

Name: Answer Key Student #: \_\_\_\_\_

UNIVERSITY OF WESTERN ONTARIO  
LONDON ONTARIO

ECONOMICS 2150b-001  
MIDTERM #2  
Version 111

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March 2011

INSTRUCTIONS:

1. The exam is *two hours* long.
2. The exam consists of *19 multiple choice questions and 5 problems*.

The multiple choice questions are worth TWO marks each, totalling 38 marks. The marks for each problem appear in brackets above each question and beside each sub-part, totalling 48 marks. The exam totals 86 marks.

3. Record your *name* and *student number* on the question paper and Scantron sheet.

There are *several versions* of the exam. Check to make sure that the precoded version number on the Scantron sheet matches the version of the exam you are writing. Students attempting to alter the code on their Scantron sheet or to write an exam with a code that is different than the one on their Scantron sheet will be considered as having cheated and subject to academic sanctions.

4. Answers to the multiple choice questions should be recorded on *both* the Scantron sheet and the question paper (because only the question paper will be returned to you). *You must have your answers recorded on the Scantron sheet in the allotted time.*

Answers to the problems are to be recorded on the question paper.

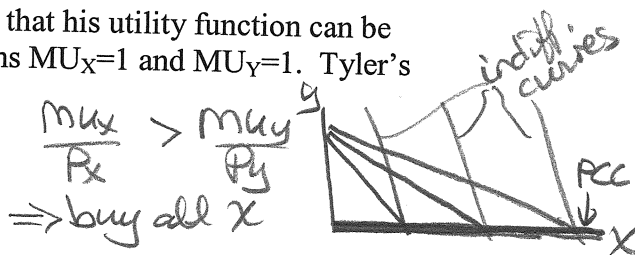
***Scrap booklets are for rough work only; THEY WILL NOT BE MARKED.***

5. Round all answers to *two decimal places*.
6. ***Hand in ALL materials***, including question paper, Scantron sheet, and scrap booklets.
7. GOOD LUCK!

**Part I: Multiple choice. Each question is worth TWO marks. Circle the correct answer. Also record your answer on the Scantron sheet.**

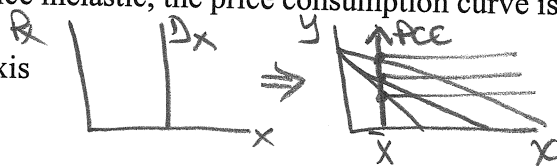
1. Suppose that X and Y are perfect substitutes for Tyler so that his utility function can be written  $U=X+Y$ , with associated marginal utility functions  $MU_X=1$  and  $MU_Y=1$ . Tyler's price consumption curve for X when  $P_X$  is less than  $P_Y$  is:

- A. a vertical line  
 B. a diagonal line given by  $Y=1/X$   
 C. a horizontal line along the X axis  
 D. a diagonal line given by  $Y=X$



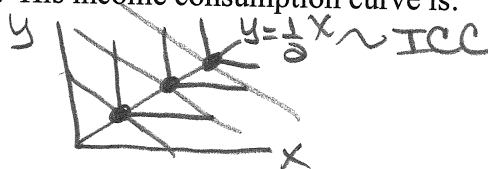
2. If the demand for X is perfectly price inelastic, the price consumption curve is:

- A. a vertical line  
 B. a horizontal line along the X axis  
 C. a 45° line  
 D. a diagonal line given by  $P=X$



3. Leo's utility function is  $U=\min(X,2Y)$ . His income consumption curve is:

- A. a vertical line  
 B. a horizontal line  
 C. a 45° line  
 D. a diagonal line given by  $Y=X/2$



4. Marlene's utility function is  $U=X^2Y$ , with associated marginal utility functions  $MU_X=2XY$  and  $MU_Y=X^2$ . She has income I and faces prices  $P_X$  and  $P_Y$ . What fraction of her income does Marlene spend on good X?

