

Due Friday, March 22

- 5 pts.
- Your professor's younger sister owns and operates a sandwich shop in Fort Walton Beach, FL. The income statement for her business shows annual revenues of \$150,000. Costs include wages for hourly employees (\$35,000), utilities (\$15,000), wholesale cost of food and other supplies (\$40,000), taxes (\$5,000), advertising (\$5,000), and insurance (\$5,000). She quit her job managing a similar business where she earned \$25,000 per year, but she pays herself no salary in this business. She and her husband own the strip mall where her sandwich shop is located, and the space occupied by her shop previously rented for \$12,000 per year. They have \$40,000 invested in the business, which they could recover if they liquidated. They ask you to help them figure out the "rate of return" they are earning on their \$40,000 that they have invested in the sandwich shop. Evaluate the economic profitability of their business.

- 6 pts.
- The following table describes the short-run production relationship for a firm that produces a single output, Q, with two inputs, L and K:

K	24	24	24	24	24	24
L	0	6	12	18	24	30
Q	0	30	96	162	192	150

Suppose that the wage rate, w, is \$5. Sketch the firm's total variable cost curve. In a separate diagram sketch its average variable cost and marginal cost curves.

- 5 pts.
- Short-run total cost is given by $SRTC = 1000 + 50Q^2$. If $Q = 10$, then what is TFC? TVC? TC? AFC? AVC? ATC? What is the marginal cost of increasing output by one unit?

- 5 pts.
- After retiring from the military, Mel decides to go into the chair-making business. In addition to wood, he uses capital and labor to produce wooden chairs. He is trying to determine whether he is using the right amount of tools and machinery with his labor force. Currently he can produce an additional chair per hour by adding two workers to his current mix of tools and machinery. Alternatively, he could rent additional tools and machinery in combination with his current labor input that would allow him to increase his output of chairs by one per hour. If Mel pays his workers a wage rate of \$10 per hour, and the rent he would have to pay for the additional capital is \$10 per hour, is Mel minimizing cost? Illustrate using an isoquant/isocost diagram. If Mel is not minimizing cost, how should he alter his input mix?

- 6 pts.
- The following points lie on the firm's long-run expansion path:

Q	20	60	90	100
L	3	6	9	12
K	2	4	6	8

- 27 pts. total
- If the firm pays $w = \$2$ per unit of labor and $v = \$3$ per unit of capital, illustrate the firm's expansion path. Your diagram should have four isoquants and four isocost lines.
 - Now illustrate four points on the firm's long-run average cost curve. Show or explain briefly how you arrive at your answer.
 - When the firm uses $L = 2$ and $K = 4$, it can produce $Q = 20$. When it uses $L = 18$ and $K = 4$, it can produce $Q = 90$. In the diagram above, illustrate three points on the firm's short-run average cost curve when it is constrained to use $K = 4$. Again, show or briefly explain.

ECO 401

Problem Set #5 KEY

Spring 2013

$$1. \quad \text{Economic Profit} = \text{Total Revenue} - \text{Explicit Costs} - \text{Implicit Costs}$$

Explicit Costs:

- wages	\$35,000
- utilities	15,000
- wholesale cost of supplies	40,000
- taxes	5,000
- advertising	5,000
- insurance	5,000
	<u>\$105,000</u>

Implicit Costs:

- opportunity cost of her labor time.	\$25,000
- opportunity cost of building space	\$12,000
- opportunity cost of foregone interest earned on their investment of \$40,000	(?)

$$\underline{\hspace{10em}} \rightarrow \$37,000$$

$$TR = \$150,000$$

$$\text{Econ } \pi = \$150,000 - \$105,000 - \$37,000 = \$8,000$$

She is earning \$8000 on her \$40,000 investment, for an annual rate of return of $\frac{8000}{40000} = 20\%$.

Unless she can invest the \$40,000 someplace else and earn more than a 20% ROR, this is a good deal.

