ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2015
William M. Boal

EXAMINATION #3 ANSWER KEY

Version A

I. Multiple choice

(1)c. (2)a. (3)b. (4)b. (5)d. (6)c. (7)d. (8)a. (9)b. (10)c.

II. Short answer

(1) a. 1.3 % . b. 0.8 %.

(2) a. 13 thousand. b. 17 thousand. c. zero (shut down).
d. \$7 = min SATC. e. \$4 = min SAVC.

(3) a. increase. b. \$10 per pound. c. increase.
d. \$20 thousand. e. decrease. f. \$32 thousand.
g. \$6 per permit. h. \$12 thousand.

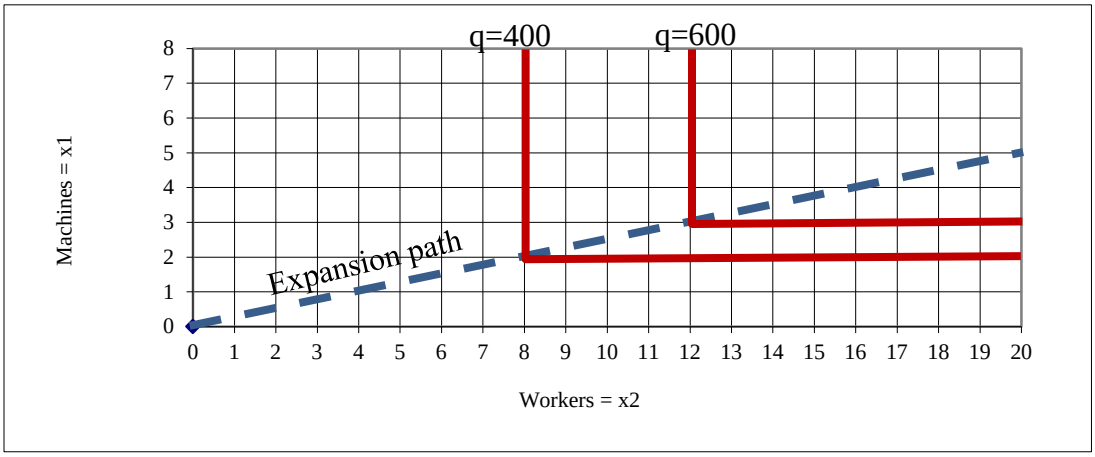
III. Problems

(1) a. $MP_1 = 3\,x_1^{-3/4}\,x_2^{3/4}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.

b. $MRSP = MP_2/MP_1 = \frac{9\,x_1^{1/4}x_2^{-1/4}}{3\,x_1^{-3/4}x_2^{3/4}} = \frac{3\,x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:
$f(ax_1, ax_2) = 12\,(ax_1)^{1/4}\,(ax_2)^{3/4} = a^{1/4}\,a^{3/4}\,12\,x_1^{1/4}x_2^{3/4} = aq$.
So this production function has CONSTANT returns to scale.

(2) a. $x_1 = (x_2/4)$. b. $q = 200\,x_1$. c. $q = 50\,x_2$.
d. $q = \min\{200\,x_1, 50\,x_2\}$.
e.



(3) a. $6 = \sqrt{x_1\, x_2}$.

b. $MRSP = MP_2/MP_1 = \frac{\frac{1}{2}X_1^{1/2}X_2^{-1/2}}{\frac{1}{2}X_1^{-1/2}X_2^{1/2}} = x_1/x_2$.

c. Set MRSP = \$5/\$20 and solve jointly with $6 = \sqrt{x_1\, x_2}$, to get x_1*=3 and x_2*=12.

d. TC(6) = 3×\$20 + 12×\$5 = \$120.

(4) a. AC = TC/q = 0.25 q^2 – 6 q + 41. Set 0 = dAC/dq = 0.5q – 6 and solve to get q_{ES} = 12.