- A. 0.5  
 B. 0.33  
 C. 0.67  
 D. 0.75  
 E. 1.0

$$X = \frac{C}{d} \frac{I}{P_X} \Rightarrow \frac{P_X X}{I} = \frac{C}{C+d} = \frac{2}{2+1} = \frac{2}{3} = 0.67$$

5. Individual demand for an inferior good that is not a Giffen good is:

- A. Downward-sloping  
 B. Upward-sloping  
 C. Vertical  
 D. Horizontal

6. A good with a positive price elasticity of demand has an individual demand that is:

- A. Downward-sloping  
 B. Upward-sloping  
 C. Vertical  
 D. Horizontal

7. Suppose the market for movie rentals has two types of consumers, adults and seniors. Suppose further that there are 300 adults and 200 seniors. The demand curve for movie rentals by *each* adult is  $Q=150-P$  and the demand for movie rentals by *each* senior is  $Q=150-0.5P$ . What is the aggregate demand for this market?

- A.  $Q_M=300-1.5P$  for  $P \leq 150$   
 B.  $Q_M=150-P$  for  $75 < P \leq 300$   
 C.  $Q_M=300-1.5P$  for  $P \leq 75$  and  $Q_M=150-P$  for  $75 < P \leq 150$   
 D.  $Q_M=45000-300P$  for  $P \leq 300$   
 E.  $Q_M=75000-400P$  for  $P \leq 150$  and  $Q_M=30000-100P$  for  $150 < P \leq 300$

$$Q_A = 300(150 - P) = 45000 - 300P \quad v.i. = 150$$

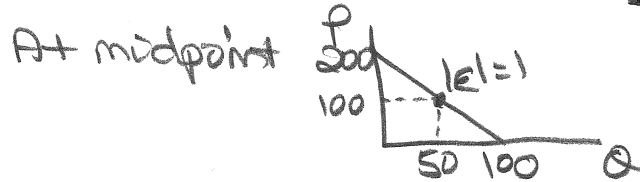
$$Q_S = 200(150 - 0.5P) = 30000 - 100P \quad v.i. = 300$$

$$Q_M = 75,000 - 400P \quad \text{for } P \leq 150$$

$$Q_M = 30000 - 100P \quad \text{for } 150 < P \leq 300$$

8. Suppose the demand curve in a particular market is given by  $Q=100-2P$ . At what quantity will demand be unitary elastic?

- A. 100  
 B. 25  
 C. 50  
 D. 10  
 E. 0



Use the following information to answer the next *two* questions:

Suppose demand for good X is  $Q_x=400-2P_x-4P_y-0.10I$ , where  $P_x$  is the price of good X,  $P_y$  is the price of good Y, and  $I$  is income. Assume that  $P_x$  is currently \$20,  $P_y$  is currently \$5, and  $I$  is currently \$100.

9. What is the own price elasticity of demand for good X at the current situation?

- A. +1.40  
 B. +0.15  
 C. -5  
 D. -0.71  
 E. -0.12

$$\epsilon = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x}{Q_x} = -2 \times \frac{20}{330} = -0.12$$

10. What is the income elasticity of demand for good X at the current situation?

- A. -1.0  
 B. -0.03  
 C. +0.41  
 D. +1.8  
 E. +100

$$\epsilon = \frac{\Delta Q_x}{\Delta I} \cdot \frac{I}{Q_x} = -0.10 \times \frac{100}{330} = -0.03$$

11. Jill pays a price of \$5 per gallon of ice cream. When the price decreases to \$3, her monthly total expenditure on ice cream increases. What does this imply about her price elasticity of demand for ice cream?

- A. It is perfectly inelastic.
- B. It is unitary elastic.
- C. It is inelastic.
- D. It is elastic.

$$TE = \downarrow P \times \uparrow Q$$

12. A firm is required to produce 10 units of output using quantities of labour and capital  $(L,K)=(3,2)$ . For which of the following production functions is the input combination technically efficient?

