

ECON 310  
Assignment #2

Use the following information for problems 1-3. Alice consumes goods X and Y. Alice's utility function is given by  $U=X^2*Y$ . From this equation, we know that  $MU_x=2XY$  and  $MU_y= X^2$ .

1. Suppose Alice has an income of \$120, the price of X,  $P_x = \$8$ , and the price of Y,  $P_y = \$2$ .

- 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.

$$120=8X + 2Y, \text{ so } Y= 60 - 4X$$

*Y-intercept: (0, 60)*

*X-intercept: (15,0)*

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

$$MV_{xy}= P_x/P_y = 4$$

- iii. What is the optimal bundle of X and Y? ( Hint, use two equations: the budget constraint and the relationship between the indifference curve and budget constraint at the optimal point)

*Equation 1: budget line,  $Y= 60-4X$*

*Equation 2: comes from  $MU_x/MU_y = P_x/P_y$*

$$2XY/X^2 = 8/2$$

$$2Y/X=4$$

$$2Y=4X$$

$$Y=2X$$

*Combine Eq 1 with Eq 2:  $2X = 60 - 4X$*

$$6X = 60$$

$$X = 10$$

$$Y = 2(10) = 20$$

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

$$U=X^2*Y = (10)^2 * 20 = 100*20 = 2000$$

2. 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.

$$60 = 8X + 2Y, Y = 30 - 4X$$

*y-intercept: (0,30)*

*x-intercept: (7.5, 0)*

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

*Eq 1: NEW budget line:  $Y = 30 - 4X$*

*Eq 2: Stays the same, because  $MU_x, MU_y, P_x, P_y$  haven't changed!*

*Combine Eq 1 and Eq 2:  $2X = 30 - 4X$*

$$6X = 30$$

$$X = 5$$

$$Y = 10$$

- iii. Is X a normal or inferior good?

*Good X is normal. When I fell, Y fell.*

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

$$U=X^2*Y = (5)^2 * 10 = 25*10 = 250$$

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

*2 Pts:  $(X, I) = (10, 120)$  &  $(5, 60)$*

$$\text{Slope: } 120-60/(10-5) = 60/5 = 12$$

$$I = mX + b$$

$$120 = (12)(10) + b$$

$$120 = 120 + b$$

$$b = 0$$

Engel Curve Equation:  $I = 15X$

- vi. When her income changes from \$120 to \$60, what is Alice's income elasticity of demand in this region?

$$\frac{\%change X}{\%change I}$$

$$[(5-10)/10]/[(60-120)/120] = -.5/-.5 = 1$$

3. Now, suppose the price of good X decreases from \$8 to \$4, 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.

$$120 = 4X + 2Y, Y = 60 - 2X$$

y-intercept: (0,60)

x-intercept: (30, 0)

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

Eq 1: NEW budget line:  $Y = 60 - 2X$

Eq 2: Prices have changed, so need to change second equation

$$MU_x/MU_y = P_x/P_y$$

$$2XY/X^2 = 4/2$$

$$2Y/X = 2$$

$$2Y = 2X$$

$$Y = X$$

Combined Eq 1 and Eq 2:  $X = 60 - 2X$

$$3X = 60$$

$$X = 20$$

$$Y = 20$$

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

Non-giffen.  $P_x$  went down and quantity demanded went up, so law of demand holds.

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

$$U = X^2Y = (20)^2 * 20 = 400 * 20 = 8000$$

- v. Construct Alice's linear demand curve for good X from these 2 points. 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. )

2 points (Q,P) = (10, 8) & (20,4)

Slope:  $(8-4)/(10-20) = -4/10 = -2/5$

$$P = -2/5 * Q + b$$

$$8 = -2/5(10) + b$$

$$8 = -4 + b$$

$$12 = b$$

$$p = -2/5Q + 12$$

- vi. What is Alice's price elasticity of demand for good X? Is Alice's demand elastic or inelastic?

$$PE = [(20-10)/10]/[(4-8)/8] = 1/(-.5) = -2, \text{ so elastic.}$$

4. 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. 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. 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?

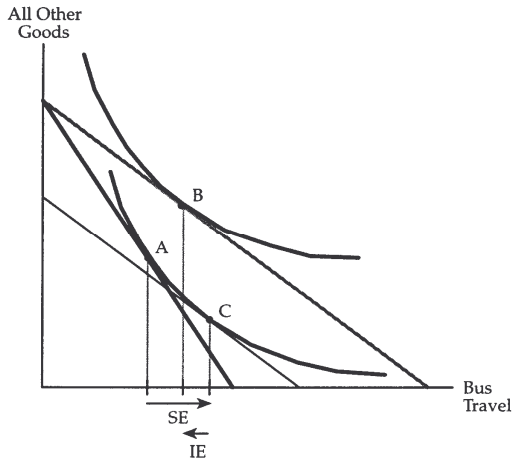
*Principle says produce where MR=MC, so produce 3 units*