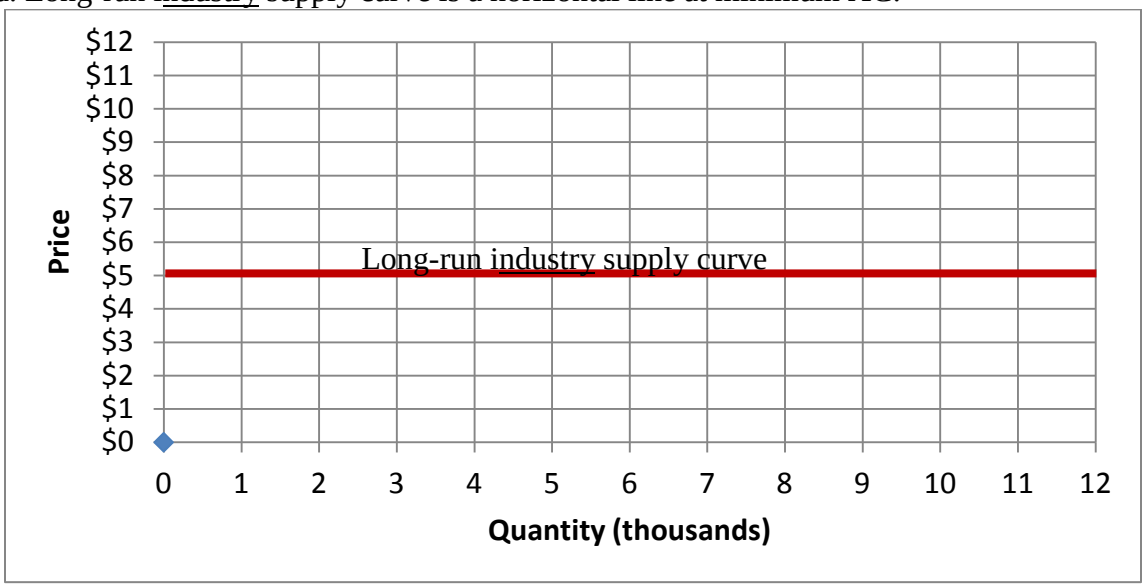
b. Breakeven price = minimum AC = AC(q_{ES}) = \$5.

c. Firm's supply curve is as follows.

If P≥\$5, P = MC(q) = dTC/dq = 0.75q^2 – 12 q + 41.

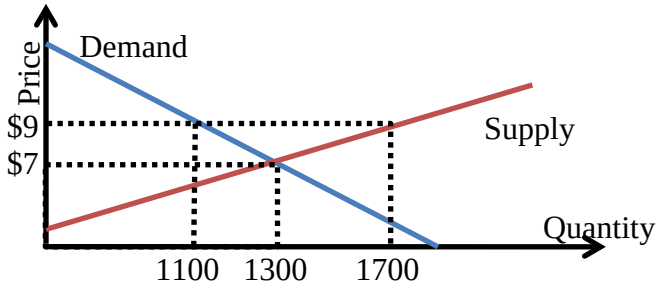
If P≤\$5, q=0 (firm shuts down).

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



(5) 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 export 600 units.



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

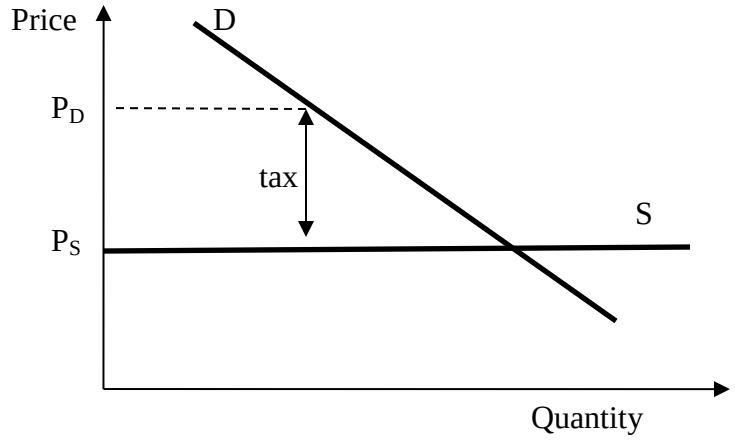
d. Producer surplus increases by \$3000, the area of the larger trapezoid.

