

Midterm ANSWER KEY.

Econ 101
Professor Guse

Monday October 15, 2007.

Instructions. You have 55 minutes to complete the exam. There are 55 points available. Please write your responses on the exam itself in the space provided. If you require additional space, write on the back of the page. You may refer only to your own handwritten, two-sided, “cheat sheet”. Calculators and all other references materials are *not* allowed. If a question asks for a numeric quantity you may leave your answer in expression form for full credit. (e.g. “ $\frac{40-30}{5}$ ” would be perfectly acceptable in place of “2”.) Be sure to label any diagrams you draw, to show your work and to explain your reasoning. Please turn in your cheat sheet with your exam. Thank you and good luck!

1. (5 Points) Define Average Product of Labor. $AP(L)$ **ANSWER:** Average Product of Labor is the average output produced by each unit of the input labor. Mathematically, if f is the production function, and (K, \dots) represents the levels of other possible inputs, then it is defined as follows

$$AP(L) = \frac{f(L, K, \dots)}{L}$$

$AP(L)$ can be seen graphically in a short-run total product curve by measuring the slope of a line connecting the origin to points on the curve.

2. (10 Points) For values of L where $AP(L)$ is greater than the marginal product of labor, $MP(L)$...

$MP(L)$ [must be¹] / [is typically²] [increasing]/[decreasing] while
 $AP(L)$ [must be]/[is typically] [increasing]/[decreasing].

For each slash, “/”, circle one option on either side of it - or simply write a sentence using those options. Explain briefly, using a diagram, if helpful.

ANSWER: For values of L where $AP(L)$ is greater than the marginal product of labor, $MP(L)$ *is typically decreasing* while $AP(L)$ *must be decreasing*. Why? First for the same reason that a new grade below your GPA pulls your GPA down, the average product of labor, $AP(L)$, must be decreasing when the marginal product of labor $MP(L)$ is below it. This is a mathematical necessity: marginals below the average pull the average down; marginals

¹“must be” = regardless of the underlying production function

²“typically” = in the case of the classical production function studied in class.

above the average pull the average up. That said, just because the marginal is below the average does not necessarily mean that the marginal itself is decreasing. However, in the case of the classical production function – in which the marginal product initially increases and then decreases, never to increase again – this is, in fact true. This is because, in that case, the average will initially increase lagging behind the marginal, until the marginal falls below the average and as mentioned, since the marginal never increases again, it certainly does not behind their intersection. **GRADING:** A good picture of the classical MP and AP curves would serve as sufficient explanation of the second point.

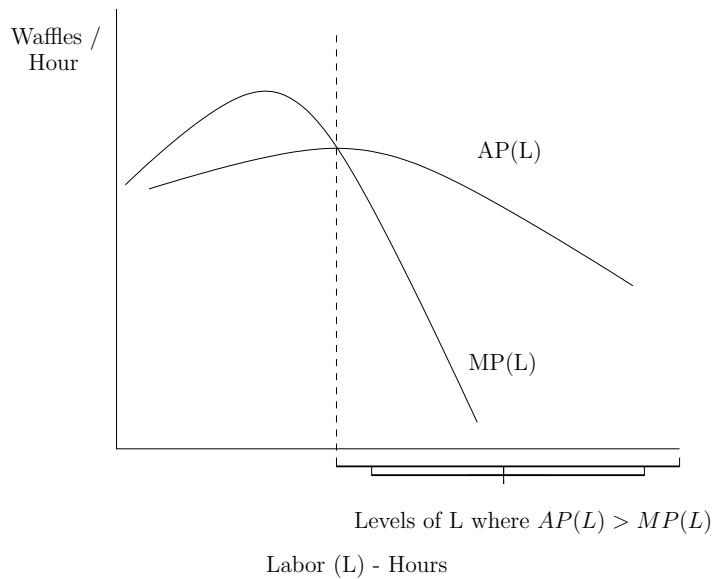


Figure 1. Classical shapes of Marginal and Average Product Curves.

3. (15 Points) Marc has \$300 to spend on mice and test-tubes. The price of mice is \$1 each. Test-tube are \$2 each. Marc decides to buy 100 mice.

(a) (5 Points) Draw a budget line showing the choices available to Marc and mark his choice. Be sure to indicate how many test-tubes he bought.

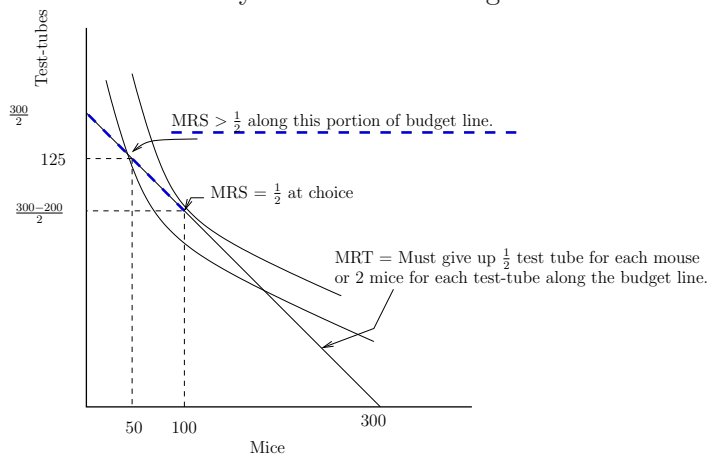


Figure 2. Marc's Budget Line and Optimal Choice.

