ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2017
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# EXAMINATION #4 ANSWER KEY

## Version A

### I. Multiple choice

(1)a. (2)e. (3)b. (4)b. (5)d. (6)c. (7)b. (8)b. (9)c. (10)b. (11)b.

### II. Short answer

(1) a. 4 units of food b. 1/4 units of clothing c. slope = -4
d. $P_{food}$ = \$2, because slope of each consumer's budget line = $-P_{clothing}/P_{food}$ = -4.

(2) a. \$6.00 b. \$4.50.

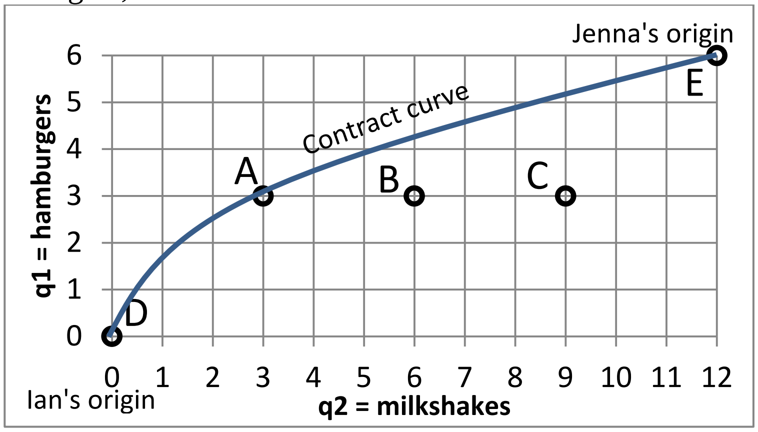
(3) a. 0.25 b. 0.05. c. zero.

(4) a. \$11 b. 8 thousand c. \$0
d. MR = 15 – Q
e. MR is straight line with P-intercept = \$15, slope = -1/thousand
f. \$12 g. 6 thousand h. \$3 thousand.

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

### III. Problems

(1) [Exchange efficiency] Note that Ian's $MRS_I = q_1 / (3q_2)$ and Jenna's $MRS_J = q_1 / q_2$ .
a. **Yes**, A is Pareto-efficient, because $MRS_I = 1/3 = MRS_J$ .
b. **No**, B is not Pareto-efficient, because $MRS_I = 1/6 \neq MRS_J = 1/2$ .
c. **No,** C is not Pareto-efficient, because $MRS_I = 1/9 \neq MRS_J = 1$ .
d. **Yes,** D is Pareto-efficient, because no one can be made better off without someone else being made worse off. Jenna has everything, so she cannot be made better off. Ian has nothing, so he cannot be made better off without taking some of Jenna's milkshakes or hamburgers, which would make Jenna worse off.
e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Ian has everything, so he cannot be made better off. Jenna has nothing, so she cannot be made better off without taking some of Ian's milkshakes or hamburgers, which would make Ian worse off.

f. 

(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = **1 + (Q/10).**

b. AC = TC/Q = **1 + (Q/20).**

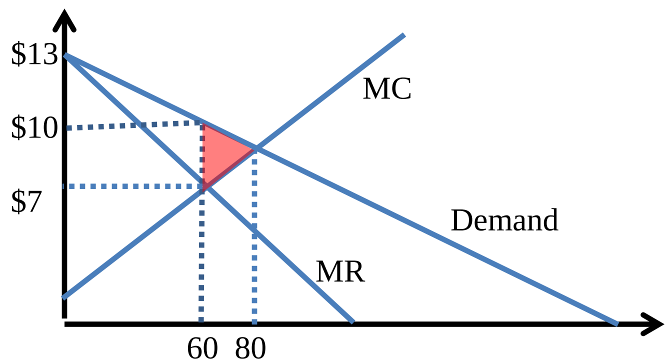
c. First find total revenue = P×Q = 13Q – ($Q^2$/20). So MR = dTR/dQ = **13 – (Q/10).**

d. Set MC = MR and solve to get Q* = **60**.

e. Substitute into demand function: P = 13 – (60/20) = **$10**.

f. Profit = TR – TC = (60×10) – (60 + $60^2$/20) = **$360**.

g. First find the efficient quantity, where demand = MC: 13 – (Q/20) = 1 + (Q/10), which yields Q=80. Then find MC(60) = 1 + (60/10) = $7. Then evaluate DWL as the area of a triangle: **$30.**




(3) [Cournot duopoly]

a. $Rev_1$ = P $q_1$ = $\mathbf{14q_1 - (q_1^2/20) - (q_1q_2/20)}$ **.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1$ = $\mathbf{14 - 2q_1/20 - q_2/20}$ **.**

