ECO 401-002, 003
Spring 2013
Test #2

Name: KEY

Nine questions in all, 100 points total. Questions 1-6: multiple choice, 5 points each, circle correct answer.

1. For a particular combination of labor and capital, the marginal product of capital is six units of output and the marginal rate of technical substitution is three K for one L. The marginal product of labor is
   a) 0.5
   b) 2.0
   c) 9.0
   d) 18.0

D

$MRTS_{L,K} = \frac{MP_L}{MP_K}$

$3 = \frac{MP_L}{6}$

2. Total cost is given by the formula $TC = a + bQ + cQ^2$. Average variable cost is given by:
   a) $b + cQ$
   b) $b + 2cQ$
   c) $bQ + cQ^2$
   d) $a/Q + b + cQ$

A

$TVC = bQ + cQ^2$

$AVC = \frac{TVC}{Q} = b + cQ$

3. TFC = \$2000, AVC = \$10, and ATC = \$12. What is Q?
   a) 100
   b) 500
   c) 1000
   d) Can't be determined from the information given.

C

$AFC = ATC - AVC = 2$

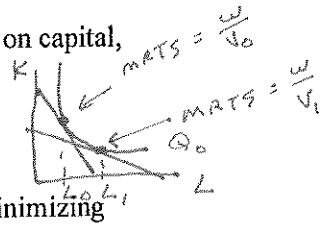
$AFC = TFC/Q \qquad 2 = \frac{2000}{Q}$

4. The short-run average total cost curve is U-shaped because:
   a) AFC + AVC = ATC
   b) AFC is constantly declining
   c) Beyond some point AVC slopes upward because of diminishing returns
   d) All of the above

D

5. A firm is currently employing L and K so as to minimize cost. The rental rate on capital, v, rises. What will happen to $MRTS_{L,K}$ as the firm adjusts its input mix?
   a) It will increase, because relatively more K will be used.
   b) It will decrease, because relatively more L will be used.
   c) It will decrease, because relatively more K will be used.
   d) It will remain unchanged, because a change in v will not affect the cost-minimizing input mix.

B



6. At its current usage of L and K, $MP_L = 15$, $MP_K = 250$, w = \$25, and v = \$400. The firm should
   a) Use more L and less K.
   b) Use less L and more K.
   c) Keep its relative usage of L and K unchanged.
   d) Increase its output by using less of both L and K.

B

cost minimization:

$\frac{MP_L}{MP_K} = \frac{w}{v}$, so $\frac{MP_L}{w} = \frac{MP_K}{v}$

$\frac{15}{25} \stackrel{?}{=} \frac{250}{400}$

.6 ≠ .625, i.e. another dollar spent on capital yields more output than another dollar spent on labor

7. (20 pts.) Janet opens a shop in Mt. Pleasant, SC that sells Christmas items to tourists. Her sales revenues are $400,000 per year. She incurs costs of $200,000 for cost of goods sold, $75,000 for wages paid to hourly employees, $20,000 for taxes and insurance, $25,000 for rent, and $10,000 for utilities. Janet works full time in the shop and doesn't pay herself a salary. Formerly she worked as a secretary for the local high school earning $45,000 per year. She and her husband have $100,000 of their savings tied up as working capital in the business. They typically earn 5% on their investments in mutual funds.

a) What are Janet's accounting profits?

Total Revenue = $400 K

Explicit Costs:

CoG Sold	200 K
wages	75 K
taxes, insurance	20 K
rent	25 K
utilities	10 K
	$330 K

accounting profit = TR − total Explicit Costs

= $400 K − $330 K

= $70,000

b) What are Janet's economic profits? Should she continue in the business?

Econ π = TR − Total Explicit Cost − total Implicit Costs

Implicit Costs:

- opportunity cost of her time = $45,000
- foregone interest earnings = $100,000 @ 5% = $5,000

Econ π = $400,000 − $330,000 − $50,000 = $20,000

So, Janet is $20,000 better off than in her next best alternative.

c) After several years, Janet decides that she wants to retire. She offers to sell the business to her sister, who is a CPA earning $80,000 per year. Her sister evaluates the business and declares that to be a bad idea for her. Is she making a mistake? What would her economic profits be? (Assume that she would take $100,000 out of her own savings and pay Janet for her investment in the business.)