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

IV. Critical thinking

(1) One should **disagree** with this statement. When firms compete and there is free entry, **economic profits** are driven to zero. But that does not mean **accounting profits** are driven to zero. Instead, zero economic profit implies that investors are making a normal rate of return and small-business owners are making as much as they would working for someone else. So firms do not necessarily fail and free competition does not destroy industries.

(2) If supply is perfectly elastic, the supply curve is **horizontal**. In this situation, a tax raises the total price (including the tax) paid by buyers, but has no effect on the net price (excluding the tax) received by sellers. Also, consumer surplus is reduced by the tax, but producer surplus is still zero and unchanged as a result of the tax. So **buyers bear the entire burden of the tax**. (Full credit requires a graph like that below.)



Version B

I. Multiple choice

(1)d. (2)d. (3)c. (4)a. (5)a. (6)d. (7)a. (8)b. (9)c. (10)d.

II. Short answer

(1) a. 1.7 % . b. 0.4 %.

(2) a. zero (shut down). b. 12 thousand. c. 15 thousand.
d. \$8 = min SATC. e. \$2 = min SAVC.

(3) a. 8 thousand pounds. b. excess supply. c. 6 thousand pounds.
d. increase. e. \$15 thousand. f. decrease.
g. \$18 thousand. h. \$3 thousand.

III. Problems

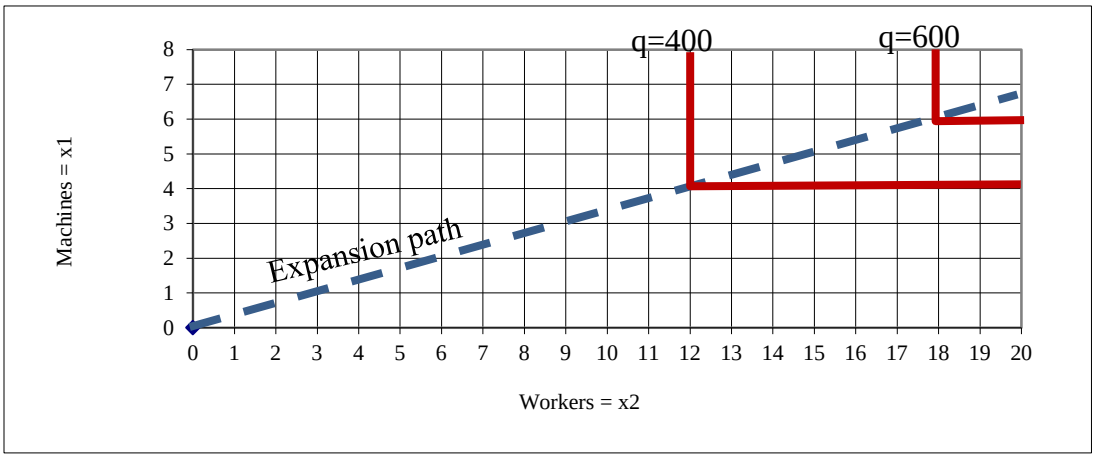
(1) a. $MP_1 = 3\,x_1^{-4/5}\,x_2^{3/5}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.

b. $MRSP = MP_2/MP_1 = \frac{9\,x_1^{1/5}x_2^{-2/5}}{3\,x_1^{-4/5}x_2^{3/5}} = \frac{3\,x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:

