

ANSWERS to Homework 4. Short-Run Supply

Econ 101 Professor Guse

Fall, 2006. Due Oct 17.

1. Lena's Llamas makes fine wool (H) using land (A) and labor (L). If Lena rents 10 acres of land, her output will be given according to the following schedule. Suppose the price of wool is \$10 per pound and wages are \$30 per hour. Land rents for \$10 per acre.

Labor (Hours)	Output (Pounds)	Marg Prod	Avg Prod	Tot. Cost	Marg Cost	Avg VC
0	0					
1	5	5	5.0	130	6	6
2	12	7	6.0	160	4.3	5
3	20	8	6.3	190	3.75	4.5
4	28	8	7.0	220	3.75	4.3
5	35	7	7.0	250	4.3	4.3
6	40	5	6.7	280	6	4.5
7	44	4	6.3	310	7.5	4.77
8	48	4	6.0	340	7.5	5.0
9	50	2	5.5	370	15	5.4
10	51	1	5.1	400	30	5.9
11	51	0	4.6			

- (a) Sketch the total product curve associated with 10 acres of land. **ANSWER:** A diagram with Labor on the horizontal axis and Output on the vertical axis plotting the points from those two columns in the table above.

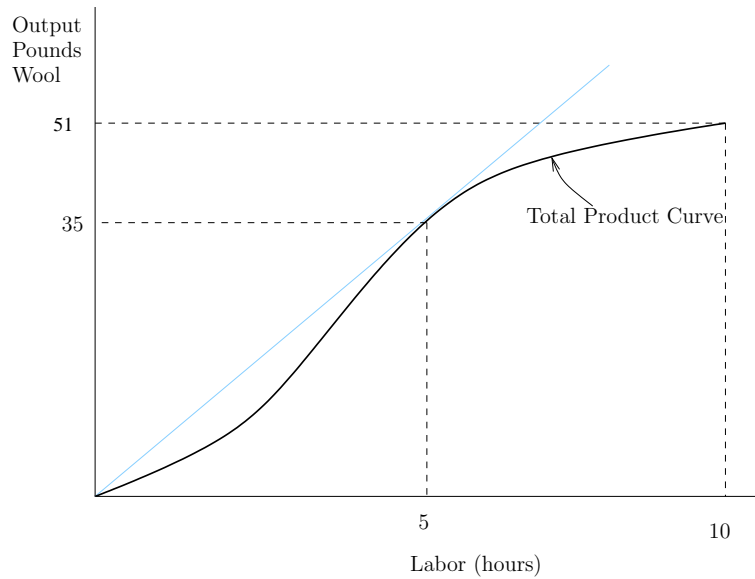


Figure ?? . Lena's Total Product Curve For Wool. Note that a line connecting the point (5, 35) back to the origin is just tangent to the curve. What is the significance of this? Would this be true at other points?

- (b) Sketch the marginal product and average product curves associated with 10 acres of land. **ANSWER:** A diagram with Labor on the horizontal axis and pounds / hour on the vertical axis with two graphs, one plotting the points from labor and marg product columns, the other plotting the point from the labor and average product columns in the table above.

