$6 to \$3, but her income stays at the original level of \$120.

- i. Write the equation for Alice's new budget line. Draw this graphically on the same graph from problem 1, part i.

120 = 3X + 3Y, so Y = 40 - X, graph has Y intercept at (0,40), X-intercept at (40,0).

- ii. What is the new optimal bundle of X and Y?

Use the new budget constraint and the new condition derived from change in MU_x/MU_y . Now we have Y = X ($MU_x/MU_y = P_x/P_y = 1$) and Y = 40 - X. Setting these two equations equal, we get X = 20 and Y = 20.

- iii. Is Y a giffen or a non-giffen good?

Y is a non-giffen good. When its price fell, Alice consumed more of Y. Thus, Y follows the law of demand.

- iv. What is Alice's utility at this point?

$$\text{Her utility} = X * Y = 20 * 20 = 400$$

- v. Construct Alice's linear demand curve for good Y from these 2 points (the point you found in #2 with the original price and quantity and the new price and quantity found in this question). Derive the equation and illustrate it graphically. (Note: this curve has different axes, so you will need to use a different graph than that from part i.)

Use the two points on Alice's demand curve (Q,P) = (10, 6) & (20, 3)

The slope of the line connecting these points is -3/10

We know a linear line fits $P = mQ + b$, so we can use the slope -3/10 = m and one of the points to find the constant b in the demand equation:

$$6 = (-3/10) * 10 + b. \text{ Solving for } b, \text{ we get } b = 9.$$

The demand equation is thus, $P = -3/10Q + 9$

- vi. What is Alice's price elasticity of demand for good Y in this region? Is Alice's demand elastic, unit elastic, or inelastic in this region?

$PE = \%change\ in\ Y / \%change\ in\ P$. Use the two points we used in part vi.
 $PE = [(20-10)/10] / [(3-6)/6] = 2$. So her demand is elastic at this point.

4. 4 pts. Consider the following:

- i. Can a good have both a downward sloping Engel curve and a downward sloping demand curve? Why or why not?

Yes. If a good has a downward sloping Engel curve, it means as income rises, X falls. So the good is an inferior good. If a good has a downward sloping demand curve, it is non-giffen. We've shown in class that if the substitution effect is larger than the income effect the good is non-giffen, but if the substitution effect is smaller than the income effect the good can be giffen. Thus, an inferior good can be non-giffen.

- ii. Can a good have both an upward sloping Engel curve and an upward sloping demand curve? Why or why not?

NO. If a good has an upward sloping Engel curve as income rises, X rises. So the good is a normal good. If it has an upward sloping demand curve, as its price rises, quantity demanded increases, so the good is a giffen good. We've shown that a normal good can't be giffen.

5. 6 pts. Fill in the table below.

Demand				Total Cost		
Quantity	Price	Total Revenue	Marginal Revenue	Quantity	Dollars	Marginal Cost
0 units	\$35/unit	\$0	-----	0 units	\$0	-----
1	30	30	\$30	1	4	\$4
2	25	50	20	2	11	7
3	20	60	10	3	21	10
4	15	60	0	4	34	13
5	10	50	-10	5	50	16

6. 4 pts The following questions refer to the table in part 5.

- i. What is the total profit from selling two units?

$$TP = TR - TC = 50 - 11 = \$39$$

- ii. According to the equimarginal principle, how many units should the firm produce in order to maximize its profit?

Principle says produce where $MR=MC$, so produce 3 units

- iii. Suppose, that in addition to its per-unit costs listed above, a flat fee of \$10 is imposed on the seller. Will this seller continue to produce? If so, how many units will he produce? Why?

Yes, he will still produce 3 units, because his MC is not affected by a change in fixed cost and his profit is still positive.

7. Suppose you have 24 hours per day that you can allocate between leisure and working at a wage of \$2 per hour. [10pts]

- i.. Draw your budget constraint between “leisure hours” on the horizontal axis and “income” on the vertical axis and draw an indifference curve that illustrates your optimal point. Label this point A. Be sure to label your intercepts. (1 pt)

Should have initial budget line with y-intercept at (0,48) and x-intercept at (24,0)

Suppose your wage increases to \$3 per hour.

- ii. Draw your new budget line in the diagram above. (1 pt)

Should have new budget line with y-intercept at (0,72) and x-intercept at (24,0)

- iii. According to the substitution effect, should your wage hike increase or decrease your leisure time? Why? ***__decrease, because the price of leisure has gone up, so consume less of it*** (2 pts)
(Hint: What is the price of an hour of leisure? Has the price of leisure gone up or down? What does this mean in terms of the substitution effect?)

