

EXAMINATION 3 ANSWER KEY “Firms and Competition”

Version A

I. Multiple choice

- (1)c. (2)b. (3)d. (4)b. (5)d. (6)b. (7)b. (8)b. (9)b. (10)d.
(11)c. (12)b. (13)a. (14)b. (15)b.

II. Short answer

- (1) a. 6.5 percent. b. 1.5 percent.
(2) a. 3 units. b. 4 units. c. \$100.
d. 2 units. c. \$140.
(3) a. \$7 (because breakeven price = min(SATC)).
b. \$2 (because shutdown price = min(SAVC)).
c. 11 thousand (using rule $P=MC$ to find q).
d. 12 thousand (using rule $P=MC$ to find q).
e. 0 thousand (because price is below shutdown price).
(4) a. \$6. b. 9 thousand. c. \$4 per pumpkin.
d. \$7 per pumpkin. e. increase. f. \$8 thousand.
g. increase. h. \$16 thousand. i. \$27 thousand.
j. \$3 thousand.

III. Problems

- (1) [Input substitution]
a. $MP_1 = 3x_1^{-1/2}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.
b. $MRSP = \frac{MP_2}{MP_1} = \frac{2x_2^{-1/2}}{3x_1^{-1/2}} = \left(\frac{2}{3}\right) \left(\frac{x_1}{x_2}\right)^{1/2}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, the numerator decreases and the denominator increases. Therefore, MRSP decreases.
c. Check returns to scale:
 $f(ax_1, ax_2) = 6(ax_1)^{1/2} + 4(ax_2)^{1/2} = 6a^{1/2}x_1^{1/2} + 4a^{1/2}x_2^{1/2}$
 $= a^{1/2}(6x_1^{1/2} + 4x_2^{1/2}) = a^{1/2}q < aq$, for all $a > 1$.
Thus, multiplying all inputs by the same factor (a) causes output to increase by a smaller factor. So, this production function has DECREASING returns to scale.

(2) [Cost minimization]

a. Equation for isoquant: $90 = 5 x_1^{1/2} x_2^{1/2}$ or $18 = x_1^{1/2} x_2^{1/2}$.

b. $MRSP = MP_2/MP_1 = \frac{(5/2) x_1^{1/2} x_2^{-1/2}}{(5/2) x_1^{-1/2} x_2^{1/2}} = x_1/x_2$.

c. Set $MRSP = w_2/w_1 = \$10/\90 (the tangency condition) and solve jointly with $90 = 5 x_1^{1/2} x_2^{1/2}$ (the isoquant) to get $x_1^*=6$ and $x_2^*=54$.

d. $TC(50) = 6 \times \$90 + 54 \times \$10 = \$1080$.

(3) [Cost curves; Long-run market equilibrium]

a. $AC = TC/q = 0.02 q^2 - 0.8 q + 18$.

Set $0 = dAC/dq = 0.04 q - 0.8$ and solve to get $q_{ES} = 20$.

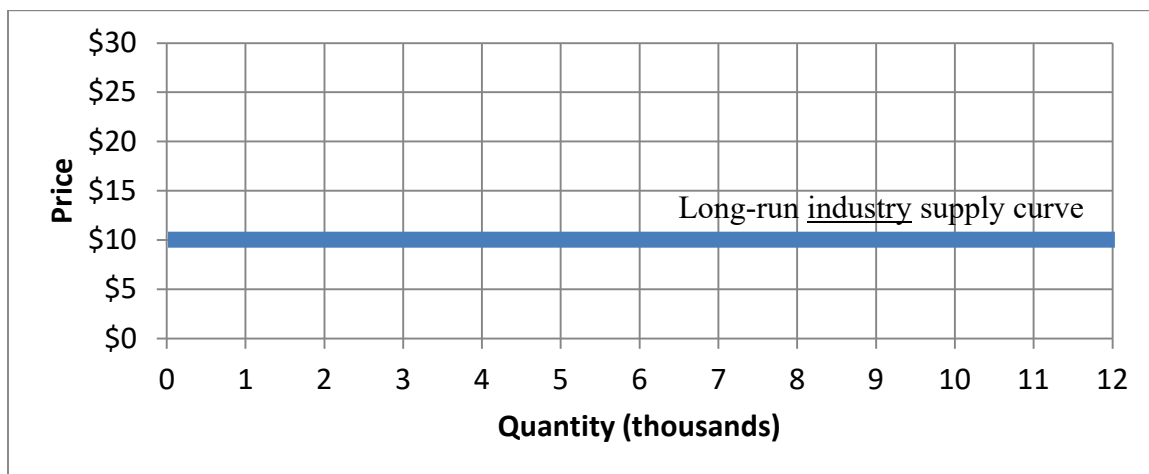
b. Breakeven price = minimum AC = $AC(q_{ES}) = \$10$.

