ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2021
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FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

(1)b. (2)b. (3)d. (4)b. (5)c. (6)b. (7)b. (8)d. (9)c. (10)e.
(11)b. (12)a. (13)c. (14)c. (15)c. (16)d. (17)a. (18)b. (19)a. (20)a.
(21)b.

II. Short answer

(1) a. \$3. b. 10 units. c. \$10.
d. 4 units. e. -4 units. f. -2 units

(2) a. necessary good. b. increase. c. 2 %.
d. decrease. e. 6 %.

(3) a. 7 thousand b. 9 thousand. c. 0 thousand.
d. \$7. e. \$4.

(4) a. import. b. 6 million pounds. c. increase.
d. \$14 million. e. decrease. f. \$8 million.
g. increase. h. \$6 million.

(5) a. \$5. b. 7 thousand. c. \$0 thousand.
d. MR = 12 – 2Q. e. P-intercept=\$12, Q-intercept=6 thousand.
f. \$8, on demand curve. g. 4 thousand. h. \$6 thousand.

(6) a. 3 units of clothing. b. 1/3 units of food. c. -3.
d. \$18.

(7) a. yes, yes. b. no, no. c. no, yes.

(8) a. 2 units. b. MSB=1200-100Q. c. 11 units.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $60 = 4\,q_1 + 9\,q_2$.

b. MRSC = $MU_2/MU_1 = \dfrac{q_2^{-2}}{q_1^{-2}} = \left(\dfrac{q_1}{q_2}\right)^2$.

c. Solve the tangency condition (MRSC = $p_2/p_1 = 9/4$) jointly with equation for budget line (see part a) to get $q_1^* = 6$, $q_2^* = 4$.

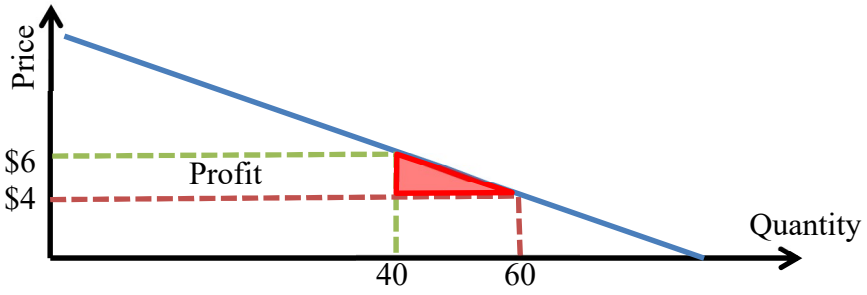
(2) [Production functions]

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

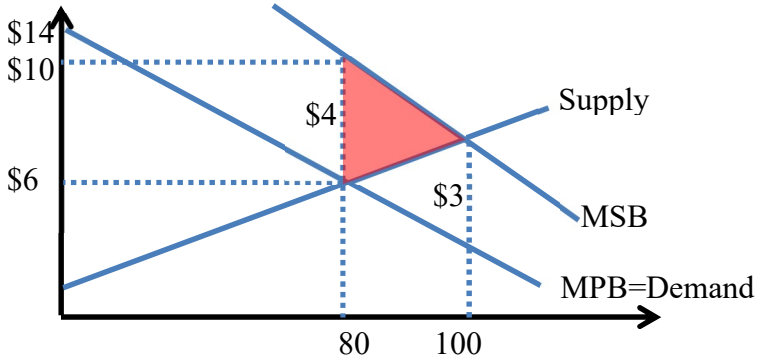
b. $MRSP = MP_2/MP_1 = \dfrac{(3/4)\,x_2^{-1/4}}{6\,x_1^{-1/4}} = \dfrac{1}{8}\left(\dfrac{x_1}{x_2}\right)^{1/4}$. Yes, this function does have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:
$f(ax_1, ax_2) = 8\,(ax_1)^{3/4} + (ax_2)^{3/4} = 8\,a^{3/4}\,x_1{}^{3/4} + a^{3/4}\,x_2{}^{3/4}$
$= a^{3/4}\left(8\,x_1{}^{3/4} + x_2{}^{3/4}\right) = a^{3/4}q < aq$, 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.