Sister's implicit costs:

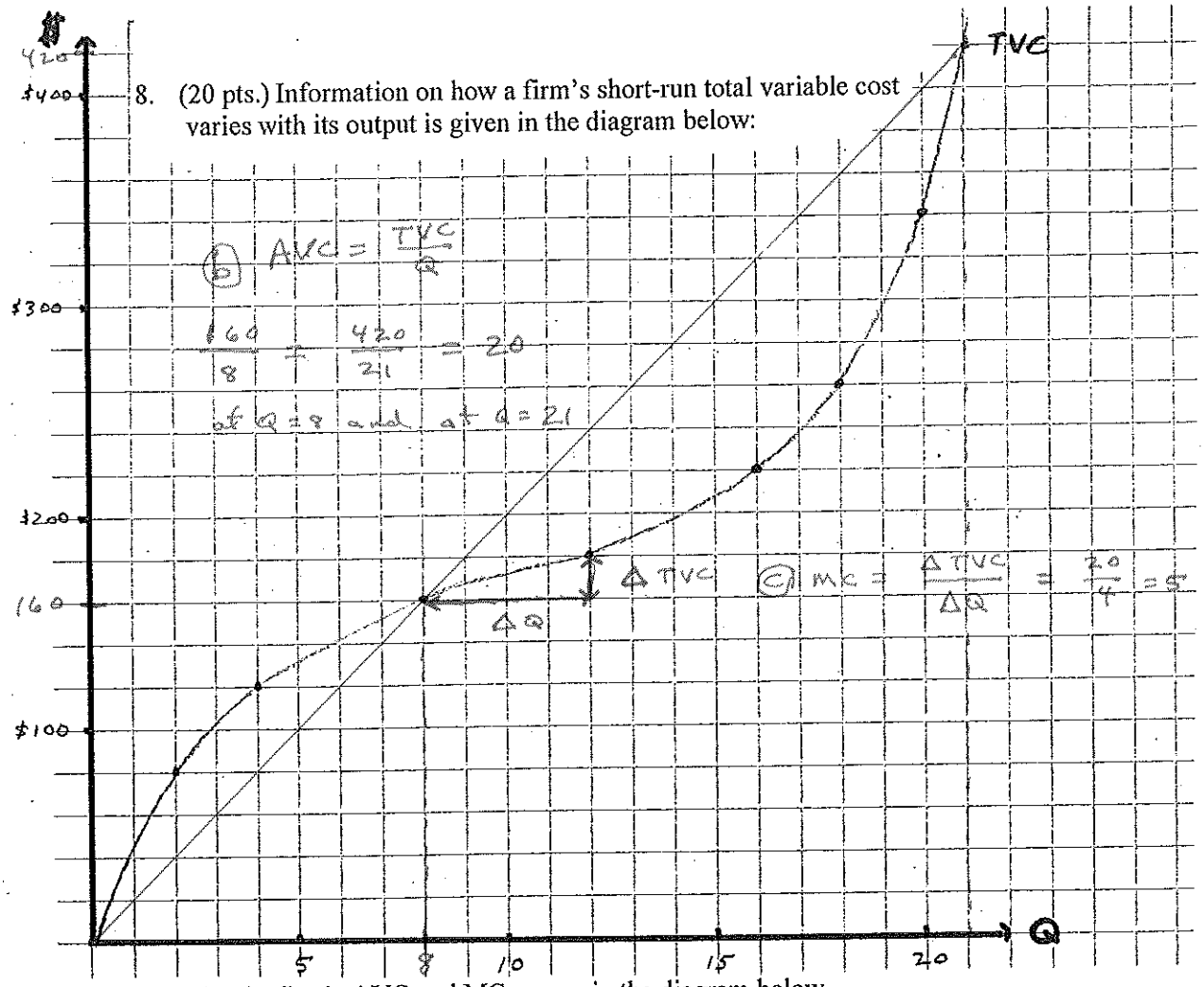
- opp. cost of her time = $80,000
- foregone interest = $5,000