- (1)  $Q=20\min(\frac{1}{3}L, \frac{1}{2}K)$
- (2)  $Q=LK^2$
- (3)  $Q=2L + 2K$

- A. 1, 2 and 3
- B. 1 and 2
- C. 1 and 3
- D. 2 only
- E. 3 only

$$Q = 20\min(\frac{1}{3}(3), \frac{1}{2}(2)) = 20\min(1, 1) = 20 \text{ too much}$$

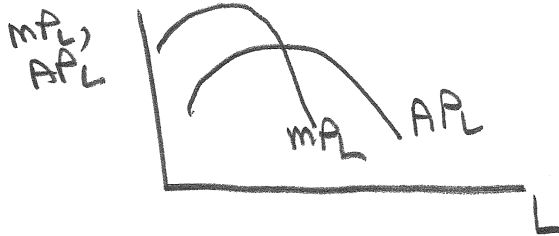
$$Q = (3)(2)^2 = 12 \text{ too much}$$

$$Q = 2(3) + 2(2) = 10 \checkmark$$

13. Identify the truthfulness of the following statements.

- I. If marginal product of labour is falling, then average product of labour must also be falling. **False**
- II. If marginal product of labour is greater than average product of labour, then average product must be rising.

- A. Both I and II are true.
- B. Both I and II are false.
- C. I is true; II is false.
- D. I is false; II is true.



14. For the production function  $Q=10L^{3/4}K^{1/4}$ , the equation for a typical isoquant is

- A.  $K=Q/10L^{1/2}$
- B.  $K=Q^2/100L^{3/2}$
- C.  $K=Q^2/L$
- D.  $K=Q^4/10000L^3$
- E.  $K=Q/1000L^{3/4}$

$$K^{1/4} = \frac{Q}{10L^{3/4}}$$

$$K = \left(\frac{Q}{10L^{3/4}}\right)^4$$

$$= \frac{Q^4}{10^4 (L^{3/4})^4}$$

$$= \frac{Q^4}{10000L^3}$$

15. Consider the production function  $Q=4L^2K^3$ , where  $MP_L=8LK^3$  and  $MP_K=12L^2K^2$ . The  $MRTS_{L,K}$  is

- A.  $3L/2K$
- B.  $4L/K$
- C.  $12K/8L$
- D.  $2K/3L$
- E.  $3/2$

$$MRTS = \frac{MP_L}{MP_K} = \frac{8LK^3}{12L^2K^2} = \frac{2}{3} \frac{K}{L}$$

16. Suppose that in a particular production process, labour and capital are perfect substitutes so that 3 units of labour are equivalent to 6 units of capital in producing 2 units of output. Which function best represents this production process:

- A.  $Q = \min(\frac{2}{3}L, \frac{1}{3}K)$
- B.  $Q = \min(3L, 6K)$
- C.  $Q = 2L^3 K^6$
- D.  $Q = 3L + 6K$

$$Q = D(A L + B K)$$

$$Q = D(2L + K)$$

either  $Q = D \cdot 2(3)$

$$2 = D \cdot 6 \Rightarrow D = \frac{1}{3}$$

$$Q = D(6)$$

$$2 = D(6) \Rightarrow D = \frac{1}{3}$$

$$\therefore Q = \frac{1}{3}(2L + K) = \frac{2}{3}L + \frac{1}{3}K$$

E.  $Q = \frac{2}{3}L + \frac{1}{3}K$

17. Suppose that in a particular production process, exactly 3 workers and 6 machines are required to produce 2 units of output. Which function best represents this production process:

- A.  $Q = \min(\frac{2}{3}L, \frac{1}{3}K)$
- B.  $Q = \min(3L, 6K)$
- C.  $Q = 2L^3 K^6$
- D.  $Q = 3L + 6K$
- E.  $Q = \frac{2}{3}L + \frac{1}{3}K$

$$K = 2L$$

$$Q = D \min(AL, BK)$$

$$Q = D \min(2L, K)$$

$$2 = D \min(2(3), 6)$$

$$2 = D \cdot 6 \rightarrow D = \frac{1}{3}$$

$$\therefore Q = \frac{1}{3} \min(2L, K)$$

or  $Q = \min(\frac{2}{3}L, \frac{1}{3}K)$

18. A firm operates with a technology that is characterized by a diminishing and continuously varying marginal rate of technical substitution. Which function best represents this production process.