- 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.*

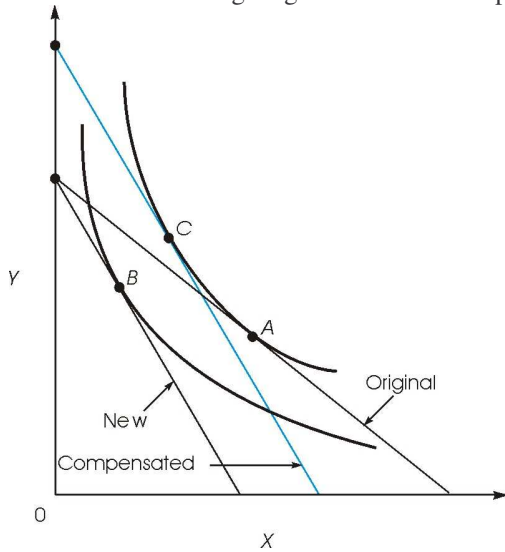
7. Suppose the demand curve for bus travel is downward sloping, and the income elasticity of demand for bus travel is negative.

- (i) Design an indifference curve-budget line diagram showing the substitution and income effects created when the price of bus travel falls. In your diagram, place bus travel on the horizontal axis and all other goods on the vertical axis. Assume the substitution effect is larger than the income effect.



8. Multiple Choice:

Refer to the following diagram for the next 4 problems



- a. When the budget line shifts from the "Original" to the "New", the price of \_\_\_\_.
- X increases.*
  - X decreases
  - Y increases
  - Y decreases

b. 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

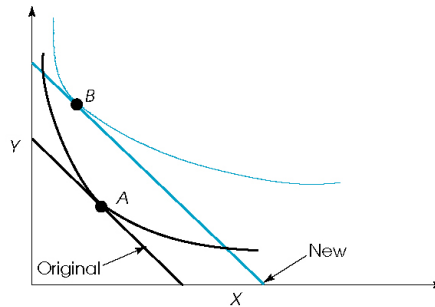
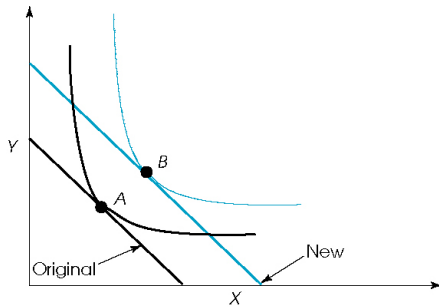
c. The move from C to B with respect to the quantity of good X refers to the

- A. Substitution Effect
- B. **Income Effect**
- C. Can't tell

d. 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:



e. 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

f. 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

g. 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

h. 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

- i. As increasing amounts of a good are produced, the marginal cost of production tends to
- rise**
  - fall
  - remain constant
  - change unpredictably
- j. Costs that are independent of the firm's level of output are called
- fixed costs.**
  - marginal costs.
  - opportunity costs.
  - sunk costs.
- k. If an activity is worth pursuing at all, then it should be pursued up to the point where
- total cost equals total benefit.
  - average cost equals average benefit.
  - marginal cost equals marginal benefit.**
  - sunk costs equal zero.
- l. If a firm's marginal cost exceeds its marginal revenue, then
- the firm's profit is negative (i.e., the firm is suffering losses).
  - the firm should shut down its operations.
  - cutting back production will increase the firm's profit.**
  - the firm should reduce its per-unit cost by increasing its output.

### Marginal Cost of Production

The following questions refer to the following table which shows a firm's marginal cost of production.

Quantity (number of units)	1	2	3	4	5	6	7	8
Marginal Cost (dollars per unit)	3	4	6	9	13	18	24	31

- m. Refer to Marginal Cost of Production. Suppose the firm has \$20 in fixed costs. Its total cost of producing 4 units of output is
- \$29.
  - \$33.
  - \$56.
  - \$42.**
- n. Refer to Marginal Cost of Production. Suppose demand for the firm's product is horizontal at a price of \$18 per unit. How much output should the firm produce in order to maximize its profit?
- 3 units.
  - 4 units.
  - 6 units.**
  - 7 units.
- o. Refer to Marginal Cost of Production. Suppose the firm has \$20 in fixed costs, and demand for the firm's product is horizontal at a price of \$18 per unit. What is the firm's maximum profit?
- \$33.
  - \$35.**
  - \$73.
  - \$88.

p. Refer to Marginal Cost of Production. Suppose the firm's fixed costs increase to \$60, and demand for the firm's product remains horizontal at a price of \$18 per unit. What is the firm's maximum profit?

a. \$-7.

**b. \$-5.**

c. \$33.

d. \$48.

q. Refer to Marginal Cost of Production. If the firm has \$20 in fixed costs, producing 4 units generates variable costs of

**a. \$22.**

b. \$35.

c. \$42.

d. \$55.