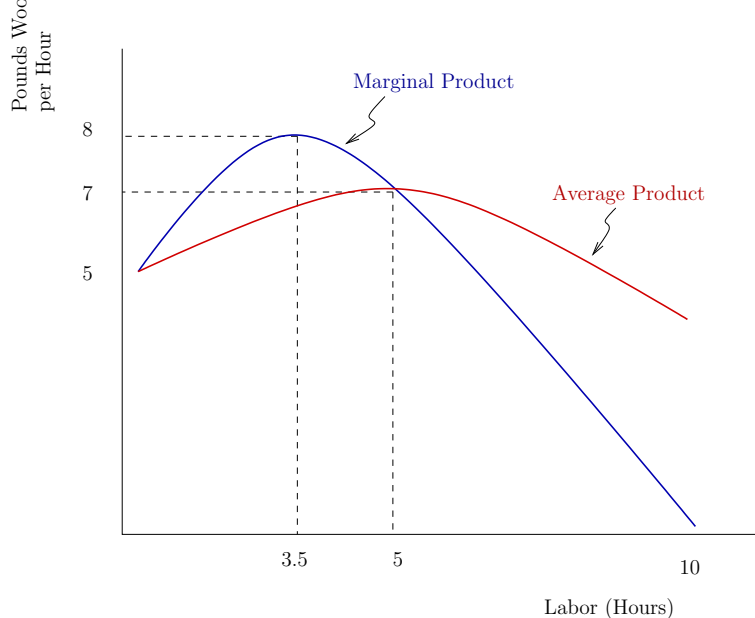


Figure ?? . Marginal and Average Produce of Labor Curves. Note from the table that marginal product reaches a peak of 8 pounds per hour somewhere between the 3rd and 4th hour of labor. Also note that AP reaches a maximum value of 7 pounds per hour at the 5th hour of labor where is crosses the MP curve. How does this relate to the previous figure?

- (c) Ole says to Lena after she rents the ten acres, “I betcha hire at least five hours labor for this operation or none at all”. Would you take Ole’s bet. Explain. (Hint answer this question last and then explain why you could have answered it at this point in your analysis.) **ANSWER:** Ole is correct. The stage of production reach after 5 units of labor and 35 units of output is the shutdown point. If you saved this question for last you know this is point where MC and AVC are equal - both at \$7 per pound. In other words if Lena gets a price for her ouput greater than \$7 per pounds she will hire at least 5 hours of labor. If not, she will shutdown. You could have confirmed Ole’s conjecture without knowing the MC and AVC functions, since this point must also correspond to the point where MP equals AP. Remember $MC = \frac{w}{MP}$ while $AVC = \frac{w}{AP}$.
- (d) Sketch Lena’s short-run total cost curve.

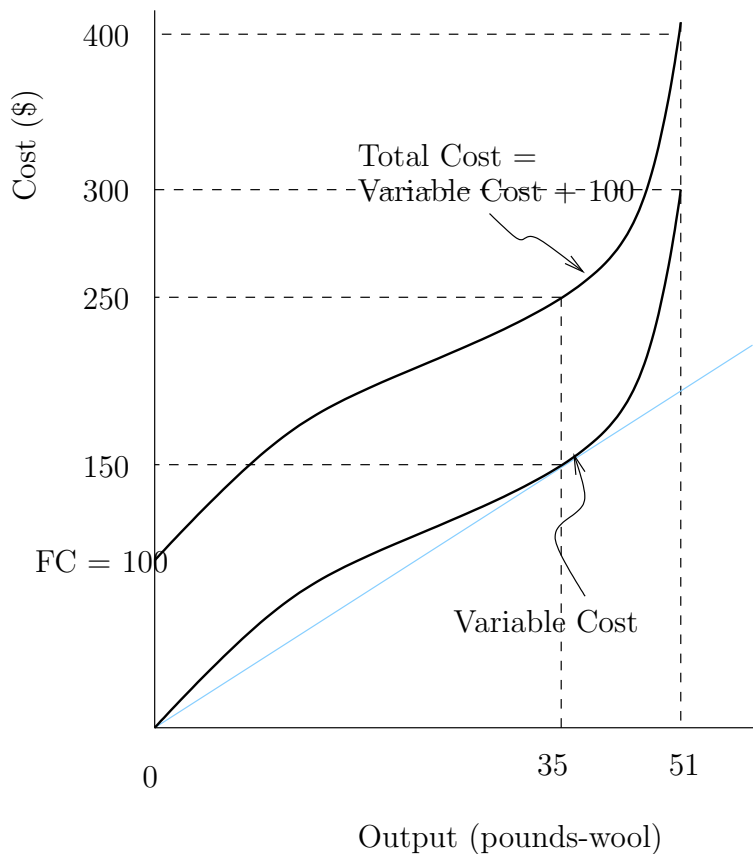


Figure ???. Total Cost and Variable Cost. Note that a line drawn from the point (35, 150) on the VC curve back to the origin is just tangent to the curve at that point. What does this mean?

- (e) Sketch Lena’s short-run marginal cost curve.
- (f) Sketch Lena’s average variable cost curve.