A.  $Q = \min\left(\frac{2}{3}L, \frac{1}{3}K\right)$

B.  $Q = \min(3L, 6K)$

C.  $Q = 2L^3 K^6$

D.  $Q = 3L + 6K$

E.  $Q = \frac{2}{3}L + \frac{1}{3}K$

MRTS is either  $\infty$ , undefined or zero

MRTS is constant

19. Which of the following production functions exhibit constant returns to scale?

(1)  $Q = 20\min\left(\frac{1}{3}L, \frac{1}{2}K\right)$

(2)  $Q = LK^2$

(3)  $Q = 2L + 2K$

A. 1, 2 and 3

B. 1 and 2

C. 1 and 3

D. 2 only

E. 3 only

$\alpha + \beta > 1$   
 $\therefore$  IRTS

**Part II: Problems. Marks for each problem appear in brackets above each question and beside each sub-part. Record your answers directly on the question paper in the spaces provided.**

(8 marks)

1. Consider a consumer with an income of  $I=320$ , facing prices of  $P_X=1, P_Y=1$  and with utility  $U=12XY$  (and  $MU_X=12Y$  and  $MU_Y=12X$ ). Suppose prices rise so that the new prices become  $P_X=2$  and  $P_Y=4$ , but the consumer's income is indexed to the cost of living so that the budget line shifts out just enough that the old bundle (at the original prices) is just affordable. Answer the following questions:

- (2) a. The original consumption basket (basket A) has a  $(X,Y)$  coordinate of (160,160)
- (2) b. The final consumption basket (basket B) has a  $(X,Y)$  coordinate of (240,120)
- (2) c. The original budget line has a horizontal intercept of 320 and a vertical intercept of 320.
- (2) d. The final (cost of living adjusted) budget line has a horizontal intercept of 480 and a vertical intercept of 240.

$x = \frac{1}{2} \frac{320}{1} = 160$   
 $y = \frac{1}{2} \frac{320}{1} = 160$   
 $P_X X + P_Y Y = I + COLA$   
 $2(160) + 4(160) = 320 + COLA$   
 $COLA = 640$   
 $\therefore X = \frac{1}{2} \frac{(160 + 320)}{1}$   
 $y = \frac{2}{4} \frac{(160 + 320)}{1}$

(8 marks)

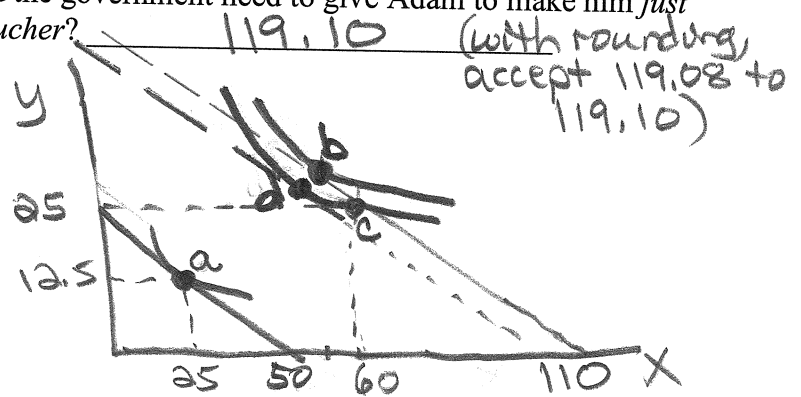
2. Adam consumes two goods, food X and clothing Y. Adam's utility function is  $U = XY$ , with  $MU_X=Y$  and  $MU_Y=X$ . Suppose the price of good X (food) is  $P_X = 2$ , the price of good Y (clothing) is  $P_Y = 4$ , and Adam's income is  $I = 100$ . Answer the following questions.

- (2) a. Adam's optimal consumption bundle has a  $(X,Y)$  coordinate of (25, 12.5)
- (2) b. Now suppose that the government gives Adam a \$120 income subsidy. Adam's new optimal consumption bundle will have a  $(X,Y)$  coordinate of (55, 27.5)
- (2) c. Now suppose that instead of the \$120 income subsidy the government gives Adam a \$120 food voucher that can be spent only on food (good X). Adam's new optimal consumption bundle will have a  $(X,Y)$  coordinate of (60, 25). (Careful: remember that  $P_X=2$ , so how many units of X can Adam buy with the voucher?)

$x = \frac{1}{2} \frac{100}{2} = 25$   
 $y = \frac{1}{4} \frac{100}{4} = 12.5$



(2)d. What amount of cash subsidy would the government need to give Adam to make him just as well off as with the \$120 food voucher?