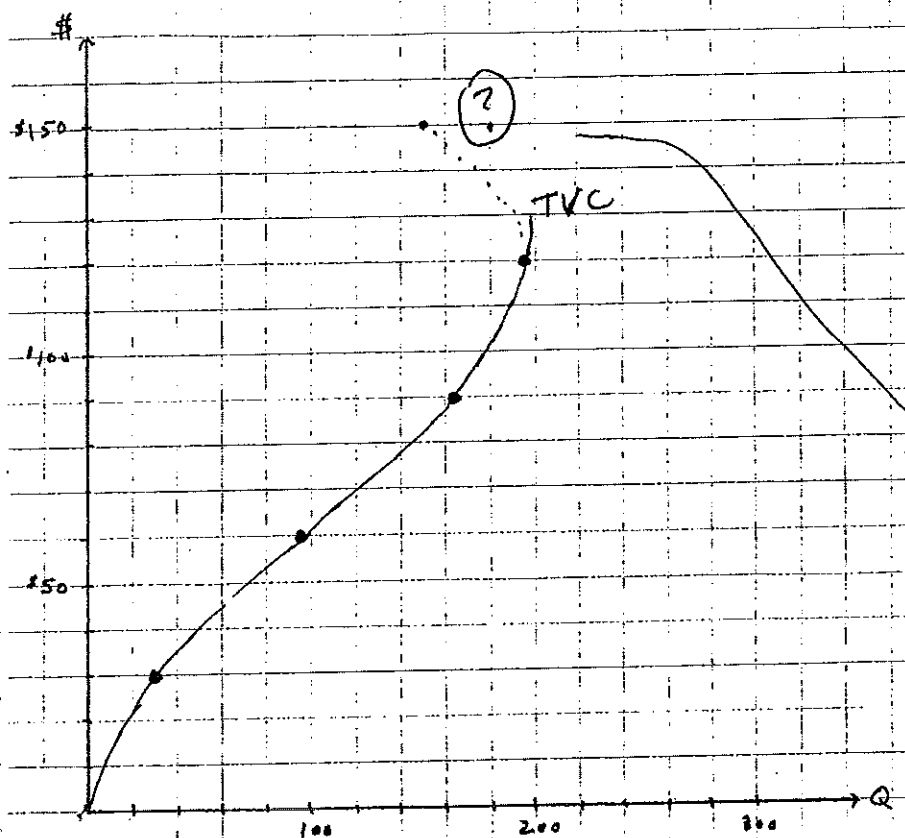
2.

The following table describes the short-run production relationship for a firm that produces a single output, Q , with two inputs, L and K :

K	24	24	24	24	24	24
L	0	6	12	18	24	30
Q	0	30	96	162	192	150

a) Suppose that the wage rate, w , is \$5. Sketch the firm's total variable cost curve in the diagram below.

(a)

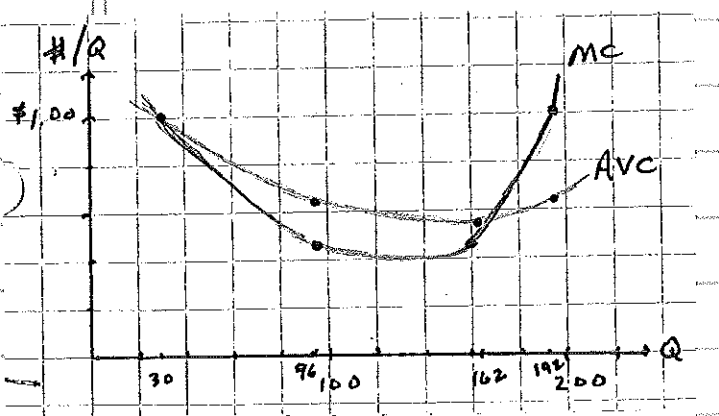


$$TVC = w \cdot L$$

L	Q	TVC
0	0	0
6	30	30
12	96	60
18	162	90
24	192	120
30	150	-

TVC curve does not bend backwards because you would never use $L=30$ to produce $Q=150$!!

(b)



$$TVC = w \cdot L$$

$$MC = \frac{\Delta TVC}{\Delta Q}$$

L	Q	TVC	MC	AVC
0	0	0	-	-
6	30	30	1.00	1.00
12	96	60	.454	.625
18	162	90	.454	.556
24	192	120	1.00	.625
30	150	-	-	-

3. $SRTC = TFC + TVC = 1000 + 50Q^2$

- if $Q=0$, then $TC = 1000 = TFC$
- $TVC = 50Q^2$, if $Q=10$, then $TVC = 5000$
- if $Q=10$, then $TC = 1000 + 5000 = 6000$
- if $Q=10$ and $TFC = 1000$, then $AFC = 100$
- if $Q=10$ and $TVC = 5000$, then $AVC = 500$
- if $Q=10$ and $AFC = 100$ and $AVC = 500$, then $ATC = 600$
- if $Q=10$ then $TC = 6000$.