c. A firm's supply curve shows how much the firm will produce for any given price. If $P >$ minimum average cost, the profit-maximizing firm will choose an output level where $P = MC(q)$, and if $P <$ minimum average cost, it will produce nothing. So, this firm's supply curve is given by the following equations.

If $P \geq \$10$, $P = MC(q) = dTC/dq = 0.06 q^2 - 0.8 q + 18$.

If $P \leq \$10$, $q = 0$ (firm shuts down).

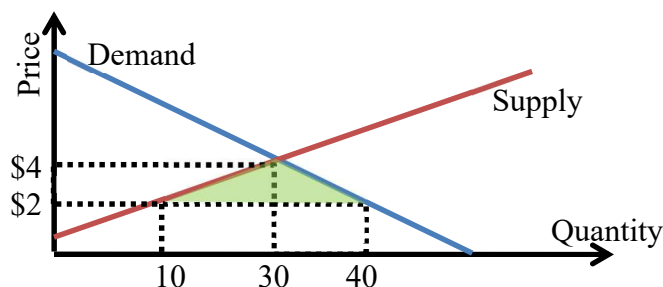
d. The long-run industry supply curve is a horizontal line at minimum AC:



(4) [Welfare effects of international trade]

a. Set $Q_D = Q_S$ and solve to get $P^* = \$4$ and $Q^* = 30$.

b. With international trade, $P_W = \$2$. Substituting into demand and supply gives $Q_D = 40$ and $Q_S = 10$, so the country IMPORTS $40 - 10 = 30$ units.



- c. Consumer surplus increases by \$70, the area of the large trapezoid bounded by the two prices and the demand curve.
- d. Producer surplus decreases by \$40, the area of the small trapezoid, the area of the small trapezoid bounded by the two prices and the supply curve..
- e. Economic efficiency increases by $\$70 - \$40 = \$30$, the area of the green triangle.

IV. Critical thinking

(1) Yes! Example production function: $q = x_1^{2/3} x_2^{2/3}$.

Marginal products are $MP_1 = (2/3) x_1^{-1/3} x_2^{2/3}$ and $MP_2 = (2/3) x_1^{2/3} x_2^{-1/3}$. MP_1 evidently decreases as x_1 increases and x_2 is held constant. MP_2 evidently decreases as x_2 increases and x_1 is held constant. So this production function has *diminishing returns* to each input separately.

Returns to scale can be checked as follows.

$(a x_1)^{2/3} (a x_2)^{2/3} = a^{2/3} x_1^{2/3} a^{2/3} x_2^{2/3} = a^{4/3} x_1^{2/3} x_2^{2/3} = a^{4/3} q > a q$, for a > 1 , so this production function has *increasing returns to scale*.

Another example production function might be $q = x_1^{3/4} x_2^{3/4}$.

(2) Competition with free entry drives *economic* profits to zero, but that does not mean all firms fail. Zero *economic* profit means that investors are earning the same rate of return as their next best alternative, so there is no reason for the firm to exit the industry.