① at c:  $U = XY = 60(25) = 1500$

②  $\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$   
 $\frac{y}{x} = \frac{2}{4} \Rightarrow y = \frac{1}{2}x$

③  $\Rightarrow 1500 = x(\frac{1}{2}x)$   
 $x = 54.77 \therefore y = 27.39$

$\Rightarrow 2(54.77) + 4(27.39) = 219.10$   
 $219.10 - 100 = 119.10$

(with rounding, accept 119.08 to 119.10)

$$\frac{MU_X}{P_X} \stackrel{?}{=} \frac{MU_Y}{P_Y} \Rightarrow \frac{6}{P_X} \stackrel{?}{=} \frac{10}{5} \Rightarrow P_X = 3$$

(13 marks)

3. Benjamin's utility function is  $U=6X+10Y$ , with  $MU_X=6$  and  $MU_Y=10$ . Suppose the price of good Y is  $P_Y=5$ , and Benjamin's income is  $I=30$ .

(5) a. If the price of good X is  $P_X$ , answer the following questions about the quantity demanded of X (remembering that the quantity demanded of X can be either a single number or a range of numbers):

When  $P_X=4$ , the quantity demanded of X is 0.

When  $P_X=3$ , the quantity demanded of X is  $0 \leq X \leq 10$ .

When  $P_X=2$ , the quantity demanded of X is 15.

When  $P_X=1$ , the quantity demanded of X is 30.

if  $P_X > 3$ ,  
buy all Y  
if  $P_X < 3$   
buy all X  
( $X = \frac{I}{P_X}$ )

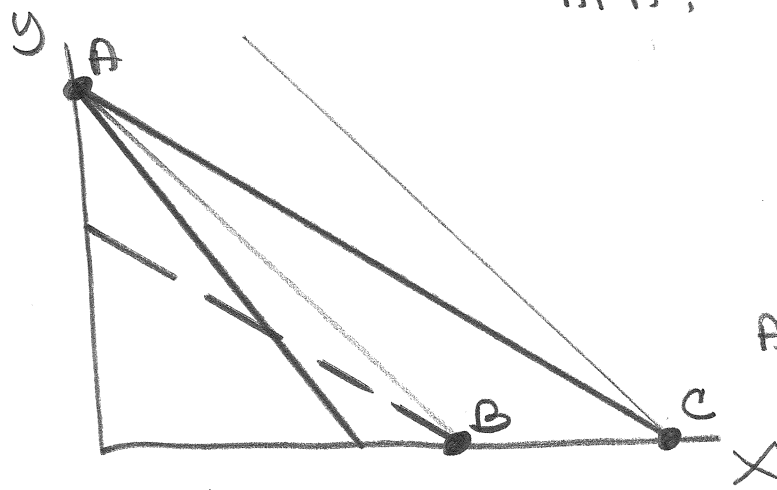
b. Let the price of X initially be  $P_X=5$ . Now suppose that Benjamin receives a subsidy of \$2.50 per unit of X purchased. Answer the following questions regarding the income and substitution effects of the price change.  $P_X=5 \rightarrow P_X=5-2.50=2.50$

(2) i. The original consumption basket (basket A) has a (X,Y) coordinate of (0, 6).

(2) ii. The final consumption basket (basket C) has a (X,Y) coordinate of (12, 0).

(2) iii. The Hicksian decomposition basket (basket B) has a (X,Y) coordinate of (10, 0).

(2) iv. The Hicksian decomposition budget line has a horizontal intercept of 10 and a vertical intercept of 5.