(3) [Cournot duopoly]
a. $TR_1 = P\ q_1 =$ **$10q_1 - (q_1^2/10) - (q_1q_2/10)$.**
b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 =$ **$10 - 2q_1/10 - q_2/10$.**
c. Set $MR_1 = MC = \$4$ and solve to get **$q_1^* = 30 - q_2/2$.**
d. Since $q_1^* = q_2^*$, $q_1^* = 30 - q_1^*/2$. Solving yields **$q_1^* = 20 = q_2^*$** .
e. $Q^* = q_1^* + q_2^* =$ **40**. Substituting into demand equation: $P^* = 10 - (40/10) =$ **\$6.**
f. Profit = $(P^* \times Q^*) - (AC \times Q^*) = (P^* - AC) \times Q^* = (6-4) \times 40 =$ **\$80.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $MC = \$4 = P = 10 - (Q/10)$ and solving to get $Q = 60$. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity $Q^*=40$ to the efficient quantity = 60 (see below). This is the area of a triangle, equal to **\$20**.



(4) [External benefit and Pigou subsidy]
a. Set $P_D = P_S$ and solve to get $Q^{**} = 80$, $P = \$6$.
b. $MSB = P_D + MEB = 22 - (3Q/20)$.
c. Set $MSB = P_S$ and solve to get $Q^* = 100$.
d. $DWL = (1/2) \times (100\text{-}80) \times 4 = \$40$.
e. Pigou subsidy rate = $MEB(100) = \$3$.



(5) [Uncertainty, risk aversion, demand for insurance.] $U(I) = 20 - (80/I)$
a. $E(I) = (0.50 \times 40) + (0.50 \times 10) = \$25$.
b. $E(U) = 0.50 \times (20 - 80/40) + 0.50 \times (20 - 80/10) = 15$ utils.
c. Set $U(I) = 20 - 80/I = 15$ and solve to get $I^* = \$16$.
d. Willing to pay \$40 - \$16 = \$24.
e. Fair insurance premium = $0.50 \times \$30 = \$15$.

(6) [Hidden characteristics and adverse selection]
a. $P_D = 50 + EL = 350 - 0.2\ Q$.
b. $MC = EL = 300 - 0.2\ Q$.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: $P_D > MC$ for all values of Q.
d. $AC = 300 - 0.1\ Q$.
e. Set $P_D = AC$ and solve to get $Q = 500$. $P = AC(500) = \$250$.

IV. Critical thinking

(1) To meet the target at least cost, pollution limits q_A and $q_B=12-q_A$ should be set so that $MB_A = MB_B$, or $10 - (q_A/2) = 6 - ([12-q_A]/2$. Solving gives $q_A^* = 10$ units and $q_B^* = 2$ units.

(2) The government will likely make a *loss* with this program. Owners know the true current market value of their houses (at least approximately) while the government does not know (or ignores) the market value, so the market value is a *hidden characteristic*. The government has agreed to pay 90 percent of the original price. If the market value of the house is more than the government's price, the owner will not sell to the government—if they wish to sell, they will do so on the open market.
Only owners of houses whose market value is less than the government's price will sell to the government. This results in *adverse selection*. The government will always find itself paying more than the market value for houses, resulting in a *loss*.

Version B

I. Multiple choice

(1)a. (2)a. (3)c. (4)a. (5)d. (6)d. (7)f. (8)b. (9)d. (10)a.
(11)e. (12)b. (13)b. (14)a. (15)c. (16)b. (17)b. (18)a. (19)b. (20)b.
(21)d.

II. Short answer

(1) a. \$2. b. 10 units. c. \$6.
d. 2 units. e. -6 units. f. -2 units

(2) a. luxury or superior good. b. increase. c. 5 %.
d. increase. e. 1 %.

(3) a. 0 thousand b. 11 thousand. c. 8 thousand.
d. \$6. e. \$2.

(4) a. export. b. 6 million pounds. c. decrease.
d. $10 million. e. increase. f. $16 million.
g. increase. h. $6 million.

(5) a. $3. b. 9 thousand. c. $0 thousand.
d. MR = 12 – 2Q. e. P-intercept=$12, Q-intercept=6 thousand.
f. $7, on demand curve. g. 5 thousand. h. $10 thousand.

(6) a. 1/2 units of clothing. b. 2 units of food. c. -1/2.
d. $3.

(7) a. no, no. b. yes, yes. c. no, yes.

(8) a. 3 units. b. MSB=1300-100Q. c. 12 units.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $60 = 3\ q_1 + 2\ q_2$.

b. $MRSC = MU_2/MU_1 = (\ ½\ q_2^{-1/2}\ ) / (\ ½\ q_1^{-1/2}\ ) = q_2^{-1/2} / q_1^{-1/2} = (q_1 / q_2)^{1/2}$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 2/3$) jointly with equation for budget line (see part a) to get $q_1^* = 8$, $q_2^* = 18$.