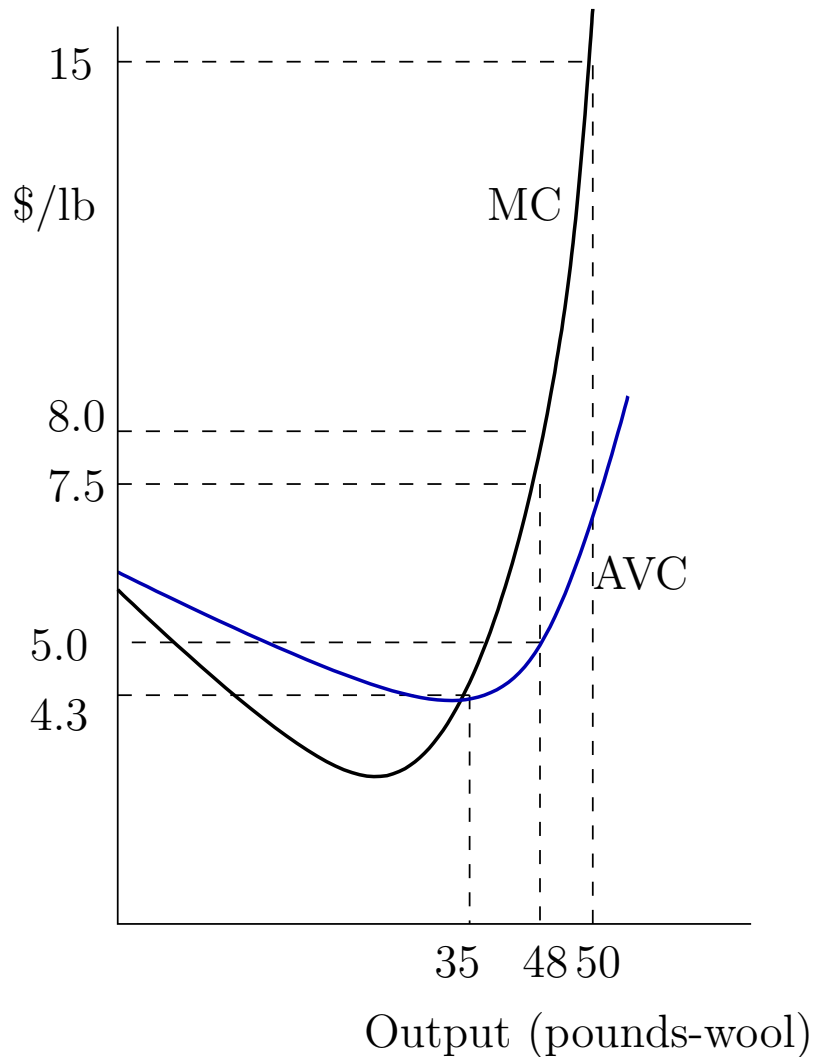


Figure ???. Marginal (MC) and Average Variable Cost (AVC) Curves. Here we see that the shutdown price is approximately \$4.3 per pound. If Lena faced that price and decided to operate the best she could do would be to make 35 pounds and therefore \$150 in revenue which just matches what it would cost her in wages to hire the 5 hours of labor necessary to make 35 pounds. We also see that the optimal output level when she faces a price of \$8 is about 48 pounds since the marginal cost at 48 pounds is 7.5 or just below \$8. (Remember she must hire labor in whole hour increments. So going past 48 means hiring a 9th hour of labor and making 50 pounds. While this would bring in \$16 more in revenue it would cost \$30 more in wages. So She should stop at 48 pounds.)

- (g) If wool sells for \$8 per pound, how much wool will Lena make and what will her profit be? (Assume that she must hire labor in whole hours.) **ANSWER** From the marginal cost figure in the table, we see that she would make 48 units at this price, hiring 8 units of labor. Her total cost would be \$100 in fixed cost for the land plus \$240 in wages for the labor for a total of \$340 (as indicated in the table). Her total revenue would be 8×48 dollars or \$384. Hence profit would be \$44. Alternatively we could use the formula from class $(Price - AVC)Q - FC = (8 - 5)48 - 100 = 44$.

- (h) How high does the price of wool need to be to make it worth-while for Lena to produce any wool? **ANSWER:** Marginal Cost at the shutdown point, \$4.3 / pound.