At A:

①  $5X + 5Y = 30$

②  $\frac{MU_X}{P_X} < \frac{MU_Y}{P_Y}$   
 $\therefore$  buy all Y  
( $X=0$ )

②  $\rightarrow$  ①  $5Y = 30$   
 $\Rightarrow Y = 6$

At C: ①  $2.5X + 5Y = 30$

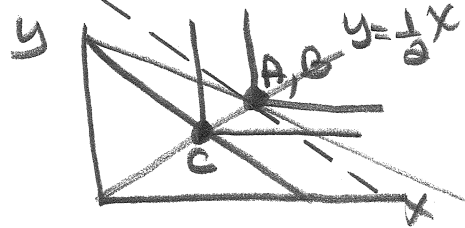
②  $\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$   
 $\therefore$  buy all X  
( $Y=0$ )

②  $\rightarrow$  ①  $2.5X = 30$   
 $\Rightarrow X = 12$

At B: ①  $U_{B=A} = 6(0) + 10(6) = 60$   
 $\therefore 60 = 6X + 10Y$

②  $\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$   
 $\therefore$  buy all X ( $Y=0$ )

②  $\rightarrow$  ①  $60 = 6X \Rightarrow X = 10 \Rightarrow 2.5(10) + 5(0) = I^{Dec} = 25$



(11 marks)

4. Peter has utility function  $U = \min(X, 2Y)$  and faces prices  $P_X = 1$ ,  $P_Y = 2$  and income  $I = 100$ . Now suppose that a tax of \$2 per unit of X purchased is imposed. Answer the following questions regarding the income and substitution effects of the price change.

$P_X = 1 \rightarrow P_X = 1 + 2 = 3$

$X = \frac{I}{P_X + \frac{1}{2}P_Y}$   
 $= \frac{100}{1+1}$

(2) a. The original consumption basket (basket A) has a (X,Y) coordinate of (50, 25).

(2) b. The final consumption basket (basket C) has a (X,Y) coordinate of (25, 12.5).

(2) c. The Hicksian decomposition basket (basket B) has a (X,Y) coordinate of (50, 25).

(2) d. The Hicksian decomposition budget line has a horizontal intercept of 66.67 and a vertical intercept of 100.

$X = \frac{I}{3+1}$   
 $= \frac{100}{4}$   
 $= 25$   
 $3(50) + 2(25) = 200$

(1) e. Is good X a normal good or inferior good ? (Circle the correct answer)

(1) f. Is good X an ordinary good or Giffen good ? (Circle the correct answer)

$X = \frac{I}{P_X + \frac{1}{2}P_Y}$

(1) g. Is the sign of the cross-price elasticity of demand for X positive or negative ? (Circle the correct answer)

(8 marks)

5. John purchases two goods, *Insulin* (Good X) and *Other Goods* (Good Y). John is a diabetic and requires 10 units of insulin per day to survive; any excess insulin is totally useless to him and any amount of insulin less than the required amount kills him. John prefers more to less of *Other Goods*. Suppose the price of *Other Goods* is  $P_Y = 1$  and John's income is  $I = 200$ . If the price of insulin *increases* from  $P_{X1} = 2$  to  $P_{X2} = 4$ , answer the following questions regarding the income and substitution effects of the price change.

(2) a. The original consumption basket (basket A) has a (X,Y) coordinate of (10, 180).

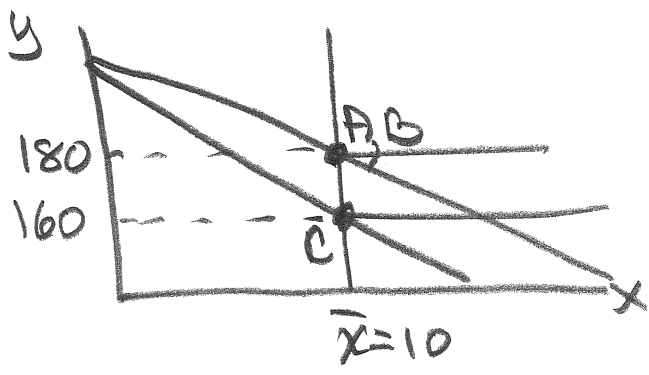
(2) b. The final consumption basket (basket C) has a (X,Y) coordinate of (10, 160).

(2) c. The Hicksian decomposition basket (basket B) has a (X,Y) coordinate of (10, 180).

(2) d. The Hicksian decomposition budget line has a horizontal intercept of 55 and a vertical intercept of 220.

$2\bar{x} + y = 200$   
 $2(10) + y = 200$   
 $\Rightarrow y = 180$

$4\bar{x} + y = 200$   
 $\Rightarrow y = 160$



$4(10) + 180 = 220 = I_{Dec}$