ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2017
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EXAMINATION #3 ANSWER KEY

Version A

I. Multiple choice

(1)d. (2)b. (3)d. (4)b. (5)d. (6)a. (7)b. (8)b. (9)b.

II. Short answer

(1)	a. 2.4 % .	b. 0.6 %.	
(2)	a. 3 units.	b. 6 units.	c. $60.
	d. 6 units.	e. $75.	
(3)	a. 80 thousand.	b. excess demand.	c. 30 thousand.
	d. decrease.	e. $90 thousand.	f. increase.
	g. $60 thousand.	h. $30 thousand.	

III. Problems

(1) [Production functions]

a. $MP_1 = x_1^{-1/2}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.

b. $MRSP = MP_2/MP_1 = \frac{2\ x_1^{0.8} x_2^{-0.6}}{4\ x_1^{-0.2} x_2^{0.4}} = \frac{2\ x_1^{1/2}}{x_2^{1/2}}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:

$f(ax_1, ax_2) = 2\ (ax_1)^{1/2} + 4(ax_2)^{1/2} = 2\ a^{1/2}\ x_1^{1/2} + \ 4\ a^{1/2}\ x_2^{1/2}$,

$= a^{1/2} \left(2\ x_1^{1/2} + 4\ x_2^{1/2}\right) = a^{1/2}\ q < a\ q$, for a>1.

So this production function has DECREASING returns to scale.

(2) [Cost minimization]

a. $200 = 4\ x_1^{0.5}\ x_2^{0.5}\ \ or\ \ 50 = \ x_1^{0.5}\ x_2^{0.5}$.

b. $MRSP = MP_2/MP_1 = \frac{2\ \ x_1^{0.5}\ x_2^{-0.5}}{2\ x_1^{-0.5}\ x_2^{0.5}} = x_1/x_2$.

c. Set MRSP = $10/$40 and solve jointly with $50 = \ x_1^{0.5}\ x_2^{0.5}$, to get x_1*=25 and x_2*=100.

d. TC(200) = 25×$40 + 100×$10 = $2000.

(3) [Short-run profit maximization and supply]

a. Set P = MC and solve for q: 11 = q+1, or q* = 10.

b. Profit = TR – TC = ($11×10) – [SVC(10) +8] = $110 – 68 = $42.

c. Breakeven price = minimum SATC. So first find SATC:

SATC = (SVC + SFC)/q = (0.5 q^2 + q + 8) / q = 0.5 q + 1 + (8/q).

Then set dSATC/dq = 0: 0.5 – (8/q^2) = 0, which yields q=4.

Finally substitute: SATC(4) = 0.5(4) + 1 + (8/4) = $5.

(4) [Long-run profit maximization and supply]

a. $AC = TC/q = 0.05\ q^2 - 2\ q + 28$.

Set $0 = dAC/dq = 0.1q - 2$ and solve to get $q_{ES} = 20$.

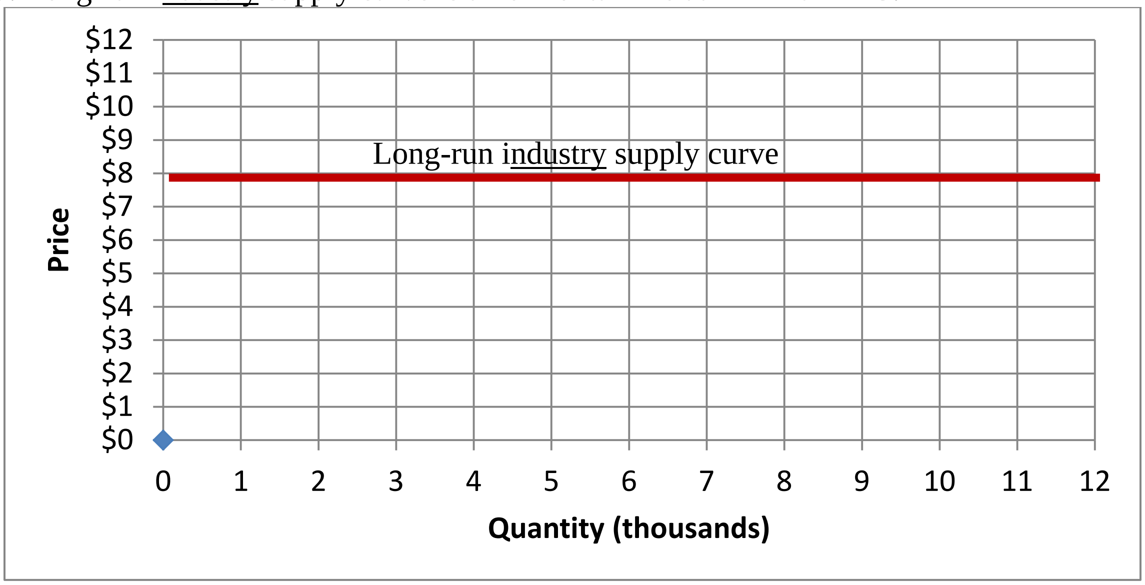
b. Breakeven price = minimum AC = $AC(q_{ES})$ = \$8.