$85,000

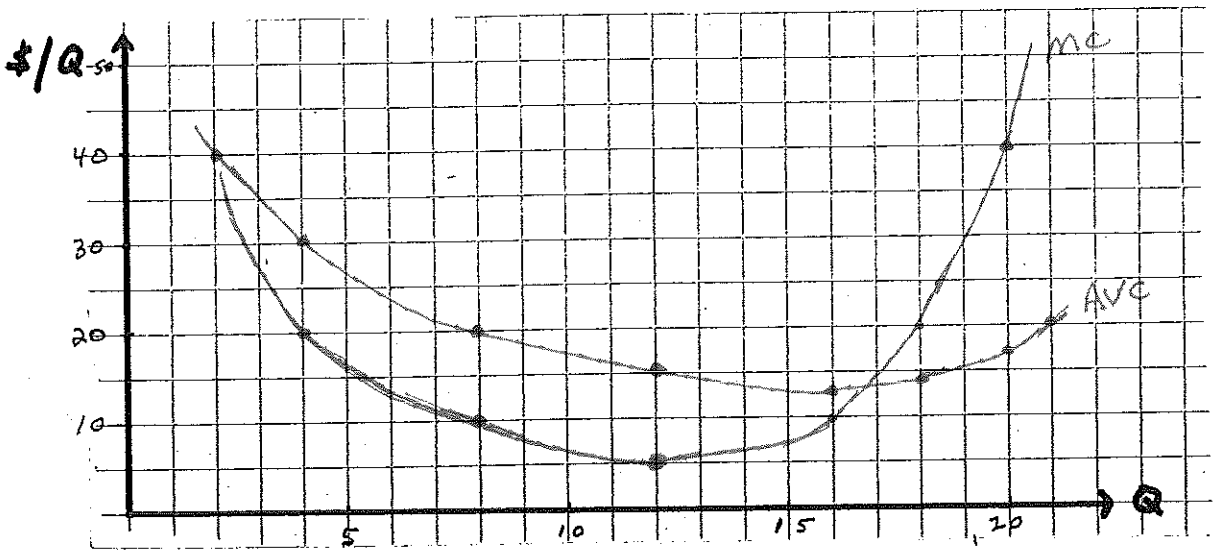
Sister's econ π = $400 K − $330 K − $85 K

= −$15,000, so it would be a bad idea for her sister to buy the shop and run it.

8. (20 pts.) Information on how a firm's short-run total variable cost varies with its output is given in the diagram below:



10 a) Plot the firm's AVC and MC curves in the diagram below.

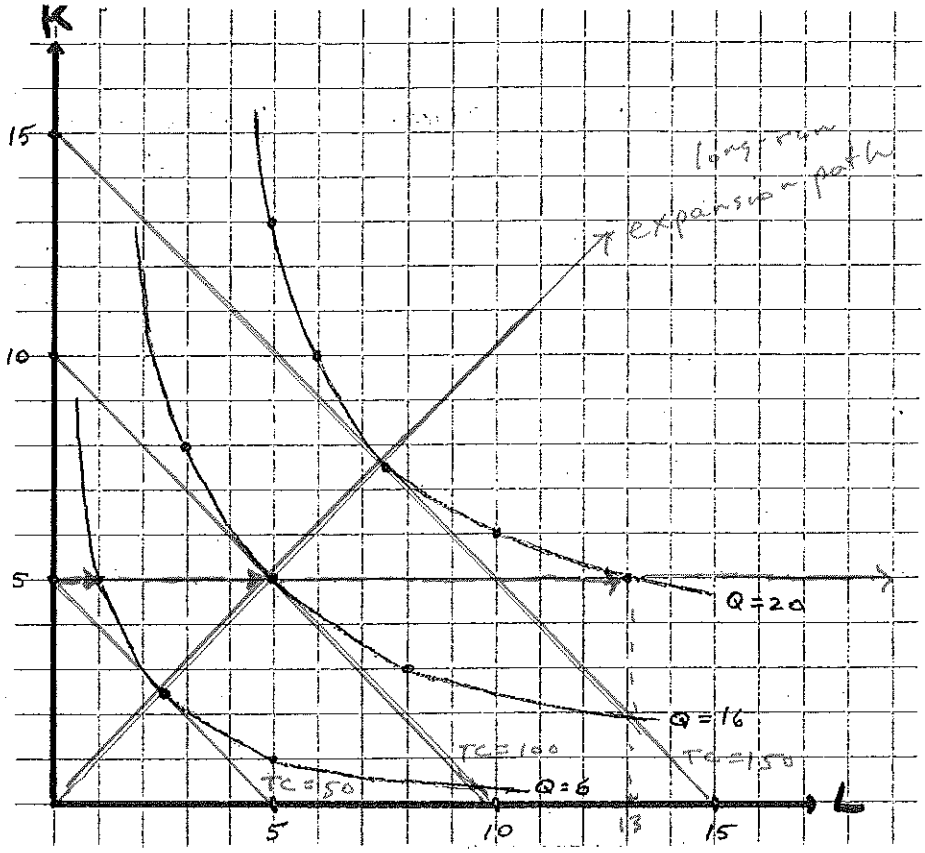


Q	TVC	mc	AVC
0	0		
2	80	40	40
4	120	20	30
8	160	10	20
12	180	5	15
16	220	10	13.75
18	260	20	14.45
20	340	40	17
21	420	80	20

5 b) Show/explain graphically on the TVC diagram how you get AVC when Q = 8 and when Q = 21.

