

Homework 4
Econ 361
Intermediate Microeconomic Analysis
Spring 2012
30 points

1. (5 points) If an input exhibits diminishing marginal returns does this mean that as the quantity of the input is increased, the quantity of output falls?

No. The change in output with respect to the change in one input, holding all other inputs constant, is the marginal return of the input (e.g. dq/dL). This can be a positive number (an increase in labor increases output) but increase at a decreasing rate (one additional worker increases output by less than the previous worker did). This is common, as crowding capital with more workers pulls less and less additional output from each additional worker.

2. (5 points) Holding all other inputs constant, if the marginal product of labor is falling, must the average product of labor also be falling?

No. If MPL is falling, MPL need not be falling. However, if APL is falling, then the MPL must be below the average product of labor. What matters is the value of the MPL relative to the average product of labor, not the trend in MPL:

If $MPL > APL$, APL is rising.

If $MPL < APL$, APL is falling.

3. (5 points) In production with one variable input, is the steepest point of the total product curve the point of highest average product?

No.

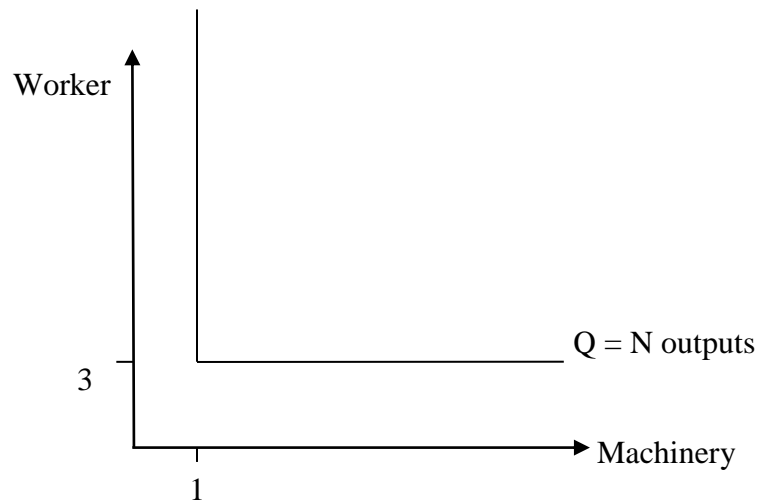
$$AP = TP / L$$

$$MP = dQ/dL$$

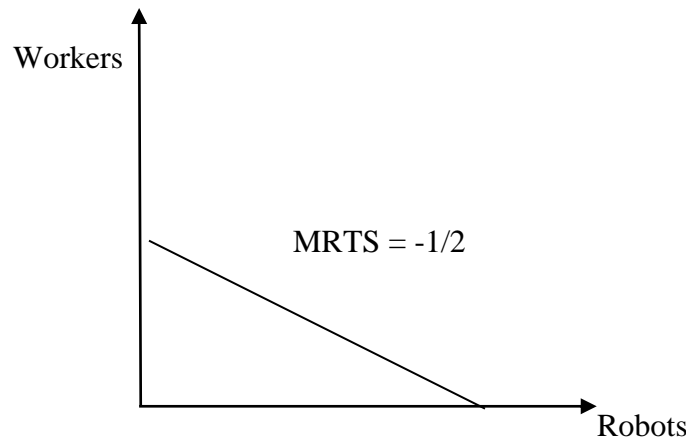
The APL continues to rise while the MPL is falling as long as the MPL is above the APL. APL equals to the slope of the line from origin to the point on the TP curve. The steepest point of the TP curve, reflected by the slope of the tangent line of the point on TP curve, represents the highest MPL, not APL.

4. (15 points) For each of the following examples, draw a representative isoquant. What can you say about the marginal rate of technical substitution in each case?

a. A firm requires exactly three workers to operate each piece of machinery in the factory.



b. A firm can always trade one worker for two robots and hold output constant.



The MRTS is constant, as workers and robots are perfect substitutes.

c. A firm can hire only college students to produce its output, or it can hire some combination of college and high school student employees. For each college student employee let go, the firm must hire an increasing number of high school employees to maintain the same level of output.

Place high school students on the vertical axis and college students on the horizontal. The slope of the isoquant measures the number of high school students that can be exchanged for a college student while still maintaining output. At the bottom end of the isoquant, at point A, the isoquant hits the college student's axis because it is possible to produce with college students only and no high school students. As we move up the isoquant and give

up college students, we must hire more and more high school students to replace each college student. This happens when there are diminishing marginal returns to an input. The slope increases (in absolute value) as we move up the isoquant. The isoquant is therefore convex and there is a diminishing marginal rate of technical substitution.