c. Firm's supply curve is as follows.

If $P \geq \$8$, $P = MC(q) = dTC/dq = 0.15q^2 - 4\ q + 28$.

If $P \leq \$8$, q=0 (firm shuts down).

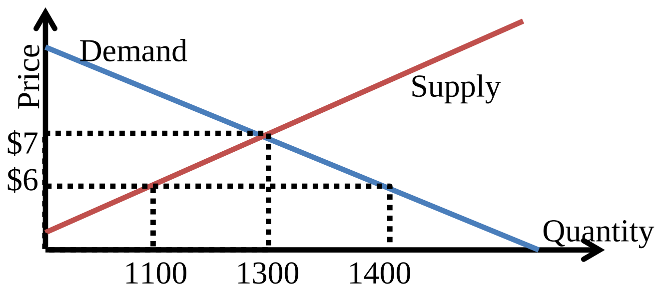
d. Long-run industry supply curve is a horizontal line at minimum AC:



(5) [Welfare effects of international trade]

a. Set $Q_D = Q_S$ and solve to get $P^* = \$7$ and $Q^* = 1300$.

b. At $P = \$6$, $Q_D = 1400$ and $Q_S = 1100$. So the country will import 300 units.



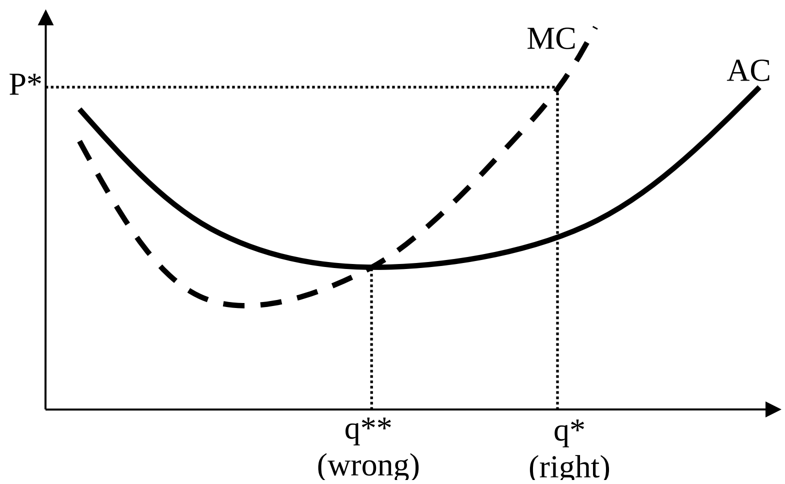
c. Consumer surplus increases by \$1350, the area of the larger trapezoid.

d. Producer surplus decreases by \$1200, the area of the smaller trapezoid.