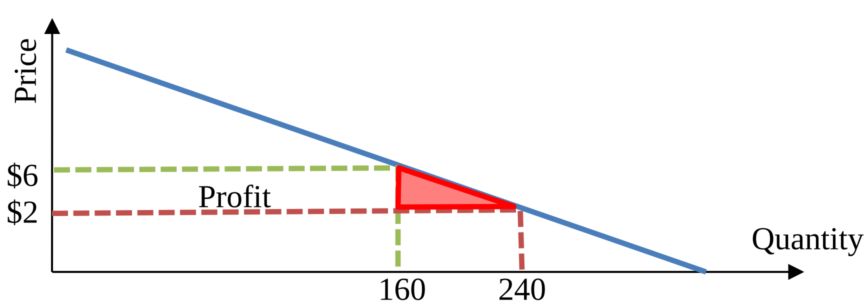
c. Set $MR_1$ = MC = $4 and solve to get $\mathbf{q_1^* = 120 - q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 120 - q_1^*/2$ . Solving yields $\mathbf{q_1^* = 80}$ $= q_2^*$ .

e. Q* = $q_1^* + q_2^*$ = **160**. Substituting into demand equation: P* = 14 – (160/20) = **$6.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (6-2)×160 = **$640.**

g. The efficient level of output lies where marginal cost intersects demand (“marginal cost pricing”). Find this quantity by setting MC = $2 = P = 14 – (Q/20) and solving to get Q = 240. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=160 to the efficient quantity = 240 (see below). This is the area of a triangle, equal to **$160**.



**IV. Critical thinking**

(1) Perfect price discrimination
To maximize profit, choose quantity where MC = demand: Q = 80.
Revenue = area of trapezoid: $\left(\frac{13+9}{2}\right) \times 80 = \$880$ .
Profit = Revenue – TC = 880 – (80 + [$80^2$/20]) = \$480.

(2) Collusion
To maximize the sum of profits, choose quantity where joint marginal cost equals MR:
$MC_J$ = 2 = 14 – (Q/10), giving Q = 120.
Find price from the demand curve: P = 14 – (120/20) = \$6.
Profit = (P-AC) × Q = (8-2) × 120 = \$720.

## Version B

**I. Multiple choice**

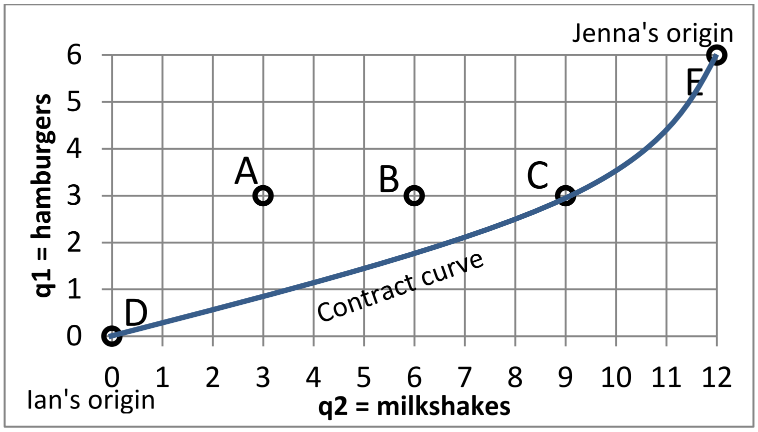
(1)e. (2)b. (3)c. (4)c. (5)c. (6)b. (7)c. (8)a. (9)b. (10)d. (11)d.

**II. Short answer**

(1) a. 2 units of food b. 1/2 units of clothing c. slope = -2
d. $P_{food}$ = \$4, because slope of each consumer's budget line = $-P_{clothing}/P_{food}$ = -2.
(2) a. \$10.00 b. \$6.00.
(3) a. 0. 5 b. 0.1. c. zero.
(4) a. \$8 b. 6 thousand c. \$0
d. MR = 14 – 2Q
e. MR is straight line with P-intercept = \$14, slope = -2/thousand
f. \$10 g. 4 thousand h. \$4 thousand.
(5) a. no, yes, no, yes b. no, no, no, no (New Firm has no dominant strategy)
c. no, no, no, yes.