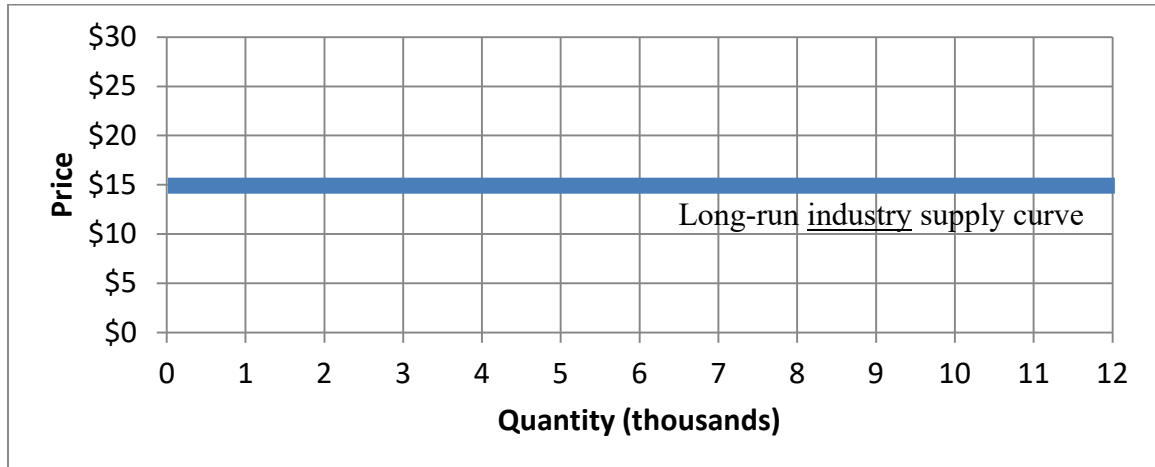
Version B

I. Multiple choice

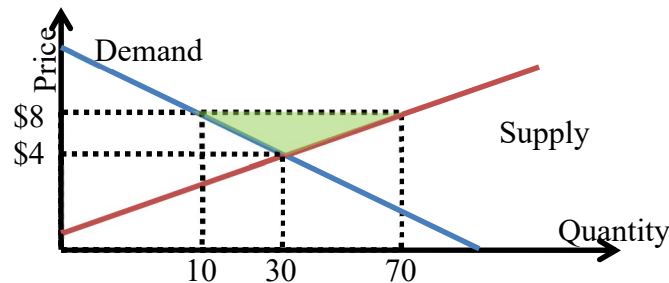
- (1)d. (2)a. (3)c. (4)d. (5)f. (6)d. (7)a. (8)a. (9)f. (10)b.
 (11)d. (12)d. (13)d. (14)a. (15)a.

II. Short answer

- (1) a. 7 percent. b. 3 percent.
 (2) a. 3 units. b. 4 units. c. \$100.
 d. 8 units. c. \$120.
 (3) a. \$6 (because breakeven price = $\min(\text{SATC})$).
 b. \$3 (because shutdown price = $\min(\text{SAVC})$).
 c. 12 thousand (using rule $P=MC$ to find q).
 d. 0 thousand (because price is below shutdown price).
 e. 10 thousand (using rule $P=MC$ to find q).



- (4) [Welfare effects of international trade]
 a. Set $Q_D = Q_S$ and solve to get $P^* = \$4$ and $Q^* = 30$.
 b. With international trade, we are given that $P_W = \$8$. Substituting into demand and supply gives $Q_D = 10$ and $Q_S = 70$, so the country EXPORTS $70 - 10 = 60$ units.



- c. Consumer surplus decreases by \$80, the area of the small trapezoid bounded by the two prices and the demand curve.
 d. Producer surplus increases by \$200, the area of the large trapezoid bounded by the two prices and the supply curve.
 e. Economic efficiency increases by $\$200 - \$80 = \$120$, the area of the green triangle.

IV. Critical thinking

(Same as Version A above.)

[end of answer key]