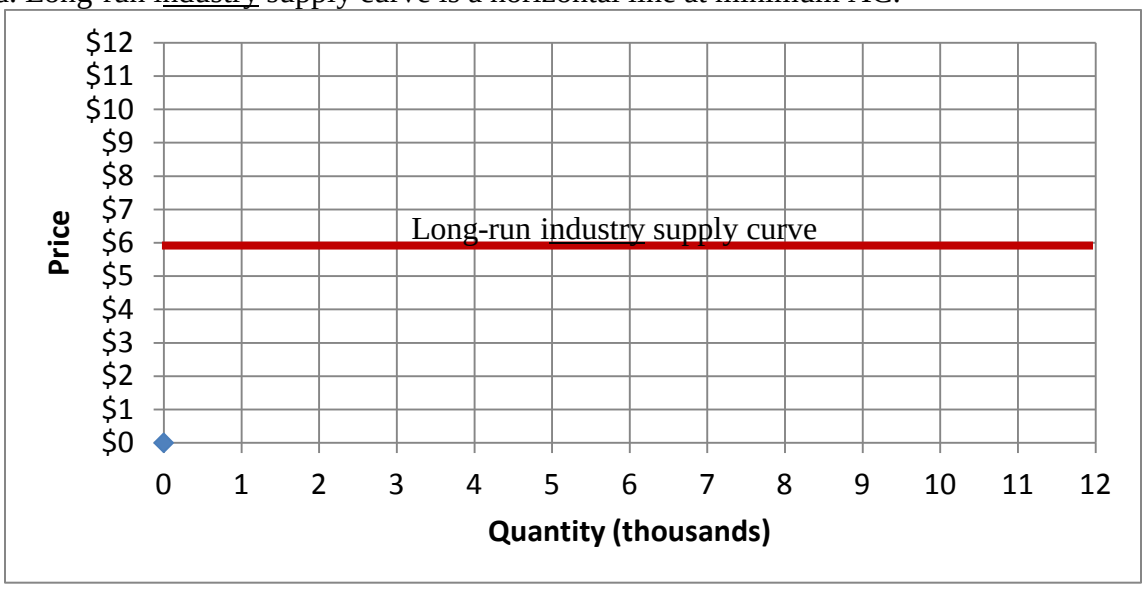
$f(ax_1, ax_2) = 15\ (ax_1)^{1/5}\ (ax_2)^{3/5} = a^{1/5}\ a^{3/5}\ 15\ x_1^{1/5} x_2^{3/5} = a^{4/5}\ q < aq$, for a>1.
So this production function has DECREASING returns to scale.

(2) a. $x_1 = (x_2/3)$. b. $q = 100\ x_1$. c. $q = 100\ x_2/3$.
d. $q = \min\{100\ x_1, 100\ x_2/3\}$.
e.

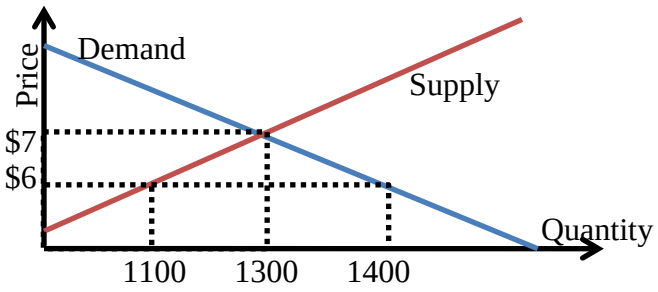


(3) a. $10 = \sqrt{x_1\ x_2}$.
b. $MRSP = MP_2/MP_1 = \frac{\frac{1}{2} X_1^{1/2} X_2^{-1/2}}{\frac{1}{2} X_1^{-1/2} X_2^{1/2}} = x_1/x_2$.
c. Set MRSP = \$4/\$16 and solve jointly with $10 = \sqrt{x_1\ x_2}$, to get $x_1^*=5$ and $x_2^*=20$.
d. TC(10) = 5×\$16 + 20×\$4 = \$160.