(2) [Production functions]

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

b. $MRSP = MP_2/MP_1 = \frac{6\ x_1^{3/4}\ x_2^{-1/4}}{6\ x_1^{-1/4}\ x_2^{3/4}} = \frac{x_1}{x_2}$. Yes, this function does have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.

c. Check returns to scale:

$f(ax_1, ax_2) = 8\ (ax_1)^{3/4}\ (ax_2)^{3/4} = 8\ a^{3/4}\ x_1^{3/4}\ a^{3/4}\ x_2^{3/4}$

$= a^{3/4}\ a^{3/4}\ \left(8\ x_1^{3/4}\ x_2^{3/4}\right) = a^{3/2}\ q > aq,$ for all a>1.

Thus, multiplying all inputs by the same factor (a) causes output to increase by a larger factor. So this production function has INCREASING returns to scale.

(3) [Cournot duopoly]

a. $TR_1 = P\ q_1 =$ **$15q_1 – (q_1^2/10) – (q_1q_2/10)$.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 =$ **$15 – (2q_1/10) – (q_2/10)$.**

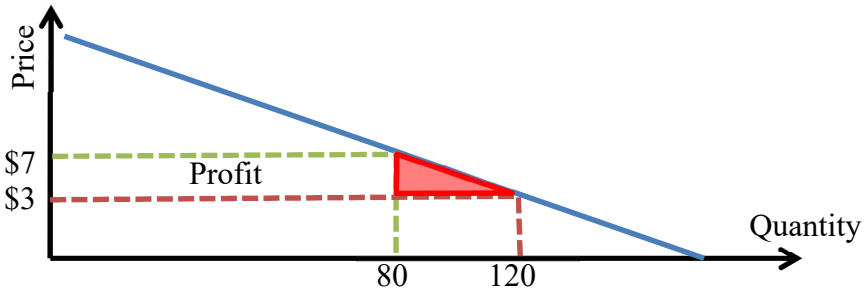
c. Set $MR_1 = MC = \$3$ and solve to get **$q_1^* = 60 – (q_2/2)$.**

d. Since $q_1^* = q_2^*$, $q_1^* = 60 – q_1^*/2$. Solving yields **$q_1^* = 40 = q_2^*$** .

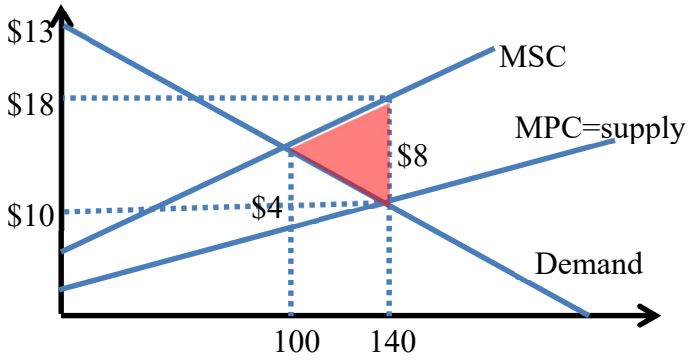
e. $Q^* = q_1^* + q_2^* =$ **80**. Substituting into demand equation: $P^* = 15 – (80/10) =$ **$7.**

f. Profit = $(P^* \times Q^*) – (AC \times Q^*) = (P^* - AC) \times Q^* = (7-3) \times 80 =$ **$320.**

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $MC = \$3 = P = 15 – (Q/10)$ and solving to get $Q = 120$. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity $Q^*=80$ to the efficient quantity = 120 (see below). This is the area of a triangle, equal to **$80**.



(4) [External cost and Pigou tax]
a. Set $P_D = P_S$ and solve to get Q** = 140, P = \$10.
b. MSC = P_S + MEC = 4 + (Q/10).
c. Set MSC = P_D and solve to get Q* = 100.
d. DWL = (1/2) × (140-100) × 8 = \$160.
e. Pigou tax rate = MEC(100) = \$6.



(5) [Uncertainty, risk aversion, demand for insurance.] U(I) = 30 – (200/I)
a. E(I) = (0.75 × 100) + (0.25 × 20) = \$80 .
b. E(U) = 0.75 × (30 – 200/100) + 0.25 × (30 – 200/20) = 26 utils.
c. Set U(I) = 30 – 200/I = 26 and solve to get I* = \$50 .
d. Willing to pay \$100 - \$50 = \$50.
e. Fair insurance premium = 0.25 × \$80 = \$20 .

(6) [Hidden characteristics and adverse selection]
a. P_D = 60 + EL = 560 – 0.4 Q.
b. MC = EL = 500 – 0.4 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.
d. AC = 500 – 0.2 Q.
e. Set P_D = AC and solve to get Q = 300. P = AC(300) = \$440.

IV. Critical thinking

Same as version A.

[end of answer key]