- iv. If leisure is a normal good, will the income effect of this wage hike increase or decrease your leisure time? Why? ***__increase, the wage hike has made you “richer”. Since you can work a fewer number of hours and earn the same amount of income, the income effect would say, work fewer and consume more leisure__*** (2 pts)
(Hint: Are you poorer or richer due to the wage change? What does this mean in terms of the income effect?)

- v. On your indifference curve diagram above, decompose the effect of the wage increase into a substitution effect and an income effect assuming leisure is a normal good and that the substitution effect is larger than the income effect of the wage increase. (Note: label and use the points A, B and C to illustrate the two effects) Has your leisure time increased or decreased due to this wage hike? (4 pts)

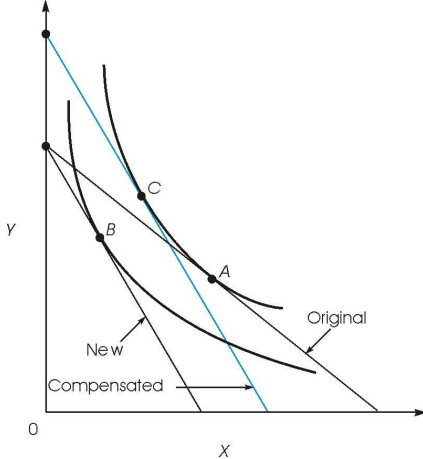
It should decrease because the sub effect says decrease, income says increase and sub is greater, so decrease overall

Your sub effect should be A to C where C is left of A (decrease leisure) and where A and C are on same IC.

Your income effect should be C to B where B is to the right of C (increase leisure) and to the left of A (sub effect greater than income). B should be on NEW budget line which should be parallel to the budget line that is tangent at point C on the original IC.

8. 10 pts Multiple Choice:

Refer to the following diagram for the next 4 problems



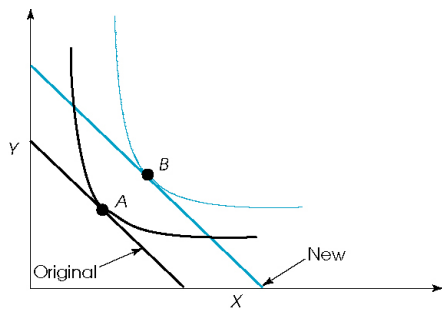
- i. When the budget line shifts from the “Original” to the “New”, the price of _____.
 - A. *X increases.*
 - B. *X decreases*
 - C. *Y increases*
 - D. *Y decreases*

- ii. When the price change in the previous question occurs, the actual consumption of good X changes from ____ to _____.
 - A. *A to B*
 - B. *A to C*
 - C. *B to C*
 - D. *C to A*
 - E. *B to A*

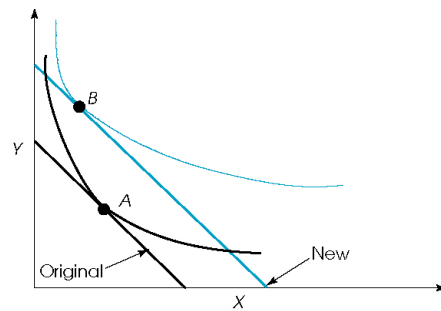
- iii. The move from C to B with respect to the quantity of good X refers to the
 - A. *Substitution Effect*
 - B. *Income Effect*
 - C. *Can't tell*

- iv. In this case, X is a _____ good.
 - A. *Giffen*
 - B. *Inferior*
 - C. *Normal*
 - D. *Leontief*

Refer to the following graphs for the next two questions:



(A)



(B)

v. The good depicted in (A) is:

- A. an inferior good, so the slope of the Engel curve for this good is positive
- B. an inferior good, so the slope of the Engel curve for this good is negative
- C. a normal good, so the slope of the Engel curve for this good is positive
- D. a normal good, so the slope of the Engel curve for this good is negative

vi. The good depicted in (B) is:

- A. an inferior good, so the slope of the Engel curve for this good is positive
- B. an inferior good, so the slope of the Engel curve for this good is negative
- C. a normal good, so the slope of the Engel curve for this good is positive
- D. a normal good, so the slope of the Engel curve for this good is negative

vii. Whenever a worker's marginal product is greater than the average product, adding that worker causes average product to:

- A. rise
- B. fall
- C. remain constant
- D. change unpredictably

viii. If a firm's total cost associated with producing 10 units is \$100 and his fixed costs are \$10. Then the firm's average variable cost of producing 10 units is:

- A. \$10
- B. \$90
- C. \$9
- D. \$1

ix. As increasing amounts of a good are produced, the marginal cost of production tends to

- A. rise
- B. fall
- C. remain constant
- D. change unpredictably

x. Costs that are independent of the firm's level of output are called

- A. fixed costs.
- B. marginal costs.
- C. opportunity costs.
- D. sunk costs.