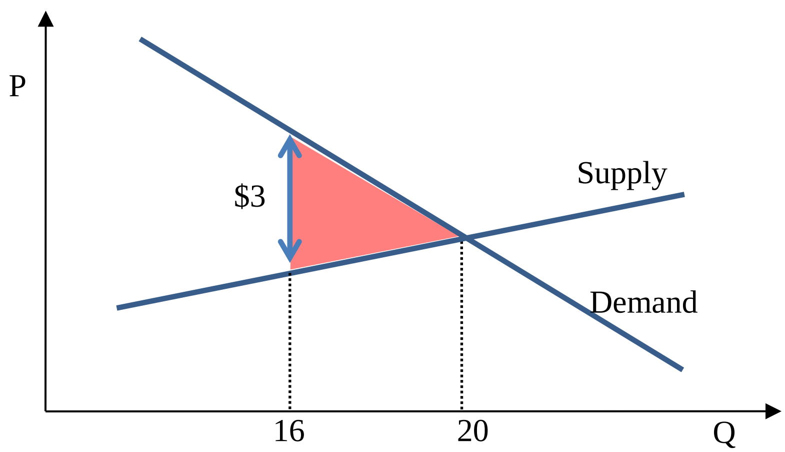
e. The country as a whole gains \$1350 - \$1200 = \$150.

IV. Critical thinking

(1) [The following answer uses a long-run framework, where there are no fixed costs. A similar answer in a short-run framework would be acceptable.] Profit is maximized when the firm operates at the output level where *market price equals marginal cost*, provided price is greater than minimum average cost. (If price is less than average cost, total profit is maximized when the output level is zero.) Thus, the total-profit-maximizing level of output *depends on the market price*. In general, the two output levels will be different, as shown in the graph below. Here, P* is the market price, q* is the output level that maximizes total profit, and q** is the output level where average cost is lowest.



(2) Construct the graph as follows. We are given that the initial quantity is 20 million, so demand and supply intersecting at that quantity. We are given that the $3 tax causes quantity to fall to 16 million, which implies that demand is higher than supply by $3 (the amount of the tax) at 16 million. The area of the deadweight loss triangle is therefore $6 million, assuming demand and supply are approximately linear. So as a result of the tax, the country's overall welfare *decreases by $6 million*. (Note that with the information given in this question, it is not possible to compute separately the loss of consumer surplus or the loss of producer surplus.)



Version B

I. Multiple choice

(1)c. (2)d. (3)f. (4)a. (5)b. (6)b. (7)a. (8)a. (9)c.

II. Short answer

(1) a. 2.3 % . b. 0.7 %.

(2) a. 5 units. b. 8 units. c. $90.
d. 7 units. e. $10.

(3) a. 80 thousand. b. excess supply. c. 60 thousand.
d. increase. e. $150 thousand. f. decrease.
g. $180 thousand. h. $30 thousand.

III. Problems

(1) [Production functions]

a. $MP_1 = 5$. NO, there are no diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 remains constant.

b. $MRSP = MP_2/MP_1 = \frac{10}{5} = 2$. NO, this function does not have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP remains constant.

c. Check returns to scale:

$f(ax_1, ax_2) = 5\ (ax_1) \quad + 10(ax_2) \quad = a\ (5x_1 + 10x_2) = aq$.

So this production function has CONSTANT returns to scale.

(2) [Cost minimization]

a. $600 = 10x_1x_2\ \ or\ \ 60 = x_1x_2$.

b. $MRSP = MP_2/MP_1 = \frac{10\ x_1}{10\ x_2} = x_1/x_2$.

c. Set MRSP = $24/$10 and solve jointly with $60 = x_1x_2$, to get x_1*=12 and x_2*=5.

d. TC(600) = 12×$10 + 5×$24 = $240.

(3) [Short-run profit maximization and supply]

a. Set P = MC and solve for q: 5 = 0.5 q + 1, or q* = 8.

b. Profit = TR – TC = ($5×8) – [SVC(8) +4] = $40 – 28 = $12.

c. Breakeven price = minimum SATC. So first find SATC:

SATC = (SVC + SFC)/q = (0.25 q^2 + q + 4) / q = 0.25 q + 1 + (4/q).

Then set dSATC/dq = 0: 0.25 – (4/q^2) = 0, which yields q=4.