5 c) Show/explain graphically on the TVC diagram how you get MC when Q increases from 8 to 12.

9. (30 pts.) The following diagram contains information about a firm's production function: Q=f(L,K). The firm uses labor (L) and capital (K) to produce an output (Q). Three isoquants corresponding to outputs of Q=6, Q=16, and Q=20 are illustrated.



short run expansion path when $\bar{K} = 5$.

a) Does the firm experience increasing, constant, or decreasing returns to scale? Explain
5 using actual numbers from the diagram.

L	K	Q	
2.5	2.5	6	> double all inputs, output more than doubles, so increasing returns to scale
5	5	16	> increase all inputs by factor of 1.5, output increases by factor of 1.25, so decreasing returns to scale
7.5	7.5	20	

b) Does the firm experience short-run diminishing returns? Explain by calculating MP_L
5 when K is fixed at K=5 and Q increases from 6 to 16 to 20.

$MP_L = \frac{\Delta Q}{\Delta L}$

L	K	Q	
0	5	0	
1	5	6	> 6
5	5	16	> 2.5
13	5	20	> .5

MP_L is declining as L increases - so short run diminishing returns.

c) If w, the per unit price of L, and v, the per unit price of K, both are equal to \$10, draw
10 isocost lines that illustrate the minimum cost of producing Q=6, Q=16, and Q=20 and sketch in the firm's long-run expansion path. Be sure to label your isocost lines and expansion path in the diagram.

K	L	Q	LRTC	LRATC
2.5	2.5	6	50	8.33
5	5	16	100	6.25
7.5	7.5	20	150	7.50

d) Plot four points on the firm's long-run total cost curve, corresponding to Q=0, 6, 16, and 20, in the diagram below. Then plot four points on the firm's short-run total cost curve when K is fixed at K=5 for the same four outputs. (Hint: what is TFC if Q=0?)

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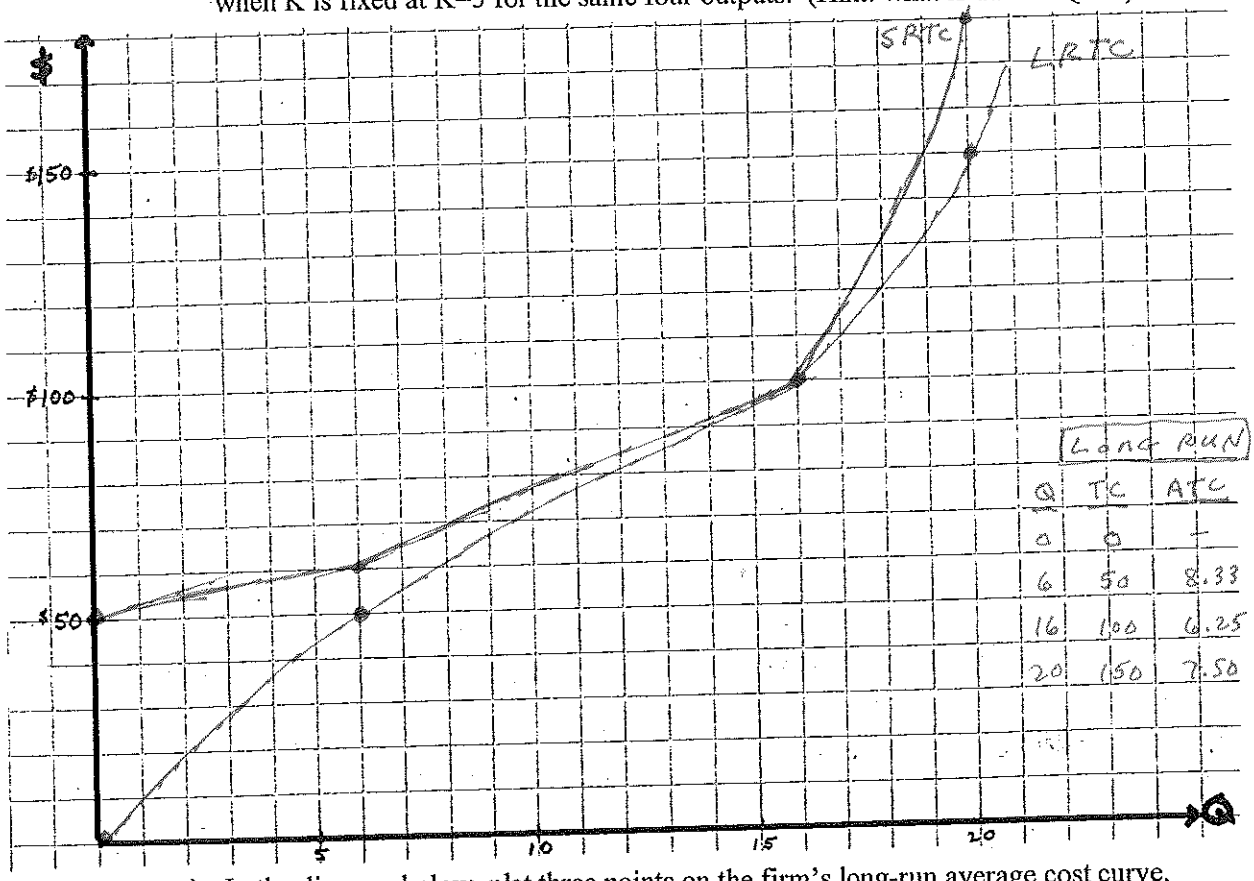