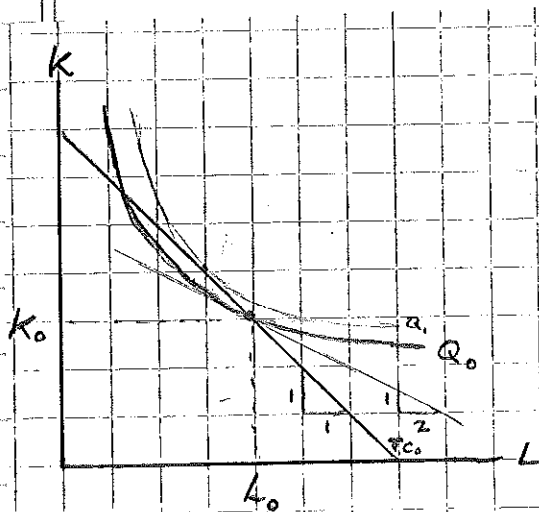
if $Q=11$ then $TC = 1000 + 50(11)^2 = 7050$
 $MC = \frac{\Delta TC}{\Delta Q} = 1050 \Rightarrow MC$ of 11th unit of output

4. Mel's current output = Q_0 , using L_0 and K_0 :

$MPL = .5$ and $MPK = 1.0$
 $MRTS_{L,K} = -\frac{\Delta K}{\Delta L} \Big|_Q = \frac{MPL}{MPK} = \frac{.5}{1.0} = \frac{1}{2}$

if $w = \$10$ and $r = \$10$,
 then $MRTS_{L,K} = \frac{MPL}{MPK} \neq \frac{w}{r}$,

so Mel is not minimizing the cost of producing Q_0 :



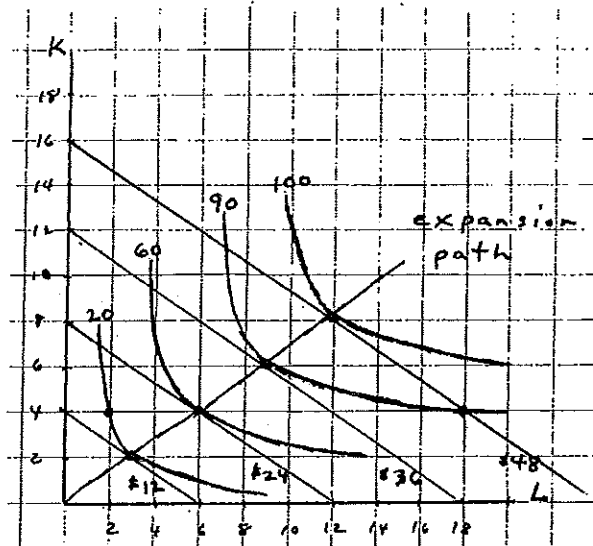
at L_0, K_0 , total cost of producing Q_0 is TC_0 .
 Mel could increase output to Q_1 and keep Total Cost the same by using more K and less L .

The following points lie on the firm's long-run expansion path:

5.

Q	20	60	90	100
L	3	6	9	12
K	2	4	6	8

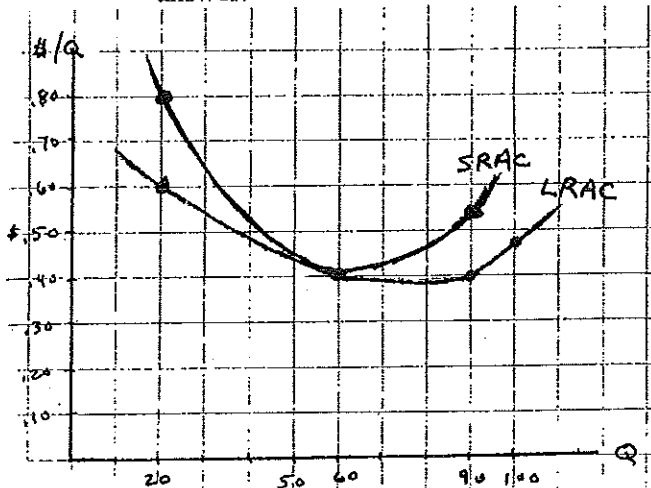
- a) If the firm pays $w = \$2$ per unit of labor and $v = \$3$ per unit of capital, illustrate the firm's expansion path. Your diagram should have four isoquants and four isocost lines.



$$TC = wL + vK$$

L = 3	K = 2	TC = \$12
6	4	\$24
9	6	\$36
12	8	\$48

- b) Now illustrate four points on the firm's long-run average cost curve. It would be prudent to show or explain briefly how you arrive at your answer.



$$TC = w \cdot L + v \cdot K$$

$$ATC = TC / Q$$

$$\frac{Q}{Q} \quad \frac{TC}{Q} \quad \frac{LRAC}{1} \quad \frac{ATC}{1}$$

20	\$12	\$0.60
60	\$24	\$0.40
90	\$36	\$0.40
100	\$48	\$0.48

- c) When the firm uses $L=2$ and $K=4$, it can produce $Q=20$. When it uses $L=18$ and $K=4$, it can produce $Q=90$. In the diagram above, illustrate three points on the firm's short-run average cost curve when it is constrained to use $K=4$. Again, show or briefly explain.

L=2	K=4	Q=20	TC = \$16	ATC = \$.80
L=6	K=4	Q=60	TC = \$24	ATC = \$.40
L=18	K=4	Q=90	TC = \$48	ATC = \$.53