Finally substitute: SATC(4) = 0.25(4) + 1 + (4/4) = $3.

(4) [Long-run profit maximization and supply]

a. AC = TC/q = 0.05 q^2 – q + 10.

Set 0 = dAC/dq = 0.1q – 1 and solve to get q_{ES} = 10.

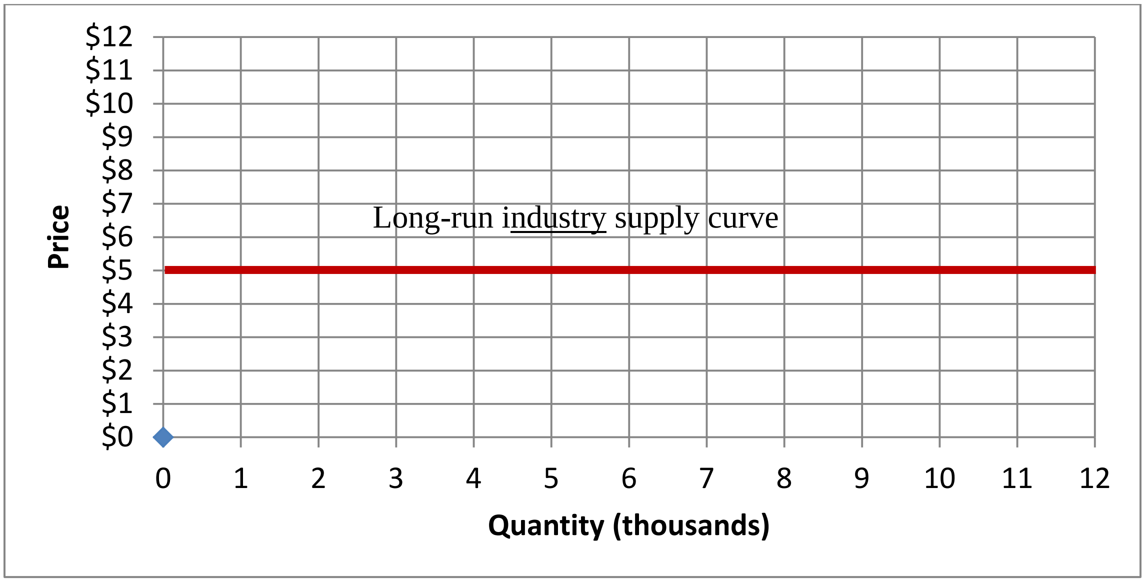
b. Breakeven price = minimum AC = AC(q_{ES}) = $5.

c. <u>Firm's</u> supply curve is as follows.

If P≥$5, P = MC(q) = dTC/dq = 0.15q^2 – 2 q + 10.

If P≤$5, q=0 (firm shuts down).

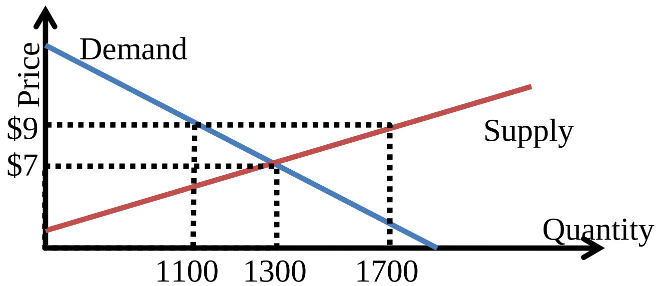
d. Long-run i<u>ndustry</u> supply curve is a horizontal line at minimum AC:



(5) [Welfare effects of international trade]

a. Set $Q_D = Q_S$ and solve to get $P^* = \$7$ and $Q^* = 1300$.

b. At $P = \$9$, $Q_D = 1100$ and $Q_S = 1700$. So the country will <u>export 600 units</u>.



c. Consumer surplus decreases by $2400, the area of the smaller trapezoid.

d. Producer surplus increases by $3000, the area of the larger trapezoid.

e. The country as a whole gains $3000 - $2400 = $600.

IV. Critical thinking

(Same as Version A above.)

[end of answer key]