**III. Problems**

(1) [Exchange efficiency] Note that Ian's $MRS_I = q_1 / (3q_2)$ and Jenna's $MRS_J = q_1 / q_2$ .
b. **No**, A is not Pareto-efficient, because $MRS_I = 2 \neq MRS_J = 2/9$ .
c. **No,** B is not Pareto-efficient, because $MRS_I = 1 \neq MRS_J = 1/3$ .
a. **Yes**, C is Pareto-efficient, because $MRS_I = 2/3 = MRS_J$ .
d. **Yes,** D is Pareto-efficient, because no one can be made better off without someone else being made worse off. Jenna has everything, so she cannot be made better off. Ian has nothing, so he cannot be made better off without taking some of Jenna's milkshakes or hamburgers, which would make Jenna worse off.
e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Ian has everything, so he cannot be made better off. Jenna has nothing, so she cannot be made better off without taking some of Ian's milkshakes or hamburgers, which would make Ian worse off.

f. 


(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = **1 + (Q/25).**

b. AC = TC/Q = **1 + (Q/50).**

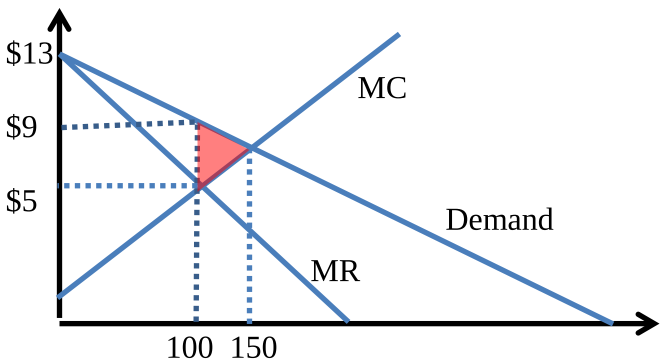
c. First find total revenue = P×Q = 13Q – ($Q^2$/25). So MR = dTR/dQ = **13 – (2Q/25).**

d. Set MC = MR and solve to get Q* = **100**.

e. Substitute into demand function: P = 13 – (100/25) = **$9**.

f. Profit = TR – TC = (100×9) – (100 + $100^2$/50) = **$600**.

g. First find the efficient quantity, where demand = MC: 13 – (Q/25) = 1 + (Q/25), which yields Q=150. Then find MC(100) = 1 + (100/25) = $5. Then evaluate DWL as the area of a triangle: **$100.**




(3) [Cournot duopoly]

a. $Rev_1 = P\, q_1$ = $\mathbf{15q_1 – (q_1^2/50) – (q_1q_2/50)}$ **.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1$ = $\mathbf{15 – 2q_1/50 – q_2/50}$ **.**

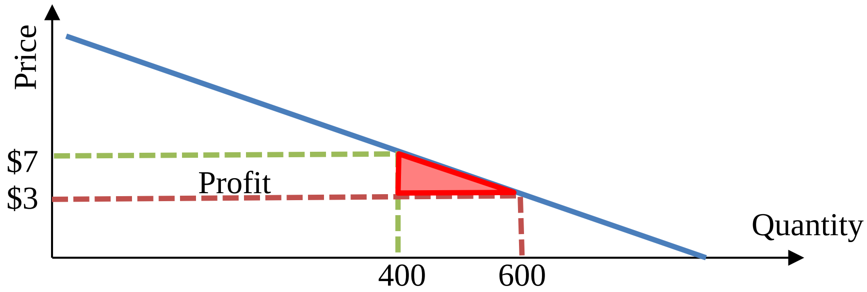
c. Set $MR_1$ = MC = $3 and solve to get $\mathbf{q_1^* = 300 – q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 300 – q_1^*/2$ . Solving yields $\mathbf{q_1^* = 200}$ $= q_2^*$ .

e. $Q^* = q_1^* + q_2^*$ = **400**. Substituting into demand equation: P* = 15 – (400/50) = **$7.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (7-3)×400 = **$160.**

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/50) and solving to get Q = 600. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=400 to the efficient quantity = 600 (see below). This is the area of a triangle, equal to **$400**.




**IV. Critical thinking**

(1) Perfect price discrimination

To maximize profit, choose quantity where MC = demand: Q = 150.

Revenue = area of trapezoid: $\left(\frac{13+7}{2}\right) \times 150 = \$1500$ .

Profit = Revenue – TC = 1500 – (150 + [$150^2$/50]) = $900.

(2) Collusion

To maximize the sum of profits, choose quantity where joint marginal cost equals MR:
$MC_J$ = 3 = 15 – (Q/25), giving Q = 300.
Find price from the demand curve: P = 15 – (300/50) = $9.
Profit = (P-AC) × Q = (9-3) × 300 = $1800.

[end of answer key]e