(4) a. $AC = TC/q = 0.2\ q^2 - 6\ q + 51$. Set $0 = dAC/dq = 0.4q - 6$ and solve to get $q_{ES} = 15$.
b. Breakeven price = minimum AC = $AC(q_{ES})$ = \$6.
c. Firm's supply curve is as follows.
If $P \geq \$6$, $P = MC(q) = dTC/dq = 0.6\ q^2 - 12\ q + 51$.
If $P \leq \$6$, $q=0$ (firm shuts down).
d. Long-run industry supply curve is a horizontal line at minimum AC:



(5) 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 <u>import 300 units</u>.



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
Same as Version A.

Version C

I. Multiple choice
(1)a. (2)b. (3)a. (4)c. (5)b. (6)a. (7)b. (8)d. (9)d. (10)c.

II. Short answer

(1) a. 1.9 % . b. 0.2 %.

(2) a. 12 thousand. b. 10 thousand. c. zero (shut down).
d. \$9 = min SATC. e. \$3 = min SAVC.

(3) a. 4 thousand pounds. b. excess demand. c. 9 thousand pounds.
d. decrease. e. \$21 thousand. f. decrease.
g. \$6 thousand. h. \$27 thousand.

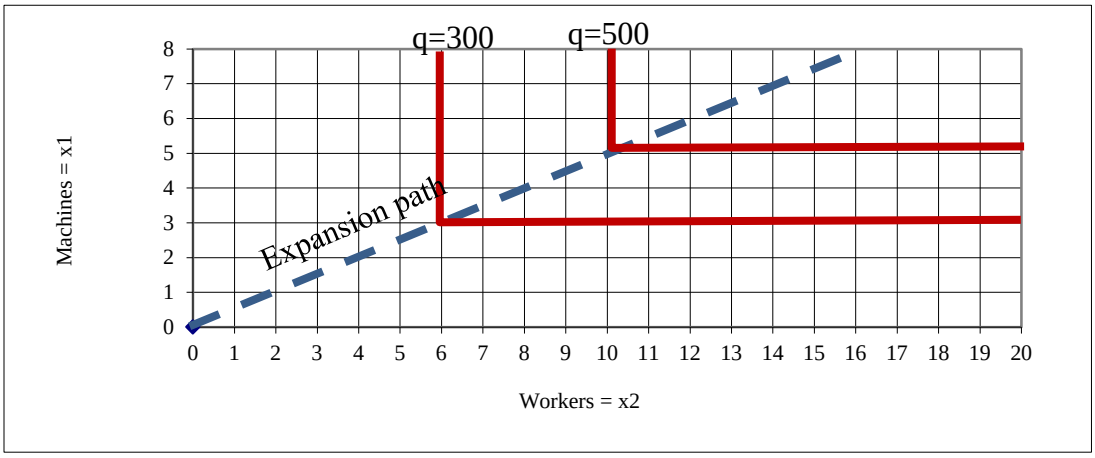
III. Problems

(1) a. $MP_1 = 6\,x_1^{-3/5}\,x_2^{4/5}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.

b. $MRSP = MP_2/MP_1 = \frac{12\;x_1^{2/5}x_2^{-1/5}}{6\;x_1^{-3/5}x_2^{4/5}} = \frac{2\,x_1}{x_2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:
$f(ax_1, ax_2) = 15\,(ax_1)^{2/5}\,(ax_2)^{4/5} = a^{2/5}\,a^{4/5}\,15\,x_1^{2/5}x_2^{4/5} = a^{6/5}\,q > aq$, for a>1.
So this production function has INCREASING returns to scale.

(2) a. $x_1 = (x_2/2)$. b. $q = 100\,x_1$. c. $q = 100\,x_2/2 = 50\,x_2$.
d. $q = \min\{100\,x_1, 50\,x_2\}$.
e.



(3) a. $12 = \sqrt{x_1 x_2}$.

b. $MRSP = MP_2/MP_1 = \frac{\frac{1}{2}X_1^{1/2}X_2^{-1/2}}{\frac{1}{2}X_1^{-1/2}X_2^{1/2}} = x_1/x_2$.

c. Set MRSP = \$4/\$9 and solve jointly with $12 = \sqrt{x_1 x_2}$, to get x_1*=8 and x_2*=18.

d. TC(10) = 8×\$9 + 4×\$18 = \$144.

