

## Production in the Short Run Practice

Chapter 7 (Lipsey, Ragan, Storer, 2008)

### Question 1

- a. production function
- b. economic profits; opportunity cost
- c. short run; long run

### Question 2

- a. law of (eventually) diminishing returns (to the variable factor)
- b. marginal product (of the variable factor)
- c. above; as long as; below

### Question 3

- a. minimum
- b. increase
- c. capacity

### Question 7

- a. The average product of labor is equal to total output divided by the number of units of labor input. The values are shown in the table below and the *AP* curve is plotted in the figure below.
- b. The marginal product of labor is equal to the *change* in total output divided by the *change* in labor input that brought it about. In the table above, we compute the marginal product according to the change in values from one row to the next, so the first row is left empty. The *MP* curve is plotted in the figure above. Note that the values are plotted at the midpoints of the units of labor.

### Average Product Marginal Product

$$AP = 200/100 = 2.0$$

$$AP = 260/120 = 2.17 \quad MP = 60/20 = 3.0$$

$$AP = 350/140 = 2.5 \quad MP = 90/20 = 4.5$$

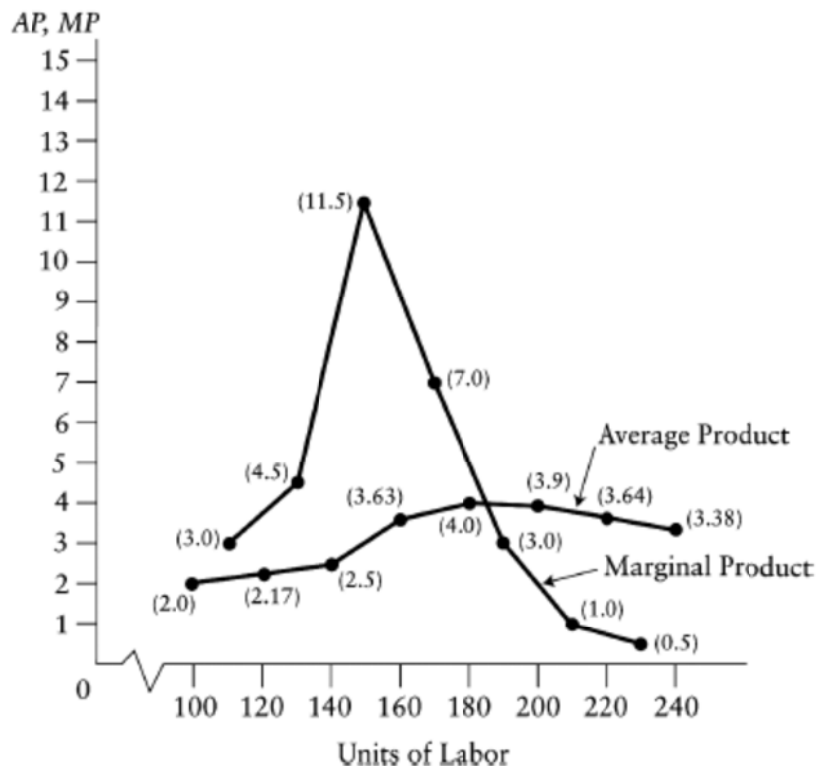
$$AP = 580/160 = 3.63 \quad MP = 230/20 = 11.5$$

$$AP = 720/180 = 4.0 \quad MP = 140/20 = 7.0$$

$$AP = 780/200 = 3.9 \quad MP = 60/20 = 3.0$$

$$AP = 800/220 = 3.64 \quad MP = 20/20 = 1.0$$

$$AP = 810/240 = 3.38 \quad MP = 10/20 = 0.5$$



c. The law of diminishing marginal returns is satisfied for labor because (eventually) the marginal product of labor falls as more and more labor is used.

d. As we explained in the text, the average product of labor can only rise if the marginal product exceeds the average product. This relationship is seen clearly in the figure for levels of labor input below 180. Similarly, the average product of labor only falls when the marginal product is less than the average product, as seen in the figure for values of labor above 180. It follows that the *MP* curve must intersect the *AP* curve at its maximum, as shown in the figure.

### Question 8

a. Average fixed cost (*AFC*) is equal to total fixed cost (*TFC*) divided by the level of output. The values for *AFC* are shown in the table below.

b. Average variable cost (*AVC*) is equal to total variable cost (*TVC*) divided by the level of output. The values for *AVC* are shown in the table below.

c. Average total cost (*ATC*) is equal to total cost (*TVC* + *TFC*) divided by the level of output.

The values for *ATC* are shown in the table below. The firm's "capacity" is the level of output at which *ATC* is minimized, which in this case is 8 (thousands) bicycles per year.

Output (000s per year)	AFC Average Fixed Cost (\$)	AVC Average Variable Cost (\$)	ATC Average Total Cost (\$)
1	$200/1 = 200$	$40/1 = 40$	240
2	$200/2 = 100$	$70/2 = 35$	135
3	$200/3 = 66.7$	$105/3 = 35$	101.7
4	$200/4 = 50$	$120/4 = 30$	80
5	$200/5 = 40$	$135/5 = 27$	67
6	$200/6 = 33.3$	$155/6 = 25.8$	59.1
7	$200/7 = 28.6$	$185/7 = 26.4$	55.0
8	$200/8 = 25$	$230/8 = 28.8$	53.8
9	$200/9 = 22.2$	$290/9 = 32.2$	54.4
10	$200/10 = 20$	$350/10 = 35$	55
11	$200/11 = 18.2$	$425/11 = 38.6$	56.8

d.