LONG RUN

Q	TC	ATC
0	0	–
6	50	8.33
16	100	6.25
20	150	7.50

e) In the diagram below, plot three points on the firm's long-run average cost curve, corresponding to Q=6, 16, and 20. Then plot three points on the firm's short-run average total cost curve when K is fixed at K=5 for the same three outputs.

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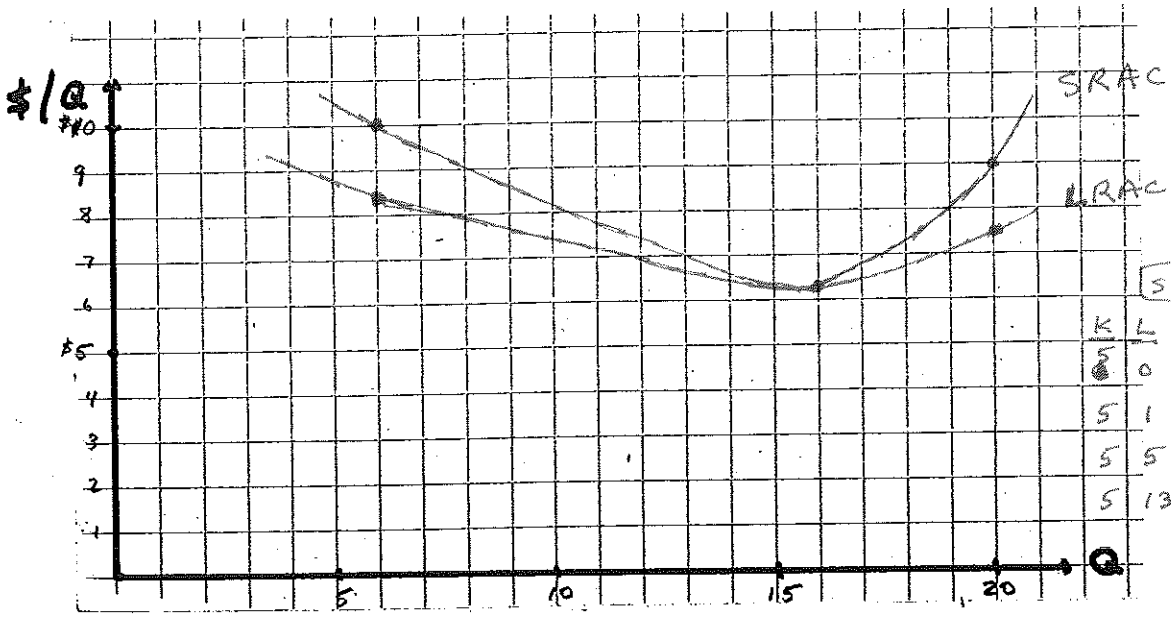

SHORT RUN

K	L	Q	TC	ATC
5	0	0	50	–
5	1	6	60	10
5	5	16	100	6.25
5	13	20	180	9