(4) a. AC = TC/q = 0.05 q^2 – 2 q + 29. Set 0 = dAC/dq = 0.1 q – 2 and solve to get q_{ES} = 20.

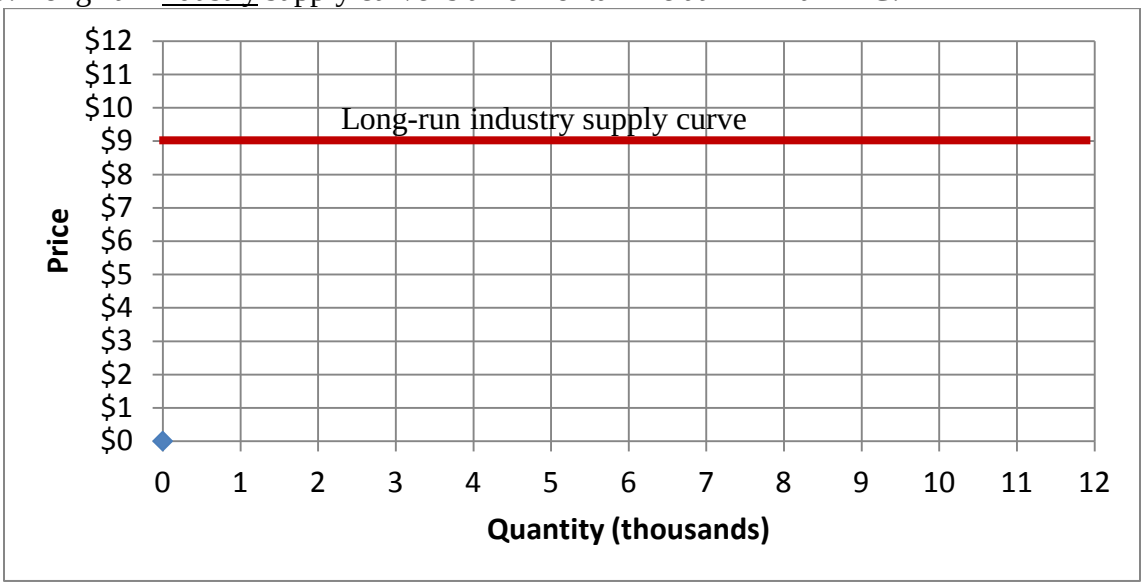
b. Breakeven price = minimum AC = AC(q_{ES}) = \$9.

c. Firm's supply curve is as follows.

If P≥\$9, P = MC(q) = dTC/dq = 0.15 q^2 – 4 q + 29.

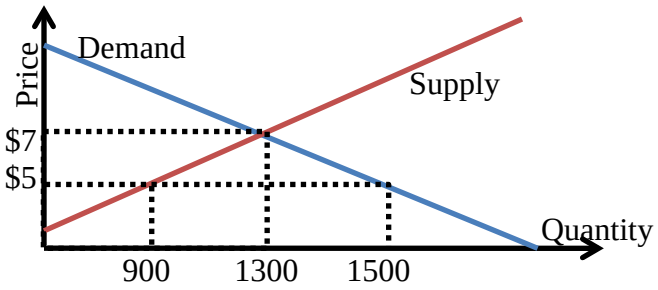
If P≤\$9, q=0 (firm shuts down).

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



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

b. At P = \$5, Q_D = 1500 and Q_S = 900. So the country will import 600 units.



c. Consumer surplus increases by $2800, the area of the larger trapezoid.
d. Producer surplus decreases by $2200, the area of the smaller trapezoid.
e. The country as a whole gains $2800 - $2200 = $600.

IV. Critical thinking
Same as Version A.

[end of answer key]