- (b) (10 Points) Suppose instead of \$300 Marc was given 50 mice and 125 test-tubes. What can you say about Marc's willingness to trade mice for additional test-tubes? (i.e. How many test-tubes would he ask for in exchange for one of his mice?) Hint: an exact answer may not be possible. **ANSWER.** As we can see on the picture above. His MRS cannot be smaller than $\frac{1}{2}$ at the point (50,125). Therefore he is willing to give-up *more* than $\frac{1}{2}$ test-tube for a mouse from this point. Put in the way the question poses it, the most mice Marc is willing to give up in exchange for a test-tube is *less* than 2 from this point. In other words, he may still be willing to trade away mice for more test-tubes, but just not as many mice as the market prices stated in the first part of the problem imply.
4. (15 Points) Suppose that Zach's Clothes Pins, Inc. has, in the short run, a fixed level of capital investment in pin-making equipment worth \$80. Meanwhile labor (L) is a variable input for Zach's. For their current capital investment, the maximum of Zach's AP(L) curve is 50 pins / hour. Assume the wage is \$10/hour and the price of additional capital is \$1 / unit.
- (a) (10 Points) How many clothes pins will Zach produce if the price of clothes pins is \$0.15 per pin. Explain. **ANSWER.** Remember $AVC = \frac{w}{AP}$. Since the maximum of the AP(L) curve is 50 pins per hour, this means that the minimum point of the Average Variable Cost curve, $AVC(Q)$, must be \$0.20 per pin. Recall also that the minimum of the Average Variable Cost corresponds to the firm's short-run shutdown price. Hence if the going price of pine is only \$0.15 per pin, the best (profit-maximizing) thing to do is to make 0 pins.
- (b) (5 Points) What is Zach's profit when the price is \$0.15? **Answer.** The profit of making 0 pins is exactly -\$80, since they still must pay the cost of capital which is said to be fixed.
5. (15 Points) The diagram below shows Al and Betty's combined daily PPF for crepes (C) and dijon mustard (D). Al's individual PPF for these two good is also shown in the same picture. Assume that both individual and combined PPFs represents the production possibilities when the agents work alone.³

³In other words, the combined PPF does not represent any possible complementarities from having Al and Betty work together in a production process.

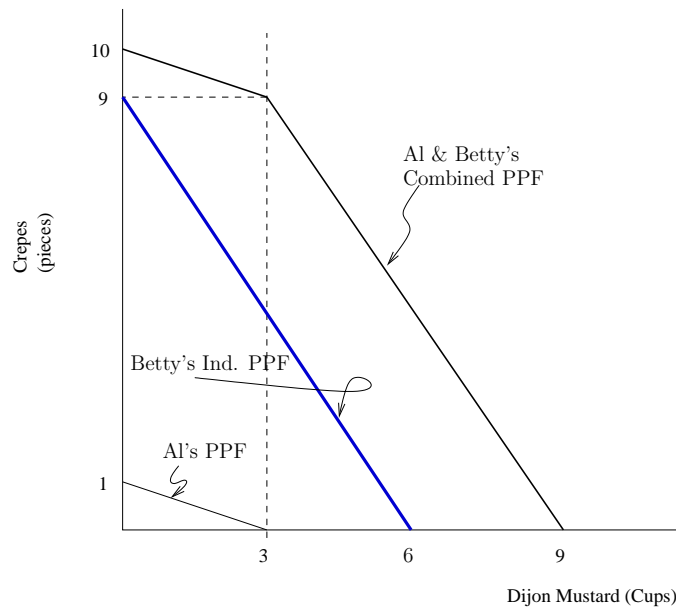


Figure 3.

- (a) (6 Points) Draw Betty's individual PPF for crepes and dijon mustard (in the same diagram, if possible).
- (b) (1 Point) Al has a comparative advantage in the production of ... **ANSWER:** Mustard. At the margin, only $\frac{1}{3}$ of a crepe is lost for each additional cup of Mustard Al produces. Meanwhile $\frac{3}{2}$ crepes are lost for each cup of mustard made by Betty. Hence the opportunity cost in terms of crepes of Al making mustard is lower and he, therefore, has a comparative advantage in Mustard.
- (c) (1 Point) Betty has a comparative advantage in the production of ... **ANSWER.** Conversely Betty has the CA in crepe production. For each Crepe she makes only $\frac{2}{3}$ of a cup of mustard is lost, while 3 cups must be given up when Al devotes time to making a crepe.
- (d) (7 points) Explain answers. **ANSWER.** See above.